Grains of Truth:
Science and the Evolution of International Desertification Policymaking

by

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ABSTRACT

This study explores changing perceptions of dryland degradation (*desertification*) as revealed through twentieth century intergovernmental policies. Between the 1930s and 1990s these policies reflected markedly different ideas regarding the nature of the problem (e.g., global or local), its causes (e.g., natural or anthropogenic), and its remedies (e.g., based on modern science or indigenous knowledge). In the 1970s, for example, policies portrayed desertification as a phenomenon of worldwide extent. They identified "irrational systems of productivity" as primarily responsible for the problem and prescribed technological means for its amelioration. In the 1990s policies emphasized the local variability of land degradation. They attributed desertification to complex interactions involving ecological, political and economic factors, and called for decentralized programs and public participation.

This thesis argues that the history of desertification as a policy issue does not conform to traditional notions of progress whereby advances in science enable and underwrite advances toward effective governance. In this case, varied framings of the problem, rather than emerging from improved understandings of nature, arose from interactions linking the creation of scientific knowledge with the formation of international environmental institutions. The study identifies four discrete periods of international desertification politics: colonial, modernist, internationalist and pluralist, and undertakes a comparison of expert advisory processes, quantification, and visual representations across the periods. On the basis of this comparison the thesis presents an alternative interpretation of policy change and identifies three processes by which science and international governance were mutually constitutive and evolved in tandem: authorization, inscription, and boundary work. Authorization is the process that determines whose knowledge counts and what methods of knowledge production are valid. Inscription describes the means by which institutional resources and priorities embed problem framings and causal narratives. Boundary work concerns efforts to organize activities, delegate responsibility, and determine rules of participation. In the desertification case, boundary work proved important in delineating realms of science and non-science, lay-expert, natural-social, and local-global. Recognition of these processes opens the way to redefining expertise and redesigning expert advisory processes in current international environmental regimes.

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Acknowledgments

As an undergraduate studying civil engineering and English, I was skeptical that I would ever find an endeavor that reconciled my affinity for the elegance of science with my fascination for depths of meaning found in language and art. Familiar with my inner tensions, an acquaintance once described graduate school at the Massachusetts Institute of Technology (MIT) as the last place I would find resolution. Fortunately, I did not heed these words of caution. I enrolled in MIT's Civil and Environmental Engineering Department with the sense that the richness of opportunities in Cambridge, Massachusetts would somehow enable me to satisfy the seemingly irreconcilable passions tugging me in opposite directions. This hunch proved correct. With the help of colleagues, friends and family, my graduate education and its culmination in this thesis has marked a life-changing personal and professional journey.

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Throughout my graduate career I have had the good fortune of working in a number of superb institutional settings. MIT's flexible policies regarding doctoral studies made it possible for me to pursue research that did not fit neatly into any one of the

Institute's departments or programs, and to bring together eminent scholars from different fields and schools to advise me. MIT's Parsons Laboratory for Water Resources served as my home at MIT for two years while I worked toward my Master's Degree. Through the Parsons Lab, I met a number of wonderful people and put down roots in the MIT community. MIT's Department of Civil and Environmental Engineering has continued to help me negotiate the various administrative aspects of graduate education. The Environmental Policy Group in MIT's Department of Urban Studies and Planning provided a second home as I embarked on new academic pursuits. At a critical time in my graduate work I spent a year as a pre-doctoral fellow in the Global Environmental Assessment (GEA) Project at Harvard's Kennedy School of Government. There I had the pleasure of working with an excellent group of faculty and fellows, led by Bill Clark. As part of my GEA tenure I also spent six weeks at the Institute for Applied Systems Analysis in Laxenburg, Austria. In all of these settings I benefited from the help of excellent librarians, especially Tom Parris, and staff, particularly Jackie Donoghue and Marjorie Noack.

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As always my family has provided a bedrock of support, reminding me to laugh and live life when these things tended to get lost in the demands of a graduate school existence. They were always there to celebrate the triumphs and provide a safe haven when things got rough. I am especially thankful to my brother Chris, to Ann Marie, Raymond and Colleen DeMarco, and to Vera Bevini.

I dedicate this work to my parents, Mary Elizabeth and Richard Long and to Rob. They have each traveled different parts of this journey with me and I am forever grateful for their inspiration and encouragement.

Prologue

In the mid-1970s television news crews provided inhabitants of the industrialized world with unforgettable glimpses of the struggles and human tragedies that so often plague residents of arid regions. Pictures of parched landscapes and emaciated children in living rooms across North America and Europe highlighted the human inequities that contribute to catastrophic dryland crises in politically and economically troubled places. Americans, while familiar with their own desert regions, could hardly feel a sense of oneness with the starving African people. Yet, transmission of these desperate images throughout the globe also reflected (and perhaps promoted) a growing sense that the social and ecological burdens of dryland peoples had to be shouldered, in part, by a worldwide community. Nowhere did these burdens seem greater than in Africa.

Dry climates are synonymous with human suffering. Soil fertility and water are not sufficient to support the degree of agricultural productivity found in more temperate areas. The adequacy of the food supply is, therefore, uncertain. In addition, dryland areas experience extreme fluctuations in temperature and humidity. Long periods of low rainfall can deplete the soil of moisture, leaving desiccated landscapes and withered crops, incapable of yielding precious agricultural resources. When torrential rains terminate dry spells, the land cannot easily absorb the water and it races across the ground's surface. The water floods communities, erodes soil and vegetation in its path, and is wasted for human purposes.

So-called arid and semi-arid lands stretch across northern Africa, border the Mediterranean and occupy parts of central Asia, the western coast of South America and southwest North America. Calamities of drought and famine, however, are not evenly dispersed among these regions. Such disasters wreak the greatest devastation at sites of social and natural instability and where inequitable distribution of global resources is most sorely apparent. The southwestern United States and Australia contain deserts and arid climates. During the 1930s severe drought and economic depression in the Great Plains of the United States gave way to agricultural and social devastation often called the Dust Bowl. Aside from such notable exceptions, however, developed countries have not experienced nearly the level of hardship that has accompanied climate anomalies in other settings. In places like the Sahel, India and South America, for example, people must contend with a multitude of threats to human well being. It is the combination of these ecological, financial and political hardships, which give rise to disasters such as famine. Preconditions for disaster are, perhaps, most apparent in African countries. Rainfall is exceedingly variable and natural resources, to begin with, are deficient. Frequent droughts contribute to depletion of precious water reserves, drying of soils and withering of vegetation. Economies are not developed and people lack the fiscal and technological means which can aid societies in withstanding vagaries of climate. Political systems are often unstable. They frequently lack the ability or will to promote sound natural resource use and to erect buffers to cushion people against unfavorable ecological change. Oppressive regimes, civil wars and absence of coherent, dependable policies all handicap individuals in their attempts to secure and maintain their personal livelihoods.

One of the most publicized accounts of arid region calamities occurred in the Sahel between 1968-74. During this period, rainfall in Mauritania and Niamey dropped by nearly 50 percent. Decreases in production of crops and livestock were commensurate and observers estimated drought-related human deaths at 100,000 persons. Other manifestations took the form of human migration and increased dependency on foreign aid (Copans, 1983). Similar problems surfaced during the 1975 drought in Belize, where colonial style agricultural practices were still in use and undermined the ability of farmers to cope with rainfall shortages. Inhabitants lost millions of dollars (Belize) in livestock values. Grain production dropped by 50% and immense shortfalls in rice production required replacements from commercial imports (Hall, 1983). Similar crises have afflicted India, Pakistan, central Asia and the Soviet Union.

Through a number of complex and interconnected processes, crises in disadvantaged arid regions have become, in a sense, globalized. The media, employing ever more sophisticated information technology has managed to shrink the world and make events happening thousands of miles away appear as though they are happening next door. Decolonization by European countries followed by an increasingly prominent role for international institutions has helped to match the plight of developing countries with the technical and financial resources of developed countries, particularly on environmental problems. Within this context, international institutions and actors have taken up the task of understanding and addressing difficulties associated with natural and social systems in arid regions.

Multilateral policies on desertification (land degradation in arid regions) provide a noteworthy example of such actions. This form of environmental deterioration, though variously defined, has been closely linked to processes of drought and famine. Over the past eighty years, a number of intergovernmental initiatives have sought to alleviate this menace. Consistently, developed and developing countries supporting these programs have taken the position that people *can* and should do something to end, or at least ameliorate, desertification. Yet, they also agree that, despite substantial effort, little has been accomplished toward realizing this goal. The following account of tried and failed attempts at international environmental initiatives explores the difficulties associated with finding coherent solutions to the problem of dryland degradation. Attempts at desertification policymaking, for example, have not consistently built on one another. They have, instead, reflected markedly different interpretations of what desertification is, how it happens, and who or what is responsible for it. In order to understand this complex, non-linear evolution and some of the reasons why dryland problems have proved so resistant to policy remedies, it will be necessary to examine the linkages between international governance systems and changing knowledge and perceptions of arid regions. The following chapters take up this challenge.

CHAPTER 1

Understanding Policy Change

1.1 Motivation and Research Goals

The past three decades have witnessed the "globalization" of environmental issues and a marked growth in international environmental agreements.[1] In addressing the complexity of problems such as ozone depletion, climate change, and biodiversity, policymakers have increasingly looked to science for guidance in identifying global threats and their consequences. Deference to scientific and other forms of expertise is evident in the growth of global change research (Sand, 1991), and in the proliferation of expert advisory bodies and other institutional mechanisms created to inform negotiation and implementation of environmental accords.[2] Nevertheless, our understanding of relationships linking science and multilateral environmental policymaking lags far behind the rate at which we sign new treaties, convene international expert committees, and fund large-scale scientific assessments. Surprisingly little systematic analysis has been carried out to investigate policy formulation at the international level and how it relates to the production, interpretation, and dissemination of knowledge about the global environment.

Much of the research addressing questions of science and international environmental policymaking asks how science *influences* policy. Scholarship in the fields of international relations and policy studies suggests that science is important primarily because it can prompt policymakers to redefine their interests. Many analyses, for example, describe the discovery of the ozone hole as a turning point in the Montreal Protocol negotiations. They suggest that as scientists verified the hole's existence and made it visible to the public, industrialized countries revised their priorities and their

[1] Between 1974 and 1990 over 67 environmental treaties were concluded comprising approximately 51 percent of the total number of treaties. Before the United Nations Conference on the Human Environment (UNCHE) 1.23 treaties were signed annually. Since UNCHE this rate increased to 4.2 per year (Haas and Sundgren, 1993).

[2] Such bodies include the Intergovernmental Panel on Climate Change (IPCC), the expert assessment panels for ozone agreements, and the Subsidiary Body on Scientific, Technical and Technological Advice under the Convention on Biological Diversity.

expectations about what they could accomplish as parties to the agreement (Haas, 1992b; Porter and Brown, 1991).

Other analyses suggest that science is mainly a political resource, and policymakers selectively marshal knowledge claims to advance their pre-determined political positions. In 1989 non-governmental organizations working on wildlife conservation issues sponsored a study of the African elephant. The study concluded that the Convention on Trade in Endangered Species should declare the African elephant threatened with extinction and should ban most trade in this elephant. According to Porter and Brown (1991), parties to the Convention rejected or accepted the reports' findings depending on whether or not they supported policies for other reasons.[3]

While the above analyses may call attention to science as an important element of international environmental policymaking, they also tend to black-box the concept of knowledge. As with much research in international relations and policy studies, these accounts focus on knowledge claims alone, without examining the tacit negotiations that produce these claims nor the processes through which people come to view them (or not) as authoritative and credible. These facets of knowledge production, dissemination and use are considered unproblematic because science itself is assumed to be either monolithic and shaped outside of institutional, cultural and historical contexts, or else wholly subservient to politics. Hence, the ozone hole seems to possess autonomous agency and independent explanatory power (Jasanoff, 1996a), while the African elephant assessment seems to be little more than a political weapon. In either case, scientific knowledge appears as something separate from politics and either acting *on* or acted *upon* by politics, rather than as something integral to and evolving with political decisionmaking.

Underlying many of these conventional views of science and international politics is the assumption that scientific knowledge accumulates along a linear pathway toward an

[3] Collinridge and Reeve (1986) argue that a policymaking environment is always either under-critical or over-critical of scientific claims. In under-critical environments a policy position is firmly established and science that supports this position is not highly scrutinized. In over-critical environments, participants in the policy process are divided on which course of action to adopt. Each group marshals scientific claims in support of its own position, while challenging the validity of information presented by the opposing side. Such "analytical intractability" can persist endlessly until some external event changes dynamics within the policy community (Sabatier and Jenkins-Smith, 1993)

ever truer and more certain understanding of environmental degradation. International policies and policy debates tend to suggest that, over time, scientific knowledge naturally converges around a narrowly-defined, widely-accepted perception of a problem. As noted in *Agenda 21*, Chapter 35, "Science for Sustainable Development,"

> ...A first step towards improving the scientific basis for these strategies is a better understanding of land, oceans, atmosphere and their interlocking water, nutrient and biogeochemical cycles and energy flows which all form part of the Earth system. This is essential if a more accurate estimate is to be provided of the carrying capacity of the planet Earth and of its resilience under the many stresses placed upon it by human activities. The sciences can provide this understanding through increased research into the underlying ecological processes and through the application of modern, effective and efficient tools that are now available, such as remote-sensing devices, robotic monitoring instruments and computing and modelling capabilities. The sciences are playing an important role in linking the fundamental significance of the Earth system as life support to appropriate strategies for development which build on its continued functioning. The sciences should continue to play an increasing role in providing for an improvement in the efficiency of resource utilization and in finding new development practices, resources, and alternatives...Thus, the sciences are increasingly being understood as an essential component in the search for feasible pathways towards sustainable development (*Agenda 21*, Chapter 12 (2)).

This excerpt from *Agenda 21* reflects predominant views of science in international environmental policymaking contexts: namely, it portrays science as an important basis for policymaking and an unquestioned vehicle of progress. As suggested by *Agenda 21*'s reference to a "more accurate estimate" of carrying capacity, there is a "right" perception of the problem amenable to discovery through scientific research. *Agenda 21* further implies that as science facilitates such convergence around understandings of environmental phenomena, science can and should also inform the ways in which people interact with and respond to these phenomena, as through development activities. Overall, this "more-is-better" philosophy of science assumes that more research and scientific information about the environment automatically translate into more efficient, effective and robust policies.

This more-is-better approach also pervades notions of capacity and capacity building regarding international environmental politics. Both observers of and participants in international environmental policymaking tend to assume that equality across scientific and technical resources of regime members is an important prerequisite for equitable participation by these members. Levy et al. (1993: 407), for example, argue that governments possessing comparatively weak technical capacity are likely to adopt vague negotiating positions in policy debates because their constituents (due largely to lack of scientific information) have not developed sufficient concern for an environmental problem. These authors also suggest that "technically ignorant" governments tend to adopt vague policy positions because they are unsure of the ecological, financial and political implications of various policy commitments. To remedy the apparent disparities and reluctance arising from imbalances in scientific and technological resources, scholars such as Levy et al. (1993) advocate regular scientific monitoring of the environment, monitoring and publication of state environmental policies, and

> widespread development of scientific knowledge concerning the various causes of environmental damage, the various consequences of suspected pollutants, thus providing more accurate agenda specification over time (Levy, et al., 1993: 412).

Hence, these authors, like those of *Agenda 21*, emphasize science as a path to more correct understandings of the environment and ultimately to more effective policy. They call for "open-ended knowledge creation" so that scientific analysis and re-analysis of problems can continuously inform policymaking.

In the present study, I depart from conventional views of science and policymaking. My approach stands in contrast to perspectives that frame science and politics as wholly separate activities and focus on the role of scientific information in redefining interests or in serving as a political weapon. Instead, I take the position that scientific knowledge and political order, as reflected in policies and governing bodies, are co-produced (Jasanoff and Wynne, 1998).[4] In other words, the stabilization of factual

[4] Susskind and Elliott (1983) also used the term "co-production" in their volume on citizen action and citizen participation in the decisionmaking of western European governments. However, their use of the

findings and the creation of social relationships, identities, and institutions are interdependent. Understandings of natural and social systems, and the ways we go about developing these understandings, influence how we organize treaty regimes and intergovernmental agencies and how we regulate human interactions with the environment. Similarly, the structure, composition and resources of social institutions influence what scientific questions get asked, who has the authority to answer them, and what the answers look like and signify.

I also question notions of progress that tend to follow from conventional conceptions of science as an autonomous provider of ever improving knowledge about environmental phenomena. Perceptions of problems such as acid rain and ozone depletion seem to have narrowed over time to a set of widely-held perceptions of what constitutes causes of and appropriate responses to these forms of degradation. However, science and policymaking for problems such as deforestation and desertification have not followed the same trajectory. In these histories science did not provide a singular, linear pathway to greater truth and certainty on the part of researchers and policymakers. Rather, at different points in time, policies regarding these issues reflected markedly different ideas about the source of the degradation, its manifestations and what should be done about it. My aim in this analysis is to understand relationships linking science and politics in a case where there has not been closure around a singular problem definition. In particular, I ask: in what ways do experts, policymakers, and institutions participate in simultaneous creation of scientific knowledge and political order? And how might enhanced understanding of these processes inform the way we conceptualize, organize and conduct science and international environmental policymaking? These questions form the primary motivation for the research.

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term differs markedly from that of scholars in the field of Science and Technology Studies, as described in the text. Susskind and Elliot defined co-production as a "pattern of participation in which decisions are made through face-to-face negotiation between decisionmakers and residents claiming a major stake in particular decisions." In doing so, public officials and citizens accept each other's involvement in the decisionmaking process and the possibility that both citizens and government might participate in the production of management and development processes.

1.2 Research Approach: Case Comparison

Between roughly 1920 and the present, desertification politics have passed through four major changes or eras, which I term *colonial*, *modernist*, *internationalist* and *pluralist*. Each era is characterized by a unique and prevailing set of ideas about the nature, causes and remedies of dryland degradation. I seek to explain this evolution through a comparative study in which each of the four eras constitutes a case.[5] I look within and across the cases to examine how varying perceptions of desertification took shape, gained prominence, and (in some instances) lost credibility. My analysis is based primarily on policy documents, negotiating texts, scientific literature, and interviews with agency officials, government representatives, scientists, and expert advisors.

The following discussion, as summarized in Table 1, briefly describes the four eras of desertification science and policy. As with any idealized scheme, this periodization oversimplifies desertification's complex history. It is not meant to imply that this history is linear or that it took place in four wholly distinct compartments. Yet these labels provide a useful organizational structure that facilitates discussion about the different types of desertification "paradigms" that have existed over the last eighty years.

What I term the *colonial* era begins in the early 1920s, when claims of an advancing Sahara desert first appeared (e.g., Bovill, 1921), and extends until World War II commenced and African forestry research slowed. The *modernist* period begins in the early 1950s with the early stages of decolonization in Africa and development of the Arid Zone Research Programme under the United Nations Educational, Cultural and Scientific Organization (UNESCO). This era continues through the United Nations Conference on Desertification (UNCOD) in 1977, and ends in the early 1980s as the first critiques of UNCOD policies began to appear. The *internationalist* era picks up in the early 1980s as these critiques emerge and continues until the early 1990s with the United Nations Conference on Environment and Development (UNCED, the Rio Conference). The *pluralist* era begins with the Rio Conference and extends through the 1990s, with the

[5] See Long (1997) and Long (1998) for early formulations of this approach.

signing of the *Convention to Combat Desertification*[6] (CCD, or the *Convention*) and the early stages of its implementation. Each time period reflects a different dominant framing of the desertification problem. Comparison and contrast of these varied framings over time provides insight into the cultural, social and political contexts from which they emerged. Below are brief vignettes of each period, highlighting some of its key features. In-depth descriptions of these periods are presented in Chapter 2. As ideas about the nature of degradation changed over time, so did the terminology used to described degradation processes. Many of these terms and their definitions appear in Table 2.

Colonial

The colonists saw dryland degradation as a national problem, arising largely from the ignorance of African natives and amenable to natural resource policies and African adoption of European farming practices. In 1937 the French and British colonial administrations in West Africa set up a joint Forestry Commission to investigate reports of severe dryland degradation south of the Sahara. The commissioners refuted forester E. P. Stebbing's claims of a southwardly advancing desert. They similarly dismissed theories that the West African climate was becoming increasingly arid, thereby shrinking water bodies and destroying vegetation. However, the Commission agreed with Stebbing's research revealing extensive deforestation due to shifting cultivation, a farming method apparently popular among the indigenous African peoples. According to reports of the time, a shifting cultivator would fell and burn a track of forest and farm the land with minimal maintenance effort. Once crop yield began to diminish, he moved on to another track of forest to repeat the same process. In lieu of transnational projects involving extensive forest belts, the panel recommended European-style agriculture, increased forest reserves, and greater coordination among colonial natural resource departments.

[6] The full title of the treaty is the United Nations Convention to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa.

Table 1: Policy Comparison

Framing/Eras	Colonial	Modernist	Internationalist	Pluralist
Time Period	Early 1920s to World War II	Early 1950s to Late 1970s	Early 1980s to Early 1990s	1992+
Policy Statement	Anglo-French Forestry Commission	*Plan of Action to Combat Desertification*	*Agenda 21*, Chapter 12	*Convention to Combat Desertification*
Domain	West Africa • French Niger Colony • Northern Nigeria • Commission views degradation as a local issue.	Global problem framing based largely on the physical extent of degradation.	Global problem framing still prominent, but eventually questioned. Debates regarding regional versus international nature of the problem arise during UNCED.	The global nature of desertification is subject to debate. • Links to climate change • Regional annexes • International partnerships
Definition	Debates concern: • Desiccation • Encroaching deserts	From drought to desertification. Spread of desert-like conditions arising from direct physical interactions with the land.	Land degradation	Land degradation
Causation	Natural factors versus shifting cultivation.	"Irrational systems of productivity:" overgrazing, salinization, overcultivation.	"Climatic variations and human activities."	"Complex interactions among physical, biological, political, social, cultural and economic factors."
Remedies	Coordination among natural resource departments	"Proximate solution" • Top-down • Technological fixes	Basic research, increased vegetation, poverty eradication, popular participation.	Bottom-up approach: • Public participation • Local and traditional knowledge

Table 2: Frequently Used Terms

Term	General Meaning
Progressive desiccation	A purported trend of increasing aridity in West Africa during the 1920s and 1930s. Some colonial researchers believed that this phenomenon resulted in shrunken streams, lowered water tables, decreased vegetation, desert encroachment and human migration. However, observers disagreed as to which of these symptoms existed and what causal mechanisms were responsible for degradation.
Desert encroachment	The expansion of a desert outward from its center.
Shifting cultivation	Process by which a farmer deforests an area of land, cultivates crops on this land with minimal upkeep and then moves to a new tract of land to repeat the process.
Land	Refers generally to soil, vegetation and hydrology. According to the *Convention to Combat Desertification* land means: "terrestrial bioproductive system that comprises soil, vegetation, other biota, and the ecological and hydrological processes that operate within the system (CCD, 1994, Article 1(e): 7).
Land use	Refers generally to activities that deplete or alter land resources. They include grazing, irrigation, cropping and deforestation.
Land degradation	"…reduction or loss, in arid, semi-arid and dry sub-humid areas of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest and woodlands resulting from land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns…" (CCD, 1994, Article 1(f): 7).
Arid, semi-arid and dry sub-humid areas	"…areas, other than polar and sub-polar regions, in which the ratio of annual precipitation to potential evapotranspiration falls within the range from 0.05 to 0.65" (CCD, 1994, Article1(g): 8).

Modernist

Policymakers in the 1970s viewed desertification as a problem of global extent, arising from irrational land use practices, and amenable to scientific and technological solutions. Between August 29 and September 9 1977, five hundred delegates from 94 countries gathered in Nairobi, Kenya for the United Nations Conference on Desertification (the Conference or UNCOD). The Conference followed two years of extensive research and assessment activities. These efforts took place under the leadership of the Conference Secretariat, housed in the United Nations Environment Programme (UNEP). At the Conference, government representatives negotiated an international *Plan of Action to Combat Desertification* (the *Plan* or PACD). The *Plan* portrayed desertification as a global problem arising from "irrational" land use practices and linked to the African drought and famine crisis of 1968-1973. It also emphasized the effects of land degradation on human welfare and the economic development of affected communities. In the face of these problems, country representatives prescribed a "proximate solution" for desertification (UNCOD, 1978: p. 8). This solution focused on improving various livelihood systems through internationally-coordinated national policies, guided by scientific expertise (mainly from developed countries) and facilitated by western-style technologies.

Internationalist

The 1980s were a decade of evaluation and critique regarding desertification science and policy. The 1980s also marked period in which competing national perspectives influenced international cooperation on environmental issues. UNEP set about measuring the global "status" and "rate" of desertification's "advance." When assessment results suggested a worsening of the problem, UNEP expressed disappointment with the *Plan*'s implementation (Tolba, 1984; Dregne, 1984, Mabbutt, 1984; UNEP, 1984; Tolba 1987). Outside UNEP, Swedish researchers used remote sensing studies to question the very existence of desertification (Helldén, 1988). Others criticized the ways that desertification had been conceptualized and addressed in the 1970s. They took issue with the multiple meanings ascribed to the term (Glantz and Orlovsky, 1983; Verstraete, 1986), heavy reliance on natural as opposed to social science expertise (Spooner and Mann, 1982), methodologies used to characterize desertification (Caldwell, 1984; Warren and Agnew, 1988), and causal narratives that portrayed victims of desertification as obstacles to rather than resources for its remedy. By the early 1990s, even UNEP began to re-examine the *Plan*'s definition of desertification and its top-down solutions (UNEP, 1991). In the midst of preparations for the Rio Summit desertification once again became the subject of an international policy statement. Chapter 12 of *Agenda 21* identified desertification as a problem of land degradation arising from "climatic variations and human activities." Policy remedies included poverty eradication and popular participation, as well as basic research and increased vegetation.

Pluralist

Policies in the 1990s portrayed a more complex vision of desertification processes and emphasized local participation and the use of indigenous knowledge and practices along with science in addressing the issue. On May 24, 1993, diplomats from developed and developing countries revisited Nairobi as part of the Intergovernmental Negotiating Committee for the Elaboration of an International Convention to Combat Desertification (INCD). Unlike participants in the 1977 conference, these delegates did not identify a single factor, such as land use, as responsible for desertification. Neither did they portray scientific expertise as the primary means for defining desertification and devising its solutions. As early as the first negotiating session, participants began painting a more complex picture of desertification. They pointed to complex interactions among ecological, social and political factors (CCD, 1994: Preamble) as responsible for desertification. Rather than "top-down" policies based on more "rational" land use and western technologies, developed and developing countries alike called for a "bottom-up" approach involving local communities and greater participation by women and non-governmental organizations. Instead of focusing exclusively on "science," the *Convention* emphasized the broader category of "knowledge." This discursive shift focused attention on both previously unrecognized forms of knowing, and modern science as useful resources in understanding and ameliorating desertification.

1.3 Theoretical Background

In this study I attempt to explain how changes in desertification policy came about and what they can teach us about relationships between scientific knowledge and international environmental policymaking. Knowledge is an important aspect of the desertification story because throughout the twentieth century there have been significantly different understandings of purportedly the same phenomenon – land degradation. Policies are also a key feature of this history because they reflect prevailing ideas about both the nature of the problem and how to ameliorate it via social regulation and environmental management.

In attempting to understand the evolution of desertification as a transnational policy issue, I turn to three theoretical frameworks that address questions of knowledge and policymaking: regime theory, the Advocacy Coalition Framework (ACF), and science and technology studies (S&TS). In the following sections I briefly describe and critique these research approaches. The cognitivist school of regime theory and the ACF tend to focus on how political actors use scientific knowledge and how new information changes the behavior of these actors. While these research areas make valuable contributions in recognizing cognitive factors as an important element of policymaking and policy change, they rest on several assumptions that are at odds with the desertification case. In particular, they tend to assume that knowledge accumulates in a uni-directional fashion and largely in isolation of societal factors. In contrast, S&TS scholarship provides a more useful set of tools for analyzing the history of desertification policy. Researchers in this field examine the plurality and social constructedness of knowledge. They acknowledge the existence of multiple methods of knowing a complex environmental phenomenon and the non-linear pathways by which knowledge development proceeds. They analyze the cultural and ideological factors embedded in production, representations and perceptions of knowledge, and probe ways in which understandings of natural and social systems intersect with efforts to govern and live within these systems.

1.3.1 Regime Theory

Regime theorists seek to explain the collective management of global and regional interdependence (Hurrell and Kingsbury, 1992).[7] They investigate why states act collectively on certain issues and how they develop practices, rules and arrangements intended to guide behavior. In short, this line of scholarship furthers understanding about the formation and evolution of regimes (Young, 1998: Haas, 1993). Regimes are defined as:

> ...sets of implicit or explicit principles, norms, rules and decisionmaking procedures around which actors' expectations converge in a given area of international relations (Krasner, 1983: 2; also quoted in Haas, 1989: 381).[8]

By this definition, regimes are not simply policy agreements or treaties, but are, instead, social institutions that embody patterns of behavior in compliance with a set of norms and rules (Hurrell and Kingsbury, 1992).[9]

Krasner's (1983) classic edited volume depicted regimes as an intervening variable between causes and policy outcomes. Debates among regime theorists focus on whether material conditions, interests, or ideas are the primary driver of regime formation and evolution (Haas, 1989; Haas, 1992a; Young, 1994; Young, 1998).[10] Realists and

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[7] Regime theory grew out of interdependence theory (Keohane and Nye, 1977), a reaction to state-centered international relations scholarship. Interdependence theory suggested that transnational, societal factors, not just relations among states, were important in shaping international politics. Contrary to some of the assertions of interdependence theory, states have remained a central player in the face of economic interdependence (List and Rittberger, 1992).

[8] "Principles are beliefs of fact, causation, and rectitude. Norms are standards of behavior defined in terms of rights and obligations. Rules are specific prescriptions or proscriptions for action. Decisionmaking procedures are prevailing practices for making and implementing collective choice" (Krasner, 1983: 2; also quoted in Haas, 1989: 381).

[9] A regime, for example, is not a treaty. "Whereas a treaty is a legal instrument stipulating rights and obligations, a regime is a social institution wherein stable patterns of behaviour result from compliance with certain norms and rules, whether these are laid down in a legally binding instrument or not" (Hurrell and Kingsbury, 1992: 90).

[10] Krasner (1983a) summarized the determinants of regime development as: self interest, political power, norms and principles, habits and customs, and knowledge. More recent work on regimes has consolidated these factors into power, interests, and knowledge.

neorealists maintain that actors who possess the greatest material power act as hegemons during the process of regime formation and change. These actors dictate the norms and rules of the regime and thereby determine relationships among parties to the regime and their respective roles in managing environmental problems. Utilitarians rely on game theoretic or microeconomic explanations. They believe that participants in the process of regime formation act to maximize their own benefits.

Cognitivists, by contrast, believe that agreement about the causes and solutions of a problem can motivate regime development.[11] They look to consensual knowledge and social learning for explanations about regime formation and change. They also maintain that new information can enable actors to redefine their interests and thereby learn over time (Haas, 1993; Young, 1994).[12] [13] Cognitivists generally view knowledge as emerging outside of political forums. They are interested in how this knowledge influences the policy process and argue that scientific findings are important because they can alter behavior. As regime participants acquire new knowledge they are assumed to refine their understanding of a problem. This may cause them to support a new regime, or change the course of an existing one.

Students of international environmental regimes tend to believe that cognitive factors have their greatest impact on a regime during its early stages of development. In other words, ideas and scientific knowledge are thought to be most important during agenda formation and fact-finding (Porter and Brown, 1991).[14] [15] During this process,

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[11] This relates to the Gramscian notion of a hegemonic worldview (Cox, 1983; Young, 1994).

[12] Regime theory has been the subject of critiques since its emergence as part of the international relations literature. In 1983, Susan Strange denounced regime theory as faddish, imprecise, value-biased, static in its conceptualization of regimes, and narrow in its focus on state-centered paradigms. More recently, even key proponents of this school of thought lament the tendency of some scholars to focus on a single factor such as hegemonic stability and the role of expert coalitions in explaining regime formation and change (Young,1998). Despite these criticisms, however, regime theory has persisted well into the 1990s and has proliferated especially among scholars interested in international environmental governance.

[13] This school of thought constituted a major departure from traditional international relations theory and its emphasis on interest, and economic-based explanations for international cooperation. As noted by Stephen Krasner in 1983, regime theory was potentially liberating for structuralists because it emphasized the role of "learning, cognitive ideas, and understanding" -- factors usually dismissed as causal explanations in political science.

[14] Students of international politics tend to conceive of the regime formation process as comprised of three stages: agenda formation, negotiation, and operationalization or regime strengthening (Young, 1998; Porter and Brown, 1991). During agenda formation, relevant actors in the international community identify a problem, its causes and possible remedies. Throughout the negotiation phase, states engage in bargaining

parties are said to develop authoritative statements about the problem, and interested parties endorse the regime if they believe these problem statements are valid and necessitate regime formation:[16]

> Agenda formation calls for intellectual leadership to frame issues, to present them in ways that capture the imagination of attentive publics, and to bring the weight of the scientific community and other groups of experts to bear in persuading policymakers of the importance of the issues at stake (Young, 1998: 23).

According to regime theorists, ideas have less impact on later stages of regime development, while interests and material power have more. By this time, it is assumed, the problem has been defined and regime participants set out to forge and implement regulations aimed at remedying the problem. During implementation, policymakers engage in legislative and administrative politics as they negotiate the allocation of resources required for implementation (Young, 1998: 24).

Epistemic Communities

One way in which scientific knowledge is thought to influence regime development is through epistemic communities. Epistemic communities are coalitions of experts who share research methodologies and normative convictions, unite in pursuit of a common policy enterprise, develop and disseminate knowledge about a given policy problem, and contribute significantly to regime formation around a given policy issue. Epistemic community members share normative beliefs that provide a "value-based rationale" for

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over what international action should take place. During implementation, or regime strengthening the initial agreement is put into practice and states engage in further bargaining to forge new agreements, and/or amend existing agreements. Porter and Brown (1991) add a fourth stage of fact-finding between agenda setting and bargaining; this phase does not occur in all cases, and sometimes blends in with bargaining activities. Fact-finding is a collective attempt by states to jointly discover more information about an issue and to clarify disagreements about the cause, nature, and extent of the problem. Porter and Brown (1991) suggest that when no joint fact-finding takes place, states who oppose regime formation can openly challenge perceptions of the problem established during the issue definition stage.

[15] Young (1998) suggests that interests are more important during the negotiation stage of regime formation, while allocation of material resources and enforcement are key factors during the operationalization stage.

[16] The international environmental institutions literature similarly portrays scientific knowledge as central to agenda setting. Keohane et al. (1993: 8), for example, suggest that international institutions contribute to "more appropriate agendas" by "reflecting the convergence of political and technical consensus about the nature of environmental threats."

taking social action (Haas, 1992a: 3). These members also subscribe to a set of methodologies for knowledge validation that guide the analysis of problems impacting society. Problem analysis leads to a shared understanding of problem causes. Insight into causal relationships enables the community to develop shared ideas about what types of policy should be put in place. According to cognitivists, as an epistemic community champions a policy enterprise, the community helps to catalyze international cooperation and policy formulation (Haas, 1992a: 3).

According to a well-known case study by Peter Haas, epistemic community activity significantly influenced the negotiation of the Mediterranean Action Plan, a regional treaty aimed at controlling marine pollution. Haas suggests that individual scientists who shared common beliefs regarding ecological values, the causes and severity of pollution, and appropriate policy responses, coordinated a lobbying effort. Their coalition encouraged government cooperation and domestic intervention aimed at protecting the Mediterranean environment (Haas, 1990). Other studies have analyzed the role of epistemic communities in regimes for ozone depletion and whaling (Haas, 1992b, Peterson, 1992).

Regimes and Learning

Although the role of knowledge is thought to decrease in later periods of regime development, learning is believed to be a primary process through which cognitive factors shape a regime's evolution. Cognitivists believe that regime change occurs when new knowledge causes regime participants to redefine their interests. The regime, in other words, is viewed as the dependent variable transformed by new information:

> ...a major independent variable is new information, a major intervening variable is the mode of information-processing at the state level, and the dependent variable is the regime pattern (Haas, 1993: 175).

Haas (1993) also suggests that new knowledge has the potential to transcend ideology, especially when it is consensual.

Ernst B. Haas, a noted political scientist, adopted a similar approach in his 1990 analysis of three international organizations. Addressing the role of knowledge, power and learning in organization change, he sought to explain how, over time, a given organization defines and redefines the problem it intends to solve. Haas claimed that problem definitions change through one of two processes: adaptation and learning. Adaptation refers to incremental change that occurs without a questioning of causal theories, underlying values, or the organization's purpose. In contrast, learning is a behavior change that can occur when epistemic communities present consensual knowledge to decisionmakers within an organization. This knowledge causes actors to question prior theories, values and the organization's overall purpose. As actors redefine the organization's goals they also revise the means for achieving these goals.

> ...the knowledge available about the problem at issue influences the way decision makers define the interest at stake in the solution to the problem; political objectives and technical knowledge are combined to arrive at a conception of what constitutes one's interest" (E. Haas, 1990: 9)... The doing of actors can then be described by observers as an exercise of defining and realizing interests informed by changing scientific knowledge about man and nature (E. Haas, 1990: 11).

Both Peter and Ernst Haas note that scientific knowledge is integral to policymaking. Ultimately, however, they seem to suggest that science acts autonomously on the political process by changing interests and decisionmaking.

Limitations of Regime Theory

The cognitivist school of regime theory makes a valuable contribution by recognizing knowledge as an important component of policymaking. However, this approach has several limitations that diminish its usefulness in understanding relationships linking the science and politics of desertification. As mentioned above, this view tends to portray science as exogenous to policymaking, to black box knowledge and treat it as a singular category, and to assume that knowledge accumulates in a linear fashion over time, thereby progressively reducing uncertainty and enabling policymakers to make more enlightened and more accurate choices.

The regime theory perspective separates the cognitive elements of policymaking from interests and material elements. This is apparent in the "either or" formulations used to describe regime formation and in the notion that agenda setting is the primary site for knowledge use. Regime change, for example, is said to result from influences that are *either* realist *or* utilitarian *or* cognitive. According to Young (1994: 39) "most observers believe that ideas matter in the sense that their impact on processes of regime formation is independent of the exercise of power or the interplay of interests." Regime theorists therefore imply that knowledge is somehow disconnected from these other factors. This belief also pervades assumptions about the role of knowledge during different stages of the policy process. The suggestion that knowledge is most important before political negotiations get underway, implies that knowledge creation and policymaking happen in sequential order. Knowledge is largely isolated from ideological influences, and acts primarily to enlighten individuals and assist them in redefining their interests. [17]

Similar ideas permeate the literature on epistemic communities. Epistemic community research importantly reveals knowledge to be a basis for community building and for the formation of social identity. Epistemic community theory, however, has been criticized on several fronts for the questions it leaves unanswered and for its limited usefulness in informing policymaking (Susskind, 1994).[18] In most cases, for example, it is unclear whether epistemic communities can be legitimately treated as independent variables. The approach also fails to examine the processes by which knowledge and networks develop and knowledge claims achieve acceptance. It obscures critical

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[17] Yet, even some regime theorists suggest that there is something missing from this sort of approach. As one researcher remarked, "...there is something disembodied about this line of thought; it seems to rely on a spontaneous process that has no engine to drive it" (Young, 1994: 96).

[18] Some critics of epistemic community theory question the political power ascribed to these networks and the means by which they achieve cognitive authority (Jasanoff, 1996a). Porter and Brown note that scientists may support and enable some environmental regimes, but "remain divided or even captured by particular government or private interests in others" (Porter and Brown, 1991: 25). Oran Young suggests that scientists can call attention to a problem, enhance understanding, present alternative solutions, and provide means of implementing solutions. However, he questions the ability of a group of experts to "manipulate" political decisionmaking. Young goes so far as to question whether epistemic communities are actually a product of regime formation rather than its agents. (Young, 1994: 97; Young, 1993: 439). Lawrence Susskind supports the idea that networks of experts might subscribe to an agreed problem definition or causal model. However, Susskind is doubtful that experts, divorced from national interests, would agree on policy responses or would compete effectively against national representatives who support alternative response measures (Susskind, 1994: 75).

questions of values and power, which are inevitably central to international environmental negotiations (Jasanoff, 1996a; Litfin, 1994). This approach also tends to bypass consideration of institutions and their role in creating, communicating and using knowledge. Peter Haas, for example, notes the potential importance of organizational structures in diffusing knowledge and determining its impacts, but admits that epistemic community studies do not explore these factors (Haas, 1992a: 28). They tend to focus, instead, on the fate of a knowledge claim once it appears as part of the political debate. There is little consideration of why or how this knowledge emerged and how the processes by which it was shaped may have influenced or been influenced by ideological, institutional, and/or cultural factors.

The learning literature focuses on how development of new knowledge follows a linear pathway carrying policymakers ever closer to understanding their true interests. The desertification story, however, does not fit this simple scenario. Rather, scientific research in this area has encountered stops and starts, sideways diversions, and even the reenactment of old controversies. For example, debates about desert encroachment that began in the 1920s were repeated virtually verbatim in the 1970s. Similarly, understandings about the interactions of climate and desertification have followed a pattern more closely resembling a circle than a straight line. The 1920s witnessed lively debates about progressive desiccation. Some scientists argued that a trend of increasing aridity was killing the vegetation and depleting water sources (Hubert, 1920). Others contended that the climate had alternated between wet and dry intervals since the Quaternary Period (Jones, 1938; Falconer, 1938). Similar discussions surfaced in the 1970s and 1990s as experts and policymakers debated the relative contributions of long-term climate change, short-term climate variability, and human factors in prompting desertification (Charney, 1975; Jackson and Idso, 1975; Hare, 1977; Hare, 1983; Williams and Balling, 1996; Balling, 1993).

Even a cursory glance at the four eras of desertification policy identified above suggests that there is more going on than simply the production of objective knowledge, wholly dictated by nature and impersonally influencing decisionmaking. Knowledge and policies regarding desertification have been negotiated simultaneously (rather than in sequence) for decades. Politics has evolved in tandem with the acceptance of different forms of knowledge and means of knowledge production. Colonial visions of desertification as a local rather than a transnational problem had much to do with methods of dryland observation and with the organization of the French and British administrations. Similarly, UNEP's position as a fledgling international agency coupled with certain mapping techniques and North/South dynamics all contributed to transforming West African drought and famine problems of the early 1970s into an international desertification problem. Hence, scientific understandings of desertification evolved in tandem with politics in an interactive rather than a linear cause-and-effect process.

1.3.2 *The Advocacy Coalition Framework*

The Advocacy Coalition Framework is another line of scholarship concerned with scientific knowledge, policy change, and coalitions (although not simply expert coalitions).[19] Like regime theory, the ACF focuses on the effects of knowledge on policymaking, the use of technical information as a tool of persuasion in political debate, and the role of new knowledge in enabling policymakers to develop a more accurate picture of the world and their priorities. Unlike regime theory, however, the ACF acknowledges to some degree the social construction of knowledge. According to Sabatier and Jenkins-Smith (1993), policy analysis is a process through which individuals agree to the validity of claims involving facts and values. A knowledge claim is analytically tractable (i.e., authoritative and credible) when it is based on recognized data, methods and theories.

The ACF focuses on policy subsystems: groups of actors from all levels of government, private organizations, and interest groups who focus on policy problems such as water quality, mental health or air transportation (Sabatier, 1993). Within a subsystem, actors who share common normative and causal beliefs [20] act collectively as

[19] Although the ACF was developed based on case studies of domestic policymaking, Granville Sewell (forthcoming) has applied the model to international climate change policymaking.
[20] Belief systems provide the "glue" that binds a coalition together. These belief systems reflect ideas about how the world operates. They include basic normative convictions, policy objectives that arise from these

an advocacy coalition. Government programs and policies arise from interactions among these competing coalitions and perturbations external to the subsystem. Relatively stable parameters such as the nature of the problem, the distribution of natural resources, and the legal structure of the political system impose similarly stable constraints on these dynamics.

Here, as in regime theory, knowledge is believed to affect policy formulation through a learning process by which scientific and technical analysis can alter beliefs within a coalition or within the broader policy subsystem.[21] Four principles govern the role of technical information in policy learning and the policy change that can arise from this learning: (1) analysis is usually stimulated by threats to core aspects of one's own belief system or by the perception that another competing coalition has an opportunity to realize its core values; (2) technical information is critical for alerting people to the possibility that a policy issue affects their interests; (3) advocacy coalitions often use technical information to justify and elaborate their policy positions; (4) such substantiation is generally necessary if actors wish to translate their beliefs into policy. Political power is not enough to ensure the dominance of a coalition within the subsystem. This coalition must also provide the technical information necessary to convince other actors that its positions regarding policy objectives and the means for obtaining them are sound (Sabatier and Jenkins-Smith, 1993: 45).

The ACF outlines favorable conditions for "productive analytical debate." Some of these conditions concern the nature of expert forums.[22] Because analysis is a social

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convictions, and ideas about the means for realizing these policy objectives. Sabatier (1993) distinguishes between three elements of a belief system: deep core beliefs, near (policy) core beliefs, and secondary beliefs. Deep core beliefs are fundamental normative and ontological axioms that reflect an individual's philosophical orientation. These apply to all policy areas and are very difficult to change. Sabatier likens change in deep core beliefs to religious conversion. Near core, or policy core beliefs, are fundamental policy positions. These positions concern strategies for translating normative convictions into policy. Policy core beliefs relate to the specific policy area and are difficult, but possible, to change if conditions are conducive to change. Secondary aspects focus on instrumental decisions and information searches necessary to implement the policy core. These beliefs are moderately easy to change and constitute the topic of most administrative and legislative policymaking (Sabatier, 1993: 30-1).

[21] Technical information is also said to mobilize "latent actors," individuals who would become active in the policy subsystem if they had access to the relevant information. Advocacy coalitions often activate latent constituencies and increase their influence in the subsystem (Sabatier, 1993: 24).

[22] Analytical intractability pertains to issues subject to a high degree of uncertainty. These issues are complex, perceived causal mechanisms span several policy areas, and policy objectives regarding these issues differ among groups (Jenkins-Smith and Sabatier, 1993b: 51).

process involving discussion of facts and values, the forum for this discussion plays an important role in technical analysis. According to the ACF, an open forum invites the expression of many diverse viewpoints but lacks the shared norms that underlie scientific inquiry. Professional forums constitute a type of closed setting in which screening assures that participants subscribe to common protocols for development and verification of analytical claims. Professional forums limit the range of views expressed, as well as the level of conflict among those views. Sabatier and Jenkins-Smith (1993) suggest that professional forums with diverse political membership are more apt to reach a consensus over highly contentious issues than more open and democratic forums (Sabatier and Jenkins-Smith, 1993).

The ACF departs in several important ways from regime theory. First, the ACF recognizes that the data and methodologies used to produce knowledge influence the authority and credibility of that knowledge. Second, the ACF acknowledges that the actors who participate in knowledge creation (e.g., via an expert panel) can have important effects on who ultimately accepts the knowledge as valid and persuasive. Third, the ACF model recognizes the possibility of multiple knowledge positions based on divergent policy interests of advocacy coalitions.[23] These insights are important in breaking down the black box that surrounds traditional conceptions of science as independent of politics.

However, ACF adherents, like regime theorists, tend to focus on how knowledge influences beliefs and serves as an instrument of political persuasion. There is little consideration of how institutional contexts, cultures and interests could be embedded in knowledge claims, and how scientific practices may affect not only an issue's analytical tractability, but also the legitimation of certain institutional structures and problem framings. In addition, the ACF stops short of probing how and what determinants of credibility, sources of authority, modes of communication, social contexts and techniques

[23] Munro (1993) compares Kuhn's *The Structure of Scientific Revolutions*, to the ACF. He suggests that policy learning within a given policy paradigm is akin to normal science. Similarly, major policy failures are like scientific revolutions in bringing about the revision of deep-seeded beliefs and normative convictions. In this analogy, however, Munro seems to assume incorrectly that Kuhn's revolutions propel science closer and closer to the truth.

of validation make knowledge claims more or less open to deconstruction and more or less stable over time.[24] As discussed in the next section, the field of science and technology studies addresses many of these issues.

3.3 *Science and Technology Studies*

Researchers in the field of S&TS view science and technology to be an integral aspect of social activity – worthy of deep intellectual analysis, in large part because science enjoys a revered position as objective and free, or ideally free from values (Jasanoff, 1996b). This position often obscures the social processes through which scientific knowledge is constructed. S&TS aims to make these processes apparent to investigate their implications for how science is integrated with other social activities. S&TS scholars do not reject the idea that science seeks out truth (Jasanoff, 1996b). Rather they work to understand what constitutes "truth" in different contexts and the means by which it is discovered, accepted, communicated – and, as is important in policy settings, deconstructed or reconstructed as an authoritative basis for action. Research in this field explores knowledge production as a cultural, political and institutional activity. This entails investigation of the socially relevant meanings and implications of scientific claims and representations, as well as questioning of taken-for-granted categories, classifications, and boundaries (Jasanoff, 1996b).[25]

With his groundbreaking study in 1962, Thomas Kuhn challenged the idea that a progressive accumulation of scientific knowledge carries us necessarily closer to a truer vision of the world. Kuhn called attention to the possibility of multiple co-existing perceptions of nature. He contended that personal and historical accidents can lead one of many competing "paradigms" to comprise the worldview of a particular scientific

[24] I am not suggesting that coalitions have not been a factor in desertification's evolution. They have. Coalition dynamics have also changed over time, with UNEP becoming less involved since its "reign" in the 1970s, and non-governmental organizations (NGOs) becoming important participants in policy negotiations of the 1990s (Corell, 1999). However, these factors by no means offer exhaustive explanations of why governments sometimes viewed dryland degradation as a global problem, and at other times they did not. Nor do these factors fully explain why policies in the 1970s cited human land use as the primary cause of desertification (UNCOD, 1978), while in the 1990s policies identified "climatic variations and human activities" (CCD, 1994: Article 1(a)) as responsible.

[25] In drawing upon these ideas in my research, I am not suggesting that there are no knowable facts about the world and how it works. I am simply interested in how people go about discovering, articulating, trusting, and deconstructing such facts.

community at a given point in time. Once this world view is established, scientists take up the day-to-day tasks of "normal science" in confirming and augmenting their shared beliefs, while also suppressing anomalies that challenge these beliefs. But these anomalies, in Kuhn's account, inevitably resurface. When the accumulation of such anomalies subverts the basis of the existing scientific enterprise, a scientific revolution may take place. Through this revolution the community members reach a different set of shared beliefs and commitments.

More recent scholarship has shown that interpretations of the natural world depend on the social context from which they emerge, as well as on nature itself. Ideology, culture, values and materiality are part of knowledge production in just the same way that they are integral to any other social activities. Consequently, even when using purportedly objective scientific methods, individuals can come to different conclusions about the causes, impacts and implications of a given natural phenomenon. People from different political positions are apt to view the world in ways that conform to their expectations and personal interests (Fairhead and Leach, 1996; Nelkin, 1992). Similarly, national-scale approaches to issues of science and technology tend to reflect culturally embedded beliefs and priorities, as well as attitudes toward risk, uncertainty, and regulation (Brickman et al., 1985; Jasanoff, 1986, 1987). Even ideas about what constitutes "knowledge" may vary with social context. In some cases failure to recognize lay knowledge, as reflected in the observations and interpretations of local people have accompanied major failures on the part of more traditionally "scientific" projects (Wynne 1989; Fairhead and Leach, 1996; Leach and Mearns, 1996; Scott, 1998).

In developing these insights, S&TS scholars examine practices and artifacts through which knowledge is constructed and represented. In the context of this thesis, practices are the formal and informal techniques employed by scientists, policymakers, institutions, and governments as they create knowledge and policy regarding the global environment. While these techniques are not governed by any distinct sets of rules, they comprise widely agreed upon and frequently used methodologies. "Practice" might refer to routine methods of negotiation whereby diplomats debate and modify the elements of a negotiating text until they reach consensus. Similarly, "practice" might describe established methods for conducting statistical analyses of desertification impacts. Artifacts are embodiments, inscriptions or representations of knowledge and policy (e.g., Latour and Woolgar, 1979; Latour, 1990). They may be textual or material, but are firm enough to be portable or to circulate beyond their original place of production. Generally, these artifacts are produced through application of one or more practices. A treaty, for example, might be an artifact generated through policy negotiations. The treaty embodies elements of the negotiation process and reflects a convergence of relevant views. A graph, chart, or map might be an artifact generated through statistical analysis of desertification. These artifacts serve as vehicles for communicating and representing information about desertification's impacts. As discussed below, the practices and artifacts of knowledge production and policymaking are deeply intertwined.

S&TS research has brought to light many ways in which institutions engage in or interact with the production, dissemination and use of scientific knowledge. Some studies have revealed the practices and politics of the laboratory as paramount to knowledge construction (Latour and Woolgar, 1979). Others have investigated expert advisory panels and their role in delineating the boundaries between scientific and non-scientific institutions (Jasanoff, 1990; Gieryn, 1995). At broader scales, we see that science itself has been integral to the rise of liberal democratic states. Ezrahi (1990), for example, has persuasively argued that democratic governments draw on science to construct and maintain their authority, legitimacy, and accountability in the eyes of the public. Others have demonstrated how particular notions of objectivity and quantification practices are integral to certain social identities (Porter, 1995) and governing structures (Jasanoff, 1986).

In building on contributions from S&TS and related fields, Jasanoff and Wynne (1998) use the notion of "co-production," to usefully articulate the interdependence of scientific knowledge and political order. According to this model, scientific knowledge and social order evolve jointly. Knowledge is not self-contained in its own isolated sphere, but is instead integral to many aspects of social activity. Furthermore, scientific knowledge is contingent not only on the natural world, but also on historical events, social practices, and institutions that contribute to its construction, dissemination and use.

Policies depend on specific knowledge claims, but also on the ways in which science is conducted, communicated and used. In addition, the social/institutional contexts in which knowledge production happens significantly shape the practices and representations of scientific knowledge, just as much as problem diagnoses and policy prescriptions are shaped by scientific inquiry.

Co-production is a powerful conceptual resource. It facilitates identification and analysis of important and complex relationships involving knowledge and decisionmaking. Yet, to some extent these relationships have yet to be examined and sorted out in detail through careful empirical research. Questions remain about the identifying features of co-production, the roles of different actors and institutions in this process, and how these factors vary across different contexts. Other questions concern relationships linking co-production with social constructivist insights into knowledge creation. In what ways, for example, are practices and artifacts integral to co-production processes? And in what ways does co-production further the understanding of phenomena such as quantification, standardization and visual representation? As discussed in Section 1.4, the desertification case provides an auspicious site for addressing these questions.

1.3.4 *Summary of Theoretical Basis*

Regime theorists and proponents of the Advocacy Coalition Framework (ACF) have made important contributions to political science and policy analysis by calling attention to science in the policymaking process, something largely overlooked in standard realist accounts of international relations and much policy studies work. The regime theory and ACF literatures highlight the role of ideas and the importance of problem framing in policymaking. Research on epistemic communities links knowledge to social identity by suggesting that expert groups share not only research methodologies and adherence to certain causal explanations, but also values, normative beliefs, and commitments to social action. The ACF literature similarly portrays technical knowledge as integral to the belief systems of social collectives. This model acknowledges that data, analytical methods, and expert forums involved in knowledge production and technical debates can influence the perceived validity and credibility of a given knowledge claim.

However, these approaches provide only limited insights into the desertification story because they stop short of problematizing knowledge itself. They imply that knowledge claims affect the policy process only to the extent they are used to raise general concern for a problem or influence decisionmaking. Regime theory, in particular, assumes scientific knowledge to be apolitical and, in its ideal state, divorced from power and ideology. Understandings of the world seem to emanate from objective observations of nature and in isolation from historical, ideological, and cultural contexts. This suggests that science is a monolithic process, governed by a universal and objective scientific method, rather than comprised of multiple, negotiated, and locally constituted agreements about analytical methods, standardization practices, modes of visual representation, and rules for interpretation of findings. As pointed out by students of science and technology studies, these latter aspects of knowledge production are not only socially and culturally contingent (e.g., Brickman et al., 1985), but are also deeply intertwined with the creation of political order.

In revealing the interdependence of scientific knowledge and political order, science and technology studies provides many tools and insights useful in analyzing the desertification case. S&TS demonstrates that knowledge is often pluralistic and takes shape through social processes. These processes in turn may impart cultural, ideological and institutional character to scientific understandings, just as the understandings themselves embed and shape institutions, politics and policies.

The concept of co-production importantly points to the interdependence of scientific knowledge and political order. Studies have demonstrated, for example, how polities (Ezrahi, 1990), regulatory regimes and the courts (Jasanoff, 1995) depend upon science for guidance and legitimacy, while at the same time participating in the construction of that knowledge. Similar approaches have been applied in understanding international environmental policy (e.g., Taylor, 1992; Zehr, 1994; Wynne, 1995; Jasanoff and Wynne, 1998). Yet little, if any work, has explicitly defined ways in which institutions for international environmental policymaking and management are involved in co-production.

1.4 Thesis Argument

As noted above, science did not progress in a linear fashion carrying policymakers ever closer to a true understanding of desertification. The twentieth century has not witnessed closure and consensus around a singular meaning of desertification or a narrow set of remedies. Rather, at different points in time institutional settings, individuals, methods, and types of knowledge gave rise to disparate perceptions of the issue and its solutions. Knowledge about desertification did not emerge in isolation from institutional and political contexts. Rather, institutions and policies regarding desertification have evolved in tandem with knowledge about it. Cultural, social and political features of the regime are embedded in different framings of desertification, just as knowledge about this issue has helped to validate (or invalidate) colonial views of the African people, assumptions about successful development efforts, and the participation of various actor groups.

Hence, science and policy regarding desertification have not evolved according to traditional notions of scientific enlightenment or progress. Each era of desertification's history reflects both different understandings of dryland degradation and different forms of political order aimed at ameliorating it. Decades of analysis and expert advice for desertification did little to make its highly complex natural-social facets tractable in a policy sense. The story suggests that when causal narratives are unclear and widely open to debate (as in the desertification case), convergence around a narrow set of problem framings and policy prescriptions (even after years of research and assessment) may be unlikely. Under such circumstances, changes in prevailing perceptions, representations and approaches regarding the problem will be highly dependent on changes in broader governance systems and institutional contexts.

Despite marked variations in international policies, I argue that disparate ideas about desertification arose by way of identifiable knowledge-policy interactions common to each of the four eras. By comparing and contrasting science and policymaking across the four eras I observe specific ways in which knowledge and policy were mutually constitutive. This analysis focuses on two types of observations. First, I identify key ways in which institutions participated in the creation of desertification science and policy. By institutions I mean the individuals, forums, rules, and practices that comprise administrative bodies, organizations, and regimes. Through a broad historical analysis of desertification science and policymaking, I demonstrate how the assumptions and worldviews embedded in international institutions were translated into varying perceptions of the desertification problem across four policy eras. Second, I analyze ways in which practices and artifacts contribute to co-production. I explore the specific means by which scientists, policymakers, and institutions developed, contested, and changed the dominant framings of desertification. In particular, I show how expert advisory processes, quantification, and visual representations of desertification varied with diagnoses of and prescriptions for the desertification problem.

1.4.1 *Authorization, Inscription and Boundary Work*

Institutional settings affect the ways in which scientists, policymakers and others go about understanding and managing human/environment interactions.[26] Institutions are highly visible collectives and often have considerable resources. Consequently, institutions can be particularly powerful in framing a policy problem, identifying its remedies, and implementing these remedies. Institutions help to determine what knowledge and whose knowledge counts; what questions are relevant and important; how questions should be answered (i.e., what methodologies are valid); and how answers (knowledge claims) should be represented, interpreted, and used. I identify three primary ways in which institutions have shaped dominant framings of desertification and corresponding policies. I refer to these functions as *authorization*, *inscription* and *boundary work*.[27]

Authorization refers to the role of institutions in determining whose knowledge counts and what methods of knowledge production are valid. International institutions

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[26] This is by no means a uni-directional cause-and-effect relationship. Institutions reflect certain understandings of the world and assumptions about political order. Institutions are at once products and sites of co-production as well as participants in co-production processes.
[27] Haas et al. (1993) also identifies three institutional functions. They argue that effective institutions are able to change levels of concern regarding an issue, provide contracting environments, and affect capacity. However, this model does not provide tools for examining knowledge production.

such as the World Health Organization, the climate change regime, and the United Nations Environment Programme design research agendas and convene expert panels. This work can have direct implications for policy, especially when the research or expert advice is developed explicitly in support of policymaking activities. In the desertification case, institutions such as the French and British colonial administrations in Africa, the United Nations Environment Programme, the United Nations General Assembly, and the Desertification Secretariat were instrumental in defining the meaning of "expert." By selecting expert advisors and designing expert mandates, these organizations determined whose visions of desertification were legitimate and what methods for developing such visions were valid and useful. The colonial administrators relied on the analysis of foresters, hydrologists, and botanists. UNEP (the 1977 Conference Secretariat) convened natural and physical science experts from fields such as soil science, climatology, and physical geography. In the early 1990s, the expert advisory group to the negotiating committee Secretariat included social as well as natural scientists. This Secretariat also encouraged non-governmental organizations to share their understandings of desertification.

Institutions can also be instrumental in defining relationships linking experts to policy negotiations. The Secretariat to the Intergovernmental Negotiating Committee on Desertification decided the timing of expert meetings in relation to policy deliberations and also determined what modes of communication connected experts and policymakers. These decisions significantly shaped perceptions and expectations of science, as well as overall deference to science on the part of policymakers and others. In the 1970s, for example, the United Nations Environment Programme was central in determining that the natural and physical sciences should provide the primary tools for understanding and ameliorating desertification. In the 1990s, the Desertification Secretariat and Parties to the *Convention* have been much more receptive to social science perspectives and to lay and non-western forms of knowledge in addressing desertification.

Inscription, on the other hand, is the process by which institutional characteristics get inscribed on the definition of the problem itself. Environmental problems are generally defined according to their causes and impacts. These causal "narratives"

(Cronon, 1992; Leach and Mearns, 1996) indicate a set of remedies for ameliorating the problem. The desertification case shows that causal narratives and policy prescriptions often reflect and are aligned with the interests, resources, and jurisdictional domain of prominent institutions and governing bodies.

Each era of desertification policy reflects different ideas about desertification's causes, impacts and remedies. As demonstrated in the following chapters, these features of desertification's definition reflect the capabilities and priorities of the institutions that dominated the policymaking process. The colonial and modernist era policies pointed to allegedly irrational land use practices on the part of Africans as the primary reason for desertification. This problem framing was compatible with the imperial agenda, not only in their disrespect for local methodologies, but also because solutions included improved coordination among natural resource departments and the introduction of European-style, permanent agriculture. In the 1970s, the United Nations Environment Programme advocated desertification policies that supported the tenets of international development, and promoted scientific and technological solutions. More recent policies reflect a broader causal narrative that points to "climate variations and human activities" (CCD, 1994: Article 1(a)) as responsible for desertification. They prescribe community-based projects and greater reliance on local forms of knowledge. These developments reflect UNEP's fading role in the desertification debate combined with greater participation by non-governmental organizations.

Boundary work refers to the ways in which institutions define and differentiate categories and organize activities in addressing a particular policy problem. It is part of almost any successful institutional function, and is integral, for example, to both authorization and inscription processes. Institutions and other collectives draw boundaries for many different purposes. Expert advisory panels, for example, engage in boundary work when they distinguish realms of science from those of non-science (Jasanoff, 1990). Of particular interest in the desertification case are the ways in which institutions delineate boundaries between lay-expert, science-policy, and global-local.

Lay-expert and science-policy boundaries in the desertification case were primarily determined through authorization processes. Institutions distinguished between experts and non-experts as they established research priorities, created research agendas, and selected members of advisory committees. Institutions defined the realms of science and policy respectively when they issued a certain mandate to experts and another to policymakers, established rules of participation, and structured relationships linking expert and policymaking bodies. The changing role of social scientists and non-governmental organizations, for example, played a major role in shaping the way that Parties to the regime collectively thought about desertification and its remedies. In the 1970s social scientists were largely excluded from expert deliberations and non-governmental organizations were not generally viewed as bearers of expert knowledge. Throughout the 1980s and into the 1990s, however, the desertification regime made room for these perspectives, in effect blurring the boundaries between lay and expert. A similar blurring has occurred in regard to science/policy boundaries. Whereas scientists in the 1970s carried out their work in advance of policy negotiations, experts advising the Desertification Secretariat during the 1990s engaged (although communicating through the Secretariat) in an iterative interaction with policymakers. Some of the experts actually drafted portions of the negotiating texts.

The four eras of desertification policy also reflect changing ideas about the local and global character of desertification. The colonial administrations rejected transnational framings of West African land degradation in favor of more local framings. In contrast, modernist approaches to desertification in the 1950s and 1970s, emphasized the global extent of degradation and the need to use similarly global, universal, scientific methods to understand and remedy it. Desertification policies of the 1990s returned to a largely localized view of desertification, while still retaining the global features necessary to support an international treaty.

The processes by which desertification has been defined and redefined as local or global are closely tied to processes of institutional inscription. The desertification case suggests that institutions tend to construct problems in their own image. The causes and solutions of a given policy problem framing often corresponded to the agenda, tools and resources of the dominant institutions involved with interpreting and remedying the problem. Hence, the colonial administrations saw dryland degradation as a local problem that should be managed by natural resource departments. The United Nations Environment Programme, on the other hand, saw desertification as a global problem, aligned with UNEP's international agenda, and amenable to technical solutions and the transfer of resources from North to South.

1.4.2 *Chapter Overview*

Table 3 briefly sketches the contents of *Chapters 2* through *5*. The columns in Table 3, like those of Table 1 represent four international approaches to desertification. The rows of the table summarize, in a highly abbreviated fashion, the following four chapters. These chapters address the historical context in which desertification policy took shape, expert advisory processes, quantification methods and representations, and visual representations of knowledge.

The second row of the table corresponds to *Chapter 2*, which provides an historical overview of the desertification issue, and highlights dominant international institutions and key features of the political dynamics of each era. During the 1920s and 30s, for example, French and British administrations in West Africa generally operated as independent governance systems, relying heavily on the expertise of specialists in fields such as geography and forestry. The native African peoples were, of course, ruled by and subservient to colonists, who treated the Africans as uncivilized and inferior. A new global order began to take hold after World War II and Africa began a long route to independence. "Third World" development became an objective of the international community writ large as they attempted to attain worldwide prosperity with the tools of science and technology. The United Nations Environment Programme (UNEP, a fledgling agency) was highly influential in championing scientifically and technologically-grounded approaches to environmental issues included in its mandate. The 1980s and the early 1990s marked a period of increasing interest in so-called global environmental issues and movement away from attempts on the part of industrialized countries to impose science and technology on developing countries in their efforts to address environmental problems. Throughout the 1980s, UNEP continued to function as the lead agency on desertification issues. However, during this period national

Table 3: Institutions, Practices and Artifacts

	Colonial	Modernist	Internationalist	Pluralist
Dominant Institutions	Colonial powers in West Africa	UNEP	UNEP National governments	Desertification Secretariat, INCD, COP
Expert Advisory Processes	Independent researchers. Foresters, geographers, agriculturalists serving in colonial administrations.	Linear model • Two-year process • Hierarchy of expertise • Natural scientists dominate	Policy Evaluation • Ad hoc panels Independent critiques • Social science • Greater attention to local • UNEP's credibility in question	Iterative model • Broader notion of expert • Pluralistic forums • Disciplinary, geographic and gender diversity
Quantification	Relative measures	Global statistics	Measures and management • "Status and rate" • Global statistics questioned • Critiques call for new methods of counting	• Development and use of global statistics diminishes • New indicators address gender and capacity-building issues
Visual Representations	Photographs and Maps of Africa • Personal & colonial perspectives • France/Britain • Natural/Human • Colonists/Africans	Lamprey's analysis of an advancing Sahara. *World Map* • International agencies • Global • Simplification and aggregation • Standardized measures of physical parameters • Land use	*World Atlas* • UNEP Consultants • Global, continental and case studies • Local input and observations • Complexity – extensive textual component • Pluralistic visions	New forms of visualization • Scientists and non-scientists • ISS • Web photographs • A CCD logo • Documentaries

governments (such as those who participated in the ozone negotiations of the mid 1980s and the Rio Summit in 1992) acting independently or in coalitions, held sway over political deliberations and the content of policy statements. The later 1990s has seen a broadening of participation in environmental politics. While national governments ultimately make international policy, there has been growing interest in public participation as reflected in, for example, local *Agenda 21* initiatives. In the desertification context new institutional mechanisms such as a Conference of Parties and a Secretariat have replaced UNEP in its leadership position on desertification issues and have fostered a substantial role for non-governmental organizations in the policymaking process

Chapters 3 through *5* analyze practices and artifacts as both instruments and embodiments of authorization, inscription and boundary work. Practices and artifacts that have been important in desertification's history concern expert advisory processes, quantification and visual representation. Reliance on expert advisory panels has been a frequent practice in international environmental policymaking. In addition, experts on these panels employed various modes of analysis and communication that also constitute practices. While expert panels themselves are not portable artifacts they generate such artifacts in the form of reports, charts, graphs and numerical estimates. The design and operation of expert advisory processes have embedded dominant views of desertification. For example, technocratic approaches to desertification coincided with elite panels of natural scientists. More democratic forums for sharing of expert knowledge coincided with views of desertification as complex and locally contingent. Global maps of desertification reflected perceptions of desertification as a worldwide problem with scientifically knowable characteristics. At the same time, such maps were instruments used to establish desertification as a global (rather than local) problem and to legitimate the role of international institutions in solving this problem. Similarly, expressions such as "irrational land use practices" were useful in establishing and representing the authority of western farming methods over non-western methods.

Expert Advisory Processes

Chapter 3 explores authorization, inscription, and boundary work as they relate to expert advice. By tracing the evolution of desertification policy and formalized forums for expertise, this chapter illustrates the role of expert advisory processes as both sites for inscription and instruments of inscription. In building expert advisory bodies, institutions identify sources of authoritative knowledge and define relationships linking scientists and policymakers. As extensions of dominant institutions, expert advisory processes inscribe institutional capacities onto problem framings, and define the meaning and importance of "local" and "global." Institutions select members of advisory bodies. Hence, expert advisory processes involve individuals whom the supporting institutions deem to be authoritative, trustworthy, and possessing of relevant knowledge. In addition, institutions allocate responsibility to experts and wield considerable control over their role in the policymaking process. Given the role of institutions in constructing expert advice, it is not surprising that expert panels often interpret a problem and its remedies in a way that conforms to the resources and priorities of the institution they serve. Institutions and expert panels themselves also engage in boundary work. They draw boundaries when including some types of experts and not others or when delegating some tasks to experts and others to non-experts. Other boundaries emerge through problem framing when an issue is interpreted as local or global, social or physical.

