

USDA Forest Service  
International Institute of Tropical Forestry  
**Sabana Field Research Station**

Luquillo, Puerto Rico

**VISITOR GUIDE FOR CONDUCTING RESEARCH  
IN THE  
LUQUILLO EXPERIMENTAL FOREST**



# quick look

The Sabana Field Research Station is one of several USDA Forest Service facilities and research areas located within Puerto Rico and the U.S. Virgin Islands. It is situated in northeastern Puerto Rico near the eastern boundary of the El Yunque National Forest/Luquillo Experimental Forest, and is part of a broader network of research sites within in the National Forest. The station is a short drive from the Bisley Experimental Watersheds, and is about a one-hour drive from the International Institute of Tropical Forestry headquarters in Río Piedras, a sector of San Juan.

## PHYSICAL ADDRESS

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## MAILING ADDRESS

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[Sabana Field Research Station Webpage](http://www.fs.usda.gov/detail/iitf/research/?cid=FSEPRD486693)  
(<http://www.fs.usda.gov/detail/iitf/research/?cid=FSEPRD486693>)

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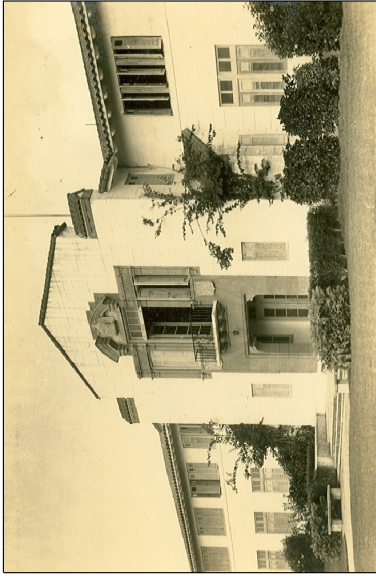
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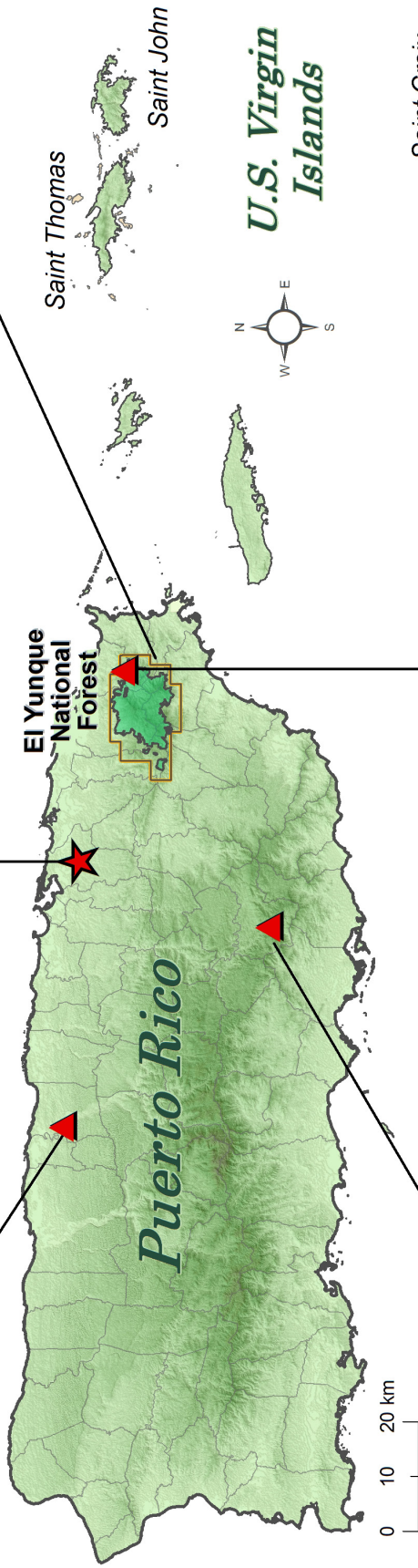
Manatí Research Area



International Institute of Tropical Forestry  
Headquarters (Río Piedras)



Luquillo Experimental Forest  
(also named El Yunque National Forest)



