

TOWARD A SHIFTING INHABITATION  
*KAHO'OLAWA, HAWAII*

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Bachelor of Arts in English  
Williams College, 2000

Submitted to the Department of Architecture in partial fulfillment  
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at the  
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Author \_\_\_\_\_

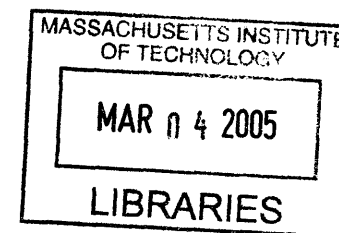
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January 14, 2005

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**ROTCH**

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*and my classmates, who could make any trauma worthwhile, with trips to the lunch trucks, computer advice, island expertise, giddiness, gossip, and more...*

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**ABSTRACT**

The island of Kaho'olawe is a desert island in the Romantic sense: it is unapproachable and un-settle-able, yet always an object of desire. Waterless, used for military target practice, cleaned up, and being replanted, the island requires an architecture that acknowledges and aids the continual re-making of the site.

This project is an infrastructure -- physical and programmatic -- for connection and access to Kaho'olawe; in certain locations, the infrastructure manifests itself as architectural gestures, shelters for people who come to the island.

The infrastructure is for people and plants, inscribing continual change on different scales of time and space.

The architecture consciously makes and records traces, and the traces in turn are remade by subsequent visitors and re-arrangements of the architecture.

Thesis Advisor: J. Meejin Yoon  
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I began my thesis project by falling in unrequited love with a site. The island of Kaho'olawe is a desert island in the Romantic sense: it is unapproachable and un-settle-able, yet always an object of desire. Waterless, used for military target practice, cleaned up, and being replanted, the island requires an architecture that acknowledges and aids the continual re-making of the site.

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***what has it been, where is it going***

In myth and history, Kaho'olawe figures as both an underdog and a place of magic and power. Over the years it had little or no fresh water, but abundant supplies of fish and quarries for adzes, sustaining a small permanent population of Hawaiians. The island was an important site for religious ceremonies and navigation, and it still contains a wide range of comparatively undisturbed archaeological sites.

Kaho'olawe itself could be viewed as a screen, onto which is projected various desires: source of fish and adzes, place for goats to multiply, center of navigation, shelter from shipwreck, ranch, military practice target. Now, Kaho'olawe is cocooned by enough history, bureaucracy, and public sentiment to ensure that it will never be developed as the other Hawaiian island have been – no resorts, offices, highways or housing tracts. **That “it will not be permanently inhabited” is taken as a given.**



The most recent desire projected onto Kaho'olawe is that it be remade as an unspoiled Eden, a protected place returned to native vegetation and culture. Yet

**this desire does not fully imagine the future roles of people as caretakers and visitors, or acknowledge the powerful allure of seeing and dreaming of an uninhabited island.**

And many desires Kaho'olawe has hosted have been damaging, and the screen is inevitably marked by past images and desires; it is scarred.



***how do people approach the  
unapproachable, settle the unsettlable***

As plants begin to colonize a blank lava flow, adapting themselves and the landscape, so people begin to re-inhabit a land. A human presence is inevitable and necessary on Kaho'olawe – restoration ecology requires many experts and volunteers, the movement of large amounts of plant matter and equipment, water supply systems, and so forth.

**It is a question of *how* humans insert themselves into natural processes; *how* to facilitate a constant effacement of their presence, even as humans re-make the island.**

*Roland Barthes liked to use the story of the Argonauts, ordered by the Gods to complete their long journey in one and the same ship – the Argo – against the certainty of the boat's gradual deterioration. Over the course of the voyage the Argonauts slowly replaced each piece of the ship, 'so that they ended with an entirely new ship, without having to alter either its name or its form.*

*This ship Argo is highly useful. It affords the allegory of an eminently structural object, created not by genius, inspiration, determination, evolution, but by two modest actions (which cannot be caught up in any mystique of creation): substitution (one part replaces another, as in a paradigm) and nomination (the name is in no way linked to the stability of the parts: by dint of combinations made within one and the same name, nothing is left of the origin: Argo is an object with no other cause than its name, with no other identity than its form.<sup>1</sup>*

As the island is restored, it hosts increasing numbers of visitors and plants. Both populations are ephemeral, and both are temporal, in that population numbers remain the same or increase, but are always made up of a different mix of bodies. In this view of the island, human presence is not so much about impermanency as it is about rotation, and continual change – and how this movement is enabled. Embedded in this question are issues of time, for the movement is tied to time on various scales: volunteers and students experience and move about the island in different ways; pili grass grows more quickly than a wiliwili tree, and disperses itself more widely.



**against permanence;  
for a conscious un-inhabitation**

The shelters become whimsical-practical exaggerations of responses to ecological needs. In an age of environmentalism, the shelters take on a didactic role, yet they are also bizarre in their adaptation to the land (how can a building on a desert island not be bizarre?), located as they are in an ambivalent zone between building and landscape, or, more accurately, between building and the bandages on an all-but-destroyed landscape.

The architecture consciously makes and records traces, and the traces in turn are remade by subsequent visitors and re-arrangements of the architecture. Embedded in this mode of operation

**is using the way things  
are planted and planned  
to prevent permanent  
inhabitation.**

**catching**

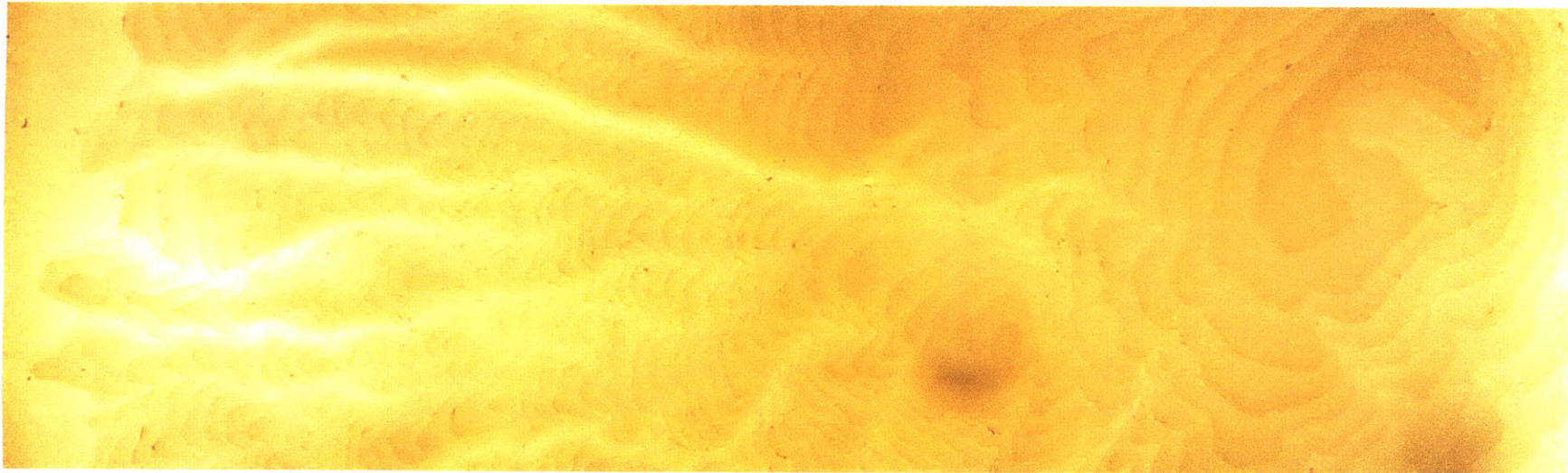
*Continental islands serve as a reminder that the sea is on top of the earth, taking advantage of the slightest sagging in the highest structures; oceanic islands, that the earth is still there, under the sea, gathering its strength to punch through to the surface. We can assume that these elements are in constant strife, displaying a repulsion for one another. In this we find nothing to reassure us. Also, that an island is deserted must appear philosophically normal to us. Humans cannot live, nor live in security, unless they assume that the active struggle between earth and water is over, or at least contained.... They must somehow persuade themselves that a struggle of this kind does not exist, or that it has somehow ended. In one way or another, the very existence of islands is the negation of this point of view, of this effort, this conviction. <sup>2</sup>*

-- Deleuze

Deleuze's recognition of the conflict between the sea and the earth is a goad to begin to understand the importance of working within the dynamic air-water-land interactions happening on Kaho'olawe. These interactions create and destroy – the sea wears at the land, storms scour the ground and pour red dirt into the sea, gentle rains nurture plants which in turn keep the ground from washing away.



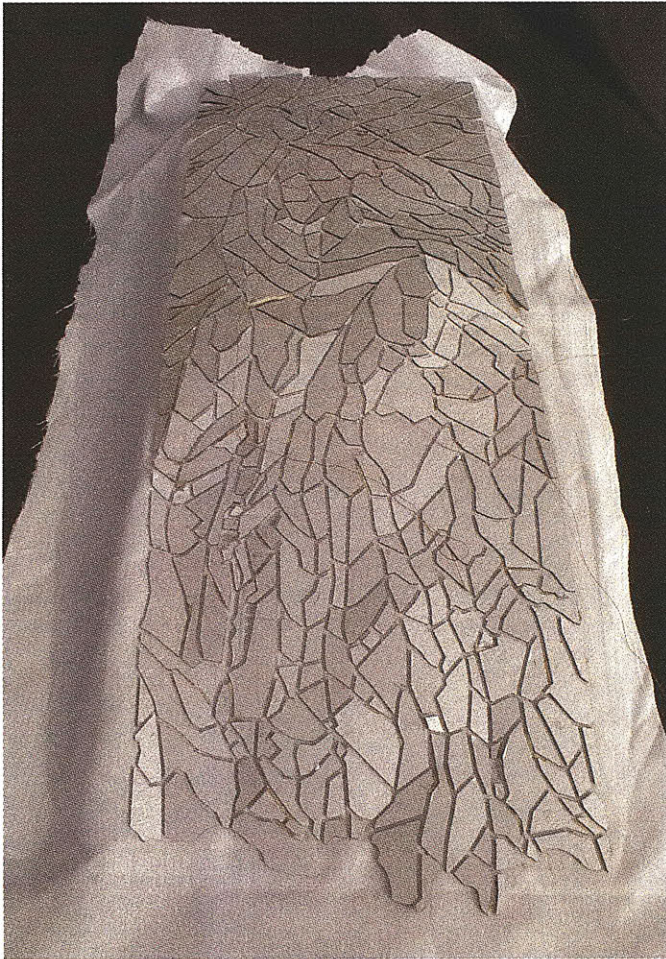
In restoration ecology work on Kaho'olawe, growing-soil is precious and fresh water is precious. **The pervading impulse is to catch:** to catch rainwater for plants and people, to catch earth so it is not washed away, to catch fog from the air and condense it into fresh water. The rain-catching, earth-catching, and fog-catching are all intimately tied to water and the land. These catching actions are also tied to a certain play with distances, a collapsing of distance: far-away things become close or tangible.



## **visible/invisible**

*The surface in landscape is more particular than the abstract surfaces currently proliferating in architectural design. These folded or warped surfaces [usually computer generated] are thin and immaterial – ephemeral scrimms of data. The surface in landscape, on the other hand, is always distinguished by its material or performative characteristics. Or, to be more precise, its performative characteristics are the direct result of its material characteristics. Slope, hardness or softness, permeability, depth, or soil chemistry are all variables that influence the behavior of surfaces.<sup>3</sup>*

– Stan Allen



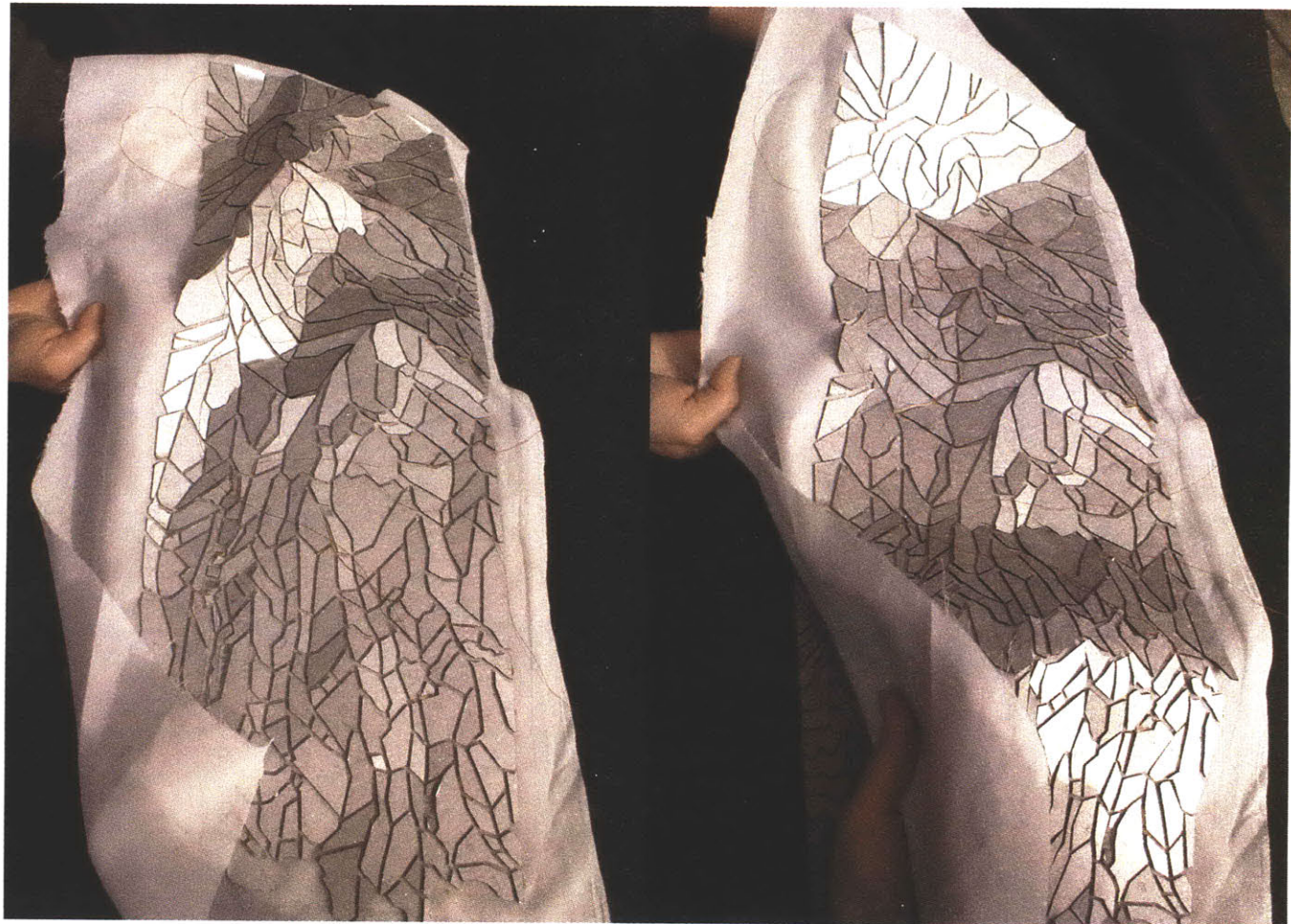
While it is tempting to read this and idealize landscape as more truthful than architecture, it is perhaps more useful to be inspired by the notion that simple shelters can gain richness when they enter into the performative actions of the landscape. In this way, the experience of accessing Kaho'olawe is also enriched.

Permanence is inhibited when land and building shift between visibility and invisibility. The quality of visibility can be determined by natural forces, and air-water-land interactions. When mist forms and collects on rocks, lichens result; the invisible water in the air has been transformed to visible dew, used by plants. The Kamohio shrine on Kaho'olawe was discovered and excavated on a 1913 archaeological expedition, only to be buried by a rockfall; shortly after the military stopped bombing Kaho'olawe in 1990, the cave was looted – other archaeological sites have been exposed by the massive amounts of erosion on the island.<sup>4</sup> Spatial arrangements also affect the play between invisible and visible: it is Kaho'olawe's location, hidden in Maui's rain shadow and scoured by a wind tunnel that has kept it bare in comparison to the other Hawaiian islands. Erosion happens when wind or water interacts with the land, and it results in dispersal and re-accretion of sediment.



Inserting a building into the play of natural forces can make that building visible/invisible.

In the larger scale of this project, issues center on the struggles and interactions between land and water; in the small moments, it becomes a question of how these interactions are manifest. Thus, catchers are linked with shelters, making magnified sites of human intervention into the landscape. Dealing with natural forces is balanced by what pieces of program are specifically designed to accomplish. These small-scale moments are linked by the movements and needs of plants and people. Within the larger goal of the rehabilitation of an island, these interventions are a first step: purposely bizarre and provocative.



