# Drinking Up the Desert



by

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ABSTRACT

As one of the fastest-growing cities in America, Tucson, Arizona suffers from a classic case of urban sprawl. Fueled by the prevalence of lot splits and cheap suburban land, little was done to curb the city's unsustainable growth until 1998, when the discovery of endangered pygmy owls in Tucson sparked the creation of the Sonoran Desert Conservation Plan. The plan aims to preserve biodiversity in Tucson and surrounding Pima County by limiting development in biologically sensitive areas of the desert. In addition, Pima County is applying for a county-wide Section 10 Permit from US Fish & Wildlife Service.

Water is another limiting factor in the city's growth. When Tucson overdrafted its groundwater resources, the city bought additional water from the Colorado River, which was channeled to Tucson through the Central Arizona Project. Due to infrastructure problems, initial delivery of canal water in 1992 was shut down in 1994. Tucson Water, the city's main water utility, later turned to recharge and recovery as a way to treat river water. Even with the addition of river water, Tucson, like other cities in the American Southwest, continues to search for new water sources for its ever-growing population.

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Tucson is the kind of desert you want to own. When the sun slides over the majestic saguaro cacti and the roadrunners hop like ungainly stilt-walkers, it's hard not to imagine claiming a slice of it for yourself. These are not the sand dunes of the Sahara; Tucson lies in the midst of the Sonoran Desert, a surprisingly lush landscape that extends far beyond the city limits. There's space out here, and it's easy to build a house on the edge of town, to pave the driveway but leave the backyard in its natural state. Soon the wildlife appear: woodpeckers and javelinas, lizards and quail. In springtime the ocotillos start blooming, flower buds tapered like orange asparagus tips. By fall the hummingbirds wobble drunkenly in flight, drugged on fermented saguaro fruit. Except for brief monsoons that dump water from the sky, turning the land into a vibrant field of wildflowers, the weather stays sunny and dry year-round. All is well, until the neighbors move in.

One morning the view out the back porch is blocked by another house, part of a new subdivision just two blocks further into the desert. That house marks the new boundary of the city—for a little while, at least. *The money is in the dirt,* runs the age-old mantra of development. *And the dirt is cheaper at the edge.*

Many who move to Tucson end up destroying the desert isolation they came for. David Taylor, one of the city's demographic advisors, says "We're schizophrenic about growth. When we're at work we're for more sales, bigger staff. In the driveway coming home at night we're for fewer people scaring their quail, blocking their view."

As one of the fastest-growing cities in America, Tucson suffers from a classic case of urban sprawl. "Drive 'till you qualify" is the slogan for those seeking affordable homes far from the urban center, yet close enough for daily commutes. From any hilltop

one can see the city spread out like a bulging amoeba, a staggering mass of retail stores and flat, adobe-style homes. The roads seem to go on forever, curving up over the horizon. Back in 1998, twelve acres of desert a *day* were bladed down, bulldozed under and paved for new development. Throughout Tucson and surrounding Pima County, developers submitted plans for enormous subdivisions on pristine desert lands, and with few exceptions, the County Board of Supervisors approved them all.

Then came the tiny carnivorous bird. In May of 1998 a nesting pair of cactus ferruginous pygmy owls was found in northwest Tucson at the site of a planned high school. Only a year earlier, the birds had been declared endangered under the US Endangered Species Act, and destruction of their habitat was punishable by federal law.

"It became a kids verses owl issue," remembers Scott Richardson, a biologist from US Fish & Wildlife. "Which was about the worst situation you could have."

Following a series of lawsuits, Amphitheater High School was eventually built, complete with wildlife corridors at the campus edge. By then it was too late for the owls. None remain in the northwest section of town; they've fled into the wild, far from the encroaching development.

As of January 2009, Arizona's pygmy owls number in the 40s, though larger populations exist in Mexico and Texas. Biologists in Tucson are keeping tabs on the state's remaining owls, and when I expressed interest in seeing one for myself, Richardson agreed to take me on an owl search.

We set out shortly before dawn under a three-quarter moon, heading west out of the city. A pink-faced man dressed in jeans, red flannel shirt, and a Fish and Wildlife baseball cap, Richardson seems eager to escape the office for a few hours in the field.

Recent budget cuts have eliminated many of the owl surveys. Richardson is fond of recounting tales from the days of plenty, of the hours spent attaching leg bands and radio transmitters onto the birds. "You slip an empty juice container over their heads, and once it goes dark, they calm down."

That's the easy part. To catch an owl in the first place, Richardson lured them in by planting an owl decoy (a plastic lawn ornament with feathers glued on top) in the territory of a real pygmy owl. Once the trap was set, Richardson would drape the decoy in fine netting and play the recorded call of an owl declaring its territory. "For how little they are, they're ferocious." He rubs the back of his hand as if remembering an old wound. Barely six inches long, pygmy owls are endowed with disproportionally large yellow talons. "I've been dive-bombed by owls [defending their turf]. It feels like getting hit in the head with a baseball."

After half an hour's drive, the sky before us pales from black to deep gray. The flank of a mountain rises up on the right, covered in dark scrubby plants. "Those are the Tucson Mountains," says Richardson. We've passed from Tucson Valley into Avra Valley with hardly a break in the buildings on either side. Historically, development was limited by the mountain ranges that border Tucson on all sides, but in recent years, new construction has spilled over the foothills and into the adjacent valley.

When the pygmy owls were discovered in 1998, "that was kind of the whole wakeup call to the community," says Richardson. "Instead of sea turtles in some far-off coast or grizzly bears in Yellowstone, people saw this endangered species in their own backyard."

The Endangered Species Act of 1973 promises protection against the "take" of endangered species—anyone who killed or harmed the species could face $50,000 fines or a year's imprisonment. But there was a way out. An amendment in Section 10 of the Act allowed private developers to destroy critical habitat as long as they were offsetting the harm in other ways. Developers can apply for a Section 10 permit by submitting a Habitat Conservation Plan. If the habitat plan describes how developers will mitigate "take"—by creating wildlife preserves, for example—then construction can continue as usual.

"It's a 'get out of jail free' card," said Carolyn Campbell, Executive Director of the Coalition for Sonoran Desert Protection. Galvanized by the owl listing and the high school fiasco, officials in Pima County began drafting a habitat plan for the entire county. It was the ultimate time-saver: a county-wide Section 10 permit would save developers the trouble of applying for permits on a case-by-case basis.

News of the plan sent alarm bells ringing among local environmentalists. A 1998 report by Defenders of Wildlife had warned against common pitfalls. Some habitat plans suffered from a net loss in critical habitat; others were based on inexact science. Too often, the planning board included a token environmentalist who held little influence in the process. In fact, many developers were in favor of these habitat plans—they saw them as quick fixes that did little to stall construction projects.