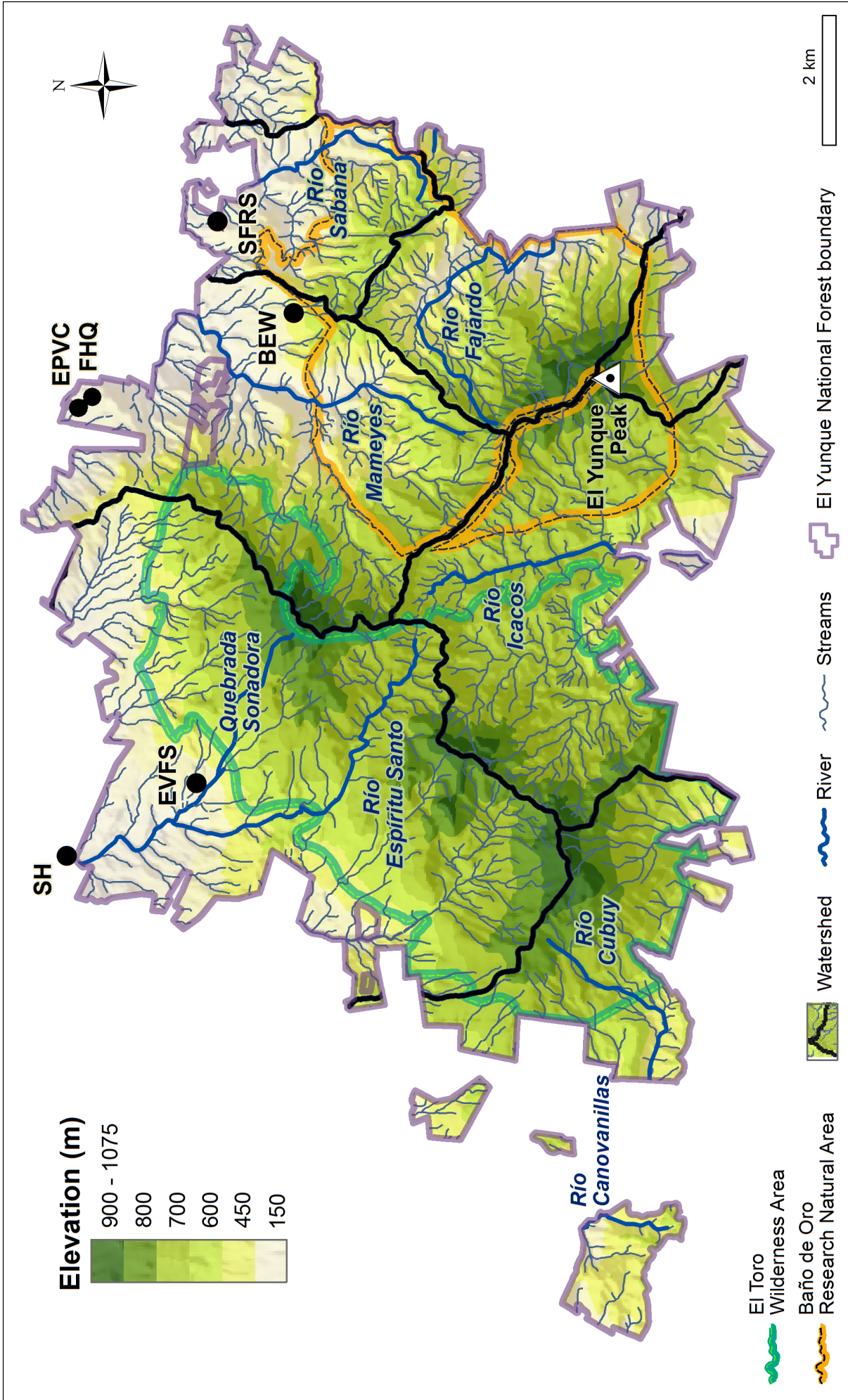
Guayama Research Area



Sabana Field  
Research Station



Estate Thomas  
Experimental Forest



Field stations, research sites and watersheds, and Wilderness Areas in the Luquillo Experimental Forest. Map by O. Ramos.



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SABANA FIELD  
RESEARCH STATION

INTERNATIONAL INSTITUTE  
OF  
TROPICAL FORESTRY



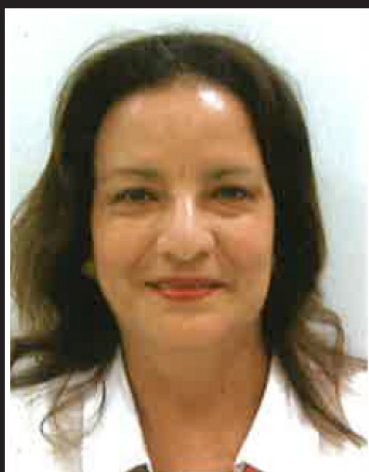
U.S. DEPARTMENT OF AGRICULTURE

# welcome



Dr. Grizelle González, Institute Project Leader

Welcome to the Luquillo Experimental Forest and the Sabana Field Research Station! For more than twenty years, we have welcomed researchers to the station from around the world, serving as a hub for field-based investigation that has contributed to the advancement of tropical forest science in Puerto Rico and beyond. Whether you come to study El Yunque's unique flora or fauna, its watershed dynamics or biogeochemical cycles, I hope your stay with us will be both scientifically and culturally rewarding. Please come visit, safely explore the forest, develop innovative ideas – and return again.



Miriam Salgado, Sabana Field Research Station Manager

Welcome to the Sabana Field Research Station, located at the northeast entrance to the Luquillo Experimental Forest in Luquillo, Puerto Rico. As both a Forest Service employee and a local resident of the Sabana community, I invite you to spend a minute learning about our facilities, and the diversity of opportunities for conducting research in El Yunque. I hope your stay with us is a pleasant one and can fill all your expectations. Many thanks for sharing with us on this occasion; I look forward to greeting you personally when you arrive. ¡Saludos!

# introduction

The Sabana Field Research Station is a facility of the USDA Forest Service's International Institute of Tropical Forestry (Institute), a center for excellence where creativity and accomplishments result in timely products and services that anticipate the needs of society as it mitigates and adapts to environmental change. Our mission is to develop and disseminate scientifically-based knowledge that contributes to the conservation of forests, wildlife, and watersheds of the American tropics in the context of environmental change. Furthermore, the Institute strives to cultivate an inclusive environment and ensure that all who visit our facilities are provided equal access to opportunities, programs, and services that are available.

