



CASE STUDY

Bahia Beach Resort is the first resort to be certified as Gold Sanctuary in the Caribbean by Audubon International Signature Program. The Golf Course has a Silver Sanctuary Certification. The project was also selected by the Puerto Rico Homebuilders Association to receive the Heritage and Sustainable Community of the Year Award for 2008, and the golf course was honored with the 2009 Green Award by the well-known magazine Golf Inc.

Bahia Beach Resort and Golf Club is a 483 acre property located in Rio Grande, Puerto Rico. The project's boundaries are a two mile beach on the Atlantic Ocean to the North, and the mangroves of the Espiritu Santo River Nature Reserve to the North East. It is located between the Espiritu Santo and The Herrera rivers watersheds in the foothills of the Luquillo mountain range, that hosts the 28,000 thousand-acre "El Yunque" Caribbean National Forest of the US Forest Service. This forest is one of the most bio diverse forests managed by the USDA Forest Service.



Bahia Beach and the Espiritu Santo River

Both aforementioned rivers are born in "El Yunque" and drain into the Atlantic Ocean. Bahia is located on the last section of an ecological corridor that extends from the high elevations (more than 3,000 feet) at El Yunque Rain Forest down to the coast of Río Grande. Part of this corridor is the Espiritu Santo river which surrounds the East boundary. The Espiritu Santo River is one of the most scenic rivers in Puerto Rico. It extends for 11.9 miles from the highlands of el Yunque to the Atlantic Ocean at Bahía Beach. The fresh water input of this river is essential to maintain the fresh and salt

water balance of the Espíritu Santo Estuary. For decades the river has been a source of income to the local fishermen. Recently, it has become a most wanted ecoturistic attraction for kayakers who go bird watching and nature photography enthusiasts.

This geographical location and the diversity of its ecosystems within the premises nourish the site with both inland and coastal species. All this makes the location of the property a key element in regional conservation initiatives, ecological connectivity, functionality and integrity.



Hole # 18 El Yunque view



Espiritu Santo River and El Yunque

In the past the property has had different uses. It was once a cattle farm, then a mining site for sand extraction, which created the pond areas, a sugar cane plantation and a coconut palm plantation. The forest that is presently on the site is a secondary low coastal shrub, with pockets of palm trees associated with Maria Trees, Almond trees, Flamboyant trees, pink trumpet trees, and other numerous species. A Mangrove forest near the Espiritu Santo River borders the project, with the presence of four species of Mangrove trees: Red, Black, White, and Buttonwood. Coconut palm trees and swamp ferns (*Acrosticum aureum*) grow on the boundaries.

The former coconut plantation at Bahía Beach was part of more than 10,000 acres of Coconut palms (*Cocos nucifera*) planted for commercial use in Puerto Rico under the Spanish crown. The palm tree was introduced from Cabo Verde Islands, West of Africa, in the early 16th century, although it is believed to be native to the Indo-Pacific. This tree is one of the most beneficial to mankind. The leaves can be used to cover roofs and the trunk is used as construction wood. The gigantic seeds, one of the largest in the world, provide water, food, oil and raw materials for arts and crafts.

This Resort community includes a renovated 18 -hole golf course designed by Robert Trent Jones II, a golf club and restaurant, 24 estate single family homes, golf villas, beach villas, townhomes, a St. Regis hotel and spa, and a small commercial center under construction. The existing property is dominated by the golf course,

and 70 acres of lakes created years ago by mining activities, as mentioned before. The golf course was redesigned considering the importance of ecological and environmental factors, connectivity, and the need to enhance habitat for wildlife conservation.

Leatherback turtles, are an endangered species and are the largest sea turtle, they nest every year on the 2 miles of beach along the Atlantic Ocean. A conservation and protection program is in place and in close coordination with the Department of Environmental and Natural Resources of Puerto Rico.

The Resort has a nature-based focus that includes integrated architecture and a commitment to preserve about 65 percent of the land as green area. Working to honor this commitment, the Bahía Beach Resort has transplanted more than 5,000 trees and coconut palms, propagated and planted more than 62,000 native or naturalized plants and trees, added more than 6,500 linear feet of aquatics, converted about 3 acres from grass to shrubs, and transplanted wild ferns and Oyster plants throughout the property. The success rate of the transplant program has been 80%, which is a high outcome for this kind of initiative and first of its kind locally.

