

GAVIOTAS

Building a Sustainable Community

by Laurie Guevara-Stone

Gaviotas, Colombia, founder Paolo Lugari at the community meeting hall.

Nearly 40 years ago, Paolo Lugari, a young, idealistic development specialist, united a group of scientists, artisans, street kids, and local Guahibo Indians with the common cause of building an eco-village in the bleak eastern plains of Colombia, some 300 miles east of Bogota, the country's capital. His rationale: "If humanity is to survive, we must move out of the cities, and learn to live sustainably in areas where people have not tried to survive before."

Through trial and error, Lugari and this remarkable group succeeded in designing sustainable technologies for the tropical climate, and transformed



A Gaviotas resident plants trees in the row created by the biodiesel-powered tree planter.



20,000 acres of once-barren land into a regenerated rain forest. Today, the village of Gaviotas is home to 200 people and revered by the United Nations as a model of sustainable development. The people, known as Gaviotans, manufacture their own solar hot water collectors, windmills, and a highly efficient water pump. They produce all of their own food, and earn an income through the sale of their renewable energy products, sustainable forest goods, and spring water.

In March 2010, I visited this extraordinary community to see firsthand the secrets of its success. Friends of Gaviotas, a U.S.-based nonprofit group, coordinated a two-day tour for a group of people interested in sustainable development.



Visitors to Gaviotas each plant a ceremonial tree as part of their tour.



Creating synergies is part of the Gaviotan way. Mycorrhiza, a beneficial fungus, helps the newly planted trees absorb nutrients.

In its three decades, Gaviotas has planted 8 million trees and cultivated the largest planted forest in Colombia—without using any fertilizers or chemicals. To accomplish such a feat with a relatively small work-force and resources, Gaviotas engineers built an efficient, biodiesel-fueled tree planter—a double-row planter that can plant one seedling every three seconds, or 250 acres in a 24-hour period.

The community began planting Caribbean pines in the early 1980s. Rather than adhering to conventional forestry practices, the Gaviotans experimented and developed site-specific methods that work with the tropical climate. The key is a small fungus called mycorrhiza—a very important part of Gaviotas, according to Lugari, who says, “Life is sustained by the things you don’t see.” The fungus, which doesn’t occur naturally in the area, had to be brought in from the jungles of Honduras and Guatemala, where foresters used it to treat soil on pine plantations. The fungi’s spores bond with the roots of the trees and aid in the absorption of nutrients in the region’s highly acidic soil.

Bogota Beginnings

Our visit began with a stopover at Gaviotas headquarters in Bogota, which serves as a business office and a distribution hub for the community’s renewable energy products and forestry goods.

We spent the better part of the morning rapt in discussion with Lugari, who captivated visitors with tales of the Gaviotans’ early years and his poetic philosophies on the importance of “replenishing the vegetable skin of the earth.” He underscored the fact that trees can absorb the carbon dioxide gases we produce, and advocated that planting a tree can help save humanity—a point he drove home with an overview of Gaviotas’ reforestation efforts.

Innovations through Experimentation

According to Lugari, the community thrives on overcoming obstacles through experimentation. People are encouraged to read academic texts but with a critical eye, and approach problems without any preconceived notions of what can or cannot be achieved. “The only fixed idea in Gaviotas,” Lugari

Striking Liquid Gold

After planting the first of their Caribbean pines, Lugari and his team realized that the golden resin produced by the bark of these trees can be turned into rosin, which is widely used in a variety of commercial products and could be sold to generate income for the village. The resin naturally regenerates beneath the surface of the bark, and, if extracted properly, the trees are not damaged. With the support of several international and domestic grants, they expanded the forest and developed sustainable practices for harvesting, refining, and packaging the resin. In the two decades since, production has increased to 1,500 tons of rosin a year and generates 80% of the community’s revenue.



Resin harvested from the Caribbean pine plantation is processed and turned into rosin, providing income for the community.





Flat-plate collectors made by the Gaviotas residents are used throughout the community and in the city of Bogota.

This Bogota, Colombia, hospital boasts the largest solar hot water system of any hospital in the world—and uses Gaviotas-made collectors.

says, “is that nothing is done that is not sustainable in the final balance.”

Maintaining this freethinking atmosphere has meant doing away with some outside influences—most notably, the Internet. After two years, the community decided to disconnect its solar-powered Internet connection and “return to thinking.” According to Lugari, the community determined that Web access was stifling its progress—people were turning to the Web for preconceived ideas rather than working together to dream up innovative solutions for tasks large and small.

