A Future Compromised: Agriculture and Aquaculture Compete for Water

By Talli Nauman | February 28, 2007

Agriculture and aquaculture are important activities in the Gulf of California region, not only for their economic contribution, but also for their environmental consequences. Their main impact is on water. Overuse and abuse cause uncalculated damage to public health. Shrimp farming and crop harvesting produce income. But with it comes the cost of stream and sea water contamination from fertilizers, pesticides, and wastes. What's more, they entail large-scale land use changes. Against this backdrop, surprising technological breakthroughs give rise to many development uncertainties. Perhaps more important than the technology is the public participation in decisions about it. Currents of thought are just now converging about ways to take advantage of recent generations' progress toward more environmentally friendly resource management. However, the viewpoints of the stakeholders involved are still polarized.

In the Gulf of California region, the states of Sonora, Sinaloa, and Nayarit stand out for their agricultural and food processing. These activities make up 8-9% of the region's GDP, which is significant compared with the 2.3% contributed by fishing in Sonora or the 4% generated by fishing in Sinaloa. Farming and ranching account for 17% of employment, with an additional 5% due to agribusiness. Nationally, Sonora and Baja California are among the top producers of wheat, soy, corn, and grapes, while Sinaloa is a prime vegetable grower.

On the dark side of the balance sheet, agriculture consumes 80% of the fresh water available in the region, wasting 60% of that. The National Water Commission categorizes 41% of the region's aquifers as overexploited. This situation has drained the resources that sustain agricultural activities, and it has provoked destruction of biodiversity, including species for which the real value is not yet known. The three main sources of both surface and underground water pollution in the region are: salt intrusion due to agricultural water use extraction; municipal and agricultural discharges; and solid waste, consisting of everything from cast-off agrochemical containers to winery residues, hog farm muck, factories releases, and boat offloads. The farm sector generates more than 60% of the wastewater, including not only organic runoff, but also fertilizers and pesticides. Many of these do not break down; rather they concentrate when they flow to the sea, negatively affecting flora and fauna. Over exploitation of

Farming and ranching account for 17% of employment in the gulf region. Photo: Talli Nauman.

the aquifers in the states of Baja California, Baja California Sur, and Sonora has caused saline seepage so bad it has rendered former productive lands useless.

Meanwhile aquaculture is expanding unabashed. All the Gulf of California states are involved in it. Pacific shrimp farming grew more than 500% in a 10-year period and represents 26% of Mexico's shrimp production. The expansion corresponds to a worldwide phenomenon in which 50% of all commercial shrimp now comes from farms. In 2004, cultivated shrimp accounted for 81% of the product from the Gulf of California region. Shrimp farms on the banks of the gulf number 390 and represent 97.6% of the region's aquaculture GDP. Fresh water fish farmed on land make up 13.5% of aquaculture. Offshore, 3.5% of the activity is shellfish and 0.2% is other fish. The coast of Sonora has more than 40,000 acres (15,000 hectares) of shrimp farms. The Baja Peninsula has more than a dozen offshore farms.

Aquaculture is expanding unabashed. Photo: José Aguilar Manjarrez, FAO.

Unfortunately, aquaculture and shrimp farming are the principle reason for mangrove deforestation, responsible for 52% of mangrove destruction worldwide, according to Greenpeace. More than 75% of the discharges authorized by the National Water Commission in Sonora are from the aquaculture industry, the state's largest source of them. They all go into the Gulf of California. Among pollutants are fertilizers, ammonia, organic material, antibiotics, and disinfectants. They reduce oxygen in the water and have a cumulative impact on the health of the marine ecosystem, as well as on consumers of the seafood that concentrates the detritus, according to Sonora's non-profit Food and Development Research Center.

Promoters of organic growing and so-called "new agriculture" posit widely disparate alternative techniques for environmental protection. However, the former operate on such a small scale and the latter on such a giant one that both prompt doubts about their ability to involve people in safeguarding the region's fresh and salt water.

Underground Water Recedes as Globalization Advances

Since the mid 1980s, the states in the Gulf of California region have reoriented their production toward export agriculture. The epoch of free trade, with its policies against small independent producers, favored *maquiladora* style agricultural activities: From the valleys of Santo Domingo and Mexicali in Baja California, to San Luis Rio Colorado, Caborca and Hermosillo in Sonora, big foreign companies invest in mass production to supply their markets abroad with grain, fruit, vegetables, and meat at accessible prices. Their profit margin relies on low wages and avoiding other production costs such as water and public health protection. The environment and the tax role pay the price.