As an environmentally - responsible community, committed to sustainable development, at Bahía Beach, we acknowledge the sensitive nature of our premises. Accordingly, we have adopted diverse environmental conservation policies and programs. In order to achieve the goals of these programs, a team of professionals known as the “green team” was instituted from the beginning of the project. The team is composed of a marine biologist, a biologist, an ecologist, a landscape architect and one agronomist. These specialists are responsible for the implementation of the environmental policies and the proper management of the natural communities. The team promotes sustainable values within the community, monitors the resources, and oversees environmental quality and compliance with the Audubon International Certifications. In addition, the group organizes nature immersions and hands-on activities such as bird- watching and nature walks. The team is active in the conservation efforts in the neighboring communities of Río Grande and Loíza. The green team also leads nature management projects such as the biological control of aquatic invasive weeds with grass carps.

Wildlife Conservation and Habitat Enhancement

The property and the landscape are highly influenced by the coastal climate and the estuarine ecosystems in the vicinity. The area offers a mosaic of natural communities including marshes, lagoons, a coconut plantation, fresh water swamp, mangroves, sandy beach, coral reefs and coastal and secondary forests, together producing a natural complex of great value for wildlife.

Maria trees, Coconut palms, and Almond trees dominate the vegetation. The main habitat centers within the property are the riparian zone around Espiritu Santo River,

the beach and the two Island Reserves surrounded by the lakes.

Wildlife inventory

The wildlife inventory is extensive and increases permanently with the arrival of new species as occasional migrants, visitors or as residents. More than 46 species of birds have been recorded, which include the endemic Puerto Rican Woodpecker, the Puerto Rican emerald hummingbird, the mangrove cuckoo, Great Egrets, Great Blue Herons, Ospreys, and the former endangered Brown Pelican, removed from the endangered species list on December 2009. The native Caribbean Coot is a resident now and inhabits all the lakes around the property. Among the amphibians, the Coqui is the most well known on the island because of its distinctive call. Reptiles from lizards, iguanas, fresh water turtles to marine turtles like the endangered Leatherback are present or near the resort.



Caribbean Coot



Osprey

Leatherback turtles nesting season

Leatherbacks nest on the beach from February to July each year and a conservation project in close coordination with the Puerto Rican Natural Resources Department is in place to protect these magnificent animals during their early stages of life.

When a nest is found it is immediately notified to the Department of Natural and Environmental Resources. The DNER personnel marks the area for

protection and for educational purposes. The Bahia Beach staff patrols the beach to protect the nests and in order to avoid vandalism. Hatching of nests starts typically in

June and ends by August.



Turtle marks and nest protected

A group of residents will be trained by the Natural Resources officer on turtle watching techniques as well as form a volunteers program to organize beach surveillance and educate people on the importance of the nesting season and for the turtle population as a whole.

Manatee Conservation

Manatees are also present in the waters around the Resort. The Caribbean Stranding Network, a non profit organization, has a comprehensive conservation program on manatees in Puerto Rico. An aerial survey for Manatees observation was done by the Network on the south coast of Puerto Rico. Our Natural Resources Manager joined the team in order to provide them with support, building up a collaborative trust and identifying projects for fauna conservation.



Manatee's book cover

A joint venture has been developed with a private university and the Caribbean Stranding Network to work for manatees' conservation. The first result was the publishing of the "Manatees of Puerto Rico" book for youngsters, sponsored by Bahia Beach Resort. The next big step will be a project to study the manatee habitat

in the Bahia Beach region thus contributing to the conservation of this endangered marine mammal.

Connectivity

Connectivity is a main environmental goal of Bahia and a key issue in wildlife conservation. Connecting corridors have been enhanced, planted and maintained. Most of the golf course has corridors crossings to allow connectivity with the lakes. A vegetation network is the ecological matrix of the project, providing connectivity between the mangroves, the lakes, the swamp areas, and the beach. and El Yunque National Forest.

Littoral transition zones and aquatics along lakes margins were planted in 11 holes in the golf course. The end result of the vegetation programs is the enhancement and maintenance of corridors for wildlife habitat and protection that provide a natural interconnected matrix in the property to connect through vegetation corridors with the Espiritu Santo River, the mangrove area, the beach



Lake buffer on golf course and residences

Tree Management, Nursery and Transplanting

The planting program is very comprehensive which includes landscaping corridors, preserves throughout the project in general. Bahia has a state of the art nursery that produces mostly native and naturalized plants and trees. The nursery has produced more than 63,000 native or naturalized plants that are planted throughout the

project. Other plants are also produced to fulfill the landscape design requirements of the Resort.