The station is an ideal setting for varied ecological research with a rich history. The property covers 0.51 ha (1.29 acres) within the El Yunque National Forest/Luquillo Experimental Forest (EYNF/LEF). It was originally established by the Forest Service in 1938 with the objective of maintaining security and surveillance of all surrounding forest areas, and for a time the Civilian Conservation Corps conducted training there. The Sabana property also housed a district office and ranger home. Later, between the 1970s and the 1980s, the field station was a staging area for processing logs used at a nearby saw mill. Around 1995, the Forest Supervisor transferred the use of the property to the Institute for research purposes, including the provision of office space for scientists and the study of tropical forest wildlife, fungal ecology, and taxonomy. At the time of this transfer, the old ranger house was used as a dormitory facility, while the old district office was used for offices of field technicians working primarily in the Institute's Bisley Experimental Watershed program. In July, 2012, the Institute completed renovations to the historic facilities, which included a new dormitory that sleeps 20 persons, a sample preparation facility, and water sample processing laboratory. The newly remodeled Sabana Field Research Station has all the amenities to accommodate individuals and groups interested in completing scientific work in the surrounding or nearby areas located within the EYNF/LEF.

In this guide you will find information related to research facilities and activities at Sabana Field Research Station and in the LEF, procedures for making reservations to stay and work at the station, guidelines for submitting study plans and attaining permits, as well as a list of safety guidelines and emergency protocols that all visitors must follow to ensure the safety of everyone at the station. Please take the time to read through this document prior to your arrival. We welcome any questions, comments, or suggestions related to your visit.



Sabana Field Research Station main entrance. Photo credit: C. Nytch.



# Research in the Luquillo Experimental Forest

The Forest Service has a long history of research and management in El Yunque National Forest, dating back to the 1920s with the establishment of large-scale trial plantings with both introduced and native tree species. In the 1930s and 1940s the Institute completed important silvicultural studies with rigorous controls to provide an important basis for tropical forest production. In 1956, El Yunque National Forest was also designated as the Luquillo Experimental Forest, and a forest management plan was developed that prescribed active management of natural stands and the development of plantations. In the 1960s the ecology of unmanaged forests was begun in earnest via long-term ecosystem studies, and experimental research about the fundamental structure and function of tropical forest ecosystems and metabolic processes in response to radiation disturbance. Ecological research strengthened during the 1980s with the establishment of the LEF as a National Science Foundation Long Term Ecological Research (LTER) Program site, and the expansion into topics such as carbon and nutrient dynamics, trophic interactions, and the forcing effects of anthropogenic and non-anthropogenic disturbances. In more recent decades, watershed and landscape perspectives have been added to the research agenda, assessing the effects of climate change and land use/land cover change on tropical ecosystems and their biodiversity, and quantifying ecosystem goods and services from novel forest communities and integrated social-ecological systems (Harris et al., 2012). Sabana Field Research Station has been at the core of many of these studies for decades, serving as a nucleus for field-based investigations and scientific advancement in the Caribbean region.

In this section, we first highlight important aspects of the environmental setting, and then discuss several of the scientific studies linked to the Sabana Field Research Station facilities and researchers, as well as other iconic research programs and projects in the LEF led by Institute scientists and collaborators. Much of this information comes from Harris et al. (2012) and the web page of the [Luquillo Long-Term Ecological Research Program](http://luq.lternet.edu) (<http://luq.lternet.edu>).

Further details about the forest, its history, physiography and climate, summaries of key research findings, and opportunities for future investigations can be found in Brown et al. (1983) and Harris et al. (2012). These and many other resources can be accessed via the U.S. Forest Service [Treesearch website](http://www.treesearch.fs.fed.us/) for research publications (<http://www.treesearch.fs.fed.us/>).



# SETTING

The Sabana Field Research Station is situated within the 11,330 hectares (28,000 acres) of the Luquillo Experimental Forest, which are characterized by steep environmental gradients, a varied natural disturbance regime, and a history of human land use. Prevailing winds coming from the Atlantic Ocean from the east rise quickly over a horizontal distance of 10 to 20 kilometers to heights greater than 1,000 m, condensing as they pass over the mountains and resulting in a wet environment with abundant water resources. Rainfall in the LEF ranges from about 3,530 mm/year at low elevations to 4,850 mm/year higher up. February through April are drier months, but monthly rainfall is variable. Mean monthly temperatures at the lowest elevations range from about 23.5 °C in January to 27 °C in September, and at the highest elevations from 17 to 20 °C.