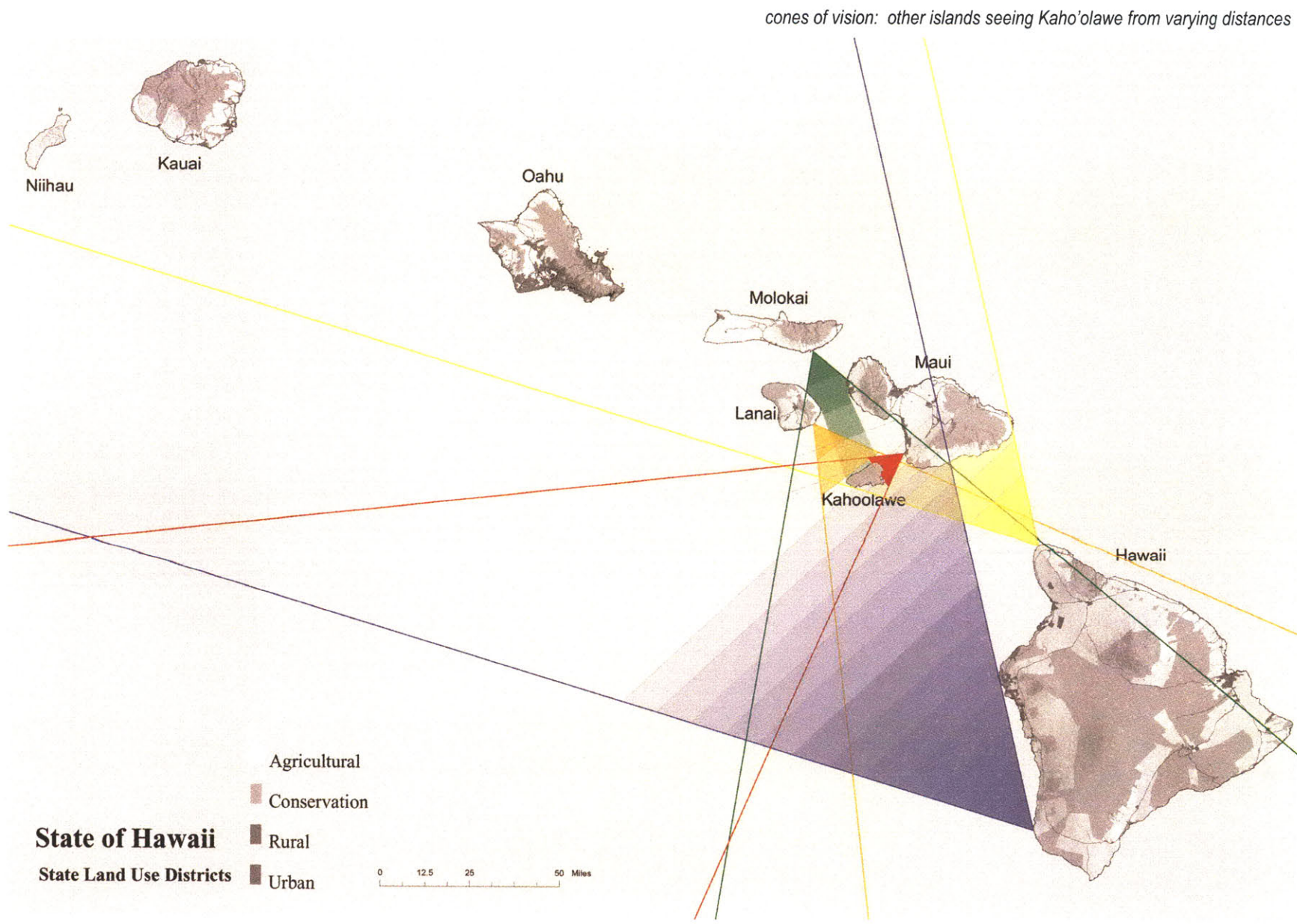
*flowplane model:  
Flowplanes are like tiny watersheds  
within watersheds: all the water in a  
flowplane goes toward one direction.  
Made into a cloth, the flowplanes can  
be draped over a site model, studied,  
and re-arranged.*

## A SHORT HISTORY OF KAHO'OLAWE

If you ask someone from Hawaii about Kaho'olawe, they know that it is the island that was bombed by the military for target practice. They probably know that the bombing stopped in 1990, after years of activism in Hawaii. And then they'll say, "But you can't go there, can you?" No commercial flights go to Kaho'olawe; flying over on the way to the Big Island, you see a red island with dramatic sea cliffs and no buildings; boats are prohibited to approach; the only way to get there is through one of the two organizations who care for the Kaho'olawe and organize monthly volunteer trips. Though Kaho'olawe's accessibility is little-known to the general public, it is an open secret, with a dedicated core of volunteers and activists who go to the island often. With the cleanup of unexploded ordnance largely complete, and the military's formal return of Kaho'olawe to the state of Hawaii in November 2003, the numbers of people going to the island for Hawaiian cultural activities and volunteer restoration work will increase.







## mythology

A complex and contradictory mythology surrounds the origin of the Hawaiian Islands; in the mythologies, Kaho'olawe is mentioned several different ways, but it is always the underdog island in some way. Kaho'olawe had four names – it meant “to take and to embrace,” or it was Kohemalamalama, “to your left and lit up;” and it was Kanaloa, named for the great god of sea and wind bringing both good and ill; once it was called Hineli'i, after the light rains.<sup>5</sup>

Maui and Kanaloa were born of Papa and Wakea. After the birth of Kanaloa, Papa returned to Tahiti. So Molokai and Lanai were born of Wakea and a different mother. Half-siblings, circling a shallow bay.

No: all the islands had the same parentage, all but Kaho'olawe, who was born of Hina and Wakea.

Or: It was Keaukanai who married Walinu'u, the sacred albino, and Kaho'olawe was born a foundling of low stature. She cut herself from the newborn, but the navel string Molokini remains, connecting mother and child nevertheless.

But some say it was because of Pele the goddess of the volcano, who saw her rival in love, the mo'o Pu'uoinaina, stretching long and unguardedly from Kaho'olawe to Makena on Maui, and cut that mo'o in two, right in the middle. The head became Molokini, the tail is Pu'uola'i at Makena.<sup>6</sup>

The Western explorers, looking in at the island, saw new mythologies and interpretations. They called the island, variously,

Tahowrowe Ta'oorowa Tah'hoo'row'a Ca  
how ra we Tohowrowa Tahourowe Taouroe  
Taurabe Tahoorowa Tahourahah Tahooraha  
Taourae Ta-hu-ra-we KA-HAU-RA-WE  
Kahurawe

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1779.: Captain King (Cook voyage): "Tahowrowe, the Wtern part of which we saw look'd very desolate, neither houses, trees, nor any cultivation that we saw: It is of a mod height, & has a sandy appearance..." "...it has no wood on it; seems a sandy poor soil, & is altogether a poor Island..."

1792: Captain Vancouver: "Rannai and Tohowrowa, which had formerly been confidered as fruitful and populous iflands, were nearly overrun with weeds, and exhausted of their inhabitants..."

1819: Jacques Arago (Freycinet expedition): "Who, then, has touched this ground barren of any greenery, who then has tried to scale these formidable ramparts on which the waves thunder and crash with such violence? No one. And yet the long and perilous reefs surround Taouroe, as if the crags had to fear the conquest of man, as if they wanted to defend themselves against all greediness the wealth that is hidden perhaps in its sides. Taouroe will be eternally uninhabited, for life there is impossible..."<sup>7</sup>



Looking at an island from the sea and looking out from an island: thinking about an island requires a constant flipping, an oscillation of perspective. There is a constant uncertainty. The form-making gesture for non-inhabitation requires this inside-out viewpoint, and consciousness of the strangeness of that viewpoint, knowing it is always subject to reversal.

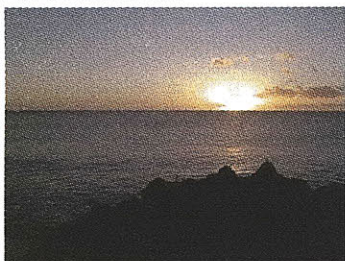




Kaho'olawe is rich with archaeological sites, including many temples (*heiau*) and fishing shrines (*ko'a*), and petroglyphs. The survival of so many sites is partly due to the inaccessibility of the island during the military period – though the bombing damaged significant areas as well, especially Pu'u Mo'iwi, site of the second-largest adz quarry in the islands. On Pu'u Moaulaiki and Pu'u Moaulanui were religious sites where students from all over Hawaii were trained in the art of celestial navigation. Navigators used knowledge of the stars, winds, and currents to sail the vast ocean between Hawaii, Tahiti, and other Pacific islands. Due to a favorable convergence of conditions, leaving from Kaho'olawe cut a few days from the trip to Tahiti.



Pu'u Moaulaiki  
Lae o Kealaikahiki



*Flood tidal currents follow the patterns of the prevailing trade wind currents, diverging around the eastern end of the island and converging off the southwest coast at Lae o Kealaikahiki. At ebb tide the direction of the tidal current reverses, although the net effect due to the over-riding importance of the wind-driven surface current is flow southward along the coast. This prevailing offshore water flow pattern at the western tip of the island favored the start of long voyages to the south by ancient Hawaiians and thus was called "The Way to Tahiti".<sup>8</sup>*

Hawaiians used the island for fishing and foraging, and for a time a sizable population farmed the island, using water catchments and brackish springs. However, those water resources were never stable, and Kaho'olawe was the least fertile of the islands, and by the time Western explorers visited Hawaii there were only a few inhabitants on Kaho'olawe.

In 1793, Captain Vancouver gave Kahekili, chief of Maui, a gift of goats, which he sent to Kaho'olawe to multiply. Multiply they did, all-too-successfully, eating most of the vegetation on the island, as erosion became a major ecological problem. Over the next two hundred years, the goats were hunted, trapped, and shot from helicopters; private ranchers and the military contracted to rid the island of them, without success until the last goat was finally killed in 1992. (One suggestion was to send tigers to the island, until it was realized that tigers could swim.)

Kaho'olawe housed a penal colony between 1825 and 1853. The twentieth century saw several suggestions to establish a prison on Kaho'olawe. There were also ill-fated honey and pineapple enterprises.



*Kamohio Shrine*



*Pu'u Mo'iwi adz quarry - lithic scatter*

*rock walls, Kuheia*



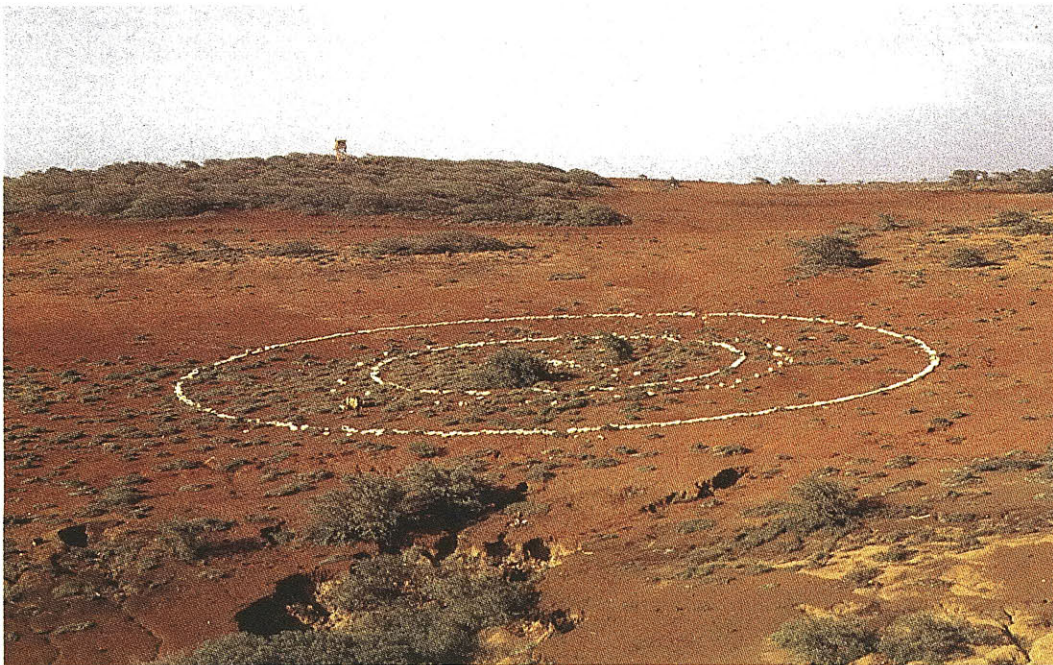
*The crime of murder was punishable by death; theft and adultery by exile, the men being sent to Kaho'olawe and the women to Lanai. ...In those days much trouble existed among the exiles for want of food....At this critical time they considered what course to pursue and decided to swim [seven miles] over to Maui, for life or death. ...Fifteen of the number, good swimmers, were chosen for the venturesome trip... Near Makena...they set out for the potato patches and gathered a quantity in bundles, making three trips nightly for three nights. They then appropriated several canoes for their needs and loading them they returned to Kahooolawe... They afterwards went over to Lae-o-kaena, Lanai, and brought all the women to Kahooolawe to share their solitude.<sup>9</sup>*



### ***the ranch period***

*Repeated attempts were made to establish ranches on the island. In the period between 1858 and 1910 leases were let and transferred to various politicians, businessmen, and ranchers. The ranching activities were not only unsuccessful, but markedly contributed to Kaho'olawe's deterioration. In an effort to end the devastation caused by grazing animals, the island was proclaimed a Territorial Forest Reserve in 1910.<sup>10</sup>*

In the 1890s, Kaho'olawe was used as a way station for opium smugglers operating between China and Hawaii. A two-and-a-half-ton cache of opium was allegedly secreted on the island, and never found.



target

### ***the military period***

With the Japanese attack on Pearl Harbor, Hawaii, in 1941, the military took over Kaho'olawe for use in training for air and sea attacks, and marine landings.

*Kaho'olawe became the most shot-at island in the Pacific; more ammunition was poured into its barren sides than either Iwo or Okinawa, where naval gunfire in the Pacific reached its peak.<sup>11</sup>*

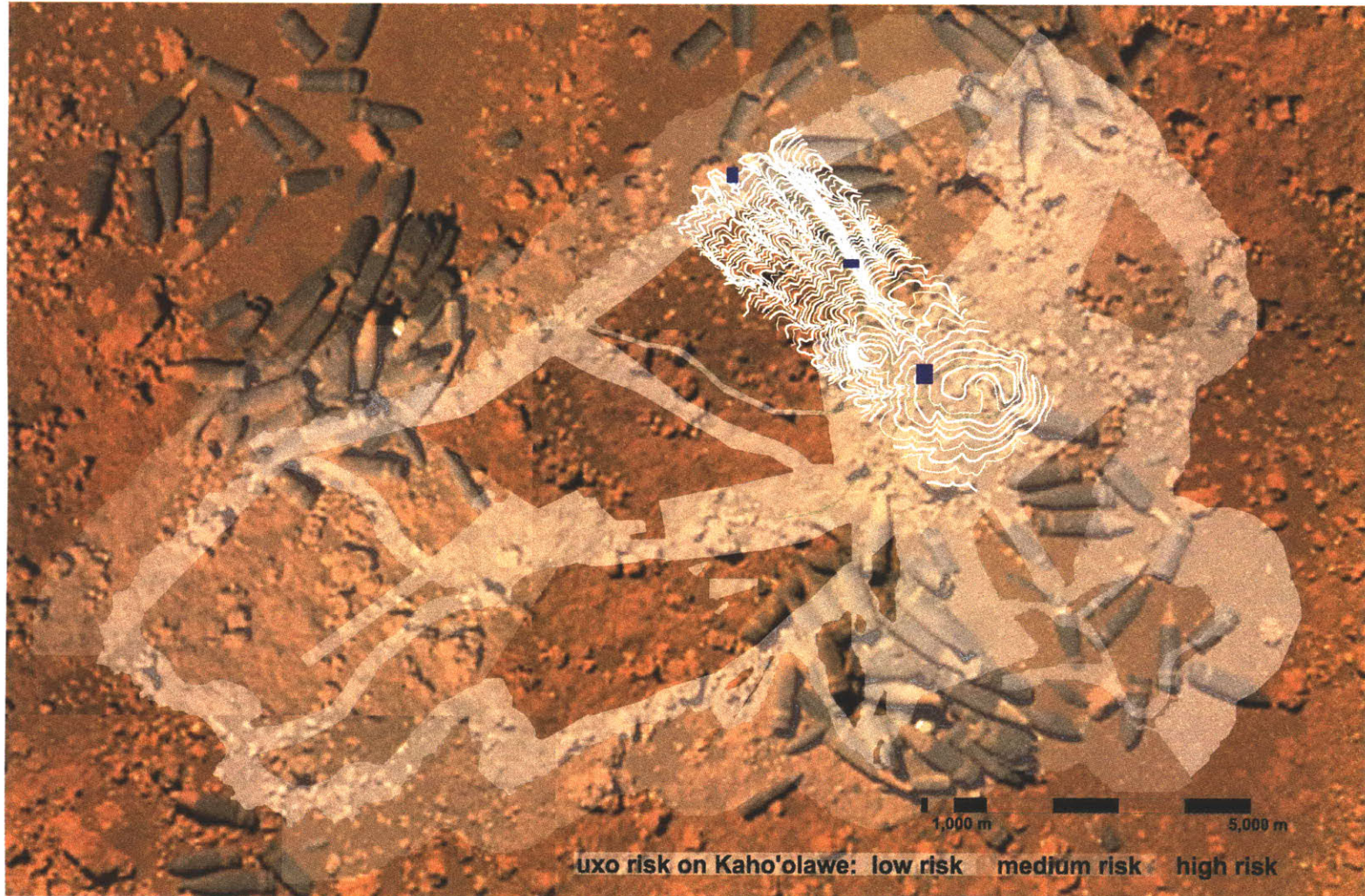
*Navy gun crews and fighter pilots complained that hitting the island from beyond the horizon or above the clouds was too easy; smaller targets were needed. ...Rocks were painted white to provide targets for shore bombardment ...A dummy airstrip 4,000 feet long and 200 feet wide was constructed as a target for aerial gunners and bombers... .Twenty-three wrecked car bodies were painted yellow and scattered along the mock runway for rocket and machine-gun practice.<sup>12</sup>*

Activism against military use of Kaho'olawe began at the end of the 1960s. Maui residents objected to the noise and vibrations, and the possible danger of stray ordnance (Maui mayor Elmer Cravalho found a live 500-lb bomb in his pasture). Hawaii's legislators began to lobby the federal government to return the island to the state. The Navy defended its continuing use of the island as necessary training for Vietnam. Besides, after years of bombing, the island had another problem - unexploded ordnance.



Defense studies indicated that there possibly were some 10,000 tons of unexploded projectiles embedded in the earth, lava, and ravines of the island.

...[Rear Admiral Davis wrote:] "I believe that the time has come to inform the local public that Kahoolawe should remain for the indefinite future an uninhabited monument to the requirements of national security."<sup>13</sup>



The UXO risk diagram straddles Kaho'olawe's past and future. It reflects both past locations of most intense bombardment and future plans for use and circulation on the island. Cleanup priorities included the roads on the island, shoreline access trails, and the planting area at Lua Makika.



## **PKO & KIRC**

Hawaiian activists wanted Kaho'olawe to be more than an uninhabited monument to the requirements of national security. Citizen activism began in the early 1970s; a group called the Protect Kaho'olawe Ohana (PKO) formed, based on a shared interest in caring for the land. This movement was part of a larger Hawaiian Renaissance, a swell of interest and pride in the native Hawaiian language and culture. At the time, there was also a surge of interest in the perceived theft of Hawaiian land and power by Americans in the 1890s, who had an interest in annexing Hawaii to the United States. The appropriation of Kaho'olawe by the military, which was bombing sites sacred to the Hawaiians, was a focal point of angry activists, who demanded in litigation and in demonstrations that the island be returned to the state; several times, activists occupied the island and disrupted military activities. The military, in turn, threatened to leave Hawaii altogether, taking away a mainstay of the economy.

Eventually, in 1980, a joint-use agreement was hammered out that allowed PKO trips to the island. During this time, the military was using the island for war games with other Pacific Rim nations belonging to RIMPAC, to bolster alliances against Communism.

In 1990, George H. W. Bush signed a law stopping the bombing and putting into motion the process that would clean up the ordnance and return Kaho'olawe to Hawaii.

Today, the island is administered by the Kaho'olawe Island Reserve Commission (KIRC). KIRC is charged with managing and restoring the island with federal money; it coordinated its efforts with the military cleanup. While KIRC works closely with the PKO, and has overlap of members, KIRC is focused on the technical and scientific aspects of the island's rehabilitation. The PKO does volunteer work with KIRC, but focuses on educational outreach and cultural activities. KIRC takes work groups to the island by helicopter, and has its base in the old military barracks at Honokanaia. The PKO takes larger family and school groups to camp at Hakioawa, at the other end of the island, by boat; part of the experience is swimming ashore with bags of supplies.