Nursery

Most of the plants are propagated from existing vegetation on the property, maintaining the genetic pool of the area. More than 1,100 trees have been produced in the nursery and planted on the project. Other native or naturalized trees are brought to the nursery to complete their development until ready for planting.



Plantings by Las Verandas

More than 4,500 trees have been transplanted within Bahia Beach. This very ambitious undertaking involves the use of proper machinery, materials and expertise to remove a tree from an area and relocating it within the property, at the same time having minimal impact on the tree and the immediate environment, while enhancing wildlife habitat and the landscape as a result.



Tree-spade transporting a Maria tree

Integrated Pest Management

It is a preventative approach, an ecologically based system that uses biological and chemical methods to control pests. On the golf course, certified seeds and practices are used to maintain a high quality turf. Practices such as aerification, vertical mowing, topdressing, maintenance of proper soil nutrient levels, sound irrigation management and proper mowing techniques are continuously used on the course.

Appropriate sun exposure is also key for healthy turf maintenance.

Pesticides when needed are used curative rather than preventive. Pesticides selection is based on a risk assessment approach that strives to use only pesticides that are based on effectiveness, non-toxic to non-target species that act and degrade quickly and are not soluble and not persistent.

In the common landscaped areas, the proper use of particularly naturalized and native species favors low occurrence of pests. Location of the plants is key on sun exposure and humidity.

Aquatic weeds can become a nuisance in recreational lakes like the ones at Bahia. Biological control of aquatic weeds with grass carps is a research project currently under execution with the collaboration of the University of Puerto Rico, Humacao, and the Natural Resources Department. A marine biology student is currently working on the research that will give information on aquatic weed control with grass carps in Puerto Rico.

Iguanas and other exotic invasive animals, are found in Bahia. There are several ways of controlling them, but we prefer nest control, a program that is in place during nesting season. Mosquito control is based on biological methods with small fish and *Bacillus tsurenginensis israelens*, a bacteria that attacks specifically the larvae of some insects.

Water Conservation and Quality

During the construction phase of the resort, surface runoff control with silt fences and sedimentation ponds are a standard practice. BMP's are used in the construction area to stop erosion and storm water pollution. Silt fences, drains and ponds are continuously monitored in the construction sites, and preventive maintenance is performed in these areas at all times.

Drains are covered with a special mesh developed to let water through avoiding sediments to pass and are also protected with organic materials to totally diminish the sediment input.

Special management zones are in place on the golf course, a 20 to 25 foot strip around all ponds is a non-spray zone. All fairways are treated as limited spray zones where a short list of pesticides that have passed a risk analysis can be used; filters and sumps are located in outputs from greens to diminish any impact on the surrounding environment. Vegetation filters are also installed at the outlet.

A plan to create a vegetation buffer area around all the ponds is under way. Most of

the golf holes have areas that acts as a buffer, wildlife habitat and connectivity corridor, connected to the vegetation matrix of the resort. These areas are planted with mostly native or naturalized plants, including wildlife and butterfly attracting plants. In play areas around the lakes, the fairways have 3 inches turf that act as an excellent buffer system.

The irrigation of the golf course is done with rainwater stored into the lakes. The irrigation system is shut down during the rainy season and rainy days, which happens at least during 4 consecutive months during the rainy period. Around naturalized areas, part circle heads have been installed where possible, causing a 15,000 gallon reduction in water use.

Rainwater storage tanks are located in the estate homes for garden irrigation and MP rotors are used in most if the landscape irrigation system, transforming it into a high uniformity low application rate sprinkler with matched precipitation even after arc and radius adjustment.

Landscaping of the St. Regis hotel considers most of the current existing vegetation staying and the use of a high percentage of native /naturalized plants with high resistance to droughts and low water irrigation for other areas. The irrigation system of the St. Regis hotel has been planed with the installation of MP rotators too. Small areas and planters will have drop lines installed for irrigation. Shrub and Sod zones have been separated in order to control areas during extreme weather conditions.

In order to follow up on the lakes water quality, monitoring tests are done quarterly in 3 different locations. Other test are performed upon need.

Natural rain gardens and elevated pathways

On the St. Regis hotel rain gardens are used for permanent management of storm water. As the construction developed at the hotel site, all of the building footprints needed to be elevated to conform the flood code. As a result all of the undisturbed vegetation areas became depressions, these areas that were interconnected were used as storm water collector areas or rain gardens. Being that the soil is basically sandy the water collected in these areas drains quickly. An overflow piping is also provided which ultimately end up in the lakes.