Many changes in desertification policy over time correspond to the changing roles and relationships involving natural/physical scientists, social scientists, and non-scientists. In the 1920s and 1930s colonial officials and academics tended to disagree about the state of the West African environment and causes of degradation. Participants in these debates included foresters, geographers, and agriculturalists, but did not include social scientists such as anthropologists. Not surprisingly, the colonial administrations viewed desertification primarily as a problem of natural resource management. In the 1970s there was a notable bias against social scientists on the part of dominant policy institutions. UNEP, for example, called on natural scientists to conduct a large-scale, two-year assessment prior to policy negotiations. The resulting agreement portrayed desertification as arising from direct human interaction with the land and emphasized the use of science and technology in ameliorating it. During the 1980s expert advisory processes under UNEP took the form of ad hoc panels. Outside of UNEP social scientists and rural ecologists began to play a much bigger role in the desertification debate. This shift in participation accompanied perceived failures in desertification policy and a questioning of earlier approaches to the issue. The 1990s have witnessed a decreased emphasis on natural science and a marked increase in attention to indigenous and traditional forms of knowledge. Forums for "knowledge sharing" have involved non-governmental organizations and policy practitioners, as well as academic scientists. Likewise, desertification policies portray a much more complex picture of issue and support social and community-based responses.

Quantification

Chapter 4 explores the varying nature of statistics and other numerical measures and their role in legitimating different approaches to desertification and allocating power among various agents. Quantification is a means by which knowledge is made universal, imbued with objectivity, and standardized (Jasanoff, 1986; Porter 1995; Jasanoff and Wynne, 1998). The desertification case reveals that quantification served these purposes not only by creating a universal science of desertification, but also by constructing a global policy issue. Global statistics served (at least temporarily) to support a belief in the global extent of desertification, and lent legitimacy to international science programs and an international policy approach. New policies for desertification emerged in tandem with new indicators to measure desertification. Hence, standards for identifying and characterizing desertification provide insight into its changing dimensions and into evolving social systems aimed at measuring and managing them. These various means and modes of quantification also obscured and aggregated various dimensions of desertification. For example, global statistics reflecting physical manifestations of desertification tended to sideline its social aspects.

A comparison of quantification practices across this history reveals that they are tightly coupled to the institutional and political context in which they emerged. In the

1920s and 30s, colonial administrations were not interested in establishing standardized measures of environmental phenomena that could be compared across national borders. Hence colonial researchers relied more on relative, qualitative measures, rather than quantitative measures of environmental change. In the 1970s, as UNEP sought to buttress international cooperation on this presumably scientific issue, the agency supported development of statistics that expressed the extent and manifestations of desertification in numerical terms and at a global scale. Throughout the 1980s, UNEP assessed progress under the Plan of Action, largely in terms of the "status and rate" of desertification. The quantitative results of these assessments came under question on the basis of quantitative methodologies and the utility of expressing aspects of desertification in terms of global percentages. Under the recent treaty on desertification, references to quantitative measures have diminished. New desertification indicators focus, not on measuring the physical extent of degradation, but on assessing institutional capacity and gender issues.

Visual Representation

As discussed in *Chapter 5*, maps constitute one of the most important forms of visual representation in the desertification case. Maps were a particularly powerful means for creating, supporting and altering global images of desertification and varied ideas about whose vision counts. Processes of map-making and maps themselves have evolved with changing perceptions of desertification. Maps portray not only beliefs about the geographical extent of desertification, but also assumptions about its causes, impacts and remedies, and who has the authority to define and interpret them.

Visual representations provide snapshots of desertification at different points in time, and therefore serve as excellent indicators for tracing and interpreting this evolution. During the 1920s and 1930s photographs and maps of the colonial researchers depicted colonial territories and often showed the personal perspectives of the researchers as seen through the lens of a camera or illustrated in their routes through the countryside. Pictures and cartographic representations of desert encroachment and other forms of degradation reflected relationships between France and Britain, perceptions of human-environment interactions and colonial attitudes toward the African peoples. During the

1970s interest in advancing deserts resurfaced with concern about the West African drought of 1968 and 1974. Although UNEP helped to sponsor a study of what was believed to be a southwardly advancing Sahara in 1975, the agency never published this analysis. It did not conform to the new vision of desertification emerging in preparations for the 1977 Conference on Desertification. As part of these preparations, several international agencies developed a *World Map of Desertification*. In contrast to maps of Saharan encroachment in West Africa, the *World Map* emphasized the global extent of desertification, the use of standardized measures in assessing it, and the role of land use in causing degradation. This map played an important role in helping to legitimate desertification as an international issue. In 1992 the *World Atlas of Desertification*, created by a number of UNEP consultants, marked a more complex and pluralistic vision of the desertification problem. Instead of a single world map, the 69-page *Atlas* contained global, continental and case study maps, based, in part, on local observation and the knowledge of local experts. The *Atlas* received little attention during negotiation of the *Convention*. Other forms of visual representation seem to be replacing the role of maps in policymaking contexts for desertification. Photographs appear on the Secretariat's web page and documentary films about desertification and a new desertification logo seem to reflect attempts on the part of the United Nations system to popularize the desertification issue.

Implications

Chapter 6 reflects on some of the theoretical and practical implications of this analysis as they relate to global environmental politics in general, as well as to ongoing activities in the desertification regime. Following a review of authorization, inscription and boundary work, the chapter reflects on how analysis of these processes might inform and enlighten science and international environmental policymaking.

CHAPTER 2

Desertification in Historical Context

Dryland degradation defies a singular definition. For better or worse, desertification's plurality has become its hallmark. Nearly every article or book written about the issue reminds us that the desertification concept has acquired more than 100 different meanings over the past several decades.[28] However, despite a cacophony of perceptions regarding desertification, its lifetime as a scientific and political concern has been punctuated by moments of relative clarity. Intergovernmental agreements on desertification have marked these moments, by forging some degree of consensus about what dryland degradation is and what should be done about it. Still, each stabilization of the desertification concept has proved fleeting. Every attempt to address desertification at the international level has generated a new interpretation of what it is, how it happens, and how people should respond to it.

As briefly described in Chapter 1, this study organizes desertification's recent history into four eras: colonial, modernist, internationalist and pluralist. The present chapter provides a more in-depth account of these changes, and situates them in a broader historical context, introducing the major agreements, individuals and institutions that comprise the story. As described below, each era reflects a different policy regime and corresponding ideas about the nature of desertification, its causes and remedies. The colonial period of the 1920s and 30s centers around the Anglo-French Forestry Commission and its response to the claims of British forester E. P. Stebbing. The modernist period commenced after World War II and continued throughout the 1970s, ending with creation of the United Nations Conference on Desertification and the resultant *Plan of Action to Combat Desertification* (PACD or the *Plan*). The internationalist period during the 1980s and early 1990s, encompassed both modernist perspectives of the 1970s and new visions of desertification emerging in the 1990s.

[28] Glantz and Orlovsky (1983) and Verstreate (1986) documented a number of meanings ascribed to desertification in the scientific and policy literatures. These varied meanings are often the target of critics contending that desertification is an ill-defined term and problematic as the subject of research and policy.

Manifestations of this period include several UNEP desertification assessments and "Managing Fragile Ecosystems: Combating Desertification and Drought," Chapter 12 of *Agenda 21*. The pluralist era encompasses most of the 1990s. This study focuses on a period beginning in the fall of 1992 and June 1994, when the Intergovernmental Negotiating Committee on Desertification completed the *Convention to Combat Desertification* (CCD or the *Convention*).

2.1 Environment and Empire: Dryland Degradation in Colonial West Africa

Many contemporary ideas about dryland degradation began to take shape in colonial West Africa. As European powers settled the African frontier seeking to profit from the land's natural resources, scientists and administrative officials examined the viability of these resources and their supporting environment.

2.1.1 *Historical Context*

Understandings of dryland degradation in the early twentieth century reflected paternalistic attitudes toward the African people and heavy reliance on scientists and other specialists within colonial administrations. The imperial powers aimed to settle and develop the African landscape and to derive profit from its varied and abundant natural resources. They viewed this, in part, as an effort to "civilize" African peoples and transfer European ways of life to the so-called dark continent. Geographers, botantists, agriculturalists, and other specialists often served as explorers. They forayed into uncharted territory to examine the countryside and assess its natural resource potential. It was out of these explorations that concern for West African dryland degradation emerged.

Colonial administrations of the early 1920s and 1930s originated in the late 1800s. The Berlin Conference of 1885 was the beginning of the end of decades of European quarrels about African imperialism. In marking out their "spheres of interest" the major powers of France, Britain, Germany, and smaller countries such as Italy, Portugal, Belgium and Spain agreed to invade and overtake Africa without fighting each other (Davidson, 1989). Much of West Africa was partitioned among Britain and France in the late 1800s. By 1914, France occupied nearly the whole of West Africa in and around the Sahara. Britain held Nigeria, the Gold Coast, Sierra Leone and Gambia, with Liberia remaining an independent country and a few smaller coastal countries belonging to Germany and Portugal. France and Britain imposed markedly different forms of governance. France adopted a centralized form of direct rule. Britain opted for a system of indirect rule, allowing its governors far more autonomy than their French counterparts.

Their success in World War I strengthened the colonial powers and invigorated their hold over the African colonies. As Europeans recovered from the War during the 1920s, they also completed their pacification objectives on African soil. When they were satisfied they had subdued warring factions in Africa, the colonial powers began to replace military governments with civilian administrations. West Africa had very few European settlers, largely because the climate was thought to be unhealthy for Europeans. Consequently, European rule in these regions took the form of a hierarchy in which European officers assumed executive positions and African men served as their underlings. French West Africa, for example, was divided into 118 districts, each governed by a French district officer. In 1938, approximately 380 British officers governed 40 million inhabitants of northern Nigeria. An additional 1200 or so British officials worked in various civil service departments such as those for medicine and agriculture (Davidson, 1989).

2.1.2 *Debating Degradation: Progressive Desiccation, Advancing Deserts and Shifting Cultivation*

Major scientific debates in the early 1900s concerned the theory of progressive desiccation. According to proponents of this theory, large-scale climatic changes were increasing West Africa's aridity and contributing to a southward movement of the Sahara desert. In 1937 and 1938 members of an Anglo-French Forestry Commission investigated scientific studies claiming progressive desiccation was occurring in West Africa. As part of their study, the Commission offered policy recommendations concerning dryland management. In doing so, they spoke to several ongoing debates about the maintenance and utilization of West Africa's environment. Unlike many progressive desiccationists who saw West Africa as threatened by transnational forces of nature, largely out of human control, the Commission dismissed progressive desiccation theory and interpreted

West Africa's problems as local and anthropogenic. Commissioners rejected claims of increasing aridity and focused instead on the role of shifting cultivation practices as responsible for environmental damage. To remedy the problem the Commission prescribed the introduction of European-style permanent agriculture and insisted that well-coordinated offices of natural resource management oversee forest reserves.

Desiccation was a broad term with multiple meanings. As the forester, E. P. Stebbing commented,

> Many conflicting opinions exist upon this word desiccation; and some, even those who have dwelt in contact with it, have frankly said they did not understand what was meant or implied (Stebbing, 1937b: 15).

In general, however, "progressive desiccation" referred to a purported trend of increasing aridity and environmental degradation in West Africa. Scientists used desiccation to explain various phenomena observed throughout West Africa. These phenomena included shrunken streams, lowered water tables, decreased vegetation, desert encroachment, and human migrations. However, observers disagreed as to which of these symptoms actually existed and what causal mechanisms were responsible for the degradation. The following discussion highlights debates about West African degradation and their culmination in a stand-off of sorts between forester, E. P. Stebbing, and the Anglo-French Forestry Commission.

Proponents of progressive desiccation theory (Hubert, 1920) believed that climatic changes in West Africa were causing the region to become increasingly arid. In 1904, for example, the French Government appointed a mission to continue previous investigations into reports of increasing aridity and desiccation. As evidence of continued deterioration, mission participants noted archeological remains of higher cultures and old irrigation systems that had fallen out of use. They also spoke with inhabitants of the area who recalled more prosperous periods and reported ongoing decay in more recent years.[29] Henry Hubert, a French geologist, was widely cited for desiccation research he performed in Senegal. This research, he claimed, supported the theory of progressive desiccation and suggested that large-scale climate changes were

[29] See Touchard (1907) and Bovill (1921) for accounts of these studies.

primarily responsible for depletion of water and vegetation in West Africa. According to Hubert (1920), the first twenty years of the twentieth century exhibited the most marked decrease in humidity, prompting drying up of rivers and wells, increased salinity in river waters, and the encroachment of the Sahara on the Sudan.[30]

Three geologists named Gautier (1908), Chudeau (1909; 1916), and Falconer (1911) challenged the desiccationists. J. D. Falconer, a government geologist, believed that the distribution of iron ore, the existence of fixed sand dunes in the northern provinces of Africa, and periodic rains indicated a return to more humid conditions. Chudeau (1916) claimed that lake levels were on the increase in the early 1900s and provided evidence that water was becoming more rather than less abundant. Gautier and Chudeau also opposed the theory of a southwardly moving Sahara. Based on analysis of eroded river beds, Gautier (1908) claimed that in the south of West Africa the steppe followed the desert, turning desert areas to vegetated land. Drawing on studies of dead dunes (dunes without vegetation), fossil dunes and drainage systems in the Sudan, Chudeau (1909) similarly claimed that the Sudan was encroaching on the Sahara, rather than the other way around.[31]

Debates about the manifestations and causes of progressive desiccation continued into the 1930s. At this time E. P. Stebbing published widely read accounts of environmental degradation in West Africa. E.P. Stebbing was one of the most prolific and well-known students of the West African environment. Stebbing, described as a sportsman-naturalist (*The Geographical Journal*, 1935), was in the Indian Forest Reserve before becoming Professor and Head of Forestry at the University of Edinburgh. He sided with the desiccationists in forecasting increasing aridity and a southwardly advancing Sahara. After a trip to Niger and northern Nigeria in March-April 1934, he published numerous books and articles. He noted several signs of degradation and desiccation including de-vegetation, deforestation, decreasing water levels (e.g., in Lake Chad) and desert encroachment. The image of advancing deserts served as a title for many of Stebbing's books and articles, such as "The Encroaching Sahara: The Threat to

[30] Bovill (1921), Edwardes (1919), and Tilho (1914; 1920) reported similar findings.
[31] Jones (1938) provides further discussion of these findings.

the West African Colonies" (1935); "The Threat of the Sahara" (1937b), and "The Man-Made Desert in Africa: Erosion and Drought" (1938).

Stebbing portrayed the Saharan encroachment issue as one that transcended political boundaries by affecting two of the world's "big Powers" (Stebbing, 1935: 518). He suggested that Britain and France sponsor research to explore desiccation and desert encroachment. The Nigerian Government and the Administration of the French Niger Colony established a Commission to investigate Stebbing's claims. As discussed in Chapter 3, the commissioners rejected the notion that progressive desiccation threatened West Africa. They similarly dismissed Stebbing's claim of an advancing Sahara. In response to the Commission's report and other critiques, Stebbing retracted his claims of advancing deserts and colonial administrations continued with their respective national land use management schemes.

2.2 Global Problems and Global Knowledge: Science, Development and Desertification

The lively forestry debates of the colonial era quieted during the 1940s as World War II captured the attention of European powers and began to transform their colonial empires. Not until the 1950s did widespread interest in African drylands revive. New research into arid regions accompanied the initial stages of African decolonization, the first inklings of global environmental consciousness, and increasing attention to worldwide economic development. Activities of this period culminated in a major international conference and policy agreement -- the 1977 United Nations Conference on Desertification and its *Plan of Action to Combat Desertification*. According to the *Plan*, desertification was an urgent, and "spreading" threat to economic prosperity in dryland regions. The *Plan* justified international cooperation on the issue based on desertification's physical extent, monetary costs to the international community, and the need for North-South transfers. *Plan* authors saw climate as an important factor in desertification processes. However, they perceived desertification not as a natural hazard, but as a problem arising primarily from irrational human land use practices. Policy remedies focused on "proximate solutions" based largely on the application of science and technology to "improve" land use and support development objectives.

2.2.1 *Historical Context*

Modernist approaches to desertification policy were deeply intertwined with post-World War II transformations in international governance, development and environmental policy. Activities in these areas reflected broadening relationships between North and South, increasing reliance on science and technology as keys to the world's prosperity, and a growing belief in global environmental stewardship as a focus of international cooperation.

Decolonizing Drylands

The war ushered in a new global order when a depleted Europe could no longer maintain its colonies. As Africa began a twenty-year road to independence beginning in the 1950s, its welfare increasingly became the responsibility of the international community at large, rather than the concern of specific colonial powers. Industrialized countries adopted "third world" development as an international objective and regarded science and technology as tools necessary for its attainment (Shinn et al., 1997). Themes of science and development were similarly evident in international programs devoted to drylands research. Projects involving basic scientific research were aimed at standardizing analysis and universalizing understandings of dryland regions. Environmental protection, after emerging on domestic agendas in many industrialized countries during the 1960s, became the subject of a major international conference in 1972. These developments provided a backdrop for the Desertification Conference and provided seeds for many of the ideas at the heart of the 1977 *Plan of Action.*

Desertification linked forestry investigations of the colonial era to international science initiatives of later decades. A. Aubreville, a French forester, is widely credited with coining the term desertification in a 1949 publication.[32] Aubreville prepared cross sections of latitudinal vegetation zones in West Africa and concluded that destruction of forest and savanna zones was taking place (Aubreville, 1949; Mortimore, 1989). According to Aubreville,

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[32] Those who credit Aubreville with inventing the term "desertification," include: Mortimore (1989), Verstraete (1986), Odingo (1990) and Stiles (1995).

> ce sont des déserts qui naissaent aujourd'hui, sous nos yeux, dans les pays où il tombe cependant annuellement de 700 à plus de 1500 mm de pluies (Aubreville, A. 1949 Climats, forets et désertification de l'Afrique tropicales, Societé d'Éditions Géographiques et Coloniales, Paris).

Aubreville claimed that new deserts were emerging in regions where the annual rainfall ranged between 700 mm to 1,500 mm. He labeled the process of desert creation "desertification" and linked it with certain rainfall conditions. Like the Anglo-French Forestry Commission, Aubreville suggested that humans were primarily responsible for the formation of new desert regions. He attributed these changes to burning, clearing and erosion and likened them to a skin disease, or "leprosy" spreading over the face of Africa (Aubreville, 1949, as translated in Mortimore, 1989: 14).[33]

Aubreville's findings appeared just as major changes were remaking international relations. The colonial powers were about to begin withdrawing from their colonies as international institutions began to provide new contexts for North-South interactions. Whereas development and aid programs for Africa formerly provided vehicles for colonial expansion (e.g., The British Development and Aid Plan of 1929), "third world" development after World War II generally fell to international organizations such as the United Nations and the World Bank. These institutions sought to foster economic security and prosperity in developing countries, often via the application of science and technology. In 1965, the United Nations Development Programme (UNDP) evolved out of United Nations Technical Assistance Programme of the late 1950s. Science and technology continued to be an important piece of UNDP's agenda and central to development efforts throughout the UN system (Rittberger, 1982).

Globalizing Drylands

Interest in Aubreville's ideas and in dryland environments persisted throughout this shuffling of world order. In 1951 development, science and drylands came together as the focus of a major international science initiative sponsored by the United Nations Educational, Scientific and Cultural Organization (UNESCO). The Arid Zone

[33] Several papers by Chavelier in 1950 relayed the same doomsday message that adherents of progressive desiccation relayed in the 1920s and 1930s (see Mortimore, 1989).

Programme was one of only a handful of arid studies research programs at the time, and its members included natural scientists from many regions of the world. The Programme's general practice was to develop a state-of-the art report on a given subject and follow it with an international symposium devoted to the same topic (Batisse, 1985). Although furthering development goals was purportedly one of the Programme's overarching objectives, its activities focused primarily on basic research. Research topics included arid zone hydrology; plant ecology; human and animal ecology; climatology and microclimatology; and plant-water relationships. As evidenced by these titles, the link between scientific knowledge and practical application was often tenuous. Program participants were content with advancing scientific understanding of drylands under the assumption that such knowledge would ultimately be useful in addressing the practical challenges of arid environments

The work of the Arid Zone Programme played a major role in depicting drylands as a global phenomenon. Experts identified climatic and physical characteristics of drylands, exploring their similarities and differences throughout the world. Researchers also assessed the nature and extent of arid lands and produced widely-used and cited maps of aridity and arid regions. By standardizing dryland characteristics and showing worldwide commonalities of dryland soil, climate and vegetation, the Programme emphasized the universality of drylands, largely erasing associations between local dryland features and specific settings in Africa, Asia, and the Middle East.

These endeavors coincided with a de-politicization of dryland research. Studies through the 1930s were heavily tied to the advancement of colonial interests through cultivation of profitable natural resources, "taming" of indigenous populations, and settlement of colonial frontiers. In contrast, the Arid Zone Programme, under the UN umbrella, framed dryland issues as primarily scientific, thereby de-emphasizing political motivations that had so dominated earlier dryland analyses and interpretations. The reference to Arid *Zone*, for example, forgoes mention of particular jurisdictions or territories, implying that drylands constitute a politically neutral concept. Reference to "zone" in the singular (rather than "zones") further emphasized the framing of aridity as a universal phenomenon.[34]

International Interest in the Biosphere

The Arid Zone Programme continued for thirteen years. But with burgeoning environmental consciousness in many industrialized countries, the program's focus on aridity soon seemed too narrow.[35] With a broader conceptualization of environment and new initiatives aimed at development, not only in drylands, but in countries inhabiting all climates, the Arid Zone Programme and a newer, parallel program regarding the humid tropics merged with a new natural resource program in late 1964.[36] This program, a Natural Resources Research Advisory Committee, coincided with commencement of the International Hydrological Decade, an event focused largely on water resource issues in developing countries.

These changes occurred as a new environmentalism took hold in the 1960s. This movement accompanied newly popularized concern for chemical pollution, overexploitation of natural resources, and population growth. Rachel Carson's popular and highly influential *Silent Spring* (1962), for example, revealed the dangers of pesticide use and their harmful impacts on human health. Her work is widely credited with inspiring high level investigations into environmental degradation within and outside of the United States.

As a more holistic vision of humans and their natural surroundings emerged in popular literature and politics, UNESCO's activities underwent similar transformations. On the foundations of the Arid Zones Program UNESCO, in 1968, erected its Man and

[34] The term "zone" referred to, not only the land of arid regions, but also the flora, fauna, and climate of these regions.

[35] Caldwell (1996) cites Canada, France, Japan, Sweden, Germany, the United Kingdom and the United States as having active citizen groups lobbying for environmental protection and improved environmental quality at this time.

[36] According to Michele Batisse, the Arid Zone Programme marked the first attempt to focus international scientific resources on a worldwide development problem. "At the same time, however, the experience acquired under the Arid Zone Program had shown that most bottlenecks to development were not so much linked to aridity per se as to the way scientific research was conducted and its results, applied or not applied, and to the broader problem of evaluation, utilization and conservation of natural resources. It had also become clear that the availability of water resources in adequate quantity and quality, which was, of course, the central concern in all arid areas, was in fact a worldwide problem requiring a bold and worldwide approach" (Batisse, 1985: 23).

the Biosphere Programme. Unlike its predecessor, the Biosphere Programme addressed all types of climates, ecosystems, and social systems, rather than only those confined to arid regions.[37] This broadening focus of UNESCO's environment initiatives coincided with growing concern for the planet's fragility. Studies of the late 1960s and early 1970s warned that overpopulation and overexploitation threatened to deplete the earth's resources. In *The Population Bomb*, Ehrlich (1968) examined population growth in the context of disparate consumption patterns. He demonstrated that the consumption rate of Americans, for example, far exceeded that of their counterparts in developing countries and in many developed countries as well. In *The Limits to Growth*, Meadows et al. (1972) argued that economic stagnation, population growth, the arms race, and environmental degradation were heading the world's inhabitants toward a perilous future. They asserted that industries would outstrip the earth's carrying capacity and that extensive restructuring of developed country economies was necessary to circumvent their demise.

Governments began to view environmental protection and natural resource use as international, as well as domestic issues. Unfortunate events of the early 1970s seemed to fulfill dire prophesies of the analysts, vividly illustrating environmental interdependence across national borders. In the early 1970s, a world grain shortage threatened food security. Drought and winter snowcover in the Soviet Union (USSR) resulted in crop failures and prompted the USSR to buy large amounts of grain from the world's markets, leading to a crisis in world grain trade. Weather-related problems in the U.S., Canada and Australia decreased production of wheat, corn and soybeans just as demand for surpluses in these crops was greatest (Rockefeller, 1976). Catastrophic drought and famine in much of West Africa were particularly important to international initiatives regarding desertification. This drama caught the attention of people worldwide, as television reports carried pictures of emaciated children and parched landscapes into living rooms throughout the world. Media coverage made West Africa's

[37] An expert committee appointed by UNESCO originally considered an Indian proposal that UNESCO establish an international institute focused on arid regions. The committee rejected this idea explaining that conditions were not favorable for such an institute, but instead recommended creation of an international arid zone research council, which led eventually to an Advisory Committee on Arid Zone Research, and finally, in 1951, to the Arid Zone Research Programme. At its inception the Programme had a budget of just $14,000. By 1960, this budget reached over $300,000 per year, not including staff expenses and extrabudgetary funds (Batisse, 1985).

problems highly visible and emphasized the international dimensions of devastation and relief. Amidst these calamities, international environmental cooperation took the form of a major United Nations initiative. The United Nations Conference on the Human Environment (UNCHE) took place in Stockholm in 1972. This Stockholm Conference drew 1200 delegates from 114 countries who set out to forge a global partnership to improve the human environment, curtail the arms race and prevent a population explosion (Elliott, 1998).

The Stockholm Conference established a non-binding declaration, an action plan, and an institutional framework for addressing environmental issues. The Stockholm Declaration contained 26 principles aimed at balancing development objectives with environmental protection. The Action Plan consisted of 109 recommendations on topics including human settlements, pollution, development, and social impacts of environmental degradation. Like UNESCO's Arid Zone Programme the Stockholm Plan prescribed an international, research-based approach to soil management issues. The research agenda focused almost exclusively on standardization and analysis of physical and climatic elements of soil degradation processes. Recommendation 20 called for the "acquisition of knowledge and transfer of experience on soil capabilities, degradation, conservation and restoration..." (UNCHE, 1972: Recommendation 20). In noting preparations at FAO and UNESCO for a Soil Map of the World, Recommendation 20 called for creation of international criteria and methodologies for soil assessments. Several references to information exchange stressed the need for data regarding physical and climatic parameters such as vegetation, soil, and climate. The few references to social aspects of land management focused narrowly on agricultural practices and inadequate pricing of agricultural resources.

Stockholm also set in motion the process by which the UN General Assembly established the United Nations Environment Programme (UNEP), which later became the leading international organization regarding desertification issues. This Programme continues to serve as coordinator and catalyst,[38] of a wide range of environmental initiatives. By situating UNEP's headquarters in Nairobi, Kenya, UNEP's founders

[38] According to Elliott (1998), UNEP was given a limited mandate because existing UN agencies were jealous and developing countries were opposed to a powerful agency that might restrict their development.

aimed to both symbolize concern for developing country environments, as well as facilitate a greater role for these countries in environmental policymaking.

2.2.2 *Desertification as an International Policy Issue*

Pre-Stockholm deliberations contained the seeds of the United Nations Conference on Desertification. As part of the Stockholm process, African countries raised the problem of desert creation in international forums and ultimately inspired the 1977 *Plan of Action to Combat Desertification*. As discussed below, the *Plan* set forth new ideas about the nature of desertification, and its global dimensions, causes and remedies. In many respects the *Plan*'s provisions were emblematic of prominent trends in international environmental politics. According to the *Plan*, desertification posed a threat to international development. It affected lands throughout the world, arose from irrational land use practices, and was knowable and solvable through the use of scientific methodologies. This interpretation of desertification as a universal problem arising from a singular cause seemed ready-made for the international policy prescriptions set forth in the *Plan*, namely improvements in land management aided by the transfer of modern science and technology to affected areas.

From Advancing Deserts to Desertification

The *Plan of Action* emphatically denied any connection between desert encroachment and desertification. However, references to advancing and spreading deserts remained a tenacious feature of early multilateral efforts to develop dryland policy. Such references, for example, appeared in many international resolutions of the early 1970s. In August 1971, the first All-African Seminar on the Human Environment convened under the auspices of the Economic Commission for Africa (ECA). Their task was to plan for the upcoming Conference on the Human Environment. Much of the discussion concerned the drought and the difficulties of getting financial support to address it. However, in addition to resolutions on drought, the seminar recommended measures intended to "combat the spread of deserts in Africa" (UNCOD Secretariat, 1977: 6). This caught the attention of the ECA Conference of Ministers who noted the problems of desertification in resolution 264 (XII) and urged that the ECA collaborate with the international community in seeking solutions (UNCOD Secretariat, 1977: 6).

As UN agencies and the UN General Assembly attended to problems of drought and desertification, desert encroachment was frequently cited as an important issue. For example, Governing Councils of the United Nations Development Programme (UNDP) and the United Nations Environment Programme called for studies of drought and action plans to "check the spread of desert conditions" (UNCOD Secretariat, 1977: 6). In June, 1973, and again the following March, UNEP's Governing Council issued several decisions under the heading of "Land, water and desertification." In these decisions the Governing Council requested UNEP to help countries control the loss of productive soil caused by erosion, desertification and laterization and to offer help with land reclamation. The Council asked that UNEP give special priority to "arresting the spread of deserts," and alloted 1 million dollars of its budget for the "land,water and desertification" issue area (UNEP Governing Council Decision, June 22, 1973). During this period, UNGA passed Resolution 3054 (XXVIII), "Consideration of the Economic and Social Situation in the Sudano-Sahelian Region Stricken by Drought and Measures to be Taken for the Benefit of that Region." In this resolution the UNGA requested the UNEP Governing Council to "give priority to the search for a medium-term and long-term solution to the problems of desert encroachment in the countries bordering on the Sahara and other areas with similar geographical conditions."

By December of 1974 UNGA stepped up its efforts to formulate international policy on drylands. At this time, however, UNGA referred to "desertification," rather than "desert encroachment" in prescribing international activities. UNGA also focused on desertification to the exclusion of drought. In its resolution 3337 (XXIX) of December 12, 1974, the General Assembly initiated "International Co-operation to Combat Desertification." This decision would later prove to be key in establishing desertification as a global environmental problem requiring a multilateral policy response. In particular, the resolution called for an intergovernmental conference on desertification and a plan of action comprised of anti-desertification measures. In launching one of several international, post-Stockholm conferences,[39] the resolution made no mention of the advance or spread of deserts.

As discussed in Chapter 3, the United Nations Environment Programme, in its capacity as Conference Secretariat, organized an intensive two-year assessment process in preparation for the Conference. This process generated several assessment reports and maps aimed at characterizing the desertification problem and prescribing its remedies. The Secretariat then prepared an initial Draft *Plan of Action to Combat Desertification* (draft *Plan*) and circulated it among governments, UN agencies, researchers and others in August 1976. In January 1977, the Secretariat completed a second draft *Plan* and presented both the draft *Plan* and accompanying scientific studies at four regional meetings.[40] The Conference itself took place from August 29 to September 9, 1977.[41] Approximately 500 delegates from 94 countries convened in Nairobi Kenya to negotiate the final *Plan of Action to Combat Desertification* (UNCOD, 1978).

The Plan of Action to Combat Desertification

The *Plan* consisted of twenty-eight detailed recommendations concerning a range of topics including land management, strengthening of science and technology and international cooperation.[42] Like previous resolutions, the *Plan of Action* portrayed desertification as an urgent and global threat to land productivity and ultimately to development. Its policies were aimed at maintaining and enhancing dryland productivity by preventing desertification or by reclaiming land that had been desertified.

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[39] Several agreements on oceans, international trade in endangered species, and long-range transboundary air pollution dealing with oceans were completed during this period. The UN also convened a number of international conferences. These included, the World Food Conference (see Biswas and Biswas, 1975), a United Nations Water Conference (see Biswas, 1977), and a World Population Conference (see Biswas and Biswas, 1974).

[40] The regional preparatory meeting for the Americas was held from February 23-25, 1977 in Santiago, Chile. A regional meeting for the Mediterranean area took place in Algarve, Portugal from March 28 to April 1, 1977. A regional meeting for Africa, South of the Sahara was held from April 12-16 in Nairobi, Kenya. The regional meeting for Asia and the Pacific took place from April 19-22 in New Delhi, India (A/CONF.74/33/Add.1).

[41] Despite references to impending disaster, the Nairobi negotiations in 1977 took place during a period of abundant rainfall. Indeed for a few years, the drought appeared to be subsiding – so much that some observers attributed the later failure of UNCOD financing and policy implementation to increased rainfall levels.

[42] The *Plan* was published in 1978 along with a "Round-up of the Conference" which provided a brief history of Conference preparations along with background information on desertification processes. Resolutions adopted by the Conference and a summary of associated activities also appeared in this publication.

The *Plan* distinguished desertification from advancing deserts and portrayed desertification as a threat to economic development worldwide. Desertification, as defined in the *Plan*, was:

> ...the diminution or destruction of the biological potential of land, and can lead ultimately to desert-like conditions. It is an aspect of the widespread deterioration of ecosystems, and has diminished or destroyed the biological potential, i.e. plant and animal production, for multiple use purposes at a time when increased productivity is needed to support growing populations in quest of development (UNCOD, 1978: 7).

This definition stressed the economic valuation of land and a vision of desertification as an obstacle to international development. The focus on dryland "productivity," and "prosperity," reflected a view of the environment as first and foremost a resource, necessary for economic growth.[43] References to the profitability of anti-desertification measures elsewhere in the Conference report (see UNCOD, 1978: 1) portrayed desertification as cause for international cooperation largely because it thwarted a singular, universal quest for prosperity. This portrayal implied that development was an unproblematic goal, closely aligned with western, market-based notions of progress. The *Plan*'s vision of development as a monolithic and unquestioned good helped to situate desertification as a universal bad, an enemy that the international community should "combat."

Regarding the process of desertification, however, the *Plan* diverged from preceding policy resolutions. The *Plan* drew on the findings of pre-Conference scientific assessments in differentiating desertification from advancing deserts. A 1977 case study of Aghazer and Azawak in Niger, for example, stated that:

> Desertification does not...mean a steady encroachment by the Sahara; it is not a front whose advance can be calculated over the last 40 years. Desertification happens at particular points; *it is patchy, not linear* (A/CONF.74/14: 92; Walls, 1980: 137).

[43] This view of desertification is reminiscent in Garrett Hardin's "Tragedy of the Commons." In his piece in *Science* (1968), Hardin drew an analogy between overexploitation of English commons and unrestricted use of marine and atmospheric resources in the context of overpopulation. He argued that without individual land tenure, commons users have an incentive to overuse the resource for personal gain. He predicted that the commons would ultimately be enclosed, thereby indirectly resulting in enforced limits on population growth.

A similar interpretation of desertification made its way into the final Conference report. A preface to the *Plan of Action*, made a sharp distinction between desert encroachment and desertification.

> Deserts themselves are not the sources from which desertification springs. Except for hot winds, the deserts themselves supply none of the essential impetus for the processes described. Desertification breaks out, usually at times of drought stress, in areas of naturally vulnerable land subject to pressures of land use. These degraded patches, like a skin disease link up to carry the process over extended areas. It is generally incorrect to envision the process as an advance of the desert frontier engulfing usable land on its perimeter: the advancing sand dune is in fact a very special and localized case. Desertification, as a patchy destruction that may be far removed from any nebulous front line, is a more subtle and insidious process (UNCOD, 1978: 5).[44]

In distinguishing between desertification and desert expansion, this statement broadened the geographical extent of desertification. Advancing deserts can presumably occur only in the presence of true or natural deserts. Because such deserts exist in a very limited number of places throughout the globe, instances of desert encroachment are similarly limited. Desertification, as divorced from the concept of spreading deserts, however, was relevant to a much larger and widely dispersed land area. Any land in arid, semi-arid and dry sub-humid climates was considered susceptible.

The distinction between desertification and deserts was one of many ways in which the *Plan* portrayed desertification as a global phenomenon. Other global dimensions of desertification concerned its physical extent, costs to the international community, and the North-South transfers necessary for its amelioration. For example, statistics and maps prepared for the Conference highlighted the worldwide geographic scope of desertification.

> ...problems of desertification are larger, more widely shared, and require greater and longer term action than expected...desertification is not a

[44] Mention of "growing populations" in this definition is reminiscent of the environment and population studies of the late 1960s and early 1970s that warned against overexploitation and overpopulation. A similar element of crisis seemed to pervade the Plan as its authors noted a "well-founded sense of danger" (UNCOD, 1978: 1), and called for urgent implementation of policy measures.

> problem that concerns just a few countries. Based on climatic data, more than a third of the earth's surface is desert or semi-desert and more than 15 per cent of the world's population live in these areas" (UNCOD, 1978: 1).

The *Plan* referred to the *World Map of Desertification* as illustrative of the distribution and intensity of the problem (see Chapter 5). Statistics and cartography (see Chapters 4 and 5) were useful in portraying desertification as a universal problem and in standardizing its analysis. Maps and measures of desertification, for example, suggested that desertification could be diagnosed based on a small set of scientific criteria. Consequently, desertification, as addressed in the UNCOD context, appeared as a singular (rather than pluralistic) problem, common to many diverse areas of the world and amenable to universally applicable solutions.

Linking desertification with development was also important in portraying desertification as a global problem. The *Plan* emphasized costs that desertification posed to the international community on the whole, called for international cooperation in ameliorating degradation, and argued that anti-desertification efforts would benefit nations worldwide. According to the *Plan*, the costs of rehabilitation were rising exponentially and threatened irreversible damage to the world's land resources. To solve the problem it called for the transfer of knowledge, technology, and financial resources from developed countries to developing countries. Such transfers aligned with development practices. The *Plan* referred to the interdependence of desertification and anti-desertification activities, noting that "efforts to combat desertification must be part of a broad programme for promoting social and economic progress" (UNCOD, 1978: 7). All of these features of the *Plan* suggested that desertification was a problem of worldwide proportions, requiring remedial measures based on international cooperation.

2.3 The Internationalist Era: Evaluation and Critique

The 1980s was a decade of evaluation and critique in the arena of international desertification science-policy. Many international organizations and individual scientists spoke out about the meaning of "desertification," prospects for its amelioration, and its validity as a policy issue. When assessments indicated a desertification problem on the rise, UNEP, the agency in charge of PACD implementation,[45] re-visited some of the *Plan*'s underlying principles. Outside of UNEP, remote sensing methodologies provided new insights into land degradation and researchers in areas such as rangeland ecology and cultural anthropology pioneered new approaches to drylands management. Some criticized UN policy approaches, while others questioned the very existence of a desertification problem. Much of this work seemed destined to wipe desertification (at least as formerly conceived) from the international agenda. Yet, by the early 1990s the issue was once again on the international negotiating table. Working within an emergent "sustainable development" framework, participants in the United Nations Conference on Environment and Development (UNCED) agreed to a new definition of the issue and a slightly modified set of causal factors. However, in keeping with the *Plan of Action*'s technocratic approach, UNCED participants emphasized the global dimensions of the desertification problem and offered policy prescriptions reminiscent of those set forth at the 1977 Conference.

2.3.1 *Historical Context: UN Evaluations*

Changes in desertification policy followed on several years of UN-sponsored studies. The *Plan of Action* specified 1984 as the year in which UNEP should conduct its first evaluation of the *Plan*'s implementation. At the request of UNEP's Governing Council, a similar assessment was completed in 1991 and presented to the United Nations Conference on Environment Development (UNEP, 1991). The intervening years saw numerous, smaller scale studies performed by UNEP and other intergovernmental organizations. They measured progress in the anti-desertification campaign in terms of the worldwide land area affected by desertification and rates at which desertification was overtaking new areas. Some assessments, such as the *Provisional Methodology for Assessment and Mapping of Desertification* (FAO and UNEP, 1984) and *Desertification Revisited, Proceedings on an Ad hoc Consultative Meeting on the Assessment of*

[45]UNEP was charged with coordinating and evaluating PACD implementation. To assist UNEP, the United Nations established the Inter-Agency Working Group on Desertification (IAWGD), the Consultative Group for Desertification Control (DESCON), and a special account for financing desertification. UNEP and UNDP also undertook a joint venture under the United Nations Sudano-Sahelian Office to assist the Sudano-Sahelian region of Africa. Affected countries, however, had major responsibility for implementing the PACD (UNEP, 1991: xiv).

Desertification (Odingo, 1990a) aimed at developing new methodologies to facilitate standardized measurement of desertification processes.

Virtually all of these studies contended that efforts to implement the 1977 *Plan of Action* did not meet expectations. UNEP's *General Assessment of Progress* (1984) argued that desertification was continuing to "spread and intensify" (UNEP, 1984: 5).[46] In 1987 Mostafa Tolba remarked,

> Where are we ten years after UNCOD? It grieves me to say it, but more land and, tragically, more people are affected by desertification today than in 1977 (Tolba, 1987: cover page)

In the face of failed anti-desertification efforts, UNEP set up expert panels and assessment programs to investigate obstacles to the *Plan*'s implementation and to critically evaluate the ways in which the *Plan* defined and addressed the desertification problem. On the whole, UNEP-sponsored analyses continued to portray desertification as problem of global extent, arising from human land use, and amenable to scientific measurement and technological remedies.

At the same time, however, many of the assessments began to evolve new perspectives on desertification. In 1990, UNEP convened an expert panel to, among other things, evaluate the definition of desertification (Odingo, 1990b). Based on studies and discussions, this panel defined desertification as land degradation resulting from adverse human impact. Land degradation was said to imply:

> ...reduction of resource potential by one or a combination of processes acting on the land. These processes include water erosion, wind erosion and sedimentation by those agents, long-term reduction in the amount or diversity of natural vegetation, where relevant, and salinization and sodication (Odingo, 1990b: 3).

This definition, unlike that presented in the *Plan of Action*, did not link desertification to advancing deserts or the spread of desert-like conditions. Neither did this definition refer

[46] In 1984 several articles appeared in *Environmental Conservation* detailing the assessment's findings. Their authors had served as science advisors to the 1977 Conference Secretariat and included Mabbutt (1984) and Dregne (1984).

to ignorance or irrationality on the part of affected populations. The reference to "adverse human impact" was considerably more neutral.

During the following year, as part of the 1991 assessment, UNEP further revised the meaning of desertification for submission to the UNCED process. This study defined desertification as,

> land degradation in arid, semi-arid and dry sub-humid areas resulting *mainly* from adverse human impact (UNEP, 1991: 2).

The word "mainly" suggested that other causal factors were at work. These factors included climate fluctuations and soil resilience. In fact, participants involved in the 1991 assessment debated the merits of identifying both climate and human factors as responsible for desertification. They decided to cite only human causes because these were the mechanisms most amenable to policy intervention. They also decided that reference to climate factors might distract attention from the implementation of concrete anti-desertification measures (Interview with UNEP Advisor 3).

2.3.2 *The United Nations Conference on Environment and Development*

In the arena of international environmental policymaking, desertification re-emerged in the context of "sustainable development." Vaguely-defined, yet widely used, this concept marked a more integrated approach to environment-development policy.[47] Previously, environment and development frequently appeared as two, mutually exclusive goals at the center of a strong North-South polarization. While many industrialized countries advocated environmental protection and conservation, most developing countries viewed this as a threat to their development, and perhaps an indirect strategy on the part of the North to perpetuate their own preeminence. In early 1983 the UN General Assembly established the World Commission on Environment and Development (WCED). The WCED, also named the Brundtland Commission after its chairperson, Gro Harlem Brundtland, Prime Minister of Norway, included 23 participants from 22 countries. More than half of these participants came from developing countries

[47] While the sustainable development concept has been generally accepted in international environmental politics, it continues to be the target of much criticism (see, for example, Elliott, 1998, pp. 183-191).

(Elliott, 1998). With its call for sustainable development, the Commission's report, *Our Common Future* (1987) emphasized complementarity rather than competition between environmental and economic priorities. The report addressed problems of population, food security, species and ecosystems, energy, industry and urbanization.[48] As indicated in the title of the Commission's report, it portrayed sustainable development as a shared set of challenges and opportunities, leading North and South jointly toward convergent rather than divergent futures.[49]

In regard to desertification, perhaps the most important of the WCED's legacies were plans for a second Stockholm-type meeting. The WCED report provided the basis for the United Nations Conference on Environment and Development (UNCED). This international summit on sustainability issues took place in Rio de Janiero in 1992. After three years of planning and preparation, the UNCED Conference produced *Agenda 21*, a statement of objectives intended to guide governments in leading an equitable and environmentally sound world into the twentieth century. *Agenda 21* addressed social and economic development; conservation and management of resources for development; the role of major groups (e.g., women, youth, and indigenous peoples); and implementation.

Chapter 12 of *Agenda 21* was "Managing Fragile Ecosystems: Combating Desertification Drought." Chapter 12 was similar to the *Plan of Action* in some respects, but also reflected many new perspectives on desertification and its remedies. Both the *Plan of Action* and *Agenda 21* portrayed desertification as a global problem. However, while the *Plan* defined desertification as a process leading to desert-like conditions, *Agenda 21* equated desertification with the more general phenomenon of "land degradation." Chapter 12 also departed from the *Plan* in identifying a broader set of causal factors. This chapter cited climatic variations as well as human activities as two of

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[48] In the WCED report, desertification once again appeared as an advancing desert phenomenon. In noting the low priority afforded to desertification, the Commission wrote: "The recent destruction of much of Africa's dryland agricultural production was more severe than if an invading army had pursued a scorched-earth policy. Yet most of the affected governments still spend far more to protect their people from the invading armies than from the invading desert" (WCED, 1987: 7). In a section entitled "Advancing Deserts," the Commission cited many of the statistics reported in UNEP's first General Assessment of Progress (1984). Interestingly, the Commission identified the causes of desertification as "a complex mix of human and climatic effects." It added that we have more control over human effects, implying that policies are best directed at land use practices, adverse terms of trade and social strife (WCED, 1987: 127-8).

[49] For example, the three major sections of the report are titled, "Common Concerns," "Common Challenges," and "Common Endeavors" (WCED, 1987).

many factors responsible for desertification, marking a broadening view of desertification processes.

Despite this new definition, however, several policy prescriptions in Chapter 12 were similar to those outlined in the 1977 *Plan of Action.* Both agreements, for example, emphasized scientific research and monitoring, changes in land use, and national action plans as key to eradicating desertification. In addition, however, Chapter 12 highlighted the importance of public participation and local knowledge. Overall, the Chapter outlined six categories of corrective activities: strengthening of the knowledge base, changes in land use activities, development and strengthening of integrated development programs for poverty eradication and promotion of alternative livelihood systems, anti-desertification programs integrated with national development plans and environmental planning, drought preparedness and drought relief schemes, and encouragement of popular participation and environmental education. Most importantly, Chapter 12 called for a new international treaty on desertification to be completed in 1994.

2.4 From the Bottom Up: Reinventing Problem and Process

As preparations and negotiations for the new treaty began there seemed to be an active attempt on the part of participants in the policy arena to distance the anti-desertification efforts of the 1990s from disappointing attempts of earlier decades. Drawing heavily on the UNCED themes of sustainable development and public participation, an international convention on desertification was completed in 1994. In several respects, the *Convention to Combat Desertification* departed from previous desertification policies. Instead of focusing solely on human land use, the treaty portrayed a more complex and holistic picture of desertification and its interaction with broader social and ecological systems. The *Convention* also suggested a new vision of desertification's global dimensions. Whereas previous agreements portrayed desertification as a uniform problem, global because of its geographic extent, the *Convention*'s regional annexes reflected pluralistic degradation processes, varying with climatic and human contexts. Remedies set forth in the *Convention* similarly departed from earlier policies in their emphasis on traditional as well as modern knowledge, in their strong support for local participation in nearly all facets of policy formulation and implementation, and in their focus on integrated solutions addressing at once, physical, biological and socio-economic aspects of desertification.

2.4.1 *A Brief Summary of Convention Negotiations*

The *Convention to Combat Desertification* followed close on the heels of the United Nations Conference on Environment and Development.[50] In October 1992, four months after UNCED, the UN General Assembly's Second Committee referred negotiations regarding UNCED and its follow-up to a working group chaired by Malaysian Ambassador Razali Ismail. Based on a draft resolution by the African Group, the working group agreed on a treaty objective and the format for the treaty negotiations. In titling the treaty, the working group determined that this agreement would aim "to combat desertification in those countries experiencing serious drought and/or desertification, particularly in Africa." They also agreed that one organizational session would take place in New York in early 1993, followed by five substantive sessions. Based on the same African resolution, the working group invited non-governmental organizations (NGOs) to contribute to the negotiating process (ENB:03:02; ENB:03:03), and called on the UN Secretary General to establish a "multi-disciplinary panel of experts to assist the ad hoc secretariat and, under its authority, to provide necessary expertise in the scientific, technical, legal and other related fields…" (ENB:03:03).[51]

A week-long organizational session in January 1993 commenced the convention preparation process. At this meeting, delegations adopted rules of procedure and a schedule of meetings, and elected officers and chairman, Ambassador Bo Kjellén of Sweden. Participants also established two working groups responsible for different parts of the *Convention*. As determined later, Working Group I led negotiations regarding the *Convention*'s preamble, principles, objectives and commitments, including financial arrangements and capacity building. Working Group II was in charge of institutional,

[50] This was not simply a matter of timing. As he commenced treaty negotiations, Bo Kjellén, Chair of the INCD, described the task ahead of delegates as an opportunity to make the dreams of Rio, "a human-centered reality" (ENB:04:11).
[51] As discussed in Chapter 3, the original African proposal called for a multi-disciplinary expert group to assist the INCD. However, resistance from developed countries caused the working group to opt for a more modest expert group (ENB:03:02).

administrative, technological and scientific provisions; research, data collection and information exchange; and procedural arrangements and other legal issues (ENB:04:11).

Over the next 18 months the Negotiating Committee[52] convened five times for approximately two-weeks each.[53] At their last session, in June 1994, the Committee adopted the final *Convention.*[54] The Chairman presided over the negotiating sessions and guided their progress.[55] The CCD Secretariat carried out administrative tasks associated with the negotiation process. The Executive Secretary, Hama Arba Diallo of Burkina Faso, headed the Secretariat and appointed its members.[56] In accordance with UN General Assembly resolutions of late 1992, an International Panel of Experts (IPED) advised the Secretariat on technical issues. As discussed in Chapter 3, this panel of nearly 20 members, included a multidisciplinary group of scientists from developed and

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[52] The negotiating committee was formally named the Intergovernmental Negotiating Committee for the Elaboration of an International *Convention* to Combat Desertification in Those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa.

[53] As discussed in Chapter 3, the first week of the first negotiating session was devoted to an "Information Sharing Segment." This session was the brainchild of the United Nations General Assembly and marked a new innovation of sorts in the context of international environmental politics. At its organizational session in January 1993, the INCD determined the seven topics that would be addressed. The Secretariat then invited speakers from UN specialized agencies, other intergovernmental organizations, non-governmental organizations and academia to give presentations pertinent to these topic areas. Representatives from various countries also gave presentations. For a summary of the Information Segment see (ENB:04:11).

[54] The *Convention* was opened for signature in Paris on October 14 1994. Pending the CCD's entry into force, the INCD held six meetings between January 1995 and August 1997. Delegates heard progress reports on the implementation of urgent action activities in Africa and interim measures in other regions. Participants also made preparations for the first Conference of Parties (COP-1). Preparations concerned the Secretariat's programme and budget, the Global Mechanism (the *Convention*'s financial mechanism), the location of the Permanent Secretariat and establishment of the Committee on Science and Technology (ENB:04:116). The fiftieth instrument of ratification was submitted to the UN in September 1996. The treaty entered into force the following December. Two Conference of Parties sessions took place in 1997, 1998 respectively. Most discussions and decisions at COP-1 focused on organizational issues. The *Convention*'s Committee on Science and Technology met for the first time and COP-1 selected Bonn, Germany as the location of the Permanent Secretariat. In addition, COP-1 marked the first-ever plenary meeting reserved specifically for dialogue with non-governmental organizations (ENB:04:116)

[55] Country delegates numbered 200 to 300 during initial meetings. Approximately 20 of these delegates were elected to a Bureau charged with assisting the Chairman. This Bureau included a Chair, three Vice Chairs, and a Rapporteur. Each of these five members represented one of the five UN groups. The extended Bureau group included various officers and representatives from the two working groups. Non-voting members (or observers) also constituted a large contingent at the negotiations. These included members of UN agencies, intergovernmental organizations and non-governmental organizations. While about 100 observers attended the first negotiating session, more than 300 observers attended the second Conference of Parties (Corell, 1999).

[56] The size of the Secretariat grew from two people at the start of negotiations, to thirty people in 1997 and had a number of different titles throughout the various stages of negotiation (Corell, 1999). Titles changed with the evolving status of the Secretariat from an ad hoc body to an interim body and ultimately to a permanent body. For consistency, I refer to this body as the Desertification Secretariat or simply the Secretariat.

developing countries. They commented on negotiating texts, provided input on various negotiation activities, and prepared reports on subjects related to their various areas of expertise (Interview with CCD Secretariat Consultant).

2.4.2 *Treaty Elements*

The *Convention* differed from past desertification policies in that it constituted a legally-binding agreement. The treaty comprised both a framework convention and four "operative instruments" or regional annexes (Kassas, 1995). The framework convention portion of the treaty included general principles, obligations, and institutional mechanisms. The principles highlighted the importance of popular and community participation, and cooperation between local and national levels, and between governmental and non-governmental organizations. The treaty urged for the integration of desertification with development initiatives and a comprehensive approach to its physical, biological, and socio-economic aspects. As discussed below, the *Convention* outlined obligations for affected and developed country parties and aimed to foster partnerships between North and South rather than more traditional, aid-based relationships (Lean, 1995).

National Action Programmes (NAPs) were designed to serve as vehicles for treaty implementation. NAPs, in conjunction with Regional and Sub-regional Action Programmes suggested that local solutions and initiatives were essential, but must be coordinated with strategies at broader scales. According to the *Convention*, NAPs should indicate factors contributing to desertification; measures to combat desertification and mitigate effects of drought; necessary resources; and roles of local communities, governments and land users. More specific provisions for NAPs were contained in the four regional annexes. The regional annexes focused on Africa, Asia, Latin America and the Caribbean, and the North Mediterranean. All of the annexes specified guidelines for combating desertification at national, sub-regional, and regional levels. Elements of regional annexes included a list of conditions specific to the region, and a sketch of action programmes, financial resources, and institutional mechanisms. Priority for Africa was evident in the African Annex which was more extensive and detailed than the remaining three annexes. The African annex included commitments for African and developed country Parties, and guidelines for preparation of action programmes, technical assistance, and follow-up.

To oversee development and implementation of NAPs and the *Convention* on the whole, the treaty established several institutions. The Conference of the Parties (COP) was established as the "supreme body" of the *Convention.* The COP oversees and regularly reviews implementation and the functioning of associated institutions. The COP also has the power to put in place and direct subsidiary bodies. A Permanent Secretariat handles administrative aspects of the *Convention* and facilitates assistance to developing country Parties. As discussed below, the treaty regime also includes a Committee on Science and Technology and a roster of independent experts. The Committee provides advice on technical matters and surveys existing networks, institutions, and agencies. The roster contains the names of individuals with relevant expertise. The COP can draw on this roster in assembling ad hoc panels to provide it with advice on specific topics when needed (Lean, 1995). The *Convention* did not establish a new source of funding to support implementation. Instead, the treaty calls for mobilization of resources through existing channels, and established a Global Mechanism to facilitate and promote this mobilization effort (Lean, 1995).

2.4.3 *A "Fresh Approach"*

The new treaty ushered in a rhetoric of "newness" and "fresh starts." Following the Rio Summit, UNEP assumed a much smaller role regarding desertification policy. However, the agency did help to develop and publicize a new approach to the issue. In the face of critics who continued to question desertification's legitimacy as the focus of international policy issue (e.g., Helldén, 1988; Rhodes, 1991), one UNEP staff member wrote:

> Various studies and publications since the mid-1980s question various aspects of the concept and extent of dryland degradation, and these have had significant consequences in political and policy-making circles, particularly in the industricalized countries. One reason for the weak support given to the proposal for a Desertification Convention by the North is thought by some to be well publicized claims that the United Nations (UN) has exaggerated the extent of the desertification problem,

> and that it has misrepresented the concept for political reasons (Stiles, 1995: 4).[57]

According to Stiles, UNEP in the late 1980s and early 1990s, was revising its view of desertification, reassessing long-standing policy approaches, and directing attention to socio-economic issues.

Literature out of UNEP and the Desertification Secretariat stressed the need for a new and "fresh" approach to the problem (Cardy, 1991). The treaty itself noted,

> despite efforts in the past, progress in combating desertification and mitigating the effects of drought has not met expectations...a new and more effective approach is needed at all levels within the framework of sustainable development (CCD, Preamble).

As discussed in Chapter 4, similar sentiments were voiced in public relations material published by the Interim Secretariat. The subtitle to "Down to Earth," a simplified guide to the *Convention*, read "...why (the *Convention*) is necessary and what is important and different about it" (Lean, 1995). Various articles and public relations literature referred to the *Convention* as an innovative solution, a "fresh approach" (Cardy, 1991) and a "new hope" (Interim CCD Secretariat, 1995). All of this seemed to reflect a concerted effort to separate the *Convention* from the widely publicized and lackluster performances of earlier decades.

Additional changes concerned the meaning of desertification. The definition of desertification as presented in the 1977 *Plan of Action* and the 1994 *Convention* contained subtle, yet important differences. These differences reflected important shifts in thinking about environment, development, valuation of ecological resources, and

[57] As references for these comments Stiles cited Thomas and Middleton (1994), Pearce (1994a; 1994b); Helldén (1991); Olssen (1983); and Warren and Agnew (1988). During the period over which the *Convention* was negotiated, UNEP sponsored a five-day workshop entitled "Listening to the People: Social Aspects of Dryland Management," held in Nairobi in December of 1993 (see Chapter 3). The aim of the workshop was to develop a better understanding of community participation and bottom-up development (ECONET, 1994a). Participants spoke on the social dimensions of desertification and dryland management, participatory methods, indigenous knowledge, gender issues, and government policies. UNEP compiled these papers in a collection entitled *The Social Aspects of Dryland Management*. Daniel Stiles of UNEP edited this volume.

human relationships to nature. The 1977 Conference on Desertification had grown out of the United Nations Conference on the *Human* Environment. In keeping with the anthropogenic orientation of its precursor, UNCOD emphasized land as first and foremost an economic resource, important primarily because of the ways in which humans used it to further development goals and support their burgeoning populations. Following on the sustainable development philosophy of the United Conference on Environment and Development, the *Convention to Combat Desertification* aimed to put environmental considerations on par with development objectives. The *Convention* equated desertification with land degradation,[58] which it defined as:

> reduction or loss in arid, semi-arid and dry sub-humid areas, of the biological or economic productivity and complexity of rainfed cropland, irrigated cropland, or range, pasture, forest, and woodlands...(CCD, 1994: 1(f))

This definition was reminiscent of the 1977 definition in referring to land as an economic resource developed through different forms of land use such as farming and pasturing. However, in distinguishing between biological and economic productivity and complexity, the 1994 definition implied that ecological viability of the land might be important for reasons not readily valued in economic terms.

The *Convention* also framed desertification as a global issue. In particular, the agreement described desertification as a global problem affecting all regions of the world. However, "global" as reflected in the *Convention* departed from earlier notions of global. The *Plan of Action* emphasized the worldwide physical extent of desertification. The *Plan*, for example, pointed to the *World Map of Desertification* as evidence of a universal and uniform desertification phenomenon that was global because it affected such a large percentage of the earth's surface area. The *Plan* did prescribe national action plans to address specific national needs. However, the *Plan* implied that no matter where desertification was occurring, it was amenable to a standard and universally applicable set of remedies.

[58] The first appearance of "land degradation" in an official definition of desertification, was in a UNEP study (Odingo, 1990). *Agenda 21*, Chapter 12 also defined desertification as land degradation but did not explicitly define the meaning of this latter term.

The *Convention*, on the other hand, portrayed desertification as a process affecting many disparate regions and ecosystems in many different ways. It noted that

> Desertification and drought are problems of global dimension in that they affect all regions of the world and that joint action of the international community is needed to combat desertification and/or mitigate the effects of drought (CCD, Preamble).

Hence, the *Convention* portrayed desertification's global dimensions as an important basis for international cooperation. However, the treaty also emphasized desertification's regional variability. This new vision of desertification was manifest in the *Convention*'s five regional annexes, each specifying the needs and challenges of particular locations. They outlined socio-economic, geographic and climatic characteristics of different areas, as well as regionally-focused policy provisions. As discussed in Chapter 5, a regional conception of desertification was also evident in the 1992 *World Atlas of Desertification.* The *Atlas* acknowledged not only varied regional conditions and policy measures, but also the existence of pluralistic interpretations of degradation. Regional and local maps in the *Atlas* featured disparate manifestations of desertification processes, as well as a variety of analytical and cartographic assessment methodologies.

2.5 Policy Change

The preceding historical sketch highlights key aspects of desertification policy[59] throughout the twentieth century. The present section presents a summary comparison of these policies. This comparison focuses on the four texts representative of each of the four eras: papers from the Anglo-French Forestry Commission; the 1977 *Plan of Action*; *Agenda 21*, Chapter 12; and The *Convention to Combat Desertification.* These statements on desertification differed in regard to definitions of dryland degradation, global framings of the issue, notions of causation, and approaches to remedial and preventative action.

In the 1930s, British and French colonial administrations in Africa dismissed theories regarding progressive desiccation and desert encroachment. The Commission's

[59] I use the term "policy" loosely in referring to findings of the Anglo-French Forestry Commission and to international statements such as *Agenda 21*, Chapter 12.

stand on this issue had implications for the presumed source of degradation and the scope and nature of policy measures. Progressive desiccationists believed that West Africa was becoming increasingly arid largely because of changes in climate (e.g., Hubert, 1920). Sympathetic colleagues identified desert encroachment as a symptom of progressive desiccation and attributed this phenomenon to a mix of natural and human-induced processes. In the face of such seemingly regional threats, E. P. Stebbing proposed the implementation of transnational policies requiring cooperation between France and Britain. Colonial officials, however, provided a much different view of degradation. According to their observations, the climate was not becoming increasingly arid and the desert was not encroaching. The only form of degradation of concern to the officials arose from shifting cultivation practices on the part of indigenous Africans. Based on this diagnosis, the commission members supported independent colonial policies rather than transnational schemes.

Between the early 1950s and late 1970s, the United Nations system took on problems of drought and desertification. In planning an international conference and developing a fledging environmental agency (UNEP), the UN targeted the latter of these problems by way of a *Plan of Action*. This *Plan* portrayed desertification as a problem of global extent and with clearly identified causes and solutions. As defined in the *Plan*, desertification was not the spread of deserts but the spread of desert-like conditions, and it had the potential to cause degradation on every continent. By virtue of its sheer physical extent and costs, desertification was said to warrant international attention. As prescribed in the *Plan*, this attention should focus on a singular anthropogenic source of degradation: irrational land use practices. By calling attention to these practices, the *Plan* emphasized the physical processes by which activities such as overgrazing, irrigation and continuous monoculture depleted the land's resources. To rectify these problems, the *Plan* called for a "proximate solution," one based largely on the application of modern science and technology through top-down, nationally-based programs.

The 1980s and early 1990s were a period of critique and questioning. UNEP evaluated progress in implementing the *Plan* and reported disappointing results. In addition, UNEP's methodologies and general approach to anti-desertification efforts came under scrutiny. In the context of a sustainable development paradigm and the

United Nations Conference on Environment and Development, desertification re-emerged as the focus of international negotiations. As reflected in Chapter 12 of *Agenda 21*, new perceptions of desertification were emerging. *This policy statement declared desertification and land degradation to be synonymous, further distancing the desertification concept from the notion of deserts or advancing deserts.* *Agenda 21* also identified a broader set of causal mechanisms as responsible for desertification. Human ignorance was no longer considered the sole source of desertification. Instead, UNCED participants agreed that a much broader set of "climatic variations and human activities" were at work. The statement continued to emphasize the global extent of degradation, heavy reliance on basic scientific research and increased vegetation. However, *Agenda 21* also contained the beginnings of a more pluralistic approach to knowledge and decentralized plans for policy implementation.

In 1994, the *Convention to Combat Desertification* departed even further from earlier policies. Under this full-fledged treaty, desertification remained a process of land degradation arising from climatic variations and human activities. However, ideas regarding desertification's global character and remedies were largely and importantly new. While previous agreements had stressed the singularity of desertification's causes and manifestations, the *Convention* presented desertification as involving complex interactions among ecological, social and economic factors. Consequently, the treaty highlighted the need to tailor anti-desertification efforts to ecological, cultural, economic and political factors inherent in each local context. As reflected in the regional annexes and country obligations, the problem was global, not only because of the total area of land it covered, but because its amelioration required "partnerships" linking developed and developing countries and institutions at local, national, regional and international levels. The policy prescriptions in the *Convention* did not recommend specific technologies and practices, but instead emphasized the need for a process based on public participation at the local level and reliant on indigenous knowledge and practices, in combination with modern science and appropriate technology.

The remaining chapters focus on explaining how and why these policy changes came about. The discussion centers on processes of authorization, inscription and boundary work and examines their role in problem framing (e.g., how did the perception of desertification as a global problem gain legitimacy?); responsibility (e.g., in what ways did changing causal narratives apportion blame and empower and disempower different groups to act?); participation (e.g., how did different problem framings dictate rules of participation?).

CHAPTER 3

Constructing Expertise, Environment and Policy

Expert advice has been part of desertification policymaking throughout the century. However, the definition of expert, the nature of expert institutions,[60] and interactions connecting experts with political decisionmakers have varied markedly during this period. These changes emerged alongside continuous transformations in widely held perceptions of dryland degradation and international attempts at its amelioration.

In the 1930s the Anglo-French Forestry Commission refuted claims of an advancing desert and proposals for transnational forest belts. They interpreted environmental degradation as a local phenomenon arising from "primitive" modes of agriculture and lack of coordination among colonial natural resource departments. In the 1970s, the United Nations Environment Programme commissioned natural scientists, primarily from developed countries, to participate in extensive assessment activities in preparation for the United Nations Conference on Desertification. On the basis of these assessments, UNEP portrayed desertification as a "coherent" global problem arising from unsound land use practices and amenable to technological solutions.

In the 1980s, as UNEP convened various panels of natural scientists to assess implementation of the *Plan of Action*, the agency focused on measuring the physical extent of land degradation and the rate of its "advance" at the global scale. However, new voices outside United Nations circles also began to attract attention. While some researchers severely questioned the very existence of desertification, others, voicing social science and rural ecology perspectives, began to offer new insights into its local dimensions. By the time of negotiations for a *Convention to Combat Desertification*

[60] Expert advisory processes as defined in this chapter include panels, committees, and symposia, commissioned by intergovernmental organizations to provide specialized knowledge on some aspect or aspects of desertification and/or related issues for the purposes of policymaking or policy evaluation. Here, the definition of intergovernmental organization is broad, including, for example, the United Nations General Assembly, the United Nations Environment Programme, and the Intergovernmental Negotiating Committee on Desertification.

(CCD or the *Convention*) in early 1993, UNEP was fading as the leading international institution on desertification and a new model of expert advice was in place. A relatively small panel of natural and social scientists consulted for the Desertification Secretariat throughout treaty negotiations. By most accounts, however, these experts did not play key roles in framing the desertification issue. Just as modern science diminished as the means for understanding desertification processes, modern science and technology occupied a much less prominent place among desertification's solutions. Unlike the technocratic, top-down approach under the *Plan of Action* and UNEP, the new *Convention* looked to alternative forms of knowledge and public participation as implements of amelioration.

This chapter demonstrates how expert advisory processes for international desertification policymaking were inextricably linked to the institutions that gave rise to them. In the desertification context, as in many other international environmental regimes, the design, activities and use of expert advisory processes encompassed a fairly formalized set of practices. Practices involve, inter alia, the creation of mandates, explicit or implicit guidelines for participation, and rules governing the timing and nature of interactions between experts and policymakers. While the very cultures and interactions comprising expert advisory processes had implications that reached beyond the confines of the expert process itself, expert advisors often generated portable artifacts in the form of texts, maps, and other forms of visual representation.

3.1 Analytical Framework

Desertification advisory panels and expert consultants enjoyed varying degrees of autonomy in deciding what scientific questions to ask and how to answer them. For example, while UNEP assigned specific research topics to its experts and monitored their work fairly closely, experts consulting for the Desertification Secretariat in 1993 and 1994 had substantial latitude in shaping their personal contributions to the process. Nevertheless, throughout desertification's history, dominant institutions such as colonial empires, UNEP, and the Desertification Secretariat served as the ultimate determinants regarding the structure and composition of expert bodies, their mandate, and their role in policymaking activities. The desertification case further suggests that, by controlling so many aspects of expert activities, institutions colored not only the shape and look of advisory processes, but also the knowledge claims and policy prescriptions they generated. In particular, the processes and products of expert consultations tended to reflect the objectives and capacities of their commissioning institutions. For example, the Anglo-French Forestry Commission advocated a local framing of degradation amenable to control by individual colonial administrations. By contrast, UNEP's advisors in the 1970s portrayed desertification as a global problem, knowable through natural science, and manageable ultimately, via a centralized international agency.

The following sections explore four eras of desertification policymaking in terms of three themes. The first theme concerns the *design* of expert processes, their mandate and relationship to policymakers. Discussions regarding this theme examine the "model" of expert advice. For example, does the expert process reflect a conception of science and policymaking as sequential whereby scientific assessments take place prior to policy negotiation and are expected to "feed into" these negotiations? Or does the expert process reflect an interactive view of science and policymaking in which experts are directly engaged with policy deliberations? Other aspects of design concern the mandate and methodologies of experts. What questions, for example, are advisors expected to answer and what modes of inquiry, representation and communication do they employ?[61] The second theme, *composition*, refers to the question of who counts as an expert? Who is perceived as possessing the required authority to "witness" natural and social phenomena in question? Is deference paid to natural scientists, social scientists, or non-scientists? The third and final theme pertains to *institutional capacity and problem framing*. This theme concerns ways in which expert processes embody the priorities of their respective commissioning institutions, and support problem framings which conform to the resources and capacities of these institutions. Do expert assessments on behalf of individual national governments, for example, tend to interpret issues as inherently local and amenable to administrative control? Similarly, do advisory processes

[61] While the present chapter addresses these questions in a general sense, Chapters 4 and 5 explore quantification and visual representation in more detail.

for international institutions tend to frame problems as fundamentally global and necessitating multilateral cooperation?