Concerned about the plan's outcome, a group of 40 environmental and neighborhood groups joined to form the Coalition for Sonoran Desert Protection. "We wanted to be in the driver's seat as much as we could," said Campbell, and their timing was perfect. Through a series of coincidental elections and appointments, by 1997 the

Pima County Board of Supervisors was vastly more pro-environmental than it had been for the past thirty years.

In May 1998, the Board agreed to pursue a two-part approach: they would create a Sonoran Desert Conservation Plan to preserve Pima County's most biologically valuable lands. Parts of the desert plan would also form the basis of the Section 10 habitat plan.

"It's about quality of life," says Richardson. The desert plan goes above and beyond the habitat plan requirements. Rather than focus on individual species, the desert plan was made to preserve biodiversity: it limits development within the habitat of 36 species threatened by development. The county also passed a $174 million bond measure in 2004 for open-space acquisition; the purchased wilderness lands will be used as credit for the Section 10 application.

According to Campbell, Pima County's habitat plan is unique because it is "embedded" inside the county's land-use plan. This has jump-started conservation—while the desert plan and the habitat plan are mutually compatible, progress on the habitat plan is slow. After dozens of public meetings, hundreds of reports, and more than ten years, Draft V of the plan was completed in January 2009. Final submission to US Fish and Wildlife is scheduled for 2010. Meanwhile, the county has been enforcing the desert plan since 2001.

Ironically, despite the flurry of land-use changes initiated by the pygmy owl, the bird was delisted from the endangered species list in 2006. Industry lawsuits argued that since most pygmy owls live in Mexico, birds in the United States were no longer considered endangered. According to Peter Galvin, founder of the Center for Biological

Diversity, the courts essentially "wrote off" the American owls. Since 2006, Galvin's group has been working to reverse the delisting.

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*Stalking Owls*

The owl's new legal status hasn't affected the desert plan. Pygmy owls remain among the 36 species protected in Pima County, though it's nearly impossible to find one in the wild unless, like Richardson, you already know its general territory.

As we continue to drive, the houses thin away on either side. A rim of brilliant orange appears over the mountaintops. We turn off the highway onto a side street, and suddenly the smooth cadence of wheels on pavement shifts into a bouncing jolt. The dirt road beneath us is pockmarked like the surface of Mars.

"This is a lot split," says Richardson grimly, as the car bumps past a row of dusty trailers half-hidden behind derelict cars and shriveled palo verde trees. The neighborhood's mailboxes are clustered in a cul-de-sac, each dented metal box perched on dilapidated wooden posts.

Lot splits are a curious artifact of Arizona. According to state law, landowners who split their land into five or fewer parcels are exempt from most county regulations. Unlike developers of subdivisions (when the land in divided into six or more parcels), lot split owners can develop the land without paying for paved roads, streetlights, or other infrastructure. It is the legacy of a former era, set in place to ensure easy land sales, and in many cases, it has resulted in poorly planned neighborhoods that lack resources. "This

road gets slick when it rains," Richardson tells me. It would be like driving on spongy peanut butter. And during the summer, there are dust problems.

Some lot splits boast gleaming vacation homes set in the foothills of scenic mountains, but the one we are driving through is the more typical image of those who live on the edge of civilization. There's a wildness about the place, a sense that we are honing in on owl territory at last. Gone are the retail stores and streetlights of Tucson. Twisting and turning in the bumpy lane, all I see are ramshackle trailers parked among stunted desert plants. When I mention that the residents must live close to the pygmy owls, Richardson laughs. "I doubt they're interested in endangered owls." Those who come here seek isolation, preferring to live without government interference.

Soon even the trailers have disappeared, and our car, a white Dodge Durango, slows to a crawl. We are driving through old ranchland, surrounded by acres of creosote bushes that glisten in the sunrise.

Saguaros start appearing as we climb in elevation. The younger ones are single shafts that stand like prickly posts; the multiple arms don't grow until the cacti are at least 60 years old. Round, grapefruit-sized holes in several cacti give the impression that they're rotting from the inside out. These are woodpecker nests, perfect for pygmy owls who swoop in after the woodpeckers move out—though sometimes the owl will kill any bird within before claiming the nest for itself.

Richardson stops the car in the middle of a cactus field about 2,000 feet above sea level. From surveys conducted the previous year, Richardson knows there should be two or three owls in the area. The easiest way to lure them out is to play the recording of an

owl's territorial call. It's enough to send a real owl screeching back at the challenger for hours.

"I can't promise an owl," Richardson cautions. They're most active in late February, when their hormones are "all jazzed up" in preparation for the mating season. As it's only January, there's a chance that the owls could ignore us altogether.

The air outside the car is startlingly cold. Distant mountains appear blue against the brilliant, sun-filled sky. Richardson slips a CD into a portable music player, which he then attaches to a plastic megaphone before pressing "Play."

The megaphone emits a series of sharp, steady hoots, each one clipped at the end. Silence. Richardson tries again, swiveling the megaphone in another direction.

"Is that it?" I say in a hushed whisper, as somewhere far off an echoing cry answers back.

"That's a woodpecker," Richardson replies. "They can sound similar."

Several tries later, we finally hear the soft calls of a real owl. "There!" Richardson freezes. "Can you hear?"

I can hear, but not see. In an effort to lure him in, Richardson plays another call, this one of a female owl. The real one whistles back. "He's moving away," Richardson breathes, then steps lightly in the direction of the call.

The owl leads us on a meandering trip through shin-high choya cacti. "The problem is, they're like little ventriloquists," grumbles Richardson as we swerve again, drawn by the maddening call that seems to get no closer. "He's spooked," says Richardson guiltily after ten minutes' tramping. "Let's stop harassing him."

We return to the car, and Richardson drives about a mile away, stopping by a wash that he believes lies in the territory of a single male owl. A wash is the western term for a streambed. Like most streams in Tucson, this one is ephemeral, running only after strong seasonal rains. At the moment the wash is simply a dirt trench lined with straggly trees. People go horseback riding in washes, which remain dry for so long that the flash floods which rip through them during summer monsoons have claimed many a victim. *Don't get swept away,* reads a warning ad in the city buses. These words are printed next to the grisly image of a drowned girl, her hair dripping as she hangs limp in the arms of her rescuer. *Don't play in flowing washes.*

Up until fifty years ago, Tucson's streams ran year-round, and the Santa Cruz River on the west side of town flowed deep with water. But rivers are fed by groundwater bubbling up from beneath the surface, and Tucson had long drained its shallow surface waters.