KIRC



PKO



## KAHO'OLAWE'S NATURAL HISTORY & ECOLOGY

### *geology*

Kaho'olawe and the other Hawaiian islands were formed by a volcano in the middle of the Pacific plate. The bulk of Kaho'olawe was formed from the crater in the center of the northeast part of the island, Lua Makika. Later, cinder cones, called *pu'u*, were formed by small eruptions – due to the simple dome form of Kaho'olawe, the *pu'u* are very visible; they and the other three Maui Nui islands orient visitors on Kaho'olawe.

present-day Maui, Kaho'olawe, Molokai, and Lanai were joined as one land mass, called Maui Nui. During the last ice age, Kaho'olawe was submerged to a level 800' above the present shoreline; the water receded, but Kaho'olawe was separated from Maui by the Alalakeiki Channel. This geologic connection with Maui is reflected both in myths and in politics.

The gods decided to join Kaho'olawe with the island of Maui. So one night the demigod Maui connected his magical fishhook to Kaho'olawe and all the gods pulled. The morning light came too soon, and the gods turned to look back, causing the hook to break off from the island. The section that the hook broke off became the islet Molokini. Even the gods suffer the consequences of looking back while pulling something.<sup>14</sup>

*From its shape and appearance, it is not improbable that it once formed a part of Maui, from which it may have been detached by some violent convulsion connected with the action of the ancient volcanoes of Maui or Hawaii. There are but few settled residents on the island, and these are considered as under the authority of the governor of Maui.*<sup>15</sup>

*William Ellis, English missionary, 1823*

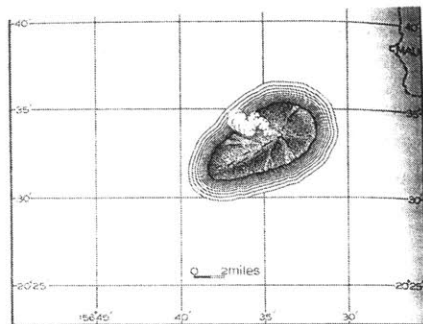


FIG. 30. Kaho'olawe during its early stage of rapid extension of this basalt flows from three rifts and a small summit crater.

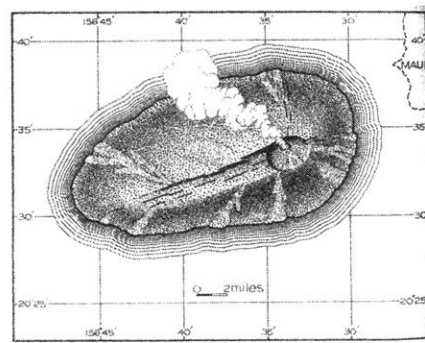


FIG. 31. Kaho'olawe during its collapse phase with a summit caldera about 8 miles across and a gaben along the southwest rift zone.

At the time major volcanic activity ceased, the





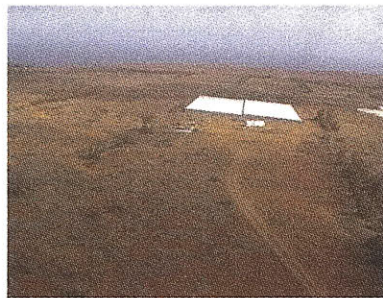
**climate considerations:  
water**

*The island of Kahoolawe lies in the rain shadow of Maui and is of low elevation. Consequently the island is relatively dry. Few data from the historical period exist, but average annual rainfall is about 63 cm (25 in). Most of the rainfall on Kahoolawe occurs during winter storms, when winds blow from the south. Rainfall produces great plumes of eroded sediment in the nearshore waters around the island.*

*Surface runoff on Kahoolawe is estimated at  $7 \times 10^7 \text{ m}^3$  (19 billion gallons) per year. At present, this surface water has an extremely high sediment load due to the lack of vegetation and consequent high rates of erosion.<sup>16</sup>*

*left: Sailor's Hat, near Honokanaia*

*below: water catchment, Lua Makika*



*The current lack of water presents one of the biggest challenges to achieving the restoration goals for Kaho'olawe. Probably always dry Compared to many other parts of Hawaii, vegetation and soil loss, surface winds, increased runoff, and alien plant introduction have significantly decreased the availability of water. ...As the island heals and regenerates, however, moisture will return to the land. ...The island's water supply stays hidden, lies in the moisture in the ground, in plants, and in dew from the night air. ...It hangs in the clouds across the channel on the slopes of Haleakala, and the clouds that brush across the island without rain.<sup>17</sup>*

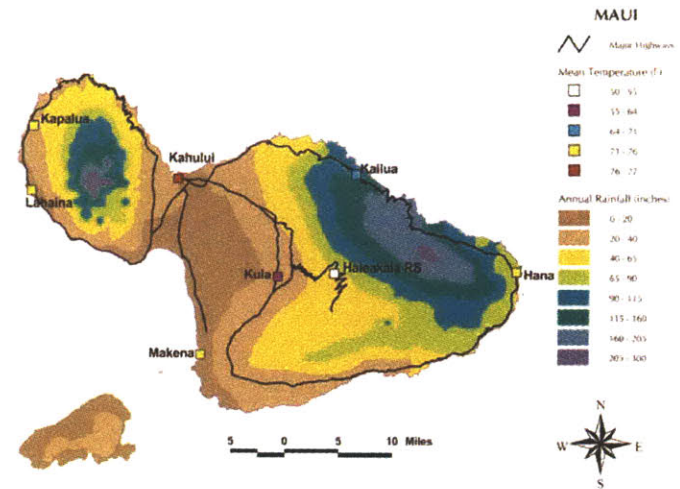
Until the island is more regenerated, KIRC plans to use water from catchments, including one recently built at Lua Makika that has a catchment area of almost an acre. Lua Makika crater itself is a natural reservoir, and plants do well there.

Currently, Kaho'olawe's basal water lens is brackish. It was cracked by 500 tons of TNT detonated to simulate the effects of an atomic blast on nearby ships, which formed a crater known as Sailor's Hat.

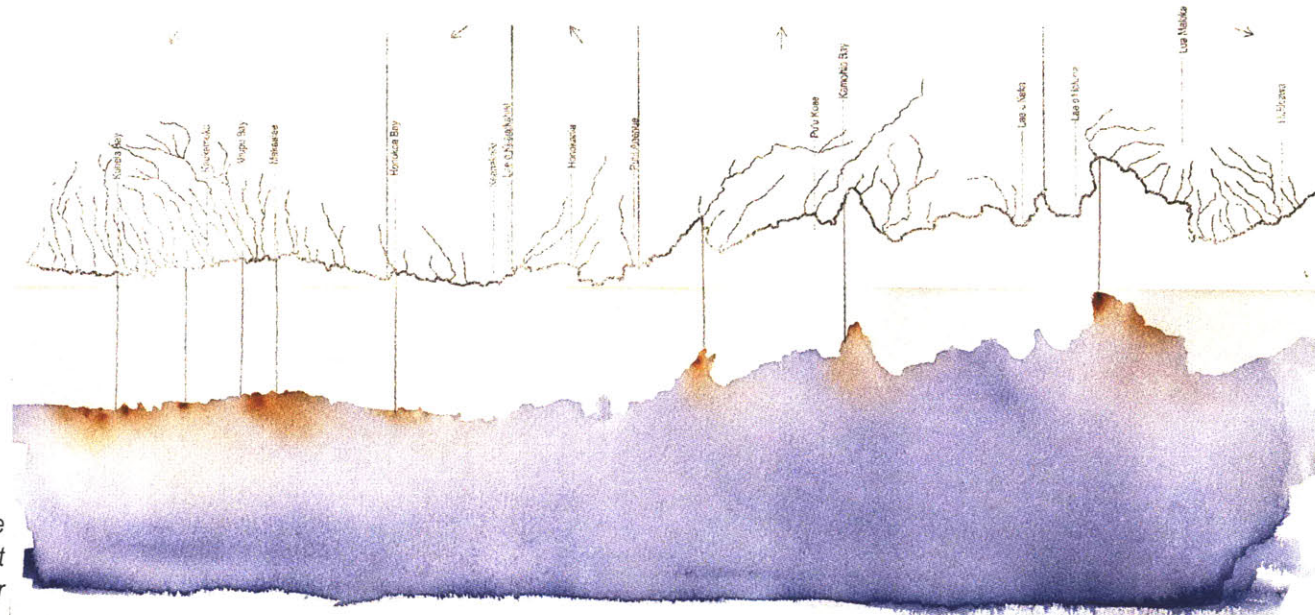


**climate considerations:  
erosion**

The physical environment of Kaho'olawe is severely degraded. Erosion has removed top soil from much of the island, up to six to eight feet deep in some places. During heavy rains on the vast areas of barren hardpan water rushes down steep slopes, cutting deep gullies, and carrying large amounts of soil into the sea. An estimated 1,880,000 tons of soil continues to be lost each year as a result of erosion. ... Much of the rainfall on Kaho'olawe comes in short, heavy downpours and very little water soaks into the ground as there is little vegetation to facilitate this process.<sup>18</sup>



**hardpan**  
a condition of the soil or subsoil in which the soil grains become cemented together by such bonding agents as iron oxide and calcium carbonate, forming a hard, impervious mass. It is disadvantageous to farming, interfering with the circulation of moisture in the soil and with the growth of roots through the soil.<sup>19</sup>



right: expanded coastline indicating areas of greatest erosion plumes in the water



***climate considerations:  
wind***

*Wind patterns in the Hawaiian Islands are dominated by the northeast trade winds produced by the Pacific High northeast of Hawaii. ... Haleakala on the island of Maui deflects and funnels trade winds to the east across Kahoolawe at speeds of  $8.2 - 9.3 \text{ m sec}^{-1}$  (16 to 18 knots). The strong and persistent trade winds have contributed to severe erosion of Kahoolawe in the last 150 years after grazing by introduced livestock destroyed most of the covering vegetation. Numerous reports describe large dust clouds blowing off the island.<sup>20</sup>*

The Navy's agreement to take over the island provided for a soil conservation and ungulate limitation program, but these were not pursued with great effort.

While the bombing itself did not destroy the island (if anything, bomb craters helped trees become established in the otherwise virtually-impenetrable hardpan), the presence of ordnance made effective conservation extremely difficult, and required an expensive, 10-year cleanup effort. KIRC and the Navy have discussed re-establishing the windbreak planting program, with the military remotely detonating shaped charges for planting holes.



## **planting**

*Most of the plants on Kaho'olawe are aggressive, hearty alien species. Several small native plant communities do exist. Natal redtop, buffalgrass, kiawe, and other alien species dominate most vegetated areas, competing not only with native plants, but also posing a serious fire hazard. The relatively few native plants (when compared to alien flora) severely limits Kaho'olawe's seed supply for natural regeneration.*

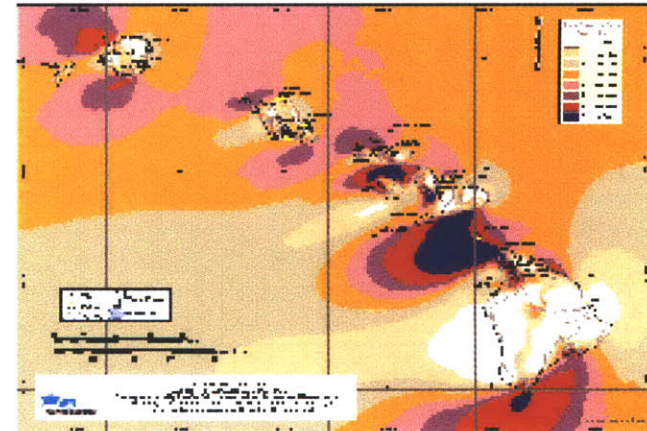
*An abundance of information on primary plant community succession in wet forest habitats in Hawaii exist, but little is known about succession in dryland forest and shrubland.<sup>21</sup>*

Estimated numbers of plants required:

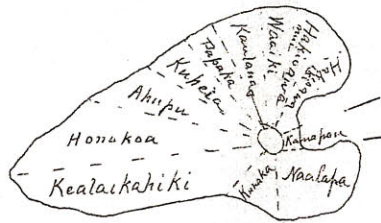
12,000 acres barren hardpan

- if plant 1/3, need 32 million plants; each acre gets 20-30 trees, 200 shrubs, 7,600 grass plugs & creepers
- at first: potted plants; later, perhaps able to seed directly into mulch and tilled soil
- KIRC would like to plant ~150 acres/yr
- KIRC has planted 15-20,000 seedlings/yr since 1999; survival rates of 20% were increased to 80-90% with irrigation
- 450 tree saplings, 30,000 shrub seedlings, 1.1 million grass plugs & creeper plants
- if water through first dry season, 80% survival rate; if no water, 40%

wind map: darker colors indicate stronger winds



*Kaho'olawe is an ahupua'a  
divided into ili as per map*

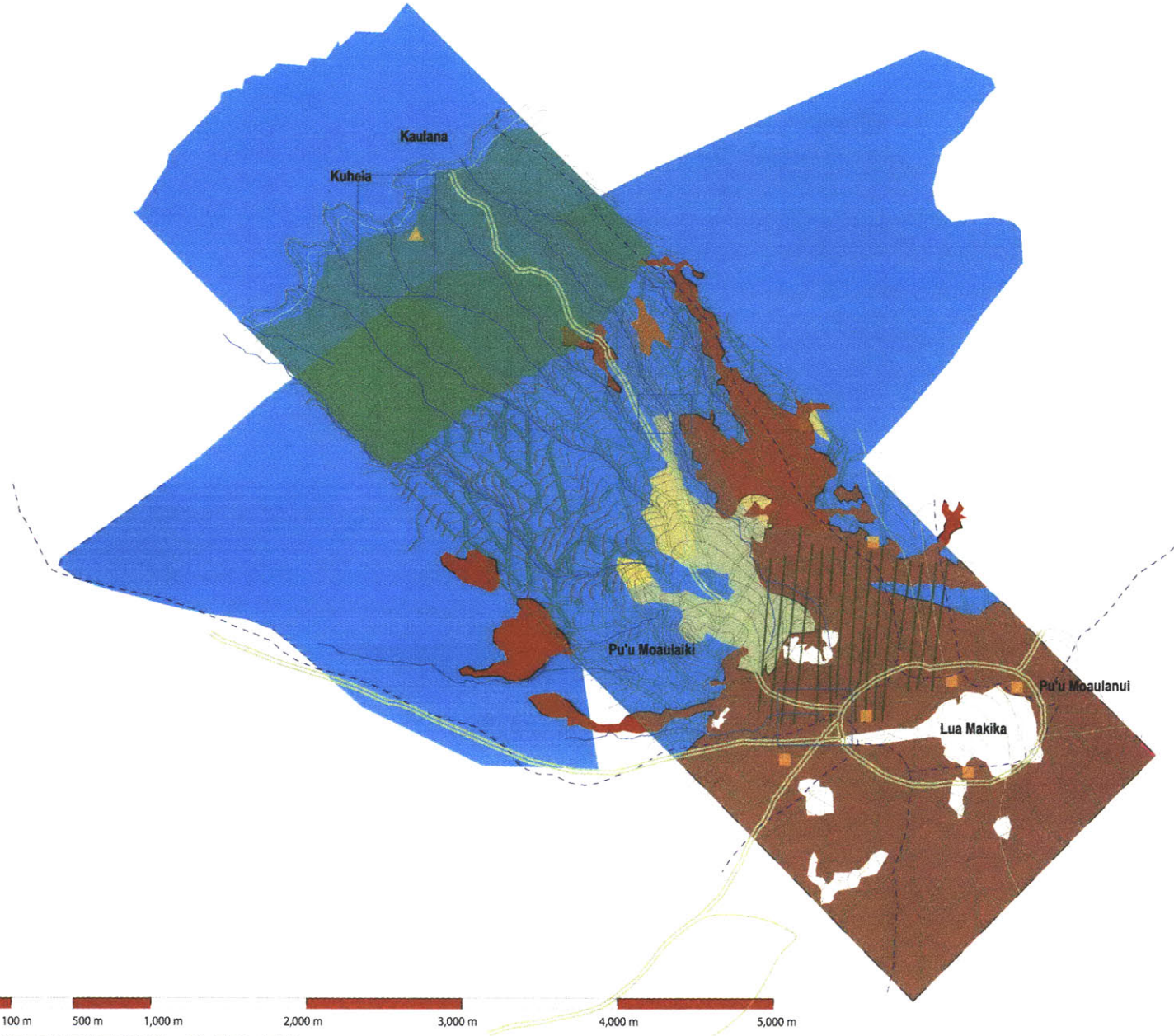


### **locating the interventions**

The major land division used in pre-contact Hawaii was the *ahupua'a*, usually a segment of land running from the mountains to the ocean, and containing all the resources (fresh water, forest land, farm land, fishing resources) that were necessary to sustain a population. *Ahupua'a* varied widely in size, and were further divided into *ili*. Kaho'olawe's twelve *ili* made up a single *ahupua'a* within a larger district comprising the southwest coast of Maui. These mountain-to-sea divisions continue to be relevant when managing erosion and watersheds. The interventions of the thesis project are located within the Kuheia *ili*.

The Kuheia *ili* has a broad spectrum of past uses, histories, and natural conditions. Kuheia Bay is "well-protected...and provides one of the safest ocean accesses to Kaho'olawe year-round."<sup>22</sup> It was the base for ranching activity on the island (the bay was used for shipping cattle), and traces of ranch building foundations and rock walls remain. Nearby Kaulana Bay was the location of a penal camp in the 1800s. In pre-contact times, Pu'u Moaulaiki and Pu'u Moaulanui, cinder cones with unobstructed views all around the island, were places where navigators trained. "As one of the major cultural and educational centers for the island, the Kuheia/Kaulana 'ili should contain the main repository for the island's cultural and historic artifacts."<sup>23</sup> The Kuheia *ili* also contains a broad range of conditions for plants – hardpan, kiawe scrub, and gullies.





Each intervention has an active and a hibernating condition.

Each intervention will host a different constituency of visitors. Each constituency had its own time period, and different passions.

The plan for the *ili* requires constant movement between the interventions, movement determined by activity, users, and time of year.

Plants (and some people) are transported from Kihei on Maui to Kaho'olawe by barge; they land at Kuheia, where there is a shelter for the planting volunteers. The plants are transported from Kuheia to Lua Makika, the highest area of the island, named for the crater that formed it, now reduced to hardpan and prone to erosion. At the lowest edge of the hardpan, in an eroded gully, is the base for an archaeology field school that will survey and work with the sites on the island. At Lua Makika is a camp for apprentices studying celestial navigation. Moving between the locations has the added dimension of traversing sections of land cleared of UXOs to differing levels of safety.

At Kuheia, which hosts the largest numbers of plants and people, fresh water-catching is a priority. It is an advantage to concentrate these larger numbers in one location – with the difficulties of construction and transport, building and supplying the largest structure at the edge of the ocean requires less transport. Impact on the island is concentrated, rather than dispersed.