Insights regarding these themes are relevant to literatures of science and technology studies, policy studies and the history of science. While adhering to a much different vision of science and politics than that presented in this study, authors such as Majone (1989), Ozawa (1991), and Sabatier and Jenkins-Smith (1993) have suggested that participation and forums for technical debate often have consequences for outcomes of such debates. Majone (1989) argued that adversarial interactions were the best means for developing science policy. According to Majone (1989), "objective analysis, unassisted by advocacy and persuasion is seldom sufficient to achieve major policy innovation." In contrast, Ozawa (1991) advocated consensus-based methods involving stakeholders, decisionmakers and experts as a means for handling technical policy disputes. Sabatier and Jenkins-Smith (1993), on the other hand, suggested that technocratic advisory processes, which are closed to public participation and which involve experts with common professional norms are the most conducive to robust policymaking. While these authors generally share a view of science and policy as fundamentally separate enterprises, their contributions, nevertheless, further suggest that questions of structure, process and participation in regard to expert advisory activities, have a bearing on policy formulation.

Sheila Jasanoff in her study, *The Fifth Branch* (1990), revealed science advice to be an integral component of regulatory decisionmaking. Based on studies regarding the use of expert committees by federal agencies in the United States, her analysis revealed how expert deliberations involve simultaneous negotiation of technical and political controversies, with expert participants engaging in boundary work to delineate what counts as science and what counts as policy. The study further demonstrated that the ability of such negotiated boundaries to withstand public scrutiny depends in part on the procedure, structure and composition of expert panels. Important process characteristics include experts' ability to transcend disciplinary boundaries, committee membership, participation by different publics, the role of agencies in defining the subject of study, and procedures by which participants engage in deliberation. The analysis below explores questions of participation and advisory committee design in the context of international environmental politics. It also builds on Jasanoff's (1990) notion of boundary work as involving not only the delineation of science-policy boundaries, but also the demarcation of natural-social and lay-expert realms.

Research in science and technology studies and in history of science and politics have demonstrated the interdependence of science and social order reflected in my suggestion that advisory processes are, in part, instruments of institutional inscription. Shapin and Schaffer (1985), through analysis of debates involving Hobbes and Boyle and the rise of experimentalism showed that processes of knowledge production ultimately hinged on politics, while political order similarly depended on solutions to problems of knowledge. Ezrahi (1990) demonstrated how liberal democracies draw on science for authority, legitimacy and accountability. Jasanoff (1995) in her analysis of science and the American judicial system demonstrated the role of the courts in producing public understandings of science and technology, while at the same time using science to resolve disputes. The case of desertification similarly reveals an interdependence and simultaneous construction of science and international policy. In particular, it vividly highlights the role of institutional priorities and resources in constraining and shaping problem framings.

Studies revealing the interdependence of scientific knowledge and social order also emphasized the importance of systems for determining what knowledge and methods were authoritative. Shapin and Shaffer (1985) examined multiple witnessing as a process necessary for generating matters of fact. Jasanoff (1995) explored the role of the courts in constructing and deconstructing expertise. She considered different cultures of expert witnessing and the role of the judicial system in testing credibility of adversary processes and in certifying witnesses and their testimony as admissible or not. Witnessing also proves important in the desertification case. In designing the structure and membership of expert panels, presiding institutions have often determined who constituted important and credible witnesses for interpreting desertification phenomena. However, when independent scientists and the press questioned the credibility of these very institutions, new voices of authority began to emerge and were later incorporated into the new regime.

The nature of expert forums, boundary work, and witnessing are all important in understanding desertification politics and how these politics evolved with changing institutions and problem framings.

3.2 Science Advice and Colonial West Africa

Debates about West African desiccation and an advancing Sahara during the 1930s provide insight into the role of expert advice in French and British colonial West Africa and into colonial priorities and resources inherent in then-current perceptions of environmental degradation. The resoluteness with which the Commission seemed to refute E. P. Stebbing's claims illustrates, in part, the deference that colonial administrations and researchers paid to government-appointed experts. The credentials of the various Commission members further reflected French and British reliance on ecological specialists in devising and carrying out administrative policies. While boundaries separating colonial scientists and natural resource managers were often difficult to delineate, boundaries between natural and social scientists were not. Although anthropologists, for example, worked on relevant issues in West Africa, governments and natural scientists did not consult them on problems of desiccation. Natural science communities, however, were not devoid of controversies concerning the nature of desiccation and its remedies. The Stebbing-Commission debate, for example, highlights two divergent views of the West African environment and its management. Whereas Stebbing portrayed desiccation as a singular threat to the region, warranting transnational forest belt schemes, the Commission perceived degradation as a local phenomenon, best managed through improved administrative coordination. Acceptance of the Commission's proposals over Stebbing's suggests that colonial objectives and attitudes were inscribed in predominant visions of the West African environment.

3.2.1 *West Africa's Fifth Branch: Science Advisors as Policymakers*[62]

Colonial administrations relied heavily on scientists and other specialists in fields such as forestry, agriculture, medicine, and economics. In doing so, colonial governments

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[62] From title of Jasanoff (1990).

authorized the views of scientists who served as administrative officers, as well as outside expert consultants. In the young colonies, geographical departments handled all aspects of colonial governance. However, beginning in the late 1920s and continuing to approximately 1945, administrations received support from a wider variety of specialists. Full-time expert advisors and advisory committees provided input on decisionmaking regarding farming geology and economics. Over time, full-fledged natural resource departments formed and played an active role in policy development. A conservation ideology began to take hold around this time and its adherents sought to maintain what they saw as "Nature's balance." By preserving a stable equilibrium among natural resource use in different sectors, colonists sought to ensure viability of valuable exports (Hargreaves, 1996: 46).

West African exports included groundnuts, cotton, hides and skin (Jones, 1938), and colonial leaders were interested in maintaining an environment that could support their profitablility. Studies by individual researchers and natural resource mangers were central to these efforts. Some investigations focused on climate and land management, with droughts providing a popular topic for government-appointed commissions and independent researchers. In 1904, for example, reports of desiccation prompted France to commission an examination of dryland degradation. Several years of low rainfall from 1905 to 1920 prompted analysis concerning broader climatic trends and their possible effects on the African landscape. In 1920 the French Comité d'Etudes for West Africa commissioned a study of desséchment progressif (Hubert, 1920)[63] to determine whether increasing aridity posed a threat to land, water and vegetation.

Colonial priorities and attitudes did more than motivate scientific inquiry. They were integral to the processes and products of science. French scientists generally focused their attention on French territories, while British scientists studied the British colonies. References to British and French borders populated the writings of the scientists, as did references to ignorant and violent native tribes.[64] Support for the settlement of Africa in Europe's image, was in many places unmistakable. In 1931, for

[63] See also Mortimore (1989).
[64] Examples abound throughout the scientific literature of the period. Examples, include Hubert (1920), Schwarz (1923), Bovill (1921), Stebbing (1935), Jones (1938).

example, an accomplished British agriculturalist described deserts and man as being at war. Though he spoke of the Kalahari in east Africa, his fervor for colonial settlement is emblematic of many writings of the time. In personifying the desert MacDonald wrote:

> He is waging eternal war with us. He does not want men. He wants desolation...Half-a-century has come and gone, and what have we done? The white man has joined hands with the native vandal, and year after year the work of ceaseless destruction goes on. Not a single tree is ever planted...Is it possible, then, the reader may ask, to check the advance of the desert, conquer the crop-blighting winds of aridity, and ameliorate the climatic conditions of a vast country such as the Kalahari? Yes; but three things are essential – Population, Conservation and Afforestation (MacDonald, 1913: 3,4).

Growing populations alone were not the answer. To be successful, it was thought, Africans needed to employ European methods of resource management, forestry, and agriculture to support favorable ecological and economic conditions.

In Search of True Facts

Scientific research as a basis or potential basis for colonial policies was also apparent in recommendations by Stebbing and the commissioners. They did not limit their analyses to interpretation of natural phenomenon alone (e.g, in determining whether or not progressive desiccation was occurring). They also translated their scientific findings into specific policy recommendations. Some of Stebbing's recommendations illustrate the role of expert advice as perceived in the colonial context. He recommended that a government-appointed expert group confirm his findings before France and Britain take joint policy action. As Stebbing concluded:

> the true facts on the subject of the present advance southwards and threat of the Sahara can be substantiated in one way only—by the appointment of a small Commission of officers carefully selected for their knowledge of the local conditions on both sides of the frontier. (Stebbing, 1937a: 232, also quoted in Stamp, 1940: 297).

Stebbing's reference to "true facts" suggests a belief in rational administrative decisionmaking, based on objective scientific knowledge and balanced representation of colonial governments. The equating of experts and colonial officers implicit in his recommendation reveals the primary role of the government specialist in government as responsible for assuring this objectivity. Stebbing's view of expert advice as the *only* means for obtaining such facts underscores colonial dependence on science as a source of authority and as a source of guidance regarding how to settle and manage the new frontier.[65]

The Nigerian Government and the Administration of the French Niger Colony heeded Stebbing's recommendation. In 1936 they appointed a joint commission to examine his claims of desiccation and a southwardly advancing Sahara around northern Nigeria. In the words of one Commissioner, Stebbing presented a "more gloomy view of the future of West Africa than any of his predecessors in this field" (Jones, 1938: 401). Stebbing's vision suggested to colonial administrators that farmland fertility and water supplies in the northern Nigerian provinces were in jeopardy. As described by Jones (1938), export trade in groundnuts, cotton, hides and skins made this a "rich agricultural region" and "a most important factor in the economic life of the Protectorate." Stebbing's predictions were particularly relevant to the 218,389 tons of groundnuts grown in the most northerly districts. If Stebbing's accounts of an advancing Sahara were correct, these crops would be in "immediate danger" and the colonial administrations could not ignore his warning (Jones, 1938: 401).

In keeping with Stebbing's prescribed mandate, the Niger Colony and Britain appointed a small group of seven officers from both colonies. The governments directed them,

> to inspect the country on both sides of the Anglo/French boundary and to collect all available data from which conclusions can be drawn as to the progress of desiccation...and the extent to which desert conditions are being created, and what is causing these conditions (Falconer, 1938: 355).

[65] The next section discusses colonial ideas about what counts as authoritative knowledge. Such ideas are evident in Stebbing's references to experts who are government-appointed, representative of diverse geographic regions, and knowledgeable about local conditions.

This mandate was clearly aimed at generating an evaluation of Stebbing's claims. In collecting "all available data" the Commission's purpose was to provide a scientifically-grounded basis for government decisionmaking. The commissioners carried out this mandate in 1936 and early 1937 (Falconer, 1938: 355),[66] by traversing the route depicted in Figure 4 (see Chapter 5). The commissioners commenced their journey near Sokoto and moved eastward on the Nigerian border to Lake Chad through Katsina, Kano and Geidam. On the return trip the group began in Nguigmi and traveled along the French border to Niamey through Zinder, Maradi, with a northern detour to Agad'es. At each town the Commission questioned chiefs and local councilors about water supply changes, agricultural practices, sand movement, and vegetation changes. They authored a brief report of their findings to the government (Stamp, 1940), but published extensive accounts of their findings in scientific journals (e.g., Jones, 1938; Collier and Dundas, 1937).

Following their investigation, the Commission rejected the claim that the West African climate was becoming progressively dry. On issues of humidity, surface and subsurface water, population migration, and desert encroachment, the Commission systematically refuted nearly all of Stebbing's observations and conclusions. The Commissioners believed (along with earlier studies[67]) that West Africa's rainfall was not decreasing according to any secular trend. They argued instead that 1936 had been "an exceptionally wet year" and that surface water was increasing. On the subject of subsurface water, the Commission referred to the Geological Survey of Nigeria, which maintained that the water-table was "to all intents and purposes stationary" (Jones, 1938: 417). As far as population migrations, the Commission attributed these to political and economic factors, rather than to progressive desiccation (Jones, 1938). Furthermore, the Commission claimed that Stebbing had mistaken an outcrop of sandstone near Maradi for

[66] According to Jones (1938), the Commission carried out their fieldwork between December 1996 and February 1997. Dundas, another Commission member, said the Commission visited the colony from January to March 1937 (Dundas, 1938). Most of his paper presents a detailed description of the vegetation types east of the River Niger and north of Dahomey and Nigeria. His classification scheme is based on names given in an Imperial Forestry Institute Paper by Dr. J. Burtt Davy (1938), "The Classification of Tropical Woody Vegetation-types."

[67] Examples include Chudeau (1909), Falconer (1911) and Gautier (1935).

a southwardly moving Sahara. They similarly reported that live dunes of the Sahara existed over 150 miles from the Nigerian border. According to the Commission, the potential encroachment of the Sahara on the Sudan was a remote possibility because sand displacement was occurring at slow rates and dunes without vegetation were likely to become anchored by vegetation quickly in the then-present climate conditions. The officers concluded that climatic changes in West Africa were accompanied by gradual expansions and contractions of the Sahara.

The Commission also disagreed with Stebbing on several points regarding deforestation. According to the commissioners, Stebbing lacked evidence to support his claim of deforestation in northern Nigeria. Commission members suggested that, in the town of Geidam, Stebbing mistook fertile farmland (observed during the dry season) for a desert-like area. They argued that drying and dead trees in Niger were not evidence of desiccation, but were, instead, signs of tree asphyxiation following clay deposition at the bottom of marsh depressions. In other areas, the Commission found soil erosion to be responsible for tree deaths. The commission similarly rejected the notion that increased aridity contributed to deforestation or lowering of the water table. They believed that several climate fluctuations took place between the early Quaternary period and the 1930s. Evidence of such fluctuations included anchored dunes in Quaternary river valleys and isolation and divergent evolution of crocodiles and North African elephants. However, the Commission *agreed* with Stebbing that shifting cultivation presented a major threat to the West African countryside.

Stebbing's Advancing Desert Retreats

In response to the Commission's report and other critiques, Stebbing modified his claims of advancing deserts. Stebbing published his article and talk, "The Encroaching Sahara: the Threat to the West African Colonies" in *The Geographical Journal* in December of 1937. In it he dramatically portrayed the desert's advance. By January 1938 he published a book entitled *The Man-Made Desert in Africa* (Stebbing, 1938a) which begins with a response to his critics. Stebbing conceded that his descriptions of the advancing desert had been misleading. He had not meant to imply a wave-like, southward advance of the desert. In April 1938 Stebbing published a response to detractors such as Francis Rodd (1938) and J.D. Falconer (1937, 1938) in *The Geographical Journal* (Stebbing, 1938b). This time Stebbing's tone was more defensive:

> I have already admitted an inadvertent mistake in using the latter term for my address to the Royal Geographical Society in 1935. I had never imagined that I should be credited with the idea that the Sahara was advancing in great waves like the incoming tide of a sea. The main theme of my paper and book is forest degradation which leads to erosion, and as a late stage to barren land—sand, or sheet rock, or other form, depending upon the locality and environment. Owing to the presence of a great desert to the north the process is hastened by blown sand in the colonies on the southern edge of the Sahara (Stebbing, 1938b: 357).

In later writings Stebbing adopted the term "erosion" in lieu of references to desert advance, sand invasion, sand penetration, and sand displacement that had colored his earlier publications. He also emphasized the presence human-induced (rather than climate-induced) forms of erosion arising from practices such as shifting cultivation (Stebbing, 1938b).

3.2.2 *Colonial Authorities*

The Commission was praised for its analysis. In expressing relief at the Sahara's apparent stability, fellow scientists and administrative authors also commended the Commission's investigation. J. D. Falconer referred to the study as based on a "very complete reconnaissance of the area" (Falconer, 1938: 354). Dudley Stamp (1940), of the London School of Economics, remarked how Commission member Brynmor Jones refuted Stebbing's claims with "complete scientific thoroughness." Stamp cited the Commission's knowledge of local conditions, as well as their reliance on many different types of evidence and a wide array of literature (Stamp, 1940: 299). Other scientists such as Jacks and Whyte (1939) simply referred to Stebbing's advancing desert concept as incorrect, without giving specific credit to the Commission.[68] Acceptance of the

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[68] Scientists writing in the last decade continue to refer to the authority with which the Commission challenged Stebbing. As noted by Harold Dregne a prominent desertification expert since the 1950s, "The most striking refutation of Stebbing's thesis about the advancing Sahara came from an Anglo-French forestry commission study…" (Dregne and Tucker, 1987: 17). Jeremy Swift, who also served as a UN

Commission's findings reflects, in part, their authority as perceived by fellow scientists and administrators. The discussion below outlines the Commission's membership and relates it to colonial ideas regarding natural and social science, and to the importance placed on knowledge of local conditions.

The Commission was international and multidisciplinary. In addition, all Commission members served in either the French or British administrations. The group included two senior administrators, one from Britain and one from France, two British Nigerian foresters and one geologist, and two Inspectors of Forests and Water Supply of French West Africa (Stamp, 1940). Aubreville, a French forester, led the French delegation. The governments' reliance on natural science in matters of environmental degradation is clear in the Commission's membership. Their methodology and analyses also reflect attention to and knowledge about the local environment. In keeping with Stebbing's recommendations, it appears that colonial governments selected commission members, in part "for their knowledge of the local conditions on both sides of the frontier" (Stebbing, 1937a: 232). As discussed below, the colonists valued and, therefore, authorized the views of individuals possessing both natural science expertise and familiarity with local conditions.

A Challenge for the Natural Sciences

Scientists and colonial administrative officers considered environmental well-being as dependent on natural as well as anthropogenic factors. Nature was considered inherently balanced. Humans, however, in overexploiting nature's resources could disrupt this balance. Yet, while scientists often referred to migrations, economic factors, and human land use systems as manifestations and causes of degradation, they generally did not seek deeper understanding of these phenomena. Despite the various social factors involved, West African degradation remained a problem for natural science to understand and address. According to Collier and Dundas (Commission members and Senior Assistant Conservators of Forests in Nigeria), the Commission agreed with Stebbing that

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expert on desertification in the 1980s, similarly remarked that "the Commission systematically refuted most of Stebbing's assertions" (Swift, 1996: 76).

uncontrolled development in the form of shifting cultivation, was leading to deforestation along the international border, posing "good reason for anxiety." While further north, the French Niger Colony faced a "completely different problem" of a reversed trade flow, resulting from decrease in population (Collier and Dundas, 1937: 191-2). Collier and Dundas mentioned development, trade, shifting cultivation and population. However, in no place did they defer to anthropologists or economists or even mention their relevance. Instead, they defined the colonies' problems in largely physical terms such as desiccation, deforestation, and spreading deserts. These issues fell under the intellectual jurisdictions of foresters, agriculture scientists, geologists and meteorologists. For the most part, natural scientists took the social dimensions of degradation and dryland management for granted. They did not seek deeper understanding of the political, economic, and cultural processes at work.

Despite parallel developments in fields of ecology and anthropology, experts in these two areas did not cross paths, at least not in relation to the progressive desiccation debate. British cultural anthropology, in particular, was building a central and lasting foundation for the development of major theoretical perspectives in its field.[69] Many ideas generated through this process seemed to echo thinking in the world of geography and forestry. In particular, anthropologists, like their natural science counterparts, were developing a holistic view of environmental and social phenomena, while increasingly focusing on local, micro-level dynamics and their relevance to global trends.[70] The functionalist or structural-functionalist school in anthropology, in short, assumed that "all of the contemporaneous cultural and social features of a stable society could be assumed to form part of a coherent and interdependent system. The task of the interpreter was to infer the connections" (Moore, 1993: 7). Functionalist scholars sought to understand these interdependencies through the study of small communities from the inside.

[69] British social anthropology between 1920 and 1960 was much more influential than French work in the same area. Moore (1993) refers to the decades 1920-1960 as the "classic period of the growth of anthropology."

[70] A French anthropology pioneer in France was Maurice Delafosse who died in 1926. He was a French colonial officer from West Africa who taught at Ecole Coloniale and the Institue d'Ethnologie where he trained many colonial officers in ethnographic methods. Twenty years after his death the premier French Africanist was Marcel Griaule who focused primarily on museum work and artifacts and later on the themes of ritual, myth and symbol. But his work had only limited influence outside of France (Moore, 1993: 7-8).

Concern for local insights and the dynamics of localized systems were similarly of interest to British anthropology and to the British colonial administrations in general. Because the British government sought to delegate authority to local entities the study of local organizations and social institutions in Africa was of great interest to colonial administrations. British colonial administrations operated under a system of "Indirect Rule." The British believed that, where possible, local government should be carried out through indigenous political institutions, which were assembled to exist in self-governing "tribes." While the government occasionally used anthropologists to collect needed information, it more frequently relied on local political officers (Moore, 1993).

Much like the movement reflected in Jacks and Whyte's (1939) *World Survey of Soil Erosion*, anthropology, beginning in the late 1930s and continuing into the next two decades, began to adopt a broader view of its research subjects. Instead of focusing on isolated, local settings, studies of rural-urban relationships revealed that "the African countryside was imbedded in a much larger set of political and economic relations" (Moore, 1993: 14). In the late 1930s, for example, anthropologists began to seek out universal laws to describe their findings. This approach emanated from A.R. Radcliffe-Brown's work in 1937. Although he was not an Africanist, his teachings derived from Durkheim's works on cultural comparisons and proposed "that anthropology was a comparative sociology, which should be devoted to the discovery of social laws...Such laws would be like the laws of natural science" (Moore, 1993: 11).

While anthropology and some areas of natural science were developing similar ideas during the early 1900s, synergy and sharing of these ideas did not occur. Foresters and other natural scientists continued their focus on the physical aspects of degradation and anthropologists were frequently passed over for relevant government work in favor of political officers (Moore, 1993).

Debates Among Natural Scientists

Although anthropologists did not participate in West African environmental studies of the colonial period, there was no shortage of debates and competition across disciplinary lines. Dating back to at least the beginning of the twentieth century, disciplinary identity has factored into scientific debates about dryland environments. The work of Stebbing and the Commission surfaced amidst this climate and reflected many of its characteristics.

The complex African environment and phenomena such as land degradation, aridity, advancing deserts, and migration have been accessible to a wide array of observers. In a sense the colonies opened up a giant experiment for western scientists. Foresters, geologists, climatologists and agriculturalists brought a multitude of methodologies, languages and practices to bear on the Continent's puzzles. Often scientists from a given specialty focused on just one of the many interconnected elements of the ecosystem (e.g., rivers, forests, savannah cover, agriculture). In journal articles of the time scientists revealed their disciplinary affiliations and were often critical of those with different training. Ideas or theories on particular issues were usually ascribed to a certain disciplinary perspective. Consequently, authors regularly referred to "the geologists' view..." or the "foresters' view..." in summarizing the literature on a particular point. For example, meteorologists and forestry experts often disagreed over the relationships linking forests and rainfall patterns. "While the meteorologists have denied such a relationship, they are modifying their views to be somewhat more compatible with the uncompromising opinion held by forestry experts in many different parts of the world" (Bovill, 1921: 259).[71]

In opposing the theory of progressive desiccation, Jones closely aligned himself with the geologists, Gautier, Chudeau and Falconer and against Hubert. Gautier argued, based on river bed erosion in the north and fixed dunes in the Sudan, that "in the north the desert has followed the steppe, and in the south the steppe has followed the desert." Chudeau observed *dead ergs*, fossil dunes and drainage systems in the Sudan and concluded that the Sudan was encroaching on the Sahara. Based on rainfall records, Chudeau found sounds of increasing humidity in the Sudan (see Bovill, 1921: 265).

Jacks and Whyte (1939: 250) alluded to the reputations of various scientific disciplines when comparing engineering and chemistry approaches to soil management with ecology-based approaches. They noted that engineers and chemists were successful

[71] Similar generalizations were made in referring to the "French view" or "British view" of various natural phenomena. The theory of progressive desiccation, for example, was often attributed to the French (e.g., Stamp, 1940).

in altering vegetation in cool regions by changing the soil type. Tropical soils, however, required the expertise of the ecologist who "does not command the respect as either of the others" (Jacks and Whyte, 1939: 250).

Witnessing

In the eyes of fellow officers and scientists, much of the Commission's authority derived from its members' first-hand familiarity with local conditions. Many participants in the progressive desiccation debate viewed academic researchers as lacking intimate understandings of local environments. Members of the geography community, for example, faulted Stebbing for his apparent misperceptions of West African conditions. The colonial officer, because of his long-term residence in Africa and familiarity with local ecosystems, was a more credible witness in the eyes of his scientific colleagues and the government. Accolades for the Commission's work, and critiques of Stebbing's claims illustrate the authority of local witnesses.

Well before the Stebbing-Commission debate, Bovill (1921), a staunch believer in advancing deserts, suggested that proponents of desert encroachment theory possessed a local perspective and were, therefore, more knowledgeable about dryland phenomena. In referring to the southward migration of people in the Sudan region he made the following comments.

> It is the conviction of those who are in intimate contact with the natives that this dislocation of the population is entirely due to the encroachment of the Sahara...The division of opinion is not altogether surprising. It is probably due to the difference in point of view between the geologist and the administrative official. The field geologist in so vast and imperfectly known a country as the northern half of Africa is required to range over great areas; he seldom has an opportunity of becoming intimately acquainted with any single district, and the scarcely perceptible processes of nature such as the gradual shrinkage of wells, lakes, and even rivers, are not unlikely to escape his notice; nor is he called upon to solve the problems arising out of the consequent dislocation of the population. Moreover, in his training, and in the exercise of his profession, mere decades, and perhaps centuries, are periods of time of no great significance. The local official, on the other hand, is usually required to serve for long periods in very limited areas, with which he becomes

> intimately acquainted, and with the inhabitants of which he is in constant and intimate contact. Under his eye the slight processes of nature, especially when connected with the vital question of water-supply are far less likely to escape observation. It is chiefly from this source that springs that ever growing mass of evidence of increasing aridity. Unfortunately almost the whole of this evidence lies inaccessibly hid in the files of provincial offices (Bovill, 1921: 265-6).

Bovill's statement provides insight into what types of knowledge were valued around the time of the Commission's study. The membership of the Commission (as exclusively colonial officers), reflects Bovill's ideas regarding who possesses the more useful and authoritative knowledge.

Francis Rodd (1938) questioned Stebbing's conclusions regarding progressive desiccation and desert encroachment. Rodd, who spent considerable time in West Africa, asserted, contrary to Stebbing, that the Sahara had actually retreated rather than advanced. In supporting this conclusion, he referred to his "own experience" and to "native accounts." Rodd further suggested that Stebbing happened to visit West Africa during a dry spell.

> A traveler in one of the areas where no rain has fallen for several years will inevitably be led to the conclusion that vegetation is declining. If that traveler has not happened to cross another area where rain has fallen consecutively for several years after a dry interval his judgment will be biased. The local evidence of the European is also curiously unreliable in many cases. The European, especially in the dry seasons, is always apt to exaggerate desiccation and the advance of the desert (Rodd, 1938: 354-5).

According to Rodd, the only reliable observations of West Africa, are those conducted over "longish periods." He recommended that visitors spend more than one rainy season before coming to any definite conclusions (Rodd, 1938: 355-6).

As Jones, a member of the Dommission, remarked in his account of the Commission's study: "There are, however, observers with considerable experience in West Africa who are not in accord with many of Professor Stebbing's conclusions" (Jones, 1938: 27). According to several workers (as opposed to visitors) in French and

British West Africa, the theory of progressive desiccation was incompatible with the evidence.

Jones demonstrated his own experience and intimate knowledge of local conditions throughout his paper. One example concerns his explanation of pools of water. Stebbing claimed these pools to be the remains of dried rivers. According to Jones, however, these pools resulted from the flat topography and interruption of ancient drainage systems. He also provided their Hausa name as tabki (pl. tabkuna) and a detailed account of how pools form after the deposition of fine material at the base of the depressions. Further illustrating his familiarity with not only the local landscape, but its people as well, Jones described how local people increased the water holding capacity of tabkuna by trampling them with their cattle. A similar disagreement between Stebbing and Jones concerned tree deaths. Stebbing concluded that dead and dying trees in Komadugu Yobe resulted from depleted water supplies. Jones argued that tree deaths resulted from the tabkuna formation process. Clay at the tabkuna's surface accumulates around tree roots, eventually forming an impervious layer, and leading to tree asphyxiation. To illustrate the ability of sand to seal out moisture, and to further demonstrate his local experience, Jones noted how some Africans stored corn in dry sand below a clayey surface to prevent damage to the corn from flooding. In response to Stebbing's suggestion that the harmattan was reducing soil fertility, Jones noted a native tradition in which a good harmattan means a good harvest (Jones, 1938).

While both Stebbing and the Commission interviewed local officials about the state of the environment and the environmental changes they had observed, Stebbing was criticized for relying too heavily on second-hand accounts, rather than his own, first-hand observations. Stebbing based many of his conclusions on discussions with local officials. The Emir of Katsina won Stebbing over as a "very popular ruler and great sportsman," and asked for assistance in "stemming the invasion." He showed Stebbing plans "to create belts of plantations across the countryside..." (Stebbing, 1935: 511). One of this Emir's Councilors, a sort of land agent, accompanied Stebbing for part of his travels and pointed out examples of "desiccation and deterioration" that had occurred in the previous twenty to thirty years (Stebbing, 1935: 511).

Stebbing's critics questioned his reliance on the first-hand observations of others. For example, Stebbing and the Commission came to different conclusions about water table levels and their implications for desiccation. Whereas Stebbing believed decreased water levels indicated progressive desiccation, the Commission disagreed and faulted Stebbing's lack of local experience. The Commission spoke with local councilors about water supply changes and made their own observations of water levels in Lake Chad, rivers and groundwater in the area (Falconer, 1938: 355). In reference to deepening wells as indicators of progressive desiccation, Jones (1938) explained that the "primitive" construction of wells can lead the "casual observer" to believe the wells have become progressively deeper. Consequently, the Commission deferred to the Geological Survey of Nigeria in concluding that the water level was stationary (Jones, 1938: 417).

Falconer, a supporter of the Commission's assessment, similarly faulted Stebbing's unfamiliarity with local conditions. Falconer questioned Stebbing's speculation about the water table levels by criticizing his reliance on villagers' accounts. "Thus, if 'proof of the steady advance of the Sahara exists' (p. 47) on the southern side of the Nigerian frontier—tangible proof, and not mere speculation –it is nowhere contained in Professor Stebbing's book" (Falconer, 1937: 551). The Commission and its supporters, many of them colonial officials in West Africa, valued deep understandings of local conditions. The Commission commanded greater authority than Stebbing, in large part because in the eyes of scientists and other officials they possessed a more credible understanding of local phenomena. As discussed in the following section, their local expertise also buttressed the Commission's recommendations for local, as opposed to regional management schemes.

3.2.3 *Policy Prescriptions: Transnational Cooperation versus National Resource Management*

Just as Stebbing and the Commission held different views of the degradation problem, they also voiced different ideas about what should be done about it. Stebbing called for bi-lateral cooperation between France and Britain and a transnational forest belt to stem the desert. The Commission on the other hand, advocated introduction of permanent, European style agriculture and enhanced coordination among natural resource departments.

According to Stebbing, the problems of desiccation transcended political boundaries. "It may be pointed out that this erosion and desiccation matter in Africa is not a parochial or even a one-Colony one. The existing political or administrative divisions into Colonies, British or French, are purely fortuitous. Man's mis-use of the soil and Nature's retaliation are alike indifferent to the man-made frontier or boundary" (Stebbing, 1938c: 17). According to Stebbing, the problem required an international response. He described desert encroachment as an "invasion," thereby characterizing the problem as a military enemy against which "two of the big Powers of the world" can unite. As Stebbing remarked:

> ...isolated efforts to stop the progress of the Sahara are unlikely to stem the invasion. A much wider policy is required (Stebbing, 1935: 518).

In his book, *The Forests of West Africa and the Sahara*, he called for barriers against the advancing desert (Stebbing, 1937a; also see Falconer, 1937: 550). Stebbing called on the colonial administrations to reserve a "Northern International Forest Belt" to hold back the desert. The belt would consist of degraded dry mixed deciduous forest and extend from Haute Volta to Lake Chad. A second "Central Protective Belt" would consist of degraded moist mixed deciduous forest and extend from Lake Chad, through Geidam and West to Segu (Figure 2, see Chapter 5).

Stebbing's view of the West African environment emphasized systemic natural forces (e.g., climate and desert encroachment) largely outside the direct influence of human intervention. In contrast, the Commission depicted a problem that was more amenable to government regulation. In many respects the very structure and disciplinary composition of the Commission mirrored the problem diagnosis and prescriptions it offered.

In response to Stebbing, the Commission denounced "danger from the outside" such as progressive desiccation or large-scale climatic phenomena as a plausible explanation for environmental problems in Africa. They, instead, emphasized the role of localized human land use – activities amenable to administrative policies. According to two Commission members:

> …degradation of vegetation-type in this region, widespread though it may be, is entirely due to cultivation and confined to farmlands. It in no way indicates increasing aridity, nor a danger from outside to be guarded against, but is the sign of local soil impoverishment which, if continued, must either in time put a limit to the increase of population or give rise in some exceptional year to disastrous famine Collier and Dundas (1937: 191).

By framing degradation as local, the Commissioners made it more manageable. Their interest in proactive management efforts is evident in their disdain for the passive approach that Stebbing's systemic vision might have required.

> It is no consolation to an administration, or to the members of a crowded and starving community whose lands are no longer adequately productive, to know that the soil will recover if left alone for fifty to a hundred years (Collier and Dundas, 1937: 191).

The "wait and see" approach implicit in Stebbing's findings, would not have been palatable to the Colonial administrations. A remedy based on the control of human behavior and management of natural resources would fit much more easily with the administrations' overall objectives.

By rejecting Stebbing's interpretation of the environment, the Commission was also free to reject regional policy responses in favor of cheaper, national measures. The Commission, for example, did not endorse Stebbing's recommendation for a forest belt to hold back the desert. Jones (1938) said that sand displacement need not be addressed with "expensive regional schemes" (Jones, 1938: 422). Similarly Collier and Dundas (1937) asserted that a natural belt of vegetation already existed in northern Nigeria and was superior to any that could be built by man. However, the Commission did acknowledge that local displacement of sand by wind posed a problem for farmers. Consequently, they recommended placement of shelter belts at right angles to localize and control erosion in the north by protecting remaining patches of vegetation. They also advocated the maintenance of trees in farmland areas and the placement of hedges or tree lines at field boundaries (Stamp, 1940; Falconer, 1938: 356). All of these responses called for local regulation and management.

The Commission also interpreted some of the observed problems as inevitable side-effects stemming from pursuit of colonial objectives. Although the Commission agreed with Stebbing that shifting cultivation was causing widespread deforestation in the region, they saw it as a byproduct of colonial expansion and pacification of the region.

> Before the European occupation the people were compelled to live in settlements or within easy reach of a town in which they could take refuge during raids by neighbouring tribes. The pacification of the country has safeguarded life and property, and consequently in the last twenty years shifting cultivation has expanded to a remarkable extent. The present rate of distribution of forest in Nigeria by shifting cultivation has been estimated at 100 square miles a year (Jones, 1938: 413).

Colonial expansion was believed to have decreased civil strife in many areas. According to this view, the African people felt more secure in establishing stable livelihoods and many turned to agriculture based on shifting cultivation.

The Commission viewed the "European model" of agriculture (see Falconer, 1938: 356) (or fixed cultivation) as the best method for maintaining equilibrium between human and natural systems. The group's observations at Kano reflect these ideas. As two commissioners remarked: "There can be no spectacular creation of balanced conditions such as have been evolved by the natives themselves around Kano City …" (Collier and Dundas, 1937: 193). The group observed that more "prosperous" farming and "stable living conditions" accompanied permanent cultivation systems. "The Commission is of opinion therefore that the standards of living and farming naturally attained at Kano could be reached elsewhere by the organization of 'permanent farmlands, properly demarcated, regularly manured, adequately timbered with trees of economic value and with an assured supply of water" (quoted in Falconer, 1938: 356).

In recognizing shifting agriculture as the primary cause of deforestation, the Commission advocated the European Model of agriculture as the most promising remedy. Thus, the Commission's view of degradation lent itself to localized (rather than regional) forms of management and the imposition of European agricultural practices. Jones, for example, advocated the regulation of shifting cultivation coupled with incentives for fixed cultivation. He cited a discussion with the District Head of that area who described the conversion of bush to farmland. "The replacement of bush by farmlands, where these are permanent, is surely a sign of progress. It is a process which has taken place in all civilized countries" (Jones, 1938: 411). Similarly, the Commission recommended conservation throughout the region and maintenance of farmland fertility through permanent cropping (Collier and Dundas, 1937).

Ecological Balance and Department Coordination

The Commission and its vision of the northern Nigerian problems highlight disciplinary tensions and an early notion of equilibrium that continued to color desertification debates of the 1970s and beyond. Ultimately, Commission members viewed solutions as resting in successful agency coordination and balance among different development objectives. This vision reflects the multi-disciplinary, multi-departmental Commission membership. It also suggests that institutional structures of government departments, advisory panels, and scientific disciplines were central to early framings of dryland degradation.

Collier and Dundas' (1937: 193) prescribed measures for achieving the "balanced conditions" observed at Kano City. Thus, the ideal situation was an equilibrium state between people (colonial expansion/native agriculture) and their environment (natural resources), whereby permanent cultivation was maintained in conjunction with ample water and forest reserves. This notion of equilibrium was based on a more-or-less holistic view of the world in which social systems interact with natural systems, and different categories of nature (e.g., forests and water) interact with one another. Collier and Dundas suggested that the bureaucracy in charge of managing these interdependent natural resources was key to maintaining the desired equilibrium. However, the institutional boundaries that separated these departments and disciplines often tend to demarcate opposing sides of technical and policy controversies. Ultimately, such institutional structures heavily influence overall problem framing and policy prescriptions.

Many of the Commission's recommendations focused on agency coordination. They assigned specific tasks to the various departments. The group suggested that geographical officers identify areas where deforestation could lead to uncontrolled run-off or erosion and segregate lands not useful for permanent farmlands. The Veterinary Department took responsibility for determining which lands were suitable for grazing and which were best for providing fuel and forest produce for agricultural lands. In the words of Collier and Dundas,

> But whatever is done, the most important point of all is that there shall be the closest co-ordination of the activities of all Technical Departments. The Forestry Department must realize that deforestation in many places connotes true progress and desirable development; the Agricultural Department must realize that well-placed forests are essential to ensure permanency of cultivation in a country, and the Geological Survey must realize that the creation of water supplies has an effect upon population movements which cannot be ignored by the Forestry and Agricultural Departments in the farming and execution of their plans. Development must be considered as a whole, with the principle in mind that the greatest benefit to the individual is by no means invariably the greatest benefit to the community (Collier and Dundas, 1937: 193).

So whereas Stebbing emphasized intergovernmental cooperation, the Commission advocated departmental coordination. Just as their rejection of "outside dangers" enabled the Commission to recommend localized management policies, so the notion of balance between human and natural systems suggested that coordination among natural resource departments could maintain this equilibrium.

3.2.4 *Recap*

In appointing the commissioners, the French and British colonial administrations ultimately authorized a view of the West African environment based on the local experience of natural resource managers, their training in the natural sciences and their support for colonial priorities and perspectives. Not surprisingly, the Commission interpreted dryland degradation in a way that conformed to the attitudes and goals of the colonial administrations. The Commission's emphasis on shifting cultivation and the need for European-style agriculture reflected their assumptions regarding both the ignorance of the African peoples and their faith in European style agriculture as the best means for ameliorating degradation. In concluding that degradation was ultimately a question of resource management, commissioners defined this issue as one requiring the attention of local natural resource departments rather than bi-lateral cooperation.

Policy prescriptions offered by both Stebbing and the Commission further illustrated the realms of science and policymaking as delineated by the colonial administrations. In general, these were not wholly separate realms. On the contrary, they were integral to one another. Many administrators were also scientists, and management of natural resources in the colonies required scientific analysis of these resources and the ecosystems in which they existed. Hence, throughout the expanding specialized departments of West Africa, scientific inquiry was part of policymaking and implementation. Many contributors to scientific journals had served in both academic and administrative positions in the colonies. Stebbing and the Commission, for example, did not confine their analyses to the scientific aspects of their investigations. Often their ultimate objective was to relate their scientific findings to specific policy questions facing their respective countries. They did so by offering specific policy recommendations. The goals and information needs of the colonial empire also motivated scientific inquiry and helped to shape research agendas of independent scientists. Stebbing and fellow contributors to *The Geographical Journal*, for example, regularly took on issues and research problems of direct interest to the colonial administrations as they sought to preserve and profit from the natural resources of their empires.

3.3 From Science to Policy: Modernist Visions of Expert Advice and Environmental Degradation

Dryland research activity quieted during World War II but revived again in the early 1950s with the United Nations Educational, Scientific and Cultural Organization (UNESCO). As described in Box 1 and Chapter 2, UNESCO's Arid Zone Program played a major role in constructing drylands as a global phenomenon, amenable to analysis by natural scientists. In 1972, the United Nations Conference on the Human

Environment (UNCHE or the Stockholm Conference) set forth a highly technical and research-oriented approach to soil management. Around this time, West African countries approached the United Nations for help in addressing problems associated with severe drought and famine. Desertification was among these issues and quickly became a focus of international policy (see Chapter 2). The United Nations Conference on Desertification (UNCOD) took place in Nairobi, Kenya from August 29 and September 9, 1977 and produced a *Plan of Action to Combat Desertification* (PACD, or the *Plan*). According to the PACD, desertification was a physical problem of global extent, resulting from human disturbance of nature's equilibrium. Desertification's remedy was thought to reside in "rational land use practices" facilitated by imported technologies and the administration of national action plans.

The policy prescriptions contained in the PACD reflected extensive scientific assessment processes that preceded its negotiation. Scientific preparations for UNCOD took place over a two year period under the direction of the United Nations Environment Programme (UNEP). Deeply intertwined with UNEP's agenda, these preparations were based on the assumption that the production and assessment of scientific knowledge should take place prior to policymaking and should provide negotiators with an objective and consensus-based view of desertification and its possible remedies. Consequently, expert advisory activities for UNCOD involved carefully selected groups of scientists who met in isolation from diplomatic forums to define the desertification and prescribe its solutions. These natural scientists, mostly from developed countries, depicted desertification as primarily an ecological problem that transcended international boundaries and could be ameliorated via the tools of science and technology.

Box 1:
UNESCO's Arid Zones Progamme and the Internationalization of Drylands

As African decolonization began in the 1950s, dryland concerns that had formerly occupied European colonial powers, became the responsibility of the broader international community. International stability was thought to hinge, in part, on the health and prosperity of newly independent nations. The US and the rest of the developed world took an active role in fostering third world modernization through early development programs such as the United Nations Economic Committee for Latin America. Modernization theory supported the notion that industrial development and its grounding in science and technology were key to economic growth. Accompanying these ideas were notions that a "universal pattern of modernity" could emerge from disparate traditions, cultures and values. However, most modernization theories lacked "attention to deeper socio-cultural structures and the political adolescence of most countries in the South" (Shinn et. al, 1997: 9).

The North addressed drylands issues much in the same way it approached the challenges of development. UNESCO's Arid Zone Program (founded in 1951) defined drylands as an international science issue. Over the following decade, the Programme came to encompass 200 desert research institutes which operated in 40 countries. Primarily the studies furthered basic science rather than applied science. They focused on discovery of natural laws and assessment of ecosystem limitations. The Programme generated a newsletter, conferences and symposia. It also supported publication of a research review series and special reports on a wide range of topics. Occasionally studies were directed at general audiences and attempted to peak interest by reporting the accelerating loss of agriculturally productive lands in arid regions. However, these reports, were unable to achieve "theatrical success in capturing the public ear" (Walls, 1980: 5). In 1962 UNESCO merged the Arid Zone Programme with the broader natural resource program.

Attempts to integrate social science into the Programme's research agenda failed in the late 1950s. During its first six years, the Programme's experts employed natural science and methodologies such as mapping and vegetation and soil classification. When Harold Dregne, a soil scientist, and prominent Programme participant remarked that the "research findings know no national boundaries," (Dregne, 1970: insert page), he illustrated the value attached to universal, standardized knowledge claims. Around 1957 Programme administrators attempted to broaden the natural science focus. They recognized that development projects also required attention to social activity. Consequently, UNESCO attempted to involve sociologists and anthropologists in integrated survey teams. However, the results were disappointing. The social science component never reached field-level analysis (Batisse, 1985). While the natural science work was believed to transcend national and cultural boundaries, social/cultural studies would have reflected these boundaries – something for which the Arid Zones Programme was not prepared. The diversity of social/human situations defied the types of universal findings that the Programme valued. Contributions from social scientists could not be readily integrated with efforts of the natural scientists who had established the Programme's core methodologies.

3.3.1 *A Linear Science-Policy Model*

In the mid-1970s, the United Nations General Assembly (UNGA) placed heavy emphasis on science as the basis for policymaking and afforded UNEP a central role in creating both knowledge and policy. The activities of these institutions reflected definite ideas about science and its relationship to politics. After much debate between developing countries that favored an international conference and developed countries who did not, UNGA, on December 17, 1974, adopted Resolution 3337(XXIX) on "International Co-operation to Combat Desertification." This resolution called for a United Nations Conference on Desertification to take place in 1977. It also stipulated the utilization of all available knowledge and noted what it called an "urgent need to prepare a world integrated programme of development research and application of science and technology to solve the special problems of desertification…" UNGA also called for:

- Preparation of a world map of areas affected and those likely to be affected by desertification processes;
- The assessment of all available data and information on desertification and its consequences for development process of affected countries; and
- Preparation of an anti-desertification action program "including the building-up of the indigenous and autonomous science and technology capacity in areas concerned" (UNEP, 1978: 124-5).

In the same resolution, UNGA called on the Executive Director of the United Nations Environment Programme (Maurice Strong) to establish a small conference secretariat. It also requested the UN Secretary-General and relevant UN bodies to convene an ad hoc interagency task force to assist the Conference Secretariat in carrying out its work. These tasks, as prescribed by UNGA, proved extremely important in shaping pre-Conference scientific activity and its role in the Conference and in framing desertification policy.

UNEP's directors embraced this mandate. It provided a perfect, flexible vehicle with which to establish their fledgling agency as a scientifically credible organization with sympathies toward developing country issues. As Mostafa Tolba assumed UNEP's

Executive Directorship in 1975, he and his deputy Ralph Townley set to work constructing what Tolba believed to be a new field of knowledge. UNGA's call for scientific and technological solutions to the desertification problem and Tolba's personal commitments to science as a basis for both sound policy were central to the creation of desertification as an international science policy issue.

Building a Scientific Foundation

Implicit in the UNGA mandate was a vision of science and policymaking and their relationship to one another. According to this mandate, science should take place prior to policy negotiation and should provide diplomats with a foundation of knowledge upon which to base their decisions. Tolba's comments reflected this enlightenment-style approach to policymaking when he addressed the first session of UNCOD.

> It is the scientists and technicians who formulate the problems with precision, describe their characteristics, specify their dimensions, and, most important, tell us what <u>should</u> be done about them. It is those in political life who tell us what <u>can</u> be done about them, and then, most important, take action in terms of their sense of human, political and economic possibilities. In this order of events, science dominates the opening scenes of our quest: the climax is played out in the realm of practical affairs (A/CONF.74/L.1: 1).

The experts that Tolba commissioned were well aware of the stark divide that Tolba envisioned between science and politics. Ten years after UNCOD, Harold Dregne a key consultant to UNCOD remarked: "Mostafa Tolba, as chairman of the consultant meetings, made it clear from the beginning that he was interested only in establishing a sound scientific foundation for understanding and combating desertification. No bombast, no politics" (Dregne, 1987: 11). Similarly, in referring to conferences such as UNCOD, Walls (a member of the UNCOD Secretariat) remarked "...these are unique occasions when scholars and scientists, those who know, are brought together with political leaders, men who can act, in an effort to reach and carry through a course of rational action. Together, they embody the world as will and idea..." (Walls, 1980: 9).

The New Science of Desertification

Ralph Townley, the UNEP administrator in charge of putting this model of science and policy into practice, echoed Tolba's remarks.

> In conferences of this kind, the preparations are expected to provide solid, scientific foundations for the recommendations that are contained in the customary plan of action. The delegations, representing Governments, are then asked to provide the political will that is required to implement the recommendation. Although they serve as arenas in which science and policy converge, the conferences are fundamentally political events" (Townley, 1978: 69).

To fulfill UNGA's mandate, Tolba and Townley mobilized a Conference Secretariat and oversaw an Inter-Agency Working Group and several expert consultants. The Conference Secretariat included approximately 21 individuals, housed within UNEP, who focused primarily on administrative issues. An Inter-agency Working Group included representatives of various UN agencies that served as a sort of general oversight/advisory body. In addition, the Secretariat hired a large number of individual scientific consultants to carry out a host of advisory and assessment-related tasks.

Conference preparations commenced in early 1975 and involved a hierarchy of scientific consultants. At the top of this hierarchy was what one participant described as the "inner circle" (Interview with UNCOD Advisor 2). This group of natural scientists met approximately every two months with Ralph Townley and Mostafa Tolba to frame and guide scientific analyses. Below the "inner circle" was a group of 7 scientists commissioned to write thematic reports on four aspects of desertification. These reports, or Component Reviews, dealt with climatic, ecological, demographic and technological aspects of the desertification problem. Other consultants and organizations were commissioned to prepare case studies for analyzing desertification in specific geographical and historical contexts. National governments prepared feasibility studies of transnational projects for ameliorating and preventing desertification. Individuals and intergovernmental organizations prepared maps of desertification (see Chapter 5). Finally, the American Association for the Advancement of Science (AAAS) sponsored a symposium that took place immediately prior to the Conference. The goal of this symposium was to develop physical, social and biological indicators of desertification. The above-mentioned activities resulted in several forms of documentation:

- Four Component Review reports on climatological, ecological, demographic and technological aspects of desertification, plus an Overview, synthesis report (A/CONF.74/1; UNCOD Secretariat, 1977);[72]
- Case studies of desertification in six regions/countries (A/CONF.74/4);[73]
- Nine associated case studies supplied by governments (Biswas and Biswas, 1980);[74]
- Feasibility studies for transnational projects (e.g., A/CONF.74/25; A/CONF.74: 29);
- Four maps of desertification hazard, the status of desertification in hot arid regions, a climate aridity index, and an experimental world scheme of aridity and drought probability (A/CONF.74/31); and
- A handbook of desertification indicators (Reining, 1978).

Along with these tangible products, assessment activities are credited with sparking desertification research and greater awareness of the desertification issue.

Tolba believed that, through these many endeavors, the Conference Secretariat contributed significantly to development of a new scientific field. As he explained at the opening of UNCOD, the universal nature of desertification and the need for an international response to it required a "structure and coherence" that the issue lacked because of its "fragment(ation) among a great variety of disciplines." (A/CONF.74/L.1: 1-2). Consequently, UNCOD commissioned experts from several different fields to provide "order and structure to the subject" (A/CONF.74/L.2: 2).

> Contained in these documents are the results of the extensive surveys and scientific investigations carried out by individual scientists and by members of the Inter-Agency Task Force on Desertification and of the

[72] Also see A/CONF.74/5; A/CONF.74/6; A/CONF.74/7; and A/CONF.74/8.
[73] The document A/CONF.74/4 contains a synthesis of the six case studies. Individual case studies appear in documents A/CONF.74/9; A/CONF.74/10; A/CONF.74/11; A/CONF.74/12; A/CONF.74/13; and A/CONF.74/14.
[74] Australia, Iran, Israel, Peoples Republic of China the U.S.S.R, and the United States submitted case studies.

> Panel of Senior Advisors to the Conference Secretary-General. This huge input of the Scientific Community led to a clear identification of the principal points on which our scientific colleagues found themselves in agreement, and which constitute the heart of the problem (A/CONF.74/L.2: 3).

Tolba also emphasized the interdisciplinary nature of the consultants. Yet, while they did represent different disciplines, virtually all of them were natural scientists. The following section discusses participants in the UNCOD assessment process.

3.3.2 *Administrators and Advisers*

Just like the "top-down" approach prescribed in the *Plan of Action*, scientific activities preceding the conference reflected a hierarchical structure. At the top of the pyramid was Mostafa Tolba, Executive Director of UNEP, and his assistant Ralph Townley. These men worked closely with a small group of experts in conceptualizing the desertification issue and the key components of policy. They oversaw the work of various other consultants and advisors, including authors of the four above-mentioned Component reviews. There are several characteristics of these individuals and their work that are important to note. By an overwhelming majority, these participants were natural scientists who supported a global framing of desertification. Their interest in this problem focused largely on physical processes and manifestations of desertification. Analysis of physical parameters, or at least quantifiable social parameters (such as demographics) generated research results, often generalizable to global scales. Because insights offered by experts in fields such as anthropology and sociology were not easily generalized in this way, UNEP and its "inner circle" advisors tended to exclude such experts from deliberations. By focusing on the physical, land use-related causes of desertification, key advisors were also free to place considerable emphasis on the use of science and technology as remedies for desertification. As discussed further below, the expert culture surrounding conference preparations had important implications for policy.

The following sections focus on some of the personalities and processes that featured prominently in UNCOD preparations. The discussion describes Tolba and Townley, two personalities who played an important role in orchestrating assessment activities. It also examines the core group of expert advisors and the preparation of expert reports.

Tolba the Scientist

Tolba's scientific background colored UNEP's role in UNCOD preparations and its extensive use of expert consultants. Born in 1922 in Gharbia, Egypt, Tolba received his B.S. in botany from Cairo University in 1943 and his PhD from the University of London in 1949. After serving as a professor of microbiology at Cairo University and as Professor of botany at Baghdad University, he became the assistant secretary general of the National Science Council of Egypt. He later assumed positions in Egyptian government including undersecretary of state in the Ministry of Education. Eventually, he led the Egyptian delegation to the Stockholm Conference in 1972. Tolba proved very useful in assisting Maurice Strong, Chair of the UNCHE negotiations in helping to rally developing country support for various issues. In 1972, when Maurice Strong assumed the helm of a brand new UNEP, Tolba became his Deputy Executive Director. (Who's Who, 1998; Interview with UNEP Official 1)

Tolba took pride in his nationality and scientific training and was fond of reminding his colleagues of these two characteristics. He would often preface his statements with "I am an Egyptian…" On other occasions he'd begin with the phrase, "I am a scientist…" (Interview with UNEP Official 1). These phrases reflect, not only Tolba's identity, but also the identity he was trying to sculpt for UNEP. Science offered a potential source of personal credibility and credibility for UNEP.

Tolba was a controversial figure in his role at UNEP during the 1970s and 1980s. Some people were skeptical of his individual wisdom and creativity because he so often relied on science advisors.[75] Many of his detractors and supporters, however, agreed that his intellectual acumen and diplomatic skills were unparalleled. A prominent member of UNCOD's Secretariat described Tolba as a "distinguished microbiologist" (Walls, 1980). Another colleague remembered that when scientists were called to UNEP to serve on expert advisory panels for various issues, they would oftentimes insist on meeting with

[75] Interviews with UNCOD Advisor 1, UNEP Advisor 2, and UNEP Official 1.

Tolba and would decline to attend if Tolba, the man who could understand their science, was not available to meet with them in person (Interview with UN Official 1). Even one of Tolba's harshest critics described his "extraordinary mind with command of everything and amazing attention to detail" (Interview with UNCOD Advisor 1). In her account of the UNCOD negotiations, Margaret Biswas speculated that, perhaps, the "stature of its Secretary General" differentiated UNCOD from the host of post-Stockholm conferences in the 1970s (Biswas, 1978: 261). According to her, Tolba was a primary explanation for the "unusual harmony and cooperation" and "unusual degree of consensus on both causes and solutions." "Governments recognized his command of the subject, and were prepared to trust his recommendations as being the correct road to implement demonstrated resolve" (Biswas, 1978: 261). Both Biswas and UNCOD Secretariat member James Walls commented on Tolba's practicality. Walls believed that Tolba's attention to cost issues exemplified this characteristic.

Townley, the Administrator

Ralph Townley, in directing the UNCOD Secretariat, was instrumental in designing the processes by which desertification knowledge was produced. In doing so he played a major role in shaping the very nature of that knowledge and its dissemination. Townley recognized the Secretariat's role in creating a subject area that, up until that point, was largely unknown to the general public and lacked a coherent, singular definition among academicians. As Tolba's deputy, Townley's interpreted and implemented the UNGA resolution calling for the "The assessment of all available data and information on desertification and its consequences on the development process of the countries affected…." (UNGA Resolution 3337 (XXIX)). According to Townley, everything known about desertification was to be assembled or created (Walls, 1980). As Townley remarked, this was:

> A tall order by any standards, but an even taller one when we found that the word was not in the dictionary and no library had it in its classification. We might well have spent the entire period of preparation for the conference searching for a definition. This we eschewed and we found

ourselves willy-nilly creating a new scientific discipline (Townley, 1983: 4).[76]

Hence, Townley shared Tolba's view that UNEP, in preparing for the conference, had the job of essentially piecing together a new scientific field.

Ralph Townley's stint at UNEP in the mid-1970s was just one stop in a long career as a civil servant. An Englishman, Townley earned Bachelor of Science and Master of Science degrees in economics from the University of London and served in HM Merchant Marine in the Second World War. He joined the UN soon after completing his formal education. Although he took his first position in 1952 on the agreement that his tenure last just one year, he remained with the United Nations until 1984 when he retired as a director. During this period he held numerous positions including those of Special Assistant to the Under-Secretary-General for Economic and Social Affairs, Deputy Secretary General of the World Population Conference and Program Chief in the UN Development Programme. Between 1984 and 1994 he served as a senior consultant to the Secretariat on East Africa, the Middle East and Central America and chaired a General Assembly Committee on the Middle East. He published two books on international affairs as well as several novels and plays. Townley became Deputy Executive Director of the United Nations Environment Programme in the mid 1970s and soon assumed the role of Secretariat Director for the United Nations Conference on Desertification in 1975.

Townley's primary concern prior to UNCOD was smooth and efficient management of its preparations. Townley was quite well known in UN circles for running a "tight ship." His colleagues describe him as a great conversationalist and a successful manager (Interviews with UNCOD Advisors 1, 2 and 3). He was a skilled administrator and civil servant and prided himself on conducting his work efficiently and on time. Many of his recollections of the UNCOD process focus on the prompt completion of reports, their translation into UN languages and their distribution to

[76] This was not to imply, however, that the phenomenon itself was a new development. As Townley remarked, "the process itself, resulting in land degradation and lowered productivity, is at least as old as settled agriculture" (Townley, 1978: 69).

delegates. His concern for procedure is evident in the way he later described UNCOD preparations. He saw this process as consisting of five steps:

1) Obtain agreement for the country that is going to host the conference;
2) Invite governments to attend;
3) Prepare the scientific base for political discussion;
4) Draft the plan of action (a declaration of intent about what is to be done of the problem) and get agreement on it;
5) Send the declaration to UNGA for approval (Interview with Ralph Townley).

In another account Townley described:

> Conference papers were prepared by the best minds available in the scientific community. They were reviewed carefully in the United Nations system and in regional meetings of government technicians and were linked to a draft plan of action—rare for a conference of this kind—in half a dozen languages well beforehand. The conference itself came to swift political conclusions but was not politically diverted (Townley, 1983: 4).

This outline suggests that Townley did not see himself as a knowledge producer, but rather as an administrator and facilitator of knowledge production and scientific assessment.

Yet, Townley (in conjunction with Tolba) was much more than a manager. His decisions were instrumental in interpreting UNEP's mandate, defining what knowledge counted, who would produce it and how it would be produced. Though he was not a scientist, Townley's work on item three of the agenda he outlined for himself proved instrumental in shaping UNCOD and the desertification issue itself. As a preliminary step in completing this task, Townley and his assistants reviewed relevant literature in search of information that could address questions of import to the UNCOD: "why, in the first place, had desertification occurred at all? How had the process manifested itself? What lessons could be learned that would lead to specific recommendations in the *Plan of Action…*?" (Walls, 1980: 16). Townley set about this task first by hiring a Vietnamese consultant, Khoi Pham to review UNESCO's studies on arid lands. Townley instructed Khoi Pham to search for information applicable to the development of an action plan on desertification. To Townley's dismay the consultant unearthed only one short paper that Townley deemed useful, a short executive brief on land degradation (Interview with Ralph Townley).

The "Inner Circle"

In addition to his literature surveys, Townley began to assemble a group of expert advisors to assist him in navigating this new field and in preparing a draft *Plan of Action*. This select group of scientists was characterized by several of the more peripheral participants as the "inner circle" and the "club" (Interviews with UNCOD Advisors 1 and 2). Early in the process they made several important decisions that ultimately shaped the form and substance of the assessment endeavor. In addition, the "inner circle" constituted a closed forum for knowledge production. Its very existence implied that policy-relevant expert knowledge should not derive from open, democratic processes, but from highly controlled deliberations among scientists.

Membership in this select club of the "inner circle" was not determined, via a diplomatic method aimed at ensuring disciplinary and geographic diversity as in several of the more recent expert advisory panels for climate change, biodiversity and desertification. Rather, participation in the "inner circle" was highly dependent on personal connections and collegial ties among those involved. Townley coordinated the first group that met in the Aspen Institute, West Germany in mid-1975 and went on to convene in other cities alternating among Geneva, New York and Nairobi about every four months leading up to the Conference. The core group, which varied modestly each time they met consisted of Professor Mohammad Kassas, Professor of Botany, University of Cairo (Egypt); Harold Dregne, Professor of Plant and Soil Science, Texas Tech University (United States); Jack Mabbutt, Professor of Geography, University of New South Wales (Australia); and Boris Rozanov, Professor of Soil Science, Moscow University (USSR). Tolba was present at these expert meetings and was heavily involved and extremely interested in their content. Occasionally the group would call on other specialists to join in the discussion on specific topics such as meteorology, economics and anthropology. But each of these specialists would join the group only one or two times to provide special input (Interview with UNCOD Advisor 4).

Most of these core participants were from traditional natural science disciplines of soil science and botany. The geographers in the group were similarly inclined to natural science and quantitative analysis. They tended to apply a macro-scale view of the world (Interview with UNCOD Advisor 2). The majority of these experts were also from the West and even more were trained in the West. Tolba and Kassas were Egyptian, but both had been educated in London. No Africans were represented in the inner circle, nor in any of the major assessment work conducted for the Conference. As Ralph Townley explained, it was very difficult to find anyone at all who had expertise on the near-non-existent topic. So finding a scientist from Africa was even more difficult. Although the group did bring in consulting scientists for one or two meetings, all sessions were held in English with only occasional translation into French. According to one key participant, the language barrier posed problems and was, on occasion awkward, when a visitor to the group did not have a solid command of English and could not express his/her ideas effectively (Interview with UNCOD Advisor 4).

Dregne explained that UNEP looked long and hard to find experts who could participate. He said, however, that it was difficult to find people with whom they could develop close personal relationships and trust. So in selecting members to participate its seems that familiar faces were important - not necessarily to reward or recognize friends but to build a group in which the members could trust one another (Interview with UNCOD Advisor 4). Ten years later Dregne remarked "Participation in the planning for UNCOD was a truly rewarding experience. Having the opportunity to benefit from the valuable insights of Mohammed Kassas, Jack Mabbutt, Boris Rozanov, and Gilbert White, in particular, was a distinct pleasure" (Dregne, 1987: 11). Dregne's comments reflect the sense of community that built up among these individuals as they engaged in the UNCOD preparations.

The presence of the inner circle implies that knowledge production is not a democratic process. The belief that desertification was a global problem that conformed to natural laws seemed to obliterate any need for geographic diversity among the experts.

If knowledge about desertification was not contingent on local circumstance, than local knowledge need not be represented in expert deliberations.

Component Reviews and an Expert Hierarchy in Action

While the inner circle worked as special advisors to the UNCOD Secretariat they did not author any major scientific reports for the Conference. Instead, a more junior group of scientists prepared the four Component Review papers. The relationship involving the inner circle and the Component Review authors reflected a hierarchical structure for science advice. In addition, the Component Reviews themselves were more than just another set of technical reports. They represented an emphasis on natural science and the physical or easily quantified aspects of the desertification problem.

In referring to the reviews, a Secretariat member remarked how the topic of desertification "seemed to cleave naturally into four components" (Walls, 1980:11). Tolba similarly commented how participants in the advisory process "saw the subject as falling naturally into four components" (A/CONF.74/L.1: 2). In fact, it was Townley who developed this thematic organization. Townley's structuring of the Component Reviews marked a new approach to science advice in UN environmental conferences. In similar conferences during the post-Stockholm decade, diplomats generally received scientific information via numerous disparate reports and papers. Townley decided that the UNCOD Secretariat would oversee compilation of a more cohesive set of scientific studies - ones that would later be said by Tolba to lend structure and coherence to many fragmented bits of knowledge about desertification. Townley proposed that experts write four reports, each on a different aspect of desertification. He suggested four themes to Tolba and to the "inner circle" and they agreed (Interview with Ralph Townley). The four thematic papers, called Component Reviews, addressed the climatological, ecological, demographic and technological aspects of the desertification problem.

The inner circle then identified authors and Townley gave them their assignments. They chose Kenneth Hare, a Canadian climatologist to write a report on climate and desertification. This study discussed characteristics of the world's dry climates and their varability, and various ways in which this variability interacts with desertification processes. A group of geographers from Clark University in Worcester, Massachusetts (USA) authored a paper entitled "Population, Society and Desertification." They focused on demographic aspects of desertification including migration trends and population dynamics. They also examined various livelihood methods and their vulnerability to desertification, and discussed social consequences arising from it. Andrew Warren and Judith Maizels, geographers from the University of London, wrote on the ecological aspects of desertification. They explored processes at work in dry ecosystems and effects of exploitation in these ecosystems. Dregne suggested that his colleague, Manuel Anaya Garduño of Mexico prepare the report on technology and desertification. This study examined the use of technology in combating desertification in rural, urban and industrial contexts. While the report noted the role of technology in exacerbating desertification, it focused primarily on how technology could be employed to ameliorate the problem. The authors had substantial freedom and latitude to carry out the studies as they saw fit over the period of approximately one year. They would report to the "inner circle" periodically to present their studies and receive comments from Tolba and other Secretariat members.

The inner circle was also instrumental in defining the overall framing of desertification and the PACD's policy measures. These experts, for example, championed a focus on desertification as a problem of human land use (similar to the colonists' focus on shifting cultivation). The early talks among this group tended to focus on drought. But the scientists gradually realized that "drought wasn't the real problem." In their discussions they began to see drought as a normal, natural event. Moreover, drought was not something that could be directly ameliorated or controlled by people. Desertification, on the other hand, could be remedied through more rational land use practices (Interview UNCOD Advisor 4).

Once the inner circle made such decisions they were resistant to ideas that did not support their vision of desertification and the policy recommendations they envisioned for the PACD. This tended to frustrate the younger generation of Component Review authors who often introduced unconventional ideas, only to have them swept under the rug by the more senior scientists. The inner circle embraced ideas that supported their focus on more rational land use practices. But, "there were other things the 'club' didn't want to hear" (Interview with UNCOD Advisor 1). His colleague similarly recalled "The core group did not listen. They were all senior people and each had positions to defend" (Interview with UNCOD Advisor 3). For example, when Douglas Johnson suggested that soil movement, in some situations, could be beneficial, he came into conflict with Boris Rozanov, an "old school soil scientist." "Boris would never agree with this and it was an argument that people didn't want to hear" (Interview with UNCOD Advisor 3).

Component Reviews on climatic, ecological, demographic and technological aspects of desertification were prefaced by chapter entitled "Desertification: An Overview." James Walls, a writer and editor, known for his skill in making technical material accessible to lay readers authored this chapter[77] (Walls, 1980: xi). The UNCOD Secretariat intended the Overview as an Executive Summary for delegates (Interview with UNEP Official 1). In writing the Overview, Walls drew upon the various case studies and Component Reviews.

The Overview addressed the causes, consequences and remedies of desertification. In keeping with the provisions of the PACD, the Overview emphasized the global dimensions of the desertification problem and the role of human land use in ameliorating it. The report opened with a vivid account of the drought and famine crisis of 1968-73, thereby lending a sense of universality and urgency to the desertification issue.[78] The section on "Processes of Desertification," depicted the problem as a physical one. Degradation was not a question of broader social interactions, trade imbalances, poverty or gender relations at the household level. Instead, it involved man's direct interference with the climate, and land and vegetation balances in dry lands. The concept of natural equilibrium and the role of human land use in disrupting this equilibrium was central to the Overview's message. According to the Anglo-French Forestry Commission, degradation resulted from human disturbance of nature's balance. In similar fashion the UNCOD experts proposed:

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[77] Walls had worked with Ralph Townley as a writer and editor for the World Population Conference and he saw such conferences as an opportunity to explore a problem that had puzzled him since his experience with the Peach Corps in 1961: namely, "why there are so many poor people in a world so filled with riches" (Walls, 1980).

[78] As discussed below, the emergence of desertification policy from the drought and famine crisis marked an important transformation.

> Under natural conditions and through appropriate strategies, the dry land ecosystems maintain a balanced exchange of water and energy, but a favourable equilibrium is readily disturbed when man makes use of the land. (UNCOD Secretariat, 1977: 13).

> "Failure in resilience usually arises from sudden and severe disturbance, and such disturbances, in the present world, are almost always the work of man…it (desertification) occurs when man penetrates such environments and acts there—often out of his need for survival – without an understanding of or proper regard for their sensitivities and limitations" (UNCOD Secretariat, 1977: 21).

This focus on human behavior also appears in the climate assessments. Just as the colonial experts rejected the possibility of an "outside danger" or progressive desiccation, the Overview and Hare's climate study dismissed the role of global climate change as a cause of desertification. The Overview noted that uncertainty associated with the general circulation "should not…be taken to imply that man is a victim of recently accelerated desertification rather than its active agent" (UNCOD Secretariat, 1977: 19). In contrast, the Overview gave credence to the notion that overexploitation of land through activities such as overgrazing could inhibit rainfall in local areas.

The notion of equilibrium and a focus on human land use supported a technocratic approach to desertfication's solution. Just as the colonists had denounced shifting cultivation and supported a European Model of agriculture, the Overview called for an end to nomadic forms of pastoralism, in favor of more rational land use practices and the introduction of western technologies. The Overview and technological study for UNCOD recommended the sedentarization of nomads, and several specific measures including mapping of land use types, mechanized equipment, research into revegetation methods, introduction of more climate-resistant crops, improved weather forecasts, and improved irrigation schemes.