That groundwater is the life-force of the valley. With 12 inches of rain a year (compared to the national average of about 30 inches)—most of that evaporating before it reaches the ground, and the Colorado River 300 miles away, Tucson was settled by those who could dig wells. When population soared, the aquifer dropped as wells began to pump not just groundwater but surface waters as well. The rivers dried up, destroying with them the riparian zones (riverbank areas) that are crucial habitats for much of the wildlife in this parched environment.

Pygmy owls adapted better than most. Dry as it is, the owls prefer living close to the wash, where trees, nourished by seasonal floods, offer cover from predators. As we track this new owl, which glides from tree to tree beside the wash, Richardson scans the

area with his binoculars. I can see nothing, but after awhile it's clear that the owl has decided to stay put.

"There!" Richardson hands me the binoculars. The owl is perched halfway up a palo verde tree about 30 yards away, a bundle of brown and white feathers camouflaged perfectly against the thin branch. He turns his head, still returning the challenge, and I can see the fierce yellow eyes beneath a black-banded forehead, the long reddish tail dipping behind a squat body. Slowly, with many detours behind nearby cacti, I inch my way closer, trying to keep out of sight. About ten yards away I look down to regain my footing, and when I raise my head he's gone, the branch's sudden rebound the only sign of its released weight.

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*Finding Space*

There was a developer once, says Richardson, who was fascinated by the pygmy owl's fame. This man was invited to accompany some biologists during an owl survey and given permission to hold an owl as it was banded. Something about that tiny feathery body took hold, and soon after, while developing a 500-acre lot, the developer left 420 acres untouched, preserved as open space for the area's wildlife.

Preservation of open space is a major tool of the Sonoran Desert Conservation Plan. In 1999 the county created a steering committee to draft recommendations for the desert plan. At the same time, a team of scientists was charged with mapping the county. From the beginning, the two groups were kept separate.

"I think the [desert plan] has persisted because the scientists have stayed out of the advocacy," said Bill Shaw, a biologist at the University of Arizona who led the science team. "We've had this great partnership with Carolyn Campbell's group. They did the lobbying and we would just testify on the biological consequences [of development or habitat destruction]. It's pretty hard to argue with a biologist if he's just talking about science."

Shielded from politics, the scientists began setting up the plan's biological baseline. All maps of Arizona land ownership resemble rainbow checkerboards. State Trust Lands lie side-by-side with private and county lands. Native American Tribal Lands run alongside federal Bureau of Land Management lands--there is no rhyme or reason to the layout. Ignoring only Tribal Lands (which are autonomous nations) and incorporated Pima County (urban areas within the county that lack much biodiversity in the first place), all private and public lands were considered fair game. The scientists' goal was to identify the areas essential for preserving biodiversity and to plan human activities around that.

First came a list of 55 species that were vulnerable in the face of continued growth (since 1999, that list has been shortened to 36 species). Ten are already listed as federally endangered or threatened, while others, such as the Mexican long-tongued bat and the needle-spined pineapple cactus, are native to the region and threatened by habitat destruction. Shaw called the list a "broad surrogate for Pima County's biodiversity."

The scientists studied each species in detail, recording its population status and habitat requirements. At the same time, they generated county maps of topography, soil, and vegetation. Over the next year, the team collaborated with species experts to develop

models of each species' habitats. And when all 55 maps were done, they were joined together to find where five or more species overlapped.

"It wasn't about where the species occur," clarified Shaw. "But where their *potential* habitat is—which is an important distinction." A species' habitat can change with time, so protecting areas where the species might live in the future would lead to "a long-term solution that will work for a hundred years."

The final map is called the Conservation Land System. It is a work of art, blending, watercolor-like, patches of green, purple, and blue. Major riparian areas stand out like blue veins. The biological core areas—where five or more species overlap—are shaded dark green. Regions with three or four species (called multiple use areas) are in light green. Together, they create an open loop, like a backwards "c," around Tucson (the left side of the loop is the Tohono O'odham Reservation). Purple arrows fan out in all directions, denoting the wildlife corridors that connect protected regions.

Under the map's guidelines, 95% of riparian areas must be left untouched. So if developers wants to upzone (increase the number of houses per acre) on 100 acres of riparian land, they can only build on 5 acres. Similarly, 85% of biological core regions and 67% of multiple use areas are kept as open space.

If the whole thing looks like a patchy sort of urban growth boundary, it's not—the term, at least, is dangerous to use, not to mention inaccurate. For all its regulations, the desert plan has some fundamental limitations. Even those who wholeheartedly support the plan know it's a way of re-directing growth to less sensitive areas of the desert rather than placing a limit on growth altogether.

The map's guidelines are only triggered when developers request an upzoning, or increase in the density of homes in an area. And there's no question of applying the guidelines to all construction built to existing zoning standards. When I mentioned the possibility to Ben Changkakoti, a former employee of Development Services, he simply laughed.

"[It would open up] a hornet's nest," he said ruefully when I visited his office. A thin man with black hair pulled into a short ponytail, Changkakoti was drinking water from an Obama Inauguration Day mug printed with the numbers 1.20.09. "Desert cities are the canaries of development," he said emphatically. The desert plan was designed to help Tucson shift from uncontrolled sprawl to a better-managed urban center, one that could serve as a blueprint for burgeoning cities elsewhere in the country. An urban planner by training, Changkakoti's greatest fear was the prevalence of lot splits. While lot splits follow the same open-space guidelines as subdivisions, their very nature promotes impromptu communities that spring up "fifty miles south of nowhere... [creating] gravely auto-dependent [districts], usually on land of high biological value." The neighborhoods expand like rabbit warrens: when a patch of land is sliced into five parcels, each individual parcel can be divided again and again into five more parcels until the zoning limit is reached. Cut off from essential city infrastructure, families make do with overpumped wells and septic tanks that threaten groundwater supplies. Some neighborhoods become public health hazards: narrow roads prevent emergency vehicle access; dust rising from dirt roads ignites respiratory illnesses; houses built on flood-prone land get washed out during storms.

The county has a strict no-bailout policy. When frustrated residents start banging on office doors demanding better roads or hookups to municipal water companies, the answer is always a polite but firm "no." Lack of money is a problem, and more importantly, the county is not in the business of paying for the residents' life choices. On occasion, Pima County has purchased low-lying lands after the houses were washed away by storms, but it was to prevent future residents from moving in, rather than compensating the owners.

*Does development pay for itself?* That is the county's constant question. For Changkakoti, unregulated lot splits are a blemish on the landscape, a vehicle for unstoppable development. "People don't come here for the quality of Tucson's pavement," said Changkakoti. They come for the landscape that is so easily destroyed. Many of the regulatory approvals that subdivision developers must go through—finding an assured water supply, paying for hydrology consultations on flood risk—are not required for lot split developers. So lot splits are built at much higher rates, often too quickly for the county to keep track of where they are.