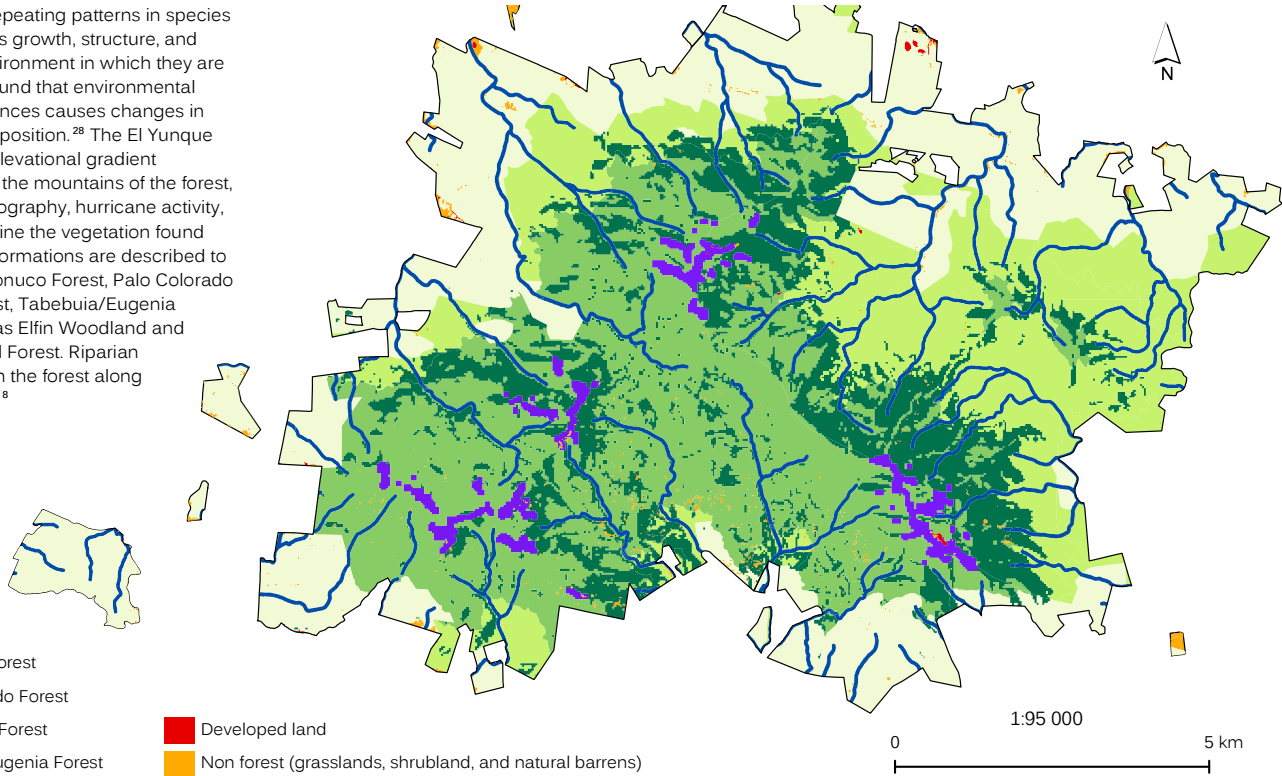
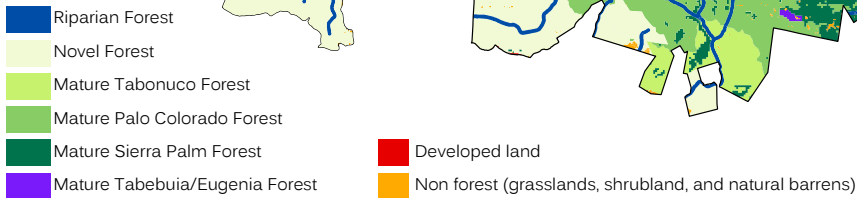
The Luquillo Mountains. Photo credit: M.M. Rivera-Costa.

The geology of the Luquillo Mountains is mainly described as igneous rock formed in the Cretaceous, with some intrusive Tertiary materials. Soils are deep, weathered, and moderately rich in nutrients. Decomposition is inhibited by waterlogging. Streams have steep channels with many boulders and series of pools and riffles. The dynamics of stream ecosystems are strongly influenced by physical factors, such as the rapid change in elevation from headwaters to coastal plains, the intensity and frequency of rainfall events, and the high temporal variability of stream discharge. Common non-anthropogenic disturbances that influence the LEF include treefalls, landslides, hurricanes, floods. Anthropogenic disturbances, many of which occurred in the past, include road construction, charcoal production, clearing for pasture and crops, creation of coffee plantations, and logging. Together these disturbances affect the structure and functions of the forest landscape across variable spatial and temporal scales.

There are several life zones (*sensu* Holdridge, 1967) in the Luquillo Mountains, delineated on the basis of environmental conditions that affect ecophysiological function. Subtropical wet forest and subtropical rain forest are found at low and mid elevations, while forests at higher elevations are classified as subtropical lower montane wet forest or subtropical lower montane rain forest. There is also an area of subtropical moist forest at low elevations on the southwest slope. Variations in solar radiation, temperature, rainfall, soil type, topographic position, and anthropogenic disturbance regime along the elevational gradient contribute to shifts in vegetation and community structure.

Forest types represent repeating patterns in species composition of forests, its growth, structure, and relationship with the environment in which they are found. Scientists have found that environmental variation over short distances causes changes in forest structure and composition.<sup>28</sup> The El Yunque National Forest's steep elevational gradient influences the climate in the mountains of the forest, and together with its topography, hurricane activity, and land use history, define the vegetation found here.<sup>28</sup> Five main forest formations are described to occur in El Yunque: Tabonuco Forest, Palo Colorado Forest, Sierra Palm Forest, Tabebuia/Eugenia Woodland (also known as Elfin Woodland and Dwarf Forest), and Novel Forest. Riparian habitats are also found in the forest along river margins and banks.<sup>8</sup>

#### Forest Types



Distribution of dominant forest types in the Luquillo Experimental Forest. Map from the El Yunque Forest Assessment Plan 2014.