Rain garden by the St. Regis construction site

Wooden elevated cart paths were constructed instead of concrete walks to preserve the root system of the trees and to allow water to get evenly distributed. Only staff will transit on golf carts and guests will either walk or take a shuttle to different areas of the hotel.



Elevated pathway under construction

Energy and materials efficiency

In our tropical climate air conditioning is an important item. Air conditioning is highly efficient in the residences, hotel, club and office facilities and it is equipped with programmable thermostats and clocks for the main facilities to avoid unnecessary air conditioning use during unoccupied hours. The St. Regis has a central cooling system that required a higher initial investment but the energy efficiency is very high and the system performance supersedes the one originally designed. An intelligent system is located in each of the rooms of the hotel to have complete control of the air conditioning and light use. Everything is computerized and the maintenance crew will be able to fix problems faster and efficiently.

The wattage consumption of the St. Regis hotel was cut to almost half during the design phase and the most efficient system is being installed throughout the hotel.

Other controls of energy use is the use of energy efficient office equipment, most of the office equipment is turn off when the employees leave the premises. High performance pumps with precise control systems are also used for the St. Regis residences pools.

Several options have been tested for the Resort lighting. Some of the road lighting is LED, but mostly is fluorescent. Low consumption bulbs are used in the main facilities such as the club house, but will be changed to LED eventually.

Outdoor lighting is directed to the vegetation or paths, no lighting is or will be directed to the sky or natural areas. Near the beach the lighting becomes even more conservative and is properly directed to avoid any interference with the natural process that occurs at the beach.

The St. Regis hotel water heating has a natural gas system as the energy source, thus exploring the use of other energy alternatives.

Green building

Materials and techniques that are environmentally friendly which improve air quality conditions or have a lower chemical content are being used in the new construction. Some examples are the use of Gold Bond Gypsum Board on the structures, which includes a side that is made of 100% recycled purple paper, also low and zero VOC paints are used in the Golf Club house, the estates lots and the indoor areas of the hotel structures.

Pool chlorinators are based on a salt system that breaks the molecules to produce just the right amount of chlorine that is needed at a certain moment. The system is precisely controlled to avoid waste of energy.

A very small corridor around each building or structure was cleared of vegetation for the handling of machinery and materials for the construction. Most of the vegetation was maintained and increased as part of the trees transplanting and enhancing program.

Waste Management

To reduce the Bahia Beach ecological footprint, Bahia integrated a waste management program that aims to Reduce the production of waste, to Reuse materials and to Recycle products.

Reduction and reuse is the policy that we are applying specially in the Molasses restaurant, the cocotero and the beach club. A comprehensive plan to change the use of disposable elements for reusable ones is in place. Additionally, waste materials that are organic in nature, such as plant material, are processed onsite producing a semi compost or mulch, depending on the time stored and grind size used. The material has already been used around the project for new plantings or as mulch. At St. Regis hotel landscape plantings is using this material as topsoil.

Training has been done with our staff and contractors. Permanent follow up and

monitoring has helped to raise the commitment and understanding of the process.

Recycling of frying oil from the restaurant to produce biodiesel is a step forward towards diminishing waste production and generate alternative energy in Puerto Rico. A tank for oil storage is located behind the restaurant.

The recycling program is working in front and back of the house areas, as well as the administrative offices. Residents and guests are also part of the program, having recycling bins in every unit and recycling containers in every floor of the buildings as well as the Estate homes. The recycled materials are paper, cardboard, plastic, glass, and aluminum cans. The construction areas is also committed to recycling, materials such as metals, concrete and wood. Used motor oil is recycled in the mechanical area as well.

All other waste is managed by a company that operates within the area under Federal and local regulations.

Lakes management

Having 70 acres in lakes or ponds is a major maintenance challenge, especially because the lakes are managed as natural areas and their maintenance has to be done accordingly. Having the lake conditions with brackish water and very high pH, a submersed plant identified as *Najas marina*, spiny naiad, has taken over most of the lakes because it has an invasive behavior under these ideal environmental conditions.