The archaeologists' base at the edge of the hardpan actively catches the eroding earth. Using much the same strategy as archaeologists sifting debris for artifacts, the building becomes layers of screening. The structure is a magnification of a system of check dams that collect soil and runoff from the hardpan.

The navigators' camp at Lua Makika belongs to the realm of sky and water, with land incidental: "For students, being at the top of Kaho'olawe was the next best thing to actually being in a canoe on the open ocean."<sup>24</sup>

**days**

temperature variation:  
mist clouds settle between Pu'u Moaulaiki and Lua Kealialalo

**months**

- July - August
  - propagate planting materials
  - monitor & weed outplantings
  - select erosion control & revegetation sites
  - water per dry season program
- March - June
  - monitor & weed outplantings & erosion control sites
  - water per dry season program
- November - February
  - transport to Kaho'olawe after first rain:
    - plants
    - fertilizer & supplies
    - workers
    - food
  - move plants to outplanting sites
  - plant & spread seeds
  - fertilize & weed planting areas
- September - October
  - collect mulch resources
  - begin site preparation
  - monitor and weed outplantings
  - water per dry season program

**years**

archaeology field school — 7-10 students + teachers 1 month duration — 25-50 years



planting maintenance — 5-8 volunteers — 3-day duration — 50-100 years



intensive planting volunteer work — 10-30 volunteers — 5-day duration — 50 years



apprentice program in celestial navigation — 5-7 students + teachers — 1 week duration — 100 years +





## **barge**

*KIRC will establish a nursery on Maui. Initially, seeds and cuttings will come from either the USDA Natural Resources Conservation Service's Plant Materials Center on Moloka'i, or from collections by staff and volunteers. Later, KIRC will develop its own seed source at the Maui nursery. While initially the nursery will propagate 10,000 plants annually, the capacity will have to be expanded to meet KIRC restoration goals. In addition to growing tables, this facility requires space and equipment to process and store seeds. The nursery also needs a secure area for tools and planting supplies.<sup>25</sup>*

An alternate strategy would replace the nursery with a nursery barge.

The nursery barge functions as a third island, navigating between Maui and Kaho'olawe. Seeds from Kaho'olawe are propagated in Kihei, where fresh water is more plentiful; in the rainy season, the seedlings are returned to Kaho'olawe, and planted in hardpan areas. It is a vessel of transference – neither and both, it can only be on Maui, on Kaho'olawe, or in transit at any given time. It is also an ark, preserving through transit the biological heritage of Kaho'olawe. The barge is a visible reminder of Kaho'olawe's dependence on Maui.

Kihei, the site of KIRC's future headquarters, is the barge's main contact point on Maui. This is where volunteers and plants prepare for transport. Kihei is a hedonistic, short-attention-span, fun-obsessed, resort area, an example of unplanned rampant resort development. Its assets are plentiful lodging, sunny beaches, snorkel rentals and boat tours; it is cheerfully and unreflectively a-historical, always ready for the

next batch of tourists. This is in contrast with the extreme seriousness with which Kaho'olawe is treated. Yet there is an opportunity to educate the casual visitor about Kaho'olawe's history and future -- when the barge is in Kihei, it is a literal part of Kaho'olawe that can be visited. The barge is a conduit to the island, but it can also function as a replacement for the Kaho'olawe.

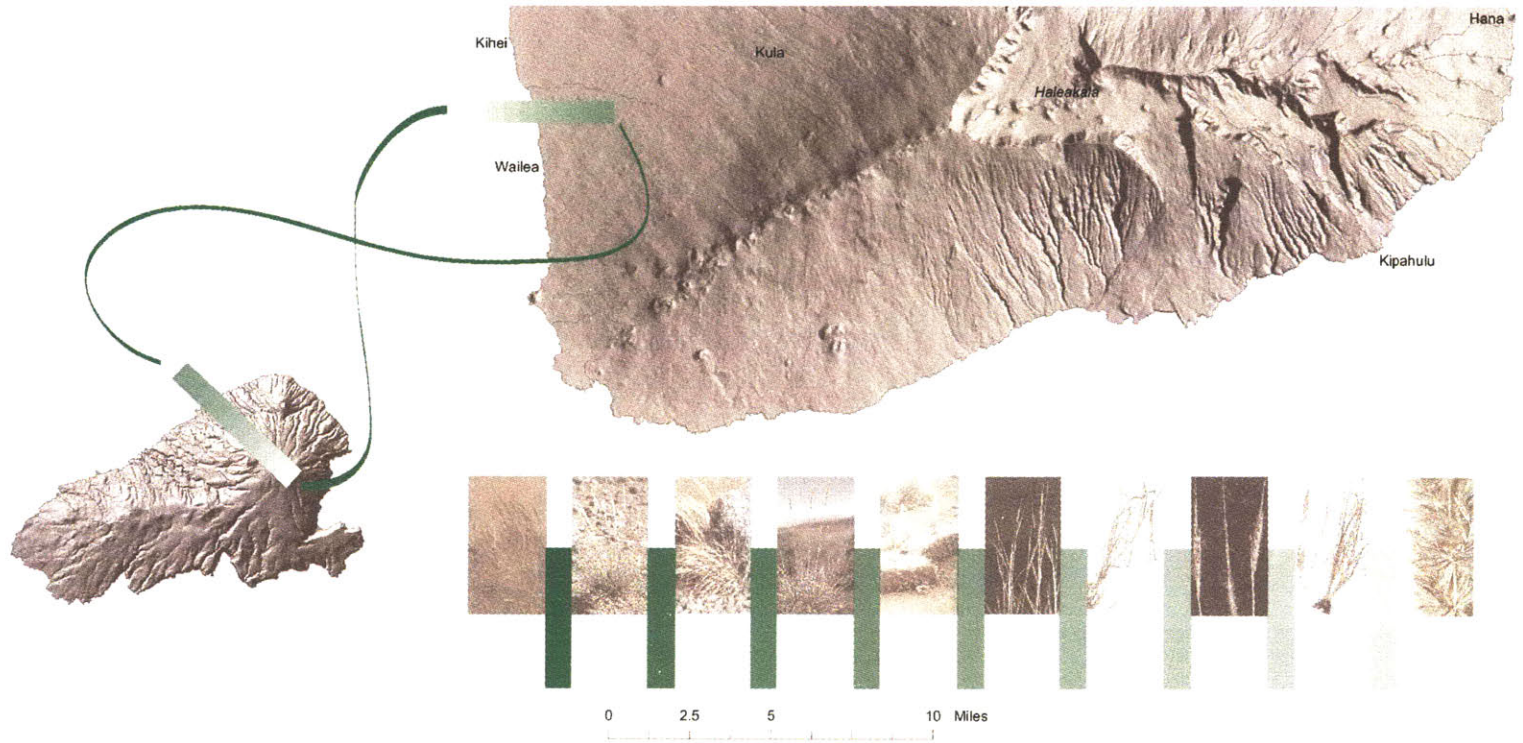
The barge is a literal link between Maui and Kaho'olawe, but its scope also encompasses the other islands closest to Kaho'olawe. Lanai and Molokai, the other two islands of Maui Nui, are considered acceptable as sources of seeds for Kaho'olawe, particularly seeds from the coastal areas which face Kaho'olawe.

barge calculations: 4"x4" pots, 9 plants/sq ft; if barge is 150'x32', 4,500 sq ft, then barge could hold 40,500 plants and nothing else



Personal Island  
project by Vito Acconci

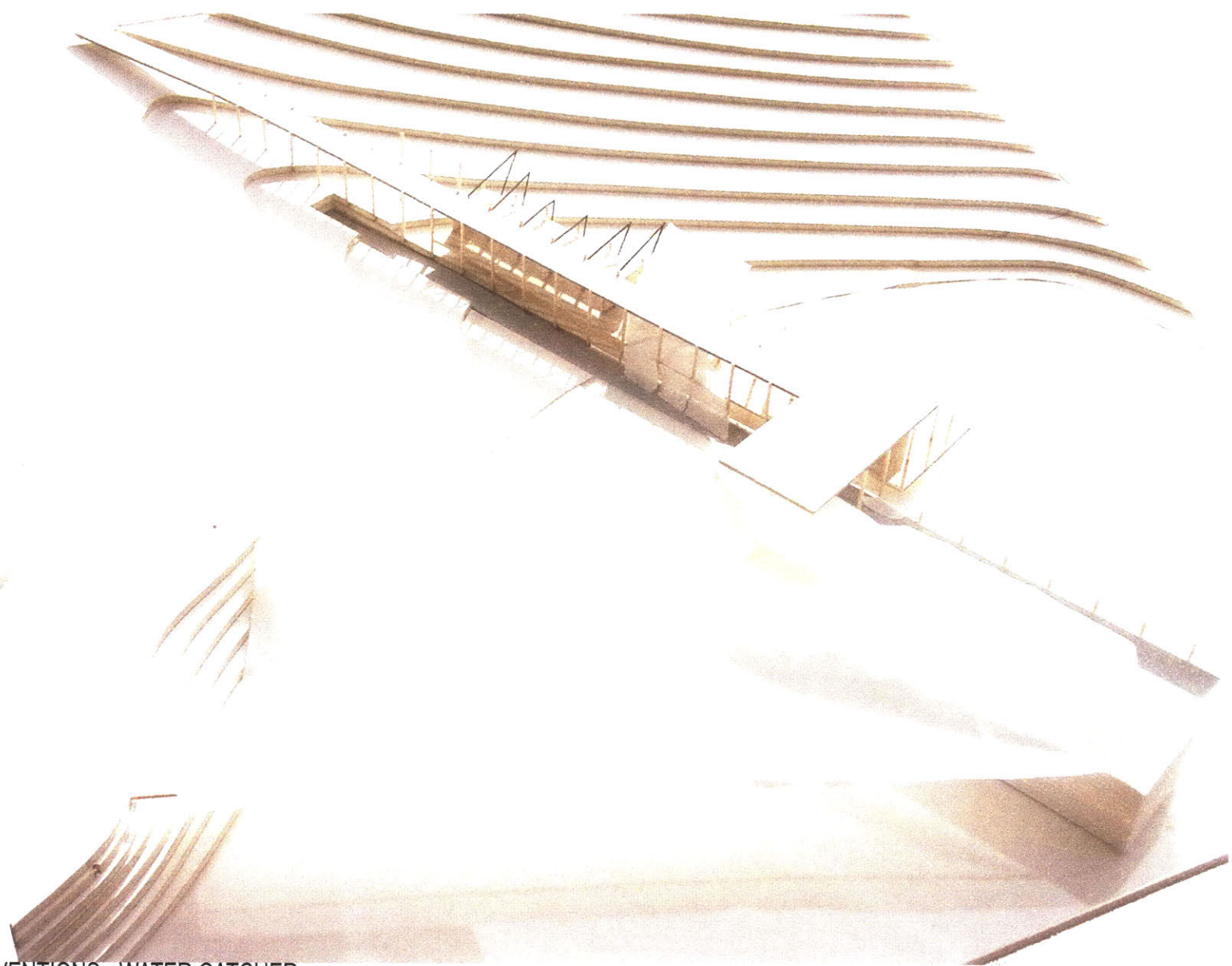




**KUHEIA:**  
***water catcher***

Kuheia is the arrival point for plants and people. The shore, the most overt place of struggle between the sea and the land, constantly shifts between stability and instability; when the diagonally sloping ground intersects with the horizontal surface of the water there is a constant switching of elements wiping each other out, as each renews itself and effaces the other – waves smoothing and leveling the shore, the sand absorbing the water.

The building takes the form of a pier. The pier supports a causeway which allows trucks to transport plants and supplies from the barge to the road leading to the planting areas. The open structure of the pier is filled in places by program elements requiring walls: bathrooms, kitchen storage, sleeping areas. The central area of the shelter, which spans the area where land meets water, is flexible in program and always open to the elements; this is the area for gathering, working, and eating.





**When inactive, the walled parts of the building are enclosed; during use, the walls open to varying degrees. Twice a year, at the beginning and end of the rainy season, many volunteers are needed to enact the shift in the building from open to closed, and to set up the rain-catchers associated with the shelter. Activity level also determines the ability of the building to function as a structure for catching rainwater.**

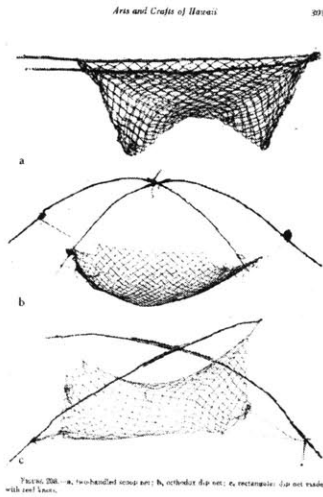
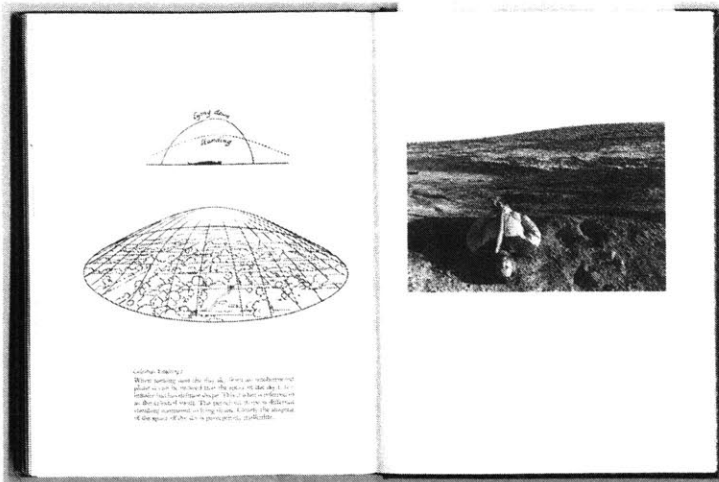


FIGURE 206. a, two-handled net; b, one-handled net; c, rectangular dip-net made with reed frame.



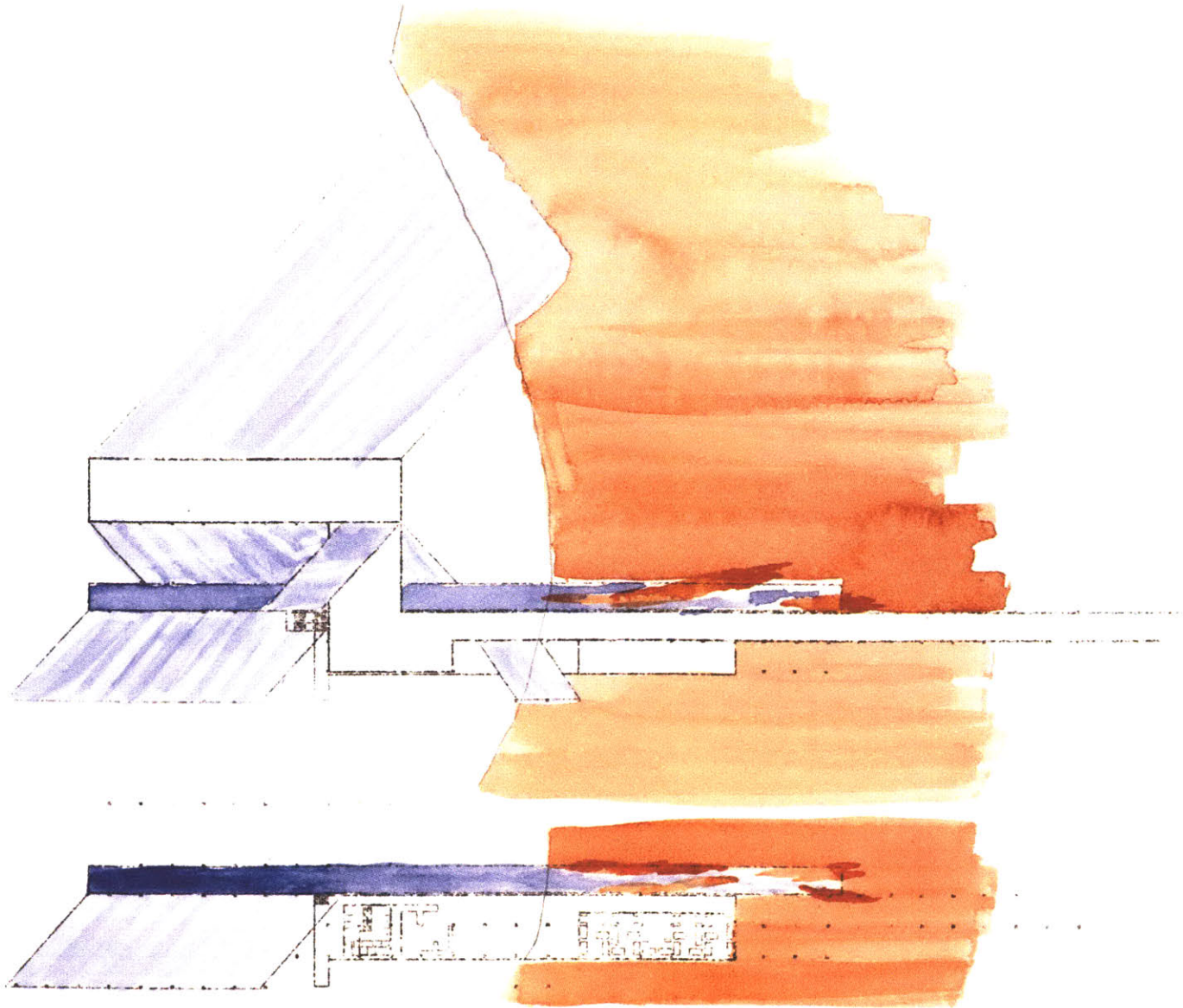
top:  
Hawaiian dip-nets; pulling up tightens the net, capturing the fish

bottom:  
James Turrell's diagrams of celestial vaulting lying down, the net is cast; standing, the net is pulled in

Cloth sails catch water, funneling it into a cistern, which runs the length of the building and is set into both ocean and land. The cistern also collects runoff water from the land; this water, laden with sediment, is filtered through baffles. The sails bridge land and sea, and juxtapose fresh water with salt water. On Kaho'olawe, as on a ship, fresh water is precious, and its improbability is emphasized by its proximity to salt water.

The sails function as nets; in this sort of net, water becomes the focus rather than the medium of the device. Throwing out a net is a hopeful act; under the gathering influence of a net, distances are collapsed, and far-away things are caught and drawn close. When the barge is in residence on Kaho'olawe, the net is cast and drawn tight, bringing water to the cistern.