Outside the Circle: Social Scientists and UNCOD Assessments

As evidenced by the Anglo-French Forestry Commission and the Arid Zone Programme (see Chapter 2 and Box 1), dryland degradation had long been defined as a problem for natural scientists to explain. UNCOD preparations similarly portrayed desertification as a physical problem involving a narrowly circumscribed relationship between humans and their direct impact on the land as a physical resource. This justified a "proximate" solution based on more rational land use practices. The natural science focus of UNCOD preparations reflected the compatibility of natural science and international environmental policymaking. Both of these endeavors involve simplification and generalization. Because science involves the discovery of parsimonious and universal natural laws, it provided the perfect vehicle for constructing desertification as a global problem. As illustrated in Chapters 4 and 5, respectively, quantification and mapping of desertification's ecological manifestations were instrumental in constructing a global vision of desertification. Although there was some interest on the part of UNCOD administrators to involve social scientists such as sociologists and anthropologists in conference preparations, attempts at integrating predominantly ecological and climatological research with these social science perspectives were not successful.

In a conversation in the Century Club in New York City with his friend and colleague, James Walls, Townley expressed his frustration at the lack of social science research on desertification. He had recently immersed himself in papers submitted to the UNESCO-UNEP Man and the Biosphere Conference (convened in Sfax, Tunisia in 1974) and was dismayed at their content. According to Townley the studies said little about the people "and yet they had been telling us for years that the social aspects of desertification are critical." According to Walls, the "they" Townley referenced were the physical scientists, who had long urged for social science expertise in addressing desertification-related problems (Walls, 1980: 16).

Despite this apparent interest in natural and social science collaboration, experts in fields of anthropology, sociology and history were largely absent the UNCOD preparations. Several years following UNCOD, Brian Spooner, an anthropologist from the University of Pennsylvania and author of the Iranian case study, criticized the lack of social science participation in UNCOD's expert forums. He described himself as the "lone social scientist" involved with Conference preparations. Spooner's involvement with UNCOD resulted from an accidental confluence of events including the Iranian government's newly-found interest in deserts and environment and Spooner's visit to Iran's Department of the Environment. In 1976 UNEP commissioned Spooner to prepare the Iranian case study for UNCOD. Consequently, he was the only consultant with training in Middle Eastern studies and anthropology. According to Spooner, "Everyone else was coming from another direction" (Interview with UNCOD Advisor 2).

Both natural science experts and Spooner himself recognized a resistance to the micro-level perspectives that fields like anthropology offered. The UNCOD experts were concerned with macro-level issues and assumed that one could solve the desertification problem by imposing new agricultural practices and technologies on people without regard to social and cultural factors (Interview with UNCOD Advisor 2). In the words of physical geographer, Andrew Warren:

> There was a positivist stamp on the science and an underlying assumption that erosion is bad. The social and physical science camps were completely separate and differentiated between social and physical realms when the interaction between the two is what really matters (Interview with UNCOD Advisor 1).

While Secretariat members understood that the problem was not purely a technical one, they were unable to integrate social science contributions with the rest of the knowledge they were collecting (Interview with UNCOD Advisor 4). In further reflecting on disciplinary cultures in the desertification context, Spooner authored the following statements.

> The concept straddles ------two sectors of science-the "two cultures" of Western society. Since desertification is diagnosed from natural symptoms, the natural scientists extend their hegemony over the debate. There is so far no social-science definition of desertification. In fact, it is difficult to see how there could be, because it would seem to be a social definition of natural process!...The biggest problem in (human) ecological studies generally today is that there is as yet no such integrative concept or framework (Spooner and Mann, 1982: 40).

> The material and the social aspects of desertification, the damage to primary productivity and the harm to people, appear so obviously related: yet they are difficult to describe satisfactorily because the natural is

> supposedly universal whereas the social is divisive… We do not yet know how to relate human activity to either evolutionary or ecosystemic processes. We tend to treat it as ecologically intrusive, because it does not fit within the boundaries of physical or biological units (Spooner and Mann, 1982: 42-3).

Spooner fought an "uphill battle" in an effort to get attention to his views. He tried to relay his ideas through long hours of discussions in both formal meetings and informal settings, but never felt as if he influenced the Secretariat's approach (Interview with UNCOD Advisor 2).

Tolba played an integral role in these disciplinary dynamics, seeming at times unwelcoming of social science perspectives. One of the Component Review authors recalled a meeting with Tolba in a Boston hotel room. The expert likened the meeting to a PhD defense in which Tolba critiqued each of the reports. In reference to one of the studies, Tolba noted that he did not approve of the word "societal," in the reports, but was perfectly happy with the use of "scientific terms" (Interview with UNCOD Advisor 1). Another UNCOD expert noted: "Tolba…believed we knew how to deal with desertification because we had the technical solutions." Tolba seemed to assume that the role of social scientists was to "tell us how to get people to do what we want them to do" (Interview with UNCOD Advisor 3). This led one advisor to conclude that few fellow advisors never understood that "you can't just order people to behave in a certain way" (Interview with UNCOD Advisor 2).

The inner circle did consult with social scientists. However, according to one UNCOD administrator, these experts were "useless." They could not speak outside of the compass of their own specific research focus. "The natural scientists, especially the geographers, were much better at working in a transdisciplinary setting" (Interview with UNEP Official 1). According to one UNCOD advisor, social scientists suffered because they lacked the quantitative models and figures that enabled the natural scientists to make observations and recommendations that were applicable at a global scale. This expert also commented that there was a certain degree of bias on the part of many of those closely involved with the expert advisory processes. Some believed that "hard" science was, in general, more useful in addressing a problem like desertification (Interview with UNCOD Advisor 4).

Spooner believed that part of this situation stemmed from lack of interest among social scientists and a reliance on geographers who were primarily concerned with macro-level issues.

> The problem here was that very few social scientists were interested in ecological problems, or even in the effects of ecological problems on human life. Even if the organisers of this ecological conference had set out to involve social scientists, it is unlikely that they would have produced anything interesting. Social science was not ready for the problem (Spooner and Mann, 1982: 44).

Geographers, however, seemed to satisfy the Secretariat's interest in and obligation to social science. As described by one of the UNCOD experts, geographers were ideal for UNEP because on the surface they appeared to straddle the realms of natural and social science. However, the experts involved with UNCOD tended to have a natural science orientation rather than a social or cultural one (Interview with UNCOD Advisor 2). They dealt with some of the human elements of desertification, but focused largely on macro-level issues of population and broad dynamics of social change (e.g., see Kates et al., 1977).

In keeping with the tradition of the colonists and UNESCO, social science was largely absent from the desertification debates of the 1970s. Emphasis on natural science was helpful in simplifying desertification and making it amenable to the scientific and technological tools of development assistance. As discussed in the next section, simplification and technological solutions were central aspects of the *Plan of Action.*

3.3.3 *The Plan of Action: Constructing a Beat-able Enemy*

In many respects the *Plan of Action* mirrored the UNCOD advisory process itself, as well as the views of its participants. This is not surprising seeing as the UNEP Secretariat, with the help of expert consultants and their reports, authored the draft *Plan of Action* submitted to conference delegates. During their two-week session together, delegates methodically stepped through this document, negotiating its contents. However, with just a few exceptions, the draft *Plan of Action* (A/CONF.74/3) and the final *Plan of Action* (A/CONF.74/36; UNCOD, 1978) were markedly similar.

In keeping with many of the Component Reviews and advisory panel discussions, the PACD portrayed desertification as a global problem in extent and urgency but arising primarily from direct interactions involving people and their environment. Although the agreement identified climate factors as an important part of desertification processes, it emphatically dismissed drought as a direct cause of the problem. At least initially, the *Plan* also sidelined the social aspects of desertification. The draft version of the *Plan* UNEP submitted to the Conference did not contain discussion of socio-economic facets of desertification. Such a discussion was added only upon the urging of some conference delegates. As far as remedies, *Plan* authors and negotiators agreed to a "proximate solution" for desertification. This solution focused on improving so-called irrational land use practices. In reflecting the hierarchical structure of UNCOD's advisory process, the *Plan* called for technologically-based, top-down programs administered by national governments.

Desertification as a Problem of Land Management

By highlighting land use practices as a major cause of desertification, the *Plan* focused attention on direct physical interaction between people and their environment. Desertification was thought to arise from a "network of cause and effect," involving poverty, lack of education, and inadequacy of resources in the face of population growth (UNCOD, 1978: 7-8). The immediate focus of policy, however, was a "less than rational system of productivity" (UNCOD, 1978: 55) based on overexploitation of resources via activities such as overgrazing, excessive mechanization, clean fallowing, deforestation, and faulty irrigation schemes (leading to salinization and alkalinization). In echoing colonial ideas regarding nature's balance, the *Plan* further implied that certain types of interaction could disrupt this balance.

> To see precisely what happens when desertification occurs, attention should be focused on that shallow meeting place between soil and

> atmosphere, where plants thrive and where a balance is maintained between incoming and outgoing energy and between water received and lost" (UNCOD, 1978: 3).

This narrow vision of desertification emanated from activities at the land surface had considerable implications for policy. UNCOD's conception of desertification focused on physical and climatic considerations such as degraded vegetation, depleted soil, deforested areas, temperature and precipitation. These parameters were amenable to standardized, scientific measurement that facilitated a global framing of desertification (see Chapters 4 and 5).

The *Plan* did acknowledge the geographical variability of desertification phenomena. It noted that different ecological characteristics and social contexts will lead to different desertification causes and processes and require varied responses. Nevertheless, the *Plan* identified natural resource management as the primary focus of policy regardless of the broader ecological and social processes at work.

> Each region may require a distinctive approach to desertification problems. With natural resource management as its primary concern, this Plan of Action recommends methods for setting priorities for action against desertification, but leaves the actual determination of priorities to national policies and plans (UNCOD, 1978: 8).

Despite socially, culturally, and environmentally variable aspects of desertification, the *Plan of Action* as an international policy agreement was expected to provide, at some level, a universal statement in prescribing anti-desertification measures. This statement derived from an understanding of desertification as first and foremost a land use problem.

From Drought to Desertification: Opting for an Anthropogenic Problem

While the *Plan* highlighted climate as an integral aspect of arid environments, it de-emphasized the possibility that climate variations might actually be responsible for desertification. In Recommendation 24, the *Plan* notes, "it is evident that climate plays a critical role in most desertification processes" (UNCOD, 1978: 32). A major pre-Conference assessment left open the possibility that long-term climate change might contribute to desertification (UNCOD Secretariat, 1977; Hare, 1977). However, the *Plan* and supporting documentation argued that relationships linking climate and desertification should not divert attention from land use techniques as the key cause of desertification and the primary focus of policy.[79]

> ....plans for land management should take into account the possibility of an even less reliable climate in the future. This should not, however, be taken to imply that man is the victim of recently accelerated desertification rather than its active agent. Clearly the answer to the question has great significance for strategies to combat desertification (UNCOD Secretariat, 1977: 19).

In other words, because climate was not subject to control or manipulation via policy measures, the *Plan* downplayed its role in desertification processes. To ensure a focus on land use practices, Conference participants omitted reference to climate as cause of desertification. The draft *Plan of Action* submitted to the Conference on August 29, 1977 defined desertification as "widespread deteriation (sic) of ecosystems under the combined pressures of adverse and fluctuating climate and excessive exploitation" (A/CONF.74/3: 2). However, the negotiators and final Plan authors removed reference to these dual causal factors, deciding, instead, to focus on the role of "overexploitation" as desertification's primary cause (UNCOD, 1978: 7). By downplaying the role of climate, UNCOD participants further emphasized that people caused desertification, and could therefore ameliorate it. This also resulted in distinguishing between drought (viewed as a natural phenomenon) and desertification (viewed as a human phenomenon). As Tolba noted,

> Although their onset cannot yet be predicted, droughts are recurrent and inevitable, and they are characteristics of arid, semi-arid and sub-humid climates. The culprit, therefore, cannot be found in the shifting play of

[79] Drought and famine were perceived as natural phenomena largely beyond human control (see Garcia, 1981). In contrast, the Plan (as discussed below) defined desertification as a problem arising from human land use. This made desertification appear considerably more amenable to policy interventions. Arguably, relationships linking climate and desertification might support desertification's framing as a global issue . Yet, for the UNCOD participants, a large role for climate change in exacerbating desertification would largely invalidate international desertification policy.

> climate. Rather it is man himself who must be viewed as the agent of desertification. It is man's action that degrades the land by misuse or overuse as he seeks to wrest a living from fragile ecosystems under unpredictable and often harsh climatic conditions, and under a variety of social and economic pressures (A/CONF.74/L.1: 3).

While the West African drought crisis ultimately put desertification on the international agenda, the UNCOD process transformed drought and associated problems of desert encroachment (see Chapter 2) into desertification, a beat-able enemy amenable to scientific and technological intervention and aligned with UNEP's interests in science and development issues.

In keeping with a focus on human-induced desertification, pre-Conference assessments also suggested that people might be responsible for regional drought episodes. The summary assessment for the Conference (UNCOD Secretariat, 1977) and a report on *Climate and Desertification* by Kenneth Hare cited well-known modeling experiments by MIT professor Jules Charney. In a 1975 journal article, Charney argued that increased albedo due to overgrazing could alter the atmospheric energy balance and increase subsidence in localized areas. In other words, just as people caused desertification, they might also contribute to regional drought conditions. Interestingly, neither Hare nor other expert contributors to UNCOD cited work challenging Charney's hypothesis. Researchers such as Jackson and Idso (1975) contended that vegetation removal in drylands could decrease soil moisture levels and radiant energy while increasing surface and near-surface temperatures. Measurements of warming near ground temperatures in several locations where vegetation was reduced suggested that hydrological conditions, rather than albedo effects, dominate surface energy balances associated vegetation removal from most drylands (Williams and Balling, 1996).[80]

[80] Research in the 1980s showed greater support for Charney's findings, but concluded that soil moisture was at least as important as albedo effects (see Williams and Balling, 1996).

Sidelining Social Dimensions

As with climatic factors, the *Plan* acknowledged social aspects of desertification, but said little about their role in desertification processes.[81] The draft *Plan*, prepared by the Conference Secretariat and submitted to Conference delegates, contained virtually no discussion of social facets of desertification. After much urging on the part of developing countries, a section entitled "Socio-economic Aspects" was added to the *Plan*'s text. Conference participants identified unequal access to resources, lack of education, population growth, deficient health services, and unsound human settlement planning as contributing factors to desertification. The role of women, land tenure, and indigenous views of the land and its use received very little attention. As discussed below, socio-economic aspects of desertification were interpreted as problems that could be fixed through the introduction of modern (mainly western), capitalist values and through education to encourage populations in affected areas to think along the lines of developed country inhabitants. Hence, plans to introduce western ideas and values, paralleled similar plans to introduce modern technologies and land use methods.

Proximate Solutions

By framing desertification as a problem of land use, *Plan* contributors also constructed science and technology as logical solutions. While scientific research could provide a deeper understanding of desertification processes, use of technology could alter the ways in which people manipulated the land's resources.[82] PACD authors acknowledged other

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[81] The Plan implied anti-desertification activities would eventually have to address social facets of the problem, the immediate solution concerned changes in land use practices (e.g., see UNCOD, 1978: 8).

[82] Emphasis on science and technology throughout the Plan, aligned with the goals of the UN General Assembly. In establishing the Conference, the UN General Assembly stated that its aim was to enable all countries, especially developing countries "to benefit from the achievements of modern science and technology for the acceleration of their economic and social progress" (UNEP, 1978: 124). Reliance on science and technology fit with the military metaphor of "arresting," "attacking" and "combating" desertification (UNCOD, 1978: 6). Following Stockholm, UNGA and other UN organizations used such metaphors in referring to desertification and drought problems. They suggested that anti-desertification efforts were best fueled and informed by scientific analysis. On May 1, 1974 UNGA issued resolution 3202 (S-VI) recommending that the international community "undertake concrete and speedy measures to arrest desertification and assist the economic development of affected areas" (UNCOD Secretariat, 1977: 6). Similarly, the Economic and Social Council's resolution 1878 (LVII) of July 16, 1974 asked that relevant UN organizations take up a "broad attack on the drought problem."

complexities of desertification, but did not attempt to comprehensively address them through policy.

> While solutions probably rest ultimately in education, social and economic advancement and the adjustment of population growth to the development of resources, the *proximate solution* centers on improved land use (UNCOD Secretariat, 1977: 8).

This "proximate solution" of improved land use called for the transfer of knowledge and technology from developed to developing countries and recommended that indigenous approaches to land management be enhanced through "strengthening of indigenous capabilities" and adoption of modern land use techniques. The *Plan* emphasized that solutions to desertification were known, but more research could increase efficacy. Specific measures included mapping and assessment efforts to determine the extent and severity of the desertification problem, and the role of both natural and social systems in contributing to it. Provisions aimed at promoting more "rational" use of resources included rational assessment of water needs and improved water supply; technical improvements to rain-fed cropping systems; improved irrigation systems; schemes for maintaining and protecting existing vegetation; "rational use of fertilizers;" and shelter belts to confine desertified areas.

While suggestions for land use improvements constituted the majority of the *Plan*'s recommendations, the agreement did include a handful of recommendations regarding socio-economic concerns. These recommendations were aimed at improving education, human settlements, and demographic information systems and policies. Like provisions for land use improvements, those regarding socio-economic issues generally called for the introduction of modern/western perspectives and techniques in affected areas. It was hoped that such a transfer would enhance presumably deficient methods of land management. The *Plan*, for example, called for "incorporation of (affected) regions in a more rational system of productivity." This included, "the introduction...of a new education system...that will allow the population to become fully aware of the ecological aspects of development and at the same time create a sense of solidarity with future generations." To enable demographic policies necessary for improved land use, the *Plan* called for "as appropriate, maintenance of an adequate rural labor force, sedentarization of nomads and resettlement of migrants from rural to urban settings" (UNCOD Secretariat, 1977: 22-3). The *Plan* also recommended improved health services and increased monitoring of the human condition in regard to desertification. Suggested indicators included population, human and environmental health, food, education, and "man as a land user." (UNCOD, 1978: 25).

To facilitate implementation of its policy recommendations, the Plan outlined several institutional and potential financial measures. To a certain extent these institutions further illustrate the centralized, top-down approach to policy embodied in the *Plan*. The *Plan* described the characteristics of national machinery and the role of the UN's Regional Commission in supporting implementation. The *Plan* also outlined tasks for UNEP and requested the UN General Assembly to establish an inter-agency working group on desertification to assist UNEP's Governing Council and UNEP's Environment Co-ordination Board in orchestrating policy implementation at the international level. In regard to financing, the *Plan* did not establish a new funding source or financial mechanism. Instead it recommended consideration of several types of financing through (1) subregional cooperation, (2) bilateral, multilateral, and multi-bilateral assistance, and (3) consultative group/club or group type financing. A fourth category proposed a special account funded, inter alia, through international taxation, donations, and international financing institutions. Although the idea never came to fruition in the desertification context, the *Plan* marked the first appearance of international taxation as a possible financing mechanism for international environmental agreements.

3.3.4 *Recap*

The PACD approach to desertification reflected the institutions and processes that gave rise to it. UNEP, a fledgling international agency led by a scientist, viewed desertification as a global problem, knowable by scientific inquiry and amenable to top-down, technological solutions. UNEP developed and legitimized this vision of desertification largely through its extensive, pre-conference assessment activities. In designating natural scientists as the "thinkers," UNEP afforded them considerable control over problem framing. Not surprisingly, as developed country experts in soil science and physical geography, these noted researchers interpreted the desertification in a way that aligned with their backgrounds and perspectives. They emphasized features of desertification that were amenable to simplification and generalization. In doing so, they supported UNEP's emphasis on "rationality" as a means for understanding and ameliorating desertification. In focusing attention on the physical processes and manifestations of desertification, scientific assessments also helped UNEP to portray desertification as a universal phenomenon. With a singular set of causes (i.e., poor land use practices) and clear physical manifestations, desertification appeared amenable to standardized, global measurements (see Chapter 4) and a proximate solution based on centralized, technological interventions.

With this framing of desertification UNEP delineated realms of local-global and natural-social. This boundary work on the part of UNEP and its consultants had important implications for issues of participation in desertification science and policymaking. In emphasizing global and physical dimensions of desertification, UNEP invited the participation of experts such as climatologists and soil scientists who were conversant with tools of generalization and standardization. At the same time, UNEP tended to close the doors on anthropologists and sociologists who emphasized the variability of desertification processes and their social dimensions. These perspectives on desertification generally did not highlight universal truths about the issue or support proximate, technocratic solutions. Also left out of the debate were the voices of people affected by desertification. UNEP did not hire African consultants to study desertification, nor did the agency consult extensively with local people in developing the draft *Plan*.[83] Their local experiences would also have been at odds with the agency's standardized portrayal of desertification. Moreover, as part of "irrational systems of

[83] Governments oversaw a handful of case studies, but these analyses focused mainly on "true deserts" which did not, in the end, fit the Plan's definition of desertification (e.g., Biswas and Biswas, 1977). UNEP also held regional meetings to review the draft Plan of Action in Santiago Chile (February 23-26, 1977), Algarve Portugal (March 28-April 1, 1977), Nairobi, Kenya (April 12-16, 1977) and New Delhi, India (April 19-22, 1977) (A/CONF.74/33). However, participants at these meetings were members of international organizations and country delegates, rather than local people or community organizations. Consequently, the sessions served primarily as preparatory meetings for the negotiations.

productivity" affected populations appeared to be the cause of desertification, rather than its solution.

3.4 The 1980s: Science Advisors as Policy Analysts

Throughout the 1980s UNEP continued in its position as the lead UN agency regarding desertification issues. As such, UNEP oversaw implementation activities under the *Plan of Action*.[84] Most expert advisory activities during this period centered on the task of policy evaluation. The agency conducted two assessments of progress, one in the early 1980s (completed in 1984), and another conducted in the late 1980s (completed in 1991). The latter study served as UNEP's primary contribution to the United Nations Conference on Environment and Development in 1992. As discussed in Chapters 4 and 5, respectively, a major thrust of these assessments concerned numerical measurements of desertification's physical extent and development of new desertification maps. Assessments also analyzed the financial status of desertification initiatives and reviewed programs and projects implemented under the *Plan*. These endeavors continued to reflect the linear view of science-policy prevalent in the 1970s. They also reflected UNEP's heavy reliance on natural scientists, this time to characterize desertification and evaluate implementation measures.

In proceeding with its assessment efforts, UNEP found itself no longer the predominant interpreter of desertification. Other voices, emphasizing the local and social facets of desertification, entered the arena and commanded considerable authority in the eyes of fellow scientists and the public. Disappointing results of PACD implementation caused UNEP to begin to develop some new perspectives on the issue. Most notably, UNEP and its assessors began to note the success of non-governmental organizations in implementing desertification projects and the need for greater attention to the human

[84] In accordance with the Plan, the agency established or convened several institutional bodies to carry out implementation tasks. It put in place a Desertification Branch to serve as a focal point in implementing the Plan, an Interagency Working Group on Desertification to facilitate cooperation among different UN agencies, and a Consultative Group for Desertification Control (DESCON), aimed at securing funding for desertification projects (Dregne, 1984). For financing the Plan, UNEP opened a special account. The agency also founded the *Desertification Control Bulletin*, published twice a year, and intended to raise awareness about desertification issues.

dimensions of degradation processes. However, UNEP's "attack" on desertification remained largely dominated by a top-down science and technology-driven approach to the issue. Critiques from outside the agency easily overshadowed UNEP's embryonic departure from its long-standing paradigm. Scientists, including some former desertification advisors, questioned the validity of some of UNEP's assessment methodologies and called for UNEP to revamp its vision of desertification policy and policy implementation.

In the aftermath of controversy and debate, UNEP (as primary assessment provider to UNCED) emerged once again as an important contributor to policy formulation. Alongside well organized and vocal African country delegates, UNEP's (1991) report on the world status of desertification and the progress of PACD implementation served as a primary source of information for UNCED delegates and its features are evident in *Agenda 21* Chapter 12. This policy statement reflected a desertification issue in transition, bringing together some of the prominent interpretations of the 1970s, while introducing new ideas that would develop more fully in the 1990s. The chapter's extensive provisions for scientific monitoring and measurement of desertification were reminiscent of modernist-style desertification policy. Yet, new ideas about the issue were evident in increased attention to public participation in anti-desertification activities and greater consideration for the appropriateness of introducing modern technology in local contexts. Perhaps the most telling feature of Chapter 12, however, was the provision establishing an Intergovernmental Negotiating Committee for a desertification treaty, the result of heavy African lobbying and an institution that would ultimately usurp UNEP's leadership role on desertification issues.

3.4.1 *Assessments and Ad Hoc Panels*

During the 1980s scientists continued to play an important role in the desertification policy arena. Their responsibilities, however, broadened as they took on tasks of policy evaluators in addition to scientific advisors. In the 1970s Tolba described scientists as the thinkers and politicians as doers – people of action. Scientists, according to Tolba, provided a factual basis for policymaking in advance of political negotiations. As the

Plan's implementation process got underway, UNEP devised another role for scientists. It convened natural scientists to evaluate implementation efforts. Just as reliance on natural scientists had contributed to the PACD's top-down framing of desertification and its remedies, so a large role for natural science in the PACD's evaluation encourage the use of a certain metrics of success. These criteria, in turn, perpetuated a focus on physical manifestations of desertification. Determination of success or failure depended largely on desertification's global extent and the rate at which desertification was "spreading."

Throughout the 1980s UNEP convened a number of expert panels and sponsored several assessment processes. The agency had several goals in initiating these studies. Many focused on developing desertification mapping and assessment methodologies, operationalizing desertification's definition (e.g., Odingo, 1990b), and examining financial aspects of implementation (e.g., UNEP, 1984; UNEP, 1991). UNEP's General Assessments of Progress published in 1984 and 1991 had the most bearing on international policy. The 1984 study fueled considerable controversy regarding UNEP's interpretation of the issue, its assessment methodologies and its approach to policy implementation. The 1991 assessment provided a forum for UNEP to respond, in part, to critics, while continuing to portray desertification as a global phenomenon amenable to standardized measurements and singular solutions.

Directives for the 1984 and 1991 assessments ultimately came from the *Plan of Action* and the UN General Assembly, respectively. However, UNEP had considerable latitude in interpreting these directives. The *Plan*, for example, simply called for a general assessment of progress seven years after the *Plan*'s completion in 1977. Similarly, the UN General Assembly in a Resolution from 1989 called for UNEP's input to the Rio Summit. The General Assembly requested UNEP to:

> contribute substantially to the discussion on desertification at the Conference, *inter alia*, by undertaking a general evaluation, sufficiently in advance of the conference, of the progress achieved in implementing the Plan of Action (General Assembly Resolution 44/172, December 19, 1989; also quoted in UNEP, 1991: xv).

Unlike its call for extensive scientific analysis prior to UNCOD, this resolution did not stipulate the use of such analyses. Hence, UNEP had considerable flexibility in designing these assessment processes. The agency opted to call on science advisors to carry out its assessment tasks. Chapter 5 contains a more detailed discussion of the 1984 and 1991 assessments and their reliance on quantitative estimates of desertification. The discussion immediately following highlights key features of these assessments as indicative of relationships linking scientists and UN institutions during the 1980s.

The 1984 assessment served mainly as a public relations effort gone wrong. Rather than demonstrating need for greater attention and resources for desertification, the assessment nearly destroyed the credibility of both UNEP and the issue itself. The study examined the "global status and trend" of desertification, a very broad summary of activities implemented under the *Plan*, a review of institutional and financial arrangements, obstacles to success and recommendations for action. The assessment's centerpiece concerned its analysis of status and trends, which took the form of several statistics regarding desertification's physical extent and the rate at which this extent was increasing. As discussed in detail in Chapter 5, statistics were generated based on response to a questionnaire sent to governments and international agencies. But responses were small in number and revealed confusion on the part of respondents regarding the meaning of desertification. The estimates relayed substantial rates of increase for desertification, but scientists familiar with the survey methodology and poor quality of responses severely questioned UNEP's dire predictions.

If UNEP had relayed its survey findings in qualitative, descriptive terms, perhaps the criticisms would have been less harsh. Instead, UNEP portrayed its assessment process as grounded in sound scientific methods. They also portrayed key assessment findings without reference to their large uncertainties, thereby leaving the numbers open as an easy target of deconstruction. When members of relevant scientific and policy communities discovered that these numbers were not reliable, they lost trust in UNEP and its picture of desertification. As discussed in Chapter 5, critics accused UNEP of misleading the public and exaggerating desertification's impacts. While some observers believed UNEP had damaged support for a worthy cause and important problem, others simply dismissed desertification as a scam.

Other elements of the 1984 study were easily lost amidst debate surrounding numerical estimates. UNEP, in keeping with the *Plan*'s provisions, clearly emphasized a national, top-down approach to desertification. According to the assessment, for example:

> National institutions and machineries to combat desertification, particularly in developing countries, are generally in need of further support and in many countries do not yet exist. Further attention needs to be given to establishing institutions capable of a government-wide co-ordinating role, through which assessment of desertification and the planning and monitoring of desertification-control programmes can be achieved (UNEP, 1984: 9).

Nevertheless, buried in over sixty pages of text were two short paragraphs on the role of non-governmental organizations (NGOs) in PACD implementation. NGOs received minimal attention despite the fact that "in some respects NGOs have been the most effective agencies in the campaign against desertification" (UNEP, 1984: 36). UNEP attributed some of their success to the local-scale focus of their work, their flexibility, and capacity for learning from past experiences. However, the report's Executive Summary suggested only that other organizations, wherever possible, take the successful actions of NGOs into account. Hence, while the inklings of new approaches to desertification were emerging from UNEP's work, they were dwarfed by large-scale scientific research endeavors.

Problems regarding the 1984 assessment opened the door to widespread criticisms and the emergence of new approaches to desertification. As discussed in the next section, new voices emerged from outside of UNEP to offer and encourage a more localized vision of desertification and its solutions. While UNEP incorporated some of these ideas in its 1991 assessment (discussed below), the agency continued to emphasize the physical and global scale dimensions of desertification. In focusing on the "world status" of desertification, for example, key messages from the assessment centered on the geographic extent of land degradation as expressed in numerical terms. However, the study also employed a new definition of desertification.[85] While this definition identified human activities as the main cause of desertification, it equated desertification with land degradation, rather than the spread of desert-like conditions. Hence, images of desertification as process were beginning to replace a focus on desertification's physical manifestations.

In addition to setting forth a new definition of desertification, the 1991 assessment also identified several factors believed to contribute to lack of progress on the issue. These included low priority given to anti-desertification initiatives, as well as lack of funding and technical assistance. UNEP also noted that technical solutions were often applied to problems of a socio-political and/or socio-economic nature, and that local populations were not fully involved in planning and implementing anti-desertification programs (UNEP, 1991: xiv). UNEP's reflections to signal a broadening vision of desertification. Whereas UNCOD participants saw desertification as primarily a physical problem, assessors in 1991 focused more attention on its social dimensions and the futility of applying technical adjustments to processes that are essentially social and dynamic in nature. This marked a significant shift in thinking from the modernist paradigm from the 1980s.

3.4.2 *New Voices of Authority*

During the 1980s, UNEP continued to rely on the expertise of natural scientists in evaluating policy implementation. However, the agency's credibility suffered largely as a result of its 1984 assessment. UNEP, so well established as a key producer of desertification knowledge, began to waver in the eyes of members of the scientific community and new voices entered the debate. Former UNEP consultants on desertification pointed out the weaknesses of UNEP's approach, while others offered new tools of inquiry and new interpretations of desertification. However, new authorities in the realms of international environmental politics were not only scientists. The UNCED

[85] An assessment in 1990 (Odingo, 1990) generated this new definition. One of the goals of that assessment was to improve desertification's definition by making it more operational, in other words, more amenable to scientific analysis and mapping.

process saw an outpouring of activity on the part of non-governmental organizations (NGOs) who lobbied for, inter alia, greater support for public participation and specific attention to local conditions and peoples in developing countries. In addition, African country representatives played an active role throughout the UNCED process, were particularly instrumental in designing the provisions of *Agenda 21*, Chapter 12 and managed to gain agreement on an international desertification treaty.

The official 1984 assessment report (UNEP/GC.12/9) did not identify any of the study's authors or contributors. These individuals comprised a small, international set of science advisors working in conjunction with UNEP administrators. Panel members included A. G. Abdel Sami of the Academy of Scientific Research and Technology (Cairo, Egypt), G. Aubert, of Services Scientifiques (Bundy, France); R. A. Perry from the Division of Land Resources at CSIRO (Australia); Jeremy Swift of the Institute for Development Studies (Sussex, UK); and Jack Mabbutt (School of Geography, University of New South Wales). UNEP participants included Mostafa Tolba, Executive Director at UNEP, and Gafaar Karrar and Daniel Stiles, both of UNEP's desertification branch (Interview with UNEP Advisor 2; Jeremy Swift's personal files, 1998).

Interestingly, UNEP published the findings of its assessment under the name of prominent desertification specialists with ongoing ties to UNEP. Each author summarized a different section of the assessment in the form of journal articles published in *Environmental Conservation.* Mabbutt (1984) discussed the status and trends of desertification as established through the assessment, and Dregne (1984) addressed accomplishments, constraints, project expenditures, and reasons for limited success. Karrar (1984) compared the *Plan*'s provisions with projects achieved at international, regional, and national levels. Tolba (1984) authored an editorial lamenting disappointing policy results and urging increased support and funding for anti-desertification initiatives. This method of publication provided for wider distribution of UNEP's findings. In addition, the authorship choices may have lent greater authority to the assessment's conclusions in the eyes of the journal's readers.

Nevertheless, scientists outside UNEP had misgivings about the agency's characterization of and approach to desertification. Some of the most prominent spokespeople had served as UNEP advisors. As discussed above, Brian Spooner (1982), an American anthropologist criticized what he saw as an overly ecological view of desertification. Geographer Andrew Warren (science advisor to UNEP during UNCOD) and his colleague Clive Agnew, criticized the ambiguity of the desertification concept, claiming it precluded rigorous scientific analysis.[86] They argued that conflicting interpretations of desertification (such as those collected through UNEP's survey) led to misleading litanies of statistics. They also declared UNEP's approach to desertification to be overly top-down and global in its focus. They urged for desertification analyses aimed at providing information useful at the local level, and recommended that grassroots changes in areas such as education and agriculture form a key component of anti-desertification efforts (Warren and Agnew, 1988).

Ridley Nelson, economist at the World Bank, recommended fundamental changes to UNEP's assessment and policy implementation activities. Nelson, like Warren, expressed concern regarding the *Plan*'s emphasis on top-down solutions and UNEP's focus on anti-desertification efforts at international and national levels, rather than local levels. Contrary to the globally uniform view of desertification presented in the *Plan of Action*, Nelson suggested that desertification's local variability precluded imposition of any standardized technocratic solution. He recommended a trial-and-error approach to policy. According to Nelson,

> ...the complexity of the problem and the local variability and the need for experimentation—much of which it is better to think of as "search" (for technical and social solutions) rather than "research" (which carries the connotation of formal academic studies)--suggests the need for predominantly village-level initiatives developmed from small-scale local experimentation rather than large multi-country regional programs (Nelson, 1990: 23).

Nelson's suggestion stood in stark contrast to UNEP's linear vision of science first, action second. UNEP's elaborate mapping and assessment activities (Chapters 5 and 6) clearly reflected a division between scientific analysis and policy implementation. Global

[86] Glantz and Orlovsky (1983) made a similar argument in their survey of numerous desertification definitions.

statistics and remote sensing studies could fill pages of progress reports for UNEP's Governing Council, but had little relevance to on-the-ground desertification projects. In light of this, Nelson suggested that knowledge production and policy implementation comprise one in the same process.

Nelson further suggested a different approach to understanding desertification. In particular, Nelson urged for reliance on biological and historical experts to uncover the sources of desertification. He believed that local historians would be of most use in this regard because they could use their knowledge of local cultures, practices, and environments to help construct a more *dynamic* picture of desertification processes. He also believed that historians, in providing insight to the past, could also assist policymakers in anticipating and planning for the future.

In the mid-to-late eighties, scientists with the local understandings Nelson talked about were just beginning to skirt the desertification debate. Anthropologists, rural economists, rural sociologists and other social scientists such as Ian Scoones, Camilla Toulmin, and Richard Behnke spoke out, not from UNEP's expert committees, but from platforms such as the Commonwealth Secretariat and the International Institute for Environment and Development (IIED). These experts helped to focus the development community on alternative models of agriculture and range ecology. Local case studies revealed that small projects were meeting success through bilateral assistance, simple technology and participation. The key lay in project design and management (Interview with IPED Member 1). Ultimately, these social scientists challenged several basic assumptions underlying the PACD and its top-down approach. Theories of disequilibrium challenged long-standing ideas about nature's balance and carrying capacity. Similarly, studies such as *Farmer First* (Chambers et al., 1989) and *Beyond Farmer First* (Scoones and Thompson, 1994) showed that technology transfer and the imposition of western practices were often inferior to programs based on local practices and community participation.

Attention to alternative solutions and local participation, as reflected in the 1991 assessment, dovetailed with research emerging from fields such as geography, rural sociology, and development studies. This research questioned orthodox, (i.e., western) interpretations of environmental change in the developing world (Blaikie, 1985; Blaikie and Brookfield, 1987; Thompson et al., 1986). Instead of viewing such change as a result of ignorance, crisis, and/or physical processes knowable by science alone, researchers began to suggest that environmental change reflected complex interactions of socio-economic and environmental processes (Batterbury et al. 1997). Multi-site erosion research projects acknowledged the high variability of social and ecological settings. Projects such as OSTROM in West Africa recognized the site-specific nature of resource management in Africa, where environmental conditions and politics were said to present unique obstacles and opportunities. In the Guesselodi Forest in Niger,[87] an initiative aimed at developing flexible dryland management systems employed a new type of research. Instead of researching a problem by investigating its dynamics in the abstract, project participants in Niger researched problems by testing different solutions[88] (Stocking, 1992).

Along with these changes, cultural ecologists and anthropologists highlighted the importance of indigenous forms of knowledge. Some argued that assumptions deeply rooted in cultures of industrialized countries, obscured other possible and important views of environmental change, including those held by people residing in affected areas. New accounts of dryland degradation claimed that the use of conventional research methods often led to misleading accounts of environmental degradation. These accounts frequently translated into remedial actions that were harmful to affected populations. Alternative research approaches encouraged greater attention to the knowledge and practices of indigenous populations and their understandings of environmental processes (Roe, 1991; Hobart, 1993).

Advancing Desert Theory Under Attack

Perhaps the most serious challenges to the desertification issue came from researchers at Lund University in Sweden. Based on remote sensing studies of the Sahel, Ulf Hellden and his colleagues took issue with advancing desert interpretations of desertification. In

[87] See Fries (1990) as cited in Stocking (1992).
[88] This project won the "Innovations for Development Association Award" (IDEA), one million Kroner ($180,000), given by Sweden for innovative projects in rural development.

doing so they questioned the very existence of desertification. As discussed in Chapter 5, the Lund group claimed to debunk a 1974 UNEP-sponsored study by Hugh Lamprey, asserting the Sahara was moving southward by 5.5 kilometers per year. In widely publicized articles, the researchers and the popular press portrayed the Lund findings as an ominous challenge to desertification and associated policy enterprises.[89] Scientists and journalists alike questioned the validity of the desertification issue. Headlines asked: "Is Desertification a Myth?" (Binns, 1990),[90] and proclaimed: "The sun is setting on creeping desert theory" (Hawkes, 1992).[91] Some scientists, such as S. L. Rhodes (1991) called for a "rethinking" of the desertification problem. He called for more accurate assessments of land degradation's location and severity, based largely on the use of remote sensing technology.

The power of the Lund research in jeopardizing the credibility of UNEP and the desertification issue itself, derived, in part, from mixed messages contained in the *Plan of Action* and emanating from UNEP. On the one hand, the *Plan* and UNEP distanced desertification and advancing deserts. On the other hand, they employed rhetoric and imagery that often implied these terms were synonymous. Parts of the 1977 Conference report emphatically denied a link between desertification and spreading deserts. A pre-Conference case study of Aghazer and Azawak in Niger, for example, stated that,

> Desertification does not...mean a steady encroachment by the Sahara; it is not a front whose advance can be calculated over the last 40 years. Desertification happens at particular points; *it is patchy, not linear* (A/CONF.74/14: 92; Walls, 1980: 137).

UNCOD agreed with this interpretation. A preface to the *Plan of Action*, made a sharp distinction between desert encroachment and desertification.

> Deserts themselves are not the sources from which desertification springs. Except for hot winds, the deserts themselves supply none of the essential

[89] Later writings by geographers and development experts included Thomas and Middleton (1994) and Swift (1996).
[90] At the time of his article, published in the journal *Geography*, Dr. J. A. Binns was a lecturer in Geography in the School of African and Asian studies, University of Sussex.
[91] Nigel Hawkes reported on the Lund University findings in the *London Times*.

impetus for the processes described. Desertification breaks out, usually at times of drought stress, in areas of naturally vulnerable land subject to pressures of land use. These degraded patches, like a skin disease link up to carry the process over extended areas. It is generally incorrect to envision the process as an advance of the desert frontier engulfing usable land on its perimeter: the advancing sand dune is in fact a very special and localized case. Desertification, as a patchy destruction that may be far removed from any nebulous front line, is a more subtle and insidious process (UNCOD, 1978: 5).[92]

Despite attempts to distance desertification from desert encroachment, references throughout the 1977 policy suggested that these two processes were the same.[93] The *Plan* itself made reference to the "advance" and "spread," of desertification, thereby capitalizing on dramatic advancing desert imagery, while maintaining that desertification constituted a more universal problem. The *Plan*'s objective, for example, was "to prevent and arrest the *advance* of desertification and where possible, to reclaim desertified land for productive use" (UNCOD, 1978: 7, emphasis added). The *Plan* also proposed remedial measures intended to thwart advancing desert fronts. Greenbelts (areas of vegetation near desert edges) were suggested as the basis for transnational projects to halt the dune advance (p. 20). Recommendations for smaller scale shelter belts and the vegetation of desert uplands similarly suggested a spreading desert phenomenon. This portrayal of desertification reflected many years of UNESCO research, and a number of pre-UNCOD studies (e.g., Rapp et al. (1976) and Lamprey (1975)). These analyses defined desertification as an advancing desert phenomenon.

Even UNEP literature seemed to conflate desertification with advancing deserts. In expressing the growing problem of desertification, as estimated by UNEP, Mostafa Tolba remarked:

> In many ways the term "desertification" is misleading. The popular image of sand dune encroachment is only a minor part of the problem.

[92] Mention of "growing populations" in this definition is reminiscent of the environment and population studies of the late 1960s and early 1970s that warned against overexploitation and overpopulation. A similar element of crisis seemed to pervade the Plan as its authors noted a "well-founded sense of danger" (UNCOD, 1978: 1), and called for urgent implementation of policy measures.

[93] In addition, most of the case studies prepared for the Conference focused on so-called true, or natural deserts, rather than sites of land degradation. See for example, Biswas and Biswas (1977).

Yet, three years later, Tolba invoked the same advancing desert imagery he had cautioned against.

> In spite of hundreds of millions of dollars devoted to controlling the spread of deserts over the past ten years, they continue to roll forward...Our goal is to roll back the desert (Tolba, 1987: cover page).

Remote sensing appeared to shake the foundations of international desertification science and policy. However, UNEP revised its view of desertification in time for the next tabling of desertification in multilateral negotiations. In helping to modify the UN's definition of desertification and its approach to desertification policy, UNEP played an important role in setting desertification's course toward an international treaty.

Changing of the Guard at UNEP

In the early 1990s, UNEP began to take account of its critics and incorporate their perspectives into an evolving vision of the desertification problem. In 1990 and 1991, UNEP continued to select natural scientists to serve on expert panels. Based on their work, UNEP continued to portray desertification as a global problem in need of standardized, basic scientific measurement and analysis. However, a broader policy evaluation followed by a change in leadership in UNEP's desertification offices eventually infused the agency's desertification unit with a new set of priorities.

Mostafa Tolba was still Executive Director at UNEP for the pre-UNCED assessments, and he called on primarily natural scientists to participate in expert panels and assessment activities. In 1990, for example, the agency convened an Ad Hoc Consultation on Assessment of Global Desertification: Status and Methodologies (February 15-17, 1990). Nearly all participants in this consultation were geographers and soil scientists. Professor Richard Samson Odingo, Professor of Geography at the University of Nairobi, edited the collection of papers presented at the meeting. He also authored an extensive survey piece examining the programmatic consequences of desertification's definition. In this study he responded to critiques calling for a more operational definition of desertification (e.g., Warren and Agnew, 1988; Nelson, 1990). Based on Odingo's survey of past definitions, he advised the consultation meeting on what he saw as possible improvements to conventional interpretations of desertification. In particular, he characterized desertification as a more subtle process of land degradation. He also recommended increased attention to socio-economic and political facets of the problem and greater attention to activities at all levels, especially at national and local levels.

Tolba also secured the assistance of Boris Rozanov, Professor of Pedology at Moscow State University. Rozanov had worked at UNEP from 1976 to 1980 as principal officer and senior program officer in the desertification unit. In September 1990, Rozanov rejoined UNEP as special advisor to Tolba (Desertification Control Bulletin, 1991).[94] A few months before returning to UNEP Rozanov provided a major contribution to the agency's 1990 desertification assessment. His paper, "An Assessment of Global Desertification: Status and Methodologies," served as a discussion piece at the Ad-Hoc Consultation Meeting of the same name, held in Nairobi from February 15-17, 1990. UNEP's Desertification Control Programme Activity Center had asked Rozanov to examine the "global magnitude" of desertification and various methodologies available for its assessment. The study provided brief, qualitative descriptions of desertification in several regions throughout the world. Based on this survey Rozanov concluded that desertification was "still active and progressing" and UNEP was "fully justified in its struggle against desertification as a first priority environmental issue" (Rozanov, 1990: 70). In addition, however, he addressed "doubts and arguments concerning the assessment of desertification." In recounting a large number of desertification definitions and associated assessment methodologies, he concluded, in agreement with many of the issue's detractors:

[94] In 1963, Rozanov obtained his DrSc in pedology at Moscow State University where he later worked as a lecturer and researcher. Rozanov also worked in Rangoon, Burma where he set up the Land-Use Bureau and trained its staff. He was a visiting professor at Alexandria University in Cairo, Egypt; served as expert advisor to UNESCO; and consulted on government projects (*Desertification Control Bulletin*, 1991).

> Thus, due to a certain diversity in desertification definitions and corresponding methodologies for its assessment, the global picture has become rather vague and much disputed (Rozanov, 1990: 72).

Yet, Rozanov did not waver from the conviction that global, quantitative measurements of desertification were important in addressing it. He urged for a more precise definition and standardized global assessment methods. While Rozanov did not propose his own methodology, his study provided participants in the consultation meeting with a review of previous techniques.

The early 1990s also saw a changing of the guard at UNEP. Franklin Cardy (formerly of the World Bank) became Assistant Executive Director of Environment Management and Institutional support at UNEP. He also assumed the directorship of UNEP's Desertification Control Programme Activity Center and was largely responsible for supporting new perspectives on the issue (Interview with UNEP Advisor 1). Cardy emphasized socio-economic aspects of desertification processes, as well as their biological and climatic features. With his "fresh approach" to desertification Cardy (in keeping with UNEP tradition) portrayed the problem as a global one. Yet, his definition of "global" departed from that of his UNEP predecessors.

> The world is becoming interdependent; stability, security, humanitarian and economic concerns are all contributing to the recognition of the Earth as a "global village" or, more specifically, a global ecosystem made up of interdependent states (Cardy, 1991).

Cardy viewed desertification as part of interdependent, social, economic and environmental processes. These processes involved migration and urbanization, biological diversity and world food markets and required responses attentive to social issues and the need for local participation.

3.4.3 *Policy in Transition: Agenda 21*

Assessment processes prior to the Rio Summit adhered to the same linear model of science and policy whereby expert deliberations and political deliberations occur in sequence, with reports, maps and other forms of communication and representations traveling from assessors to negotiators in time for policy negotiation. In this process, UNEP served as the Conference's science advisor on desertification issues. Within this traditional/familiar framework, UNEP revised its approach to desertification and UNCED participants incorporated many of UNEP's new ideas into policy. The 1991 study and *Agenda 21*, Chapter 12 shared several characteristics. Both emphasized the global dimensions of desertification and the need for large-scale scientific analysis of desertification worldwide. They also suggested a broader definition of desertification and noted that technology was not a universally applicable panacea.

UNEP, however, was by no means the sole source of ideas for UNCED. African countries played a major role in tabling desertification and drought issues and in shaping UNCED's approach to them. The United Nations Sudano-Sahelian Office (UNSO) organized two regional meetings to facilitate development of a common approach to subregional concerns.[95] One meeting took place in Ouagodougou in February 1991. The other convened in Cairo in the following July. UNSO prepared an assessment of desertification and drought in the Sudano-Sahelian region: 1985-1991, as well as a report entitled "Alternative and Sustainable Systems of Production and Livelihood in Marginal Lands." This study presented examples of alternative methods of income generation worldwide (Desertification Control Bulletin, 1993). As discussed in Section 3.5, African countries played a more active role in the UNCED process than they had in the UNCOD preparations. African countries lobbied heavily for attention to desertification. They also collectively prepared and proposed draft text for inclusion in the policy statement, and were strong proponents of an international treaty on desertification.

The Advancing Desert Retreats

In response to a number of criticisms, UNEP revisited the PACD's definition of desertification. A new definition, developed through expert panels in 1990 and 1991, departed from the UNCOD vision of desertification in three major ways. UNEP's (1991)

[95] The UNSO meetings produced "the Sudano-Sahelian Platform for Action on UNCED negotiations and beyond," which contributed to the African Common Position for Africa (Desertification Control Bulletin, 1993).

assessment did not mention deserts, thereby distancing the desertification concept from advancing desert phenomena. It determined desertification and land degradation to be synonymous, thereby broadening the perceived scope of desertification processes. The report also provided new views regarding desertification's causes. Whereas the 1977 policy identified irrational land use methods as the primary reason for desertification, UNEP moved away from the paternalistic implications of "irrationality," for example, and began to portray desertification as arising from a number of factors, some anthropogenic and some not.

UNEP developed new definitions of desertification in assessment processes during 1990 and 1991. Based, in part, on Odingo's (1990a; 1990b) analysis and recommendations, the Ad Hoc Consultation Meeting in 1990 defined desertification as land degradation resulting from adverse human impact. Land degradation was said to imply:

> ...reduction of resource potential by one or a combination of processes acting on the land. These processes include water erosion, wind erosion and sedimentation by those agents, long-term reduction in the amount or diversity of natural vegetation, where relevant, and salinization and sodication (Odingo, 1990a: 3).

This definition, unlike that presented in the *Plan of Action*, did not link desertification to advancing deserts or the spread of desert-like conditions. Neither did this definition refer to ignorance or irrationality on the part of affected populations. The reference to "adverse human impact" was considerably more neutral than references to irrational land use practices in the 1977 agreement.

During the following year, as part of the 1991 assessment, UNEP further revised the meaning of desertification for submission to the UNCED process. This study defined desertification as:

> land degradation in arid, semi-arid and dry sub-humid areas resulting *mainly* from adverse human impact (UNEP, 1991: 2).

The word "mainly" suggested that other causal factors were at work. These factors included climate fluctuations and soil resilience. In fact, participants involved in the 1991 assessment debated the merits of identifying both climate and human factors as responsible for desertification. They decided to cite human causes only because these were the mechanisms most amenable to policy intervention. They also decided that reference to climate factors might distract attention from the implementation of concrete anti-desertification measures (Interview with UNEP Advisor 3).

UNCED negotiators disagreed as to the definition of desertification. While some agreed with UNEP's sole emphasis on human factors, others urged for inclusion of both natural as well as human factors. Amidst growing interest in climate change and a new climate change treaty, delegates finally opted to augment UNEP's definition by identifying both climate and human factors as important in desertification processes (PrepCom III, 1991). They defined desertification as "land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors including climatic variations and human activities" (*Agenda 21*, Chapter 12: 12.2). Reference to "human activities" marked a departure from the derogatory tone of "irrational" land use and "adverse human impact" of earlier definitions. Reference to "climatic variations" put anthropogenic and natural causes on par with each other, signaling a shift in thinking about who and what was responsible for desertification. This attribution had several implications. In one sense, it suggested that people were, in part, victims rather than agents of desertification.[96] It also implied that developed countries might contribute to desertification through global warming. In commenting on plans for an international desertification convention based on this definition, B. Mokgothu, Botswana's assistant minister for local government, lands and housing noted:

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[96] With equal emphasis on anthropogenic and climatic causal factors in bringing about desertification, Chapter 12 suggested that drought planning and relief constitute a core aspect of desertification policy. Drought preparedness and relief schemes centered on strategies for food deficiencies, storage and transport, contingency crop planning, weather forecasts, agricultural extension services, training in early warning methods. As far as addressing drought and ameliorating its effects, *Agenda 21* called for several preventative measures. These included development and use of drought resistant, and fast growing plant species, as long as they are appropriate for a given ecosystem. *Agenda 21* also recommended seasonal weather forecasting for contingency planning, research to reduce water loss, and increase water absorption and water harvesting. Other measures included risk mapping, remote sensing and crop forecasting.

> ...the main function of such a convention will be to establish the causal relationship between global warming, drought, and floods, and between drought poverty; techniques for rehabilitation of areas subject to desertification; and, most important, financial and institutional mechanisms for redressing the problem (Shepherd, 1992: 47, paraphrasing Mokgothu).

Regardless of the climate-desertification interactions at stake, Mokgothu's comment vividly illustrates the complexity of desertification as portrayed in *Agenda 21*. According to this interpretation, desertification was not amenable to singular causal explanations or proximate solutions.

Just as desertification's causes were identified as climatic as well as anthropogenic (see Chapter 2), Chapter 12's objectives included combating both desertification and drought.[97] To facilitate attainment of these goals, Chapter 12 outlined six program areas concerned with: research and monitoring; soil conservation and increased vegetation; strengthening development programs; national action plans that integrate development and environmental planning; drought preparedness and relief schemes; and popular participation activities associated with anti-desertification and drought management efforts. Several of these areas are discussed below.

Basic Research

In building on UNEP's new definition of desertification, *Agenda 21* also adopted many of UNEP's ideas regarding the need to monitor and assess desertification at global scales, with greater attention to socio-economic factors. Whereas, the 1977 policy proclaimed that solutions to the desertification problem were known, *Agenda 21* contended that UNEP studies in 1991, 1984, *and* 1977, "revealed insufficient basic knowledge of desertification processes." In light of this conclusion, negotiators adopted a largely UNEP-esque approach to producing desertficiation knowledge. In particular, they emphasized the need for worldwide observation and monitoring systems for analysis of drought and desertification. Assessment criteria, however, indicated a more holistic

[97] The title of *Agenda 21* implies that it is possible to combat drought directly by encouraging rainfall, or otherwise altering precipitation patterns. The text of Chapter 12, however, focuses, not on manipulating the weather, but on drought preparedness, relief and coping schemes.

vision of desertification processes than that prominent in the 1970s. At the urging of delegates, these critieria included ecological, economic, and social factors (A/CONF.151/PC/WG.1/L.29). To facilitate monitoring, they further recommended the use of a wide range of indicators to track items such as natural resources, housing, employment, education and local participation. These suggestions stood in stark contrast to the *Plan*'s schemes calling for improved climatological, meterological, and hydrological stations for surveying desertification indicators such as the state of vegetative cover, dust transport, migration of wildlife, and changes in irrigated lands (UNCOD, 1978: 2).

Increased Vegetation

While the context of desertification policy implementation was beginning to broaden to encompass new forms of knowledge and wider set of environmental processes, the specifics of land management policy remained a narrow question of maintaining a natural balance and ensuring sufficient vegetative cover. As explained above, policymakers were beginning to view desertification processes in a more complex and holistic light in identifying human as well as climatic factors as responsible factors. However, remedies for degradation associated with these processes remained mechanistic and focused on direct, physical interactions with the land. They similarly implied that indigenous land use techniques were inherently deficient in sustaining livelihoods

> ...traditional livelihood systems based on agropastoral systems are often inadequate and unsustainable, particularly in view of the effects of drought and increasing demographic pressure. (*Agenda 21*, Chapter 12, paragraph 12.26).

As reflected in the global statistics cited in *Agenda 21*, Chapter 12 (see above), Chapter 12 negotiators associated desertification with specific types of land use such as pasturing, rainfed cropping and irrigated cropping. Consequently, these negotiators prescribed land use improvements through soil conservation, afforestation and reforestation, green belts, increased vegetation cover and stabilization of the hydrological balance. These measures were aimed at increasing the land's carrying capacity and helping to maintain biotic resources. This program area prescribed more sustainable land use policies and practices, and improved management of water and soil resources. However, *Agenda 21* did not stipulate what might be deficient about existing systems. Similarly, the chapter said little about how to improve these systems except to make them more "sustainable." So, whereas, the 1977 policy set forth some specific guidance on how to make land use systems more "rational," *Agenda 21* did not specify where improvements should be made or how they should be carried out.

Alternative Authorities

While *Agenda 21* clearly recommended the use of modern science techniques and practices for furthering its objectives, the agreement also promoted local-scale anti-desertification activities and integration of modern and traditional ways of knowing. But African countries, in particular, argued that anti-desertification efforts must ultimately take place at local levels, and with the use of technologies acceptable to local populations (A/CONF.151/PC/WG.1/L.29; Shephard, 1992). UNEP mentioned traditional forms of knowledge in its 1991 assessment, but only briefly. Although the concept of "traditional knowledge" was never clearly defined in the policy text, recognition of a type of knowledge other than scientific knowledge was an important development. Reference to the category of "knowledge" itself marked the beginning of an important transformation in desertification politics. Though the full extent of these changes did not take hold until later in the decade, the notion that different *knowledges* existed and could fruitfully contribute to anti-desertification efforts was beginning to gain greater support in the midst of the Rio Summit.[98] As one of six Program Areas, *Agenda 21* called for development of land use models based on local practices. It was thought that such practices could enhance understanding of the various natural and human factors contributing to desertification. Chapter 12 also recommended that indigenous knowledge

[98] In a very few places the Plan of Action also noted a role for traditional knowledge. It recommended, that "particular attention be given to the utilization of local experience, knowledge, and expertise..." (UNCOD, 1978: 16) and referred to utilization of untapped skills and experience at the local level (UNCOD, 1978: 27). Yet, the vast majority of the Plan focused on modern science and technology as the key desertification tools. Furthermore, most references to non-scientific understandings of desertification recommended that they be strengthened and improved.

be integrated with modern science and technology. Other provisions called for research on traditional approaches to land use management and environmental conservation and protection; integrating indigenous knowledge on forests, rangelands and other natural systems; and integrating knowledge in these areas with research efforts concerning desertification and drought.

Decentralization

In regard to development efforts, the *Plan* differed from previous policies in calling for decentralized initiatives coupled with local empowerment. *Agenda 21* included provisions to enhance development efforts directed toward poverty alleviation and promotion of alternative livelihood systems. In response to these problems, *Agenda 21* (unlike the 1977 *Plan*) prescribed natural resource management based on innovative indigenous technologies. It also called for the building of capacity in village communities to enable inhabitants of these communities to take charge of developing and managing natural resources. *Agenda 21* further recommended rural credit and savings through banks in rural areas, development of market infrastructure in local areas, investmentment in dryland development, and public participation in design as well as implementation of policy efforts.

Plans for a New Treaty

While UNEP's evolving approach to desertification aligned closely with Chapter 12, this chapter's most important provision set in motion a process that would ultimately sidestep UNEP as the main international agency on desertification issues. At the fourth Preparatory Committee for UNCED, intense debate divided North and South on the question of whether to establish an intergovernmental negotiating committee for developing a desertification treaty. In a bit of horse-trading, African countries agreed to commit to a Framework Convention on Climate Change, in exchange for a desertification treaty. The treaty was slated for completion by June 1994 and UN General Assembly working groups commenced preparations in the following months.

3.4.4 *Recap*

In the context of the Rio Summit, UNEP was no longer the institution overseeing development of desertification policy. Hence, Chapter 12 of *Agenda 21* reflected the capacities and goals of UNCED delegates more than the resources and priorities of UNEP. Provisions for basic research and increased vegetation seemed reminiscent of UNCOD and of UNEP's approach to desertification throughout the 1980s. Throughout this period, the agency continued to view natural science as providing the tools necessary to understand desertification and evaluate desertification policies. UNEP was beginning to acknowledge the regional diversity of desertification and the importance of socio-economic factors. However, Chapter 12's references to different forms of knowledge and decentralization of anti-desertification activities were more reflective of the African countries who lobbied hard for attention to desertification alongside climate change and biodiversity. This policy statement, in ushering in a new treaty, signaled the emergence of new institutions, new authorities and authorization processes, and a redrawing of boundaries. Over the next year, an intergovernmental negotiating committee and its Secretariat replaced UNEP in its leadership role. They recognized non-scientific forms of authority and redirected attention to the local and social contingencies of desertification processes.

3.5 The INCD: New Visions of Knowledge and Policy

Preparations to convene an Intergovernmental Negotiating Committee on Desertification (INCD) commenced toward the end of 1992. UNEP was no longer the primary institution overseeing desertification activities.[99] The United Nations General Assembly developed a framework for INCD negotiations. To put this framework into operation, UNGA established a new Desertification Secretariat, wholly independent from UNEP.[100]

[99] UNEP's presence at INCD meetings diminished gradually over the first several sessions. At INCD-1, UNEP representatives were among the first speakers of the negotiation portion of the meeting (the second week). Elizabeth Dowdeswell spoke via a video taped message, while Franklin Cardy, UNEP's new highest ranking desertification administrator delivered a strong endorsement for incorporation of indigenous knowledge in planning, greater attention to the human dimensions of desertification, standardization of assessment practices, and strengthening of research institutes (ENB:04:11).

[100] Changes were occurring within UNEP as well. Elizabeth Dowdeswell, of Canada, replaced Mostafa Tolba as Executive Director. With Dowdeswell at the helm, the organization assumed the role of a

Under the leadership of this small but growing Secretariat,[101] the negotiations, and the role of experts therein differed markedly from desertification policymaking of previous decades. The INCD process reflected a new vision of science and politics manifest in a decreasing role for modern science in designing desertification policy, an iterative model of expert-policy maker interactions, and a more pluralistic approach to understanding and addressing desertification.

3.5.1 *Designing Expert Forums*

Expert forums for the INCD were unlike those for previous desertification negotiations. While the mandate for expert advice originated once again in the United Nations General Assembly, the Desertification Secretariat played an important role in interpreting, implementing and augmenting this mandate. Processes for more traditional forms of expert advice (e.g., from scientists and UN agencies) were more inclusive than their predecessors. In particular, advisory bodies encompassed a greater range of scientific disciplines, and their activities reflected an iterative rather than linear model of science and policymaking. There were two formalized forums expressly for expert knowledge production and dissemination -- an Information Sharing Segment and an International Panel of Experts (IPED).

In addition, the Secretariat and other organizations sponsored conferences outside of INCD negotiating sessions. For the most part, these conferences were aimed at the

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supporting, rather than leading institution on desertification issues. UNEP's presence at INCD meetings diminished gradually over the first several negotiating sessions. At the first meeting of the Intergovernmental Negotiating Committee on Desertification (INCD-1), UNEP representatives were among the first speakers of the negotiation portion of the meeting (the second week). Elizabeth Dowdeswell spoke via a video taped message, while Franklin Cardy, UNEP's new highest ranking desertification administrator, delivered a strong endorsement for incorporation of indigenous knowledge in planning activities, greater attention to the human dimensions of desertification, standardization of assessment practices, and strengthening of research institutes (ENB:04:03; ENB:04:08). As the sessions continued, however, UNEP assumed a lower profile. Much of the agency's work took place behind the scenes. As Dowdeswell noted in her speech to the INCD in 1994, UNEP actively supported the Desertification Secretariat via financial resources for the preparation of case studies, support for the Organization of Africa Unity and Asian and Latin American countries. UNEP also enabled NGO representatives to participate in INCD and other meetings and continued in its Joint Venture with the United Nations Development Programme (UNDP) to provide financial support to the United Nations Sudano-Sahelian Office (ECONET, 1994a). As Dowdeswell noted, "The $1.5 million per year we have provided is matched by UNDP and has been used by UNSO to generate almost $300 million of funding for desertification control work in 22 countries of the Sudano-Sahelian region" (ECONET, 1994a).

[101] Corell (1999) noted that at start of negotiations, the Secretariat had just two members, but grew to a size of approximately thirty by the late 1990s.

participation of non-governmental organizations, providing them an opportunity to share information and coalesce around common policy positions. In her detailed and important case study of the INCD negotiations, Elisabeth Corell (1999) argued that non-governmental organizations (NGOs) constituted an alternative source of expertise for INCD delegates. She concluded that NGOs were more influential in their knowledge provider role than members of the International Panel of Experts (IPED). One might object to labeling NGOs as experts, arguing instead that they are interest groups communicating particular pieces of analysis or information that support their political views (e.g., in the mode of Sabatier and Jenkins-Smith, 1993). Nevertheless, these groups saw themselves as providing specialized information to the delegates. Furthermore, the Secretariat provided NGOs with funding support and gave them opportunities to share information and develop policy recommendations in conference-like settings. In doing so, the Secretariat *authorized* the views of these groups, thereby facilitating dissemination of these views in the INCD process.

UNGA Mandates

As with the UNCOD preparations, the UNGA and the Committee Secretariat played a considerable role in establishing advisory processes and defining their rules and mandates. Decisions regarding the INCD process, however, reflected a much different view of science and policy. The UNCOD model of expert advice was a linear one in which an elite and largely insulated group of natural scientists carried out assessments and made policy recommendations. Policymakers could modify the proposals, but ultimately mobilized action on the issues. In contrast, designers of the INCD model did not look to science for a unified vision of desertification, but, rather, established an iterative process between negotiators and experts. The Information Sharing Segment enabled "sharing" of different types of knowledge in an open, democratic forum where the audience could directly engage with speakers. In regard to the IPED, iteration took place through the Secretariat and, for the most part, did not involve direct interaction between IPED members and delegates. Nevertheless, experts were engaged throughout negotiations as the Secretariat solicited their comments on treaty drafts.

The design of these various expert mechanisms began to take shape during UNCED follow-up activities in late 1992. UNEP, the agency that had designed and conducted desertification policy assessments for nearly twenty years, played no direct role in these deliberations. UNGA's Second Committee, which handled social and economic issues, decided that negotiations regarding follow-up work for UNCED would take place in an open-ended working group chaired by Malaysian Ambassador Razali Ismail (who had chaired the UNCED institutions working group). Desertification and drought were among the topics this group addressed (ENB:03:02). In doing so, they set forth a general framework for INCD institutions and their general responsibilities. These deliberations often split along North-South lines. Through compromise, however, country representatives developed an outline for the INCD process including provisions for an expert panel and Information Sharing Segment. The new Desertification Secretariat[102] was then in charge of putting the INCD in action.

The African Group played an active role in designing the INCD process. In early October, this coalition began preparing a draft resolution presented by Algeria, Mauritania and Tunisia. By October 28 the African Group of economic experts, under the chairmanship of Benin, agreed on a draft resolution. On October 30, the African group agreed to the resolution on the ambassadorial level and forwarded it to the Group of 77 as a "non-paper." The draft resolution called for an international convention "to combat desertification in those countries experiencing serious drought and/or desertification, particularly in Africa" by 1994. In line with the suggestion of Burkina Faso during UNCED, the resolution proposed an organizational session to be held in New York in February 1993, followed by five substantive sessions. The draft resolution also invited relevant NGOs to contribute to the negotiating process and called on the Secretary-General of UNGA to establish a multi-disciplinary expert group to assist the INCD (ENB:03:02).

Designing institutional mechanisms for science advice and knowledge dissemination was also an important part of Working Group deliberations. In general,

[102] As Corell (1999) notes, the official title and status of the Secretariat changed several times throughout the negotiation process. For present purposes, I will simply refer to this institution as the Desertification Secretariat, while acknowledging that at various points in time it went by names such as *ad hoc* Secretariat, interim Secretariat and later on, Permanent Secretariat.

developing countries called for larger more extensive scientific advisory panels on the assumption that such panels would lend stature and legitimacy to the desertification issue. However, developed countries, as the major donor countries, resisted large-scale panels and processes because of the resources they would require. The arguments of developed countries diverged from provisions of *Agenda 21*, Chapter 12, noting insufficient basic knowledge of desertification. These countries argued that fifty years of scientific assessment on desertification had already generated a knowledge base that could adequately support treaty negotiations (ENB:03:02). So, unlike previous decades, when UNGA and UNEP embraced large-scale advisory enterprises with relative ease, the 1990s saw North-South debates surface over these issues.

The Information Sharing Segment

North-South compromises gave rise to expert advisory innovations. On December 22, 1992, the UNGA passed Resolution 47/188. This decision called for an Information Sharing Segment (ISS) at the start of negotiations. The US was a strong proponent of the ISS idea. It argued that such a forum would enable negotiators to develop a common understanding of desertification (Interview CCD Secretariat Consultant 1). Of course another benefit was the relative low cost of such an endeavor. This innovation, however, also reflected new perspectives on science advice and its relationship to policy negotiations. While the UNCOD process relied on a formalized set of scientific panels and assessments to generate and relay knowledge to negotiators, the INCD process encouraged the "sharing" of information. In the seminar-like setting a wide array of both scientists and practitioners presented papers, while delegates and other observers listened to the presentations and had opportunities to engage in dialogue with speakers.

The Information Sharing Segment occupied the first four days of the first INCD negotiating meeting.[103] During this process, individual scientists and representatives from international and intergovernmental organizations presented papers on various aspects of the desertification issue. The Information Sharing Segment signaled a

[103] As discussed in Chapter 2, there was one organizational session of the INCD and a total of five negotiating sessions prior to completion of the *Convention to Combat Desertification*. INCD-5 was followed by six interim session and two meetings of the Conference of Parties.

changing perspective on science advice. It embodied a broader view of desertification, encompassing not just land use causes and physical manifestations of degradation, but also problems of drought, socio-economic factors, and challenges of bi-lateral assistance. This contrasted with the UNCOD approach to expertise. In 1977, UNEP sought to provide "coherence" to the subject of desertification, by integrating knowledge across many fragmented disciplines and perspectives. The agency, for example, identified four subjects for expert inquiry (climate and desertification, technology and desertification; ecological aspects of the problem; and population and social facets).

The ISS, however, reflected a more democratic approach to assessment design and knowledge dissemination. In January 1993, the INCD itself determined the agenda for the Information Sharing Segment. This decision took place at the INCD's first meeting (an organizational session) after the INCD Chair, Bo Kjellén, proposed an agenda for the ISS.[104] Delegates agreed to allow four days of presentations according to the following outline of topics: "(1) desertification, drought and the global environment, (2) causes, general extent and consequences of land degradation in arid, semi-arid and dry sub-humid areas, (3) social and economic dimensions, (4) patterns of bilateral and multilateral assistance programmes, (5) experience with international, regional, sub-regional and national programmes to combat desertification and mitigate drought in developing countries, (6) experiences of developed countries, and (7) some possible elements of a new strategy to promote sustainable development in countries experiencing drought and desertification" (IPED, 1993). This agenda portrayed a somewhat broader vision of desertification than that reflected in earlier policies. Causes, extent and consequences which were central themes in the UNCOD process, were just one of many considerations comprising the ISS agenda. Explicit mention of social and economic dimensions at the outset of the negotiation process marked additional departures from the UNCOD approach.