Onion harvest: Growers have reoriented their production toward export agriculture. Photo: Talli Nauman.

Federal policy includes programs and rules for reducing water use and waste, part of an intense debate over privatization of the resource. The Coast of Hermosillo Irrigation District was the first in the country to obtain a concession for private management following deregulation initiated in 1992 with the reform of the National Waters Law. Later, large companies with U.S. ties gathered up the water rights, much to the dismay of *ejidos*

(trust land clusters), municipalities, and industries. Meanwhile, taxpayers subsidized 90% of the electricity for irrigation. Worse yet, the measures didn't secure success.

Today, farming on the Coast of Hermosillo is almost a lost cause. The level of the water table here, as well as in the other coastal aquifers of Caborca and Guaymas, has dropped to 150 feet (50 meters) below sea level, so all these reserves are contaminated by salt water intrusion. In some places, nothing grows. "The considerable volume of water destined for agriculture has caused irreversible damage in the coastal aquifers," says Jose Castillo Gurrola, researcher and professor at the University of Sonora.

Farms are victims of municipal water pollution and related injustice, too. In a half dozen complaints from the Gulf of California region filed at the North American Commission for Environmental Cooperation, the Magdalena River Cleanup Committee had to turn to the trinational venue to seek a remedy for illegal discharges from the townships of Imuris, Magdalena de Kino, and Santa Ana. "Sonoran society is currently paying the debt it has to nature, due to bad management of resources, water among them," Gurrola says. "They haven't known how to use water adequately, and almost every part of the state is suffering problems of shortage or quality."

Sometimes the demands of global trading run counter to rational resource use. "The Sonora experience raises our awareness that water shortage arises from a complex mix of factors, including market incentives to continue overexploiting the aquifers for export crops," observes Anne Browning-Aiken, researcher at the Udall Center for Studies in Public Policy at the University of Arizona.

Surface Waters Supply the Heirs of the Green Revolution

The rivers that once supplied the Upper Gulf of California have been detoured to agriculture to the extent that they now carry little fresh water to the sea. The Sonoyta River created the Morua and La Pinta estuaries in Puerto Peñasco, but no longer flows to these wildlife nurseries, except in the case of a flood. You can travel the length of Sonora on Highway 15 and not see a single riverbed with water. Many arroyos are marked by heavy machinery tracks, as if deepening them would secure a stream flow. On the route from Guaymas to Ciudad Obregon, goats graze on the shoulder of the Yaqui River Bridge. The water course is dry as a bone. The trees along its banks died long ago. The river water has been channeled to crops, helping make Sonora and Sinaloa the states with the highest percentage of irrigated agriculture in the country.

Sonora and Sinaloa have the highest percentage of irrigated agriculture in the country. Photo Talli Nauman.

In this area, not only the river and the bridge bear the name of the Yaquis, or Yoreme, as they call themselves. The Yaqui headdress with deer antlers dominates the design of the Sonora state shield. A figure of a Yaqui dancer in bronze welcomes arrivals to Ciudad Obregon, the center of activity for the farmers of the most important irrigation districts that also bear their name, the Yaqui and Mayo valleys. But the generalized veneration of the tribe belies the marginalization the indigenous group experiences. The real idol of the economic development here has his name engraved on one of Ciudad Obregon's wide, central streets burgeoning with petunia, bougainvilleas, shrubs, and trees: Doctor Norman Borlaug Avenue. The father of the so-called Green Revolution won the Nobel Prize in 1970 for the experiments he conducted for decades here under an agreement between the Rockefeller Foundation and the Mexican government to increase rural productivity.

His crop manipulation achieved a resistant wheat that facilitated planting the grain on massive extensions of land, a concept that still inspires agribusiness in the area. One of its representatives, Luis Signoret Felix, president of the Southern Sonora Agricultural Organizations Association, explains the situation of its 1,500 producers and their agricultural workers, who grow all the wheat for the pasta in Mexico and 80% of the export wheat.