*Kuheia plans*

*top:  
active state (barge in residence)*

*bottom:  
hibernation state (nets pulled in)*

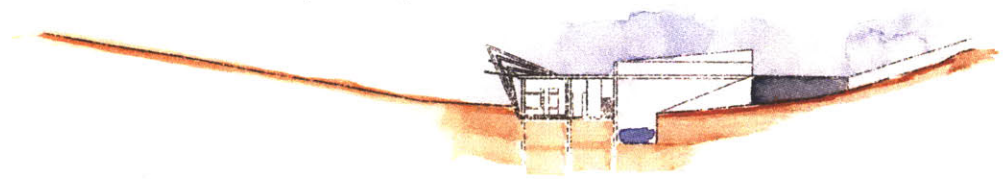
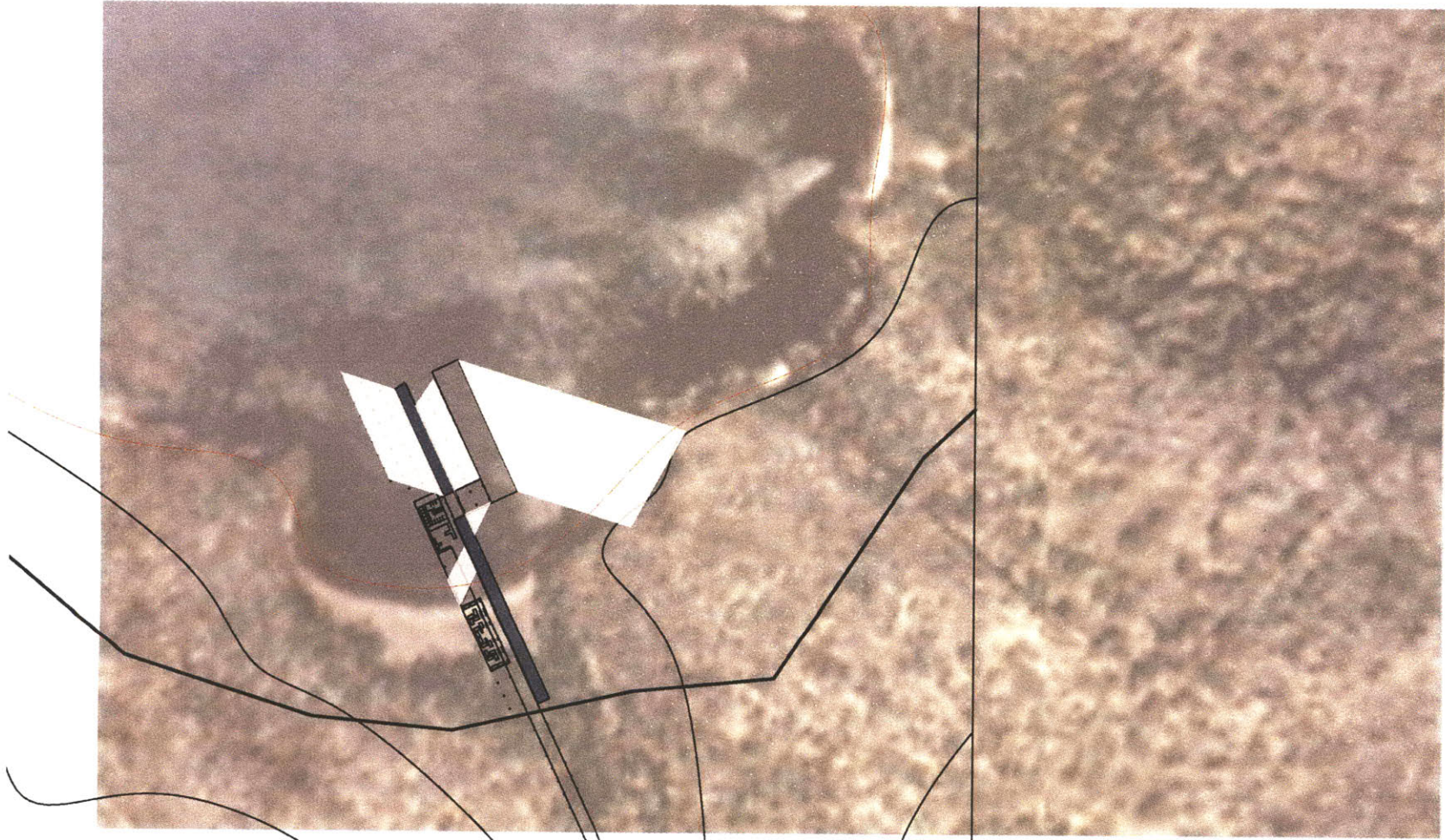
*barge unloading, Honokanaia*



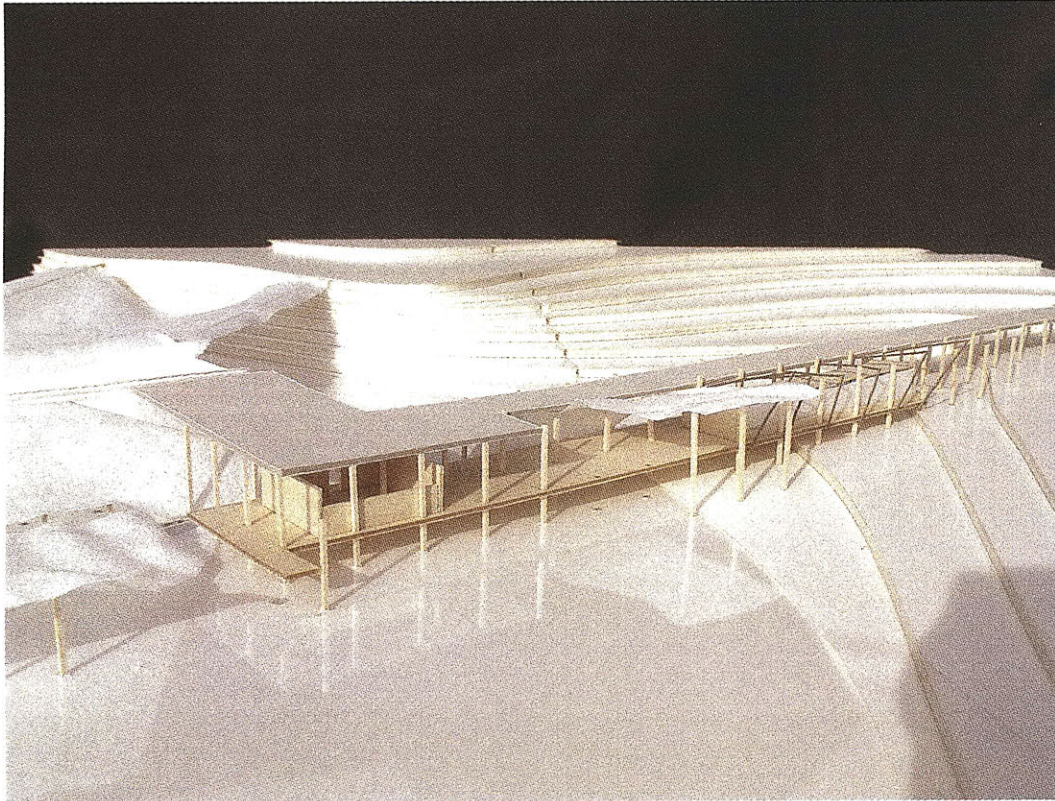
The barge, tied up, is caught in the building's net; a foreign element has been pulled into the zone of the island, and added on to it, even as the barge helps to pull the island out to sea.

*A nursery and holding facility on Kaho'olawe will be for additional propagation. Also, plants and seeds arriving from other islands may require some protection from the wind and sun before being planted. These holding facilities can provide quarantine screening to aid in preventing the spread or introduction of pests and disease.<sup>26</sup>*







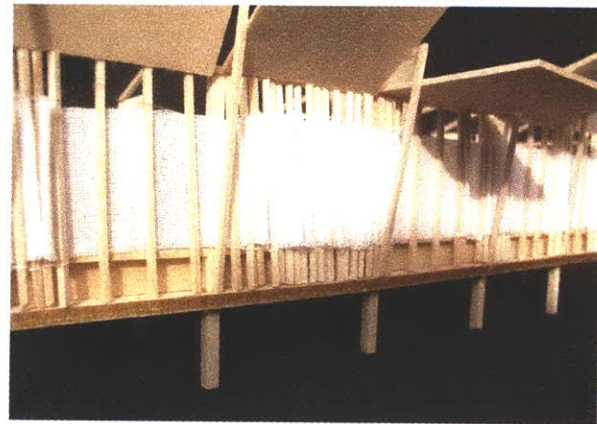
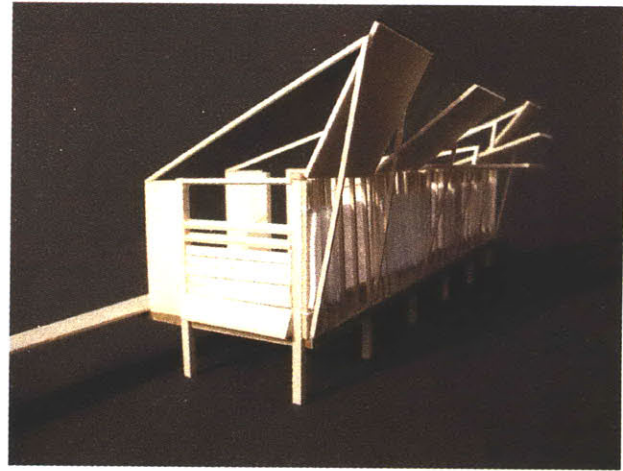
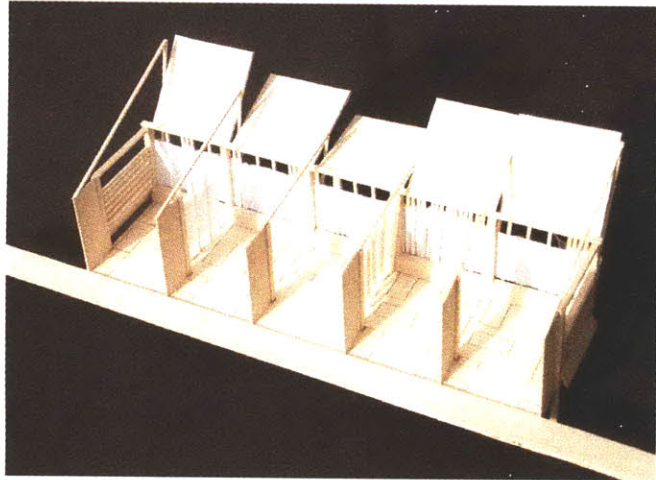


***program:***

catchments for potable water  
composting toilets  
kitchen  
mouse-proofed storage facilities  
dormitories

The dormitory must be able to variously house school groups, community groups, and family groups; the groups could comprise 5-36 individuals. Within a field of bunks, dividers can be re-arranged to screen varying numbers of sleepers and social groupings.

Traditionally, Hawaiian houses were thatched with pili grass. Once attached, the bundles of thatch could be re-arranged, creating windows if light or air were needed. The shading system on the dormitories is an adaptation of this flexibility; the screen-and-support system can be compressed or expanded according to different needs of privacy, light, and air. Each area can control its own window conditions.







**ecology:**

*HUMAN WATER CONSUMPTION:  
During short-term trips, staff and  
volunteers would require a minimum of  
ten gallons per person per day.<sup>27</sup>*

plan for 5-36 people/week during rainy season;  
constant turnover

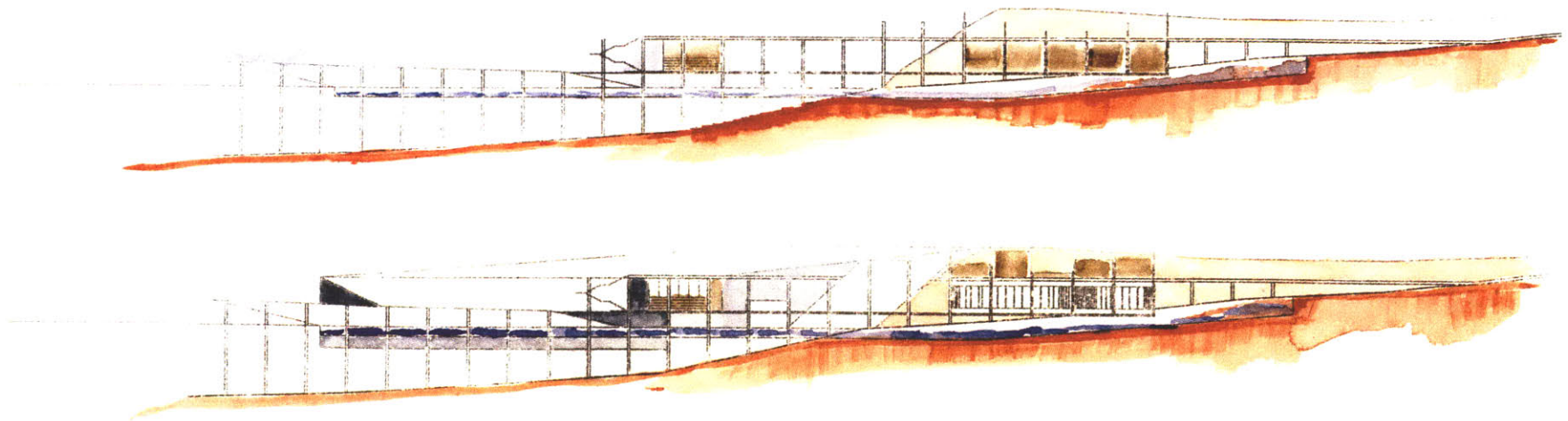
need average 150 gallons/day fresh water, some  
potable (desalination practical)

to hold 20,000 gallons at Kuheia: 2,673  
cubic feet tank

to collect water with sails: 1 acre =  
43,560 sq ft; ea acre catchment could  
provide 537,000 gallons water/yr if 20"  
rain (only 10" at Kuheia); total annual  
water for 1 acre outplanting = 64,000  
gallons

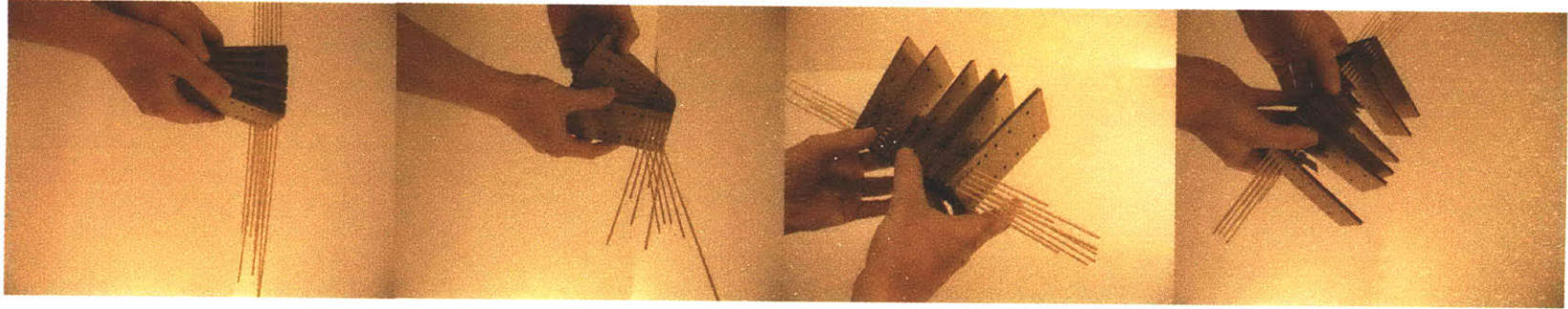


*Kuheia sectional elevations*  
top:  
*hibernation state (nets pulled in)*  
bottom:  
*active state (barge in residence)*



***hardpan edge:  
earth catcher***

The vertical gives the meaning of the horizontal. One is alive because of the other.<sup>28</sup>-  
Le Corbusier



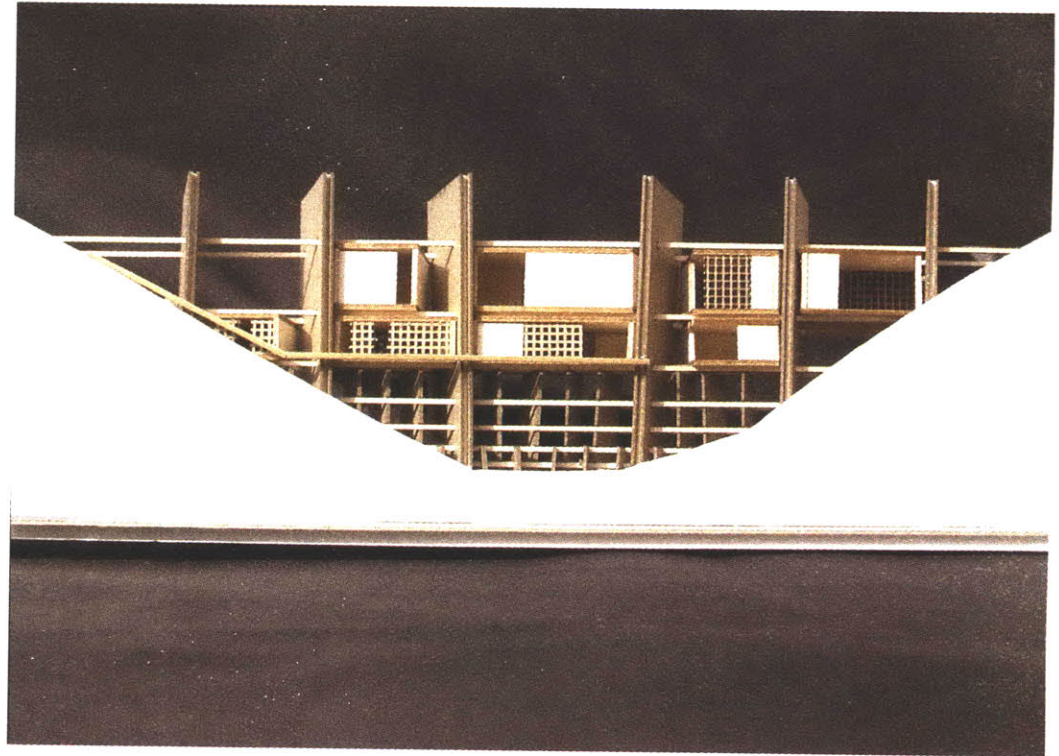




This intervention works with the force of erosion. Functioning as both bulwark and bridge, the shelter is built of a series of screens that create a dam for the earth as it washes down a gully.

**As an earth-catcher, the building is a force that makes the land level.**

After a willful vertical gesture, the horizontal accretes randomly. The strong vertical structure of the shelter becomes an agent of leveling the earth behind it, creating the horizontal plane of a terrace. This is one flat area within a larger system – all along this gully and others, restoration workers will create a series of check dams. The shelter can be thought of as a check dam on a larger scale.