Lower elevational forests in the LEF are dominated by tabonuco trees (*Dacryodes excelsa*), while palo colorado (*Cyrilla racemiflora*) is abundant at mid-elevations. Palm forests, dominated by the sierra palm (*Prestoea montana*), occur at all elevations wherever very steep slopes and saturated soils prevail. Elfin forests occur on the mountain peaks, because trees are short in stature in response to waterlogged soils and limited photosynthesis due to low solar radiation in cloud covered areas. However, clear boundaries between where one forest type stops and another starts are nonexistent. Rather, the distribution of vegetation varies continuously over the landscape rather than as discrete categories.

The faunal community in the Luquillo Mountains is a novel assemblage consisting of both native and introduced species that are influenced by the same environmental gradients and disturbance processes as the flora. The only native mammals in the area are bats; all other mammals (dogs, cats, rats, and mongooses) are introduced. Birds include several species endemic to Puerto Rico, such as the Puerto Rican Tody, an understory insectivore, and the Puerto Rican Parrot, an endangered species. Among the herpetofauna in the LEF are several species of anole lizards and coqui frogs, as well as the native Puerto Rican Boa.

# LUQUILLO LONG-TERM ECOLOGICAL RESEARCH PROGRAM

One of the iconic research programs associated with the Sabana Field Research Station is the Luquillo Long-Term Ecological Research Program (LUQ-LTER). LUQ-LTER is part of the Long Term Ecological Research Network, which was created by the National Science Foundation in 1980 to conduct site-based research on ecological issues that can last decades and span large geographical areas.

Since 1988, the LEF has represented the only tropical terrestrial site in the LTER Network, with focal research on the effects of long-term climate patterns, intense disturbances (hurricanes and landslides), and forest harvesting on biota and biogeochemical cycling.

The LUQ-LTER Program includes both terrestrial and aquatic studies, from the peaks of the Luquillo Mountains to the coastal ecosystems of San Juan. It encompasses strong gradients of both climate and land use through a multidisciplinary effort involving population and community ecologists, microbiologists, aquatic ecologists, ecosystem scientists, and social scientists.

LUQ-LTER is uniquely valuable for its focus on a forested mountainous landscape on a tropical island in the midst of the Caribbean biodiversity hotspot. Results from the LUQ program have improved understanding of montane forest ecosystems that provided the foundation for complementary research efforts such as the National Science Foundation's Critical Zone Observatory (CZO) and Urban Long Term Research Area (ULTRA) programs, as well as the U.S. Geological Survey's Water, Energy and Biogeochemical Budgets (WEBB) Program, and the Center for Tropical Forest Science (CTFS), which compares tropical forests around the world.

Summaries of the research setting and prominent research findings from the LUQ-LTER over the past several decades can be found in Odum (1970), Reagan and Waide (1996) and Brokaw et al. (2012).

LUQ's primary administrative and laboratory facilities are located at the University of Puerto Rico-Río Piedras (UPRRP) and Institute headquarters in Río Piedras. Field research is conducted at multiple sites throughout the LEF, including the Sabana Field Research Station, the [El Verde Field Station](http://evfs.ites.upr.edu/) (EVFS; <http://evfs.ites.upr.edu/>), the Stream House, the Bisley Experimental Watersheds, and East Peak. For additional information about LUQ-LTER please visit the [Luquillo LTER website](http://luq.lternet.edu/home-luq). (<http://luq.lternet.edu/home-luq>)



Meteorological station on East Peak. Photo credit: M.M. Rivera-Costa.

## Long-term measurements and experiments in tabonuco forest

### *Luquillo Forest Dynamics Plot*

Among the signature long-term studies of the LUQ-LTER located at EVFS is the Luquillo Forest Dynamics Plot (LFDP), a 16 hectare forest research grid located in the subtropical wet forest/tabonuco forest zone (200 – 600 m asl). It is part of the Center for Tropical Forest Science international network of research plots. The plot has a history of land use disturbance and also hurricane damage. These two disturbance types interact and influence forest community dynamics and species composition.

Spatially explicit censuses of trees, shrubs, seedlings, and phenology/seed rain are conducted in the plot at time intervals relevant to their dynamics. Since 1990, more than 170,000 woody stems have been tagged and identified in the LFDP to examine the mechanisms promoting species diversity and coexistence in tropical forests, such as competition, heterogeneous environmental conditions, and disturbance processes. Dendrometers on the largest trees and annual measurements of coarse woody debris allow for estimations of carbon storage.

Abiotic conditions including soil moisture and canopy light regime are also monitored. The abundance of key heterotrophs, including gastropods and phasmids, as well as lizards, frogs, and birds are annually measured at forty locations placed on a 60 m x 60 m grid in the LFDP.

Further details about the LFDP and important research findings can be revealed in Thompson et al. (2002), Zimmerman et al. (2010), and Uriarte et al. (2012).



Measuring trees in the Luquillo Forest Dynamics Plot. Photo Credit: J. Holt.