Historically, the Arizona Legislature has placed few restrictions on lot splits. Changkakoti hopes the state will change its constitution within a few decades; he's fighting tradition. In the days of the Wild West, lot splits allowed fathers to say, "Here you go, son. Build your house on this land." But can we afford to keep them in the twenty-first century?

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The next day, I drove across town to meet Bill Arnold, a developer who was very much in favor of lot splits. Arnold's office sat in the same building as the Bank of

Tucson, a towering white edifice with tinted windows. The grounds were covered in dark, thick grass, the sidewalks still damp from an earlier watering. Compared to most places in Tucson, this was an extravagance, a rare patch of green in a city that promoted xeriscaping—the use of native desert plants instead of grassy lawns. After days of walking across gravel-covered yards, it was a shock to feel soft springy turf beneath my feet.

Black marble tiled the lobby floor, and Arnold's name was listed on a shining plaque as "William G. Arnold, Ltd." Arnold greeted me in his office, dressed in jeans, a flannel shirt, and cowboy boots that stopped just below his knees. The window had a panoramic view of Tucson. I could just make out the blurred edge of the city near the foothills of distant mountains.

"See that?" Arnold pointed to a patch of flat-roofed homes several miles away. "I used to camp out there as a Boy Scout." Then he leaned forward in his chair, hands clasped together, and said, "You vote, don't you?" When I answered yes, somewhat confused, Arnold continued, "You also vote with your feet. You choose where you live."

According to the last survey (conducted in 1998), 41% of housing permits were issued for non-subdivision homes. "Forty-one percent of people are saying they want some freedom…I think it's fair to balance the desire of the consumer with the desire of the bureaucrat."

Remember, said Arnold, "the Wild West, the cowboy mentality—it's still here." Changkakoti's nightmare was the bliss of anti-regulationists. For those who were anti-government, the last thing they wanted was to live in "cookie cutter homes" where they

would be forced to follow neighborhood rules about trash curb pickup. "A lot of people don't want to live in a safe little nanny community. They just don't."

As long as the buyers understood what they were getting into, "the question of whether or not that should be permitted—to me, I find it hard to even ask it. Why shouldn't it be permitted…if that buyer needs an ambulance and that ambulance can't get to them [due to bad roads], that's their choice!"

And despite all the bad press, lot splits, Arnold argued, were not the disasters they're purported to be. "[The county] only shows you the bastard stepchildren [of lot splits] so you get the reaction they want you to have." Those dilapidated homes had become the public face of lot splits, but Arnold was here to show off its model citizens. Years ago, he drove around town snapping pictures of buildings, then asked people to distinguish between subdivisions and lot splits.

"See this?" Now he brought out a collection of photos. "Rincon High School." A sturdy brown building that looked like a typical school. "Not in a subdivision…this fire station? Same." The next picture showed a house with peeling paint at the end of a dirt-covered driveway. "This house is part of a subdivision!"

Arnold's pictures couldn't hide the disparity between manicured lawns and dusty trailer parks. The average subdivided property is worth four times as much as the average lot split. "You have to have some means for affordable housing [if you get rid of lot splits]", admitted Changkakoti.

In the meantime, Arnold had a solution for the county's lot split frustrations. Some urban neighborhoods have created what are called improvement districts—areas where business owners use a self-imposed tax to pay for streetlights and better roads. So

why isn't the county promoting improvement districts for lot splits? "I understand [the county's] point of view," said Arnold. "If someone was banging on my door, yelling at me because I'm not giving them [the services] they think I should give them, I would get to the point too where...the easiest process to make them go away is to [ban them altogether]." But it wouldn't be hard, he added, to help the lot splits help themselves.

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Arnold's career as a developer spans 30 years, long enough to have changed some of his own views on growth. He resisted the traditional story of environmentalists verses developers. Even Carolyn Campbell, Executive Director of the Coalition for Sonoran Desert Protection, called Arnold "kind of a friend"—a remarkable statement, given that Arnold was the developer who sold the land for Amphitheater High School in the first place. Like most of his colleagues, Arnold started out as a "semi-cold opponent" of the desert plan.

"[But] over time, I became very much a supporter." For one thing, the county used the promise of the Section 10 permit as "the golden carrot." Currently, developers who seek to build on endangered species habitat must apply individually to the federal government for a Section 10 permit. Once the habitat plan is approved, Pima County will be able to streamline the process for all developers.

"Theoretically," said Arnold, "that's [what] we've been assured...I guess the proof will be in the pudding."

He leaned back in his chair, and it was then that I saw the toy pygmy owl perched on his bookshelf. The bird's head was sticking out of a plush saguaro cactus; it was the kind of souvenir you might find at the Audubon shop.

"That was a present," said Arnold, a gag gift from several realtor friends who couldn't stop teasing him about his support for the desert plan.

It's lucky the Sonoran Desert plan exists; the guidelines have been in place and implemented since 2001, whereas by the time the habitat plan is approved—in 2010 at the earliest—it will have been in the works for twelve years. "It's not a bad thing," said Campbell. It showed that the county wanted to get it *right.* The biggest obstacle was the long-term monitoring plan. Endangered species can be counted, habitats can be analyzed for soil health, climate can be monitored—but how do you keep track of ecological progress over thousands of square miles? Pima County was limited by its resources; maintaining a perpetual handle on all critical habitats was simply infeasible.

These challenges have not stopped the county from buying land for conservation. As of January 2009, Pima County has purchased over 55,000 acres of land to be preserved as open space. Much of that was ranchland: acre upon acre of rolling grasslands teeming with prairie wildlife.

Peggy Rowley was one of the ranchers who sold part of her land to the county. Along with her husband and two ranch hands, she ran a 36,000-acre cattle operation south of Tucson. Straddling two watersheds (the Altar Valley and the Upper Santa Cruz), the Rowley Ranch was a corridor for local wildlife; two years ago the county purchased 9,500 acres of private land within the ranch.

Far from pushing the Rowleys away from those 9,500 acres, the county has let the family stay on as stewards of the land. "It's good for the county," Rowley told me over the phone, her deep voice equal parts amusement and respect. "They'd have a million people running out here [monitoring the site]...it's much more cost-efficient to leave the

rancher on the land, who knows the land—let the rancher take care of the defense lines and water."

In return for their land stewardship, the Rowleys could keep their cattle on those 9,500 acres. As long as they followed county guidelines on habitat conservation, their grazing herds were not a problem. The land exchange was about preventing development more than anything else. And while environmentalists might suspect Rowley to side with someone like Arnold, her views on lot splits could have come straight from Changkakoti. "It's made for a mess on the landscape." After the sale, those 9,500 acres will never be developed, never pieced out into lot splits.