[104] The organizational session took place in New York from January 26-29, 1993. In addition to outlining the Information Sharing Segment, the INCD elected officers, adopted rules of procedure, approved a preliminary calendar of meetings, and formed two working groups (IPED, 1993).

IPED

Resolution 47/188 also established a second forum for production and dissemination of expert knowledge. In particular, UNGA called for:

> ...a multi-disciplinary panel of experts to assist the *ad hoc* secretariat and, under its authority, to provide the necessary expertise in the scientific, technical, legal and other related fields, making full use of the resources and expertise within and available to Governments and/or organizations of the United Nations system dealing with drought and desertification (UNGA, 1992).

The decision to have a multidisciplinary expert body represented a compromise between developing countries that wanted an extensive IPCC advisory group and developed countries that believed this would be too expensive (Interview CCD Secretariat Consultant 1). Many developing countries argued that without an IPCC-like organization, the desertification convention would have a much lesser stature than climate change. They viewed an extensive advisory body as imbuing the issue with greater clout and believed that without such a panel, members of the international community and the public at large would perceive a desertification treaty as having less legitimacy than the other Rio conventions. With their substantial hold over the necessary purse strings, however, developed countries successfully resisted pressure for a large advisory process and North and South compromised on the small multidisciplinary panel (ENB:03:03).

Provisions for the INCD panel differed markedly from UNGA's resolution of 1974 calling for the assessment of all available data and information on desertification and its consequences. In 1992, UNGA did not make a general request for the generation or assessment of desertification knowledge. UNGA defined a much more narrow set of responsibilities for the panel. Their main goal was to act as consultants to the Secretariat. Rather than generally furthering or synthesizing knowledge about desertification, the panel was to respond to the specific questions and support needs of the Secretariat. The 1992 resolution also departed from the 1974 decisions by specifying that the panel be multidisciplinary. This detail seemed to reflect the suggestion from individual scientists (e.g., Spooner and Mann, 1982; Warren and Agnew, 1988) and more recently from UNEP itself, that efforts to address desertification required attention to a wide range of factors including ecological, social and economic considerations.

In implementing UNGA's mandate, the Desertification Secretariat established a 17-member International Panel of Experts (IPED). The aim of this Panel was to "review the program of work and contribute to elements of the convention under negotiation" (Berstein et al., 1993a). The Panel carried out these tasks through the Secretariat. Essentially, the IPED members served as consultants to the Secretariat. Their role was loosely defined. However, the majority of the panel's work involved revising of treaty texts, providing input on case study design, and preparing individual and co-authored scientific reports on various topics regarding desertification (e.g., IPED and WMO, 1996; IPED, 1995).[105]

IPED met in February 1993 and convened six more times, approximately six weeks prior to each of the first six INCD sessions (Interview with CCD Secretariat Consultant 1). On average, 13 of the 17 members attended each IPED meeting (Corell, 1999). Along with Panel members themselves, Secretariat staff members and representatives from a number of UN agencies and intergovernmental organizations also attended IPED meetings. Each IPED meeting followed a standard agenda. The Executive Secretary would deliver opening remarks. The group would then approve a report of the previous meeting, listen to updates of the INCD negotiations, case studies, NGO activities, and various workshops and meetings. At its early meetings the group provided input on case studies. On occasion they would review individual papers by IPED members and provide feedback to the authors. (Interview with CCD Consultant 1).

The IPED's overall role was much less defined than that of the UNCOD experts. The UNCOD Secretariat had a broad mandate to assemble and collect all available knowledge about desertification. UNEP translated this mandate into specific, well-defined tasks for its experts. The IPED's tasks were much less clear. In fact, at one of

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[105] Robert Balling, Jr., a climatologist on the IPED co-authored a book, *Interactions of Desertification and Climate* with Martin A. Williams (an environmental studies professor at the University of Adelaide in Australia (Williams and Balling, 1996). IPED, however, did not commission this study. The World Meteorological Organization and UNEP commissioned the work after negotiators at UNCED in 1992 defined desertification as resulting from "various factors including climatic variations and human activities" (Williams and Balling, 1996: foreward).

the first IPED meetings Robert Ryan asked the panelists to submit a proposal outlining what they intended to contribute as IPED members. He asked the panelists to prepare an outline of the sorts of work they would be doing (IPED Report 1, 1993). Yet later in the process, some of the panelists were still unsure of their role and they asked Robert Ryan how he intended to use them (Interview with IPED Member 1). So whereas, the UNCOD experts operated under a hierarchical structure and a "top-down" process of assessment, the INCD experts group operated in a much less defined framework.

Most IPED members had little or no contact with negotiators. Two exceptions were Robert Balling and Anothony M. A. Imevbore who presented papers at the Information Sharing Segment. Other exceptions were two IPED members who also served on their country delegations. The Secretariat justified their dual roles as expert and negotiator by explaining that it was difficult to find experts to represent their geographical regions (Interview with CCD Secretariat Consultant 1). Some IPED members, however, found that fellow panelists who were also delegates, tended to emphasize the interests of their home governments during discussions (Interview with IPED member 1).

Non-State Forums

The Secretariat also played an important role in facilitating NGO participation in the INCD process. The Secretariat, for example, organized workshops and meetings for NGOs between INCD sessions to assist in NGO coordination activities. With the agreement of delegates, the Secretariat provided financial and other forms of support to developing country NGOs. This support enabled NGOs to hold meetings prior to negotiating sessions and to attend INCD sessions (Corell, 1999).

New approaches to NGO participation in the INCD context led to innovations in knowledge sharing and knowledge exchange. In addition to the ISS, the Desertification Secretariat sponsored conference-like activities expressly for NGOs. The Secretariat, for example, held a five-day conference in Bamako, Mali in August 1993. The conference format involved a plenary session for presentation of papers followed by working group sessions in which participants developed their own proposals for what they believed should be included in the treaty. Approximately one hundred people came from Africa, Asia, Australia, Europe, Latin America and North America to participate in the conference. They represented NGOs, intergovernmental organizations, regional organizations and the INCD Secretariat. The Chair of the INCD, Ambassador Bo Kjellén of Sweden, also delivered an address to conference attendees. His presence and show of support for the endeavor underscored the legitimacy and authority ascribed to non-state actors in the new regime. The final report of the conference was made available to INCD participants. This report addressed a number of subjects pertinent to the Convention. They included proposals on national and regional action programs; research, technology and energy; and the role of women in anti-desertification efforts (ECONET, 1993b). Unlike the IPED reports which reached delegates late in the INCD process (see below), the timing of the Bamako meeting enabled its participants to present their positions to delegates just as negotiations were getting underway.

UNEP also sponsored a similar four-day conference in December of 1993. As evidence of UNEP's changing approach to desertification, this workshop was titled "Listening to the People: Social Aspects of Dryland Management." This initiative reflected UNEP's significantly altered views of desertification as, in essence, a complex social problem.

> Desertification control is a complex multi-sectoral issue. We have to confront this complexity if our programmes are to succeed in maintaining a sustainable environment at local levels. As the Honourable Minister of Agriculture for Uganda said in her introduction to the Uganda Case Study prepared for your Committee, "Desertification is a social problem". This is an aspect which has been inadequately recognized (ECONET, 1994a).

The UNEP of the 1990s also shared the Desertification Secretariat's enthusiasm for NGO involvement in policymaking and implementation activities. In referring to the Secretariat's support of NGOs, Dowdeswell further noted, "Your openness to their participation has already shown benefits in the substance of their contributions" (Dowdeswell, 1994).[106]

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[106] The INCD, along with the Spanish government and UNEP also sponsored the Almira Symposium on Desertification and Migration. Among other things, participants at this conference stressed the right of

The "Listening to the People" workshop involved nearly one hundred social scientists, government officials, non-governmental representatives and UN staff members. The conference organizers aimed to develop ways to implement *Agenda 21* provisions regarding social aspects of dryland management and provide guidance to relevant institutions, including UNEP and the INCD. This conference, like the Bamako workshop, involved a mix of plenary and workshop sessions. Discussions focused on traditional and western approaches to land management, gender issues in dryland management, government policies and environmental refugees. Near the close of the meeting, participants debated and reached consensus on several anti-desertification strategies. Consensus statements focused on the need for changes in power relationships among actors at international; national and local levels; more effective communication channels for people at local levels; government support for bottom-up programs; land reform based on existing systems of ownership; and respect and utilization of indigenous knowledge (ECONET, 1993c).

3.5.2 *New Authorities*

During the 1970s and 1980s UNEP looked to science as a primary voice of authority on desertification issues. The emergent desertification regime of the 1990s, however, had a different attitude toward science and how science advice could contribute to policymaking. However, among scientists, familiar disciplinary differences appeared to resurface.

Once UNGA put the ISS and IPED frameworks in place, it was up to the INCD Secretariat to put them into practice. This time, no one in the Secretariat shared Tolba's professed reverence for science. Robert Ryan, a US Ambassador to the UN chaired the IPED. He earned a Master's degree in economics from MIT, but had no training in the natural sciences. He worked as a diplomat for many years and led the US delegation to UNCED in 1992. In contrast to dominant views during the 1970s, Ryan believed in the notion of "demand driven science." With this philosophy, Ryan did not believe in force-

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people who wish to remain at home to do so. They called for the maintenance of sustainable and enabling environments in which people can persevere despite hardships and difficult conditions (e.g., see Dowdeswell, 1994).

feeding scientific knowledge to delegates, but saw the IPED as engaging in an interactive process by consulting with the Secretariat in areas where they needed the specialized skills of the scientists. Under Ryan's direction experts interacted with delegates indirectly through the Secretariat, primarily by reviewing and commenting on treaty texts. The IPED also authored thematic reports on issues such as pastoralism, water issues, and biodiversity. However, most of these were completed too late in the process to be of use to delegates as they negotiated the Convention. Ryan assumed his chairmanship of IPED with considerable enthusiasm. Throughout most of the eighteen months leading up to the treaty's completion, Ryan believed that the IPED would actually remain the key source of science advice during treaty implementation, or at least during the interim session (Interview with CCD Consultant 1).

Some members of the Secretariat, however, were less enthusiastic about the IPED and its role in desertification's future. Unlike Tolba, who integrated his own scientific interests and pride into the heart of UNEP's desertification activities, the Secretariat's Executive Director, Hama Arba Diallo, brought a different emphasis to the administration. Diallo, for example, was originally from a pastoralist community in Burkina Faso and brought a respect for traditional practices of indigenous peoples to the new regime. In expressing support for the preservation and use of traditional land use methods, as well as his own connection to these methods, Diallo noted: "If they know that I am saying here that they also have to change their traditional production methods, I don't have a home any more!" (ECO, 1993e). Along with this new perspective, some Secretariat members were simply indifferent about science advice and its potential for making substantial contributions to negotiations. The Secretariat dissolved the Panel in December 1994 reportedly because of pressure from delegates who did not want the panel to continue during the interim session when negotiations might be in a limbo state and when they preferred to have scarce resources directed toward anti-desertification activities in Africa (Corell, 1999).

Some INCD delegates, IPED members, and Secretariat staff suggested that the Secretariat intentionally marginalized the IPED's role in negotiations. They believed that the Secretariat used the panel as a symbol of legitimacy, but minimized the panel's activities so that scientific debates would not interfere with the negotiations (Corell, 1999). Some delegates and observers viewed the IPED's low profile and general lack of scientific assessment activities as a shortcoming of the negotiations. Mohammad Kassas, an extremely active UNEP advisor throughout the 1970s and much of the 1980s lamented:

> It was evident that the committee did not have the support of a large body of scientists, as had the Intergovernmental Panel on Climate Change. That panel provided the negotiators for the Framework Convention on Climate Change...with massive and progressively updated information on issues relevant to climate change. This lack of scientific and technical support left the negotiators, predominantly diplomats, seriously handicapped (Kassas, 1995: 177).

The Earth Negotiations Bulletin reported similar sentiments from delegates who expressed disappointment that "the immense body of technical and scientific expertise on desertification did not fully infuse the *Convention* as much as had been hoped. These delegates were disappointed that the treaty text did not include more details regarding the causes and consequences of desertification" (ENB: 04:55).

Interviews with Secretariat staff in early 1997 revealed an ambivalent view toward scientific expertise and its relevance to the treaty regime. While few of these staff members had been actively involved in the treaty negotiations of 1993-4, their views seemed to echo the attitudes of some of their predecessors. None of the staff members questioned viewed desertification science as a central focus of the Secretariat or a key aspect of treaty implementation. They stressed, for example, the need to build linkages between regimes for climate change, biological diversity and desertification (Interview with CCD Secretariat Staff Member 1), and the role of NGOS in linking local and national and local activities (Interview with CCD Secretariat Staff Member 2).

Information Sharers

In preparing for the Information Sharing Segment, the Secretariat invited (and thereby authorized) many individual experts, UN agencies and governments to prepare background papers and presentations for this session. As discussed below, only two of the speakers were also IPED members (Interview with CCD Secretariat Consultant 1). ISS presentations contained many disparate visions of desertification from diverse disciplinary perspectives. Speakers diverged on any number of points including the definition of desertification, and its causes and consequences. As an example, this section describes views of some speakers regarding causes of desertification. Papers by the Food and Agriculture Organization (FAO), International Fund for Agricultural Development (IFAD), and individual scientists indicated a departure from UNCOD's focus on human land use. They also portrayed a new vision of desertification as a problem that is locally contingent and open to many different interpretations (Long, 1996).

Representatives from FAO listed several human activities contributing to dryland degradation. They noted, "loss of topsoil through water erosion is the most common type of human-induced soil degradation" (Sombroed and Sene, 1993: 4). Their list also included cultivation of fragile soils, overgrazing, uncontrolled fire use, and unsuitable agricultural machinery. According to FAO, ``all of these activities derive from two root causes: from poverty and underdevelopment, or from 'modern' development which disregards the impact of the technologies" (Sombroed and Sene, 1993: 3). They also highlighted typical factors associated with poverty and underdevelopment: malnutrition, lack of credit access, limited access to education, migration, and lack of technical advice (Sombroed and Sene, 1993).

A resource economist from IFAD spoke about economic, social and cultural causes and consequences of drought and desertification. According to IFAD,

> The causes of desertification are rooted in socio-economic factors. . .the relative importance of socio-economic causes of drought is debatable. Significantly, both the causes and consequences of drought and desertification are mediated by the socio-economic context in which they occur (Ahmed, 1993: 1).

IFAD stated that desertification results from "cumulative outcome of unsustainable land use practices" (Ahmed, 1993: 2). These practices include several broad categories:

expansion of rainfed cultivation onto unsuitable lands, shallow mining, overgrazing, groundwater mining, and uncontrolled biomass harvesting. IFAD characterized these activities as a ``rational response to incentives and constraints" (Ahmed, 1993: 3). Constraints and incentives prompt a divergence between private and social accounting. These can be outlined as international and national policy processes, institutional issues (tenurial ambiguities, technology systems, social services), marginalization of important groups (gender and ethnic biases), population growth, migration, drought and natural disasters, civil strife, and political conflicts (Ahmed, 1993).

Professor Imevbore from the University of Nigeria discussed relationships between desertification and biodiversity. Imevbore related dryland degradation processes to four principal factors: ecosystem fragility, population pressures leading to land exploitation, economic considerations that hinder appropriate long-term land use on a long-term basis, and political unrest. Professor Imevbore presented estimates of desertification according to percentage of land affected. His list of causes include land clearing, salinization, overstocking, urbanization, overgrazing, and fuelwood collection.

The information session papers revealed a multitude of causal relationships related to desertification. In similar fashion, other ISS speakers presented diverse views of the issue, emphasizing different key issues and desertification processes. Whereas the UNCOD Secretariat may have likely viewed the Info Session and its multiple messages as a failure, the INCD Secretariat pronounced it a success and made the ISS papers accessible to the general public. In the words of one Secretariat member, "the impact of the Information Sharing Segment was immense" (Interview with CCD Secretariat Consultant 1). One IPED member noted the ISS' role in highlighting socio-economic factors and in communicating the importance of public participation in desertification projects (Interview with IPED Member 1). Following the ISS, delegates generally agreed that the session had effectively communicated the nature and extent of the desertification problem. Their discussions following the ISS focused on local participation; economic incentives, an integral role for women in anti-desertification initiatives, technology exchange, and information collection and exchange (ENB:04:11).

Creating the Panel

The Desertification Secretariat had wide latitude (within its budget constraints, that is) in assembling and managing the multidisciplinary panel as they saw fit. While the Secretariat originally planned to select a group of just twelve experts, the number expanded as the Secretariat sought to include a gender balanced group with a broad range of geographic and disciplinary backgrounds (ENB:04:02). The Panel was intended to include only independent experts working in their own capacities. Early in the negotiation process some countries voiced interest in making nominations to the panel. The Executive Director of the Secretariat, Ambassador Diallo, explained, however, that members were not serving on the Panel as government representatives. They were appointed "privately," with input from UN agencies (ENB:04:01).

The Secretariat selected IPED members during the first week of February 1993. During the speedy selection process they consulted with organizations such as FAO, the United Nations Development Programme (UNDP), UNEP and the World Meteorological Organization (WMO) (Interview with CCD Secretariat Consultant 1). Robert Ryan, special advisor to the INCD Secretariat and IPED Chairman, outlined five criteria he and the Secretariat employed in selecting IPED members (Interview with CCD Secretariat Consultant 1). They were:

Language. IPED candidates were reasonably fluent in English or French because there were no funds for hiring translators for other languages. However, while some Panel members claimed fluency in either French or English, their proficiency during the meetings was not adequate to enable them to fully participate. Hence, not all Panel members engaged fully in IPED discussions.

Disciplinary representation. The Secretariat tried to strike a balance between physical and social scientists. Ryan explained that this disciplinary diversity was particularly important for addressing the broad and complex area of sustainable development.

Geographical distribution. This diversity would enable representation from Africa, as well as from Asia, Latin America, Europe and the United States. Such diversity was seen as important in providing a balance of views within the Panel and assuring its legitimacy in the eyes of delegates.

Gender balance. The Secretariat ran into difficulties in obtaining nominations for women who worked outside UN agencies. Robert Ryan explained that these difficulties resulted in the inclusion of just three women Panel members.

Access to resources and influence in scientific circles. The Secretariat sought to recruit IPED members who could convene groups of colleagues outside of IPED to carry out extra-curricular studies.

Because the IPED was meant to function as an independent, non-governmental body, the Secretariat also searched outside of governments for most of its experts.

Based on its selection process, IPED assembled a panel consisting of a total of 17 members. Five members were African, four were Asian, six were European, one was Latin American, and one was North American. Nine of these 17 panelists were from developing countries. As reported by the Secretariat, the Panel included experts in fields of agro-forestry, alternative energy systems, biology, climatology, dryland ecology, geographical information systems, historical geography, land economics, soil science, and water conservation and resource management (Corell, 1999).

The IPED's composition marked a significant shift from the expert processes for UNCOD. In 1975, UNEP, chose expert advisors largely on the basis of established, collegial connections. Tolba and Kassas, for example, were long time friends. Kassas and Dregne had worked together on UNESCO's Arid Zone Program. Dregne recommended Garduño to author the report on desertification and technology. Hence, UNEP built its assessment processes around people who were already part of a network. As far as disciplinary affiliation, the core experts were natural scientists and (as discussed above) preferred to work with other natural scientists throughout the process. However, consideration of gender, geography and language played little role in the expert selection process. UNEP was not under pressure from governments to assemble a diverse, representative expert group. There seemed to be a sentiment both inside and outside of UNEP, that knowledge necessary for combating desertification would necessarily come from developed countries. "Rationality" was an important theme in the *Plan of Action* and throughout UNCOD preparations. Because science was assumed to be a rational, objective pursuit, perhaps UNCOD participants did not view scientific knowledge as culturally or politically contingent, and therefore did not see a need for diversity in expert institutions.

In contrast, the INCD Secretariat did not view expert knowledge as universal. They viewed knowledge as contingent on the various criteria employed in creating the IPED. In order to address the many facets of desertification comprehensively and in order to have legitimacy in the eyes of negotiators, the panel would have to reflect (to a certain extent) their varied perspectives and priorities. Evaluations of the 1977 *Plan of Action* suggested that certain views and sources of knowledge were underrepresented in implementation activities and their low profile was believed to have contributed to the disappointing results of policy implementation. More importantly, perhaps, policymakers no longer viewed science and technology as a panacea for challenges facing developing countries. Projects inside and outside of the desertification realm proved this approach to be overly simplistic and not sufficiently accommodating of the various perspectives, forms of knowledge, and cultural contexts where technocratic policy interventions were attempted. In this new climate, the Secretariat had little choice but to make its panel as diverse as possible.

IPED Activities

The IPED worked closely with the ad hoc Secretariat in reviewing negotiating texts, and preparing papers on desertification-related issues. The IPED also provided the Secretariat with advice regarding several case studies. These studies were intended to inform the creation of National Action Plans, but were completed too late in the process to receive much attention (Interview with CCD Secretariat Staff Member 2; Interview with CCD Secretariat Consultant 1; Corell, 1999). For some tasks, the IPED broke into working groups organized around topics and disciplines: interactions of desertification and climate; biodiversity and desertification; economic causes and social consequences; alternative energy systems; and water resources. In these groups IPED members carried out individual studies and worked on various aspects of treaty development (Interview with CCD Secretariat Consultant 1).

Occasionally, when the IPED did not have the time or expertise to address a specific issue, panel members worked with groups of outside scientists (Interview with CCD Secretariat Consultant 1). IPED members Stein Bie and Anthony Imevbore compiled a set of regional studies of desertification and its relationship to biodiversity. The authors engaged colleagues from a number of institutions around the world to contribute to the volume. The study reinforced a pluralistic approach to desertification as reflected in the INCD process on the whole. For example, the editors and authors focused on the peculiarities of desertification in various parts of the world, including China, southern Europe, Sahelian and northern Africa, and Latin America. However, the study was not published until 1995 and, consequently, was not available to negotiators while they crafted the *Convention*'s text. In 1996, the Secretariat published a study prepared by the IPED and the World Meteorological Organization (WMO) on problems and challenges of water resource management and desertification (IPED and WMO, 1996). This analysis differed from many of UNEP's desertification assessments in its focus on socio-economic facets of desertification and water issues.

> Whatever the nature of intervention, size of installation and techniques used, the main obstacles to the adoption of sensible and sustainable water-resource development and management methods are socio-economic in essence (IPED, 1996: 3).

Unlike the Garduño study of 1977, the report by IPED and WMO stressed the importance of adapting techniques and technologies to the specific societal contexts. The analysis also presented a general survey of water management issues across nine regions worldwide, thereby emphasizing the variability of water resource concerns. According to a Secretariat member, these papers "were not terribly critical to the negotiations. The negotiations didn't turn much on the papers and they had a greater impact outside of delegates... in terms of raising awareness" (Interview with CCD Secretariat Consultant 1).

In retrospect, Robert Ryan commented that the IPED's most important role was drafting pre-treaty texts and later drafting, commenting on, and reviewing negotiating texts. According to Ryan, the IPED was a sounding board on the treaty text" (Interview with CCD Secretariat Consultant 1). The Panel assisted the Secretariat in compiling government submissions. They also provided input on definitions used in the treaty and prepared papers on various topics. Often, however, the group would help to word the text. At its first meeting, for example, the Secretariat requested the IPED's input on elements of the *Convention* – what they should contain, their format and specificity. In particular, Robert Ryan requested input on the *Convention*'s objectives and obligations, suggesting that the IPED probably had little to contribute to the preamble. The IPED spent a lot of time trying to articulate the objective of the *Convention*. According to Ryan, fifty to sixty percent of the treaty's objective was developed by the IPED (Interview with CCD Secretariat Consultant 1).

IPED members differed, however, in their views of the Panel and its role in negotiations. One member of the IPED remarked that his IPED experience was the highlight of his career. S/he felt that s/he made several concrete contributions to the INCD process by producing text that was incorporated into the final *Convention* (Interview with IPED Member 3). Other members had a dimmer outlook on their IPED experience. One went so far as to describe it as "painful" because s/he did not have a clear vision of the policymaking process and how they fit into it. To this expert, the INCD process was a "black box." According to this expert:

> We would meet and review a new version of the convention 6 weeks before the next INCD. We'd find some things erased and other things introduced...I felt used...Decisions were made outside of what we would say in IPED meetings. IPED members were not given a clear view of the process (Interview with IPED Member 2).

Another IPED member expressed dismay that the timing of IPED meetings prevented the group from making more of an impact on negotiating texts that were sometimes already on their way to delegates. This expert remarked that in UN processes, "this may just be how things are done...I came into the process cold. If I came into the process again I would know and understand the limits of the process" (Interview with IPED Member 1). Another expert drafted a page of the *Convention*, only to find that it was "eaten up" somewhere in the process.

Symbolically, the IPED highlights several important features of the INCD and its departure from early approaches to science and policy. In particular, the IPED's small size and small role indicate that, during the INCD negotiations, the UN system, diplomats and other relevant organizations, did not perceive desertification as a "scientific" issue per se.[107] It ceased to be a problem stemming from interference with nature's balance and became a problem of social organization and the employment of local expertise. As discussed below, non-governmental organizations played a much more active role in disseminating information to delegates, raising general awareness of the desertification problem, and pioneering new ways to address it.

Non-governmental Organizations

NGOs played an active role in INCD negotiations. NGOs, at the INCD negotiations represented a number of regions worldwide. Of the 30 NGOs most active in the INCD negotiations, over 36% of them were based in Africa. These groups worked as a well-coordinated and cohesive unit, making unified interventions on the negotiating floor, holding workshops, training new NGOs and lobbying delegates. These efforts led some delegates and Secretariat members to conclude that NGOs contributed significantly to shaping the *Convention* text (Corell, 1999).[108]

The NGO newsletter ECO served as an important vehicle for communicating NGO views on a variety of themes. Generally NGOs generated daily issues of ECO throughout each two-week negotiating session. The format of each issue varied, but typical publications included editorial commentary on ongoing debates within the INCD, analysis of the evolving policy texts and their implications for NGO interests, news

[107] However, the CCD's Committee on Science and Technology and its Roster of Independent Experts, suggest that a new version of desertification "science" is re-emerging as part of the fledgling regime. Debates about these expert bodies are highly reflective of North/South debates over knowledge and control of expert resources.

[108] According to Corell (1999), NGOs owe their success to a number of factors. These included: widespread support for a bottom-up approach which called for greater NGO participation; homogeneity and cohesiveness among the NGO groups participating; absence of NGOs from the North; the absence of business NGOs; and a negotiating environment that welcomed NGO participation (supported, inpart by the Secretariat and the foundation laid at UNCED).

regarding desertification issues or relevant publications,[109] and statements reflecting NGO positions on a variety of issues relevant to the treaty. ECO writers expressed a number of views that ultimately appeared in the final Convention document. Many of these views, whether emanating from delegates, NGOs or elsewhere, distinguished the *Convention* from earlier policy agreements on desertification. As illustrated below, NGO positions, as reflected in ECO statements, called for greater appreciation for desertification's variability and complexity; a decentralized approach to desertification policy; a human centered vision of the problem; land tenure reform that respected local perspectives on land ownership; and a greater role for NGOs in institutions governing the treaty's implementation. NGOs saw themselves as not simply a voice for certain desertification solutions. They viewed themselves as integral to and embodying many of these solutions.

In portraying desertification as a process involving interactions of social, political, economic, cultural and ecological factors, NGOs emphasized the issue's complexity. They similarly called attention to desertification's variability across regions and even across different communities existing in proximity to one another. Hence, in the view of NGOs, different forms of desertification were not simply a product of differing ecological conditions such as those measured by aridity indices. Instead, variability in desertification process could also arise from differences in social systems. Consequently, NGOs called for programs tailored to the special ecological and social conditions existing throughout affected areas.

> Since countries are made up of communities with diverse cultures, different climatic factors, and soil types, it would not be enough to just have national action programmes but local action programmes as well. To get to specific problems faced by the people, governments should consider local action programmes which will give special attention to problems faced by different communities. For example, in the event of desertification, the problems faced by pastoralists are very different from those faced by agrarian communities. Hence, different interventions, taking into account the social, cultural, political and economic aspects, are

[109] When noted researchers Mary Tiffen, Mike Mortimore and F. Gichuki authored a book (Tiffen et al., 1994) challenging conventional wisdom regarding population and dryland erosion, ECO publicized their findings (ECO, 1994c).

> required when combating desertification in these communities (ECONET, 1993d).

In response to this complexity, NGOs advocated a systemic approach to the issue focused on increased education and training, access to land, rural banking systems and transfer of appropriate technology. They also stressed the role of women in these various aspects of anti-desertification initiatives (e.g., ECONET, 1993d).

NGOs also urged that policy implementation efforts take account of the local practices and perspectives.

> At the local level, the convention should put into place mechanisms to ensure that peoples' culture, indigenous knowledge, economic activities, coping mechanisms and their participation are taken into consideration when designing projects to combat desertification. This can be done by involving the local people in policy and decision making processes, identification, implementation and evaluation of projects aimed at combating desertification (ECONET, 1993d).

ECO contributors voiced support for the transfer of technology appropriate for local situations, taking into account social and cultural factors as well as economic considerations. They warned against reliance on bi-lateral aid as a mechanism for technology transfer, noting that this form of aid "tends to result in the introduction of supply-driven technology which does not take into account the complexities of agricultural systems and the conditions of smallholders in drylands." Furthermore, NGOs argued that, in failing to support use of indigenous technologies, the *Convention* would increase the South's dependence on the North (ECO, 1994b)

A dencentralized approach to desertification policy was similarly high on the NGO agenda. They viewed popular participation as an important means for ensuring such an approach. As noted by *ECO*, "NGOs call for a shift from the institutional centred development to a human centred one, where the overall well-being of people and their full participation is the basis for all decision making" (ECO, 1993a). Greater attention to people on the part of NGOs and other INCD participants marked a shift in emphasis away from top-down changes to the mechanics of land use such as overgrazing and salinization, and toward a systemic, societal view of desertification. NGOs viewed themselves as a means for achieving a more decentralized, human-centered approach to desertification. They lobbied for a role, under the *Convention*, in helping to educate people about their rights and about the ways in which they could address desertification and raise awareness by disseminating information about desertification to local communities, and by helping to "decentralize information centers and decision making processes" (ECO, 1993a)

NGOs lobbied hard for land tenure reform, but urged for recognition of diverse land tenure systems (ECO, 1993c).

> NGOs want the convention to acknowledge the fact that many traditional societies have a system of land tenure quite different from the Western notion of title deeds. Without such a realization, traditional land holding systems are very vulnerable to predation. For example, land used by nomadic pastoralists is usually used on a periodic or episodic basis. This land is not under-utilized as most people not familiar with such a system may think (ECO, 1993a)

NGOs called for improvements in land use practices and management schemes that were leading to degradation. However, they argued that non-western land management schemes were not inherently problematic, but rather, required understanding and respect on the part of policymakers. According to NGOs, "The convention should stress on the fact that project designs should be changed to suit the peoples' culture and not people to change their way of life to suit project designs" (ECO, 1993a). So while colonial and modernist style policies called for the introduction of European and western modes of land use into affected areas on the assumption that these were the only "rational choices," participants in the INCD process called for the recognition of indigenous practices and the importance of adapting new land use techniques to individual cultural contexts.

NGOs aimed to serve, not simply as instruments of implementation in local contexts, but as an integral part the desertification regime at the international level.

> The Convention should not limit itself to considering NGOs as executing agencies for programmes designed elsewhere, but as specific actors and

> real partners of governments, scientists and local communities in the fight against desertification (ECO, 1993b).

NGOs called for a role in policy formulation, program design and evaluation and monitoring of desertification projects. They also viewed themselves as contributing specialized knowledge to the policymaking process.

> With respect to the scientific community, NGOs expect to contribute to the definition of national research programmes. Their participation will ensure enhanced recognition of traditional knowledge and perception of local community skills and needs. They will facilitate contact between academic and community-based researchers (ECO, 1993b).

Hence, NGOs offered to serve as a bridge between providers of modern scientific forms of knowledge and other types of knowledge, although neither the NGOs nor other INCD participants clearly defined the nature of alternative forms of knowledge. This theme of mediator carried into a range of NGO proposals as they emphasized their ability to facilitate dialogue among the various actors engaged in anti-desertification activities (ECO, 1993b). NGOs also lobbied for national, as well as international NGO accreditation for the Conference of Parties, arguing that national NGOs possess important experience from working on anti-desertification projects at the ground level (ECO, 1994a).

ECO articles regarding the design of expert advisory institutions under the CCD similarly reflected NGO's self-perceptions as knowledge providers. During negotiation, the INCD agreed to establish advisory bodies that would provide input to the Conference of Parties (the group of countries implementing the treaty) on topics that required specialized knowledge or assessments. As INCD delegates debated the name, size, membership and duties of these advisory bodies, NGOs expressed some of their opinions through ECO. NGOs, for example, were opposed to labeling advisors to the Conference of the Parties as science advisors. They believed that the reference to "science" would mean the exclusion of non-scientific forms of knowledge from expert deliberations, and urged for adoption of the term "expert advisor" instead. NGOs similarly supported experts representing a wide range of disciplinary and geographic backgrounds.

> Given the extremely complex interactions that characterise the problem of desertification and especially its social and economic dimensions, it is clear that a purely technical approach to desertification is not adequate. We need to re-orient the conventional approach to research and extension towards a more people-centred and participatory one (ECO, 1994d).

They called for a new definition of expert inclusive of individuals possessing indigenous knowledge about how to cope with local conditions and the variability of arid environments. "Given the failure over the past two decades of strategies to combat desertification, which have relied heavily on the western scientific theory, a new approach to expert advice is long overdue" (ECO, 1994d).

3.5.3 New Knowledge, New Policy

The INCD process reflected a more pluralistic vision of desertification processes and a broadening view of knowledge. Similarly, the treaty provided a more complex portrayal of desertification phenomena. Rather than adhering to a singular cause and "proximate" solution the *Convention* presented desertification as a variable, complex process requiring locally tailored and locally supported projects.

Complex Interactions

Both the INCD debates about desertification and the final definition that delegates adopted reflected a more pluralistic (and perhaps, intitally more confused) perception of the meaning of desertification. The delegates engaged in a somewhat lengthy debate on the meaning of desertification, but ultimately adopted the definition presented in *Agenda 21*. However, they further elaborated on this definition by emphasizing the complexity of desertification processes.

Early in the negotiations, the definition of desertification became a sticking point for delegates.[110] Presentations during the information session revealed that, despite the

[110] Countries such as Egypt, Canada, Mali, Ghana, and Tunisia supported it.

definition set forth in *Agenda 21*, many disparate interpretations of desertification existed in research and policy initiatives worldwide. While some presenters referred to the *Agenda 21* definition, others highlighted an array of definitions, and still others did not commit to any particular definition.[111] Similarly divergent opinions surfaced during policy debate. The Secretariat, IPED, and several INCD delegations[112] supported use of the *Agenda 21* desertification definition. However, many other delegates viewed the *Agenda 21* definition only as a departure point. In general, some developing countries argued that the definition should reference socio-economic aspects of desertification and should refer to desertification's global dimensions and its links to climate change. Many developed countries, however, opposed such changes, wanting instead to limit the scope and scale of the problem (ENB:04:22; ENB:04:34; ENB:04:44).

In the end, delegates adopted the *Agenda 21* definition of desertification, with some additions. As in *Agenda 21*, the *Convention* described desertification as "land degradation" arising from "various factors including climatic variations and human activities" (CCD, 1994: 7).[113] As discussed above in the context of *Agenda 21*, attributing desertification to "various factors including climatic variations and human activities" signaled important changes regarding attitudes toward affected populations and perceptions of natural-social interactions and their role in desertification processes. Unlike *Agenda 21*, the *Convention* further elaborated on the causes of "land degradation" in noting that this phenomenon resulted from:

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[111] Some speakers stated explicitly that their presentations reflected the *Agenda 21* definition for desertification, while others did not indicate a particular definition. For example, Nessim Ahmed, a Resources Economist for the International Fund for Agricultural Development (IFAD) advocated use of the *Agenda 21* definition in his discussion about the socio-economic causes of desertification. Speakers from OECD and UNSO spoke about planning and assistance programs, but made no reference to a specific desertification definition. In describing the hydrological impacts of desertification, Habib Zebidi, Director of UNESCO's Hydrology Division, reviewed several definitions of desertification. He mentioned UNCOD's definition as "the diminution or destruction of the biological potential of the land, (which) can lead to desert-like conditions" (Zebidi, 1993: 1). Zebidi also mentioned definitions that focus on the role of humans in degrading ecosystems which have already weakened due to natural climate conditions such as drought. Giving further insight into the meaning behind these definitions, Zebidi cited five elements of the desertification process: increasing aridity, irregular runoff, accelerated wind and water erosion, soil desiccation and salinization, and decline in vegetation (Zebidi, 1993).

[112] Countries such as Egypt, Canada, Mali, Ghana, and Tunisia supported using the *Agenda 21* definition.

[113] The starting point for the "land degradation" definition was set forth in two assessments by UNEP. Odingo (1990a; 1990b) and UNEP (1991) presented similar definitions.

> ...land uses or from a process or combination of processes, including processes arising from human activities and habitation patterns such as:
> (i) soil erosion caused by wind and/or water;
> (ii) deterioration of the physical, chemical and biological or economic properties of the soil;
> (iii) long-term loss of natural vegetation (CCD, 1994: 1(f)).

Here, land use appeared as just one of many factors contributing to degradation. Rather than focusing on one cause such as irrational land use methods, this definition emphasized that multiple processes are at work. The terms "erosion," "deterioration," and "long-term loss," for example, could result from anthropogenic factors, climatic factors or a mix of such factors. As mentioned above, this view of desertification processes as pluralistic, shifted focus away from the individual farmer and toward the role of social collectives in contributing to and ameliorating desertification.

Just as the *Convention* portrayed land use as one of many possible contributors to desertification, it also presented desertification and drought, not as isolated problems, but as multifaceted issues impinging on a number of social challenges.

> ...desertification and drought affect sustainable development through their interrelationships with important social problems such as poverty, poor health and nutrition, lack of food security, and those arising from migration, displacement of persons and demographic dynamics (CCD, 1994: 4).

Because desertification and drought were part and parcel of the social and ecological settings in which they emerged, they required policy remedies that were tailored to specific local conditions and effective in addressing the entirety of social, economic and political processes at work.

The *Convention* also went beyond the *Agenda 21* definition in portraying an even more involved causal narrative. According to the *Convention*:

> ...desertification is caused by complex interactions among physical, biological, political, social, cultural and economic factors (CCD, 1994: 4).

Reference to "complex interactions" reflected the diverse views of desertification presented during the Information Sharing Segment. It also suggested a picture of desertification processes that was more dynamic and holistic than those presented in earlier agreements. Convention negotiators believed this vision of desertification as "complex interactions" required a systemic rather than mechanistic policy response. Instead of a focus on land use per se, policymakers advocated a so-called "bottom-up" approach to "sustainable management of land and water resources, leading to improved living conditions, in particular at the community level" (CCD, 1994: 8). This approach recognized the variability of desertification's sources and manifestations throughout the globe. Instead of prescribing specific changes to land use methods or technologies, the *Convention* focused on the general sorts of social arrangements that were intended to foster desertification's amelioration. A key aspect of these arrangements concerned an increased role for women and non-governmental organizations in sustainable development activities, and greater attention to the protection and utilization of indigenous knowledge and technologies in environmental planning and protection.

The Bottom-up Approach

Like the causes identified in the treaty, desertification remedies targeted not just land use, but broader social processes and interactions. These remedies emphasized a broader concept of knowledge, participatory and community-based anti-desertification initiatives, and a learning-based approach to policy implementation. Like the *Plan of Action*, the *Convention* called for National Action Programs and new institutional mechanisms to foster policy implementation at various levels. Also in keeping with the *Plan*, the *Convention* did not establish new sources of financing for addressing desertification. With these provisions, treaty authors aimed to encourage a shift from "aid to partnership." Past desertification policies were thought to reflect the one-sided process in which developed countries provided assistance to affected countries and often dictated the design of and priority given to specific projects. Similarly, central governments often imposed policy solutions on particular communities without consulting with them as part of the process. With the partnership paradigm, contributors to the *Convention* aimed to insure that projects would be developed jointly rather than "imposed by one group on another" (Lean, 1995: 14).

With easy consensus among developed and developing countries, modern science and technology continued to occupy an important place in desertification policy. For example, the treaty stated that:

> strategies to combat desertification and mitigate the effects of drought will be most effective if they are based on sound systemic observation and rigorous scientific knowledge and if they are continuously re-evaluated (CCD, Preamble).

The *Convention* also stressed the need for a global network of research institutions, standardized systems of measurement and analysis, and the use of modern technology for data collection, assessment and dissemination of information. The treaty established a Committee on Science and Technology (CST) to provide information and advice on scientific and technological matters (CCD, 1994: Article 24(1)). This committee was designed to be multidisciplinary, open to participation by all parties, and comprised of government representatives. The *Convention* specified that the CST should develop a roster of experts based on nomination from Parties. The Conference of Parties, the governing treaty body, could then appoint ad hoc panels composed of experts from the roster to advise policymakers on specific issues and questions. However, despite these institutional mechanisms focused on science, modern scientific knowledge was no longer the sole, or even the most important resource behind desertification policy.

Like *Agenda 21*, the Convention reflected a new approach to desertification-relevant knowledge, but it also further elaborated on *Agenda 21*'s suggestion that alternatives to modern science could provide valuable tools in anti-desertification efforts. The *Convention*, referred to broader categories of knowing. Instead of science alone as a key antidote for desertification, the *Convention* stressed the importance of "knowledge" in general. This included modern scientific research into climate and desertification processes, as well as understandings of local ecosystems and farming practices developed and passed from generation to generation in more localized areas. Unlike the *Plan of*

Action, which emphasized the natural and physical sciences, the *Convention* called for knowledge development through multidisciplinary and participatory research, and urged for special attention to socio-economic data and their integration with physical and biological information (CCD, 1994: Article 4(2a) and Article 16(e)). The scientist was no longer seen as the only authoritative source of knowledge. Expertise was also believed to reside in intergovernmental and non-governmental organizations, as well as in local populations (CCD 1994, Article 16(d), 17 and 18).

Traditional and local knowledge were not defined or distinguished in the treaty, but they appeared as equally, if not more valuable than modern science in the fight against desertification. Earlier agreements acknowledged traditional knowledge and techniques, but generally called for their improvement. This implied that modern perspectives and practices were inherently better than their indigenous counterparts and that developed countries should use their insights and technologies to enhance inferior, indigenous forms of knowledge. In contrast, the *Convention* called for protection and application of traditional knowledge and know-how. In doing so, the treaty portrayed traditional knowledge as useful and important, rather than inferior.[114] The treaty, for example, called for the creation of inventories of "(traditional and local) technology, knowledge, know-how and practices and their potential uses" (CCD, 1994: Article 18(2a)). Dissemination of such inventories, with appropriate legal protections it was hoped would enhance the ability of populations to cope with desertification-related challenges. The treaty also called for the integration of traditional practices and modern technology, suggesting that the complementarities in these methods could provide powerful tools in the process of policy implementation.[115]

Perhaps most central to reconstructivist remedies was an emphasis on "bottom-up" solutions to desertification. Nowhere does the term "bottom-up" appear in the treaty.

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[114] The treaty never explicitly defined local and traditional knowledge. However, it did contrast such knowledge with modern science, suggesting that local and traditional knowledge constitute ways of knowing not derived from or akin to the scientific method. It also urged that the use of local and traditional knowledge and its integration with other forms of knowledge be carried out only in conditions that were "appropriate." Yet, the Convention never defined what constitutes appropriate circumstances.

[115] This broader definition of knowledge coincided with a broader definition of expertise. The treaty, for example, referred to the expertise found in intergovernmental and non-governmental organizations, as well as in local populations. This marked an important departure from the modernist era when expertise virtually always meant scientific expertise.

However, negotiators, the Secretariat and observers used this term liberally throughout and following the negotiation process. Many of the opening speeches at the first negotiating session (from developed and developing countries alike) encouraged the negotiators to adopt a bottom-up approach to desertification (ENB:04:01). In general, this phrase, "bottom-up," served to distance desertification initiatives under the *Convention*, from the so-called "top-down" policies of the 1970s which sought to impose technologies and practices from developed countries onto people in affected areas. As described by The Centre for Our Common Future in conjunction with the Interim Secretariat for the *Convention to Combat Desertification*,

> The *Convention* breaks new ground by enshrining a bottom-up approach in international law. It repeatedly emphasizes the importance of full participation, and specifically underlines "the important role played by women." It also stresses "the special role of non-governmental organisations" and gives them an important role in ensuring implementation (Lean, 1995 :15).

The bottom-up approach referred to participation of local populations not just in the implementation of desertification policies, but in all aspects of their conception and implementation. Bottom-up features of the *Convention* also called for greater attention to women and youth, and a greater role for non-governmental organizations in Convention-related activities. The treaty called for participatory approaches in several policy areas including national action programmes; information collection, analysis, and exchange; research and development; and education.

This philosophy seemed to have unanimous support from the very beginning of negotiations. As he opened the first week of negotiations, Chairman Bo Kjellen noted the central role that public participation should play in the negotiations, and described a need to listen to people in villages. Country delegations made similar remarks in their opening speeches. The European Community, Sweden and Brazil, for example, called for action and attention at the local level. Chad, Ghana, and Jordan mentioned the importance of local communities and local knowledge, and several other countries called for a primary role for women in anti-desertification efforts (ENB:04:11).[116] With continued lobbying on the part of NGOs during negotiations, this support translated into several treaty provisions calling for participation by local communities, women, and non-governmental organizations in creation and application of relevant knowledge, development and implementation of anti-desertification programs, and in evaluation and refinement of such programs.

The bottom-up approach coincided with a more flexible, learning-oriented view of policy implementation. In stark contrast to policies of the 1970s, the *Convention* implied that desertification solutions were still under development and that flexible approaches to policy implementation could provide opportunities to learn more about desertification. The *Plan of Action* asserted that solutions to desertification were known and could be applied via a "top-down" process. According the *Plan*, there were well-known "right" ways of remedying desertification that could be imposed on affected populations by international and national organizations. The *Convention*, on the other hand, suggested that there was much left to learn about desertification. While some of this learning should take place through large scale monitoring and scientific research, other lessons were expected to emerge from on-the-ground trial and error. The *Convention*, for example, prescribed a "flexible" approach to project design, which allowed for experiment and iteration. This experimental approach to policy further reflected the bottom-up philosophy because it accepted and encouraged development and use of knowledge about desertification in more localized settings.

3.5.4 *Reflections*

The INCD process reflected new perceptions of science, policymaking and authoritative knowledge. While the Desertification Secretariat seemed to sideline science, they also promoted a more democratic vision of knowledge. The Information Sharing Segment and activities of the International Panel of Experts blurred institutional boundaries that traditionally separate science and policymaking. In authorizing NGOs as legitimate and valuable contributors to policy creation, the Secretariat ignored boundaries normally

[116] These countries included The Netherlands, Canada, Finland, Australia, Sweden and Madagascar (ENB: 04:11).

separating interest groups and treaty administrations, and widened borders that often circumscribe the realm of expertise. These institutional changes corresponded to a new vision of environmental degradation. Democratic processes, knowledge production, and dissemination gave rise to a more pluralistic view of desertification.

The Secretariat authorized a broader array of technical experts, and enabled them to interact both directly and indirectly with policymakers. In contrast to the UNCOD experts, ISS participants and IPED members were much more diverse in regard to their disciplinary and geographic backgrounds. In addition, both these groups engaged with delegates, albeit in different ways. The participants in the ISS spoke directly to delegates and were available to answer questions and engage in dialogue. The IPED, though never in direct contact with negotiators, commented on treaty texts as delegates were developing them. Both these models of science advice differed markedly from the linear science-to-policy-model at the core of the UNCOD process. Participants and observers in the INCD negotiations seem to agree that the IPED's work had little bearing on policy debates. However, the model under which they operated suggests a potentially greater role for scientists in the actual process of policy formulation. It further indicates that such a role for scientific experts, if carried out through a body like the Secretariat, would not compromise the perceived legitimacy of the experts or the policy enterprise.

NGOs acquired a voice in INCD deliberations through channels and interactions, which allowed these non-state actors to communicate directly with negotiators and attempt to inscribe their views on the negotiation process and resultant policy. The Desertification Secretariat was instrumental in authorizing non-governmental organizations and enabling these organizations to participate in the INCD process. The Secretariat also established forums in which NGO groups could come together, share information and develop coherent policy positions. In a sense, NGOs as a group appear to have served as an inscription device for the Secretariat. This administrative body was interested in promoting the bottom-up approach to desertification while distancing the new regime from past desertification failures and their dependence on the tools and insights of modern science.

Yet, it is clear from various NGO statements that this community was highly interested in becoming part and parcel of the emergent desertification regime. In particular, they lobbied for formal recognition as knowledge providers, and to a certain extent they were successful. Through interactions with the Secretariat, NGOs became part of the institutional framework from which the *Convention* emerged. Though not voting members like delegates, the NGOs participated in negotiation activities in a number of ways. Not only did they help to incorporate many of their views and ideas into the treaty text, they were also recognized as part of the emerging regime. As evidenced by Article 16 of the *Convention*, delegates recognized NGOs as possessing expertise of use in treaty implementation.

In constructing new forms of social order, the INCD process also generated new visions of natural order. Just as the INCD process sidelined scientists, but increased the overall diversity of voices among scientists and non-scientists, the resulting treaty emphasized complexity and diversity in desertification processes. The *Convention*'s bottom-up approach was markedly different from the technocratic focus on irrational land use and proximate solutions in the PACD. Furthermore, provisions throughout the *Convention* highlighted many complex elements of desertification processes. The treaty also acknowledged desertification as locally variably in regard to perceptions of the problem, as well as its sources and manifestations.

CHAPTER 4

Dimensions of Degradation: Quantification in Policymaking and Policy Evaluation

Throughout desertification's history, quantification has served to varying degrees as a vehicle for analysis, a mode of communication, a symbol of objectivity and, somewhat more surprisingly, a target of deconstruction. Initially, non-quantitative modes of analysis coincided with notions of dryland degradation as a local process amenable to colonial administrative policies. As UN agencies took on problems of dryland degradation, quantitative methodologies became more popular. Increasing reliance on numerical measures to standardize phenomena such as "aridity" were key in universalizing drylands and justifying international scientific inquiry aimed at their analysis. Global statistics expressing the magnitude, rate and extent of desertification impacts worldwide similarly focused attention on the physical and ecological manifestations of desertification rather than on desertification processes. During the 1970s these numbers buttressed the authority of international institutions in dealing with desertification, and helped to justify top-down policies. In the 1980s, however, global statistics became a focus of controversy as critics doubted their basis and accuracy, and called into question both desertification's validity and UNEP's integrity. Ultimately, these years of contention ushered in a new, less quantifiable interpretation of desertification. In the 1990s, what counted and how it was counted changed markedly as numerical representations of desertification again took a back seat to visions of desertification as primarily a local phenomenon. Policies, though still emanating from international forums, did not address a standardized, universal enemy, but rather a pluralistic, socially contingent process.

4.1 Analytical Framework

The production and employment of numerical measures in the desertification context reveal quantification to be an integral component of international environmental politics. To a large extent, the desertification story further verifies what scholarly analysis of other public arenas has demonstrated about the role of quantification and mathematical reasoning in creating social institutions and political order. Numbers, for example, comprise a universal language distanced from the particularities of local and personal experiences and central to the practices of modern science. As the basis for "rational" decisionmaking in liberal democracies, quantitative assessment criteria serve as tools of transparency and objectivity (Porter, 1995). Quantification also enables simplification and aggregation of complex processes and diverse populations. In centralized bureaucracies such streamlined views of the world are generally considered essential for the formulation of environmental management and social policy (Scott, 1998).

In realms of science and public decisionmaking, quantitative methods are associated with objectivity, exactness and universality. The rule-bound nature of these methods seems to isolate quantitative analysis from the influences of personal opinion and detach the counting and the counted from local identities and experiences. In technocratic approaches to environmental management, quantification provides for rationality and managerial efficiency, and possesses an appeal deriving from its "sometimes spurious, but undeniable, aura of respectability and credibility" (O'Riordan, 1976: 16). A cost-benefit analysis, for example, might indicate the viability of a given project, while a human health risk assessment might be used to determine the safety of a hazard waste site. Because such numerical analyses generate definitive answers, decisions based on their results appear as transparent, forgone conclusions, detached from the individuals in charge of the decision. As Ted Porter remarks: "Quantification is a way of making decisions without seeming to decide" (Porter, 1995: 8). Heavy reliance on quantitative methods in the United States government, for example, reflects, in part, demands for openness and transparency in that governance system.

Jasanoff examined the use of quantitative regulatory methods in the United States. She noted the tenacity of American quantitative risk analysis even in the face of criticisms regarding false precision, questionable methodologies, and the blurring of facts and values in numbers that essentially hide the subjective judgments of the decisionmaker. Quantitative risk analysis in the US, for example, has been an important regulatory tool for balancing risk benefits, setting standards, and determining which risks warrant regulation and which do not. In the face of unacceptable uncertainties, quantitative methods have also been used in efforts to estimate subjectivity in expert decisions or to represent uncertainty more precisely in numerical terms, as through probability distributions (Jasanoff, 1986, 1991).

Jasanoff also compared quantitative risk analysis techniques for lead regulation in the United States and Britain. She found that disparities in political and administrative cultures explained divergent approaches to risk communication (i.e., in numeric and non-numeric terms), assessment of subjectivity in expert decisions, and uncertainty in risk estimates. Cultural variations concerned the more insulated environment of civil servants and advisory committees in the UK compared to dependence on political appointments in regulatory agencies and greater public scrutiny of government decisionmaking in the US. The apparent objectivity of numerical measures allows government officials to appear unbiased in their decisionmaking. Quantitative methods also seem more transparent and open to public control. Yet, costs associated with quantitative methods and their tendency to open up new areas of conflict and protracted technical controversy cast a shadow over their potential benefits. Hence, use of quantification to "bring an unattainable level of technical rationality to decisions that are fundamentally subjective and political may weaken trust in government" (Jasanoff, 1991: 45).

Consistency across diverse individuals and settings enables numbers, statistical analyses, and mathematical formulae to serve as modes of communication among diverse groups (Porter, 1995) and as sources of credibility, authority and control over physical, biological and social processes (O'Riordan, 1976). Standardization via quantitative methods is often used as a tool of simplification and control in centralized bureaucracies. Through processes of standardization, the entity being counted or measured is generally objectified and represented in aggregate terms.

According to Benedict Anderson (1991), census-taking in peninsular Malaysia prior to and during British colonial rule illustrated standardization and quantification both as instruments of control and organization, and factors in the shaping of national identity. Enumeration schemes of pre-colonial leaders reflected an interest in tax revenue and military strength. Consequently, their census categories ignored women and children, but kept careful count of tax payers and men eligible for conscription. Over time, colonial census classifications increasingly emphasized ethno-racial hierarchies and de-emphasized religious classifications, with each individual fitting into one and only one category. Demographics generated via the census served as a basis for the state policy. Ethnic-racial classifications, for example, dictated the organization of numerous social institutions, including schools, courts, police stations, and immigration offices.

The above authors provide a theoretical basis for exploring quantification in the context of desertification science and policymaking. The nature and use of quantitative methods and numerical estimates of desertification have varied with each new institutional context, and with the priorities, values and resources it brought to the problem. To highlight changes in quantification through the four eras of desertification politics, the sections below are organized chronologically. Each section addresses three basic questions: Who was counting? What was counted (and what was not counted) and how? And what implications did quantification have for desertification policymaking? The colonists, UNEP, and the CCD regimes had their own distinct approaches to quantification, which reflected their respective institutional capacities and goals. They differed with regard to the emphasis they placed on quantification, the aspects of desertification they chose to quantify and the indicators and criteria they employed.

UNEP, for example, relied heavily on aggregate, numerical measures of desertfication's physical extent. Based on the work of scientific advisors, the agency used global statistics in legitimating desertification as a global problem and in evaluating policy implementation. In contrast, the current desertification regime has not emphasized numerical measures of desertification as a means to assess the problem or monitor policy implementation. The Committee on Science and Technology, a body of country representatives is, instead, developing indicators of desertification, which are intended to provide information on topics such as gender issues and capacities of local institutions. Analysis of these varying uses and methods of quantification further illuminates the processes of authorization, inscription and boundary work in policymaking. The employment of certain quantitative methods in desertification assessment was akin to the use of particular languages: desertification discourses included some individuals, while excluding others. In helping to frame and define desertification, quantitative methods and estimates provided instruments with which institutions constructed the desertification problem in ways that aligned with their resources and interests, whether these were scientific or non-scientific, global or local.

4.2 Qualitative Colonists

During the 1920s and 30s, colonial researchers and specialists in local management positions served as primary interpreters of the African landscape. Neither they nor the colonial administrations relied heavily on quantitative analysis or standardized measurements of environmental phenomena in these regions. Colonial governments had little need for aggregate measures of land degradation and vegetation changes aside from economic estimates regarding the productivity and profitability of agricultural and natural resources. Until the end of the 1930s, publications of colonial foresters, geographers and botanists engaged in the progressive desiccation debate were nearly devoid of numbers. These studies brimmed with personalized accounts of the African landscape, often relaying a strong sense of the researcher's identity and political leanings. Many of Stebbing's books and articles, for example, read like travelogues, tracing his encounters and impressions like a diary. He regularly presented his accounts in first person, with frequent excerpts from his field notebook. Apparent in many articles of the period was a clear alignment between the beliefs of the researcher and the priorities of the colonial empires. As noted by Jones:

> The replacement of bush by farmlands, where these are permanent, is surely a sign of progress. It is a process, which has taken place in all civilized countries (Jones, 1938: 411).

Such explicit endorsement of colonial objectives was a common feature of scientific publications of the period. Nearly all researchers supported colonial settlement of the "frontier" and the introduction of the European-style permanent agriculture throughout Africa (e.g., Stebbing, 1935, 1937; Jones, 1938; Falconer, 1938; Stamp, 1940).

4.2.1 *Relative Measures*

The colonial investigations reflected heavy reliance on direct observation by the researcher and interviews with local inhabitants. As researchers attempted to ascertain changes in vegetation, the movement of sand dunes and fluctuations in water levels, universal systems of standardization seemed largely irrelevant, and perhaps simply impractical. Standard measures of rainfall were nevertheless important as researchers compared climatic trends over long time spans. But for the botanist or forester on an expedition through the Sahel region, relative measures and the recollections of local chiefs were often of greater value than an aggregated set of rainfall data. Furthermore, such rainfall data were not even available until the turn of the century. As Collier and Dundas reported in 1937, "data on rainfall are deficient, as records have not been kept in Nigeria or Niger Colony for a sufficiently long period to be of any value" (Collier and Dunas, 1937: 187).

Analyses were standardized to the extent that researchers interested in progressive desiccation tended to evaluate similar parameters. In his analysis, for example, Jones systematically presented assessments of the following indicators: sand encroachment, retrogression of vegetation, reduction of rainfall, lowering of the water table, shrinkage of streams and lakes, and population migration. Not all researchers examined exactly the same indicators, but aimed to determine how this general set of criteria changed over time. In most cases they conducted evaluations based on temporal variations at specific locales. In characterizing periodicity in fluctuations of Lake Chad, Collier and Dundas (1937) simply described lake levels as "high" in some years and "low" in others, instead of referring to numerical values.[117] In noting migration patterns, these authors characterized movement in British territories of northern Nigeria between 1902 and 1904 as "proceeding on a considerable scale" (Collier and Dundas, 1937: 189). In referring to vegetation trends, Jones described how "several areas in the Niger Colony are much better wooded to-day than they used to be" (Jones, 1938: 411). Similarly, Stebbing remarked:

> There are considerable tracts of a dry degraded mixed deciduous forest of varying quality, subject to firing in the dry season by natives, either for shooting or grazing" (Stebbing, 1935: 508-9).

As illustrated, the colonial researchers often employed terms such as high, low,

[117] Collier and Dundas (1937) based their description on the findings of Chudeau without reference to any particular publication.

considerable and varying in lieu of specific quantitative figures. While they may not have possessed the technology and resources to ascertain such information, it also appears that scientists and officials alike did not view such measurements as necessary for evaluating possible signs of progressive desiccation. While proponents of this theory believed desiccation processes affected a large portion of West Africa, the theory's validity hinged on changes over time in the local environment and not on comparison of measurements across large spatial areas. Hence, portable, standardized quantitative figures were, for the most part, not a high priority.

This is not to say that numbers were wholly absent from colonial studies. Stebbing (1935), for example, often provided estimates of miles and acres to communicate his location to readers as he progressed in his narrative and traversed the countryside. He also used numerical estimates to describe the size of some forests tracts or areas of degraded land. Jones's (1938) account of the Commission's work opened with details regarding the northern provinces of Nigeria. In perusing the demographics and economic statistics for the region, Jones noted the population as 11.5 million with an average density of 40.58 per square mile. He also enumerated groundnut exports in terms of their tonnage and cash value. Other numerical measures concerned analysis of grain size, pH, and chemistry for harmattan dust. The Commission determined that (contrary to Stebbing's assertion) material deposited by the harmattan improved rather than harmed soil quality. For the most part, however, the colonists described changes and variations in the environment and in population patterns in qualitative terms.

Stebbing offered one important exception. He argued that the Sahara north of Tahoua was advancing southward at a rate of one kilometer per year and had done so for three centuries. He credited Monsieur A. de Loppinot, an administrative officer in the Niger Colony, with providing this estimate. Based on this rate, Stebbing predicted that the desert would overtake the village of Kano within fifty years or less (Stebbing, 1935). In indicating the reliability of the one-kilometer-per-year estimate, Stebbing referred to the experience of Lippinot noting that he had based his estimate on personal observation and inquiries and had "long service in the Niger and French Sudan colonies" (Stebbing, 1935: 515). Stebbing also noted that Lipponet's conclusion confirmed his own observations.

Collier and Dundas (1937) challenged Stebbing by describing and mapping the countryside. They noted the location of live dunes at the same location as described by Clapperton and Barth in 1921. They also described a belt of forest extending from the Niger Colony between the desert and more southern regions where rain is sufficient to support permanent agriculture. Similarly, Jones (1938) identified the position of live dunes as 150 miles north of the Nigerian frontier, and described that same tract of forest noted by Collier and Dundas (1937). Jones (1938) further noted that the forested region contained an area of dunes, often assumed by observers to constitute a potentially mobile desert edge. He explained, however, that grass firmly anchored the dunes and rather than constituting a desert edge, they were surrounded by forest on all sides. Neither Jones nor Collier and Dundas made any special attempts to demonstrate why their observations were any more accurate than those of Stebbing. As evidenced by letters to *The Geographical Journal*, the journal's readership readily accepted the Commission's findings as the more authoritative (e.g., Falconer, 1938; Stamp, 1940).

Despite refutation of Stebbing's assertions, it is interesting to consider the role that quantification played in the power of Stebbing's message, the attention it received, and the activity and debate it generated. As noted in other chapters, Stebbing's descriptions of the Sahara's advance were vivid and alarming. In estimating a specific rate of advance, Stebbing suggested that the desert's movement constituted long-term, quantifiable change. This assertion seemed to lend even further import to his message. In some respects Stebbing's dramatic estimate did help to mobilize action in the form of the Anglo-French Forestry Commission. However, the rate of advance he reported ultimately made his analysis more vulnerable to attack. He soon became an easy target of skeptics who supported preservation of national rather than initiation of transnational cooperation. In the face of the Commission's descriptive accounts of the landscape, The geography community considered Stebbing's numerical findings invalid. His number did not infuse his assertions with objectivity or persuasive power. While his rate estimate, being such a conveniently portable artifact, continued to appear in later articles and books, it was often disparaged as an almost humorous reminder of Stebbing's presumably outlandish claims (e.g., Jacks and Whyte, 1939; Stamp, 1940; Swift, 1996)

4.2.2 *Environmental Policy Analysis and Imperialism*

As reflected in the progressive desiccation debate, colonial governing institutions and the scientists they hired did not requires sophisticated quantitative methods, standardization or the appearance of rational decisionmaking in dealing with environmental problems. As reflected in the Commission's interpretation of degradation, the colonial administrations were primarily concerned with the state of natural resources in their respective jurisdictions. They did not need to know how the vegetation in northern Nigeria compared with that in French Niger, and therefore, did not develop standardization procedures for making such comparisons. When Stebbing did use a numerical estimate of desert advance to describe a supposedly transnational phenomenon, he succeeded in getting the attention of the colonial administrations and spurring a significant bilateral study.

On the whole, however, scientists and administrators concerned with environmental degradation did not require many quantitative methods in their day-to-day activities. Colonial subjects were not in a position to scrutinize the actions of their superiors, demand greater transparency in policymaking or call for objective decisionmaking. Hence, colonial administrators, while they did have to answer to the officials back in Britain, did not have the public pressure that motivates so much quantitatively based policymaking in liberal democracies with a penchant for open policymaking, like the United States.

Later, as soil erosion became recognized as a global phenomenon, calls for standardized approaches to its amelioration began to surface among members of the scientific community. In *Rape of the Earth: A World Survey of Soil Erosion*, Jacks and Whyte (1939) noted that the problem of erosion in Africa was much more difficult to control than that in America because of the diverse peoples, climates, agricultural methods, and land policies. These authors noted that land management successes in the United States were largely a result of the country's single, unified soil conservation system. Jacks and Whyte believed a similar uniform system was needed to stem worldwide economic casualties of soil erosion.

> This world-wide problem must be tackled as a whole, otherwise soil

> conservers would be placed at an immediate economic disadvantage in relation to soil exploiters....the problem is crudely but effectively solving itself through the growth of economic nationalism (Jacks and Whyte, 1939: 222).

Hence, these authors proposed not just an African-wide systems of standardization, but a global system. However, with World War II around the corner, such recommendations could not garner sufficient resources and soon fell by the wayside.

4.3 Numbers of Internationalization

Quantification became much more prominent in dryland research after World War II. In place of the local observations and personal accounts of colonial foresters, international scientific programs utilized techniques of aggregation and standardization. Increasing reliance on numerical measures coincided with interpretations of dryland degradation as a global problem arising from physical rather than social phenomena. UNESCO's Arid Zone Program, for example, standardized the concept of aridity and used maps (as discussed in Chapter 5) to illustrate arid regions worldwide. UNEP, in preparation for the United Nations Conference on Desertification, assembled estimates of desertification's global extent and statistics regarding the risks, causes and impacts of desertification. These estimates signaled that desertification was not confined to drought-stricken West Africa, but instead affected every continent. Quantitative measures further indicated that the mathematically grounded natural sciences offered appropriate means to assess and remedy desertification problems.

4.3.1 *Constructing an Arid Zone*

A worldwide aridity classification scheme was one direct result of UNESCO's efforts to establish an Arid Zone Research Program in the early 1950s. As suggested by the use of the singular term "zone" rather than "zones" in its title, participants in this program were interested in standardizing analysis of arid regions worldwide. Hence, after the program's initiation, UNESCO found itself in "immediate need" of someone to delineate the arid zone and devise a classification scheme for comparing climatic differences within it. To carry out this task the agency's Department of Natural Sciences commissioned Perveil Meigs to compile homoclimatic maps of the continents in time for the fall meeting of the Advisory Committee on Arid Zone Research in early 1951. In taking on this task Meigs set out to "...use criteria that would be significant, of world-wide application, and suitable for clear mapping (Meigs, 1953: 203).

Meigs classified drylands according to a ratio involving precipitation and temperature. While Meigs considered precipitation the essential determinant of aridity, he selected temperature as an indicator because it is the climatic factor most strongly affecting evaporation, and was the most widely monitored and widely available piece of climatic data. Meigs' maps indicated moisture, seasonal temperatures, and season of precipitation. Based on a formula developed by Thornthwaite (1948), which estimated the adequacy of precipitation in relation to the need of plants, Meigs classified dry climates as either semi-arid or arid. Based on rainfall records, Meigs further designated some regions as extremely arid. These areas, often referred to as "true deserts," had experienced at least twelve consecutive months without rainfall or exhibited no seasonal rhythm in terms of rainfall patterns. Meigs' classification scheme portrayed aridity as a worldwide phenomenon, thereby erasing or aggregating local climatic features. As Meigs commented:

> Maps on the scale used here, while useful for general world-wide comparisons, cannot show the numerous local variations of climate, particularly in mountainous areas where climate differs greatly in short distances (Meigs, 1953: 208).

The depiction of a worldwide aridity scheme was important in legitimizing UNESCO's international science program. By way of his classification scheme, Meigs depicted (and thereby constructed) the singular arid zone at the heart of the program's focus. The erasing of local features similarly corresponded to the international scientific focus of the initiative. Without inclusion of local level features and jurisdictional boundaries, the maps (like the program) appeared politically neutral and grounded in objective science.

Meigs' classification schemes and cartographic endeavors were widely used by climatologists, hydrologists and other scientists interested in dryland issues.[118] They also stimulated development of similar indices by other specialists in fields of climatology and hydrology In the 1970s Meigs' work served as an important resource for scientists and policymakers involved with the United Nations Conference on Desertification. As Kenneth Hare remarked in his pre-Conference report, "Climate and Desertification," "The best known and most widely accepted classification of the dry climates is that of Meigs (1961)" (Hare, 1977: 71). Because desertification was, by definition, a problem plaguing dryland regions (UNCOD, 1978: 4), Meigs' classification scheme provided a basis for estimating the physical extent of desertification and the number of people affected or potentially affected. Using Meigs' classification scheme, for example, the Conference Secretariat prepared a table showing estimates of dryland populations according to livelihood categories (UNCOD Secretariat, 1977; UNCOD, 1978).

Similar indices appeared in UNCOD assessments by Kenneth Hare and FAO and UNESCO. Hare's analysis of the world's dry climates adopted an index developed by Budyko (1958). This radiational index of drying (or dryness ratio, as named by Lettau in 1969) was expressed as the ratio of the mean annual net radiation (i.e., the radiation balance) to the product of mean annual precipitation and latent heat of vaporization for water. In 1958 and 1974, Budyko used this ratio to categorize land areas in terms of vegetational response. Based on dryness ratio values he designated regions of the world as desert, semi-desert, and steppe or savanna. In preparing *The World Map of Desertification*, FAO and UNESCO (in cooperation with WMO and UNEP, as discussed in Chapter 5) used bioclimatic maps as a basis for the *World Map*. Zones of aridity were calculated using a ratio of precipitation to evapotranspiration. Evaporation was calculated based on a formula developed by Howard Penman (see Penman, 1963) and requiring data regarding atmospheric humidity, wind speed, and solar radiation (A/CONF.74/2).