## *Canopy Trimming Experiment*

The Canopy Trimming Experiment (CTE) was established in the El Verde Research Area in 2004. This experiment was designed to separate the two principal effects of hurricanes, canopy opening and debris deposition and their effects on tropical ecosystem functioning. The experiment originally included four treatments (30 m x 30 m) in each of three blocks: 1) canopy trimmed, with trimmed biomass distributed on the forest floor, changing microclimate, forest floor mass, and nutrient content; 2) canopy trimmed, with trimmed biomass removed, changing microclimate; 3) canopy not trimmed, but canopy biomass from a trimmed plot distributed on the forest floor, changing forest floor mass and nutrient content; and 4) an untreated control.

The CTE has helped distinguish the effects of microclimate, detrital inputs, and different functional groups of decomposers in detrital processing and ecosystem resilience after hurricanes. Through a series of repeated canopy manipulations to treatments 1 and 4 (hurricane and control plots) that will occur at 10-year intervals over the next 50 years, the CTE will allow researchers to assess the effects of a projected increase in the frequency of intense hurricanes on forest composition, soil carbon storage, and nutrient dynamics, and their cascading effects down through the food web. The first of the repeated disturbances – the second canopy trimming treatment – took place in late 2014.

For a detailed description of the CTE and many of its findings, see the Forest Ecology and Management special issue: Tropical forest responses to large-scale experimental hurricane effects (Shiels and González, 2014).

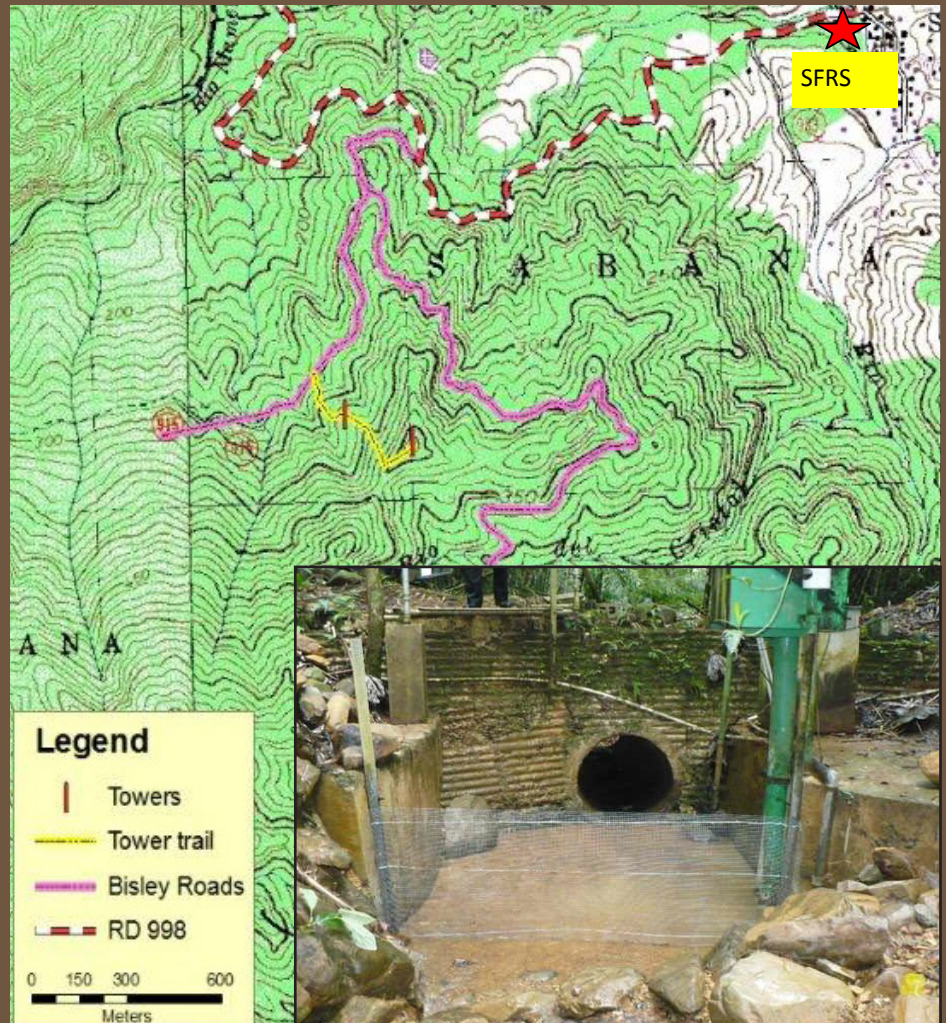


Recently denuded trees in the Canopy Trimming Experiment. Photo credit: S. Stankavich.

## Bisley Experimental Watersheds

The Bisley Experimental Watersheds (BEW) are three adjacent watersheds managed by the Institute that total 13 ha, located in tabonuco forest a few kilometers south of Sabana Field Research Station. Within this area, a number of long-term ecological, hydrological, and silvicultural research projects have been conducted since the 1980s, carried out by Institute scientists and collaborating researchers from the LUQ-LTER, the Luquillo CZO, and the U.S. Geological Survey, among others.