That was the hope, anyway. For the moment everything was going according to plan, except that the 9,500 acres were sold in 99 separate parcels, connected by tracts of State Trust Land ultimately beyond the county's control. In Arizona, the state lands existed solely to raise money for public schools. The important connectors on the Rowley Ranch were currently undeveloped, but someday, if the state decides to sell it, it will be placed on public auction, where the county has little chance of outbidding developers.

Rowley had other reasons to worry about development. Her home lay next to the Sopori KX, part of an enormous ranch that once belonged to Warner Brothers. On land, the boundary between the ranches was quite clear, but below ground they shared a common groundwater resource; water pumped up by Sopori KX would lower the water table beneath the Rowley Ranch. Then in December 2008, Pima County bought 4,000 acres of Sopori KX to ensure its future as undeveloped open space. When Rowley found out, she was ecstatic.

"We are truly excited about the Sopori becoming a part of the SDCP!!" she wrote in an email to the county. "We have worried for decades about what would happen to our water supply when they developed the Sopori KX!! Now we no longer have to worry!"

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*Fossil Water*

In Tucson, water and land are inseparable. The entire city owes its existence to an accident of geology, that aquifer of staggering proportions lying beneath the desert. This is fossil water, clear and ancient, accumulated over thousands of years, and gone in an instant.

Tucson sits in the basin and range province, a series of near-parallel mountains ("ranges") interspersed with broad valleys ("basins") that make up the American Southwest. From the air, the alternating mountain-plain-mountains look like scars gouged out by a giant's hand. For the past 50 million years, erosion has sent rocky debris skimming down the mountainsides, filling the valleys with thousands of feet of loose sand, stones, and rock. Every drop of water that falls from the sky either evaporates or meets a crack in the ground, and, falling in, continues along, sliding between sheets of rock, creeping through gaps in sand and gravel, down and down until it encounters some impermeable rock layer where it stays. Multiply this by millions of years, add to that the snowmelt and rainstorms of Arizona's past, cooler climate, and you get an aquifer large enough to be measured not in gallons or cubic meters but in acre-feet—the amount of water that covers an acre a foot deep, or half an Olympic-sized swimming pool. The Colorado River sends about 15 million acre-feet downstream each year. One acre-foot

will feed an American family of four for a year. In Tucson, where water conservation is encouraged, that estimate is closer to three years.

Tucson was seized by a population boom after World War II. By the 1960's, the city's water table was dropping three feet a year. Wells deepened to dozens, even hundreds of feet. The city's aquifers held more than 50 million acre-feet within 1,200 feet of the surface, but most of that remained out of reach. Drilling is expensive. By 2009 standards, a single-family well drilled to 50-feet costs at least $5000. The same well at 500 feet can reach $60,000.

Money wasn't the only problem. In the 1960's parts of Tucson were subsiding—literally sinking as groundwater pumping compressed the spaces between subsurface rocks. In its most spectacular form, subsidence led to fissures, cracks in the earth that split and grew into dirt trenches ten feet wide and hundreds of feet long. Tucson was overdrafting its aquifer; there simply wasn't enough rain to replenish the water on human timescales. The city's choices were few: pump deeper wells at immense cost and labor, or look for another source of water. And in the West, that answer has always been the Colorado River.

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*Gift or Boondoggle?*

Winding 336 miles from the Colorado River to Avra Valley, the Central Arizona Project (CAP) is a blue ribbon pasted across desert sands. What looks like a placid meandering canal has a width of 80 feet and a weight of 282 million pounds per mile.

Fifteen pumping stations lift the water up 2,400 feet from the river to its terminus at Tucson.

It began as a fantasy in the 1920's, based on the simple idea that you could always bring water to the people. For decades the bill stalled in the halls of Congress. The price tag was ludicrous—over $4 billion in 2009 terms—but Arizona's representatives kept reviving it; the river water was theirs by right, and they couldn't bear to see it go.

Like every state along the Colorado, Arizona had a legal right to a fixed portion of the river; the decisions had been made in the Colorado River Compact of 1922. In its case, Arizona was promised 2.8 million acre-feet a year. About half of that was granted to farmers along the riverbank. They diverted the water straight onto their cropfields, while the rest simply flowed on, unused—over a million acre-feet lost to the ocean or gobbled up by California, which was promised 4.4 million acre-feet and always looking for more. By the 1950's the canal was like an itch that burned just out of reach. United against California's greed, the Upper Colorado River Basin States (Wyoming, Nevada, Colorado) allied themselves with Arizona. During Congressional hearings in 1950, Senator O'Mahoney of Wyoming delivered the following plea:

"Mr. President, that Arizona needs more water, no one can deny. The state is there, the people are there. That they chose to go to Arizona instead of California was an exercise of their American privilege. They are there. We encouraged many of them to go there…shall we thus punish them and deny the only means by which this controversy can be settled?"

Congress authorized the canal in 1951, and negotiations began, stopped, began, for 17 years. California stuck its heels in; it would ratify the canal only if the state could

claim perpetual seniority on the river. In flood or drought, California must receive its 4.4 million acre-feet before Arizona's canal is allowed a single drop.

Arizona surrendered in 1968; California would get its guarantee. For Arizona's representatives, there was never any question of divorcing the canal from growth. The state's population quadrupled between 1920-1960. Groundwater would be the limiting factor, unless the canal piped in its glorious 1.2 million acre-feet.

Ironically, Tucson, the city with the worst groundwater depletion, struggled briefly with doubt. After construction began in 1973, it was unclear if the canal would be extended to Tucson or stop in Phoenix. Tucson's Mayor and Council were divided, with some calling for immediate salvation and others, like Council member Robert Cauthorn, stating that "this was the most gigantic and costly 'boondoggle' in the history of the State of Arizona...representing that assumption that the City of Tucson was going to continue solving the City's problems by massive interventions in natural processes [instead of] changing the City's consumption patterns."

Cauthorn, and others like him, were outvoted. Then in 1977 Congress threw in another twist: in the midst of canal construction, as Arizona continued to pump water without limit, Congress threatened to cut federal funding for the project unless Arizona got a grip on its groundwater overdraft. The state legislature scrambled to comply by passing the 1980 Groundwater Management Act.

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*Paper Water*

Within the Act, five regions of Arizona with the worst overdraft problems were saddled with additional restrictions. The area around Tucson covered nearly half of Pima County, and developers there were required to provide an Assured Water Supply: before any new houses can be built, a developer must show that water for the subdivision is "physically, legally, and continuously available" for the next one hundred years, then pay to build the water delivery infrastructure.