Unlike the growers dependent on well water for irrigation, the Yaqui and Mayo valley producers have the

benefit of dams on the rivers and gravity distribution of flow. But just like their counterparts a little to the north, they are busy with crop conversion, substituting their wheat for fruit and vegetables, oil seed cultivation, and livestock feedlots in order to become more competitive in international trade. It's not that they like the model.

"We are reconverting because there's no longer any hope for wheat," says Signoret. "Now we have other crops, vegetables, asparagus, oranges. We want miniolas, tangerines, Valencias, grapefruit, pecans. California's production is dropping due to water problems, and the consumer market for citrus is up. We're trying to do a lot of things. We're trying to change." But like the well-water users, they have 131,000 acres (53,000 hectares) of salt-damage in addition to nearly 31,000 acres (12,400 hectares) with deficient drainage.

Luís Signoret: "We're trying to change." Photo: Dahl McLean.

Up against the high cost of inputs and domestic transportation, the southern farmers are associating with Cargill and collaborating with Monsanto, among the most powerful foreign investment companies, supported with U.S. subsidies. Seeking to reduce their pesticide use and increase production to satisfy foreign market demand, they end up using more fertilizers and opting into the system of buying imported genetically modified seed. "The group here has very high productivity. This group is among the most organized in all of Mexico," says Signoret. "But how do you make your producers competitive with very little money?"

To Fumigate and Be Fumigated

Some blocks away from the association's headquarters is the office of Cobanaras, and there the Mayo Indian Mireya Jocobi Verdugo is looking for an answer to the same question, but from a different angle. She is the health and environment coordinator for the State Federation of Social Solidarity Societies, founded in 1987. Cobanaras means "governors" in the Yaqui and Mayo languages. Like the southern farmers association, this women's organization exists as a savings and loan group. But the likeness ends there. Cobanaras members use the interest from their loans for their community health promoter training project, which began when they saw cancer problems in the fields. "Out of that came a concern for how we could improve the environment ourselves," Jocobi explains.

Although 35% of the people in the valleys make a living from farming, the Mayos and their neighbors have experienced the bleakest side of agribusiness. In a Mayo population of 75,000, which makes it the largest indigenous group in Sonora, cancer is only one of the worries. Dengue is another. To kill the larva of the fly that carries the lethal fever, state health brigades distribute temefos, commercially sold as Abate. The Mayo area is the most affected in the state by the illness. As if this was not already enough, it turns out that the bug killer is an organophosphate; it belongs to a group of chemicals responsible for making 20 species of flies more resistant, constituting a long-term public health risk in addition to its toxicity to humans and its environmental impact.

The Mayos and their neighbors have experienced the bleakest side of agribusiness. Photo Talli Nauman.

Cobanaras warns about the danger of this and other agrochemicals through workshops and its bilingual weekly program *Pájara Pinta* on XEETCH 700 AM, "The Voice

of the Three Rivers," which broadcasts from the Mayo village of Etchojoa. The promoters like Jocobi, all volunteers, remind listeners that the Mayos know how to combat pestilence with less noxious alternatives, such as fungus, bacteria and plant extracts, since the tribe is a repository of an ample culture of traditional medicine, practiced to this day. They provide this orientation in the framework of an annual campaign against agrochemicals designed to educate community members about how to protect themselves from agricultural poisons, about pesticide-free agriculture, and responsible consumerism.

"Both women and men farm. It's the work that most people do most. There are youngsters who work to pay for school," says Jocobi, who used to do it during school vacations. The field hands apply malathion and parathion to wheat, as well as other organophosphates that break down the immune system. "They fumigate with pumps on their backs. Employers still don't put out information about using clothing just to spray; they don't provide water for bathing before going home; they don't supply equipment. It's dangerous," she says.

Cobanaras teaches how to separate work clothing to wash it apart from other articles and how to dispose of the polluted wash water. Its members explain how to use medicinal plants, how to make consumer choices that favor returnable glass over throw-away plastic containers, how to reduce trash volume, reuse, and recycling, trash composting, and organic gardening. They show people home canning techniques. They plant trees. They file complaints over chemical spraying. "We like to share everything that we learn. It doesn't matter whether it's with people outside the organization. We want to spread the word. We have seen changes in behavior. It eggs us on," Jocobi comments.