Such large-scale innovations include a solar hot water system that produces hot water even on overcast days; a windmill that pumps thousands of gallons of water per day from a depth of more than 120 feet; and a unique “sleeve” water pump that can extract water from much deeper depths than a conventional pump, with far less manual effort (see “Sustainable Designs” sidebar).

That afternoon, we got our first glimpse at the village’s technologies at work, as Lugari led us on a tour of a few Gaviotas-manufactured systems in Bogota. By far, the most impressive is the solar hot water system at the Hospital Universitario Mayor Méderi—the largest SHW installation on a hospital in the world. Six hundred flat-plate collectors mounted on the roof of the main building and its adjacent emergency room provide 100% of the hospital’s hot water. Equally inspiring was Sausalito, one of many Bogota neighborhoods equipped with Gaviotas solar hot water collectors. One thousand apartments in multiple, multistory buildings are outfitted with individual solar hot water systems—with one collector per unit and spherical water-storage tanks.

Gaviotas’ reach extends far beyond the capital city. All 30,000 solar hot water collectors installed throughout the country are manufactured by Gaviotas, and the community’s sleeve pump is being used in more than 600 rural villages.

A hand press is used to create earthen-cement bricks that make up many of the buildings in Gaviotas.





The Gaviotans' multiuse meeting hall (left) and this traditional house (above) are constructed of hand-pressed, earthen-cement bricks.

Village Design

The next morning, we departed for Gaviotas on a chartered plane. As we descended over the savannah into the village, we began to fully appreciate what Lugari and his team had accomplished. Acres upon acres of trees appeared amid the desolate desert that is the Los Llanos region. The contrast of the tree plantation against the barren, sun-baked lands was awe-inspiring.

Upon touching down on the dirt landing strip in Gaviotas, we were greeted by a small group of Gaviotans and led a short distance to the forest where we each planted a small acacia tree—further impressing upon us the importance of trees to the community's mission. We then boarded our transportation for the day: an old mini-bus towed by a biodiesel-fueled tractor.

Our first stop was the multipurpose hall, which serves as the meeting place, church, conference center, and game room. The most striking feature of the hall is the roof—a stainless steel parabola that was designed to optimally reflect the sun's rays at any given time throughout the day and keep the interior cool. Like most buildings in Gaviotas, the hall is built of brick-sized, pressed blocks made from a mixture that is mostly native soil, with a little cement. These are hand-made in Gaviotas with a CINVA (a Spanish acronym) manual press, developed in Colombia, and refined and tested in the community of Gaviotas. The thermal mass of the pressed blocks helps keep the interior of the building cool.

One interior wall of the hall is covered with the colorfully painted mural that depicts the last 30 years of Gaviotas. Lugari talked us through that history and gave us some insight into everyday life in Gaviotas—where there are no laws, no police, no jails, no

mayor, no weapons, and, as Lugari emphasized, no theft or corruption.

Using Natural Resources Wisely

From there, we drove into the forest groves. Though only three decades old, the forest is as dense and diverse as some of the world's most mature rain forests, boasting hundreds of species of native flora and fauna. Such rapid growth, as Lugari explained, is largely due to a series of deliberate and accidental choices. Instead of weeding out other plants that sprouted up and might have competed with the trees' roots, the village agriculturists let nature take its course, allowing the forest floor and neighboring grasses to flourish. In time, the canopy of the Caribbean pines nurtured the return of native fruit trees, plants, and animals, and the emerging forest fostered an additional 10% rainfall annually.

From the forest, we moved onto the resin distillery—the heart of the Gaviotan economy, where resin from the pines is distilled into two marketable by-products: rosin and clear

This colorful mural captures the spirit of community in Gaviotas.





This electric generator uses biodiesel to power the biodiesel fuel-making plant.

turpentine (see “Striking Liquid Gold” sidebar). The row of bicycles parked in front of the distillery is a testament to the healthy lifestyle of the car-less community. The state-of-the-art distillery, designed by Gaviotas engineers, runs off biodiesel, and like many of the residences, is adorned with beautifully carved Gaviotas art.

Adjacent to the distillery is the biofuel plant, where a mixture of pine-turpentine and used cooking oil is refined into biodiesel. The used cooking oil is collected from restaurants in Bogota—instead of returning empty after delivering the rosin and turpentine to the Gaviotas headquarters—the trucks collect drums of used oil. The biodiesel is used to run *all* of the diesel engines—electric generators, tractors, and trucks—in the village, including the generators that power the biodiesel plant. Filtered cooking oil is poured into a large tank, where methanol and a catalyst are added. After about an hour of mixing, the contents are pumped to a large settling tank, where the glycerin falls to the bottom. The biodiesel then gets washed and transferred to a storage tank. The process yields roughly 100 tons of biodiesel annually.