Arizona's developers balked. There were few places left with enough groundwater for a hundred years, and not all developers had access to river water. So before the water supply requirement could be ratified, developers created the Central Arizona Groundwater Replenishment District, an organization that could provide river water to anyone that needed it.

Under the new legislation, developers could use groundwater for all the assured water requirements. In return for a fee, the replenishment organization would then "replace" that groundwater by pumping the same volume of river water into the ground. The concept worked perfectly on paper, less so in reality. As long as pumping and restoration occurred in the same water-depleted region, it didn't matter if the two sources were physically connected. Hydrologists and water experts were not impressed.

"It's not hydrologically balanced."

"It's paper water. I call it a giant Excel spreadsheet."

"It is absolutely a loophole [in the Assured Water Supply]. And anyone who says otherwise is lying."

The replenishment district allowed development to occur in places that would have been impossible under the Assured Water Supply. Nonetheless, the Groundwater Management Act was enough to satisfy Congress; Washington, DC paid for half the cost of canal construction, which was completed in 1985. Up and down the canal, cities and farms paid for their allotments. Tucson Water, the city's main water utility, ordered an annual amount of 136,000 acre-feet (later raised for 144,000), becoming the largest customer on the canal.

November 1992. Tucson Water flipped the switch. For the first time in history, reliable river water flooded the pipes. Tucson's future seemed secure.

Within two weeks, people were calling it "dirty ditch water."

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*The Brown Water Blues*

For a city fed by ancient groundwater, the abrupt transition to river water was unacceptable. Tucson had been spoiled by some of the best groundwater in the country—water so pure it was almost *sweet.*

The Colorado River, when it came, tasted salty. There were things in it—rust fragments and dissolved solids. People began buying bottled water, or strained their taps with cheesecloth.

"I had never been an advocate of the Central Arizona Project," said Molly McKasson, freelance writer and opponent of unsustainable growth. "[But] it was the most inevitable piece of legislation in southern Arizona. It was [our] right!"

McKasson was serving as city council member of ward 6 when the water arrived. Her dislike of the canal had been based solely on issues of sustainability. Then overnight the place came apart, and suddenly the question of growth didn't matter anymore. "It was a water quality issue, one hundred percent." She wore red-framed glasses that slipped a little as she spoke. We sat in her living room drinking cinnamon-flavored iced tea, and the brown liquid in our glasses was the same color as the river water that had gushed from the taps in 1992. McKasson's ward was hit hard. Walls crumbled. Pipes exploded. "It was literally people bringing their [stained] laundry to my office, their broken appliances, their damaged curtains, asking me to come to their homes to see walls that had been rotted by this heavy-duty solution of calcified water…it had a very corrosive effect."

Even now, nearly 17 years later, McKasson's voice shook with incredulity at the remembrance. "It was not just an aesthetic thing, it was a disaster…At the time, it was the most important thing for me…My goal was not to sue the city until it was broke, but to somehow take care of all of these people. They needed to be compensated financially, and they needed explanations."

The Mayor's office was under siege from furious callers: "The water is really gross and disgusting…I am having to buy bottled water now and I think that is really sad…I am real disappointed." But Tucson had invested too much to give up easily. The price of river water was $52 an acre-foot, and that was on top of the treatment plant, a brand-new $110 million dollar facility. Unlike groundwater, the river was full of salts, minerals, and organic content (algae, bacteria, plant and animal matter) that had to be

filtered out. So despite the complaints that poured in, Mayor and Council kept the canal going for another two years.

If the city government was reeling, it was nothing compared to Tucson Water. Fourteen thousand complaints came through the utility's hotline. Newspapers began printing parodies such as "The Brown Water Blues:"

*They took away my cool, clear water*
*and gave me swill to drink.*
*It killed my fish and burst my pipes*
*left rust stains in my sink.*

*I'd get away from this crummy town*
*but I don't believe I can.*
*My woman ran off in my pickup truck*
*with the bottled water man...*

*I've got the brown water blues and I'm seein' red.*
*Can't take a bath, why get out of bed?*
*I've got the brown water blues, I'm not in the pink.*
*Somethin' weird's growin' in my sink.*

*

*The Perfect Storm*

In retrospect, Tucson Water's every decision appeared absurd. Former deputy director Bruce Johnson admitted that "we did a number of things wrong as a utility." The biggest, perhaps, was the lack of a transition period. Literally overnight, Tucson Water chose to switch half the city from all groundwater to all river water.

"It was an infrastructure problem," said Johnson. Tucson's historical groundwater was supplied by hundreds of wells scattered throughout the basin. The pipes were not set up for distribution from a central location, which was what happened when river water was first routed to the treatment plant, cleaned, and re-piped throughout the city. Some of

that water was sent through the pipes backwards, against the usual flow direction. Over the decades, old cast-iron pipes had accumulated layers of rust, which were usually plastered against the insides from the pressure of moving water. Once the water flowed in the opposite direction, all of that rust was scoured out and sent straight into homes.

River water, with its higher dissolved solids content, was more corrosive than groundwater. Operators at the treatment plant added rust inhibitors to slow down corrosion. The particular chemical they used, zinc orthophosphate, dissolved better if added to acidic water, so operators began lowering the pH of the water coming through the plant. That was when the pipes exploded. Some parts of the city had pipes so old that they had accumulated an inner carbonate lining deposited by decades of flowing water. The linings were what kept the pipes standing, but the carbonates simply dissolved in the acidic water. The utility was caught in a deadly spiral: the more rust inhibitors they added to clean up the water, the more pipes exploded.

"What we should have done…was bench testing," said Mitch Basefsky, Public Information Director of Tucson Water. They should have dug up a section of pipe to test the flow of river water, or, once the problems began, stopped delivery immediately to find the root of the problem. Instead, the utility continued changing the pH and fiddling with corrosion inhibitors in hopes of finding a magical fix.

By an unlucky coincidence, the part of Tucson that received river water had either the best groundwater or the oldest pipes. Residents experienced either the greatest difference in water quality or suffered the most from damaged infrastructure, so all the possible problems were compounded. "The public was enraged, the political process was enraged," said Johnson. In October 1994, Mayor and Council finally ordered the

treatment plant to close until water quality could be assured. Tucson Water's image was ruined. Over the next six years they would pay $2 million in damages and replace hundreds of miles of old water mains.

Taking advantage of the respite, a group of community activists introduced the Water Consumer Protection Act, or Proposition 200, to ban the direct delivery of river water into Tucson. "That group was not [at] all like the environmentalists," said McKasson, who supported the decree. The initiative was led by Bob Beaudry, a car salesman. Shortly before the city's November 1995 elections, the group leaders, united in their rage, took out a full-page ad in the *Tucson Weekly:* "CAP is Crap: Vote Yes on Prop 200!...Normally, you wouldn't find the voices on these pages in agreement on anything. In fact, if you put these half-dozen folks in a room together, you'd probably find Tucson's already staggering homicide count rise even higher..."