Long-term, detailed monitoring of biogeochemistry, climate variables, and stream runoff in Bisley has produced some of the longest environmental records on watershed processes in the Neotropics, and has made significant contributions to the understanding of hydrologic, carbon, nitrogen, and phosphorus cycling in tropical wet forests. The data from Bisley provide an unequalled opportunity to understand seasonal and inter-annual climatic variability and quantify its relationships with ecosystem processes, including the effects of multiple hurricanes, droughts, plant aboveground stoichiometry, and forest diversity and structure on biogeochemistry and faunal assemblages at the plot and watershed scales. They also contribute to collaborative analysis and research with ecologists from other experimental forests and watersheds to support synthesis and large-scale understanding of climate change parameters and stream discharge relationships.



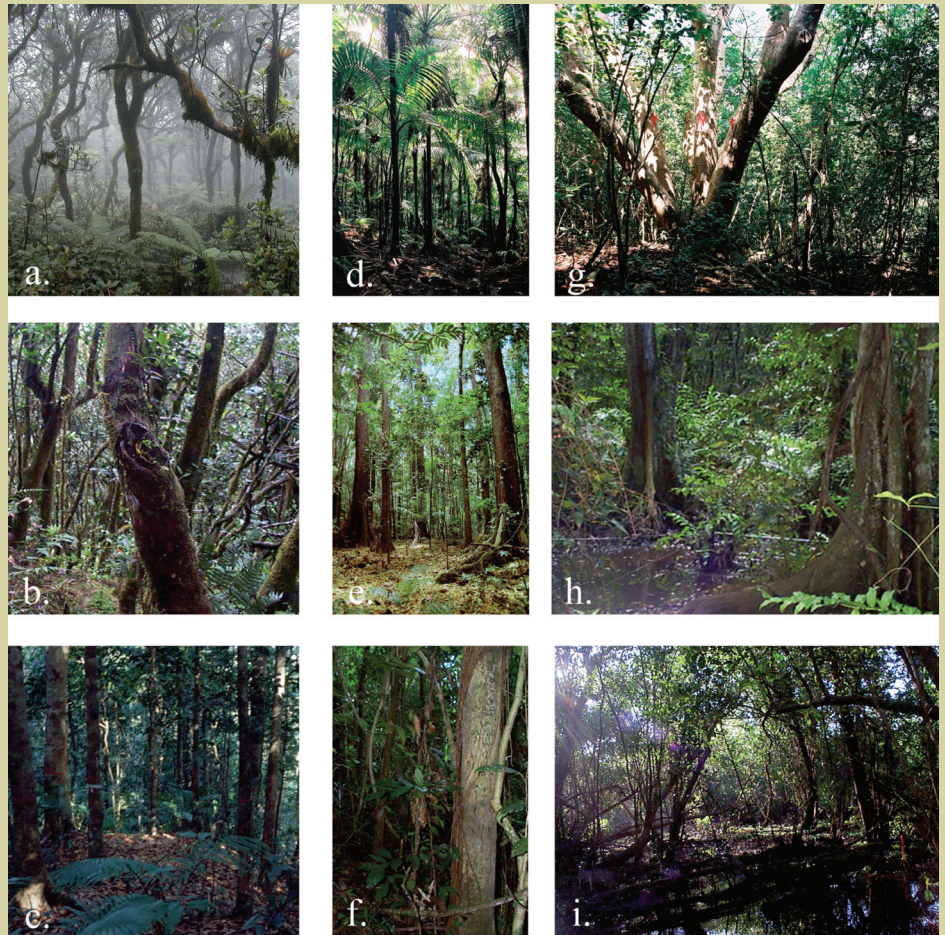
Topographic map of Bisley Experimental Watersheds and stream sampling site (inset).  
Image credits: S. Moya.

Research facilities in Bisley include two walk-up canopy towers, climate stations, three stream gages, throughfall and litter collectors, permanent ecological study plots, and areas designated for aquatic research. Forest composition and soil and plant nutrient content are monitored in 83 permanent 10 m diameter plots on a 40 x 40 m grid every 5 years. Canopy throughfall and litterfall are measured weekly. Stream chemistry and coarse particulate export are measured every two weeks in three streams. Shrimp abundances are measured twice yearly in two BEW streams, and algal abundance, ecosystem metabolism, chlorophyll a, and insect abundance are measured biannually in one BEW stream.

For additional information about the environmental context and key research findings from the BEW see Scatena (1989) and Heartsill-Scalley et al. (2007, 2010, 2012).

## Long-term Elevation Plots

There are a series of plots along the elevational gradient from the coast to the top of the Luquillo Mountains, which intersect a variety of forest types with distinct composition and structure. The plots are periodically monitored for soil properties and plant species composition, microclimate, rainfall chemistry, tree growth, litterfall, and woody debris. These data facilitate both comparisons between forest plots and analyses of temporal variation in ecosystem properties within individual plots. For further information about research conducted in the elevational gradient plots see the Ecological Bulletin by González et al. (2013).



Forest vegetation along environmental gradients in northeastern Puerto Rico. Montane forest types include (a) elfin, (b) colorado, (c) tabonuco, (d) sierra palm, and (e) mahogany plantations. Coastal and lowland forest types include (f) lowland moist secondary, (g) subtropical dry, (h) *Pterocarpus* swamp and riparian, and (i) *Laguncularia racemosa*-*Avicennia germinans* mangrove. From Weaver & Gould (2013).