Meigs' classification scheme and its derivatives were important in enabling UNEP consultants in the 1970s to standardize analysis of desertification at a global scale. Aridity classification schemes were originally developed to locate and characterize a

[118] Meig's presented a revised version of his maps in 1960 as *Distribution of Arid Homoclimates. Eastern Hemisphere. Western Hemisphere.* United Nations Maps No. 392 and No. 393, Revision 1, UNESCO, Paris, 1953. Reproductions of these maps appeared in Stamp (1961) and Dregne (1970).

worldwide arid zone based on climate conditions in various regions. UNEP similarly relied on these schemes to indicate desertification worldwide based on climatic and physical parameters. In particular, UNEP consultants used aridity measures to extrapolate information on the state of soil and vegetation. These activities had several implications for UNEP's framing of the desertification problem. In particular, they portrayed desertification as a global and essentially physical phenomenon. Desertification was global in the way that the arid zone was thought to be global. The zone exhibited common physical characteristics at different locations throughout the world. Desertification appeared to be more dependent on the state of climate, soil and vegetation than on the cultural, political and economic contexts in which it arose. Aridity schemes as a basis for desertification analysis also provided standardized, quantitative measures of desertification. These measures were consistent with UNEP's emphasis on natural science expertise as the key resource for understanding and remedying desertification. The standardized, uniform nature of these measures also enabled a simplification of desertification. For example, they supported the notion in the PACD that desertification arose from the singular cause of land use practices and was amenable to proximate solutions.

4.3.2 *Counting on UNCOD*

While desertification analyses would continue to depend on the work of Meigs. For many years to come, reliance on his formulas and classification schemes was just a starting point for a host of standardization and quantification exercises associated with Conference preparations and follow-up. The use of quantitative methods in expert studies preceeding the Conference generally supported a framing of desertification as a global problem. As part of its two-year, pre-Conference assessment, the UNEP-based Conference Secretariat, with the help of UN agencies and expert advisors, developed a number of statistics reflecting desertification's global dimensions. Arid regions, desertified or vulnerable land areas, and affected populations were among the most popular categories for enumeration. Expressed as percentages of world totals, statistics for these categories became a ubiquitous feature of desertification rhetoric beginning in the 1970s. UNEP presented some of these statistics in the form of global maps of desertification (see Chapter 5). Other estimates appeared in tabular form or in the midst of textual descriptions of desertification. Global statistics regarding desertification's geographic extent, demographic analyses, and estimates of costs and benefits helped to justify international cooperation on the issue while further highlighting the *Plan of Action*'s uniform approach to problem diagnosis and policy prescription.

Spatial Extent

Estimates of the earth's surface area experiencing or prone to desertification appeared in conjunction with references to desertification as a global problem, amenable to scientific analysis. As noted in the published UNCOD report:

> What has emerged from all this expert work...is that desertification is not a problem that concerns just a few countries. Based on climatic data, more than a third of the earth's surface is desert or semi-desert and more than 15 per cent of the world's population live in these areas. If we go by data on the nature of soil and vegetation, the total area is some 43 per cent of the earth's land surface...Further, some 30 million square kilometres (19 per cent of the earth's land surface) are threatened with desertification, and this threatened area is distributed among more than two-thirds of the world's 150 countries (UNCOD, 1978: 1).

This quote, brimming with numbers, reflects several key features of quantification and its role in framing the desertification concept and desertification policy. Reference to "all this expert work" and to desertification's relevance to "more than just a few countries," for example, reflected UNEP's reliance on science advice and global statistics as a source of legitimacy and justification for international cooperation on desertification. As noted in Chapter 4, UNEP framed desertification as an issue grounded in scientific analysis. Numbers, being the hallmark of scientific inquiry and its universal language, imbued the Secretariat's portrayal of desertification with an aura of objectivity and certainty. While UNEP referred to the numbers as estimates, no measures of uncertainty accompanied its tables and statistics.

To estimate the extent of desert and semi-desert regions, the Secretariat referred to a map of the Budyko-Lettau dryness ratio (Henning, 1970) presented in Hare's (1977) study of climate and desertification. Hare defined areas subject to desertification as drylands under pastoral and rainfed agricultural use. According to Hare, these regions generally occupied areas with a dryness ratio of between 2 and 7. Although, Hare did not specify the spatial extent of these regions, the Secretariat (as indicated in the above quote) reported the figure as greater than thirty percent of the earth's land surface. The Secretariat estimated areas subject to desertification based on a *World Map of Desertification* prepared for the Conference by FAO, UNESCO, and the World Meteorological Organization. Using the classification scheme developed by Penman (the ratio of precipitation to evapotranspiration), the agencies identified four climatic regions as hyperarid, arid, semi-arid, and subhumid. Then, based on climate, terrain, soil characteristics and vegetation, they calculated the land's vulnerability to desertification, or desertification hazard. In referencing the *World Map*, the Secretariat determined that high or very high risk areas occupied most of the arid and semi-arid regions, and extended into adjacent sub-humid regions. They further determined that potentially productive but threatened drylands covered 45 million square kilometers or 30 percent of the world's land surface (UNCOD Secretariat, 1977: 7).

> These occur so widely that two-thirds of the 150 nations of the world are affected. Through its sheer extent, therefore, desertification is a global problem (UNCOD Secretariat, 1977: 7).

The Secretariat emphasized that effects of desertification reached beyond lands immediately affected. Dust storms, for example, could transfer soil large distances while denuded trees and vegetation could lead to increased flooding downstream of desertified areas.

Statistics expressed in terms of percentage of world totals, helped to communicate the purportedly vast extent of the desertification problem. In addition, these statistics implied that desertification was the responsibility of all people whether they resided in dryland regions of not. If such a big portion of our earth was threatened or currently degraded, it could be argued that everyone had reason to worry about it. These aggregate measures also contributed to a simplified picture of desertification as a phenomenon with a standard set of characteristics that were easily identified and measured. These numbers could reflect variations in climate, vegetation and soil at more local levels.

Population

Demographics offered another widely used means for expressing desertification in numeric terms. Just as land-based aspects of desertification were represented in global statistics, the purportedly social or human elements of desertification were portrayed primarily by way of aggregated, global population figures. UNEP noted, for example, that "The dry lands under threat must be seen for what they are, the home of one-sixth of the world's population" (UNCOD Secretariat, 1977: 8). Similarly, the *Plan of Action* reported that desertification,

> ...threatens the future of 628 million people, or that 14 per cent of the world's population who live in the drylands; of this number, between 50 and 78 million people are affected directly by decreases in productivity associated with current desertification processes (UNCOD, 1978: 6).[119]

Like references to global land area, these estimates portrayed desertification as a global and scientifically measurable problem. As discussed below, enumeration of people in terms of standardized livelihood system categories further emphasized the physical aspects of desertification and its uniformity across national and cultural boundaries.

The majority of population statistics that UNEP and UNCOD cited came from a pre-Conference study commissioned from a group of researchers at Clark University's Graduate School of Geography. This study by Robert Kates, Douglas Johnson, and Kristen Johnson Haring (1977) was titled "Population, Society and Desertification." It examined population and livelihoods at risk, social causes and consequences of desertification, and responses to desertification, by focusing primarily on changes in demographic structure and spatial location as both causes and consequences desertification. The most widely quoted pieces of the analysis derived from two numerical tables. The first of these tables (see Table 4) portrayed estimates of dryland populations by region and livelihood group. In creating it, Kates et al. used a method similar to those employed in creating the global land area statistics. They used Meigs'

[119] Kates et al. (1977) determined that 50 million people were exposed to desertification and between 50 and 78 million were vulnerable to desertification.

(1953) aridity classification scheme to define what constituted dry lands and applied population estimates (from an undisclosed source) for these areas.[120] They categorized population, on the one hand, according to regional groups comprising UNEP Governing Council Meetings (i.e., Mediterranean basin, sub-Saharan Africa, Asia and the Pacific, and the Americas), and on the other hand, according to livelihood system (i.e., urban-based, agriculture-based and animal-based). They assumed that the world population in 1974 totaled 3.86 billion, and thereby that approximately 14 percent of the world population resided in dryland regions. The study noted, however, that these figures "should be read with caution," because of the doubtful accuracy of population estimates for many countries and problems in enumerating livelihood populations.

The second table by Kates et al. (1977) (see Table 5) was reproduced in the Conference report (UNCOD, 1978). This table presented estimates of populations and livelihoods resident in areas recently undergoing severe desertification. For this table, Harold Dregne estimated areas undergoing severe and very severe desertification, based on the state of soil and vegetation in areas in question.[121] Once again, Kates et al. (1977) organized the table according to the same regions and livelihood types mentioned above. This analysis gave rise to the statistic that 78 million people were threatened by desertification, with

[120] Kates et al. (1977) also determined that, of the 628 million people residing in dry lands, 72 percent lived in semi-arid zones, 27 percent lived in the arid zone and 1 percent lived in the extremely arid zone.
[121] Dregne developed three criteria for identifying severely desertified land: (1) Undesirable forbs and shrubs that have replaced grasses or have spread to such an extent that they dominate the flora; (2) Sheet wind and water erosion have largely denuded the land of vegetation, or large gullies are present, or (3) Salinity controllable by drainage and leaching has reduced crop yields to more than fifty percent." Very severe desertification criteria were as follows: "(1) Large shifting barren sand dunes have formed, or (2) Large, deep, and numerous gullies are present, or (3) Salt crusts have developed on nearly impermeable irrigated soils." These were the same criteria Dregne used in creating his map of the "Status of Desertification in Hot and Arid Regions" (UNCOD Secretariat, 1977; A/CONF.74: 31).

TABLE 1. Estimates of dryland[a] populations by region[b] and livelihood group (in thousands)

Region	Dry lands Total population[c]	Livelihood populations in dry lands: Urban based	Agriculture based	Animal based
Mediterranean Basin	106,800	42,000 (39%)	60,000 (57%)	4,200 (4%)
Sub-Saharan Africa	75,500	11,700 (15%)	46,800 (62%)	17,000 (23%)
Asia and the Pacific	378,000	106,800 (28%)	260,400 (69%)	10,300 (3%)
Americas	68,100	33,700 (50%)	29,300 (43%)	5,100 (7%)
	628,400	194,200 (31%)	397,100 (63%)	37,100 (6%)

[a]Meigs's classification (1953) including extremely arid, arid, and semi-arid areas.
[b]Groupings as designated by UNEP Governing Council for regional meetings.
[c]Total world population was estimated to be 3.86 billion in 1974.

TABLE 2. Estimates of populations and livelihoods resident in areas recently undergoing severe desertification[a] (in thousands)

Region	Total population	Urban based	Agriculture based	Animal based	Area (km²)
Mediterranean Basin	9,820	2,995 (31%)	5,900 (60%)	925 (9%)	1,320,000
Sub-Saharan Africa	16,165	3,072 (19%)	6,014 (37%)	7,079 (44%)	6,850,000
Asia and the Pacific	28,482	7,740 (27%)	14,311 (54%)	6,431 (19%)	4,361,000
Americas	24,079	7,683 (32%)	13,417 (56%)	2,979 (12%)	17,545,000
	78,546	21,490 (27%)	39,642 (51%)	17,414 (22%)	30,076,000

[a]As estimated by H. Dregne (includes both severe and very severe categories).

Tables 4 and 5 from Kates et al. (1977)

> 50 million immediately menaced through the destruction of their livelihoods and who are faced by the grim prospect of uprooting themselves from everything familiar and migrating to other areas frequently ill-equipped to receive them (UNCOD, 1978: 2).

Population statistics proved dramatic when presented in conference documentation. However, no disclaimer regarding uncertainties in the data accompanied publication of the second table in the UNCOD (1978) report.

Furthermore, Kates et al.'s (1977) demographic analyses implied a commonality among desertification processes in suggesting that they affected and interacted with populations in uniform ways. The global statistics also focused attention on livelihood systems and particular types of land use as responsible for desertification. Kates et al. (1977: 271) explained, for example, that "two basics types of agricultural livelihood exist," dry farming and irrigated farming. In regard to animal-based livelihoods, the researchers highlighted what they considered to be the most significant features. These features included mobility, flexibility, and diversification. Regarding urban-based livelihood they identified intrinsic and indirect interactions. Intrinsic interactions were said to arise from urban population densities and consumption patterns. Indirect interactions originated in areas located outside of the city. These statistics were important in suggesting that land use practices could be categorized into types that were uniform worldwide. They similarly implied that a proximate solution based on improved land use was viable.

The pre-UNCOD population study also exemplified the way in which UNEP conceived of the social dimensions of desertification. In particular, the agency and its consultants addressed social factors in much the same manner that it analyzed desertification's physical dimensions -- through quantitative methodologies that lent themselves to generalizations. The Kates et al. (1977) report was the only Component Review to directly address human aspects of desertification. Measures used in this analysis focused on demographic structure and the spatial location of populations. By enumerating all people living in dryland areas, the study created a category of "dryland population" similar to the category of "arid zone" developed under the auspices of

UNESCO and employed liberally in the UNCOD assessments. This category and the aggregate measures comprising it helped to legitimize desertification as a global problem by implying that it affected uniform categories of people (defined by where they lived, their land use practices and the climate) in uniform ways (expressed as a degree of severity). In employing aggregate measures of these population categories, it was impossible for researchers to capture locally contingent aspects of degradation processes, such as culturally embedded views of the land, land use and trade policies that have a bearing on how people interact with the land, and issues of poverty and education. While some of these issues received brief discussion in the Kates et al. (1977) report, the quantified estimates proved much more portable and were easily incorporated into speeches, policy documents and UN, scientific and popular literature. As they circulated, they relayed a simplified vision of the desertification problem as amenable to a standardized set of solutions.

Costs and Benefits

Quantification also served as an important tool in estimating the costs and benefits of anti-desertification measures. In advance of the Conference, the Secretariat arranged a set of meetings specifically intended to bring together economists and financial experts with earth science specialists. The product of this interaction was a table showing the costs of desertification and the benefits of anti-desertification efforts. The tale fwas prepared for the Conference and then revised for inclusion in the published conference report (UNCOD, 1978) (see Table 6). For three types of land (categorized as irrigated, range, or rainfed crop land), the table presented the annual rate of land degradation (in hectares), its estimated value if salvaged and if not salvaged, the cost of salvage, and the total net benefits expected for land salvaged (all in American dollars). While net benefits in 1977 were reported as $632.5 million, the 1978 table reported total net benefits as $895 million. Text accompanying the 1977 version of the table emphasized the preliminary nature of the table entries, noting that the numbers represented "educated estimates" and should be considered as a "rough order of magnitude of the elements under consideration" (UNCOD Secretariat, 1977: 9). The 1978 version of the table, published

REVISION OF TABLE PREPARED FOR THE CONFERENCE, BASING LAND VALUES ON CAPITALIZED VALUES AND ADJUSTING UNIT SALVAGE COSTS TO MORE REALISTIC LEVELS

Initial estimates of orders of magnitude of costs and benefits of corrective measures

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Type of land[1]	Annual rate of land degradation (000 hectares)[2]	Estimated value (\$ per hectare)[3]: if not salvaged	if salvaged	Gain: (4) − (3) per hectare \$	(2) × (5) Total million \$	Estimated cost of salvage[4] per hectare \$	Total (2 × 7) million \$	Net gain per hectare (5) − (7) \$	Total net benefits (2) × (9) million \$
Irrigated	125[5]	200	2,000	1,800	225	850 (250-2,000)	106	950	119
Range	3,200	2	20	18	58	10 (1-50)	32	8	26
Rain-fed Crop	2,500	50	450	400	1,000	100 (50-150)	250	300	750
TOTAL	5,825				1,283		388		895

[1] Arid and semi-arid lands only.

[2] Annual rate of land degradation is based on annual rate of change of classes of land to more degraded conditions. The degree of degradation from higher to lower classes of land has been converted to more limited areas assumed to be deteriorating from land yielding highest net return (if salvaged) to land at the point of going out of production (if not salvaged).

[3] In view of difficulties in quantifying social values, these estimates are rough conservative approximations of orders of magnitude of capitalized values. Values are calculated using an assumed net income at half of gross income divided by an assumed opportunity cost of 10 per cent, with a slight adjustment for rangelands to reflect lower opportunity costs. If social factors are included the values would be substantially higher.

[4] Figures within parentheses give ranges of salvage costs. It follows from footnote 2 that cost of salvage is the maximum, equivalent to the cost of reclamation or restoration of practically completely desertified land. Because desertification is a continuous process, the more prudent course of action would be to begin corrective investment as soon as practicable and initially to lands which offer the highest returns to ensure continued maximum production.

[5] Due to waterlogging, salinization and, to a lesser extent, alkalinization.

Table 6 From UNCOD (1978)

as part of UNCOD's report, portrayed the numbers on the whole as revised and "more realistic," but did note, in a footnote, the roughness of the capitalized value estimates. Because of difficulties in quantifying social values for the 1978 table, estimates of land values were based on estimates of capitalized values (UNCOD, 1978: 2).

The use of cost-benefit analysis on the part of the Secretariat further exemplified the emphasis on rationality and scientific objectivity in the context of desertification policymaking. As noted by O'Riordan in 1976, "resource allocation techniques such as cost-benefit, systems dynamics, and programme budgeting were created and are popular precisely because they are supposed to be 'value free' and 'rational' (page 15)." By demonstrating the costs and benefits of anti-desertification activities, UNEP aimed to provide: quantifiable reasons why countries should support desertification policy. Because social valuations of land and costs were not easily quantifiable they were excluded from consideration. As discussed below, this one table seemed to serve as a starting point for more extensive use of monetary metrics of desertification in later years.

Rate

UNEP's estimates of area of land per year lost to desertification relayed a sense of urgency, and like global statistics, became a mainstay of desertification assessments for years to come. The Conference report estimated that the world was likely to lose nearly one third of its arable land by the turn of the century (UNCOD, Secretariat, 1977: 9; UNCOD, 1978: 2-3). Similarly, Mostafa Tolba remarked:

> It is estimated that between 30,000 and 70,000 square kilometers of useful land are going out of production every year, and the most important cause of this appalling loss is desertification (UNCOD Secretariat, 1977: A/CONF.74/L.1: 3).

However, UNEP provided little information regarding the data and methodologies used in producing these statistics. Rate estimates, for example, were calculated as part of a cost and benefit analysis for the Conference. A footnote to the cost-benefit table explained that the rate of land degradation was determined based on the rate at which various categories of land exhibit more degraded conditions. The categories reflected causes of degradation, in terms of waterlogging, salinization, range deterioration, and dryland deterioration. Yet, UNEP provided no information about the scheme for classifying different levels of degradation or how changes in these levels were determined (UNCOD Secretariat, 1977: 9; UNCOD, 1978: 2).

Similarly, UNEP concluded that, if desertification were allowed to proceed further on the geographical scale suggested by the *World Map*, 700 million people would be said to face eventual risk. The source of these various estimates was unclear, as they were not attributed to any specific pre-Conference assessments or to other studies or data sources. UNEP, nevertheless, cited rates and projections of desertification's progress worldwide as justification for immediate action. The Secretariat noted that rising food requirements at least matched the rate of population growth, and projected that such changes would require an increase in food by at least one third before the end of the century in order to maintain then-current dietary standards (UNCOD Secretariat, 1977: 9). Largely because of desertification rates, the Conference argued that "preventive measures, embodied in proper land management, should be developed on a massive scale and without delay" (UNCOD Secretariat, 1977: 9). UNEP further argued that because desertification is a continuous process, investment directed at lands promising the highest returns should commence as soon as practicable (UNCOD, 1978).[122]

4.3.3 *Looking Ahead: Desertification Indicators*

Standardized measurements of desertification phenomena were not only a product of UNCOD preparations. UNEP also considered such measurements an important feature of the implementation and evaluation activities under the *Plan of Action*. The *Plan*, for example, noted that defining the magnitude and impact of desertification constituted the first stage in a several stage process for ameliorating desertification. The first recommendation in the *Plan* called for assessment and evaluation of desertification using comparable indices and the standardization of monitoring facilities and methods. In keeping with pre-Conference modes of analysis, the *Plan* called for observations

122 Rates estimating the "advance" of desertification also tended to suggest a desert encroachment image of desertification and contributed to confusion regarding the relationship of these phenomena. As discussed in Chapter 3, rates became the focus of controversy in later years as critics questioned the notion of advancing deserts, despite the PACD's disclaimer that advancing deserts were not the focus of the agreement.

covering atmospheric processes, vegetation, dust transport, soil cover, wildlife, and crops. The *Plan* similarly called for maps to represent the results of monitoring. Mostafa Tolba, in recognizing the substantial amount of groundwork to be completed before any such monitoring could start, remarked on the newness of desertification as a focus of international cooperation. He noted: "precise standards are yet to be formulated for measuring desertification and gauging its advance." He referred to the development of physical, biological and social indicators of desertification, which he said, promised to help "assess more accurately the state of the process of desertification" (A/CONF.74/L.1: 2).

Tolba's comments alluded, in part, to the Science Associations' Seminar on Desertification, which took place in Nairobi during the week preceding UNCOD (August 21-25, 1977). This meeting, organized by Priscilla Reining of the American Association for the Advancement of Science (AAAS) and chaired by Harold Dregne, focused on the development of desertification indicators.[123] Approximately thirty scientists from almost twenty countries attended the meeting along with observers from UN agencies, universities, government ministries and various organizations. The scientists came from areas of soil science, climatology, plant and animal ecology, agricultural economics, range and wildlife management, anthropology, sociology, geography, and agronomy. They aimed to develop comparable indices for monitoring desertification. Planning and development agencies worldwide were expected to use these indices in implementing the *Plan*.

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[123] Through its Office of International Science the AAAS became involved with United Nations conferences on Population, Woman, and Human Settlements. In preparation for UNCOD, AAAS established an ad hoc Advisory Committee on Desertification (headed by Harold Dregne) which was significantly larger than its permanent Committee on Arid Lands. The AAAS recognized desertification as a "complex systemic process." The project's aim was to focus scientific attention on a specific objective to enable an "effective contribution" from the scientific community. In June of 1977 AAAS sponsored a workshop at Cremona Farm in Maryland to prepare for the Nairobi Seminar. This workshop produced a "Working Paper on Indicators" that served as an agenda item and background paper for the Nairobi seminar participants. Twelve scientists attended the Cremona Workshop accompanied by Priscilla Reining and four other AAAS officers and associates.

> Only a highly focused objective can enable a small number of scientists to make an effective contribution. A considerable need existed to create consensus for precisely what processes of desertification should be measured, how, and where they should be monitored. Such measurement and assessment are called for in the first recommendation of the *Plan of Action* to Combat Desertification (Reining, 1977: xiii).

The set of indicators was first developed by a working party over a several month period prior to the seminar. These indicators included physical, biological/agricultural, and social. Many of the proposed indicators focused on physical and biological manifestations of desertification such as soil depth, soil organic matter, ground water depth and quality, and animal populations. Other indicators identified changes in settlement patterns, migration, health and conflict as categories of social indicators.

These indicators were primarily intended to provide a means for creating more maps and statistics regarding the geographic extent, location and rate of desertification. They also buttressed the notion that desertification processes could and should be standardized and thought about in terms of their international scale and scope. As discussed below, these objectives occupied UNEP throughout the next decade as the agency used various indicators to further refine the global picture of desertification it introduced in 1977.

4.4 Measures and Management

As the lead agency in charge of overseeing the *Plan*'s implementation, UNEP relied heavily on quantitative methods in continuing to study the desertification problem and assess the efficacy of anti-desertification efforts. One of UNEP's tasks was to conduct General Assessments of Progress regarding the *Plan*'s implementation. The way that UNEP interpreted this task was important. In particular, the agency channeled considerable time and resources toward measuring the "rate and extent" of desertification on a global scale. Hence, UNEP operated largely under the assumption that good management depended on good measurement. The agency continued to focus on assessing physical manifestations of desertification, instead of analyzing processes contributing to desertification. With a numerical metric of success, global statistics, such as those introduced during the 1970s, proliferated. Statistical categories continued to emphasize land use as the primary cause of desertification and to focus attention on demography as the best means for representing desertification's social dimensions.

However, while global statistics during the 1970s seemed to legitimate desertification's global framing and justify international attention to the problem, similar statistics developed in the 1980s did not meet the same degree of acceptance. Rather than imbuing the issue with an aura of objectivity and universality (e.g., O'Riordan, 1976), UNEP's methods of quantification became a target of critics who questioned the credibility of both the issue itself and UNEP as its staunchest proponent. Some scientists suggested that UNEP's quantitative estimates of desertification in the 1970s exaggerated its extent and severity. Several individuals were also highly skeptical of the methodologies UNEP applied in preparing its 1984 General Assessment of Progress. They criticized UNEP's attempt to gather information for its assessment via a questionnaire, and argued that UNEP's assessment results were at best inaccurate and at worst, fabricated. Nevertheless, global statistics continued to appear again and again in various pieces of UN literature, articles, and even in subsequent international agreements. Furthermore, UNEP continued to develop and rely on assessments of desertification's rate and extent throughout the 1980s.

4.4.1 *Policy Implementation and Quantification*

In overseeing the *Plan*'s follow-up, UNEP sponsored a number of assessment activities during the 1980s and early 1990s. The most extensive of these studies were the General Assessments of Progress, conducted at seven-year intervals following the *Plan*'s completion in 1977 (UNEP, 1984; UNEP, 1991). UNEP also carried out a number of additional studies, often in conjunction with other agencies, or through ad hoc expert panels. As such, these studies addressed mapping and assessment methodologies (FAO, 1981; FAO and UNEP, 1984; UNEP and ISRIC, 1989; Odingo, 1990a; Odingo, 1990b; Rozanov, 1990), progress in implementing the *Plan of Action*, and various definitions of desertification and their implications for policy implementation (Odingo, 1989, 1990). Through many of these studies, UNEP relied largely on quantitative measures to characterized desertification, and highlighted an important role for such measures in policy implementation. At times during the 1980s, for example, members of UNEP's administrative staff reminded expert consultants that policymakers could not base their work on the cautionary hedgings of "scientists who say they can't know anything for sure" (Interview with UNEP Advisor 2). Quantitative estimates provided at least an appearance of certainty.

Many of UNEP's assessment activities focused on measurement and mapping of desertification. An accurate assessment of desertification's physical manifestations worldwide was considered necessary for successful implementation of policy measures. The *Plan of Action* called for efforts to define the magnitude of desertification and FAO and UNEP echoed similar ideas in their 1983 analysis of assessment and mapping methodologies.

> This project was initiated with the aim of obtaining precise figures on rate and risk of desertification to assist future planning, to guide anti-desertification activities at national and regional levels as a basis for international action to combat desertification (FAO and UNEP, 1984: 1).

With this perspective, UNEP and the consultants it hired placed considerable emphasis on identifying and measuring quantifiable desertification indicators. When UNEP convened an expert meeting in May 1979 to discuss assessment and mapping methods, participants determined that "indicators should, ideally, be quantitative, sensitive to small changes in the fact being measured, easy to measure and few in number." At a second Expert Consultation in July 1981, participants approved a provisional methodology for field testing. Parameters selected for evaluation focused on physical manifestations of desertification, including degradation of vegetative cover, water erosion, wind erosion, and salinization. For assessment and mapping purposes, FAO and UNEP deemed it necessary to "describe, quantify and codify" these parameters, and then determine their status, rate and "inherent risk" (FAO and UNEP, 1983: 11-12).

An emphasis on evaluating the status and rate of desertification continued to color UNEP assessments throughout the 1980s. As discussed further below, UNEP's General Assessment of Progress in 1984 used data obtained from a questionnaire to estimate changes in desertification's physical extent and severity since 1977 and to project desertification rates to the year 2000. In 1990, UNEP commissioned Professor Boris

Rozanov, Chair of General Pedology at Moscow University, to consider issues regarding the status and global assessment of desertification. In reviewing FAO and UNEP's work in the mid-1980s, Rozanov found the proposed indicators to be impractical for measurements conducted at regional and national levels because of costs associated with collection of such detailed information. He instead called for a "simpler, more refined methodology" (Rozanov, 1990: 75).

Rozanov was an enthusiastic proponent of quantitative desertification analyses according to internationally standardized criteria and methodologies. He lamented the lack of an easily quantifiable, and therefore, "operational" definition of desertification.

> ...for the practical purposes of desertification assessment, mapping, monitoring and countermeasures, particularly at the local level, none of these definitions appear to be sufficiently operative, they lack the quantitative aspect, on the one hand, and, on the other, an unequivocal indication of what is to be assessed, mapped, monitored and fought. This lack of operability has led to differences in the methodologies used by different scientists and national and international institutions concerned with desertification in different parts of the world, as well as at different times (Rozanov, 1990: 71).

In keeping with ideas reflected by the *Plan*, Rozanov viewed quantitative assessment of desertification as an integral part of anti-desertification policy implementation. In keeping with his militaristic reference to fighting desertification, Rozanov's "know your enemy" strategy required a united front on the part of national and international institutions. Such unity, he believed, was possible only through precise characterization of desertification and international standardization in the modes and methods of scientific inquiry. In particular, he called for some "definite international methodology that would be adopted and strictly followed throughout the world" (Rozanov, 1990: 73).

To serve these purposes, Rozanov believed that quantitative information regarding desertification was essential, and he had little use for other desertification indicators. In reflecting on the availability of descriptive data from affected areas, he commented:

> There is an enormous amount of information concerning desertification in Africa, South Asia and Latin America. However, this vast fund of data, which appears in various reports and publications, does not cast any new light on the problem because it is largely qualitative and, in some cases, more emotional than factual. With some reservations this information can be used for creating a general picture, but it is hardly sufficient to prove the case beyond all reasonable doubt (Rozanov, 1990: 53).

In referring to the "emotional" aspects of qualitative data, Rozanov suggested that such observations were not obtained via the scientific method and were therefore not objective or useful in developing understandings of desertification.

UNEP's continued emphasis on desertification highlighted its interest in a simplified interpretation of desertification that facilitated generalizations about it. Quantitative measures focused attention not on processes of desertification, but on their manifestations as expressed through measurements of geographic extent and changes in this extent over time. Quantitative measures of status, rate and risk similarly obscured a view of the various social, ecological, political and economic factors associated with desertification processes. Consideration of these factors would have prevented generalization and a uniform framing of desertification.

General Assessment of Progress, 1984

Perhaps the most widely publicized and most controversial of UNEP's assessments was the 1984 General Assessment of Progress. The *Plan of Action* called for an evaluation to take place seven years after the *Plan*'s completion. The *Plan* provided few specifics regarding the methodologies and content of the assessment. Hence, UNEP had considerable leeway in designing the study, and many of its decisions echoed the approach to desertification reflected in the *Plan of Action.* In particular, UNEP again choose to assess the desertification largely in quantitative terms. In doing so, the agency focused on ascertaining desertification's physical extent at a global scale, and the rate at which this physical extent was changing. UNEP then looked to differences in 1984 and 1977 statistics as an indication of overall "progress" in ameliorating desertification. While other aspects of the assessment presented qualitative descriptions of anti-desertification activities,[124] institutional and financial arrangements, obstacles to implementation, and recommendations for the next 15 years, the most dramatic and widely cited results of the assessment were those expressed in numerical terms. Although descriptive accounts of desertification's status and trends in several geographic regions also appeared in the report, they were relegated to an annex and left out of the "Executive Summary."

UNEP began preparing of the assessment in 1982. The agency determined that the study would include four elements[125] and appointed an advisory panel to oversee its compilation.[126] A key feature of the assessment process was a questionnaire sent to 12 donor countries and 91 countries determined to be affected by desertification. The questionnaire posed questions regarding changes in population, land use and crop and livestock production since 1977; status and trend of desertification under primary land use categories (irrigated lands, rainfed croplands and rangelands); and activities implemented under the *Plan*'s recommendations. Sixty-two affected countries responded to the questionnaire, along with four donor countries.[127] In addition to the questionnaire, UNEP commissioned updates for several of the UNCOD case studies, Hare's (1977) "Climate and Desertification" piece (Hare, 1983), and a new study on demographic changes since 1977 (Caldwell, 1984). To review activities across the whole UN system, UNEP obtained records of such activities from the appropriate agencies (UNEP, 1984).

The UNEP assessment used numerical representations much in the way that the

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[124] Assessors also enumerated donor and agency projects implemented under the PACD. A table of donor projects appears on page 120 of Dregne (1984). A chart showing projects categorized according to activities highlighted int the PACD (e.g., assessment, land use planning, range improvement, and vegetation improvement) appears on page 31 of (UNEP, 1984).

[125] Science advisors heavily involved with desertification policymaking in the 1970s summarized various parts of the assessment in papers published in *Environmental Conservation* (Dregne, 1984; Karrar, 1984; Mabbutt, 1984; Tolba, 1984).

[126] Panel members included A. G. Abdel Sami of the Academy of Scientific Research and Technology (Cairo, Egypt) G. Aubert, of Services Scientifiques (Bundy, France); R. A. Perry from the Division of Land Resources at CSIRO (Australia); and Jeremy Swift of the Institute for Development Studies (Sussex, UK). Others who attended the handful of meetings included Mostafa Tolba, Executive Director of UNEP; James Mabbutt, consultant to UNEP; and Gafaar Karrar and Daniel Stiles, both of UNEP's desertification branch (Interview with UNEP Science Advisor 2; Jeremy Swift's documents 1998).

[127] In his paper entitled, "Desertification: Demographic evidence, 1973-1983," John Caldwell remarked that UNEP's questionnaire was answered by only thirty countries: fifteen in Africa, nine in Asia, five in South America, and one in North America. The discrepancy between UNEP's and Caldwell's response figures may be due to the fact that Caldwell counted only those countries who responded to population questions, while UNEP totaled all responses, whether or not they contained answers to population and demographic questions.

UNCOD experts had done – to express the physical extent and costs of desertification. Categories for quantification included the extent of desertification, populations affected, global trends, and projections to the year 2000. The UNEP study, however, provided estimates for a much larger set of regions than those included in the UNCOD studies.[128] Desertification indicators used in the assessment included growth and encroachment of mobile sand dunes and aolian sand sheets, rangeland deterioration, degradation of rain-fed croplands, waterlogging and salinization of irrigated lands, deforestation and destruction of woody vegetation, and declining availability of groundwater and surface water. Social and economic indicators, however, were not used in the assessment.

> Although it is recognized that human and social indicators may lie close to the heart of the problem, the evidence upon which to base them is not systematically available, and in many other respects they have proved difficult to monitor. Accordingly, they have not been used as primary indicators in this assessment (UNEP, 1984: 13).

The report also noted that, in general, data regarding the status and trends of desertification in various parts of the world were lacking and were found through the assessment process to be inadequate and an impediment to the Plan's implementation.

> This assessment shows that quantitative data about the status and trend of desertification are inadequate...Data are particularly lacking on the economic and social costs of desertification in terms of production lost and social welfare impaired (UNEP, 1984: 7).

Nevertheless, UNEP presented its results as certain and definitive, without mention of uncertainties relating to specific statistics. Based on the physical indicators, assessors characterized various land use types as none or slight, moderate, severe or very severe. These classifications depended on the extent and degree of degradation, losses in

[128] Regions addressed in the study were as follows: Sudano-Sahelian region; Africa South of the Sundano-Sahelian region; Mediterranean Africa; Western Asia; South Asia; USSR in Asia; China and Mongolia; Australia; Mediterranean Europe; South America and Mexico; and North America.

productivity, and required improvements.

The assessment presented a grim picture of desertification. It found that desertification was continuing to spread and intensify with six million hectares of land per year lost irretrievably to desertification or degraded to desert-like conditions. In reflecting on these results, UNEP noted:

> Desertification is shown by this assessment to be a world problem calling for an appropriate global response, not merely by virtue of its scale and urgency, but also through the universality of its impacts and causes, which extend far beyond the drylands most directly affected (UNEP, 1984: 18).

The assessment, like the UNCOD studies, reported statistics according to categories of land use and severity of desertification. For example, areas experiencing at least a moderate level of desertification included 3100 million hectares of rangeland, 335 million hectares of rainfed croplands and 40 million hectares of irrigated land, translating to 75 per cent of all productive lands in drylands. UNEP found that rural populations experiencing severe desertification escalated from 57 million in 1977 to 135 million in 1984. They estimated the direct cost of desertification at $26 billion dollars annually (excluding social costs) and attributed the majority of these costs to declines in productivity. The assessment further reported that production losses arising from desertification were equivalent to five times the cost of halting desertification. However, no explicit cost-benefit calculations or tables were presented in the report.

Population figures showed substantial increases over the 1977 estimates. Whereas the 1977 studies estimated the number of people vulnerable to desertification at 650 million, the 1984 assessment reported 850 million for the year 1984. UNEP cited three reasons for the increase: population growth; inclusion of more subhumid land areas in the category considered affected by desertification, and an increase in the extent and severity of desertification. The population numbers showed rainfed agricultural land to be the most extensively affected with over 60% of people in rainfed agricultural areas experiencing at least moderate desertification.

To assess global trends in desertification, UNEP examined forest and woodland cover and groundwater resources in regions corresponding to the three land-use categories. Assessors determined that desertification was accelerating in four regions: the Sudano-Sahelian region, Africa south of the Sudano-Sahelian region, South Asia and South America. Most discussion of desertification trends was expressed in qualitative, descriptive terms. The report concluded that desertification had continued unchanged in most land use sectors since 1977. The study also provided projections to the year 2000, estimating that dryland populations would increase to 1.2 billion, with the rural component increasing from 500 million to 600 million.

UNEP's (1984) statistics on desertification were widely quoted in UN reports and in other articles. James Mabbutt's (1984) article in *Environmental Conservation* presented a nearly verbatim account of the "status and rate" portion of the assessment, as did a ten-year retrospective on desertification policy, published by UNEP's Desertification Control Programme Activity Center (1987). In a 1984 issue of UNEP's publication *Uniterra* and in a guest editorial for *Environmental Conservation*, Tolba referred to the 1984 estimates in lamenting lack of progress in the fight against desertification. Even *Our Common Future* quoted the UNEP figures in a section entitled "Advancing Deserts."

4.4.2 *Data Deficiencies*

UNEP's assessment work in 1983 and 1984 marked the "moment when it all went wrong." These comments by an advisor to UNEP's 1984 assessment process summed up the sentiments of many observers, both inside and outside of UNEP during the early 1980s. Much doubt focused on the overall paucity of data necessary for calculating rate and status statistics and on uncertainties surrounding responses to UNEP's questionnaire. One advisor remarked that responses to the questionnaire "garbage." Even the United States was unable to fill out the survey and environment ministries in many other countries "didn't have a clue about how to answer the questionnaire." This advisor was also distressed by the methodologies and lack of transparency regarding the calculations. He described how data obtained were "thrown into computers." According to him, several of the experts involved with the assessment voiced their concerns to UNEP regarding availability and validity of the data (Interview with UNEP Advisor 2).

Correspondence between expert consultants and UNEP reflected similar impressions of the UNEP study. A draft manuscript entitled "Regional Assessment for North America," for example, noted that "Desertification is a much-used but little understood word in the US" and that "In North America there is little agreement about the status and trend of desertification" (unpublished manuscript, "Regional Assessment for North America"). Similar comments regarding ambiguity in desertification's meaning in North America, however, did not appear in the North American Annex presented in the final assessment report. In a June 25, 1983 memo, Brian Spooner, an anthropologist from the University of Pennsylvania, reported to Dr. K. F. Jalal on his analysis of desertification in Asia and the Pacific Region. Spooner relayed the problems he encountered in shifting through various research materials: "I am afraid the further I got into it the less 'hard' the data became" (Spooner memo, June 25, 1983, Jeremy Swift's files). In referencing country reports and three responses to UNEP questionnaires, Spooner continued:

> The country papers in most cases when you look closely, simply hedge rather than giving the required information, and most of the figures on the questionnaires are either too divorced from context or have other problems to have any obvious acceptable meaning (memo from Spooner to Jalal, June 25, 1983, Jeremy Swift's files).

Spooner found Australia's responses to the questionnaire lacking as well, suggesting they were based on data collected prior to 1977. To Spooner, the situation illustrated the need for more information in statistical and map form.

> It seems to me now even more than before that lack of information, both in terms of statistics and maps – especially now that progress has been made on the institutional front – is perhaps one of the most serious aspects of the whole problem (memo from Spooner to Jalal, June 25, 1983, Jeremy Swift's files).

Spooner suggested that UNEP had "shied away from" greater data collection efforts in previous years because of the significant investments required. He recommended, however, that the agency make information a key priority in subsequent years of the *Plan*'s implementation.

John C. Caldwell, a demographer at Australian National University, similarly found problems with UNEP's assessment data. Caldwell prepared a study for UNEP examining the demographics of desertification between 1973 and 1983. Originally, Caldwell intended to use the results of UNEP's questionnaire as the basis of his analysis. However, he judged that responses to the questionnaire were inadequate on several counts. According to Caldwell, the total number of respondents was low and questions posed were not clear and not well understood by respondents. He also found that the questionnaire presented information about desertification that was frequently "absurd or at variance with published sources" (Caldwell, 1984: 21). Although hesitant to draw any generalizations from the information collected, Caldwell did conclude that population growth in most "Third World" arid lands was no slower than that in humid lands. For a handful of countries he reported statistics that he considered to be accurate, but he deemed migration results overall as "all wrong," and allowed only for the conclusion that people tended to migrate from drier to wetter locations and from rural to urban areas (Caldwell, 1983: 23).

Despite the concerns of its consultants, however, UNEP went forward with publication of its assessment in time to meet its 1984 deadline. The document itself gave no indication of who contributed to or authored the study. It is most often attributed to Jack Mabbutt who played a major role in overseeing the process and published results on desertification's status and trends in a 1984 issue of *Environmental Conservation* (e.g., see Nelson, 1990; Warren and Agnew, 1988).

4.4.3 *Critics Recommend New Ways of Counting*

UNEP's findings and methodologies continued to attract criticism throughout the 1980s.[129] In 1988 Andrew Warren (former expert consultant to the 1977 Conference) and Clive Agnew, both of University College London, published papers critical of the way in which desertification had been conceptualized and addressed (Warren and Agnew, 1988a and 1988b). Desertification assessment criteria and statistics were among the things they

[129] Critiques of UNEP's desertification assessments appeared in the 1990s as well. Examples include Swift (1996) and Thomas and Middleton (1994). In 1995 Daniel Stiles of UNEP responded to the various critiques by pointing out weaknesses in critics' analyses. On the topic of UNEP's 1984 assessment, however, Stiles conceded the report "did not contain accurate statistics. The data simply do not exist" (Stiles, 1995: 14). Nevertheless, he contended that UNEP did not exaggerate the scale of the problem and went on to question the claims of Warren and Agnew (1988) and Thomas and Middleton (1994).

discussed. According to these two researchers, the "litany of statistics" was inadequate, often misleading and based on conflicting definitions of desertification. For example, in response to UNEP's claim that desertification threatened 35 percent of the earth's surface, Warren and Agnew argued that at least half of this area was very arid already and unable to support agriculture now or at any time in the future (Warren and Agnew, 1988a: 5). These authors placed most of the blame on what they called inappropriate criteria. Inappropriateness stemmed from lack of standards or baselines in measurements, inadequate attention to recoverability and resilience of degraded land, lack of attention to natural fluctuations in climate and vegetation, scarcity of data, and irrelevance of data to local land use systems (Warren and Agnew, 1988).

Warren and Agnew claimed that the measurements and assessments UNEP considered so important as a basis for policy were actually of little relevance to "life on the ground." The level of aggregation in UNEP's world maps and land classification schemes made them largely meaningless to local populations.[130] Furthermore, the design of large-scale analyses derives more from institutional priorities and available resources, than from a concern for the needs of local populations.

> The scale at which land degradation has usually been viewed has been determined more by the availability, to the authorities concerned, or data and manpower, than by its appropriateness to the inhabitants of semi-arid areas (Warren and Agnew, 1988: 7).

They added that measurement of UNEP-identified parameters would be virtually impossible at local levels because of technical and resource challenges they would pose to provincial governments. Yet, despite their skepticism regarding past analyses of desertification, they stated emphatically that they did not deny the problem's existence, but simply called for improved evaluation techniques.

A couple of years later, as the World Bank was considering its funding priorities in regard to dryland management, Ridley Nelson, an environmental specialist and economist at the Bank, undertook an analysis of desertification and came to conclusions similar to those of Warren and Agnew (1988). According to Nelson, several aspects of

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[130] The authors cited similar problems regarding erosion maps by the United States Soil Conservation Service and surveys of land degradation in Australia.

desertification had been exaggerated. These included the certainty with which the extent and solutions to desertification were known; the degree of consensus among scientists and practitioners regarding the extent, causes and solutions of desertification; and the total area of irreversibly desertified land. As an example, Nelson pointed to UNEP's claim that the number of people who inhabited lands undergoing desertification increased by 35% between 1977 and 1984. To a general reader, this statement might indicate that the number of people affected by desertification increased by 35% between 1977 and 1988. Yet, a lot of this change was due to a change in the study sample. UNEP added a large portion of sub-humid areas to its analysis in 1984, thereby increasing estimates of the affected population. While the original UNEP report mentioned the inclusion of subhumid regions as a reason for the large increase in the population figure, reproduction of the study's statistical findings in other publications did not always include this important qualification (e.g., UNEP/DCPAC, 1987: 6).

Nelson identified UNEP's 1984 questionnaire study as the source of several inaccurate and misleading statistics. He further criticized the assessment's ambiguous criteria, invisible methodologies, and failure to consider how severe African drought during the period of the study might have affected its results. However, in a somewhat more understanding tone, Nelson acknowledged the highly political context from which such estimates emerge.

> The point is not to be critical of the questionnaire or the study: given the lack of measurements in the field and the public and political demands for some quantification what else can be done? The point is to emphasize that the results, which are by far the most widely quoted evidence on the extent of desertification, have an extraordinarily shaky basis and have clearly been enormously influenced in Africa, by being completed after a long and exceptionally dry period (Nelson, 1990: 5).

Like Warren and Agnew (1988a, 1988b) Nelson believed that desertification, was, indeed, a serious problem and he recommended a number of strategies for improving efforts to characterize and ameliorate it. His suggestions called for more measurement of desertification's extent and enhanced analysis of its causes, the design of appropriate technologies, greater participation by local populations, and legislation aimed at improved land management.

Nelson recommended better quantification and mapping supported by remote sensing studies and standardized monitoring systems such as rangeland monitoring systems based on Advanced Very High Resolution Radiometry or systems developed by the International Livestock Center for Africa. In a similar vein to Warren and Agnew, however, Nelson noted that "the need is not simply for better quantification of the aggregate seriousness of desertification, it is for better mapping to show the location" (Nelson, 1990: 20). Nelson further emphasized the complexity and local variability of desertification as proof that "there are no global or regional technical solutions" (Nelson, 1990: 22). In light of the local and complex nature of the problem, Nelson suggested ordinary photography as a lower-cost means for documenting local changes. He also recommended greater reliance on biological and social historical analysis to aid understanding of local conditions and their change over time. Overall, Nelson encouraged the use of qualitative, as well as quantitative methods in identifying and understanding desertification phenomena.

Criticism regarding the 1984 assessment damaged UNEP's credibility on the desertification issue. Even more recent authors (e.g., Thomas and Middleton, 1994; Swift, 1996) continue to point to the study as an example of bad science and inaccurate reporting of results. The episode raises a number of questions: why did UNEP make the decisions it did? What made the agency's work so open to deconstruction? And, what implications did the assessment and its aftermath have to desertification science and policymaking in general? While there are no simple answers to the first question, Ridley Nelson, in noting the "public and political demands" (Nelson, 1990: 5) on UNEP highlights an important point. The UN system and others interested in the desertification issue probably had expectations regarding the way in which UNEP would evaluate progress in the PACD's implementation. Ultimately, however, such expectations derived largely from the way in which UNEP had framed the issue and the agency's role in the first place. UNEP defined desertification as a scientific and quantifiable issue. The agency also suggested that progress in implementing the PACD should and could be measured via objective methodologies and expressed in quantitative terms. Within this framework, people inside and outside of UNEP (e.g., Rozanov) expected a certain type of analysis based on quantifiable criteria and scientific modes of inquiry. If desertification had been framed differently, a questionnaire and a qualitative interpretation of its results might have been much more acceptable.

UNEP's statistics came under attack largely because they implied a sound scientific methodology and circulated widely. When available technologies and resources made it difficult for UNEP to realize its goals for a scientifically credible and quantitative assessment, the agency relied on methodologies that many scientists found questionable. Nevertheless, UNEP persisted in presenting its findings quantitatively and in a way that implied they were precise and accurate. These results, though eventually questioned, were highly portable and initially appeared in UN documents, scientific articles and in the popular press.

4.4.4 *UNEP's Response*

In UNEP's next large-scale assessment in 1991, the agency continued to emphasize quantitative analysis as a key assessment practice. However, the ways in which the agency carried out the study and presented results marked a significant change from its methods in 1984. The new analysis introduced a revised definition of the desertification problem, employed datasets that proved credible to scientists and policymakers[131] and afforded greater attention to socio-economic aspects of desertification.

In December 1989, General Assembly Resolution 44/172 requested UNEP's Governing Council to evaluate progress in implementing the *Plan of Action.* This assessment was intended to contribute to discussions regarding desertification at the United Nations Conference on Environment and Development. Preparatory studies and consultations were conducted in the next year (e.g., Odingo, 1990; Ad Hoc Consultative

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131 *Agenda 21*, Chapter 12, for example, quoted several statistics from UNEP's (1991) assessment. "Desertification is land degradation in arid, semi-arid and dry sub-humid areas resulting from various factors, including climatic variations and human activities. Desertification affects about one sixth of the world's population, 70/per/cent of all drylands, amounting to 3.6/billion hectares, and one quarter of the total land area of the world. The most obvious impact of desertification, in addition to widespread poverty, is the degradation of 3.3/billion hectares of the total area of rangeland, constituting 73/per/cent of the rangeland with a low potential for human and animal carrying capacity; decline in soil fertility and soil structure on about 47/per/cent of the dryland areas constituting marginal rainfed cropland; and the degradation of irrigated cropland, amounting to 30/per/cent of the dryland areas with a high population density and agricultural potential" (UNCED, *Agenda 21*, paragraph 12.2 – Econet version).

Meeting in 1990), followed by a final assessment published in 1991: *Status of Desertification and Implementation of the United Nations Plan of Action to Combat Desertification.* Presenting a global picture of desertification remained a priority for UNEP (e.g., see Odingo, 1990: 3), as did the use of quantitative statistics to relay the extent of desertification. The title of Chapter 1, "World Status of Desertification" was similar to aggregate, quantitative analysis of 1984. As in previous years, UNEP presented estimates of arid land area in various regions, as well as estimates of degraded land classified according to severity of degradation, land use category, and region. Its Executive Summary provided a familiar list of global statistics noting that desertification manifests itself through degradation in 73 percent of all rangelands in dryland areas, loss of soil fertility in 47 percent of all drylands used for rainfed cropping, and 30 percent of all irrigated croplands located in dryland regions.[132]

However, the 1991 assessment also differed from previous assessments in several respects. Expert consultations had resulted in a new definition of desertification. While UNEP continued to identify human land use as the primary cause of desertification, they equated desertification with land degradation. Degradation was said to imply:

> ... reduction of resource potential by one or a combination of processes acting on the land. These processes include water erosion, wind erosion and sedimentation by those agents, long term reduction in the amount or diversity of natural vegetation, where relevant, and salinization and sodication (UNEP, 1991: 1).

Based on this new definition and climate datasets (for years 1951-1980), provided by the University of East Anglia, UNEP's GEMS/GRID Programme Activity Center created a new world map of drylands. For this purpose, Mike Hulme of the University of East Anglia developed a revised scheme for aridity classifications. Instead of the Penman formula applied in the 1977 *World Map*, Hulme used Thornthwaite's method, but applied an empirical adjustment factor to address the lack of uniform climatological data for the

[132] In regard to financing for the *Plan*, UNEP presented several estimates of desertification costs according to land use and regional categories. Figures covered cost of damage, as well as costs of prevention, correction and rehabilitation.

period 1951-1980 (Interview with UNEP Advisor 3; UNEP, 1990). New definitions and formulas precluded estimates of global trends in desertification and aridity over time.

UNEP used two new global datasets in its analysis. The first showed various forms of land degradation in drylands produced by the International Center for Arid and Semi-Arid Land Studies of Texas Tech University. The second dataset provided information on soil degradation in drylands, based on the World Map of the Status of Human Induced Soil Degradation (Global Assessment of Soil Degradation, or GLASOD), prepared by the International Soil Reference and Information center (ISRIC) and UNEP in 1990. During expert consultations, debate ensued over whether the assessment report should include the figure for rangeland degradation (2,576 million hectares) as part of the total area of degraded drylands. Most scientists in the group argued that this form of rangeland degradation should not be included in the total figure because rangeland degradation was often a short-term phenomenon, while soil degradation was often of longer duration and of greater importance. Head officials at UNEP, however, argued strongly that the rangeland vegetation figures be included (Interview with UNEP Advisor 3). The final report included figures for rangeland degradation totaling 50% of the total degraded land, presumably because these figures increased the estimated extent of desertification worldwide.

In evaluating the global status of desertification, UNEP included a largely qualitative account of desertification's socio-economic aspects. In contrast to previous analyses and policy statements regarding desertification, the UNEP study remarked on the complexity of desertification processes at various levels.

> Recent developments have further underlined the fact that desertification results from complex interactions among physical, chemical, biological, socio-economic and political problems, local, national and global in nature (UNEP, 1991: 12).

Consequently, the study provided a summary account of problems associated with migration patterns, population growth, demands for production, and agricultural expansions. The assessment further noted economic aspects of desertification, specifically citing economic and development policies, trade barriers, poverty, and lack of credit available to women in rural areas (UNEP, 1991).

4.5 Quantification and the *Convention to Combat Desertification*

The process that gave rise to the *Convention to Combat Desertification* reflected a markedly different approach to quantification than seen in earlier eras. UNEP, which had served as the primary generator of desertification statistics throughout the 1970s and 1980s, no longer had a mandate to lead on the issue. In addition, Elisabeth Dowdeswell replaced Mostafa Tolba as UNEP's Executive Director and Dowdeswell appeared to be steering the agency away from additional commitments to large-scale treaty regimes. Consequently, UNEP took a back seat to the Intergovernmental Negotiating Committee and the Desertification Secretariat. In this new institutional context, the use of global estimates to characterize desertification decreased considerably. While participants in the negotiation process continued to emphasize the need for desertification monitoring at various scales and standardization of observation criteria, methodologies and indicators prescribed for desertification assessment called for local participation and greater attention to complex social processes.

The Desertification Secretariat probably makes the most use of statistics in the new regime. Public relations literature out of the Desertification Secretariat expressed the global extent of desertification in quantitative terms. The most widely-cited statistic referenced the estimated 250 million people affected by desertification, rather than its physical extent. However, various "Fact Sheets," intended to explain desertification to a general audience, quoted the figures presented in UNEP's 1991 study and quoted in *Agenda 21*, Chapter 12. Examples include the following:

> Over 250 million people are directly affected by desertification, and some one thousand million (or one billion) are at risk (CCD, 1995a)
>
> Seventy percent of the world's drylands (excluding hyper-arid deserts), or some 3,600 million hectares, are degraded. While drought is often associated with land degradation, it is a natural phenomenon that occurs when rainfall is significantly below normal recorded levels for a long time (CCD, 1995b).

> At the global level, it is estimated that the annual income foregone in the areas immediately affected by desertification amounts to approximately US$ 42 billion each year (CCD, 1995c).

Similarly, the *Convention*'s Web Page notes:

> The UN also estimates that some 70 per cent of the 5.2 billion hectares of drylands used for agriculture around the world are already degraded. Urgent action is needed, particularly in Africa. However, desertification is not just a problem for developing countries: the continent with the highest proportion of severely or moderately desertified drylands is North America. Five European countries also suffer from it, as do several members of the former Soviet Union.

Hence, numbers continue to serve as a powerful means of communication, offering a shorthand to those charged with portraying serious problems associated with desertification to the public at large. However, the numbers quoted are already nearly ten years old and the fate of such statistics remains to be seen. As discussed below, the *Convention* itself and ongoing work under the COP have focused little (if any) attention on developing quantitative measures of desertification.

Unlike previous policy agreements or statements, the *Convention* did not quote global statistics regarding desertification. Just a couple of years before, *Agenda 21*, Chapter 12 recited a litany of statistics expressing the quantified status of desertification. In contrast, the *Convention* expressed the global extent of desertification in qualitative terms. The treaty's Preamble noted:

> … arid, semi-arid and dry sub-humid areas together account for a significant proportion of the Earth's land area and are the habitat and source of livelihood for a large segment of its population (CCD, 1994: Preamble: 4).

This change signaled a movement away from quantitative, scientific analysis as the primary tool for interpreting and addressing the desertification problem. It further suggested that numerical characterizations of degradation phenomena did not adequately reflect the complexity of desertification or the emergent view of desertification as a process rather than a physical manifestation.

The objectives of desertification assessment activities and the role of quantification therein changed as well. Unlike UNEP's focus on measuring the status and rate of desertification, the *Convention* prescribed a compilation of data aimed at understanding not only the effects of desertification, but desertification processes as well. The treaty called for

> collection, analysis and exchange of relevant short term and long term data and information to ensure systematic observation of land degradation in affected areas and to understand better and assess the processes and effects of drought and desertification (CCD, 1994: Article 16: 17).

The agreement also recommended the use of compatible standards and systems, as well as physical, biological, social and economic indicators. However, it urged that collection and use of information address the needs of local communities and decisionmakers, "with a view to resolving specific problems." The treaty also stipulated that local communities be involved in collection, analysis and exchange of data. Hence, the *Convention* negotiators seemed to heed the pleas of people such as Andrew Warren and Clive Agnew who in the 1980s called for less attention to global measurements and more attention to assessment activities of direct benefit and relevance to local populations.

Reasons for this shift away from quantitative measures are numerous. Clearly a change in institutional leadership and context played an important role. As noted in Chapter 4, the Desertification Secretariat and the Intergovernmental Committee on Desertification essentially replaced UNEP and embraced a holistic vision of desertification as a complex social and ecological processes. In addition, new perceptions of "expertise" suggested that non-scientists and qualitative methods of social science could make important contributions to anti-desertification efforts. These changing attitudes were evident during the negotiation process. During the Information Sharing Segment, for example, there was relatively little focus on the status and rate of desertification. The agenda for this session included seven topic headings as listed in Chapter 3. Only one of these topics referenced the physical dimensions of desertification: "The causes, general extent and physical consequences of land degradation in arid, semi-arid, and dry sub-humid regions." Papers presented on this theme contained very few references to quantitative measures (e.g., Sombroed and Hadji, 1993; Eigen and Alabaster, 1993). Professor Imevbore an ecologist from Obaferni Awolowo University in Nigeria, and member of the International Panel of Experts, discussed the ways in which desertification affects the conservation and utilization of biodiversity. His paper was one of the most quantitative. He quoted estimates of global degradation rates, affected populations, and quantified the role of various causal mechanisms in contributing to desertification. However, his quantitative estimates of desertification constituted the exception, rather than the rule (Imevbore, 1993).

It is clear from ongoing work in the Conference of Parties that the present generation of desertification policymakers has a new approach to processes of monitoring and assessment. Recent efforts to define new desertification indicators provide the most vivid examples of this transformation. The Committee on Science and Technology is devising a methodology for developing and utilizing standardized desertification indicators. While participants in the process, in accordance with the treaty, aim to develop a standardized and systematic assessment method, many of the indicators they recently identified were dramatically different from the focus on status and rate found in the UNEP studies. As of the last Conference of Parties meeting in Fall 1998, an ad hoc expert panel suggested that assessment methods include indicators which reflect economic and social benefits to affected populations where desertification and drought were successfully addressed gender issues; impacts of future environmental and natural changes (e.g, drought early warning); and capacity building. The only social indicator common to both the UNEP and CCD processes was cost. The ad hoc panel recommended indicators to provide information on the costs associated with desertification and the effects of drought (ICCD/COP(2)/CST/3/Add.1).

It is too early in the *Convention*'s implementation process to get a full picture of what role, if any, quantification will play. Activities to date suggest that global desertification statistics continue to appear in general publications about the issue. They appear as easily portable mainstays of desertification rhetoric and evoke dramatic global images of desertification and its relevance to affected populations. However, processes currently underway within the desertification regime do not aim at producing quantitative measurements of desertification. Unlike, Mostafa Tolba who called for standardized measures to gauge desertification, the CCD focuses on understanding processes involving many complex factors not amenable to simple numeric representations. It is unclear how fruitful recent efforts under the treaty will be. Nevertheless, a new approach to indicators will potentially symbolize and facilitate different ways of comprehending and addressing desertification-related problems.

4.6 Problem Framing, Participation and Policymaking

The desertification story offers new insights into quantification and international environmental policymaking. Various forms of quantification, for example, were instrumental in authorizing particular interpreters and interpretations of desertification, framing the issue in a way that conformed to the resources and interests of dominant institutions, and defining desertification as an inherently local or global process. Statistics about the extent, effects and rate of desertification were essential to desertification's framing as a universal phenomenon, knowable through science, and deserving of attention from international institutions. Quantitative methods have played an important role in helping to simplify desertification and represent it as something amenable to management activities coordinated by an international agency. Numbers have also provided an international language for communicating dramatic evidence regarding the magnitude of desertification worldwide. Yet, in addition to "building up" the desertification issue, quantitative methods and numerical evidence also provoked much disbelief and controversy because of questionable methodologies, lack of transparency, and concerns regarding the usefulness of global measures. In contrast to American regulators who have opted for more quantitative analysis in the face of controversy and skepticism regarding carcinogenic risk analysis, participants in the desertification regime turned away from mathematical analysis and from easily quantifiable indicators of desertification when critics found them to be lacking. In the desertification case, quantification served as an instrument of problem framing and institution building, as well as a catalyst for institutional and policy change.

Understandings of land degradation as a local phenomenon in colonial Africa coincided with limited interest in quantitative, standardized means of characterizing land and vegetation changes. France and Britain preferred autonomous rather than bilateral schemes for natural resource management. These governments authorized the views of local officials trained in botany, forestry and geography to interpret and respond to evidence of land degradation. The use of relative (e.g., descriptions of groundwater levels as "high" or "low"), rather than quantitative, standardized means for characterizing land changes was important in boundary work carried out by the Anglo-French Forestry Commission. By employing non-quantitative methods for assessing Stebbing's claims, the Commission portrayed climatic and terrestrial changes (or lack thereof) as inherently local, rather than transnational. The Commission thereby inscribed the priorities and institutional features of the colonial administrations into its interpretation of the West African landscape. In de-emphasizing quantitative methods that might highlight similarities in the Nigerian and French Niger environments, the Commission members reinforced the authority of local officials, local natural resource departments, and the colonial administrations to which they belonged.

During the modernist era, efforts to quantify and standardize aridity helped to portray desertification as a uniform phenomenon, arising from physical processes and global in its extent. This view of desertification and of aridity in general coincided with the authority of natural scientists and international institutions. Natural scientists universalized the meaning of drylands using quantitative measures of rainfall and temperature. They extended desertification beyond the borders and particular environmental conditions of West Africa. They sought to develop general truths and classification schemes for land change under arid conditions, and numbers were an important part of these endeavors. Whereas colonial foresters defined land degradation as a local problem, scientists in the 1950s, 60s, and 70s carried out a different type of boundary work. Their calculations and maps redefined land degradation as a global process. Institutional organizations and scientists inscribed in their framings of desertification the belief that the issue warranted international cooperation. In doing so, they reinforced the legitimacy of international organizations as leaders in addressing land degradation. Also inherent in these quantitative, global visions of desertification was the notion that science and technology should form the core of desertification assessment and policymaking. UNEP's authority, its reliance on statistics and its centralized, uniform approach to desertification during the 1970s further exemplified the importance of quantification during this period. Quantification was important to UNEP's simplified vision of desertification. This vision emphasized desertification's global extent, its physical manifestations, and a singular set of causes and remedies.

During the 1980s numbers continued to be important in portraying desertification as a universal phenomenon. Quantification, however, also became a target of criticism and a tool for measuring the effectiveness of international desertification policy. In the 1970s statistics reinforced the authority of UNEP. In the 1980s these statistics threatened to undermine (in a sense to de-authorize) the agency. Observers began to point out, not only the questionable scientific basis of UNEP's 1984 report, but also the facets of desertification obscured or left out of conventional calculations. Warren and Agnew (1988) and Nelson (1990), for example, noted the need for attention to local variability and affected populations, not captured by global statistics and world maps. The boundary work that, in earlier decades, demarcated desertification as global, was now in question. Individuals outside of UNEP emphasized local variability in contrast to global uniformity. The utility of natural science and international institutions were similarly uncertain as the only signs of success in addressing desertification appeared in conjunction with local initiatives spearheaded by non-governmental organizations. As reliance on global statistics weakened, a clear authority and course of action were no longer inscribed in a widely-held vision of desertification.

During the 1990s, a decreasing emphasis on quantitative measures of desertification has accompanied the rise of new authorities in the desertification regime. While the Conference of Parties constitutes the main international body in charge of desertification policy, efforts are much more decentralized than in past years and non-governmental organizations and local people are regarded as key to solving problems of land degradation. A de-emphasis on standardized measures and uniform classification schemes supports the view that desertification is locally contingent and the result of numerous physical, social, economic, and ecological interactions. The CCD process did not involve boundary work to demarcate desertification as either fundamentally local or global. Regime participants address challenges of both local action and international coordination. Scientists and policymakers in the 1970s inscribed scientific and technological anti-desertification strategies in their quantitative characterizations of desertification. In contrast, the latest regime presents qualitative characterizations of the issue and promotes a bottom-up approach grounded in the notion that successful response to desertification ultimately depends on social dynamics. The transformation that occurred between the 1970s and 1990s suggests that quantitative analyses, depending on how they are conducted and used, may actually hinder efforts to focus on the locally contingent aspects of a problem, and the experiences of people living in affected locations.

In employing certain ways of counting, desertification institutions have authorized certain counters and not others. They also determined which people and phenomena get counted and which do not. During the 1970s and 80s UNEP relied heavily on quantitative techniques and looked to natural scientists for advice. Their work tended to emphasize the physical dimensions of the problem, largely overlooking social processes presumably at work. A widening of participation in the desertification arena has coincided with a decreased emphasis on numerical measures. This trend suggests that international policymaking for complex and regionally diverse issues such as desertification do not require quantitative analysis for purposes of trust or transparency. In fact, in some cases such analysis leaves some participants out of the debate and can undermine trust in institutions.

CHAPTER 5

Seeing is Believing: Visual Representations and the (Re) making of a Global Issue

Throughout the construction and reconstruction of international desertification policy, changes in the methods and nature of visual representations coincided with changing perceptions of whether desertification was a local or global problem, what features of desertification were important, and whose understanding of the issue was valid. While photography served a the preferred means for visualization among colonial researchers, increasing reliance on maps in the 1950s marked important changes in "visual culture" as expressed through dryland science. The immutability of a given representation and its mobility across linguistic, cultural and disciplinary boundaries meant that visual representations were accessible to diverse participants engaged in desertification science and international policymaking.[133] Visual images served as powerful framing objects. They reflected dominant perceptions of the issue while also helping to shape, legitimize and alter these perceptions. Photographs and varied types of climate and desertification maps over time embedded different worldviews, changing ideas about what it means to see and what there is to see (see Alpers, 1983; Latour, 1990). As an expression of "visual culture" (Latour, 1990), photographs and maps also reflected varying choices about whose vision mattered, what should be rendered visible and what should be made invisible. For example, while photographs made apparent the personal perspective of the individual research and the local people and environment, global maps in the 1970s erased a sense of the individual viewer and represented aggregate measures of aridity and population.

5.1 Analytical Framework

Themes of visibility, invisibility and mapping are evident in the evolution of cartography projections over the past several hundred years. Map projection methods used

[133] See Latour (1990) on "immutable mobiles."

throughout history reveal the power of the mapmakers in integrating their worldviews into the visual images they create. The most influential map projections emanated from Europe and reflected a European perspective. Many of these maps were designed in a way that aided the sailor in navigating ocean waters in the mid-latitudes. Moreover, the Mercator projections of 1569 magnified land areas in temperate zones, while minimizing the size of countries in the tropical regions. These projections emphasized the imperial world of Portugal and Spain and, unlike medieval Christian maps, did not center on Jerusalem. Europe appeared at the top and center of these maps, while the southern hemisphere was allotted less than half of the total map size. The popular Van der Grinten method of 1898 derived from the Mercator system. This projection style exaggerated the size of Greenland, Alaska, Canada and the USSR in global maps of the world. The National Geographical Society is credited with the wide use of these maps in the United States between 1922 and 1988, because National Geographic was a key distributor of educational materials in the United States. These maps were most notable for embedding a western perspective on the Cold War. In depicting a large, menacing USSR dwarfing Europe and Asia, they reflected western attitudes toward the USSR and suggested that fears of that country and the communist ideology were justified (Black, 1997).

Just as the Mercator projections reflected and influenced geopolitics throughout history, dryland maps shaped and were shaped by the evolving arena of international desertification policymaking. Hence, while maps served as instruments of inscription, they were also embodiments of inscription. Participants in science and policymaking activities employed the tools and products of visualization to emphasize the local or global nature of desertification, its natural and social dimensions, and varying perceptions of desertification processes. Maps also reflected the views of scientists and policymakers in regard to what knowledge and whose perspectives were authoritative, the utility of singular versus pluralistic interpretations of desertification, and the benefits of centralized or decentralized policy measures.

This chapter examines visual representations of desertification as indicators and agents of change. Changes in the nature, production and use of visual images provide insight into how and why transformations in international desertification policymaking took place. The discussion below traces visualization through all four eras of desertification policymaking. The analysis in each period focuses on three questions:[134] Whose vision did the image represent and who was the intended audience? What techniques of visualization did the image maker employ? And, what problem framings did the image embed? Answers to these questions are helpful in understanding how maps as both practices and artifacts of knowledge production contributed to processes of authorization, inscription and boundary work. In commissioning global climate maps, for example, governing bodies authorized certain visions and viewers of the desertification problem. In reflecting different categories of land use, maps served as a medium in which to inscribe causal narratives. Maps also provided a vehicle for persuading policymakers of a given causal interpretation. In regard to boundary work, visual representations served as means for both erecting and reflecting boundaries. In creating photographs and maps, participants in the desertification arena delineated what to render visible and what to make invisible. In doing so, they demarcated the realms of who should be included in knowledge production and policymaking processes and who should be excluded.