The Proposition passed, 60% to 40%. It was now illegal to directly import river water for drinking purposes unless it was as clean as the best groundwater in Tucson.

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*Full Allocation*

When hydrologist Wally Wilson was hired by Tucson Water, his reaction to Proposition 200 was, "You mean this community voted not to use its water resources? Hmm. This is a weird thing."

Bound by Proposition 200, the utility turned to what is called recharge: river water would be "recharged" by letting it percolate into the ground before pumping it back

up into municipal pipes. As this was no longer direct delivery, it satisfied every requirement of the Water Consumer Protection Act.

For $90 million dollars Tucson Water dug 300 acres of man-made basins into the floor of Avra Valley. River water would flow into the basins and trickle downward, mixing with the native groundwater before pumps delivered the hybrid into homes. It was a dilute cocktail, palatable for the standards of Tucson's spoiled residents.

"In Phoenix," said Wilson, "people don't complain about their water. They just pay their bills and drink it. And where I come from, Corpus Christi, the water tastes like dirt, always did, everyone drinks it, it's fine…here, everyone's a bit picky."

Wilson's amusement was tempered by his willingness to show off the recharge basins. We drove out to the valley in one of the utility trucks, heading west over roads that zigzagged through saguaro-carpeted hills. A roadrunner sprinted by on wire-thin legs. "This is a migration corridor," said Wilson. He kept up a running commentary as he drove, a kind of crash course on why recharge was the way to go.

Since more water was coming into the basins than what was pumped out, "we can bank water that we don't need today." On average, the basins store 30,000 acre-feet a year. In 2001 the water table beneath the basins was 380 feet down; by early 2009, depth to water was 300 feet. "That [extra] water will still be available if the canal shuts down. If you have a treatment plant and the canal goes down, you have nothing to deliver to your customers. You're highly vulnerable to drought and—look! A kingfisher, up on that wire!"

The idea of recharge also had an intrinsically cleansing effect. People felt better knowing that their water was being treated "naturally" through underground percolation.

Scientifically, too, "we get treatment advantages out of it." About 80% of the water's organic carbon content is removed as it flows downward through layers of sand and gravel, so by the time it's pumped to the surface, the river water needs much less disinfection.

The car crested a hill. "And there's your first view!"

The water appeared as slivers of blue crystal, a shimmering mirage on the horizon. We turned left, then right, descending ever lower into the valley. The basins were briefly shielded from view by a line of cacti. When I saw them again, they looked like rectangular lakes.

First designed in 1996, the eleven basins were permitted for an annual maximum of 60,000 acre-feet. Physically, they're capable of recharging more, but the basins were "bottlenecked" by delivery pipes at the canal. Shortly after the basins went online in 2001, Tucson Water assigned Wilson to re-permit them to 80,000 acre-feet by building another pump at the canal. Wilson had bigger aspirations: he wanted to reach directly for 100,000 acre-feet, "and everybody was like, 'oh no no, we would never do that. We'll never get that in there'" His voice pitched higher, mocking; he took giddy pleasure in destroying limits. "And now I just took a year and a half to permit it to 100,000!" Wilson laughed. "Well, it keeps me employed!"

We drew up next to a locked gate. Wilson scrambled out of the car to open it, and we were in. The closest basin to our left covered twenty acres but looked much smaller; its surface was sloped and tipped away from us. Wilson led the way to a piece of metal grating that extended like a tiny pier over the basin's edge.

I hadn't expected it to be so clear. The water was a deep blue and blindingly reflective under the perpetual Tucson sun. Cascades of water poured in from an underground pipe beneath our feet. Wilson, his face protected under mirrored sunglasses and a khaki-colored bucket hat, had to shout to make himself heard over the roaring waves. "This stuff is nice and clean!" Wilson yelled. "And we don't get the algae blooms everyone says. Never happens. So we've learned it's not a research project, it's a recharge project, and you can't break it, so run it. That's why we have a permit for 100,000 acre-feet."

The basins were kept on a rotating schedule, each one switched off every three months or so for routine cleanings. "You gotta learn the personality of every basin," said Wilson. He had nothing but admiration for Dee Korich, the hydrologist whose job it was to schedule basin maintenance while keeping the facility at peak performance.

Not far from the basin was a concrete-lined reservoir, built above ground like a six-foot tall swimming pool. This was the place where river and groundwater were fully mixed after being pumped up by nearby wells. Following that, pipes brought the water to the Hayden-Udall treatment plant, where chlorine was added as a disinfectant before delivery into homes.

For all its grandeur, the basins' 100,000 acre-feet capacity was still under Tucson's yearly allotment of 144,000. So Tucson Water shelled out $60 million dollars to build another series of recharge basins, fourteen miles to the south.

Still under construction, these southern basins will not be operational until 2010. For a while there was debate about whether another recharge project was the way to go.

Was the city ready for a new treatment plant, one that would clean the water up to groundwater standards?

In the end, public policy did not decide. The river did. In 2004 rumors grew of an imminent drought on the Colorado River. Tucson Water moved quickly. The new basins would take less time to construct than a treatment plant. If the city didn't act, it would lose much of its water.

Everything on the Colorado River is divided by tiers of hierarchy. Once the Secretary of Interior declares a drought, the Central Arizona Project canal must cut back immediately. Cities and Indian reservations have the highest priority—their water would be cut last, only after farmers along the canal had lost all of their water. Lowest on the totem pole was "excess" water—water that was promised but never physically used. In 2004, Tucson was recharging less than 100,000 acre-feet in its Avra Valley basins. Though it was Tucson's by right, the extra 44,000 acre-feet were considered excess. "If there's going to be a shortage on the river, we want to take our full allocation first," said Wilson. "So the [new southern basins] were sooner in time in terms of construction than getting a treatment plant up and running."

"We went ahead and started designing [these new basins], and instead of designing it, we *masterplanned* [it]"—from the beginning, the basins were envisioned to expand with time. Wilson began throwing water around like weightless abstractions, the entire flow of Tucson's allocation conjured effortlessly from his mind. Designed initially for 45,000 acre-feet, Tucson Water left plenty of room for future growth. Pipes were designed with room for future pipes working in parallel; basins were dug around the blueprints of future basins. The new basins will later be permitted for 60,000, then

140,000 acre-feet. "So we did not cripple ourselves. We can get almost our entire allocation at [the southern basins]."

With both sets of basins working at capacity, Tucson could receive 240,000 acre-feet, nearly double its annual allocation. The utility had plans. They could lease river water from Indian reservations or farmers along the Colorado. Whatever the future source, the basins would meet it.