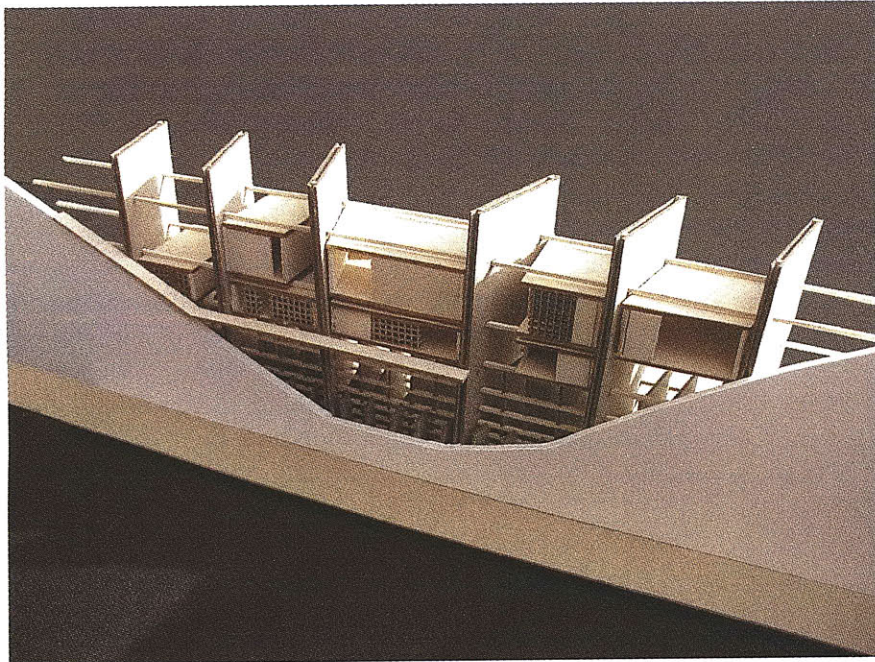


**ecology:**

*est. 1,880,000 tons of soil lost per year<sup>29</sup>*

*Erosion control technique used on Kaho'olawe:*

*check dams are permeable barriers built across a gully or waterway to slow or redirect the flow of water and increase sediment capture. They can be constructed from a variety of materials.*

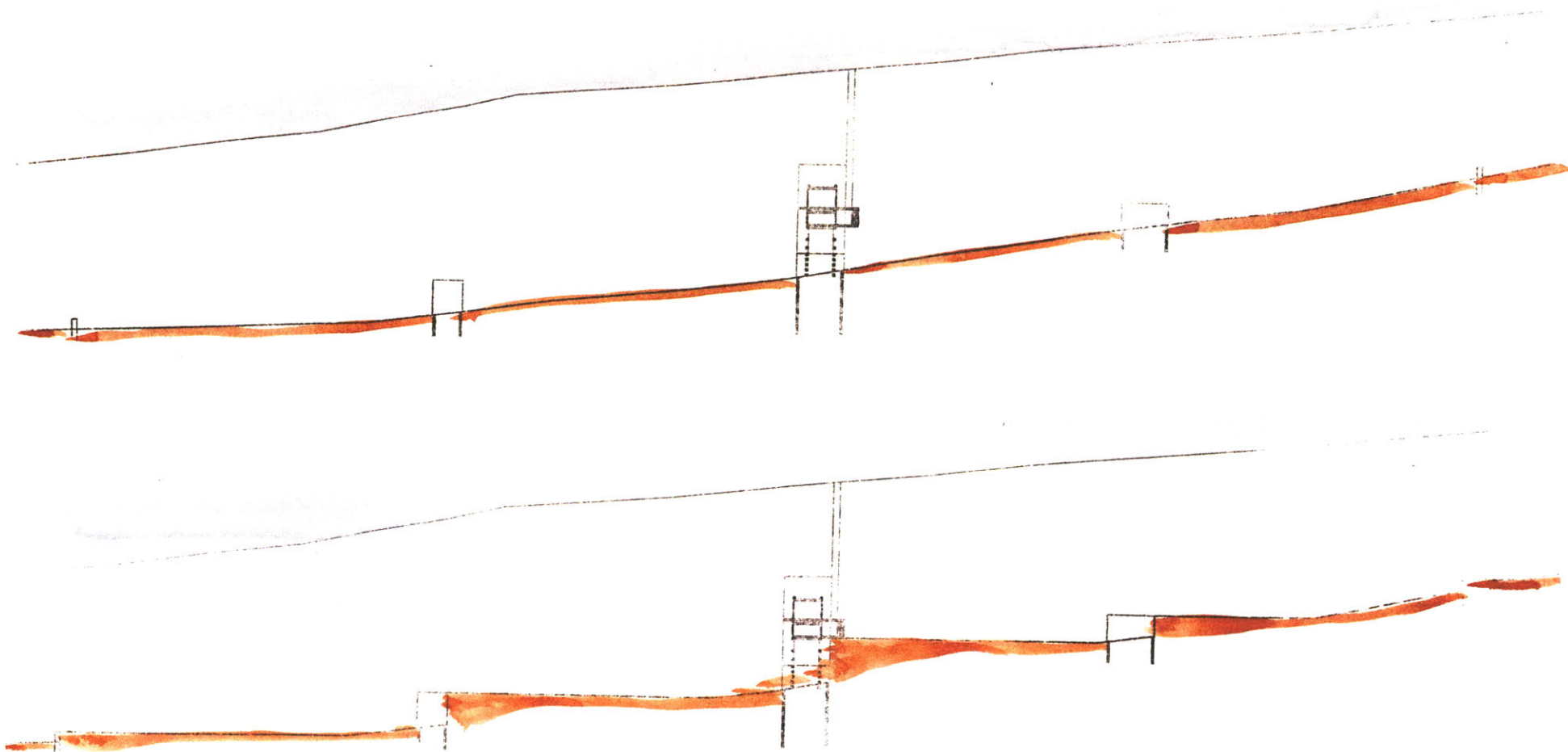


Of the three interventions, this is the most passive; it requires less active tending. It is the least easily changed, as its change is dependent on erosion filling the gully behind. It also works within the longest-term cycles of time.

Used one-to-three months out of the year, the occupied parts are high enough that it should take approximately fifty years for the screens to fill with eroded soil. After this point, the relevance of the building will be re-evaluated; the upper floor could continue to be used, but instead of being a bridge, it would be a building at the edge of a terrace (and the terrace becomes a bridge across the gully).

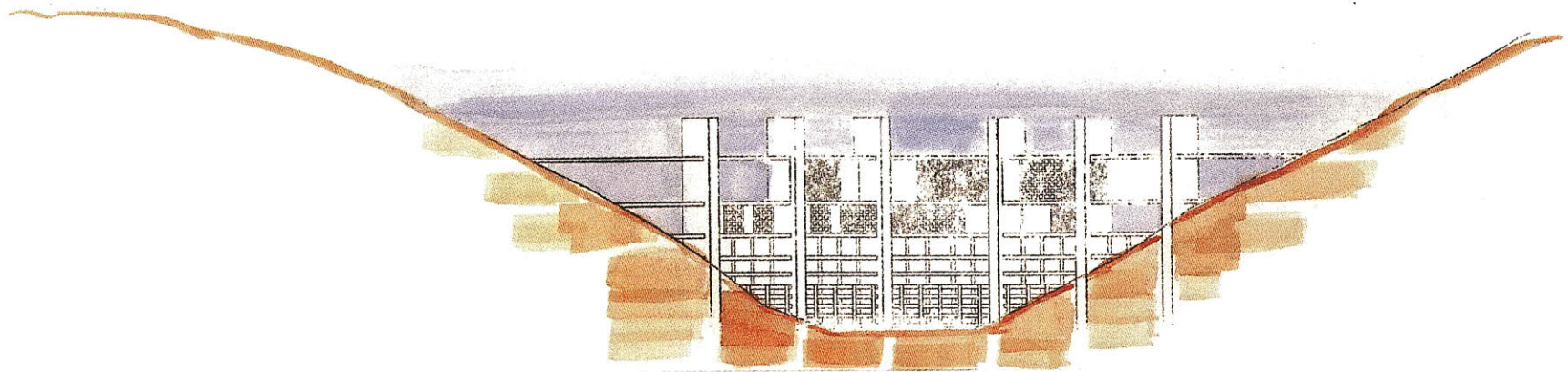
**The building may have a longer-term presence, but the longer it is there, the more it effaces itself.**



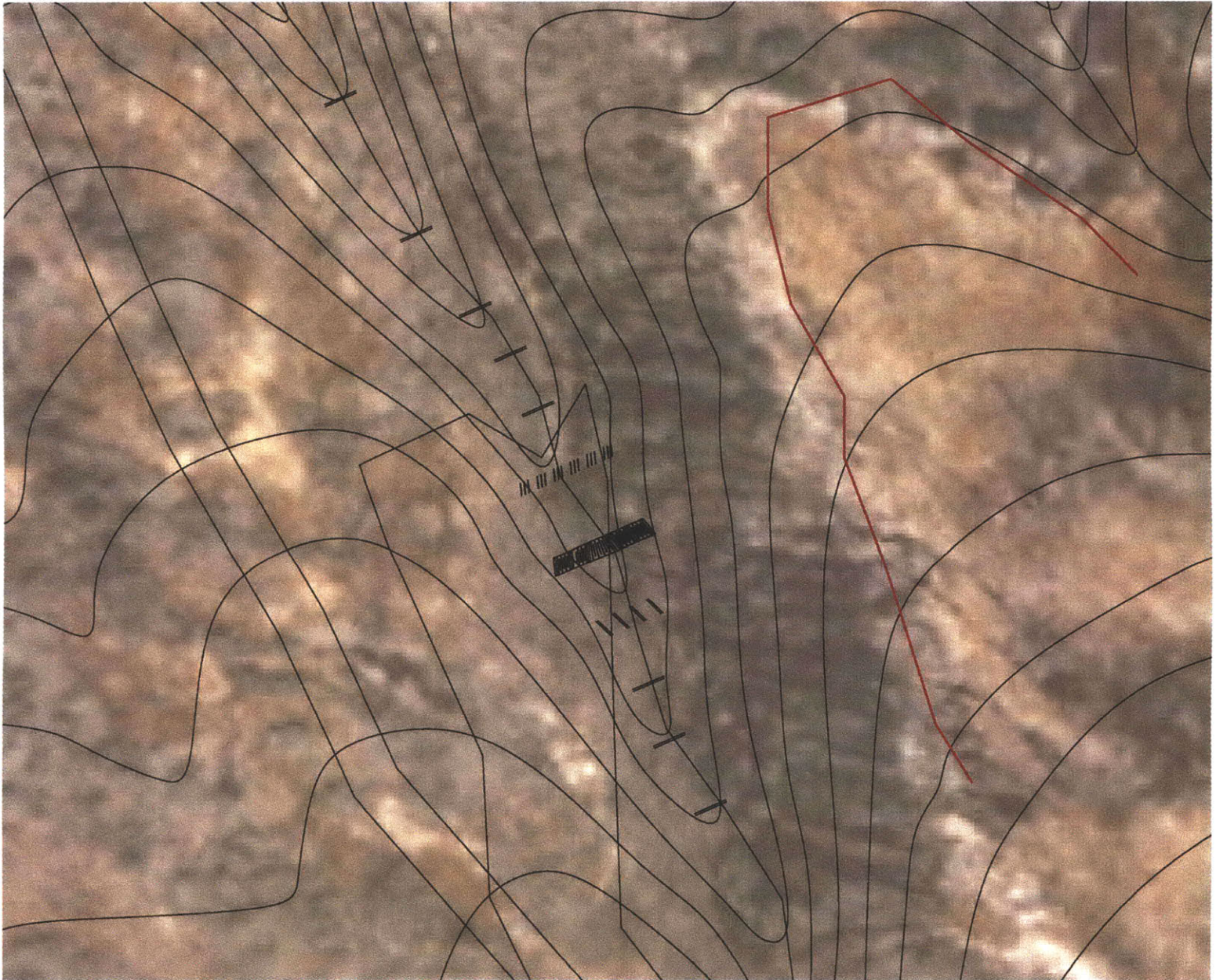


The shelter accommodates an archaeology field school, held in the summer. It provides living and working space for students as they document and study the structures and artifacts of Kaho'olawe. The school documents and stores artifacts from Kaho'olawe's entire history, including the ranch and military periods.

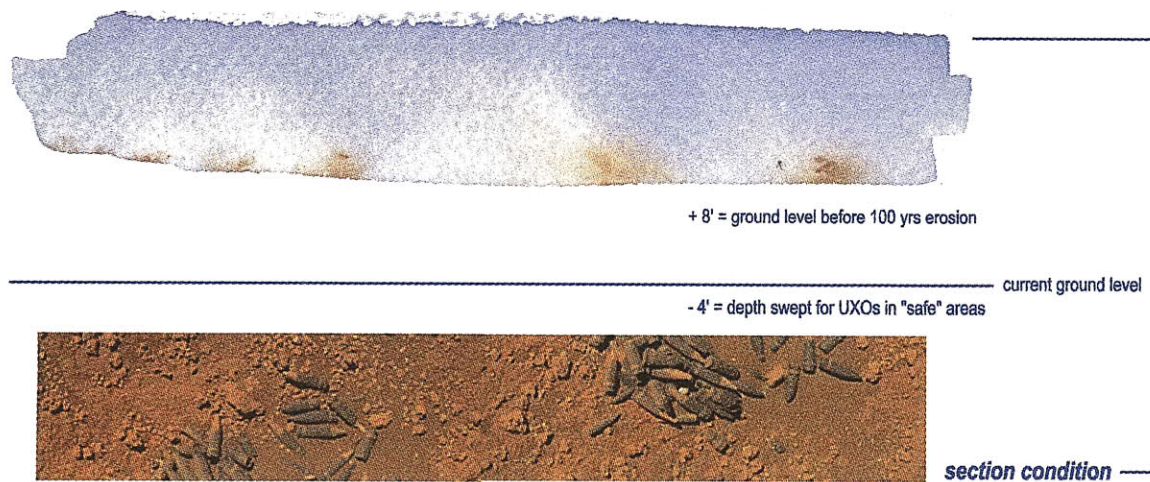
It is fitting to house the field school in a structure that consciously works with the force of erosion; not only are the building's screens inspired by the graded meshes that archaeologists use to sift debris, but erosion is an important force for exposing (and concealing) structures and artifacts on Kaho'olawe. Also, ordnance has accumulated in the deep gullies, carried there by heavy rains.











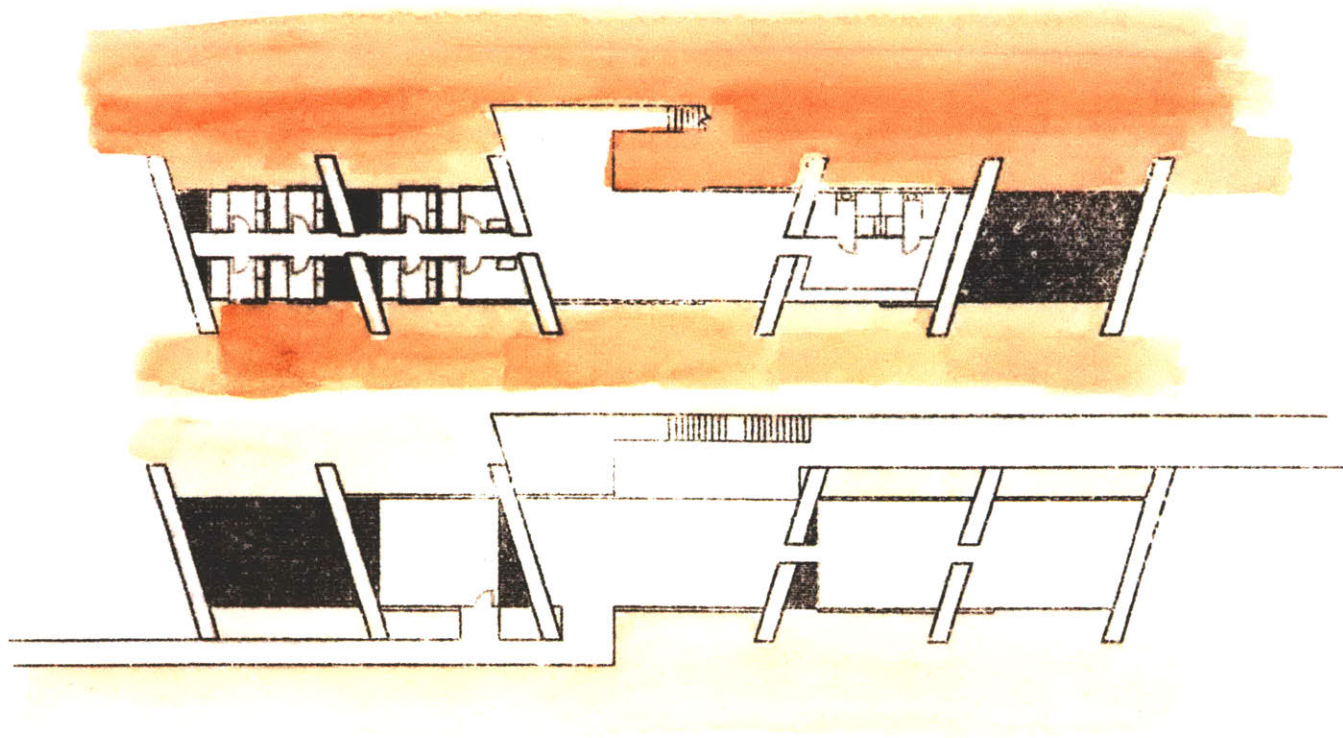
**program:**

accommodations for 3-14 people for 1-3 months  
 (field school: 1-2 leaders + students)  
 able to be secured, lightly watched over

- lower level: living spaces
- six double rooms with bunks
  - two single rooms for leaders
  - kitchen facilities
  - bathrooms
  - food storage

- upper level: working spaces
- wet & dry conservation labs
  - artifact display and study area
  - artifact storage room

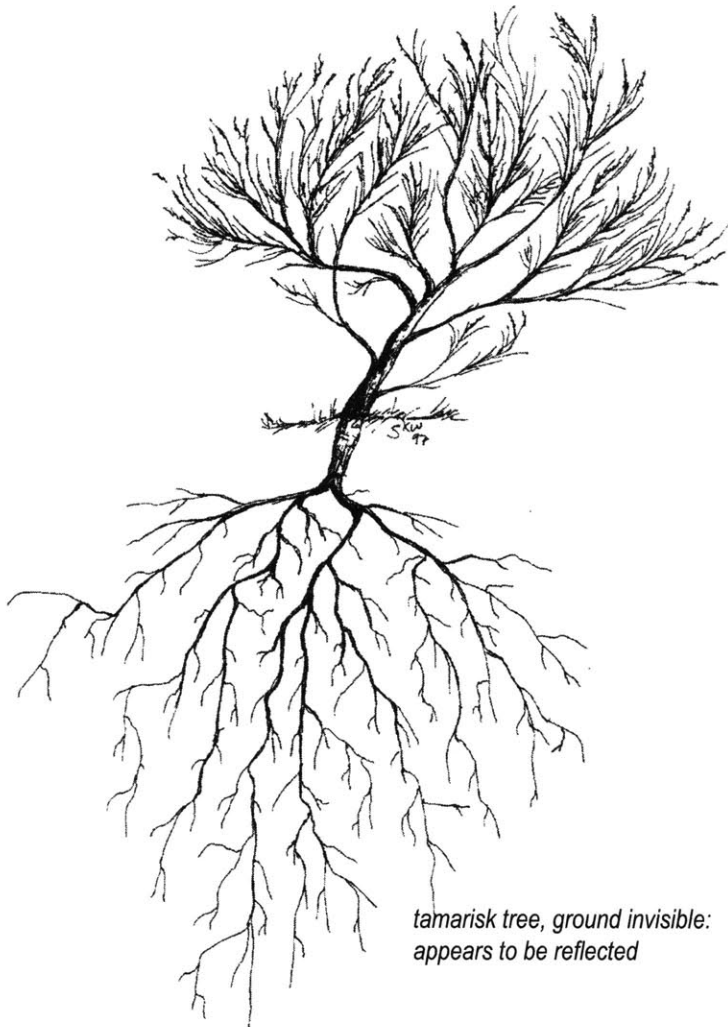
lower level:  
(left to right)  
dormitory rooms  
living area + library  
kitchen + bathroom



upper level:  
(left to right)  
storage room  
display + study area  
dry conservation lab  
wet conservation lab