5.2 Envisioning an Empire

Visual representations featured fairly frequently in scientific publications concerned with the question of progressive desiccation (Hubert, 1920), a theory that Africa's climate was becoming increasingly drier (see Chapters 2 and 3). Early in the century researchers tended to believe that this phenomenon was largely natural, stemming from changes in the general circulation and leading to the drying of rivers, vegetation degradation and movement of desert sands outward from the desert center. In later years, many foresters and geographers believed that certain human activities such as nomadism and civil unrest exacerbated the effects of progressive desiccation. Regardless of its source, progressive desiccation and associated environmental changes potentially posed serious threats to African natural resources so valued by France and Britain. Colonial commissions, as well as independent scientists, traveled from Europe to Africa to study these phenomena. They also served as explorers, providing interpretations of the colonial frontier and its

[134] The discussion does not contain an exhaustive account of all maps that have featured in desertification's history. Rather, the analysis highlights maps which played notably strong or notably weak roles in policy formulation.

inhabitants. Both photographs and maps were widely used means for relaying information about African colonies. Photographs testified to the first-hand observations of researchers and colonial officers, thereby enhancing their credibility. Maps, on the other hand, erased the personal perspective evident in photographs. However, they provided a more effective means for showing spatial relationships between environmental phenomena and colonial jurisdictions. They also enabled researchers to schematically depict environmental changes over time.

The discussion below focuses on visual representations in studies by William MacDonald, E. P. Stebbing and members of the Anglo-French Forestry Commission (AFFC). Their work represented an increasing reliance on maps by participants in the progressive desiccation debate. These maps portrayed desertification as an African, rather than a global problem and showed the shared interest of researchers in ensuring that Britain could protect and profit from Africa's natural resources. The maps also reflected the various causal narratives and policy prescriptions supported by the researchers. The desert boundary, for example, represented a struggle between humans and nature, as well as the attitudes of some colonists toward indigenous Africans. The portrayal of an international border in maps by Stebbing and the AFFC, respectively, revealed their differing opinions about whether degradation warranted a transnational policy approach or independent policy initiatives on the part of French and British colonial administrations.

5.2.1 *Through the Eyes of Environmental Explorers*

Visionaries of land degradation during the colonial era included scientists and administrative officials working in Africa. Many were trained in fields such as botany, agriculture and forestry and applied their environmental expertise to ensuring the protection and profitability of Africa's natural resources. Some also served as explorers of sorts, studying uncharted territories and delineating lands ripe for settlement. William MacDonald, E. P. Stebbing, and members of the AFFC were scientists with experience in various colonial administrations. The writings of each of these individuals reveal their strong allegiance with colonial objectives aimed at imperial expansion and the construction of colonial Africa in Europe's image.

MacDonald was an avid proponent of colonial settlement of African drylands and an expert on dryland agriculture. He held a number of advanced degrees,[135] was Fellow of the Royal Society of Edinburgh and the Geological Society of London, editor of the *Agricultural Journal*, member of the Union Department of Agricultural South Africa, Secretary of the South African Dry-Farming Congress, and Corresponding Secretary for the International Dry-Farming Congress. Based on his extensive experience as an agriculturalist, MacDonald had a personal interest and faith in opportunities afforded by agricultural techniques and technologies.

MacDonald and others such as Bovill (1921) believed that the absence of human settlement near deserts invited the desert to "creep in and swallow" fertile oases (Bovill, 1921). In his book, *Conquest of the Desert*, MacDonald touted the merits of land settlement, "the most urgent question before the people of South Africa, as well as one of the grandest problems of the age" (MacDonald, 1913: viii). He appealed to "our own people – the British race -- to come to South Africa" (MacDonald, 1913: 196). MacDonald similarly promoted development of the "empty land."

> Whether we traverse the great karroo, the wind-swept plains of the Free State, the bush veld or the low country, it is all the same—we see a vast empty land, rich beyond the dreams of fancy, waiting only for the sturdy colonist to build his home, to subdue the earth, and to make the wilderness and the solitary place rejoice (MacDonald, 1913: 191).

He believed that man should exert his dominion over nature. More specifically, MacDonald believed that colonists should control the lands of their empire and reap the financial benefits of its natural resources. His view of the "Free State," not surprisingly, seemed unconcerned with the perspective of indigenous African peoples whose lands the Europeans were called to occupy. In addition to subduing the land, the colonists took credit for pacifying the "natives" (e.g., Jones, 1938).

Over twenty years after MacDonald's accounts, E. P. Stebbing suggested that desert encroachment was not simply a matter of a ruthless nature, but also a product of indigenous African agricultural practices. He differed from earlier authors like

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[135] His book, *The Conquest of the Desert,* lists MacDonald as holding a Master's of Science in Agriculture in addition to "Sc.D, Ph.D., D.Sc." degrees (MacDonald, 1913: title page).

MacDonald, in believing that shifting agricultural practices, on the part of native Africans, were contributing to progressive desiccation and to desert encroachment at the southern edge of the Sahara.

> Until comparatively recently the Sahara has been regarded as something beyond man's scope and power to deal with. The geologist, the geographer, and the historian all appear to have accepted the great desert as a component part of the globe, in existence for a very long time, its origin mainly due to unknown catyclysms and changing climate—in other words, a desert area for which Man could have had little or no responsibility (Stebbing, 1937b: 3).

Stebbing's interpretation provided even more reason for the introduction of European cultivation techniques. They were needed, not only to stem desert invasion, but also to stop widespread degradation caused by colonial subjects. Hence, Stebbing too, called for the colonists to take up arms against the desert invasion and hold back the forces of nature.

> The initial stage and chief damage is done by the method of farming and annual burning of the forests, and when the farming ceases and is replaced by stock the forest has still to supply the food, and has still to bear the brunt of the annual firing. If we reflect that this treatment has been going on unchecked down through the centuries can it be seriously contended that sections of country would not gradually go out of cultivation and gradually become desert (Stebbing, 1937b: 34).

Stebbing argued for the introduction of European farming methods in West Africa, as a means to simultaneously replace unsound cultivation activities of the native peoples and subdue nature by restoring its balance (see Chapter 3).

Brynmor Jones, F.S. Collier and J. Dundas were members of the Anglo-French Forestry Commission. Jones was the sole geologist appointed to the Commission in 1936. He began his response to Stebbing's desert encroachment and progressive desiccation findings with a brief discussion of Nigeria's importance as a profitable British colony. In particular, he mentioned the cash value of key crops grown in the region by way of justification for an investigation into Stebbing's claims. As discussed in Chapter 3, Jones (1938) possessed an impressive familiarity with both the environment of West

Africa and the local customs of its people. Collier and Dundas (1937) worked in Nigeria as Senior Assistant Conservators of Forests (see Chapter 3). In analyzing progressive desiccation they sought lessons for natural resource management. Based on their study they urged greater coordination among administrative departments.

5.2.2 *Colonial Techniques and Representations*

Between 1900 and 1940 many of the research studies of dryland environments did not contain many visual representations. In the articles and books that did include illustrations, photographs were the most common, with maps appearing with much less frequency. Because researchers often served as their own photographers, their pictures reflected their own personal perspectives much in the same way that their interpretations of the African environment reflected their personal allegiance to British objectives of colonial expansion. Some studies included simple maps showing areas open to settlement or the route taken by researchers. In debates over progressive desiccation and desert encroachment in the mid-1930s, however, maps also served to indicate the movement (or not) of the Sahara.

Africa in Pictures

Early research on dryland degradation tended to focus on Africa, especially the regions surrounding the Sahara and Kalahari deserts. Pictures often provided a sort of photo essay, documenting the researcher's journey through the African landscape. They often depicted various types of vegetation, soil conditions, desert landscapes, and vehicles and equipment used by researchers.[136] These photographs reflected several themes important to dryland environments and politics in the early part of the century. The photos and the first-person narratives that often accompanied them, for example, emphasized the individual scientific perspectives of individual researchers, as well as their support for colonial exploration and conquest.

The Geographical Journal, a publication of the Royal Geographical Society, was a primary forum for the desiccation and desert encroachment debates between 1900 and 1940. Advertisements for camping equipment and safari jackets occupied the opening

[136] MacDonald (1913) provides many examples.

pages of its issues. These ads, like the journal's articles and illustrations, reflected research methodologies of the journal's readers and contributing authors. Foresters and geographers who were not serving as colonial administrators on the continent carried out their studies while on brief visits. With detailed descriptions of their travels, the weather and individuals met along the way, these articles and books read more like the diaries of explorers than contemporary scientific papers. Accompanying illustrations were similarly personal in nature, with photographs of desert vistas, vegetation and "natives" outnumbering maps as the favored pictorial form. For example, the cover of MacDonald's, *The Conquest of the Desert* (1913) boasts "fifty illustrations." Yet only two of these pictures are maps, while the rest are photographs. Maps, if included in studies such as this, generally showed the route taken by the researcher or the jurisdictional boundaries of the empire. Maps in this context were seldom used to depict scientific observations.

As the travelogue nature of these pictures revealed, this knowledge was generally derived, not by the Africans themselves, or even long-term residents, but by short-term visitors to the continent. The "outsiders-looking-in" character to early studies of dryland degradation paralleled the continent's occupation by imperial powers. As discussed in Chapter 3, academic researchers and long-term residents of Africa disagreed as to which group generated the more accurate observations. Stebbing, being a visitor himself, believed that he possessed a truer and more insightful vision of Africa. Stebbing argued that deforestation was at least partly responsible for apparent depletion of water in Africa. In response to officers who did not agree with him Stebbing wrote the following:

> To the forester who has had the opportunity of studying this matter of the close inter-relation of the forest with agriculture and water supplies outside of Africa the apparent difficulty of some officers whose service has been confined to Africa to recognise this close relation is perhaps not a matter of surprise (Stebbing, 1937b: 32).

But, while Stebbing believed that colonial officers lacked the breadth of perspective to understand their local environments, critics of researchers like Stebbing argued that long-term residence in Africa was necessary in order to comprehend the variability in African climates and ecosystems. As noted in Chapter 3, scientists such as Jones (1938) and

Rodd (1938) believed that it was "dangerous for a visitor to come to definite conclusions unless he has spent more than one rainy season in the desert" (Rodd, 1938).[137]

With the credibility of the researcher hinging on the accuracy of his observations, photographs helped to buttress the researcher's credibility and document his first-hand observations. They served as a testament to his presence in the region under study.

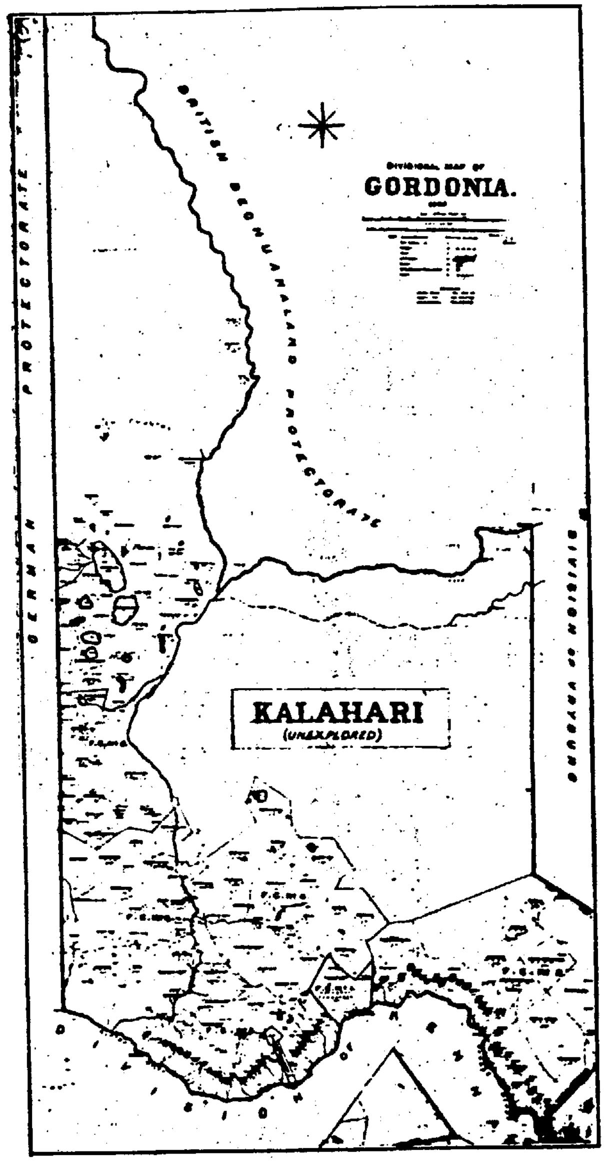
Mapping the African Frontier

Colonial researchers used maps to show their location or trace their journey. As in the case of Stebbing and the Anglo-French Forestry Commission, they occasionally employed maps to illustrate observed changes in the environment. Maps produced by Stebbing and the Commission played important roles in the desert encroachment debate.

In the 1910s and 1920s, other authors discussed the possibility of shifting desert regions, but did not use maps to illustrate movement of desert borders. In *Conquest of the Desert* (1913), one of MacDonald's two maps (see Figure 1) was titled "showing the steady advance of settlers on the desert" (MacDonald, 1913: 197). He labeled the map's center as the "unexplored Kalahari." In addition, he sought to illustrate not the spread of desert outward from the desert core, but rather the movement of settlers toward the desert center. Though the title of Bovill's 1921 article, the "Encroachment of the Sahara on the Sudan" was strikingly similar to Stebbing's, Bovill's piece contained no illustrations. The absence of illustrations in Bovill's article and similar studies of the time, suggested that visual representations and geographic measurements of the spreading desert phenomenon were not unnecessary for presenting a persuasive argument.

Twenty years later, however, maps figured prominently in some dryland debates. Perhaps the most powerful cartographic image of desertification during the colonial period was introduced by E. P. Stebbing in a 1935 article. In a presentation to the Royal

[137] Many years later, Michael Mortimore, and well-known geographer with a wealth of experience in Africa echoed the views of Stebbing's critics. According to Mortimore: "some influential contributions to the desertification debate...appear to be based on quite modest field research and limited exposure to African perceptions – including those prevailing in governmental structures or educational institutions within Africa (and which it is unwise to ignore or dismiss)" (Mortimore, 1989: 188).



SHOWING THE STEADY ADVANCE OF SETTLERS ON THE DESERT.

Figure 1: MacDonald (1913)

Geographical Society and the publication of this talk, Stebbing claimed that the Sahara desert was moving southward. The "invasion of sand" he described had potentially dire consequences. In 1937 he wrote:

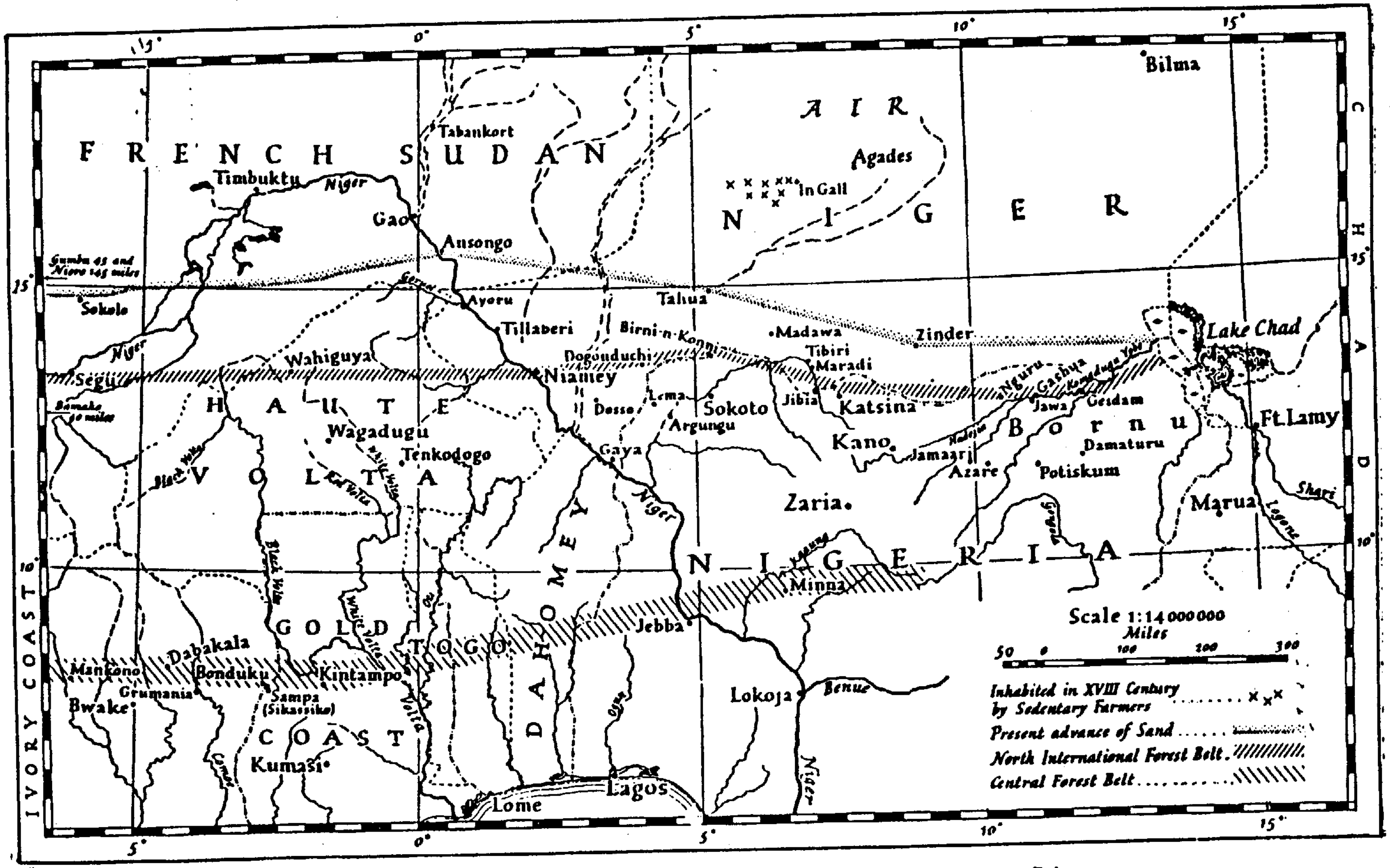
> The present-day results of investigations would appear to prove that the Sahara is far from stationary on its southern frontiers; that blown sand and desiccation are increasing in the colonies lying in juxtaposition to the desert, and that the present method of agricultural livelihood of the population living in these regions, with their unchecked action of firing the countryside annually, and methods of pasturage—all tend to assist sand penetration, drying up of water supplies, and desiccation (Stebbing, 1937b: 31).

Stebbing's 1935 article contained several photographs showing deciduous forests, savannah, and various types of vegetation.[138] The publication also contained three maps, one of which proved particularly evocative and influential (see Figure 2). Stebbing's maps marked a departure from the use of cartographic representations in previous dryland studies. In these maps Stebbing provided the first measurements of the so-called advancing Sahara. He also illustrated a forest belt scheme for halting the advance. Based on firsthand observations, and discussions with local inhabitants, Stebbing drew three types of boundaries on the map pictured in Figure 2: one line delineated what Stebbing believed to be the original desert boundary, another line indicated the desert boundary at the time of Stebbing's study and a third line represented a proposed forest-belt intended to contain the spreading desert.

This way of depicting the desert was significant, in part, because previous authors had described the spread of desert using words rather than cartography. By displaying his knowledge claims in a map format, Stebbing lent a new dimension desiccation and desert encroachment studies. At one level he provided a new scientific framework for analysis of the West African environment, by emphasizing the measure-ability and map-ability of desiccation and desert encroachment. At the same time, the controversies his maps provoked reflected disagreements about where the desert

[138] The 1935 article published in The Geographical Journal was based on a talk Stebbing delivered on March 4, 1935 at the Royal Geographical Society. He published the article in June of that year.

Figure 2: Desert Advance and Forest Belts (Stebbing, 1935)



Present Southward advance of the Sahara and suggested protection Forest Belts.

begins and where it ends, and revealed significant uncertainties surrounding the notion of spreading deserts. Stebbing's depiction of the moving desert border ultimately proved to be a tenacious symbol representing not only an ecological limit, but also relationships between the French and British, humans and nature, and Africans and colonists.

Stebbing's work put a scientific face on the claims of desiccation and desert encroachment that had preceded his 1935 paper. Stebbing's maps, for example, relayed his observations, but erased the individual viewer perspective so prominent in photographs. Instead of portraying the landscape as Stebbing saw it, the maps provided a plan view of the area in question. They depicted the Sahara region in a simplified, abstract format.

Members of the Anglo-French Forestry Commission published papers responding to Stebbing's claims. Collier and Dundas (1937) and Jones (1938) each included maps in their publications. They drew these maps based on first-hand observations, general knowledge of the region (since all were working there), and on discussions with local people they encountered on their travels. Collier and Dundas (Figure 3) showed the approximate northern limit of unirrigated cultivation and areas of extensive farming. Their map also indicated the location of different types of vegetation (e.g., woodlands, savannah) and the extent of sand dunes. Jones' map (Figure 4) depicted the route traveled by the Commission, and the approximate limit of live dunes. Both maps indicated the numerous towns and the international boundary separating British and French territories. However, Collier and Dundas more prominently indicated the international boundary separating the French Niger Colony from the British Nigerian colony.

5.2.3 *Holding Back the Desert: Mapping Causal Narratives and Policy Prescriptions*

The maps of MacDonald and those of Stebbing and the Commission reflect varying perceptions of human-environment relationships and varying attitudes of the colonists toward the colonized. MacDonald's answer to the advancing Kalahari focused on European settlements and permanent agriculture. Stebbing's policy prescriptions were represented in his illustration of a forest belt traversing French and British territories.

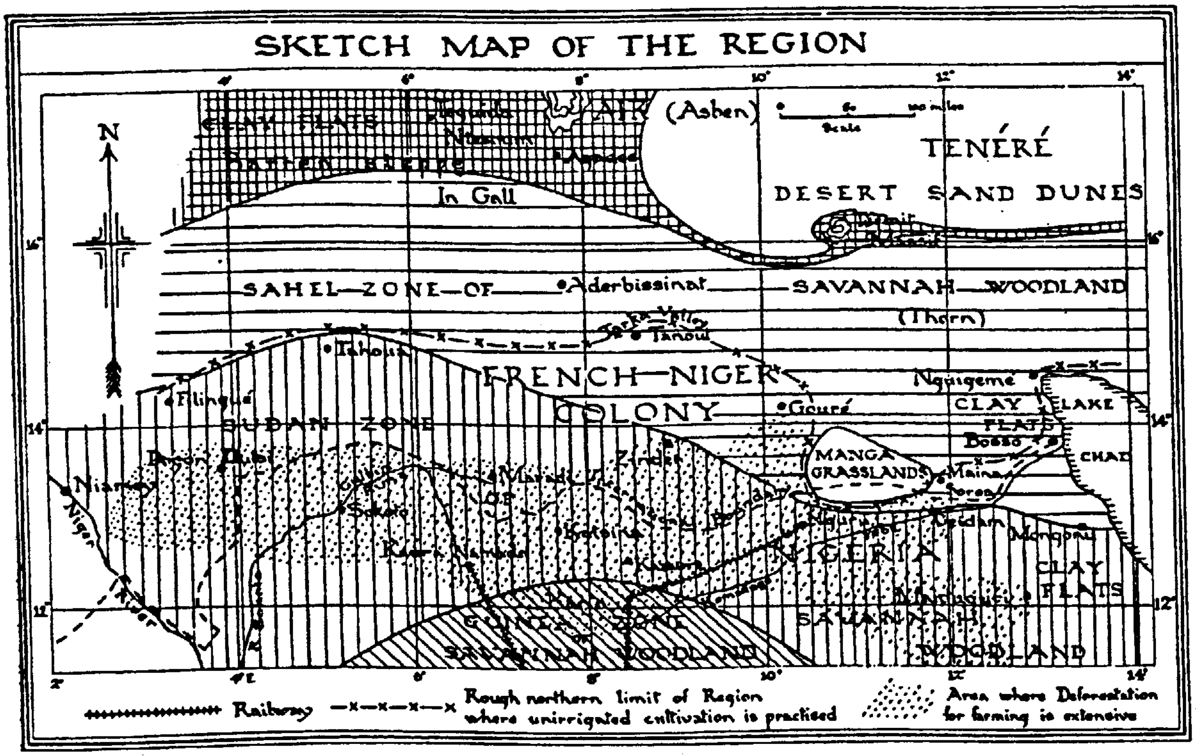
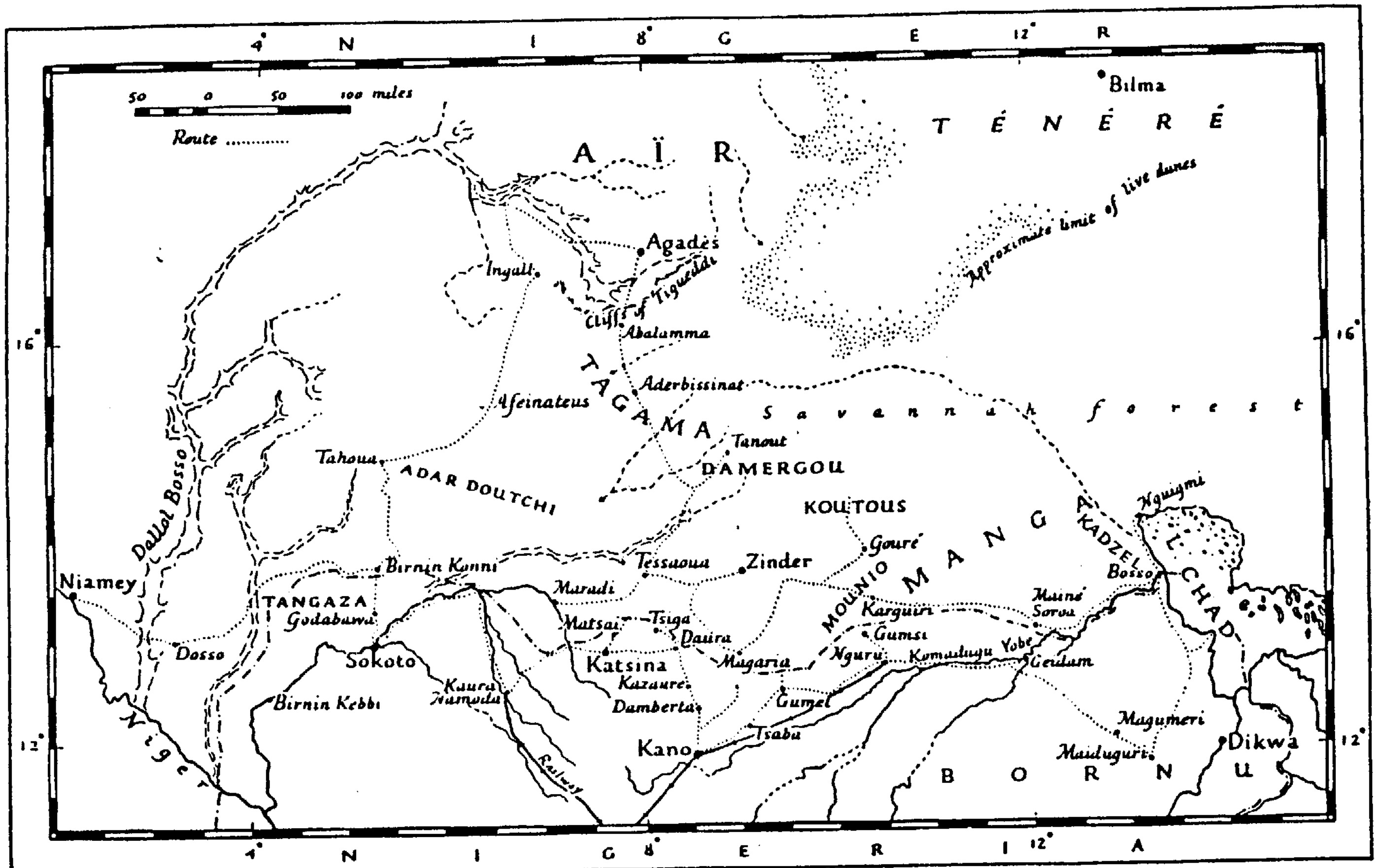


Figure 3: Collier and Dundas (1937)

Figure 4: The Commission's Route (Jones, 1938)



Nigeria and the French Niger Colony. The route shown is that followed by the Anglo-French Forestry Commission, 1936–37

The Desert Boundary

MacDonald portrayed the advancing desert as part of a hostile natural world in need of taming. Researchers such as MacDonald (1913) echoed the sentiments of colonial administrations by calling on the British to settle the African frontier and hold back the desert advance with agriculture and other forms of development. The desert, however, was not portrayed as a purely natural phenomenon. Many foresters and geographers equated desert expansion with the invasion of barbaric nomadic tribes who inhabited it. Still others saw certain African forms of agriculture as contributing to desert encroachment. Shifting cultivators, in particular, were blamed for deforesting the land and promoting the spread of desert conditions.

Humans versus Nature

Stebbing believed that a sort of bi-lateral policy was necessary to "stem the invasion" and proposed and mapped an international forest belt to contain the advancing front of desert. Although Stebbing believed that shifting cultivators contributed to desiccation and desert encroachment, his transnational forest belt scheme seemed most directly in response to a naturally spreading Sahara. In this respect, Stebbing's forest belt scheme and his cartographic depiction of it was reminiscent of MacDonald's human-versus-nature view of the African environment.

In his map, MacDonald depicted agricultural settlement as a means to contain and "shrink" deserts." MacDonald argued that challenges of African farming would be no greater than those facing settlers when they first arrived in America. In response to skeptics suggesting that South Africa was not ready for settlement, MacDonald expressed a technological optimism. "Every farmer knows that the maladies that attack his crops and his herds can best be checked and conquered by the wire fence, the Closer Settlement, cleansing dip, and the poison spray (MacDonald, 1913: 196). MacDonald's suggestions also highlighted the great importance scientists and resource managers placed on European methods of agriculture. They believed that the "European Model" of permanent agriculture offered the best promise for settling Africa (e.g., Collier and Dundas, 1937; Jones, 1938).

MacDonald also believed that drought was most prevalent in the sparsely populated wilderness. "Plant more people on your desolate lands, and then you will cease to fear drought" (MacDonald, 1913: 5). He paraphrased the speech by an Australian premier speaking in London in saying "Population was merely another term for Patriotism, meaning thereby that everyone who had the highest interests of the Commonwealth at heart must labour earnestly and ceaselessly to fill up her empty spaces with a sturdy race of British emigrants. The same might be said with equal truth of South Africa" (MacDonald, 1913: 6). MacDonald equated conservation with cultivation because he believed that ploughing and planting would cause the soil to retain moisture. He also called for afforestation to contain moving sand dunes (MacDonald, 1913: 6-7).

Colonists versus Africans

Unlike Stebbing, the Commissioners pointed to shifting cultivation as the only source of degradation threatening Africa. Their maps showed live dunes located at a much more northern location than suggested by Stebbing's maps. But while the Commission did not see a need to subdue nature, it did advocate control of the African people. Collier and Dundas' (1937) map, for example, indicated an "area where Deforestation for farming is extensive." This equating of Africans with environmental degradation was a common theme. Scientific and government departments were concerned with such issues, even managing to agree at times. As Bovill described in 1921, "The Forestry Department are keenly alive to the desiccation of the Sokoto region, and in agreement with the Political Department are strongly of opinion that the greatest harm is done by the wasteful way the farmers take up new lands" (Bovill, 1921: 259).

A French government report of 1904, described tensions between "pillaging nomads" and sedentary agriculturists. It claimed that agriculturists were refusing to plant in and invest in their resources until the government could provide security against the nomadic vandals.

> ...man himself is a contributory factor of some importance. The encroachment of the desert on its oases is largely due to the constant strife between the tribes and factions of these inhospitable regions. General insecurity has led to the reduction of the agricultural communities with the

> result that in the cultivated areas there has been less and less opposition to the desert which has crept in and all but won the day (Bovill, 1921: 268).

Bovill also describes how when Italy entered World War I and withdrew from Fezzan, it:

> threw the country open to hordes of desert tribes who live largely by brigand and loot. Equally lacking in all sense of honour and courage, they prey upon the broken, spiritless, agricultural communities of the oases. When disappointed of their booty they resort to wanton destruction of wells, palm groves, and carefully irrigated gardens. The reduction of the cultivable areas has been enormously increased by these nomads (Bovill, 1921: 176).

This problem prompted more calls for international (or at least bi-lateral) governmental responses. For example, Bovill called for a "strong central authority…capable of reducing the nomads to submission" (Bovill, 1921: 176-7). He noted that the French considerably "arrested" desert encroachment by "enforcing tranquillity on the nomads" leading to adoption of a sedentary life and political security. He said that reclamation of deserts indicates the success of these measures.

Fifteen years later, researchers were still debating the utility of transnational policy approaches to degradation. Differences of opinion were evident in the maps of Stebbing and Commission members. Stebbing's map, for example, labeled regions of the French Niger and Nigeria. However, his tran-colony lines indicating an advancing desert and proposed forest belt scheme were much more prominent than the line depicting the international boundary. In contrast, maps in both the AFFC studies showed no evidence on a transnational advancing desert front. Furthermore, lines showing the French-British border reflected the Commission's consensus that policies implemented by the colonial administrations should respect this border.

5.2.4 *Inklings of a Global Problem*

Before World War II, many of the maps and studies concerning progressive desiccation and desert encroachment focused on French and British African colonies and the prospect of exportation of natural resources. Colonial administrations had a stake in the problem, and the African environment offered an interesting site for scientific explorations on the part of French and British foresters and geographers

In the 1930s, however, scientists began to connect dryland degradation in Africa to similar problems elsewhere in the world. Lowdermilk (1935), for example, described human-induced soil erosion in China and associated problems of increased runoff. In 1939, Jacks and Whyte's *The Rape of the Earth: World Survey of Soil Erosion*, helped mark the beginning of a more international focus on land degradation. This new perspective linked African desiccation with the American Dust Bowl and with similar problems throughout China, Russia and Australia. Jacks and Whyte identified Africa as a particularly challenging area because of the numerous political jurisdictions, challenges of coordination and the "difficulty of countering native customs or prejudices" (Stamp, 1940: 300). But the Jacks and Whyte study encouraged colonial foresters to begin thinking more broadly about challenges of the African landscape. As Stamp remarked in 1940:

> There now seems little doubt that the problem before West Africa is not the special one of Saharan encroachment but the universal one of man-induced soil erosion, which necessitates remedial measures comparable with those being adopted in other parts of the world but with special modifications in view of the local agricultural system of bush fallowing and burning" (Stamp, 1940: 300).

Stamp alluded to a global perception of dryland degradation and to some degree of standardization in means for addressing it. As discussed in the next section, views like these became increasingly prominent in the 1950s and beyond.

5.3 World Maps and International Policy

During the 1950s and 1960s problems of dryland degradation increasingly occupied the agendas of international institutions. Maps of the world's dry climates helped to portray aridity as a global phenomenon. When a severe drought and famine crisis struck West Africa between 1968 and 1974, the world's attention focused on the environmental degradation and human suffering that ensued. African countries urged the United Nations to take on the problems of drought. They also noted drought-related problems, such as advancing deserts and a process called desertification. The exact relationship between spreading deserts and desertification was unclear. Some of the UN's initial decisions on these issues focused on drought and equated desertification with advancing deserts. However, by the time of the United Nations Conference on Desertification in 1977, desertification had replaced drought as a focus of UN activities. Furthermore, the Conference defined desertification not as advancing deserts in Africa, but as a worldwide phenomenon leading to the creation of desert-like conditions.

The present section considers the role of maps in desertification's emergence as an international issue. In particular, how and why were original concerns regarding African drought transformed into multi-lateral cooperation on desertification? Although the reasons for this development were varied and complex, they partly depended on the role of maps in desertification science and policymaking. As maps became increasingly global in their orientation they helped to legitimate desertification as a problem impinging on many different countries. Shifts from advancing desert portrayals to maps based on global datasets of climate, land characteristics and human and animal populations similarly helped to frame desertification as a human-induced problem of worldwide extent, arising from land use.

To illustrate these changes the discussion below highlights two mapping exercises in the 1970s. The first of these exercises reflects the United Nations Environment Programme's (UNEP's) early view of desertification as an advancing desert phenomenon. In 1975, the agency hired Hugh Lamprey to investigate reports of Sahara encroachment. Based on reconnaissance flights over West Africa, Lamprey whole-heartedly endorsed these reports. The second set of mapping endeavors concerns maps prepared for the United Nations Conference on Desertification (UNCOD) of 1977. These maps, drawing on the work of the United Nations Educational Cultural and Scientific Organization (UNESCO) in the 1950s and 1960s, portrayed desertification as a worldwide, anthropogenic phenomenon. Comparison of these two mapping initiatives provides insight into UNEP's changing vision of desertification and the role of cartography in both legitimizing and communicating this vision.

5.3.1 *Agencies and Individuals*

During the 1970s, UNEP was the primary UN agency involved with desertification mapping. The agency conducted some of its early studies in conjunction with national initiatives underway in Africa and Sweden (e.g. Lamprey, 1975; Rapp et al., 1976). In 1975, UNEP sent a consultant, Hugh Lamprey, to assist with desert encroachment research in the northern Sudan. Lamprey confirmed reports of an advancing Sahara, but UNEP left his study unpublished. His image of the advancing desert was at odds with the assessment work UNEP was conducting in preparation for a new United Nations (UN) Conference on Desertification. The picture of dryland degradation emanating from UNEP and other international organizations was not confined to Africa or to deserts. Nor were they the product of individual mapmakers. As UNEP's line of vision broadened from West Africa to encompass the entire world, the visionaries themselves changed from individual mapmakers to international organizations.

Lamprey in the Northern Sudan

The UN's interest in desertification grew out of concern for the major drought crisis in West Africa and associated problems of spreading deserts. In August 1971, the first All-African Seminar on the Human Environment convened under ECA auspices. Much of the discussion concerned the drought and the difficulties of getting financial support to address it. However, in addition to resolutions on drought, the seminar recommended measures intended to "combat the spread of deserts in Africa" (UNCOD, 1978: 6). This caught the attention of the ECA Conference of Ministers who noted the problems of desertification in resolution 264 (XII) and urged that the ECA collaborate with the international community in seeking solutions. On May 1, 1974 UNGA issued resolution 3202 (S-VI) recommending that the international community "undertake concrete and speedy measures to arrest desertification and assist the economic development of affected areas." The Economic and Social Council resolution 1878 (LVII) of July 16, 1974 asked that relevant UN organizations take up a "broad attack on the drought problem." Subsequently, Governing Councils of the United Nations Development Program (UNDP) and UNEP called for studies of drought and action plans to "check the spread of desert conditions" (UNCOD, 1978: 6).

Early UNEP-sponsored studies of dryland degradation assumed a priori that the Sahara was on the move. In May of 1974, the National Council for Research and the Ministry of Agriculture, Food and Natural Resources in Sudan issued a report on desert encroachment and sent it to UNEP as the basis for a project called "Desert Encroachment Control." The study requested UNEP's support for a proposed reconnaissance survey to show the status of desert encroachment and ecological degradation in northern Sudan. In particular, it was intended to "provide evidence on the most recent changes in desert encroachment," and to identify sites for further analysis of environmental problems and possible methods of environmental management. The Sudanese government aimed to present the report at a meeting of potential donors to the desert encroachment project.[139]

The project took place under joint sponsorship. However, its findings were attributed to Lamprey alone. The UN and the International Union for the Conservation of Nature funded the aerial reconnaissance, while Sudan's government provided ground support, including vehicles and aircraft fuel. UNEP and UNESCO sent one of their consultants to carry out the reconnaissance (Lamprey. 1975: 1). As described by his friend Ralph Townley, Lamprey was a natural scientist and great adventurer, a Himalayan mountain climber and "only happy when he was three hundred miles from nowhere" (Interview with Ralph Townley).

International Agencies

Around the time of Lamprey's work, rainfall began to improve in Africa and the crisis seemed to fade, along with the television footage that had brought pictures of emaciated children and parched landscapes into living rooms throughout the world. With these changes, the United Nations General Assembly (UNGA) began to shift its focus away from African drought and toward desertification. UNGA emphasized the international scope of desertification problems and called for extensive scientific assessment activities. In Resolution 3337 (XXIX), of 1974, UNGA recognized:

[139] Desert encroachment was similarly the focus of a study initiated in 1973 by the Secretariat for International Ecology in Sweden who published the final report in conjunction with UNEP. Like the Sudan study, this analysis (though originally intended as a global study) focused on desert encroachment in

> the urgent need to prepare a world integrated programme of development research and application of science and technology to solve the special problems of desertification in all its ramification and reclamation of land lost to desertification (UNEP, 1978: 124).

In this same resolution, UNGA called for "concerted international action to combat desertification" and requested that UNEP and other relevant and competent agencies convene an ad hoc task force to assist the Conference Secretariat to prepare various scientific assessments, including "preparation of a world map of areas affected and likely to be affected by the process of desertification" (UNEP, 1978: 124). As discussed below, the request for this map, its production, and the role it played in negotiations were important in shifting the UN's framing of desertification from an African problem to one affecting the entire world.

In 1975 UNEP, the Conference Secretariat, began planning for UNCOD. Mostafa Tolba, as Deputy Executive Director of UNEP (and Chair of the conference), seized on UNGA's requests for "studies" and placed scientific experts and their assessments of desertification at the center of UNCOD preparations (see Chapter 3). With soil scientists and geographers (mainly from developed countries), Tolba began to construct a new science of desertification. In doing so, UNEP transformed drought and its perceived effects (phenomena generally assumed to be beyond the control of people) into desertification, something that could be "attacked" and "banished" with the use of science and technology (e.g., see Tolba, 1987). Hence, Tolba and the UNEP assessment process were instrumental in creating a beat-able enemy. Maps provided a "battle" plan for these efforts.

Expert consultants to UNCOD prepared a total of four global maps of desertification-related parameters. However, UNEP emphasized the importance of one map over the other three. This map, *The World Map of Desertification* (see Figure 5), was prepared by Food and Agriculture Organization (FAO) and UNESCO in cooperation with World Meteorological Organization (WMO) and UNEP, and with the advice of "internationally recognized consultants to the Secretary-General of the Conference" (A/CONF.74/2: 3). This map showed desertification hazard and areas considered

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Africa. As reflected in its title, the question at the heart of the assessment was, *Can Desert Encroachment*

Figure 5: Thomas + Middleton (1994)

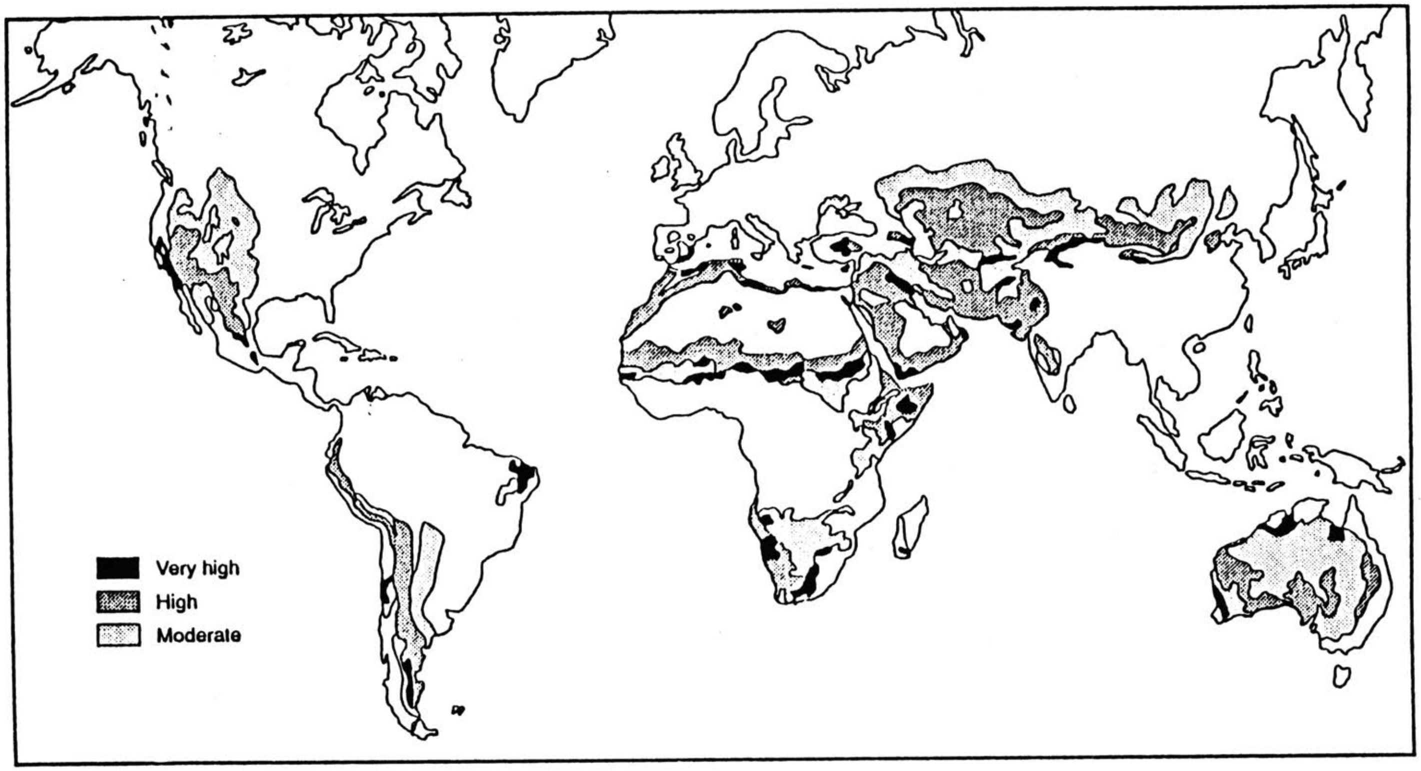

Figure 4.1 The 1977 UNCOD desertification hazard map

vulnerable to future desertification, though not necessarily experiencing desertification at present. The attribution of this map to a group of agencies marked a departure from the maps of Lamprey and the colonial foresters. Not only had the pictures of desertification become international in scope, so had the cartographers. The *World Map* marked a new trend in collective mapmaking under UNEP.

UNEP described the remaining three maps as experimental. Harold Dregne, a soil scientist from Texas Technical University produced a map entitled *Status of Desertification in the Hot Arid Regions* (see Figure 6), which identified different degrees of ecosystem degradation. Climatologists Dr. D. Henning and Professor H. Flohn of the University of Bonn created the *Climate Aridity Index Map*, which portrayed the Budyko Ratio, the ratio of radiation to precipitation. Professor V.A. Kovda, a soil scientist from Moscow State University authored the *Experimental Scheme of Aridity and Drought Probability.* Based on soil profile data he estimated climate conditions of the past and (via extrapolation) approximated the future likelihood of drought conditions. Compared to the *World Map*, however, these maps had a much lower profile during the negotiations. Conference organizers included these maps for purposes of clarification once they realized the many assumptions that went into preparing the *World Map.* They decided that a single map could not include all relevant parameters (A/CONF.74/31).

5.3.2 *Modern Maps and Methods*

Lamprey's map and the *World Map* differed in terms of both technique and content. While Lamprey relied on aerial photography and first-hand observations of the African landscape, FAO et al. (1977) utilized global datasets of standardized measurements. In terms of content, Lamprey's map portrayed both the path he took in traversing the northern Sudan and an estimated shift in the desert boundary. In contrast, the *World Map* did not relay information about the cartographer's methodology. Neither did it illustrate the results of direct observation. Instead, it showed vulnerability to desertification. Vulnerability measures reflected both climate factors and animal and population pressures. The differences in the Lamprey and world maps indicated a shift from local to global depictions of desertification, and trends toward less transparency and greater aggregation in mapmaking. These characteristics were part and parcel of the emergent

Figure 6: Dregne (1983)

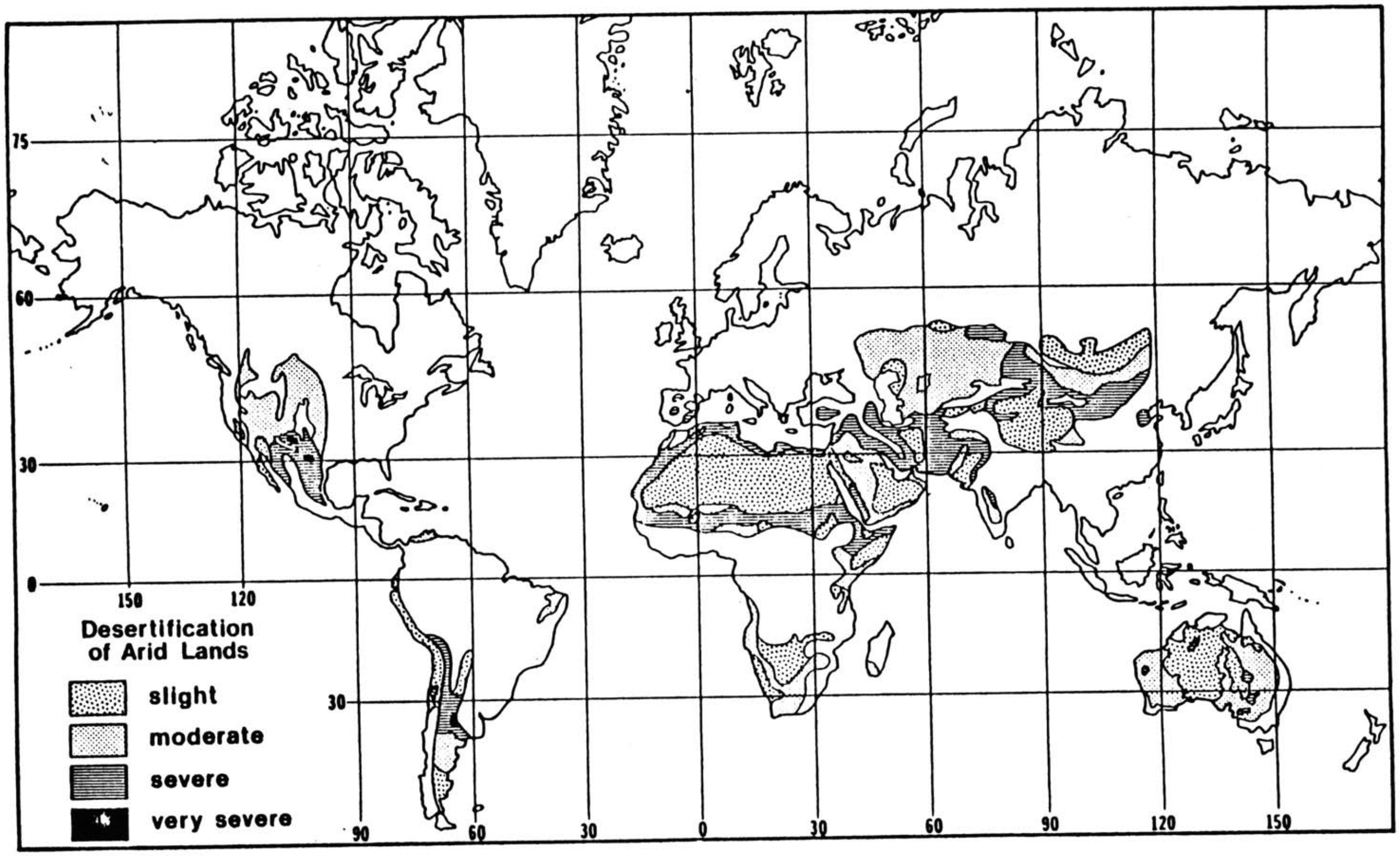

Figure 1.2. World status of desertification of arid lands

desertification issue and UNEP's approach to framing desertification as a global phenomenon with a singular cause and remedy.

Lamprey: In Flight and On Foot

Lamprey's study took place between October 21 and November 10, 1975. The reconnaissance team traveled in a four-passenger light aircraft, while a truck carrying fuel, supplies and camping equipment followed. To ascertain the position of the desert boundary, Lamprey and his team made ten north-south flights along the routes shown in Figure 7, observing signs of sand encroachment and the state of agricultural lands. By land, they ventured into some desert regions in search of signs of wildlife. Lamprey and his assistants also attended meetings with provincial governors and other administrators with whom they discussed sociological and political problems attendant on desert encroachment.

Based on aerial photographs and ground survey data, Lamprey claimed that the Sahara was on the move at the rate of 5.5 kilometers per year. Lamprey's map compared what was believed to be the current desert boundary with that delineated by Harrison and Jackson in 1958. These authors had used vegetation classification schemes to locate the position of the desert boundary. Based largely on the spatial distribution of Wadi Milk, a desert plant, Harrison and Jackson concluded that the Sahara's southern boundary had shifted south an average of 90 to 100 kilometers in the last 17 years. Lamprey examined desert encroachment in Northern Kordofan and Northern Darfur. In these regions he took account of four indicators of desert encroachment: shifts in ecological boundaries, sand encroachment, mortality of gum-producing acacia in Senegal woodlands, and failing agriculture. In assessing ecological boundaries, he primarily observed the location of various types of vegetation. His analysis of sand encroachment described drifting sand in relation to what Lamprey perceived as the desert edge. He also noted the southward shifting of the acacia trees, abandoned farms and the state of other agricultural land. In his analysis of desert encroachment in the northern Nile valley Lamprey determined that drifting sand was encroaching on alluvial sand surrounding the river and nearby depressions. He also reported moving sand dunes in the process of enveloping agricultural land and villages.

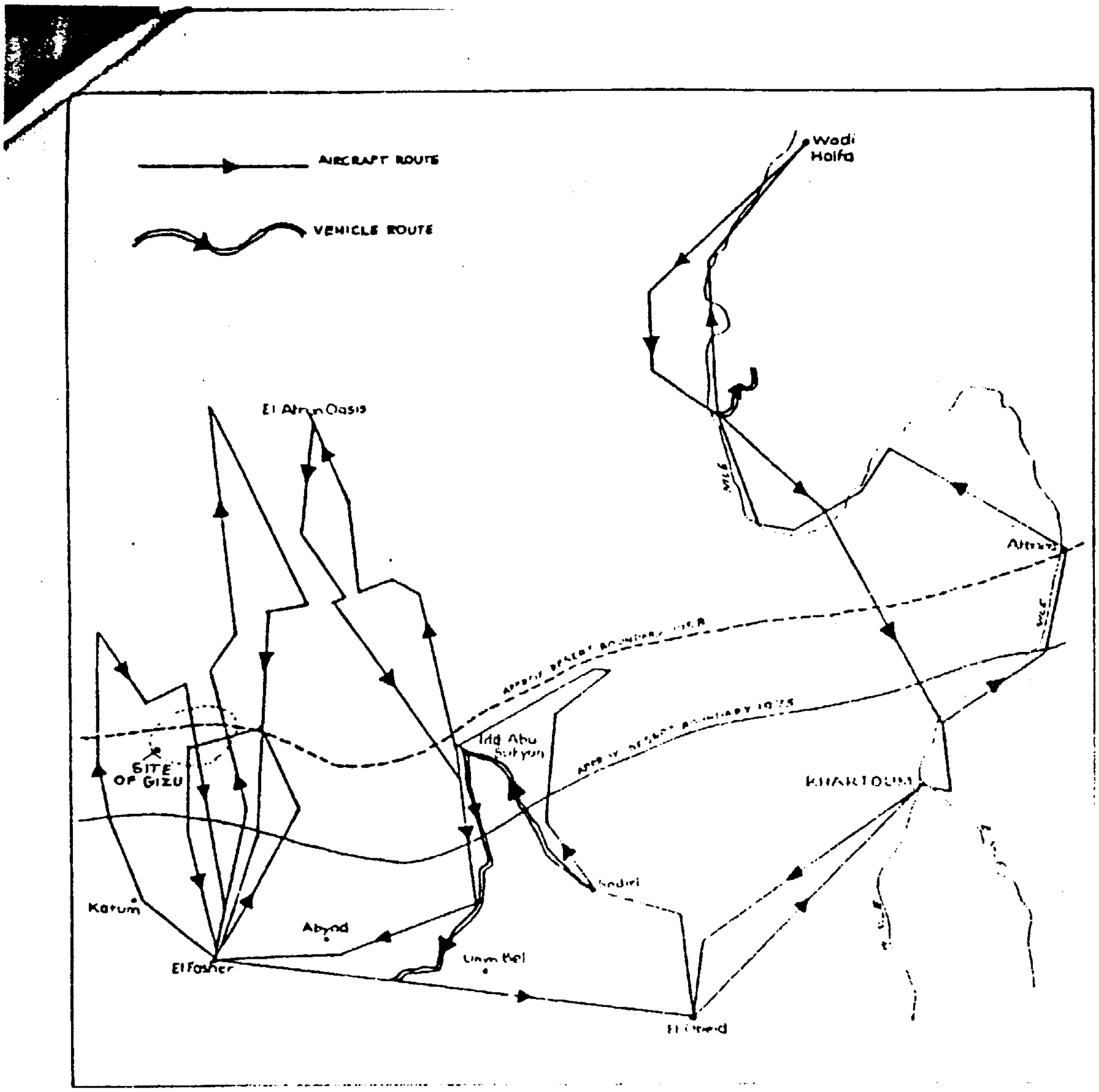

Fig. 1 The survey route taken by aircraft and vehicle in 1975

Figure 7. Lamprey (1975, 1988)

Lamprey also addressed social aspects of observed degradation. According to Lamprey, the natural resource managers participating in the study believed land use practices constituted the major factor responsible for desert encroachment. Based on conversations with local officials Lamprey concluded, much like the colonial administrators, that the lack of natural resource and land use planning policies were the most important deficiencies. Without such policies or means to enforce them, the area lacked regulations over range management, control of water resources, stocking rates, and general agricultural policies. He further suggested that questionable practices on the part of affected populations were partly to blame.

> It was appreciated by the team that the need for land-use planning and resource management could not be separated from the need to educate the rural populations, particularly as many of the problems are due to traditional and hitherto unquestioned practices (Lamprey, 1975: 4).

Lamprey commented specifically on the difficulties of imposing needed centralized policies on nomads. While officials agreed with Lamprey that such policies were needed, they deemed any attempt at controlling the nomads "unthinkable." Lamprey concluded:

> Thus, there lies at the heart of the ecological problem what appears to be an extremely difficult sociological problem. It seems unlikely that any substantial process can be made towards solving the crisis of ecological degradation in northern Sudan until a considerable measure of control over land use has been achieved (Lamprey, 1975/1988: 4).

Lamprey identified lack of ecological information of the arid zone in the northern Sudan as a major obstacle in achieving necessary management measures. He noted an "urgent need" for natural resource surveys for the production of maps and baseline data (Lamprey, 1975).

Yet, while Lamprey's paper emphasized the anthropogenic nature of desert encroachment, the advancing desert image itself connoted a vision of nature at war with humans, and of autonomous desert fronts marching forward to engulf villages. This connotation of desert encroachment was akin to initial interpretations of West African famine. Originally researchers and the general public perceived these disasters to be the result of a ruthless nature. Only several years after the 1968-1974 famine did researchers begin to argue that famine, rather than reflecting a struggle of people against a harsh climate, arose largely because of flawed social institutions (e.g., Garcia, 1981; Watts, 1983).

UNCOD Maps

The *World Map* (Figure 5) emphasized the global extent of desertification and framed it as a first and foremost a physical problem amenable to quantitative measurement and scientific analysis. UNGA resolution 3337 clearly called for a map showing areas affected by desertification, as well as areas likely to be affected. However, "because of limitations of scale and lack of comparable knowledge throughout the areas in question, no mapping of the existing degree of desertification could be attempted at the global scale" (Mabbutt, 1978: 48). Consequently, although the map was titled *World Map of Desertification*, it depicted desertification hazard, without an estimate of regions deemed to be affected by desertification. FAO et al. (1977) intended the map to "delineate, on a world scale, areas of deserts and those areas, mainly on the fringes of deserts but elsewhere as well, which are at risk of desertification" (A/CONF.74/2: 3).[140] The mapping process focused on predicting the physical manifestations of desertification in the forms of soil deterioration and accelerated mechanical erosion.

As Jack Mabbutt (1978) later reflected, creation of the *World Map* required a large degree of simplification. The basis for this map was a *Soil Map of the World* (FAO and UNESCO, 1971) at a scale of 1:5,000,000. The Map's authors noted that at more local scales, assessment of desertification hazard is only possible via historical analysis and monitoring. Thus, in creating a global-scale rendering of desertification they were forced to evaluate desertification hazard "subjectively" (A/CONF.74/2: 3). The *World*

[140] Because the *Plan of Action* was completed after production of the *World Map*, they were based on somewhat different definitions of the problem. The definition of desertification cited in the *World Map*'s documentation differed from that contained in the final UNCOD report. According to the *World Map*, desertification is "the intensification or extension of desert conditions; it is a process leading to reduced biological productivity, with consequent reduction in plant biomass, in the land's carrying capacity for livestock, in crop yields and human well-being." (A/CONF.74/2: 3). This definition implied that deserts gave rise to desertification. However, according to the UNCOD report, "Deserts themselves are not the sources from which desertification springs...It is generally incorrect to envision the process as an advance of the desert frontier engulfing usable land on its perimeter." (UNCOD, 1978: 5).

Map depicted four parameters at a scale of 1:25,000,000. The four parameters were: degree of desertification hazards in zones likely to be affected by desertification (characterized as very high, high or moderate); vulnerability of land to desertification processes (surfaces subject to sand movement, surfaces subject to salinization and alkalinization, stony or rock surfaces, and alluvial or residual surfaces); high human and animal pressure; and bioclimatic zones depicted as hyperarid, arid, semi-arid and subhumid.

Desertification risk in a given region was not a function of the sensitivity of the population, in terms of social institutions, population age or stability of food supplies. Instead, makers of the *World Map* measured desertification hazard based on vulnerability of the land combined with human or animal pressure. The land's vulnerability depended on "climate, terrain, soil and vegetation conditions." Climate was assessed using a well-known classification scheme for determining aridity zones. According to this scheme the ratio of precipitation to evapotranspiration was used to determine whether the climate in a given region was hyperarid, arid, semi-arid or subhumid.[141] Aridity categories were associated with livelihood methods. For example, nomadism was associated with the arid zone and rainfed agriculture with the subhumid zone. Indicators of vulnerability included features of such as sand movement; stony/rocky surfaces, subject to soil stripping and accelerated gully erosion; salinization and alkalinization. Human and animal pressures were based directly on estimates of population density (A/CONF.74/2: 2-3).

Population density was the only direct measurement of a human parameter featured in the *World Map*. "Population and animal densities have been used as measures of human and animal pressure on land, which, when excessive, results in overstocking, excessive cultivation through reduction of fallowing or through mechanization, and eradication of trees for firewood" (A/CONF.74/2: 6). The relationship of people and land was conceived as a one-way dynamic (i.e., the effect of people on land) and based on numbers of people, regardless of their social structures and practices. This is not to suggest that assessment of such parameters would have been possible or even

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[141] The Penman equations enable calculation of evapotranspiration based on atmospheric humidity, wind and solar radiation. Aridity zone values In areas that fell between measurement stations were interpolated based on maps of vegetation, soils and topography and based on unpublished information (A/CONF.74/2: 5).

worthwhile. Rather, this observation further highlights the emphasis on physical, rather than socio-economic parameters in the UNCOD context. Map authors assumed that, in the arid zone, significant land use pressures occurred when population density exceeded 7 inhabitants per square kilometer or one animal unit per 5 hectares of land area, where population density is taken to be a likely indicator of overcultivation or excessive vegetation cutting for fuel. In the semi-arid zone these threshold figures were 20 inhabitants per square kilometer meter and one animal unit pre hectare (A/CONF.74/2).

Tolba and map authors acknowledged uncertainties in the UNCOD maps. For example, Tolba explained that the intergovernmental institutions and individual scientists had made "every effort" to depict desertification processes cartographically as requested by the UNGA's in resolution 3337 (XXIX). However, he noted that they were "at best scientific experiments" and "implied no opinion on the part of the United Nations regarding the status of any country or territory shown on the maps." Map authors indicated that their goals in creating the map were to synthesize available cartographic information and "present it uniformly on a global basis" (A/CONF.74/2: 7). They hoped that their work would indicate potential sites for monitoring and for conservation and development programs. However, they also concluded that the *World Map* reflected just a "first approximation" which should be used to encourage national bodies to make an improved assessment of desertification. This paralleled the goals of UNGA which aimed to motivate international action on the issue through the UNCOD and its PACD (A/CONF.74/2).

5.3.3 *Constructing an International Scientific Problem*

Lamprey's project portrayed desertification as an African problem, manifest as an advancing desert edge, but deeply intertwined with sociological and political conditions at the local level. In contrast, the UN and associated institutions literally put desertification "on the map" as a global concern that was first and foremost a scientific problem. The *World Map* represented the role of multilateral institutions in mandating, and thereby contributing to the production of, scientific knowledge. World Map authors also attempted to define desertification as a challenge that science could both understand and solve. It helped to show that desertification could be observed, measured, quantified, and displayed using the tools of scientific inquiry. Together, efforts to globalize and "scientize" desertification culminated in the first attempts to standardize the issue via measurements of physical parameters.

The *World Map* also helped to establish desertification as an international issue by emphasizing its global extent and its presence beyond African borders. Some UNCOD participants viewed the *World Map* as evidence that desertification was, indeed a global problem. In his opening speech to delegates, Tolba referred to desertification as "one of the major global environmental problems." He described the *World Map of Desertification* as a "global panorama which clearly portrays the enormous dimensions of the desertification threat" (A/CONF.74/L.1). Similarly, an expert advisor to UNCOD remarked: "Despite its qualitative basis and an enforced generalization due to scale, the *World Map of Desertification* clearly demonstrates the global nature and seriousness of the threat of desertification" (Mabbutt, 1978: 49).

However, not all UNCOD participants shared these views. Delegates at regional meetings (A/CONF.74/33) and at UNCOD itself took issue with some of the maps. Many UNCOD delegates felt that the map's title was misleading, arguing that the map's portrayal of desertification risk may have exaggerated the geographic extent of degradation, thus making desertification look more "global" than it really was. Some participants called for a more democratic process of map making. It was clear from the Working Group consultations and the statements of delegates that UNCOD participants wanted effects of desertification in their home countries to be depicted accurately. Within the Working Group and in plenary, country representatives called for cartographers to consult with individual governments regarding map production. They urged UNEP to take all views concerned into account, prior to undertaking a cartographic exercise (A/CONF.74/36).

To discuss their concerns regarding the maps (especially the *World Map of Desertification*) delegates convened a working group to examine "technical inadequacies or inaccuracies in the map." The working group consisted of 18 country delegations, as well as representatives from UNESCO, FAO, WMO and the Organization of African Unity (A/CONF.74/36:109). The working group held one meeting at which several participants raised concerns about the map . They believed that the *World Map* should be combined with a global map of soil degradation from FAO to enable inclusion of humid areas. They also suggested that maps or an atlas at larger scales be used to show the dynamic elements of desertification processes. Another recommendation called for the systematic collection of data from national governments. Because of their reservations, the Working Group recommended that the committee accept the map as a "first approximation primarily intended to indicate the global magnitude of the problem." Furthermore, the committee should recognize the *World Map*'s limitations and should encourage production of detailed maps at larger scales, and additional maps showing phenomenona such as salinization, alkalinization, and seasonal drought (A/CONF.74/36).[142]

5.4 Democratizing Desertification

In the years following UNCOD, UNEP heeded the calls of conference participants who argued for improved mapping techniques. Throughout the 1980s the agency convened expert panels to address questions of mapping (e.g., Odingo, 1990; Rozanov, 1990), and worked on developing new mapping techniques and new definitions of desertification that they believed to be more "operational," and, therefore, more easily mapped. These cartographic endeavors occurred alongside evaluations and critiques of desertification science and policy. As discussed in Chapters 3 and 4, UNEP conducted two major assessments of PACD implementation in 1984 and 1991. Each lamented the PACD's failure to ameliorate land degradation and its impacts. Also during this period, several researchers published papers that were critical of the way in which desertification had been conceptualized and addressed in policy circles (e.g., Spooner and Mann, 1982; Warren and Agnew, 1988; Nelson, 1990). These evaluations helped to catalyze new conceptions of the desertification problem and new ways of visualizing it.

The *World Atlas of Desertification* (UNEP, 1992) embodied many of these changes. The *Atlas* marked the culmination of UNEP's various mapping assessment

[142] Despite the concerns of negotiators, however, the *World Map* and Dregne's *Status Map* were referenced and reproduced throughout desertification literature as symbols of the problem's global extent (e.g., Mabbutt; 1978; Walls, 1980; Dregne, 1983). As discussed in Chapters 3 and 4, only later did these maps resurface as targets of deconstruction (Warren and Agnew, 1988; Thomas and Middleton, 1994; Swift, 1996)

endeavors. Like the *World Map*, the *Atlas* portrayed physical aspects of desertification at a global scale. On the whole, however, the *Atlas* both symbolized and helped to establish a new vision of desertification emergent in the early 1990s. In contrast to the *World Map*'s portrayal of desertification as a uniform process with a singular uniform definition, the *Atlas* presented several maps of different regions of the world, with many based on divergent interpretations of desertification and its manifestations. Global maps produced through a standardized methodology derived, not from global estimates of population or land types, but from the knowledge and observations of numerous "local experts" at positions throughout the globe. The text accompanying the *Atlas* also countered advancing desert notions of desertification, explicitly noted inherent uncertainties in the maps, and acknowledged a role for climate factors in causing desertification. As embodied in the *Atlas*, these themes of plurality, democracy and uncertainty helped to usher in a new era of desertification policymaking.

5.4.1 *Atlas Makers*

The *Atlas* was created by committee. The majority of participants were physical scientists from fields such as physical geography and soil science. Several institutions and individuals participated in this process. They included the Desertification Control Programme Activity Center (DC/PAC) of UNEP, UNEP's Global Environmental Monitoring System/Global Resources Information Database (GEMS/GRID), and a large number of individual consultants. A Technical Advisory Group of approximately 14 experts assisted these departments. The chair of this group was Professor Mohammad Kassas, a soil scientist who had been heavily involved with UNCOD preparations (see Chapter 3). Two geographers authored the *Atlas* text: Dr. Nicholas Middleton of the School of Geography, University of Oxford, UK and Dr. David Thomas of the Department of Geography, University of Sheffield, UK.[143]

Several data sets were used in producing the global maps and maps of the African continent included in the *Atlas*. Two of the primary databases contained measurements of climatic parameters and soil degradation. The climate data set contained monthly

[143] Thomas and Middleton later authored a book highly critical, not of the *Atlas*, but of the way UNEP had portrayed desertification in the 1970s and much of the 1980s.

mean precipitation and temperature values derived for the Climatic Research Unit (CRU) of East Anglia, United Kingdom. The Global Assessment of Soil Degradation (GLASOD) provided soil degradation data. The GLASOD method of data collection involved a process labeled by Dregne as "structured informed opinion analysis." A coordinator was assigned for each of 21 regions worldwide. These coordinators collected published and unpublished soil degradation data. In addition, 250 experts knowledgeable about local conditions assessed existing information and used a systematic methodology to collect new information on the type, extent, degree and cause of degradation (e.g., water erosion, wind erosion, physical deterioration and chemical deterioration) (Thomas and Middleton, 1994).