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*Water Hunting*

"There's a thing in Arizona," said McKasson. "All along the river—'use it or lose it.'"

The Central Arizona Project canal was meant to save the state. It's still not enough. Tucson, like everyone else in the Southwest, is always looking for the next source of water. Even in 1968, when Arizona first accepted California's bargain, people were warning against optimism. Lawrence Mehren, Chairman of the CAP Association, said in a speech, "In our moment of elation…I am a bit fearful that the constant repetition…of the figure '1,200,000 acre feet of water' has lulled Arizonians into a false sense of security and the belief that our water problem is solved for now and forever after. This is far from fact."

The population of Pima County hit one million in 2006. Out of those, there are thousands who have no assured water supply. The Groundwater Management Act doesn't apply to lot splits, only subdivisions. Someone who sells property in a lot split can drill a well for the new residents; the well may work perfectly fine for several years or even

decades, but the developer is under no obligation to "guarantee" a continued source of water.

Take Eric Phelps, a retired home inspector who lives twenty miles south of Tucson, in a lot split neighborhood where all the private wells have gone dry. Once a week, he drives a truck with a water tank into Green Valley, a wealthy community largely populated by retirees. For twenty-six dollars a month, Phelps can pump water from the community well into his truck, then drive home where the water is piped into a 2000-gallon storage unit. "It's an adequate system," he said matter-of-factly. Except for emergencies. A day's delay in the journey could mean no water at home. Phelps considers himself lucky. He has the money for a heavy-duty truck that can haul water. Some of his neighbors, especially those below the poverty line, were forced to buy water from a commercial groundwater company that charged $200-$300 a month.

"There's no royalty out here," he said. The homes are a mix of trailers and self-built houses. Phelps, who lives in a house, moved into the neighborhood eighteen years ago. "I absolutely knew what the [water] situation was. I live out here because I choose to."

Lot split residents aren't the only ones in trouble. In its 50-year Long Range Plan, Tucson Water predicts that the utility will need new sources of water by 2035 at the latest, and 2015 at the earliest.

So what's next? The Colorado River was maxed out long ago. Its historical state allocations—Arizona's 2.8 million acre-feet, California 4.4, Colorado's 3.9, and so on—were based on the assumption that the river's annual flow was 16.5 million acre-feet. That calculation was made in the 1920's, after ten of the wettest years on record.

Realistically, the Colorado River has no more than 15 million acre-feet a year, and in some years the river is so drained by the canals along the way that the outlet delta is reduced to a soggy sandbar.

There aren't many choices left. "You can't rely on any one thing when you plan for the future," said Ralph Marra, the utility's Water Administrator. One option is Indian Water leases. Pima County's Tohono O'odham Nation holds the annual rights for 65,200 acre-feet of Colorado River water; Tucson Water could pay to lease some of that water. "If the TO Nation wants to do business, then we're in a position to do that. [But] the idea of pushing [them] is not good, [because] it would have to be a very sensitive discussion."

And there's always effluent, often sensationalized as "toilet to tap." In 2008, Orange County built the largest wastewater-to-potable water system in the world. Tucson already uses reclaimed water, or treated wastewater, to irrigate golf courses and parks. That water is not cleaned to drinking standards, but an additional treatment plant could take care of that. "You can't do that without the public acceptance," said Marra, and it would be expensive. Yet he predicted that when the need comes, "people could be more than willing to pay for it."

Greater schemes are underway on a state level. If Arizona helps with the cost, California may build desalination plants along its coast and drink desalted seawater, leaving a portion of its Colorado River allocation unused. Phoenix and Tucson would then pipe in extra river water. Of course it all depends on when demand will outstrip financial caution.

Tucson Water has no more hope of predicting the future than anyone else. In February 2009, the recession forced the utility to cut off its order of river water. "We had

to slash millions [from the budget]," recalled Wilson. The city's water supply was in no danger. There was plenty stored beneath the basins, but Tucson lost the 42,000 acre-feet it would have received for the rest of fiscal year 2009. That water didn't go to waste—it was snatched up by the town of Gilbert and other buyers, all intent on storing water for future use. Meanwhile, Tucson's recharge basins dwindled into dry pits, weeds sprouting from the cracked desert dirt. If all goes well, the city can start recharging again in 2010.

The population of Pima County may reach 1,900,000 by 2050, nearly double that of 2006. Meanwhile, per capita water use is declining as conservation gains popularity. So what will be the deciding factor?

"It's population growth."

"The economy will determine the trajectory of water [demand]."

"Water is a constant worry that's never ceased."

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*Moonscape*

On the road back from the recharge basins, we passed by a lane of rickety houses not two miles from the nearest basin. They looked like lot splits. I thought about the view from the back windows, of how phenomenally strange those basins must look sunk into the valley floor. Years ago, when the residents moved in, they would have seen an untouched expanse of desert. What did they think when the first bulldozers moved in?

Everyone wants a piece of desert. The frontier dream of a home among the saguaros is the draw of Tucson. "People move in," said Susannah Brown, a college

student who grew up in the city suburbs. "Then they want to protect the desert and don't want anyone else to come."

As water futures dwindle and desert lands disappear under pavement, that dream will soon be over. For all its efforts, Tucson's conservation measures are beset by loopholes: the Sonoran Desert plan has no way of halting growth, the replenishment district replaces groundwater to little effect—and that's not to mention the outer world beyond Pima County's control. "The Sun Corridor is going to happen," urban planner Changkakoti predicted grimly, referring to the day thirty or fifty years from now when Phoenix and Tucson will join to form one massive metropolis. "The question is, how?" Will it be a series of densely-populated urban centers or subdivisions that take over every corner of the desert? "You cannot stretch out single family homes on one-acre lots until kingdom come and declare victory under the banner of the Sun Corridor," warned Changkakoti. It would be the end of the Sonoran Desert as we know it. "You'll end up with a moonscape."

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When the pygmy owl flew away, Richardson and I drove back to town in near silence. I felt strangely honored by the bird's presence; I did not expect to ever see another. Outside the car, desert plain gave way to tumble-down trailers and the weekday rush-hour traffic speeding by, mere minutes from the owls' nests. Tucson was once the place where you could get it all: sunshine and spacious homes, clean water and saguaros on your doorstep—but no longer. Something has to give: will the same people who rallied for the pygmy owls suffer to live in dense urban housing and pay to drink reclaimed water?

"I used to think there were warring camps," said David Taylor. "Land developers who schemed great schemes about how raw desert could be turned into housing…and [in the] other crowd a sea of plaid, Birkenstock and hair, people who wanted to retreat to the Pleistocene, make everything go away…in fact those polar views exist in all of us, individually."

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