Hand and mechanical removal together with biological controls are the main treatments to pursue an integrated management of the ponds. Biological control includes submersed aquatics control with grass carp, bacterial and enzyme addition to avoid possible water breakage due to submersed plant decomposition, and mosquito control with *Bacillus tsurengenensis israelensis*. For the import of grass carp a Natural Resources Department permit was needed. The grass carps that were introduced in the ponds are sterile triploid fish, that are treated with pressure to induce the presence of 3 chromosomes. It has been proven that Grass carp controls aquatic vegetation at high percentages in other projects, the conditions in Bahia Beach are optimal for their development.

An intern from the marine biology department of the Universidad de Puerto Rico is working with this biological control as her research project with the support and in close coordination with the Department of Natural Resources. The control was approved as a research project because not enough information about weed control and grass carp is available for Puerto Rico.

The program for integrated management of *Najas marina* and other submersed invasive aquatics have been discussed with the Natural Resources Department.

Lake buffers with aquatic plants like *Eleocharys sp* were planted in most of the edges of the ponds. Terrestrial vegetation was planted in 11 holes of the golf course and in development areas to create a comprehensive and effective buffer of the ponds that act as connectivity corridors. In some areas where playability is an issue, higher cut edges the lake banks functioning as a filtration system.

In addition a 25 feet no spray zone around the lakes is in place and all the fairways are treated as limited spray zones.

Natural Resources Management Center

The floor was constructed with concrete and is sealed with a chemical and oil resistant paint. A cover has been placed over the fuel station to prevent rain from entering the area and the floor has been also sealed. The wash pad drains to a sediment trap and basic filtration system that then is dispose to the sewer system.

This facility stores equipment used by landscape maintenance, golf course, and security crews. 3 different buildings are designed to independently house golf course equipment, landscape equipment and pesticides. The main building is comprised of a dinning space, restrooms, office areas, and equipment storage space. The Natural Resources Management center is the place where meetings happen every morning before the working day starts for briefing and indicate job assignments for the day. Other facilities outside include a fueling station for gasoline and diesel as well as a reservoir for used oil.

A filtration pond for the maintenance area was built to direct rain water and any material left from equipment wash area.

Environmental awareness, outreach and education: Soul of Bahia

Alma de Bahia, or Soul of Bahia, a comprehensive program for environmental education and outreach was produced under permanent and on going development for residents, guest, staff, contractors, local community and the community at large.

Nature Guide

A guide is being prepared with information of the flora and fauna surrounding Bahia Beach. More than 50 trees and animals will be described in this guide. Most of the vegetation and fauna is already described and photographed. Bird photographs were taken during a period of a year, capturing our local species on their move.

Alexis Molinares, an ecological advisor and Marcela Cañon, the Natural Resources Manager of the property, are preparing this publication.

Community outreach

An environmental education campaign coordinated with the municipality of Rio Grande to celebrate earth week has been in place and is celebrated during the first semester of each year. By 2010 the campaign has been a success during 3 consecutive years.

More than 4,000 students from 16 public schools participated in several workshops and talks lead by the natural resources manager and a marine biology student during the first 3 years. Environmental awareness, conservation issues, and natural resource use tips are the main subjects.

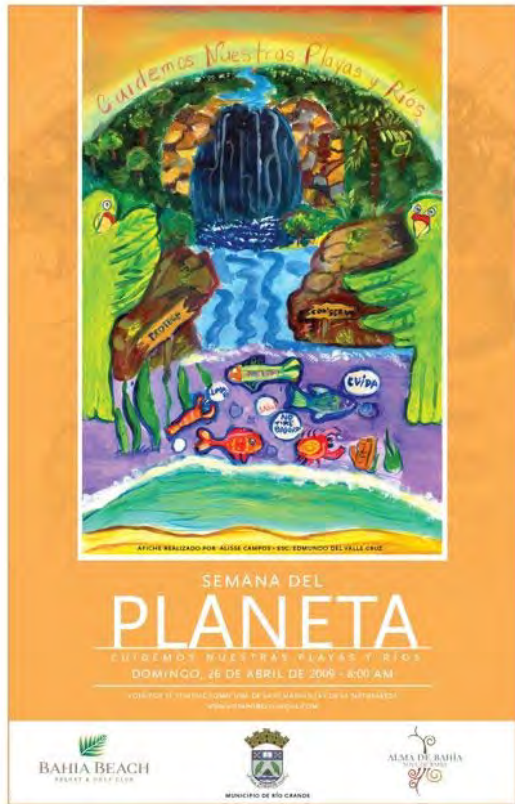


Environmental workshop at a public school

As part of the campaign an environmental inspired poster contest is organized between the elementary schools of Rio Grande municipality to design an earth week promotional poster. A very talented 4th grade student won the contest in 2009 and her work was presented in her school and was used as the official poster for the earth week celebration.