Organic Agriculture: Point of the Lance, Albeit Quixote's

Cobanaras' effort is part of a national and international trend, in which the area planted with organic techniques in Mexico has reached more than 175,000 acres (71,000 hectares), the equivalent of 0.5% of the area sown with conventional methods. It's the point of the lance, albeit Quixote's, of so-called ecological agriculture, which aims to save water and reduce toxic inputs, as well as to increase the quantity and quality of primary sector production by creating local economies of scale. It rescues ancestral practices in a movement to empower people from the ground up. If it catches on, it would help clean up the aquifers and the effluents to the gulf.

Mireya Jocobi: "We like to share everything that we learn." Photo Dahl McLean.

The Quelite Solidarity Store in Hermosillo makes a contribution to this kind of agriculture. As humble and unpresuming as it appears, it is a beacon for small producers and consumers who support ecological practices, because it is a link in the distribution chain, promoting the principles of fair trade, including equitable community participation in production. The store is a cooperative where you can find such items as La Reforma brand hibiscus jam from the Sindicatura de Jesus Maria Culiacan, Sinaloa; mesquite flour from Rancho La Inmaculada, Sonora; pickled prickly pear pads from Hermosillo; and bitter orange marmalade from Granados, Sonora.

Like Cobanaras and the producers whose labels fill the shelves, countless other groups in the gulf region are dedicated to formal and informal education, as well as transformation of production methods and services. Their combined efforts, in coalitions, such as the Northwest Mexican Coast Sustainability Alliance (Alcosta), tend to

Proactive Business, Government Join Forces: Dreams of a Blue Revolution in Agriculture

The Seaphire International company is undertaking a world-class project in Sonora called Seawater Farms Bahia Kino. By developing 25,000 to 250,000 acres (10,000 to 100,000 hectares) of shellfish and fish farms, as well as marine plants, it would reduce pressure on seafood resources while cleaning up the wastewater from shrimp aquaculture and combating global warming.

For starters, the biotech company with headquarters in Phoenix, AZ, is channeling the Gulf of California waters to irrigate a 2,500-acre (1,000-hectare) mangrove plantation and nearly 5,000 acres (2,000 hectares) of halophytes called salicornia, both of which grow in salt water and have commercial value. In addition, it will cultivate 1,235 acres (500 hectares) of shellfish, tilapia, and algae ponds.

It would convert the land around these installations into marshes in order to arrest the desertification on the Coast of Hermosillo and promote biodiversity. It would take in the salt water discharges from the adjacent shrimp farm and apply them to produce 1 billion liters of water a day through evaporation transpiration. It would create 150,000 jobs in its 60- to 100-year project life span.

If it goes ahead, it would be the first step in realizing the dream of a Blue Revolution in agriculture, so-named for the ocean water that will replace the use of ever more scarce fresh water in irrigation and primary sector production. This is the dream of a doctor in atmospheric physics and mathematics, Carl Hodges. He is the founder of The Seawater Foundation, which has obtained a technological investment worth US $20 million in the project over the past decade. Says Hodges, "Progress in sea water farm systems and their construction in Sonora will provide the planet with the first new agriculture in 10,000 years."

In April 2005, then-President Vicente Fox and Sonora Gov. Eduardo Bours visited with Hodges in the field adjacent to Bahia de Kino, where nearly 1,000 acres (400 hectares) already were planted with salicornia, thanks in part to a grant from the National Fishing and Aquaculture Commission (Conapesca) and to the state government's purchase of more than 17,000 acres (7,000 hectares) for the project. To move forward, Hodges' foundation gave U.S. $50,000 to the University of Sonora for it to obtain the recognition and backing of the World Bank's new BioCarbon Fund.

The fund would certify the project so it could offer carbon reduction credits, which another company might buy to exchange as an offset to greenhouse gas emissions, as provided in the Clean Development Mechanism established by the Kyoto Protocol. This would be possible because mangroves and salicornia store carbon dioxide in their roots.

Other, less ambitious fish farms have sullied the region's shores as well as the industry's reputation. The North American Commission for Environmental Cooperation found in 2003 that Granjas Aquanova, in Boca Cegada in the municipality of San Blas, Nayarit, broke the law by destroying nearly 50 acres (20 hectares) of mangroves, burning protected species habitat, draining and refilling lagoons, discharging polluted water, rechanneling natural water courses, setting up camps, impeding fishing, disobeying reforestation orders, and ignoring its permit conditions of maintaining a conservation area within the concession boundaries.