While the global and continental maps relied on a standardized methodology, several national and regional maps did not. Independent authors not involved in the GLASOD process contributed individual case study maps showing degradation at sub-global scales. These authors employed an array of different mapping techniques and relied on varying interpretations of desertification phenomena. Some, for example, showed both soil and vegetation degradation, while others focused solely on soil degradation. Producers also varied in regard to their treatment of climate and social factors. They employed different metrics for gauging these parameters and different methods of representation.

So while UNEP and natural scientists remained at the helm of this cartographic enterprise, the process of *Atlas* production marked changes in participation, aggregation and standardization. *Atlas* contributors encompassed a broad range of individuals working at local, regional and global scales. While some participants gathered information in each of the 21 regions and others developed individual regional and national maps, UNEP and its various consultants focused mainly on tasks of coordination and synthesis. Techniques of aggregation differed markedly from those employed in 1977. Creators of the *World Map*, for example, employed ready-made global measures of climate and human and animal populations to develop their global picture of desertification. In contrast, aggregate measures displayed in the *Atlas* derived from a "bottom-up" process whereby numerous assessments and observations took place at local and regional levels before they were aggregated. The multiplicity of maps in the *Atlas* signaled UNEP's departure from a singular, universal definition of desertification. By including maps based on differing methodologies and divergent definitions, UNEP acknowledged desertification's complexity and its varying manifestations worldwide.

5.4.2 *The Atlas*

Most maps in the *Atlas* portrayed human-induced soil degradation, supplemented with a relatively small number of maps showing climatic parameters and measures of vegetation. This 69-page document also contained several charts, graphs and substantial text organized into three sections: "Global," "Continental Africa," and "Case Studies." The *Atlas* included global maps of climatological measures, soil degradation (Figure 8) and soil degradation and vegetation (Figure 9). It also provided maps of various forms of soil degradation categorized according to the type of physical mechanisms responsible for them. These mechanisms included water erosion, chemical deterioration, and physical deterioration. Additional global maps depicted areas of soil degradation resulting from deforestation, overgrazing, agricultural activities, and overexploitation of vegetation for domestic use. The continental Africa chapter contained all of the above analyses except those for climate. Eight case studies focused primarily on Asia and Africa.

The GLASOD maps in the *Atlas* are said to reflect the definition of desertification that arose during preparation of UNEP's (1991) assessment. However, because of data limitations, maps showing vegetation degradation were small in number. As discussed in Chapters 3 and 4, UNEP convened a Panel of Senior Consultants in Geneva in April of 1991 to discuss a first draft of a revised PACD and to evaluate the definition of desertification proposed by the Nairobi meeting of the Ad-Hoc Consultative Meeting on the Assessment of desertification (Odingo, 1990). This Nairobi group defined desertification as "Land Degradation in Arid, Semi-arid and Dry Sub-humid Areas resulting from adverse human impact." They also decided, that "Land in this concept includes soil and local water resources, land surface and vegetation or crops." (UNEP, 1991: 1). However, the Geneva panel decided that a revised desertification definition should more clearly reflect the role of natural climate variation in exacerbating desertification. Given that desertification could be climate-induced as well as human-

SOIL DEGRADATION

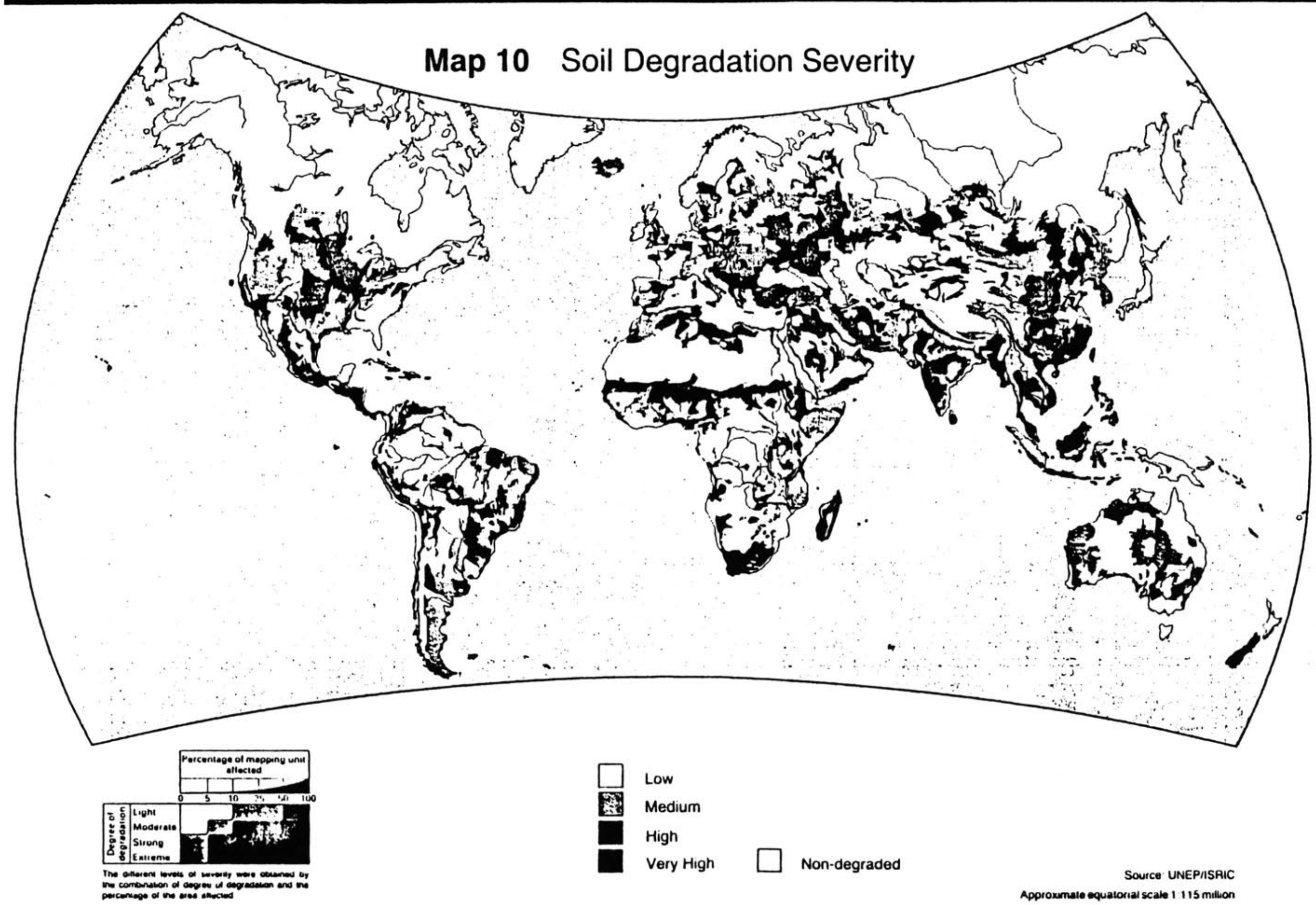
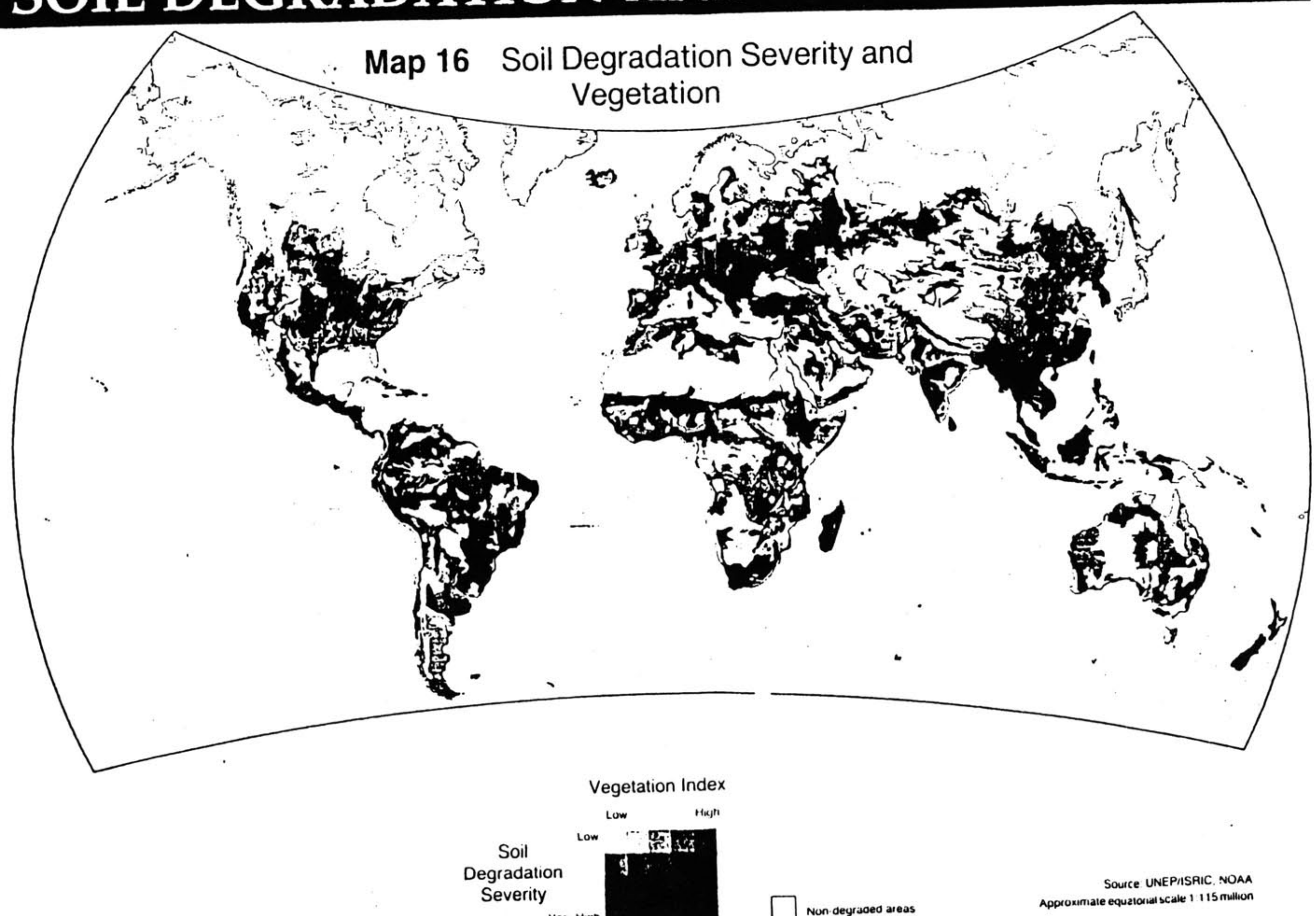


Figure 8. Soil Degradation Map from World Atlas (UNEP, 1992)

SOIL DEGRADATION AND VEGETATION



Map 16 Soil Degradation Severity and Vegetation

Figure 9: from World Atlas (UNEP, 1992)

induced, the Geneva group defined desertification as "land degradation in arid, semiarid and dry subhumid areas resulting *mainly* from adverse human impact" (UNEP, 1991: 2) (emphasis added).

In applying UNEP's (1991) definition of desertification to the *Atlas*, its creators encountered data problems. According to this definition, desertification constituted the degradation of both soil and vegetation. However, the paucity of data on vegetation degradation prompted Atlas contributors to adopt a more pluralistic approach to interpreting and mapping desertification.

> The scarcity of data on desertification and the many forms it can take has necessitated a fresh approach to assessing the problem. It is not realistic to produce a single map of world desertification. A more viable approach is to map the many indicators of desertification and the factors that affect those indicators. (UNEP, 1992: viii).

Hence, many of the global maps and maps of continental Africa reflected soil degradation rather than a combination of soil and vegetation degradation. Other maps showed climatic indicators and a combination of soil and vegetation degradation.

The Global Assessment of Soil Degradation (GLASOD) served as the data source for the global and continental maps. GLASOD provided information on two types of human-induced soil degradation: degradation resulting from the displacement of soil material (e.g., via wind or water erosion) and degradation resulting from physical and chemical processes occurring within the soil. The *Atlas* pointed out the difficulties of discerning between human and naturally-induced soil erosion. This is especially problematic, for example, during a drought period. A category of "non-degraded" lands included true deserts or hyperarid regions where the ratio of precipitation to potential evapotranspiration was less than 0.05.

Atlas creators categorized the severity of human-induced soil degradation as light, moderate, strong or extreme. These levels were determined based on comparison to "original" conditions and were defined in terms of what types of land use the region is capable of supporting and the requirements necessary for restoring areas to original productivity levels. For example, a rating of "moderate" meant "the terrain is still suitable for use in local farming systems, but with greatly reduced agricultural productivity." (UNEP, 1992: 11).

The global and continental maps were developed using UNEP's Global Resources Information Database (GRID), a system that employs geographic information systems (GIS) and remote sensing technologies for environmental assessment and monitoring (UNEP, 1992: ix). GIS enabled the researcher to create maps overlain by several datasets, thereby depicting the complexity of desertification processes. For example, to highlight areas prone to water erosion, one could superimpose a map of annual rainfall on a base map of soil degradation.

Only two of the *Atlas*' maps (one global and one continental) combined measures of soil degradation and vegetation. This global map was described as an "integrated assessment" of overall soil degradation from the GLASOD survey and vegetation production from the GVI (Global Vegetation Index). The GVI is a satellite-derived indicator of photosynthetic capacity and the relationship between plant canopy and evapotranspiration rates.[144] The soil degradation and vegetation maps were based on a twenty-color grade scheme that combined four measures of soil degradation severity with five levels of the vegetation index. The map did not indicate causal relationships between indicators and was simply meant to "highlight area within which susceptibility to soil or vegetation degradation may exist or have been realized" (UNEP, 1992: 23).

Some aspects of the *Atlas* appeared to speak directly to desertification's critics. After publications by a number of desertification skeptics during the 1980s (e.g., Spooner and Mann, 1982; Warran and Agnew, 1988; Hellden, 1988; Nelson, 1990), UNEP was particularly interested in constructing the *Atlas* in a way that was robust and better insulated from outside challengers. This emphasis on scientifically robust and reproducible measures was evident in decisions regarding estimates of potential evapotranspiration (PET). These estimates allowed researchers to calculate aridity (the ratio of precipitation to potential evapotranspiration). There are three common ways to determine PET: by direct measurement, using the theoretical Penman equation (1963),

[144] The GVI is derived from the Normalized Different Vegetation Index (NDVI), a qualitative index of photosynthetically active vegetation. The NDVI is derived from surface reflectance data from NOAA's Advanced Very High Resolution Radiometer (AVHRR) satellite. The GVI is a weekly NDVI value. A

and using the empirical Thornthwaite (1948) equation.[145] Penman is a common method and served as the basis for the 1977 aridity index map prepared for UNCOD. However, Penman relies on the direct measurement of several variables including solar radiation, wind velocity, relative humidity and temperature. Because of data scarcity in regard to these paramters, *Atlas* creators employed the Thornthwaite scheme and asked the Climate Research Unit at the University of East Anglia to derive an empirical relationship that adjusted for the tendency of the Thornthwaite equation to overestimate PET in wet and cold regions and underestimate it in dry environments. This approach, Atlas authors claimed, was more "pragmatic" and reduced errors associated with primary data collection (UNEP, 1992: 5; Interview with UNEP Advisor 3).

The authors also distinguished the advancing desert phenomenon from the problem of soil degradation. The *Atlas*, for example, differentiated between areas of human-induced soil degradation and true deserts of hyperarid regions. Atlas authors concluded that because these regions are uninhabitable due to climate and lack of vegetation, human populations are not likely to reside in or degrade them. Throughout its maps, the *Atlas*' depiction of desertification emphasized that desertification was not manifest in shifting desert boundaries, but instead constituted a more systemic problem. The *Atlas* further explained that, because of their variability, desert boundaries elude identification and measurement.

> Dryland boundaries are neither static nor abrupt. This is not surprising given the high interannual variability in mean rainfall and the occurrence of drought, which may last for periods of several years at a time. Attempts to locate boundaries on the ground or define them in terms of features such as natural vegetation are likely to fail (UNEP, 1992: 5).

Hence, with this statement Atlas authors clearly separated their work from earlier attempts to estimate desert encroachment by researchers such as Stebbing (1935), Lamprey (1975) and Helldén (1988, 1991). The *Atlas* authors further suggested that such efforts were neither scientifically meaningful or defensible.

GVI value indicates the photosynthetic capacity of plants and the relationship between plant canopy and evapotranspiration rates (UNEP, 1992: 23).

5.4.3 *Problem Framing: Plurality, Complexity and Transparency*

UNEP considered the *Atlas* to constitute part of its "fresh approach" (Cardy, 1991) to desertification. In some ways it resembled UNEP's attempts to map desertification in the 1970s. In other ways, however, the *Atlas* represented important departures from previous cartographic efforts. Like the UNCOD maps, for example, the *Atlas* emphasized physical manifestations of desertification. UNEP's objective in creating the *Atlas* was to "locate and quantify the nature of the problem" (UNEP, 1992: vii). UNEP believed that this was necessary before attempting to address the socio-economic aspects of the issue (UNEP, 1992). Like the *World Map*, the *Atlas* reflected the mechanics of human-induced soil degradation and attributed degradation to specific human processes. The *Atlas'* text, for example, provided brief descriptions of areas affected by deforestation, overgrazing, agriculture, and overexploitation of vegetation for domestic use. Also, like earlier maps, the *Atlas* depicted desertification as a global problem. The *Atlas*' preface, authored by Tolba, was reminiscent of his remarks in 1977. According to Tolba, the *Atlas* confirmed that desertification was still a global problem.

> Desertification is a global problem, demanding urgent global action. And this action must involve more than a campaign against the processes of desertification. It must become an essential part of the broad process of development and the provision of basic human needs (UNEP, 1992: iv).

Tolba believed that visual representation was among the most powerful means for communicating desertification's global dimensions. "One of the clearest ways to depict a global problem is to show it in an atlas. If it is true that one picture tells a thousand words, it is probably also true that one map of a global situation tells many more than a thousand words" (UNEP, 1992: iv).

Yet, in many ways, this global picture of desertification was a revised global picture. In particular it displayed a more pluralistic, complex and transparent interpretation of land degradation. Instead of presenting one standardized and universal portrayal of desertification, the *Atlas* incorporated global and sub-global depictions of desertification, as well as maps based on different approaches to the study and

[145] Meigs used Thornthwaite to estimate aridity in his UNESCO map of world aridity in 1953.

interpretation of the issue. Its purpose was not simply to support a global framing or international treaty on the issue, but to introduce methods of analysis and new understandings about more locally-relevant facets of desertification. *Atlas* authors acknowledged the shortcomings of a singularly global vision of desertification and asserted that worthwhile action on the issue must ultimately derive from activities at the local level. Emphasis on sub-global aspects of the issue were apparent in the sections on Africa and in the regional case studies. Both of these sections discussed issues of more local relevance.

The case studies reflect the diversity of interpretations and methodological approaches to the study of desertification. These eight analyses focused on Syria; China; Argentina (central west); Kenya (Baringo); Mali (western area); Mali (west transect); Tunisia (central north); and former USSR (Aral Sea). The Kenyan and Mali studies were based on the mapping assessment methodology devised from FAO and UNEP in 1984. Authors of the Tunisian and Aral Sea studies employed a landscape methodology. Case studies also emphasized different manifestations of desertification. While the China analysis examined effects of wind and water erosion, the Argentinean case assessed desertification hazard (a combination of vulnerability and human pressure).

UNEP's more complex vision of desertification was also evident in the extensive textual content of the *Atlas*. This textual component of the *Atlas* text marked a departure from UNEP's earlier cartographic enterprises. In keeping with the spirit of simplification and proximate solutions, the UNCOD maps were intended to relay a simple and clear picture of desertification. Consequently, texts accompanying those maps contained brief notes on methodology and very little or any discussion of map interpretation. In contrast, Middleton and Thomas authored a descriptive account of the maps, explaining the meaning of the various representations, the methods employed, and the nature of uncertainty inherent in the maps. The inclusion of considerable textual accompaniment to the maps suggested that desertification was not easily captured in map format. It was a complex process whose analysis was uncertain and open to a variety of different interpretations.

Greater textual content also enabled a greater transparency in regard to map making methodologies and underlying assumptions. Through the text, *Atlas* authors made explicit many simplifications and uncertainties inherent in the maps. Middleton and Thomas, for example, pointed out difficulties of distinguishing between human and naturally-induced soil degradation, noting that this distinction was inevitably a subjective one. They also explained that the method of coloring the polygon's of the GLASOD database tended to exaggerate the spatial extent of desertification. These authors further noted that regions of aridity as represented in the maps did not indicate homogenous climates. All of these discussions reflected a more complex vision of desertification and greater acknowledgement of the map audience. Creators of the *Atlas* did not attempt to let the maps stand on their own, as complete visual statements about desertification. They supplemented these visual images by communicating to viewers the assumptions and methodological choices not visible in the maps themselves.

5.4.4 *Debating Desertification's Global Dimensions*

The *Atlas* was distributed to delegates at the United Nations Conference on Environment and Development (UNCED). However, debates that ensued over the global nature of desertification suggest that maps played a less prominent role in these negotiations than they did in the 1970s. While Tolba believed that the *Atlas* persuasively reinforced a global framing of desertification, participants in the preparatory process for the United Nations Conference on Environment and Development disagreed as to the global or regional nature of the desertification problem. In the end delegates agreed to an international treaty on the issue, but only after resolving North-South disagreements regarding the justification for such an agreement. The seemingly decreased role for maps at UNCED seemed to signal the beginning of a lessening role of modern scientific inquiry in the context of international desertification policymaking.

At Preparatory Committee IV for UNCED, members of Working Group I, attempted to finalize the draft text for what later became Chapter 12 of *Agenda 21* (A/CONF.151/PC/100/Add.17). By the end of the session, Working Group I had reached consensus on the entire text except for two paragraphs concerning a future desertification convention (ENB:04:01). While Africa and other developing countries favored this treaty, many of industrialized countries opposed it, arguing that institutions to address desertification already existed and that the use of resources required for a new convention were not warranted.

When Working Group I convened in June 1992 at the Rio Summit, Tommy Koh, Chair of Working Group I held meetings with interested parties on the possibility of calling for a desertification convention. While some delegates preferred a regional convention to address desertification in Africa only, others called for a global treaty. Informal discussions on this topic took place among delegates throughout the day, with some reporting a compromise was close at hand (ENB:02:07). The US, which had previously favored a regional convention for Africa, changed its position in support of an international desertification convention. However, several developed countries continued to call for a regional, rather than a global convention (ENB:02:08).

When the Main Committee reconvened for its last scheduled session on June 9, 1992, issues still not agreed upon included the question of an international desertification convention (ENB:02:08). When the text for Chapter 12 reached the Main Committee on Tuesday/Wednesday (at an overnight meeting), it contained two bracketed paragraphs concerning the G-77's call for a binding desertification convention. The United States did not support this proposal and Tommy Koh established consultations on the issue. The US changed its position in the midst of these deliberations and agreed with the proposal to prepare an international desertification convention for 1994 for countries vulnerable to desertification and drought (ENB:02:13). Koh also made comments indicating that the EC, too, had changed its position (ENB:02:09).

However, the question of desertification's global dimensions threatened to muddle the fate of the compromise text that emerged from consultations. The European Commission had not objected to a proposal for a global convention during the consultations only 45 minutes before. However, to the surprise of other delegations, Portugal, on behalf of the EC, rejected the text presented to the Main Committee, arguing that "desertification is a regional problem, not necessarily warranting global action." Several developed and developing countries opposed the EC in supporting the plan and urged the EC to approve its position. These pleadings and a 45 minute adjournment for several additional consultations, notably between the EC and the African Group, ultimately led the EC to change its position and paved the way for a request to UNGA for an international desertification convention (ENB:02:13; ENB:02:09).

The *Atlas* could have supported either of the opposing positions in this debate. On the one hand, it portrayed desertification at global scales, while on the other hand it emphasized desertification's diversity and the importance of addressing it at local levels. Neither side, however, used the *Atlas* to argue its point.

5.5 New Forms of Visualization

The *Atlas* met a similar fate during negotiation of an international desertification convention. While, it served as a backdrop to the Intergovernmental Negotiating Committee on Desertification (INCD) process in 1993-4, the *Atlas* did not feature prominently in actual deliberations. Although delegates engaged in debate about the global character of desertification, they made in frequent reference to the *Atlas*. Instead, other forms of visual representation seemed to gain prominence in the new regime. The *Atlas*, for example, was presented during an Information Sharing Session (Kassas, 1995), but speakers throughout the session employed charts, graphs and photographs, as well as their own maps.

> Most of the participants stated that they thought that the information sharing segment was a success. By the end of the week, it was clear from the presentations, the overhead projections and the color slides, that desertification and drought are problems faced all over the world, in both developed and developing countries. (ENB:04:11).

Since the start of negotiations, the Desertification Secretariat has included photographs of desertified areas on its web page. In general, most uses of visual communication in the current desertification regime have occurred in conjunction with public relations activities on the part of the Secretariat Diminishing reliance on desertification maps in the early 1990s signaled both a de-emphasis on desertification as first and foremost a scientific problem, greater interest in the particularities of desertification at local levels, and the mustering of support for anti-desertification activities among a wider public audience.

Revisiting Debates about Global Dimensions

A decreasing reliance on cartographic representations of desertification was evident in INCD debates regarding and the global nature of desertification and regional annexes to the treaty.

Throughout negotiations, developed countries objected to references characterizing desertification as a "global problem." These countries believed that labeling desertification in this way implied that desertification was linked to climate change. Developed countries opposed references to desertification-climate change interactions because such references might be interpreted as a basis for North-South compensation. If, for example, desertification were seen as arising from increased concentrations of greenhouse gases, developed countries could be held at least partly responsible for the problem and obligated to contribute more resources to its amelioration.[146] In the end, the CCD described desertification as "global" in just two places in the Preamble.

> Acknowledging that desertification and drought are problems of global dimension in that they affect all regions of the world and that joint action of the international community is needed to combat desertification and/or mitigate the effects of drought (CCD, 1994: Preamble).
>
> Bearing in mind the relationship between desertification and other environmental problems of global dimension facing the international and national communities (CCD, 1994: Preamble).

These references represented a de-emphasis of desertification's global dimensions. They also downplayed possible relationships linking desertification and climate.

Other major debates on desertification's global dimensions concerned the inclusion of regional annexes to the *Convention*. These debates suggested that desertification's global extent was not definitively established by way of the *Atlas*, but was, instead, negotiable. Each regional annex described the particular region's characteristics and provided guidelines for the content of national action plans, a core component of desertification policy. Originally, INCD Chair Bo Kjellen, in accordance with UN General Assembly resolution 47/188, decided that the CCD would contain a framework convention and one regional annex directed at urgent anti-desertification activities in Africa, with other regional annexes to be negotiated subsequently. However, at the suggestion that priority for Africa take the form of a special instrument of the treaty, other affected regions clamored for similar treatment. Some Latin American and Asian countries believed that their problems deserved as much attention as Africa's and urged that negotiation of their regional annexes take place in conjunction with negotiation of Africa's regional annex. African country representatives, on the other hand, believed additional annexes would divert attention from their countries' needs. After many lengthy debates Latin America and the Caribbean, Asia and the Mediterranean (in addition to Africa) received annexes under the treaty (ENB:04:11; Kassas, 1995).

Developed countries had reservations about the feasibility and costs associated with negotiation of several annexes (ENB:04:11). Following the first negotiating session, the Chair undertook consultations with governments in hopes of working out a compromise on the timing and focus of the annexes. At INCD-2, the G-77 agreed that the African annex should be finalized by June 1994, with remaining annexes negotiated during the interim period and brought into force with the *Convention* and the African annex (ENB:04:22). All INCD-2 delegates agreed to ask the UN General Assembly for permission to negotiate annexes for Latin America and Asia. However, to complicate this matter, Latin American and Asian countries wanted their annexes completed by June 1994. Several other countries agreed, believing that without completion of these annexes, they would not know the full extent of their obligations under the treaty. Still, developed countries did not want the annexes to burden them with obligations to supply various forms of assistance (ENB:04:44). By the end of the third negotiating session, the timing of regional annexes was still unclear, as was the form that priority for Africa would take (ENB:04:34). In February 1994, following the third negotiating session, regional groups from Latin America and Asia took it upon themselves to negotiate their own regional annexes. By the end of the first week of INCD-4, draft regional implementation annexes for Latin America and the Caribbean and Asia were tabled in

[146] WMO and UNEP sponsored a study of desertification and climate in the early 1990s. This project culminated in a book by Williams and Balling (1994), drafts of which were reviewed by a panel of experts.

Working Group II (ENB:04:34). At INCD-5, annexes for Africa, Latin America and the Caribbean and Asia were agreed upon. A fourth annex, for the Northern Mediterranean was also added (Kassas, 1995).

Unlike previous desertification policies, the *Convention* codified North/South relationships and obligations, thereby negotiating yet another aspect of desertification's global extent. In previous eras, maps and measures emphasizing the geographic extent of desertification served as a primary basis for the issue's global framing. While cooperation between developed and developing countries had always been a key feature of international desertification initiatives, the *Convention* was the first multilateral agreement to outline the responsibilities of each group. Considerable debate ensued regarding the labeling of categories and the responsibilities assigned to each. Developed countries were wary that their burden would get too onerous, while developing countries sought to ensure what they saw as the needed support from industrialized countries.

In the end, the *Convention*'s negotiating committee created two categories of countries. These categories were labeled "affected countries," defined as "...countries whose lands include, in whole or in part, affected areas (CCD, 1994: Article 1(I));" and "developed country Parties" referring to "...developed country Parties and regional economic integration organizations constituted by developed countries" (CCD, 1994: Article 1(k)). Affected countries were required to address desertification within a sustainable development framework, paying due attention to the role of local participation and socio-economic factors (CCD, 1994: Article 5). Developed country Parties were obliged to support anti-desertification efforts, provide and mobilize financial resources and other forms of support, and facilitate access to appropriate technology and know-how (CCD, 1994: Article 6).[147]

New Forms of Visualization

While the *Atlas* did not feature prominently in INCD debates, other forms of visual communication have taken hold in the CCD Context. Many of these have been employed

[147] Article 4 of the treaty contained general obligations relevant to all Parties to the *Convention*. These included adoption of an integrated approach to desertification addressing physical, biological, and socio-economic aspects; integrated strategies for poverty eradication; promotion of cooperation among affected country Parties.

in public relations activities on the part of the Desertification Secretariat. The first of these appeared during the Information Sharing Session as speakers used photographs, maps, charts and graphs to communicate their points to delegates and others in the audience. Even more than the *Atlas*, these presentations portrayed a broader and more pluralistic view of desertification. They used different media of visualization, as well as different interpretations and approaches to desertification.

More recently, visualization in the desertification context has been targeted at an even wider audience. The Secretariat, for example, has a logo showing an orange sun in the horizon over an arid landscape (see Figure 10), as if to symbolize the dawn of a new desertification regime and new desertification paradigm. The Secretariat's web page shows several photographs of desertified areas and anti-desertification projects, focusing attention on the local nature of desertification phenomena. The Secretariat is also bringing its message to film media, by supporting various desertification documentaries airing on CNN, Euronews and United Nations Television (http://www.unccd.ch/lite). So as the producers of visual representation have changed in the desertification context, so have the intended audiences, the media, and the messages of visualization.

5.5 Viewers and Visions

Throughout the twentieth century pictures of land degradation varied according to whose vision was deemed to matter, what was rendered visible and invisible, and through what processes these images were displayed. These aspects of visualization helped to delineate the bounds of participation and tools of representation in terms of institutions and individuals, natural and social scientists and affected people and outside observers. As the eyes of the colonial empire, foresters and other researchers photographed and mapped the routes of their explorations and the extent of degradation they observed. In the 1970s, UNEP, in emphasizing the scientific and international nature of the desertification problem, relied on the visions of natural scientists to aggregate physical measures of desertification and portray them on a world map. As critiques called for a more complex vision of desertification, UNEP, though still creating a global vision and emphasizing the physical processes at work, called on natural scientists working at different scales and with different interpretations and methodologies. Finally, in the

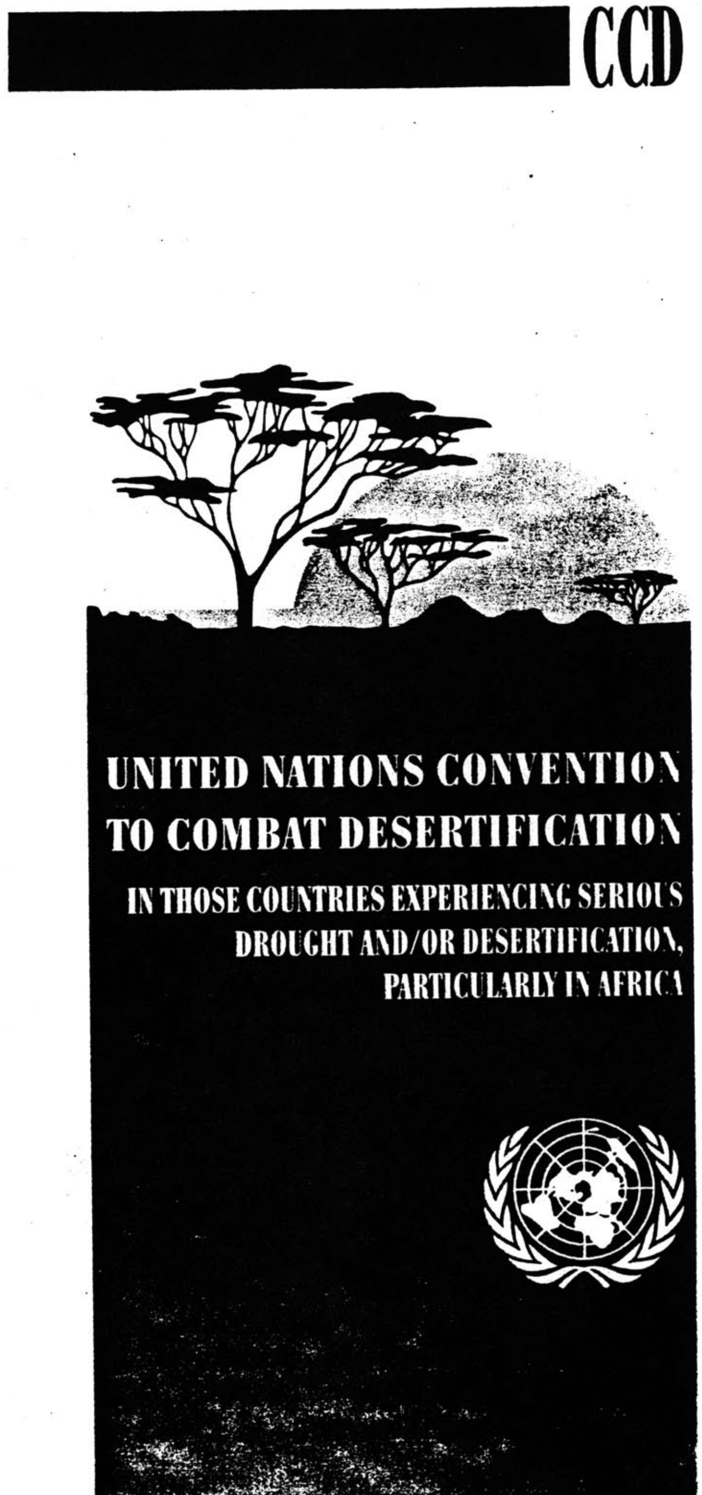


Figure 10: Cover of Pamphlet from CCD Secretariat

1990s, as political interest in maps faded, new visualization technologies and means of communication emerged, with less emphasis on portraying the global extent of desertification and more interest in illuminating its local characteristics.

For much of desertification's history the people experiencing desertification have not been the people studying desertification. Consequently, visual images, whether from colonial researchers or UNEP, have tended to objectify the affected populations rather than incorporate their perspectives into images of the problem. Stebbing's photographs showed African people and the Commissioners' maps identified regions of deforestation. Similarly, the *World Map* indicated population pressure and regions of rainfed agriculture. But while affected populations and their practices were made visible through images, their own visions of desertification were not. Only more recently has an emergent pluralistic approach to desertification invited a greater diversity of perspectives on the problem from both those with first hand experience and those from more distant vantage points.

Visual representations have also embedded the goals and capacities of the image maker in the image. While Stebbing, in arguing for a transnational forest belt, downplayed the British-French border from his map, the Commissioner's opposed to such a policy measure, highlighted the location of this border. UNEP created a vision of a uniform international problem arising from physical processes and amenable to a standardized solution. With the recognition of non-governmental organizations and indigenous knowledge as resources for addressing desertification, visual images began to reflect perspectives of more local people and particularities of local contexts.

Boundaries demarcated the realms of the visible and invisible and in doing so portrayed desertification as local or global and physical or social. Global maps of the 1970s erased the personal vision of researchers and the local variability of places experiencing degradation. The *Atlas* portrayed a more diverse range of interpretation of desertification and highlighted local variability in perceptions and ecological conditions, but continued to render broader social and cultural aspects of the issue invisible. More recent attempts to represent desertification seem to highlight the role of the audience rather than that of the image maker. The Secretariat's development of a desertification logo and desertification documentaries seem more focused on communicating the message of the new regime, rather than legitimizing it through scientifically-derived representations.

CHAPTER 6

Language and Lessons

This study began with two questions: how do experts, policymakers and institutions participate in co-production? And how might a deeper understanding of these processes inform the way we perceive and conduct science and international environmental policymaking? Chapters 3 through 5 addressed the first question through analysis of expert advice, quantification and visual representation as both indicators and agents of change in international desertification policymaking. They demonstrated how practices and artifacts of science and policymaking embody and allocate decisionmaking power, define rules of participation, and shape problem framings in ways that conform to institutional goals and capacities. The present chapter reviews these themes and explores some of their implications for policymaking.

6.1 Causation Discourses

Multilateral agreements for desertification have embedded causal narratives, widely-held ideas about sources and solutions of land degradation. These narratives took shape through practices of expert advice, quantification and visual representation and through the portable texts, measures and images they generated. In a sense, these practices and artifacts comprised and gave rise to desertification discourses, formalized languages through which participants in science and policymaking communicated. By viewing the history of desertification in terms of changing discourses, we can synthesize much of the analysis in previous chapters. Examining authorization as a discursive process allows us to ask who had voice and who did not. In regard to inscription we can ask what causal narratives were articulated and what form did this articulation take? Boundary work is integral to both authorization and inscription because it demarcates the realms of local-global, natural-social and lay-expert. The location and nature of boundaries with regard to these categories have important implications for who has voice (e.g., natural or social scientists, lay people or experts, Africans or international officials), as well as problem framing and notions of causation (e.g., is the problem local or global). The summary below provides a brief survey of authorization, inscription and boundary work as discursive processes.

6.1.1 *Voices of Authority*

In embodying and generating causal narratives, expert advice, quantification, and visual representations reflected sources of power while at the same time allocating power. French and British researchers and administrators, for example, were responsible for detecting, interpreting, and articulating the characteristics of land degradation in West Africa. Unlike indigenous peoples or even anthropologists, foresters and geographers were the key contributors to environmental debates of the early twentieth century. Their views of environmental degradation aligned with paternalistic attitudes toward African people and colonial ambitions to settle the African frontier. As the voice of environmental science and policy in colonial West Africa, researchers and administrators blamed "indiscriminate land use practices" of the African peoples for alleged degradation. This causal explanation portrayed Africans as both ignorant and responsible for degradation, effectively silencing any contributions they might have made to the debate. On the other hand, widespread communication and acceptance of this narrative bolstered the perceived superiority of European land use methods and further legitimated colonial scientists and natural resource managers in efforts to understand and ameliorate the problem.

During the modernist era, UNEP proved to be the primary source of authority in regard to desertification politics. As discussed in Chapter 3, Mostafa Tolba's interest in establishing a sound scientific basis for UNEP's activities led the 1977 Conference Secretariat to rely heavily on the expertise of natural and physical scientists from developed countries. Emphasis on science as the primary source of authority is clearly evident in the *Plan*'s identification of "irrational systems of production" as a primary target of international desertification policy. Just as the colonial policies pointed to the ignorance and primitive practices of the African people, the *Plan of Action* implied that livelihood methods of affected populations were inferior to those based on modern science and technology. This interpretation gave substantial voice to developed country researchers and buttressed the authority of developed country perspectives. At the same time, it placed developing countries in the position of receivers, rather than providers of knowledge.

During the internationalist and pluralist eras, the voices and sources of authority in desertification politics broadened. UNEP, as a centralizing force in desertification policymaking was fading from the scene and desertification was seen as arising from "various factors" and "complex interactions." Though policymakers continued to consider scientific knowledge and experience in developed countries to be an important resource, they no longer viewed developed countries as harboring a potential panacea for the desertification problem. In recognizing, first, the standing of other nations, and, second, the diversity and intricacies in desertification processes, policymakers showed a new interest in the experiences of local populations and their interpretation of and approaches to land degradation. Interest in the local level, in particular, coincided with the introduction of new ideas and new voices into the policy debate.

6.1.2 *Institutional Inscriptions and Policy Prescriptions*

Causal models of desertification imply its remedies. For example, sources of degradation described as "irrational land use practices," or "complex interactions" implicitly prescribe response measures. The former formulation calls for "rationality," in the form of scientific investigation or, perhaps, capitalist, market-based behavior. The latter suggests that a singular solution would not be sufficient, but that a systemic or holistic approach could be effective. Often remedies for desertification reflected the priorities and capabilities of dominant institutions. As illustrated above, desertification discourses have provided means for both symbolizing institutional interests and capacity and inscribing them in policy.

In the 1930s, colonial administrations were eager to infuse their territories with European culture, commerce and modes of governance. Bilateral cooperation, however, was not a key part of this plan. These priorities were clearly evident in recommendations of the Anglo-French Forestry Commission. Commissioners rejected Stebbing's proposal for a transnational forest belt and instead endorsed adoption of European methods of permanent cultivation along with greater balance among natural resource departments. These prescriptions aligned with the imperial aspirations of the French and British governments and furthered their interest in maintaining balance in the natural world.

Remedies presented in the 1977 *Plan of Action* centered on "proximate solutions" based on the transfer of modern science and technology from developed countries to affected areas. This approach supported UNEP's role as a centralized agency directing desertification initiatives and heavily reliant on scientific expertise. The *Plan*'s policy prescriptions reflected a simplified vision of the problem and a linear causal model in which anthropogenic factors (namely, improper land use methods) constituted a primary and universal causal factor. Often such simplifications are favored because they enable expedient policy processes (Hoben, 1996). In de-emphasizing climatic factors and highlighting a need for greater infusion of modern scientific knowledge, the *Plan* portrayed desertification as a perfect focus for international policy. The causes and manifestations of desertification were consistent worldwide, while remedies for these causes were known, available and aligned with the goals and priorities of UNEP. Hence, the "narrowing of vision," and careful selection of reality reflected in modernist ideas about causation afforded control and manipulative ability to institutions in power (see Scott, 1998). In other words, the simplification of desertification processes seemed at first to make them manageable.

During the nationalist era UNEP was still the main agency in charge of UN-sponsored desertification initiatives, and land use methods remained an important target of international activities. However, UNEP assessments in 1990 and 1991 had begun to point out the limitations of modernist policies. In calling for an integrated approach to desertification and sustainable development, *Agenda 21* recommended greater attention to socio-economic factors and participation by local populations. Hence, international policies were beginning to reflect the interests and concerns, not of large agencies, but of affected populations.

As UNEP's role in international desertification politics began to fade, the Intergovernmental Negotiating Committee on Desertification developed a new response to the problem. The "bottom-up" approach, rather than reflecting the goals and capacities of a key agency or colonial empire, seemed to encompass the interests and concerns of local populations. The *Convention* did not set forth specific methods to combat desertification. Rather, it focused on processes for addressing desertification. A process-centered policy was perhaps the only meaningful way to recast the vision of desertification as non-linear, complex and arising from a diverse array of natural and ecological interactions. In spelling out some elements of this process the treaty promoted greater participation by women and local organizations, protection and utilization of indigenous knowledge and practices and a flexible, trial-and-error approach to policy design. In doing so, the *Convention* reflected the interests, tools and languages of local populations rather than those of UN agencies or developed country governments.

6.1.3 *Boundaries*

Just as causal models of desertification allocated power to some groups and not to others, discourses of causation and remediation helped to frame desertification as primarily a local or global problem and to define rules of participation. As part of these processes, causal models as expressed in policy debates and agreements at once reflected and erected boundaries. They delineated the nature and extent of the problem, while designating who was in and who was out of policy dialogues.

The work of Stebbing and the Commission reflected the distinct realms of colonists and Africans and the responsibilities of France and Britain. The colonists were the ultimate interpreters and articulators regarding the state of West Africa's environment and threats to its viability. In holding shifting cultivation responsible for land degradation in West Africa, colonial researchers talked *about* affected populations, but seldom with them. The Stebbing-Commission debate also reflected differing views regarding national boundaries of degradation. Stebbing as a proponent of progressive desiccation and advancing desert theories mapped French and British colonies as a single unit and called for transnational cooperation. The Commission, claiming to find no evidence for most of

Stebbing's claims, clearly demarcated the boundary separating these two colonies, and focused attention on local-national issues of agricultural practices and administrative coordination.

The *Plan of Action* portrayed desertification as a global problem. The universal nature of scientific discourses and their use in generalizing aspects of desertification processes were key to establishing desertification as an international policy issue. Desertification's framing as a global problem was considered legitimate, not only because of its physical extent, but also because of its simplified causal model. Irrational land use, for example, appeared as a singular, universal cause amenable to the universal laws of science and technology and the solutions they offered. However, the dialogue that gave rise to this interpretation of desertification was not universal. While it engaged policymakers worldwide, developed countries and developed country scientists tended to dominate discussions about problem diagnosis and policy prescription.

With *Agenda 21*, international desertification policy began to reflect new visions of desertification's global dimensions. In highlighting the "various factors" contributing to desertification, the agreement suggested that desertification could no longer fit a simplified causal model applicable in a number of different locations. While desertification remained global in terms of the need for developed country financial and technical assistance, its framing as a uniform problem worldwide was in flux and greater attention to local variability and complexity in desertification processes helped open the door to a wider array of participants.

In acknowledging the complexity and diversity of desertification processes, the *Convention* emphasized the local, pluralistic characteristics of desertification and invited affected populations to contribute to the policy debate and its realization in local settings. Thus, while desertification remained a "global" problem deserving of an international treaty, its global character changed. Modernist era policies portrayed desertification as arising from a singular cause operating worldwide. In contrast, the *Convention* described desertification as arising from complex interactions among cultural, ecological and economic factors, which varied from location to location. Previous agreements emphasized desertification's global extent and the uniformity in its causes and remedies.

In contrast, the *Convention* called for international partnerships in addressing the problem, but highlighted its variations across different settings. With this recognition of desertification as a locally contingent but globally distributed phenomenon, the boundaries that formerly excluded local perspectives from policy debates now encompassed them. As desertification came to be perceived as a complex process varying from location to location, it became important to learn from the experiences and knowledges of affected populations.

6.2 Improving Advisory Processes

Chapter 1 explained how the preceding account of desertification policymaking challenges conventional theoretical approaches to science and politics. Not surprisingly, this account also counters a number of assumptions underlying the practice of expert advice and international environmental policymaking. Received wisdom, for example, suggests that scientific knowledge and the creation of political order are or should be separate. Traditional perspectives also imply that "good" and credible knowledge automatically provides a pathway to more effective policy. In the desertification story we see that science and governance are unavoidably interdependent. Furthermore, decades of analysis and expert advice have, at times, done little to make highly complex natural-social problems tractable. When causal narratives are unclear and wide open to debate, convergence around a narrow set of problem framings and policy prescriptions (even after years of research and assessment) may be unlikely. In such cases, changes in prevailing perceptions of and approaches to the problem will be highly dependent on changes in broader governance systems and institutional contexts.

By revealing deficiencies in received wisdom about expert advice and global environmental politics, this analysis also points to some limitations in current evaluative methods. There are two general forms of critique regarding the creation of policy relevant science. One school of thought focuses on peer review as the means to ensure credible, robust knowledge. According to this approach, experts assess the soundness of one another's knowledge claims by subjecting attendant data, methods and modes of representation to scrutiny. If these practices adhere to logical empiricist notions of the scientific method (see Hiskes and Hiskes, 1986), the resulting scientific findings are deemed credible and worthy of trust. The second mode of critique emphasizes participation as important in influencing the reliability and acceptability of knowledge claims. According to this approach, the soundness and credibility of knowledge depends, in part, on who is represented during the process of knowledge creation.

The Intergovernmental Panel on Climate Change (IPCC, perhaps the largest and most comprehensive of all global environmental assessments) exemplifies both of the above-mentioned critical paradigms. Peer review, for example, is integral to the IPCC's operation as each of the chapters and reports the IPCC publishes are reviewed by a number of scientists. The second style of critique has significantly influenced the IPCC's membership. Establishing the equal representation of developed and developing countries, for example, has been an important goal and a substantial challenge for this institution. Such equity in membership is widely viewed by scientists and policymakers alike as important for ensuring the IPCC's credibility. So, in relying on traditional evaluative criteria, policymakers now recognize wide geographic representation and gender balance to be important for ensuring the legitimacy of expert advisory processes. On the whole, however, the composition, structure and mandate of expert institutions tend to reflect visions of scientific as unproblematic and capable of being settled by experts. In addition expert bodies tend to portray knowledge as comprising easily compartmentalized categories of actors whose methodologies and knowledge claims are largely dictated by nature, have little bearing on most political concerns, and ultimately carry societies ever closer to true knowledge and effective governance.

In questioning these assumptions we begin to see the shortcomings in conventional means for designing expert processes and mandates. We can also begin to move away from standardized expert forums and develop more appropriate and effective expert advisory processes that address the particular needs and challenges facing individual regimes. The discussion below uses examples from the desertification case and the Intergovernmental Panel on Climate Change to motivate several policy recommendations. These recommendations address three general ways in which processes for formulating international science policy could be made better: (1) by addressing the tendency of regime participants to label governance decisions as purely scientific considerations and to delegate these decisions to individuals or groups who operate outside of more democratic negotiating forums; (2) by suggesting ways in which scientists and policymakers can more explicitly and effectively attend to the practices and artifacts of science and their implications for participation and responsibility; (3) by recommending ways for improving upon what has in many cases become a standardized, default approach for designing expert advisory processes.

6.2.1 *Making Governance Decisions Explicit*

Prevailing approaches to science advice overlook the interdependence of scientific knowledge and policymaking and the ways in which knowledge production and representation both contribute to and are contingent upon problem framing, institutions and rules of participation. This dual characteristic of knowledge is evident in comparing desertification policymaking across different policy eras. Analysis of expert advisory processes, quantification and visual representations reveals that realms of activity we usually designate as "science" and "politics" are more deeply interdependent than many scholars and practitioners seem to recognize. Many activities that are assumed to be purely scientific in nature, have major implications for what sort of governance systems are put in place, who participates and has authority in these systems, and who is held responsible for causing and ameliorating environmental degradation. Similarly, the nature and resources of political institutions can have a tremendous bearing on how scientific knowledge is produced, disseminated and interpreted. Failure to recognize these science-policy relationships often results in the delegation of important governance decisions to autonomous agencies and administrative bodies. Consequently, regime participants writ large often lack the opportunity to scrutinize critical determinations underlying policy decisions. Such determinations concern who has authority to interpret a problem and who is responsible for causing and ameliorating that problem. Yet, when these issues are not aired in democratic forums they are more likely to become the focus of deconstructive and destabilizing efforts down the road.

Throughout the desertification story we see that decisions about knowledge are often decisions about policy and policymaking, and vice versa. During the 1970s and 1980s, for example, methods of quantification and visual representation helped to establish the local and global dimensions of dryland degradation and to legitimize the role of international agencies in helping to formulate and implement desertification policy. On the other hand, perceptions of desertification as a physical process of global extent reinforced the assumption that knowledge about desertification should derive from the natural sciences and should take the form of universal generalizations. During the 1980s, these expectations led UNEP to devote considerable resources to developing standard definitions of desertification and measuring its physical manifestations. Nelson (1990), for example, noted the considerable public and political pressures under which UNEP conducted its 1984 assessment. When the assessment did not meet widely-held standards of scientific soundness, the agency and the issue suffered under public scrutiny. Lessening reliance on scientific understandings of desertification accompanied changes in acceptable knowledge production and assessment practices. For example, participants in the Intergovernmental Negotiating Committee on Desertification (INCD) accepted a pluralistic (as opposed to a consensus-based) forum for *sharing* information and placed less emphasis on the need for quantitative measures and scientific representations of the desertification problem.

Yet, despite the seemingly evident interdependence of scientific knowledge and political order, people engaged in policymaking practice continue to view science and politics as separate activities. They also tend to assume that scientific activity does not impinge directly on questions of participation and responsibility. During the 1970s, for example, UNEP had considerable autonomy in constructing the nature of "expertise" and relationships linking experts and policymakers. UNEP authorized natural scientists to study the issue and they drew generalizations about the physical causes and manifestations of degradation. These generalizations, in turn, buttressed UNEP's framing of desertification as a global problem, in a way that conformed to the agency's goals and resources. Delegates at the United Nations Conference on Desertification wanted the *Plan of Action* to include greater attention to social dynamics and socio-economic factors.

However, UNEP's framing of the problem, was, at that point, so embedded in the *Plan*, that these interventions from country representatives had little effect on the final policy. Ultimately the credibility of UNEP's approach to desertification came under question. Countries in a position to ameliorate land degradation did not exhibit widespread support for anti-desertification initiatives.

In the 1990s, the Desertification Secretariat, like UNEP in previous years, made important governance decisions by way of decisions about knowledge dissemination and expert advice. The Secretariat, for example, promoted the participation of new types of experts in the policy process and helped to legitimize categories of local and traditional knowledge. These activities allowed new voices to enter policy debates. They also helped to portray affected populations as embodying desertification solutions, rather than desertification sources. While the International Panel of Experts (appointed by the Secretariat) included a wider array of natural and social science disciplines than had earlier assessment activities, this panel, as managed by the Secretariat, played a relatively minor role in the negotiation process. In contrast, non-governmental organizations, supported, in part, by the Secretariat, played an important role in knowledge sharing processes. This new conception of expertise accompanied a decentralized approach to desertification policy and increased attention to "local knowledge." Greater attention to indigenous insights and practices suggested that the people who had for so long received the blame for dryland degradation, now harbored its remedy.

While the *Convention's* bottom-up policy approach appears stable at present, the regime may face tougher challenges as participants attempt to link local, disconnected anti-desertification programs with an international, centralized institutional framework as embodied by the Conference of Parties. The regime might face other difficulties in attempting to define "local knowledge" and mobilize its use and dissemination through international channels. Regardless of whether the *Convention* proves to be a success or not, the process by which it was created was problematic. Important determinations regarding governance and participation were framed as questions concerning science and expertise, and were not aired in a transparent open way in democratic negotiating forums. Consequently, these decisions are more susceptible to backlash and deconstruction because they were not developed through consensus-based processes involving a broader array of regime participants.

These examples suggest that when questions about the definition of expert and expert methodologies are addressed behind closed doors there is greater potential for credibility crises. These crises can eventually destabilize the dominant framing of an issue and attendant institutional frameworks aimed at translating this vision into policy action. While destabilization of a regime may be favorable or unfavorable based on a given set of normative convictions, repeated deconstruction and reframing of an issue and its institutional context (without ameliorating the problem) constitutes a waste of valuable resources and generally undermines efforts to prevent and remedy environmental degradation.

How can environmental regimes avoid the backlash that the desertification arena has experienced over the past several decades? A first step is to develop processes and procedures, which make apparent some of the political implications of presumably scientific issues and enable regime participants to recognize and act upon the reality that expert knowledge and its relationship to policymaking will -- and *should* -- differ to some extent with every environmental issue. As such, determinations regarding the meaning of "expert," the composition and organization of expert institutions and expert interactions with policymaking forums should be revisited anew in the context of each new regime and periodically reassessed throughout the process of regime formation. More specific suggestions for new processes and institutional mechanisms appear below.

6.2.2 *Defining Expertise and Designing Expert Forums*

Practices and Artifacts Matter

Many participants and observers concerned with international environmental politics operate under the assumption that more science will automatically mean "better" international agreements. As evidenced by the United Nations Conference on Desertification, this assumption shapes the allocation of resources and the structure of science and policymaking activities. However, calls for more science and analysis seldom acknowledge how means for producing and communicating knowledge impinge on problem definitions, policy remedies and institutional design. Science, regardless of the way it is carried out or represented, is generally equated with progress. As a brief example, *Agenda 21*, Chapter 35 "Science for Sustainable Development," calls for more specialists in a variety of disciplines worldwide (UNCED, 1992). *Agenda 21* along with an Agenda of Science for Environment and Development in the 21st Century (ASCEND), an international conference held in 1991, called for improved understanding of the environment via comprehensive scientific assessments and monitoring (Marton-Lefevre, 1994). These documents pay little attention to the various types of knowledge about the global environment and the different ways it can be developed and represented.

Lack of detail regarding practices and artifacts implies that decisions about how science is conducted and represented are unproblematic and more dependent on the ecology of the problem at hand than on the social institutions and political interactions from which they emerge. However, analysis of desertification maps and statistics suggest that methods of scientific analysis have had important implications for voice and agency in processes of policy formation. Similarly, the use of general circulation models in climate change assessments have been important in establishing emission reduction strategies as the primary focus of climate change policy. Failure to recognize such relationships between scientific methods and policy prescriptions obscures a number of important decisions.

Disciplinary Knowledge Categories May Not be the Most Relevant or Useful

In the desertification case, scientists and policymakers tended to assume that decisions about what types of knowledge and how it should be organized are self-evident. Expert assessments of desertification since the 1970s, for example, have been organized according to disciplinary boundaries and widely-recognized sectors. In preparation for the 1977 Conference, UNEP asked four small expert groups to write about the climatological, ecological, social and technological aspects of the problem. In the early 1990s, the Desertification Secretariat selected and organized the International Panel of Experts according to similar categorizations. In both cases there was little, if any, discussion about whether this formulation for expert representation made sense and would provide the most meaningful knowledge for policymaking purposes. Aside from case studies prepared for various locations, for example, there was no attempt to synthesize knowledge about desertification at regional levels. Because UNEP so readily adopted a default approach to expert organization, there was no opportunity to consider other options that might have provided more useful ways of understanding desertification..

The organization of the IPCC also exemplifies potential shortcomings of default organizational schemes. This massive assessment enterprise (whose membership numbers in the thousands) consists of three working groups focused respectively on the science of climate change, socioeconomic impacts of climate change and response strategies, respectively. The IPCC's structure mimics prevailing notions of global warming processes whereby emissions lead to temperature rise, which manifests itself in various ecological, social and economic changes that require human intervention. Hence, IPCC creators assumed that the causal narrative ascribed to climate change, in addition to describing environmental processes, should also dictate forums and processes for expert advice. Implicit in the IPCC's structure is the assumption that the perceived pathway leading from the source of degradation, to impacts, to responses should provide a framework for organizing this expert institution. Working Group I involves mainly climatologists and other physical scientists. Working Group II includes a broader array of experts concerned with ecological and social processes. Working Group III relies heavily on the expertise of economists. Regime participants, however, are now sensing the limitations of this cause-effect organization scheme for expert knowledge. While this scheme might have made sense during the early stages of regime formation, the IPCC is now considering reconfiguring its assessment process to reflect regional groupings. These groupings, it is hoped, will provide knowledge more directly relevant to policymaking.

Knowledge is not Monolithic

The tendency to view science as a uniform activity, independent of context and purpose, hinders efforts to develop more nuanced understandings of expert knowledge and international environmental policymaking. Participants in the Intergovernmental Negotiating Committee on Desertification (INCD) had a more pluralistic view of knowledge than their predecessors. The INCD process involved a wide array of knowledge providers, and delegates authorized a multidisciplinary roster of experts and acknowledged alternative forms and sources of knowledge. The *Convention* identified non-governmental organizations as possessing valuable expertise. It also emphasized the importance of local and traditional categories of knowledge.

But while the treaty reflects greater awareness of different forms of knowledge, they remain for the most part as taken-for-granted categories. Little discussion has ensued over the various assessment methods (e.g., development of desertification benchmarks and indicators) and their implications for problem framing and participation. Similarly, local knowledge though widely noted to be a bedrock feature of policy implementation has yet to be defined. Local knowledge remains even more elusive than the black-boxed concept of science. The program of work for the Committee on Science and Technology calls for development of an inventory of traditional and local technology, knowledge, know how and practices (A/AC.241/66). Perhaps this will provide a more comprehensive understanding of local knowledge. Interestingly, however, this inventory implicitly attempts to standardize and generalize various forms of local knowledge so they can be transported across geographic and cultural boundaries – thereby rendering local knowledge paradoxically non-local. These potentially important implications of the inventory, however, have not received attention during ongoing implementation activities. Consequently, they may prove problematic as regime participants attempt to operationalize the vaguely-defined concept of local knowledge.

Expert Forums

While it is too early to judge the efficacy of the new desertification regime, we can in some respects compare the *Plan of Action* and the *Convention* five years into their respective implementation phases.[148] Such a comparison suggests that the *Convention*'s more democratic approach to knowledge production and dissemination may be facilitating a more stable policy enterprise. Five years after UNCOD, anthropologist and UNEP consultant Brian Spooner criticized the 1977 Conference for what he viewed as an undue emphasis on the ecological aspects of desertification. He believed that this ecological focus detracted from the issue's varied and important social dimensions (Spooner and Mann, 1982). As discussed in Chapter 3, Spooner's commentary was just the first of many criticisms identifying what the *Plan of Action* and UNEP had omitted or overlooked in their analyses.

In contrast, the INCD process de-emphasized modern science and did not share UNEP's penchant for generalizing about the physical aspects of desertification. Instead, the delegates, the Secretariat, and other participants highlighted desertification's complexity and variability across local settings. The INCD also facilitated the participation of alternative experts in forums to share knowledge and develop policy proposals. While some participants lamented what they saw as a lack of scientific support for the negotiations (e.g., Kassas, 1995), the regime seems to be progressing without the prospect of a major credibility crises looming over the horizon. Hence, the INCD's democratic approach to expert knowledge appears to have generated a more stable framing of the desertification issue and more widely accepted policy prescriptions. As regimes for biodiversity and climate change focus increasingly on implementation and contend with ecological, social, economic and cultural variability at more local levels, they may find that the democratic approach to knowledge under development in the desertification arena offers valuable lessons.

Recommendations

There are a number of ways in which participants in international environmental regimes can more directly and effectively address questions of knowledge and governance. A first step requires that decisions regarding expertise, scientific methods and expert forums become more transparent in negotiating forums and undergo reevaluation throughout

[148] It is important to keep in mind that the PACD was a negotiated policy statement, while the *Convention* is

regime development. In general, members of the regime should address questions such as: how is science relevant to the policy questions at hand? What types of specialized knowledge are needed? Who should provide this knowledge? And, how should this knowledge be communicated? In addressing the first question, regime participants may collectively determine the types of expertise that they will call upon to inform negotiations. Specialized knowledge could be legal or climatological or could pertain to farming practices in a particular location. The second question raises issues about the authorization of particular knowledge providers, whether they are agency officials, non-governmental organizations, or natural and social scientists. The question of communication calls attention to preferred modes of representation, whether they are numeric, pictorial or verbal. As illustrated in the preceding analysis, decisions about what knowledge is represented and how it is represented in international policy forums have important implications for problem framing and participation.

At present these questions are seldom made explicit in political debate. More often administrative bodies take up these issues in carrying out their mandates, generally with little reflection regarding the interdependence of science and politics. Hence, new processes or institutional mechanisms may be necessary in order to introduce these decisions into broader decisionmaking forums and to make them a more routinized facet of international environmental policymaking. For example, in making resolutions on expert advice the United Nations General Assembly and Conference of Parties for various treaty regimes might begin by addressing a similar set of questions. Alternatively, the Conference of Parties might designate some of their members to comprise a committee to serve as a "watchdog" to flag knowledge-policy issues and ensure they receive full consideration. Such practices should take into account not only what countries participate in assessment activities, but also what types of experts participate and how they produce knowledge.

In addition to revising means for authorizing expertise, participants in international environmental regimes should rethink the design of expert advisory panels and processes and relationships linking experts and policymakers. Institutional

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a legally-binding treaty.

mechanisms for scientific and technological advice have become an automatic, standardized feature of international environmental regimes. People who participate in the design of such advisory bodies tend to assume that scientific expertise constitutes the only, or at least the most important, form of specialized knowledge. Treaties for climate change, biodiversity loss and desertification, for example, all call for the creation of panels and committees to handle technical issues. In considering the composition and organization of advisory panels participants in these regimes often fall back on a default formulation. They are primarily concerned, for example, with ensuring geographic diversity or national representation of panel members and often organize these bodies according to disciplinary specialties or sectors such as water resources, forestry, and agriculture. Generally, expert panels are separated from decisionmaking bodies. Advisory activities precede policy deliberations and written reports provide the main form of communication between expert and non-expert realms. Despite its widespread use, this approach to expert advice is unlikely to be advantageous for all issue areas and policymaking settings. Yet, in adopting this standard approach, regime participants seldom reflect critically on the meaning of "expert" and on which modes of expert-policymaker communication are optimal for a given regime.

It follows from this dissertation's argument, there is no "right" way to structure advisory processes. However, international regimes can incorporate procedures for encouraging greater reflexivity in regard to the design and functioning of expert advisory mechanisms. Instead of adopting a single standard scheme for all expert advisory processes, regime participants should consider the nature of expert forums in light of the particular issues the regime addresses. Questions that could guide the design of expert advisory processes include: what forums for expert deliberations (e.g., open, conference-like seminars or closed-door expert panels) would be most useful in addressing the policy questions at hand; what criteria should policymakers employ in selecting experts to participate in the regime (e.g., academic credentials, experience, familiarity with local conditions); how should experts and policymakers interact and communicate; and how (if at all) should expert deliberations intersect with policymaker deliberations? In answering these questions, policymakers and administrators will be in a better position to tailor advice and advisory forums to meet the particular needs of regime participants. By revisiting these questions periodically throughout regime development, regime participants can revise expert advisory processes accordingly and ensure that they meet the changing needs of the regime.

APPENDIX A

Members of the International Panel of Experts on Desertification (IPED)

1) Teresa Mendizabal Aracama, Spanish Council for Scientific Research, Spain.

2) Robert Balling, Director, Office of Climatology, Arizona State University, USA.

3) Stein W. Bie, Norwegian Center for International Agricultural Development, Norway.

4) Bert Bolin, Chairman, Intergovernmental Panel on Climate Change (WMO), Geneva.

5) Moulaye Diallo, Conseiller Techinique, Ministère du Developpement Rural de l'Environnement, Mali.

6) L. N. Harsh, Central Arid Zone Research Institute, India.

7) Mohammed Adel Hentati, Ministère de l'Environnement et de l'Aménagement du Territoire, Tunisia.

8) A.M. A. Imevbore, Director, Institute of Ecology, Obaferni Awolowo University of Nigeria.

9) Hiroshi Kadomura, Department of Geography, Tokyo Metropolitan University, Japan.

10) Nikolai G. Kharin, Desert Research Institute, Turkmenistan.

11) Wang Lixian, President, Faculty of Water and Soil Conservation, Beijing Forestry University, China.

12) H. N. Le Houerou, Centre d'Ecologie Fonctionelle et Evolutive, Centre National de la Recherche Scientifique, France.

13) Seeiso D. Liphuko, Executive Secretary, Ministry of Local Government, Land and Housing, Botswana.

14) Youba Sokona, Environnement et Developpement du Tiers Monde (ENDA), Senegal.

15) Brigitte Thébaud, Rural Economist, Canada.

16) Camilla Toulmin, International Institute for Environment and Development (IIED), UK.

17) Carlos Weber, Corporation Nacional Forestal, Chile.

APPENDIX B

Interviews

Interviews were conducted between November 1995 and January 1999. Two interviewees requested that their names not appear in the text. These individuals are referenced according to their position in regard to desertification negotiations and assessment activities (e.g., IPED Member or Secretariat Staff).

Of course it was not possible to interview scientists and colonial administrators who worked in the French and British colonies of West Africa during the 1920s and 1930s. Fortunately many of their writings relay a strong sense of their personal convictions on a variety of issues relevant to this research. Wherever possible I rely on excerpts from these writings to give voice to their authors.

Each of the interviews listed below informed the thesis. Some, but not all, of the interviews are specifically cited or quoted in the text.

Robert Balling, IPED Member, Consultant to UNEP and WMO; Professor of Climatology, Arizona State University, USA, interviewed November 3, 1995.

Avard Bishop, Legal Advisor to the Desertification Secretariat, interviewed February 10, 1997.

Sálvaño Briceno, Desertification Secretariat, interviewed February 11, 1997.

Ann Carey, United States Delegate to the International Negotiating Committee on Desertification; Special Assistant for Strategic and Natural Resources Issues, United States Department of Agriculture, Natural Resources Conservation Service, interviewed March 5, 1998.

Harold Dregne, UNEP Consultant on Desertification during the 1970s and 1980s; Professor of Soil Science, Texas Tech University, USA, interviewed November 8, 1995 and March 8, 1998.

Michael Hulme, UNEP Consultant during the late 1980s and early 1990s; Climatic Research Unit, University of East Anglia, UK, interviewed May 13, 1998.

IPED Member 1, interviewed May 12, 1998.

IPED Member 2, interviewed May 13, 1998.

Douglas Johnson, UNEP Consultant for the United Nations Conference on Desertification; Professor of Geography, Clark University, interviewed June 29, 1998.

Beaumont McClure, Delegate to the International Negotiating Committee on Desertification; Special Assistant for International Programs, United States Bureau of Land Management, interviewed January 7, 1997.

Michael Mortimore, Senior Research Associate, Department of Geography, University of Cambridge University, UK, interviewed May 14, 1998.

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Per Ryden, International Union for the Conservation of Nature, interviewed May 13, 1998.

Ian Scoones, Agricultural Ecologist, Fellow of the Institute for Development Studies, University of Sussex, UK, interviewed May 17, 1998.

Brian Spooner, UNEP Consultant on Desertification during the 1970s and 1980s; Department of Anthropology, University of Pennsylvania, USA, interviewed March 17, 1998.

Jeremy Swift, UNEP Advisor during the 1980s; Development Economist and Fellow of the Institute for Development Studies, University of Sussex, UK, interviewed May 17, 1998.

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