Next up to visit was the water purification and bottling plant—a glass and steel structure that was once a hospital. The building was converted by the Gaviotans into a water purification and water bottling plant in 1995 after realizing they could improve people’s health by distributing clean water. Shortly after Lugari and his team founded Gaviotas, they discovered that the aquifers supplied a consistent source of clean water and developed a windmill to pump water into a storage tank, where it is gravity-fed to the bottling plant. A portion of the sales of their water to restaurants in Bogota help Gaviotans provide free water to the local communities.

Though the water bottles are made from petroleum-based plastic, the Gaviotans have found innovative ways to give them a second life. The bottle is designed with a unique interlocking shape, so it can double as a Lego-like toy once it is empty. Alternatively, the bottles can be filled with sand and used as interlocking building blocks for walls, a strategy used to construct several buildings in the village. The remaining bottles are collected and sent to a recycling factory in Bogota, where they are turned into carpets, clothes, and other materials.

Renewable Electricity at Gaviotas

The water purification and bottling plant is one of two places in Gaviotas that use solar electricity, the other being the telecommunications center, where they communicate with the outside world. The telecommunications center has a stand-alone 4.5 kW PV system, with dry-cell batteries that are changed out every five years. The Gaviotan philosophy of self-sufficiency—not using imported technology—keeps solar electricity out of the picture for the most part. The

Windmills pump water to storage tanks, where it is gravity-fed to the purification and bottling plant.





A seesaw turns the chore of pumping water into child's play.



Stacked into a wall, used, sand-filled plastic water bottles get a second life.



Sustainable Designs

Solar Hot Water System—To ensure a highly efficient flat-plate collector, Gaviotas engineers stripped a copper sheet in nitric acid, then oxidized it with a solution of copper sulfate dissolved in hydrochloric acid. The outcome is a deep black color, deposited directly on the copper, resulting in a solar collector so efficient that water is heated to 120°F even on overcast days. Street kids turned solar hot water technicians manufacture the collectors in the Gaviotas factory in Bogota.

"Sleeve" Water Pump—Typical hand pumps require a person to lift a piston to make the water rise. In the Gaviotas sleeve pump, the piston stays in place inside a lightweight plastic sleeve, and the sleeve is lifted instead. This design requires much less effort and enables water pumping from much deeper wells than a conventional hand pump—its submerged piston and cylinder allow it to operate in wells with water depths greater than 10 meters. Gaviotas engineers took this idea one step further, coupling the sleeve pump to a seesaw, turning a common children's playground toy into a life-nurturing technology that can provide clean water to rural communities.

Windmill Water Pump—After building 58 different models of windmills over nine years, Gaviotas engineers finally hit on a simple and inexpensive design to suit Gaviotas' tropical climate. Building off of ideas from Holland, Australia, and Africa, the village designed a windmill that pumps thousands of gallons of water per day, and can operate at wind speeds as low as 4 miles per hour. The windmill has five aluminum blades, patterned after landing flaps Gaviotas engineers spotted in a NASA airfoil catalog, each turned inward to eliminate the need for a tail. It drives a double-acting stainless steel piston pump. The result is a windmill that is 10 times lighter than a traditional windmill, needs three times less wind, and does not need to be stopped in a storm.

Hydraulic Ram Pump—The Gaviotas Hydraulic Ram can pump thousands of gallons of water, day and night, to a maximum distance of 1,000 meters with a height of 100 meters, without electricity or fuel consumption. The ram pump uses the force of falling water, developing pressure that lifts to a point higher than where the water originally started.

majority of the plant is run on biodiesel and microhydro-generated electricity, but some of the water-analysis labs run their equipment from a 3 kW PV system. Keeping the plant cool is accomplished passively with underground ventilation ducts that funnel prevailing winds through the plant and out of the "self-cooling" roof, made of two sheets of corrugated roofing bonded together to create honeycombed air chambers.

The last stop of the tour was the microhydro plant, which produces up to 20 kilowatts, with a 1 meter of head. This plant produces the electricity used in every home throughout the community.

As we made our way back to the airstrip at the end of the tour, a drizzling rain hastened us onto the plane. Time was of the essence, since heavy rains during the wet season have been known to ground planes for weeks. As the plane made its ascent and Gaviotas slowly disappeared, I fully understood what Lugari had said earlier in the day: "Gaviotas is not a community that can be replicated. What needs to be replicated is the Gaviotas way of thinking."

Access

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Friends of Gaviotas • www.friendsofgaviotas.org • Info & hosted visits • A trip to Gaviotas is being organized for November 2010.

Gaviotas: A Village to Reinvent the World, by Alan Weisman (2008, Chelsea Green Publishing Co.)