Shrimp farms had reached nearly 2,500 acres (1,000 hectares) in northern Sonora more than a decade ago. Without controls on the discharge of fish food, antibiotics, cleaning products and artificial channels, they damaged the land, Colorado River water and marine life in the vicinity of the village of El Golfo de Santa Clara. Today, aquaculture competes with tourism and industry for the central coasts of Sonora. Operating at maximum capacity, the state's shrimp farm effluents would inject the Gulf of California with the same volume of water that is diverted from the Colorado River to California, Arizona, Nevada, and New Mexico. The waste causes dead zones and infections in marine life. Stakeholder representatives in the gulf's Marine Ecological Use Plan emphasize the need to resolve these land and water quality issues.

Seawater Farms proposes remediation not only in Bahia de Kino, but also in Puerto Peñasco, Sonora, and the state of Sinaloa. A project this daunting requires grand alliances. Hodges confers with the father of the Green Revolution, Nobel recipient Norman Borlaug. He cites the prophets of the imminent collapse of ecosystems, such as the authors of *The Limits to Growth* (1972) and *The Revenge of Gaia* (2006). In his court are members of the World Business Council for Sustainable Development.

Among the distinguished participants in the project are M.S. Swaminathan, leader of the Green Revolution in India; H.T. (Ted) Circuit, retired president of Coca Cola Latin America; José Santos Gutiérrez, president and director general of the agribusiness and construction company Mezquital de Oro (Mezoro); and Juan Ignacio Bremer, director general of the Mitsubishi parastate Exportadora de Sal (ESSA) until his retirement in 2005. Hodges views them as part of "the ultimate consortium for planetary success," an association of business people who will go beyond the corporate responsibility seen to date to inspire the rest of society to respect natural and human resources.

He used the African nation of Eritrea as a test site for a successful pilot project of the technology. But social and political change that engendered Eritrea's second war in 2000 left behind only a remnant of the effort: a women's cooperative that plants mangrove trees for use in handicrafts for sale, which is supported by non-governmental organization members. The proposal submitted to the World Bank for Sonora considers new micro industries, such as woodcrafts, honey production, and livestock feed. Permits to carry out the project remain to be obtained. -TN

strengthen environmental production alternatives, according to Rene Cordova, former executive coordinator of the Border Environment and Health Network. However, he says, "reform of the entire regional development model is needed." Regarding overexploitation of resources, including human ones, he says, "We only now are realizing the magnitude of the challenge." He admits, "We're trying to mitigate impacts, protect important biological areas, and reduce dangers, but with a pretty disjointed view of the problem."

In order to resolve the conflicts over water and land, it is crucial to update laws and increase public participation in their oversight by fostering transparent procedures that assure access to decision making. Without regulatory framework, involvement of society and different levels of government, a culture of water conservation, sufficient environmental education, and access to information, "it will be difficult to achieve sustainable and long term development in the region," states Conservation International.

Achieving all this takes time, even in the best of circumstances. Many scientists think the time is running out too fast to bring together the components necessary for reverting the damage in the region, not to mention the planet. That outlook has spawned a dramatic proposal for remediation of the coast of Sonora, a megaproject, unique in the world, which would use the polluted water from the fish farming on the edge of the Sea of Cortez in a daunting "new agriculture." (See sidebar "Dreams of a Blue Revolution in Agriculture.)

Talli Nauman is co-founder and co-director of Journalism to Raise Environmental Awareness, which is responsible for this series of investigative feature reports on sustainable development in the Gulf of California Region, made possible thanks to people throughout the region. It was sponsored by the Fondo Educación Ambiental*, International Center for Journalists, and the David and Lucile Packard Foundation. Translated for the Americas Program by Talli Nauman.*

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Recommended citation:

Talli Nauman, "A Future Compromised: Agriculture and Aquaculture Compete for Water," IRC Americas Program (Silver City, NM: International Relations Center, February 28, 2007).

Web location:

http://americas.irc-online.org/am/4035

Production Information:

Writer and Translator: Talli Nauman
Editor: Miguel Ángel Torres
Layout: Nick Henry, IRC