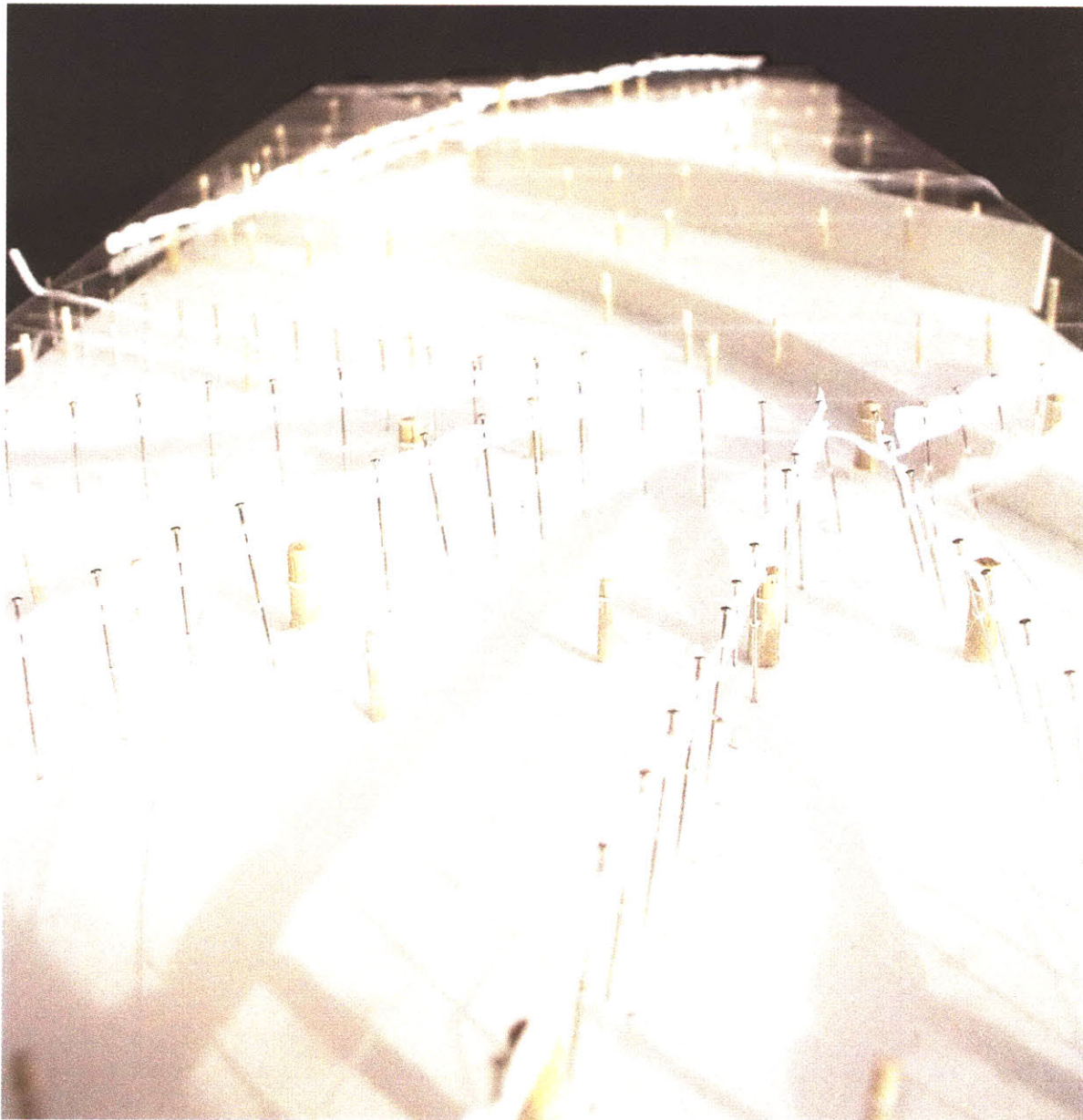
***Lua Makika:  
air catcher***

Earth, is this not what you want: to arise within us  
invisibly? – Is it not your dream  
someday to be invisible? – Earth: invisible!  
What if not transformation is your urgent commission?  
-- Rainer Maria Rilke



*tamarisk tree, ground invisible:  
appears to be reflected*







The long-term goal for Lua Makika is to grow a forest that will catch clouds on its own. Past and future use of the Lua Makika area for navigational training means that people focus on the sky and the water, with the land becoming incidental: “For students, being at the top of Kaho’olawe was the next best thing to actually being in a canoe on the open ocean.”<sup>30</sup>

The initial gesture on the site is the existing grid of windbreak trees, planted by the Navy. Future plans take this grid into account, adapting it. The Navy planted tamarisk trees in their windbreaks, which are not only not native to Hawaii, but are adapted to use any available water in the ground, making it difficult for new plantings to compete for water. Tamarisks also absorb salt spray and release it through their roots, poisoning the soil. Removing the tamarisks would be desirable, but would leave the area vulnerable to the wind.

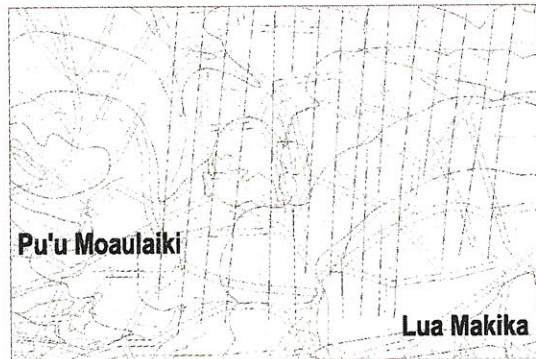
Replacing the tamarisks with sheets of mesh cloth would protect seedlings from the wind, while the cloth functions as a system of fog-catchers, providing the plants with water.

KIRC’s planting efforts focus on Lua Makika, where hardpan soil is liable to be eroded in heavy rains.









### ***planting strategy for Lua Makika***

layer 1: Navy tamarisk trees

layer 2: contour plantings (sturdy, fast-growing, erosion control)

layer 3: flowplane reinforcements ("ridges" have plants needing better drainage; "valleys" have plants needing more water)

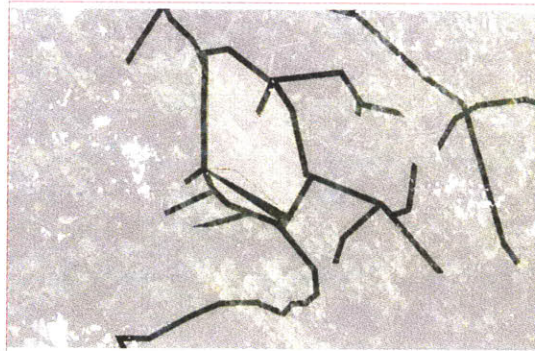
layer 4: stump datum (□ mulch-piles); fog-catchers

layer 5: mulch-piles at flowplane-contour coincidences – where they meet windbreaks, nucleus colonies of mixed smaller growth?  
 - mulch (and piles) new soil over hardpan; organic matter from off-island has too much pest risk

The windbreaks may deal with wind-generated erosion, but they are not helpful in preventing rain from creating runoff erosion. Plantings along the contours are needed to address erosion.



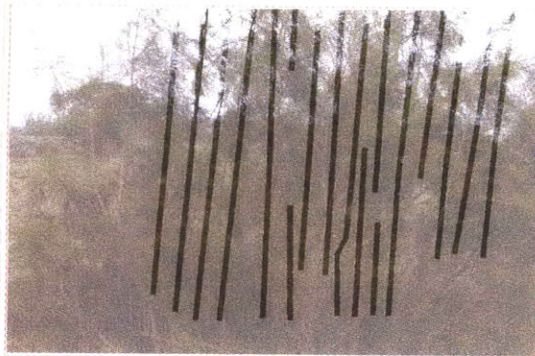
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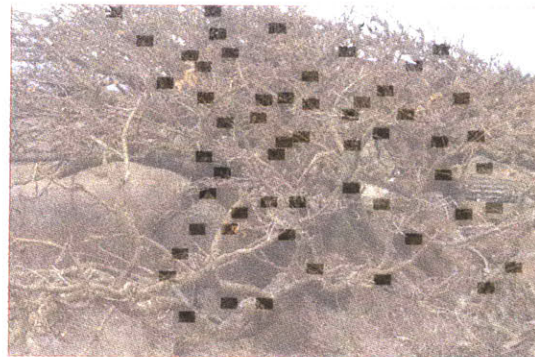
2



3



4



5

for Hawaii dryland forest:

- 1 - a'ali'i: primary bush for windbreaks and berm edges (fast-growing)
- 2 - hau: easy to grow; useful for windbreaks and fascines (especially in gullies)
- 3 - koaia: forest canopy
- 4 - tamarisk: to be chopped down
- 5 - wiliwili: forest canopy



### ***catching the air***

*Forestry reports recall a “dense forest” at the top of Kaho’olawe during the nineteenth century, and a cloud bridge that connected the island to the slopes of Haleakala. Every afternoon, the nalu winds would carry rain from Kaho’olawe back to Maui.*



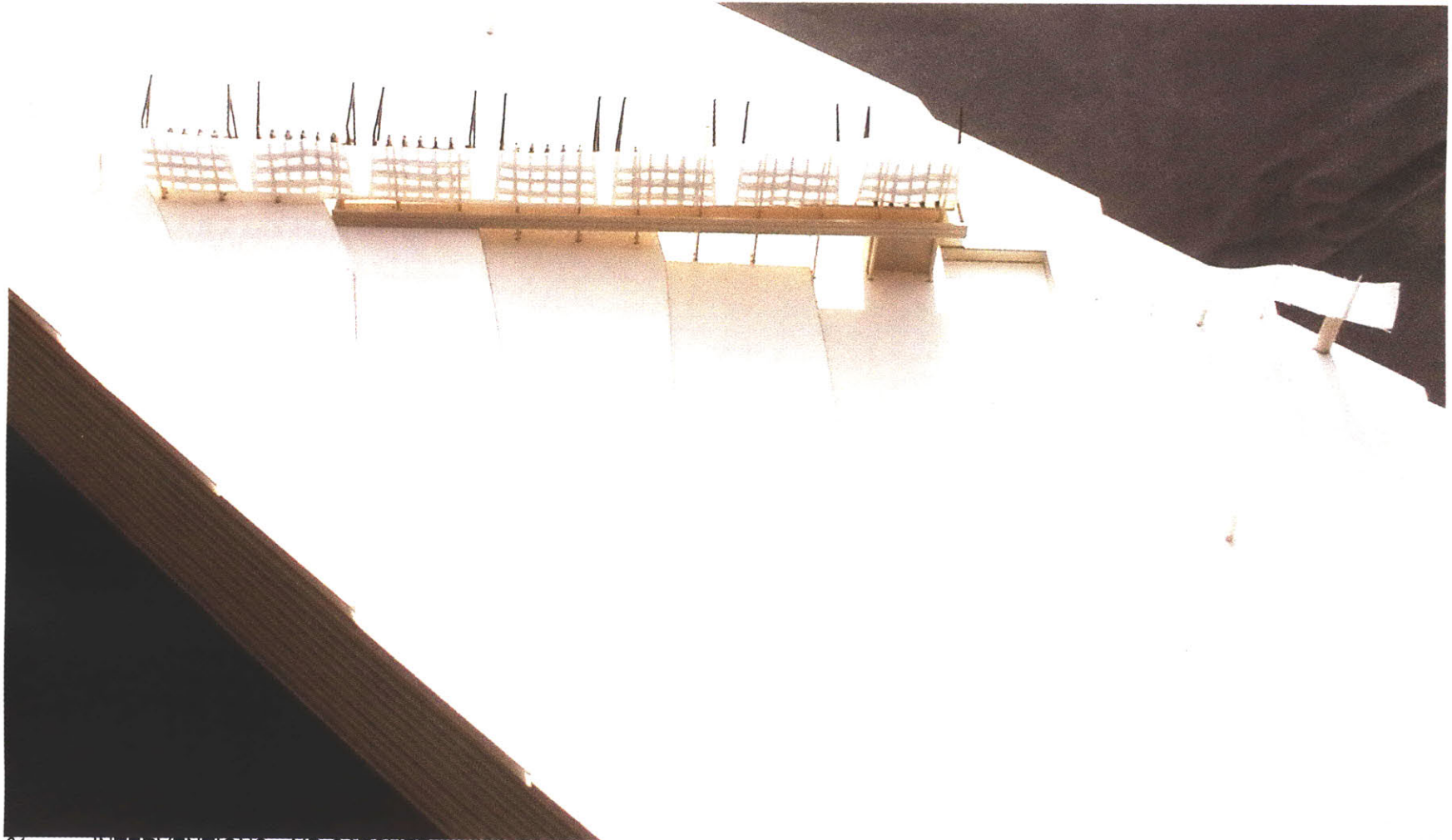
*In 1834 Reverend William Richards had recorded the use of dew as a resource, sufficient to harvest drinking water from oiled kapa [bark cloth] by those living on the island.<sup>31</sup>*

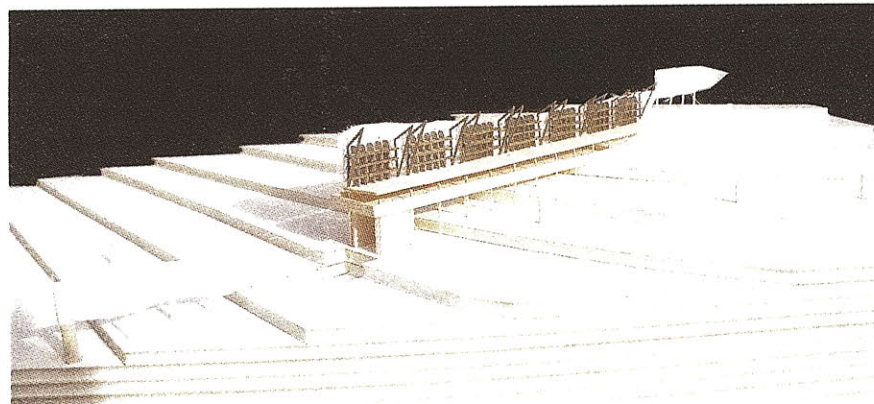


### ***precedent***

Fog catchers are used in places like Namibia and Ecuador, which have high, dry regions that get fog but little rain. Fog catchers can be extremely low-tech: mesh cloth is stretched between supports running perpendicular to the direction of the wind. When the fog comes in, it condenses on the cloth, and the fresh water runs down and is caught in troughs: invisible air becomes visible (and usable) water.







Over most of Lua Makika, the fog catchers and their water troughs are localized around individual plants and trees, channeling their water directly to the plant. In one instance, the fog catcher is localized to human use.

**The shelter for navigation students inserts itself into the fog catcher system.**



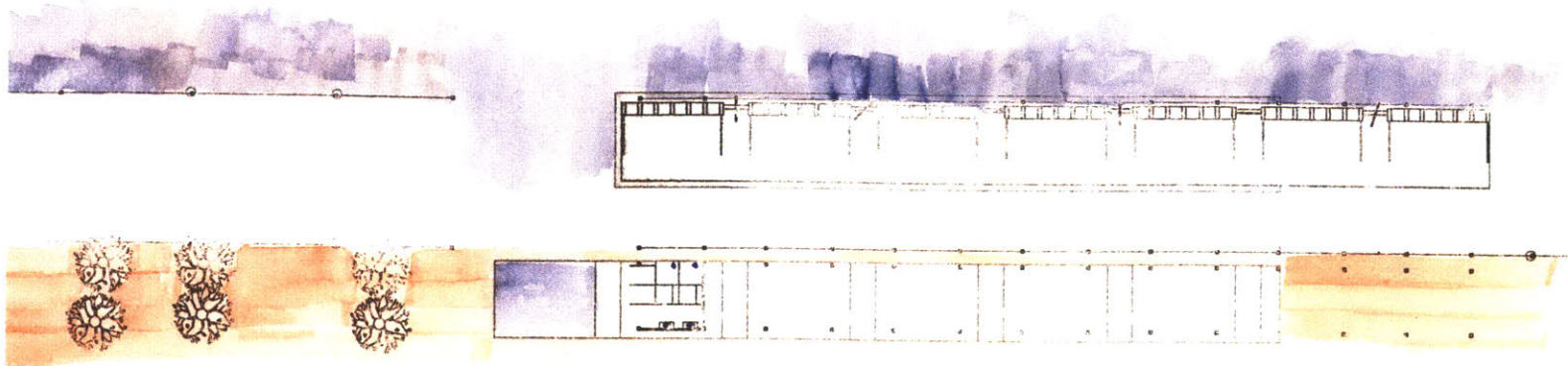
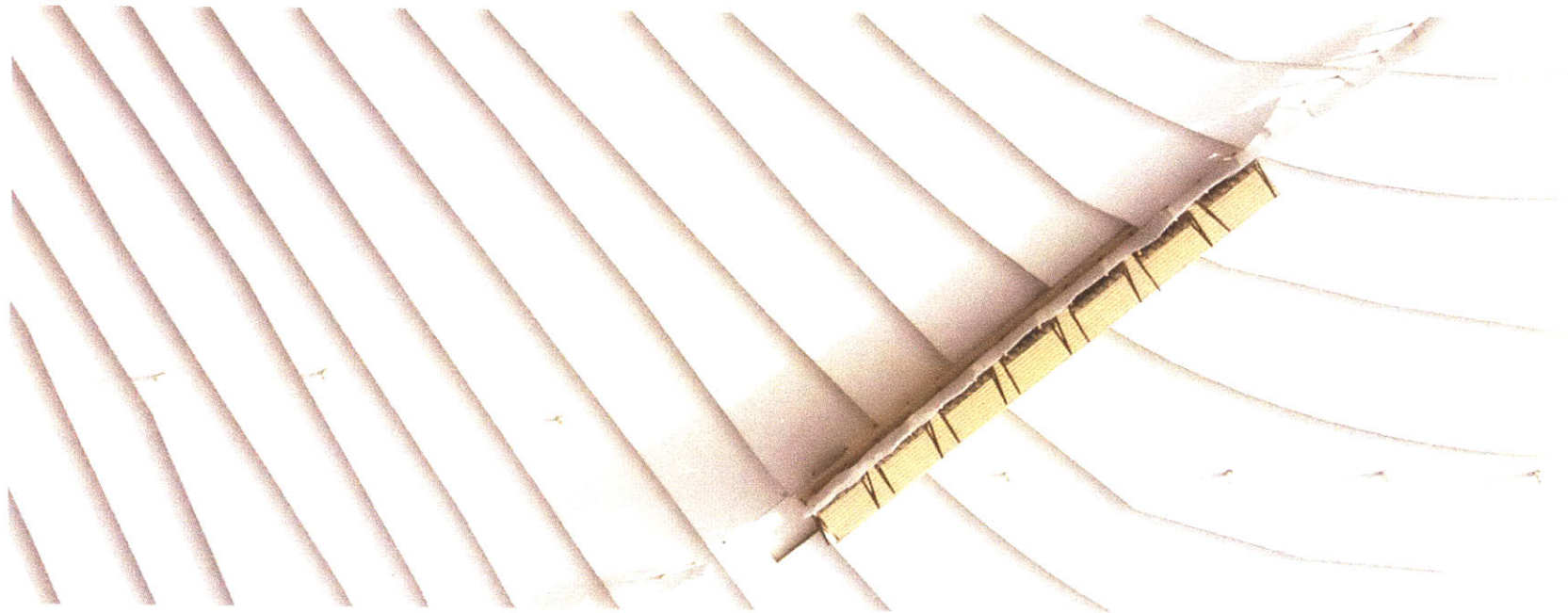