2009 contest winner with the Municipality representative, the Principal of the school and Bahia Beach staff.



Earth week posters



PARTICIPA DE NUESTRA LIMPIEZA DE PLAYA EL 25 DE ABRIL
LUGAR DE ENCUENTRO: PLAYA Y BOCA DEL RÍO HERRERA FRENTE A BERWIND
HORA 8:00AM

To wrap earth week celebration a beach clean up is organized with intermediate and high school students during the workshops sessions. During the first 3 years of the campaign more than 580 people, mostly high school students, participated on the activity that was a success. Several newspaper articles have been published locally and regionally about this campaign.



High schools participants at beach clean up

Bahia staff, residents and friends at beach clean up

Presentations on the property and on different events, either environmental or academic, are part of the outreach program. Presentations of the project and its environmental and social commitments are frequently done for different institutions and groups

The participation on a minisymposium of biological control organized by the University of Puerto Rico in Mayaguez, the Department of Natural and Environmental Resources, with the Army Corp of Engineers was a great opportunity to present Bahia Beach to the academic community.



Presentation at university of Puerto Rico

Newsletter

The newsletter has a section about nature that gives facts and updates about our natural environment and activities. In every issue, 6 a year, we include a story related to our environmental program and achievements.

Turtle watch

A Turtle watch activity with members and residents is part of the nesting season program. The activity is organized in collaboration with the PR Department of Natural and Environmental

Resources. The participants of 2009 were rewarded with a glimpse of a giant leatherback turtle track.



Employee environmental activities and training

The staff introductory program includes valuable information about the environmental importance of Bahia and the commitments required for the staff. Every new employee goes through the presentation. All staff had a training session that included a comprehensive description of Bahia's natural characteristics, its history and the commitments under the Audubon Signature Program.

During the different employee events environmental awareness and the commitment to the different activities is presented. Lectures about how special the Bahia community is and presentations that include our environmental goals, our plans and our community based approach have been organized for our employees and contractors. The recycling program is under permanent monitoring. Several meetings are permanently held within the Resort to share operational and construction issues and awareness.

Signage

Signs with environmental educational messages have been located throughout the project. This is the messages that we want to give to our residents, guests and employees.

Tree signage was located in the project to complement the nature trail and to provide information to our residents, guest, employees.



Sea Grape on Sand dollar beach with sign

Nature observation activities

The bird watching activities throughout the resort, and participation of some of our committee members have been useful opportunities to build up community engagement in nature issues and to inform about our achievements to the golfers, residents, and guests. Several birdwatching activities are held during the year with participation of guests of the Resort, either hiking, kayaking or in golf carts.



Bird watching with members



Espiritu Santo River nature kayak tour



Bird watching kayak tour



Bird watching and nature kayak tour

Nature tours of the property and the Espiritu Santo River with residents, members and guests are some of the activities that are permanently under development to educate and inspire our visitors. Periodical visits to the bioluminescent bay with residents and guests have proved to be very successful. The tour is guided and explores the function of coastal lagoons and mangroves.



Nature walk with members

Different events are held, such as astronomy night with the stars, organized with the Puerto Rican Astronomy Society. Information about the night sky and astronomy as a science were shared with two astronomers that enchanted our visitors with their knowledge.



Night under the stars

Summer camp

A masterfully green summer camp was our main activity during summer 2009. 30 kids from 4 to 11 years old took part on the first summer camp program that had a green theme. The two week ecologically friendly camp was focused on the environment, fauna, flora, waste reduction, reuse and recycling, and conservation.



Nature walk



Nature tour

Public Relations

Journal reports and written material have been produced since the beginning of the project as part of the outreach program. Local publications in El Horizonte regional newspaper and our newsletter, as well as newspaper articles in el Nuevo día, the Puerto Rico largest newspaper publication, a broad article in Caras Golf Magazine, are some of our efforts to send a message about our projects and environmental commitment to the community.

Quote

Federico Sanchez, Bahia Beach President mentioned about Audubon's International certification:

"It is an honor to receive this recognition on behalf of the Bahia Beach family. The work put in by our Green Team with the great guidance and support of Audubon International, has allowed Bahia Beach to mature into a great natural setting where residents and visitors can enjoy and cohabitate with the wonders that nature has to offer."