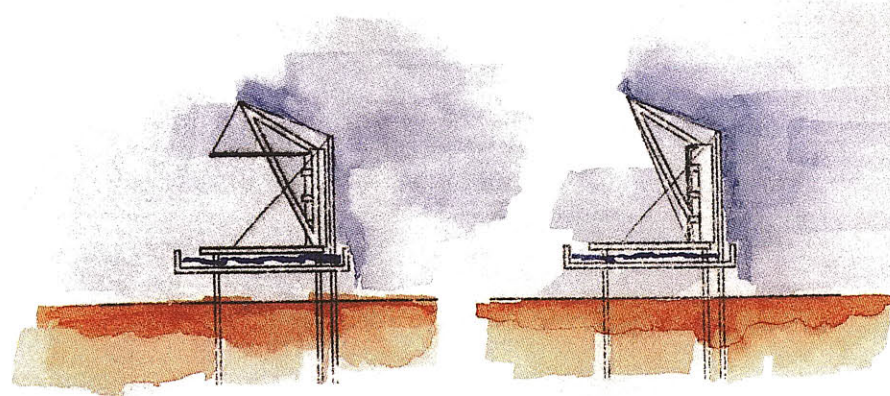
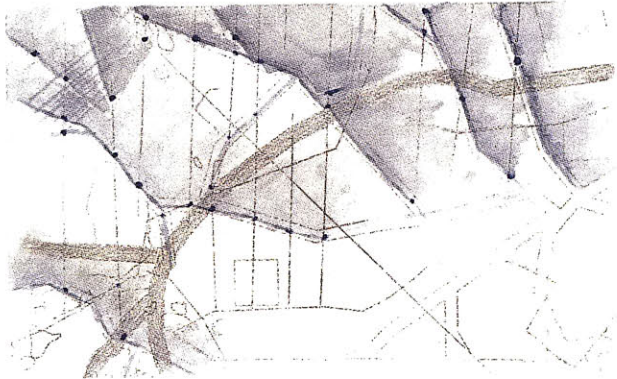
**If the land has become incidental, the tenuousness and randomness of the land surface is exposed by creating new planes; these new, human-generated planes also serve as rulers, marking the processes of the land.**

The shelter is designed around a simple plane, a platform for sleeping that hovers above a long, shallow cistern. The cistern collects water condensed by the fog-catchers associated with the wall (and roof, when occupied) of the shelter. Below the cistern is the composting toilet and shower enclosure.

Graywater is filtered and released along pipes that supply water to a grove of trees downhill from the shelter; the grove indicates that the shelter is marking the site with its own waste products.







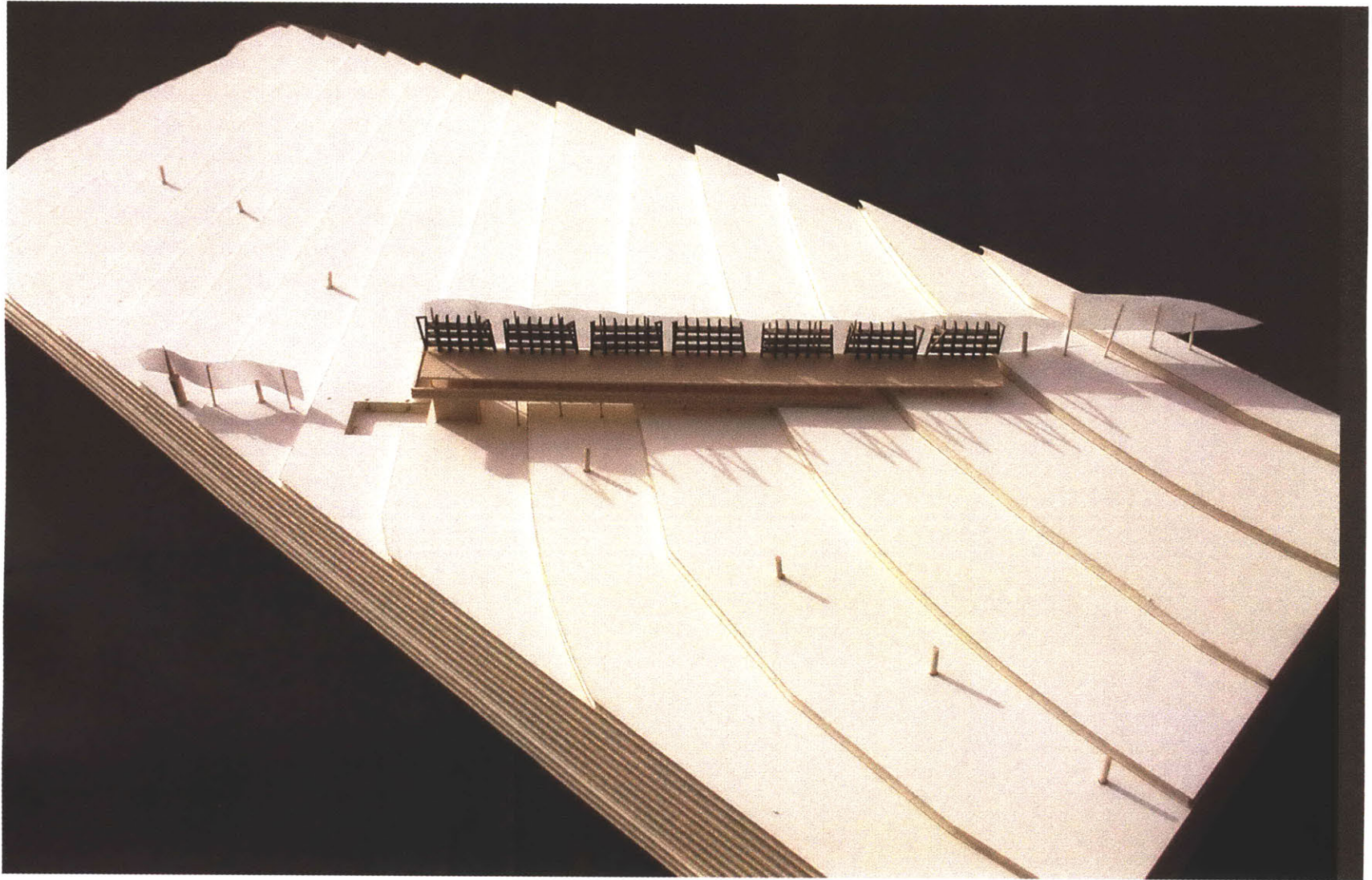
### *program*

accommodate 2-7 teachers and apprentices

- sleeping spaces on platform with associated storage wall units
- toilet and shower
- campfire area; water source for food preparation

When the shelter is unused, the platform remains open and uncovered. In use, the shelter changes on a daily basis. One person can shift a segment of the building's roof to make the wall inhabitable, and make a shelter from the rain.





## CONCLUSION

*A consciousness of the earth and ocean, such is the deserted island, ready to begin the world anew. But since human beings, even voluntarily, are not identical to the movement that puts them on the island, they are unable to join with the élan that produces the island; they always encounter it from the outside, and their presence in fact spoils its desertedness. The unity of the deserted island and its inhabitant is thus not actual, only imaginary, like the idea of looking behind the curtain when one is not behind it.<sup>32</sup>*

– Deleuze

It is natural to feel a nostalgic Romanticism toward Kaho'olawe, underdog and victim. In many ways, Kaho'olawe remains a shadow island, functioning like a phantom limb – you know its contentious history but you've forgotten it's there, until perhaps one very clear day you look off to the left of Maui and see the outline of a small, high island, its sea-cliffs in silhouette against the horizon.

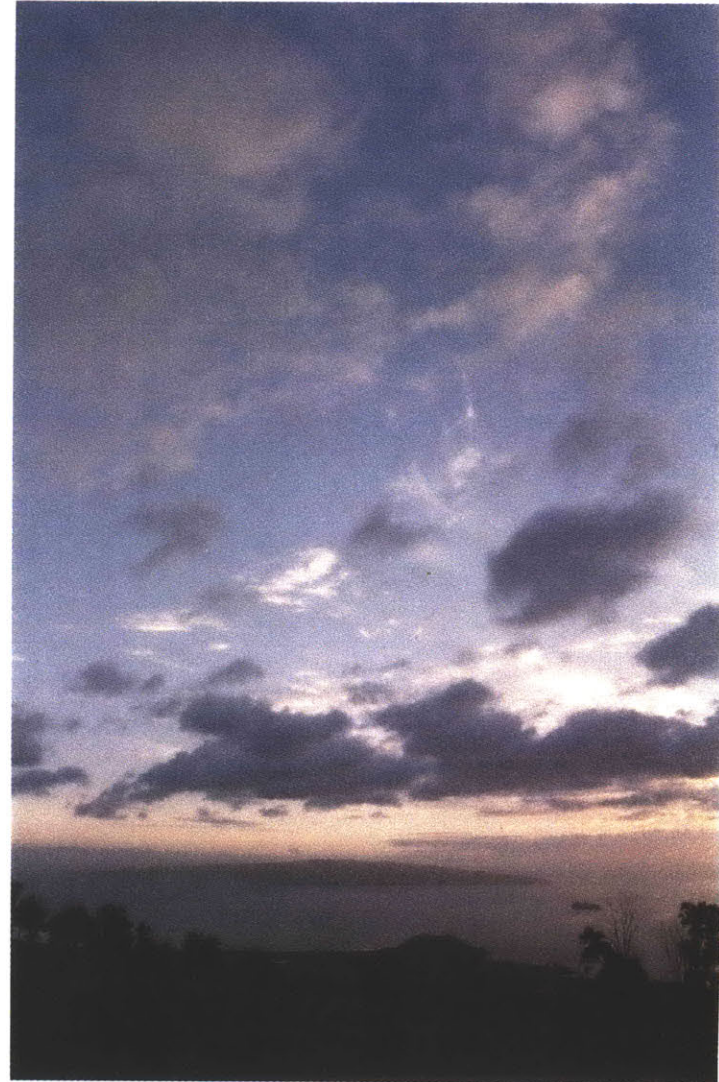
In the grand tradition of progress, exploitation, and first-settlement, inhabitation makes a mark on the earth, as permanent a mark as possible. In a ravaged and scarred landscape, nothing so definite should happen.

In formulating a strategy, it is necessary to balance between letting Kaho'olawe re-wrap itself in secrecy (the mystique that comes from inaccessibility; the protection that isolation affords archaeological sites) and exposing it to large-scale conservation and rehabilitation efforts.

The strategy becomes a continual effacing and remaking of existing natural and unnatural marks; it is a strategy for temporary visitations, of passionately-involved transience.

**(Endnotes)**

<sup>1</sup> Deleuze 11





## **occupy, tenant, engage, locate, colonize, sojourn, abide, inhabit, habitate, settle**

### SETTLE:

4. a. To cause to take up one's residence in a place; esp. to establish (a body of persons) as residents in a town or country; to plant (a colony, a town).
8. a. Of a bird, flying insect: To take up a position of rest from flight; to alight on something.
9. To come together from dispersion or wandering.
10. b. Of pain or disease: To establish itself in or on a definite part of the body.
11. b. Of a people: To take up its abode in a foreign country. Also, to establish a colony.
13. a. To sink down gradually by or as by its own weight. Of the ground: To subside. Of a structure or part of a structure: To sink downwards from its proper level.  
b. *trans.* To diminish the height of, to reduce to a lower level (a deck, topsail). Also, to cause (the land) to appear lower in the water by receding from it.
17. a. *intr.* Of a liquid: To become still after agitation or fermentation, so that the suspended particles or impurities are separated as scum or sediment.
25. To fix, make steadfast or constant (a wavering, irresolute or doubting person, heart, mind, etc.).

### ABIDE:

1. To remain in expectation, wait.
4. To stay behind, to remain (after others have gone).
8. To remain in residence; to sojourn, reside, dwell.
9. To remain or continue in some state or action, to continue to be *something*.
10. To abide *by*: *lit.* to remain with; hence, to stand firm by, to hold to, remain true to.
11. To continue in existence, endure, stand firm or sure.
12. To wait for, await; remain ready for, watch for, expect.
14. To await defiantly, to face, to encounter, withstand, or sustain.
15. To await submissively, await the disposal of, submit to.

### LOCATE:

1. *trans.* To appoint the place or situation of (the lands referred to in a grant); to fix the site of (a building, etc.).
2. To survey and define the limits of (a tract of land); to lay out (a road); to mark the position or boundaries of, to enter on or take possession of (a land-claim, a gold-mine, etc.).
3. To fix or establish in a place; to settle; *pass.* to be settled, stationed, or situated.
4. *intr.* for *refl.* To establish oneself in a place; to settle. (This is the earliest recorded use.)
7. To discover the exact place or locality of (a person or thing).



## ENDNOTES

Krauss, Rosalind E. The Originality of the Avant-Garde and Other Modernist Myths. 2

<sup>2</sup> Deleuze, Gilles. Desert Islands and Other Texts 1953-1974. 9

<sup>3</sup> Allen, Stan. "Mat Urbanism: The Thick 2-D." 124

<sup>4</sup> Reeve, Rowland B. Kaho'olawe: na leo o Kanaloa: chants and stories of Kaho'olawe. 49

<sup>5</sup> Reeve 43

<sup>6</sup> Reeve 39

<sup>7</sup> Barnard, Walther M. Kaho'olawe. 64

<sup>8</sup> [http://cramp.wcc.hawaii.edu/Study\\_Sites/Kahoolawe/](http://cramp.wcc.hawaii.edu/Study_Sites/Kahoolawe/)

<sup>9</sup> Barnard 72

<sup>10</sup> Barnard 77

<sup>11</sup> Barnard 121

<sup>12</sup> Barnard 130

<sup>13</sup> Barnard 136

<sup>14</sup> Reeve 40

<sup>15</sup> Barnard 64

<sup>16</sup> [http://cramp.wcc.hawaii.edu/Study\\_Sites/Kahoolawe/](http://cramp.wcc.hawaii.edu/Study_Sites/Kahoolawe/)

<sup>17</sup> Kaho'olawe Island Reserve Commission. Ho'ola Hou I Ke Kino O Kanaloa: Kaho'olawe environmental restoration plan. Draft. 70

<sup>18</sup> KIRC 6

<sup>19</sup> Encyclopedia.com

<sup>20</sup> [http://cramp.wcc.hawaii.edu/Study\\_Sites/Kahoolawe/](http://cramp.wcc.hawaii.edu/Study_Sites/Kahoolawe/)

<sup>21</sup> KIRC 7

<sup>22</sup> PBR Hawaii. Kaho'olawe Use Plan. 7-5

<sup>23</sup> PBR 7-5

<sup>24</sup> PBR 7-21

<sup>25</sup> KIRC 39

<sup>26</sup> KIRC 40

<sup>27</sup> KIRC 74

<sup>28</sup> Corner, James, ed. Recovering Landscape: Essays in Contemporary Landscape Architecture 179

<sup>29</sup> KIRC restoration plan on web

<sup>30</sup> PBR 7-21

<sup>31</sup> KIRC 10

<sup>32</sup> Deleuze 11



## LIST OF IMAGES AND SOURCES

NOTE: ALL IMAGES IN THIS THESIS ARE BY THE AUTHOR UNLESS OTHERWISE NOTED HERE

**page 12:**

L: Bishop Museum website:  
<http://www.bishopmuseum.org/>  
R: Aloha Airlines website: <http://www.alohaairlines.com/fly/routemaps.htm>

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KIRC archives

**page 17:** clockwise from top  
Bishop Museum website  
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Bishop Museum website

**page 18:**

<http://www.globalsecurity.org/military/facility/kahoolawe.htm>

**page 20:**

Top: KIRC archives  
Bottom: Bishop Museum website

**page 21:**

Top left: KIRC archives  
all others: Bishop Museum website

**page 22-23:**

5 images along bottom:  
Sterns, Harold T. [Geology and Ground-Water Resources of the Islands of Lanai and Kaho'olawe, Hawaii.](#)

**page 24:**

L: <http://www.globalsecurity.org/military/facility/kahoolawe.htm>  
R: <http://www.hear.org/starr/hiplants/images/index.html>

**page 25:**

rain map: [http://www.hightechmaui.com/CProfile/images/tandr\\_big.jpg](http://www.hightechmaui.com/CProfile/images/tandr_big.jpg)

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both images: KIRC archives

**page 27:**

wind map: <http://www.state.hi.us/dbedt/ert/wwg/statemap50mpowersm.gif>

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Siegel, Jennifer, ed. [Mobile: The Art of Portable Architecture](#)

**page 36:**

top: Buck, Sir Peter H (Te Rangi Hiroa). [Arts and Crafts of Hawaii.](#)  
bottom: James Turrell book

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<http://www.globalsecurity.org/military/facility/kahoolawe.htm>

**page 54:**

[mtwowo.org/SaltcedarROOTS/dwg.jpg](http://mtwowo.org/SaltcedarROOTS/dwg.jpg)

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[http://www.baobab.net/ec\\_4\\_s.JPG](http://www.baobab.net/ec_4_s.JPG)

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