## Wildlife Ecology

The LEF has served as an important site for studies of wildlife ecology, in particular the dynamics of neotropical bird species across a range of tropical forest life zones. The forest's elevational gradient, along which climate and biota vary, provides a diversity of environments in which various aspects of avian biology and ecology can be compared. Core areas of research have included the structure and composition of avian communities, the spatial ecology of Puerto Rican boas, the functional roles of different species guilds in the food web, species' exploitation of habitat niches, and their population responses to hurricane disturbance. Long-term monitoring of endemic and endangered species such as the Puerto Rican Parrot have provided essential data for the development of recovery plans. Research about bird and nest predation has likewise informed the management of the LEF's avian community.

Recent work investigates how modified habitat conditions in response to global climate change may affect vulnerable populations already at the edge of their habitat range, as well as the role of habitat fragments along the rural to urban gradient in maintaining biotic diversity and facilitating colonization of the LEF by introduced species. See Wunderle and Arendt (2011) for additional information.



Bananaquit. Image credit: I. Vicéns.



## Forest decomposition and nutrient cycling

Decomposition studies in the LEF investigate how deadwood, through its effect on soil organic matter and nutrient dynamics, can contribute to the spatial heterogeneity of soil properties, and participate in processes of soil formation and nutrient cycling in tropical wet forests.

Researchers from the Institute are examining how changes in disturbance regime (e.g., increment in hurricane frequency related with climate change), soil biota, and substrate quality affect the rate of decay, the relative abundance of fine and coarse woody debris, and the spatial distribution of soil carbon resources. Fungi are also important for maintaining fast rates of decomposition in low quality tropical leaf litter, via immobilization and translocation of limiting nutrients from sources to sinks and conserving nutrients after disturbance. In collaboration with the CTE project (described previously), Institute researchers and partners are working to disentangle the individual and interactive effects of canopy opening and green debris deposition following hurricane disturbances on phosphorus content, mass loss and fungal connectivity in decomposing leaf cohorts. Related research explores the effects of simulated hurricane disturbance on forest floor microbial communities. For additional details, see González and Seastedt (2001), Torres and González (2005), and Zalamea et al. (2007).



Decaying log and analysis of effect on soil properties. Photo credit: M. Zalamea.

## Fungal Ecology

The LEF has provided important information on fungal diversity, its distribution according to elevation, substrata and hosts, nutrient cycling and responses of species and functional groups to disturbances. The studies include beneficial mycorrhizal fungal symbionts of trees, tree and shrub pathogens, and decomposer fungi. Special emphasis has been on agaric leaf decomposer fungi that degrade lignin, thereby accelerating leaf decomposition; they also bind litter together and reduce erosion on steep slopes.

Intensive studies of fungi and fungal ecology began in the 1960s and have continued to present. Many species of fungi have been described from the LEF through National Science Foundation, Forest Service and Field Museum of Natural History supported research. Some of these fungi are apparently restricted to wet forest at high elevation and are potentially threatened by climate change. Further information about fungal communities in the Luquillo Mountains can be found in Harris et al. (2012) and Cantrell et al. (2013).



*Laetiporus caribensis*, a recently described fungal species from the Luquillo Experimental Forest. Photo credit: J. Lodge.

## Tropical Responses to Altered Climate Experiment

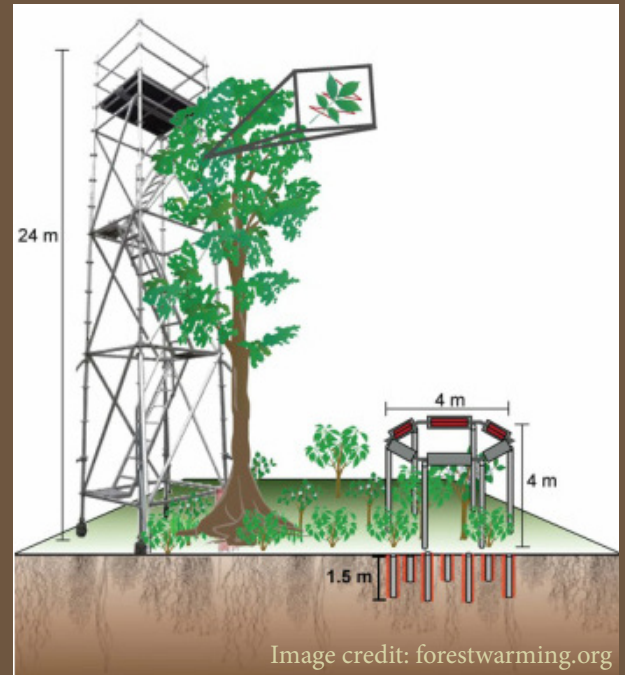
The Tropical Responses to Altered Climate Experiment (TRACE) seeks to understand how tropical forests will respond to global warming, through the evaluation of temperature responses of leaves, fine roots, and soil microbes using an array of infra-red heaters. The project concentrates on both above- and belowground forest components to provide an integrated understanding of the mechanisms of carbon storage and flux that will help inform how local effects feed back to climate at the global-scale. Specific objectives are two-fold:

1) Assess the mechanisms behind and effects of warming on C and nutrient cycling and storage in tropical forest soils;

2) Investigate threshold temperature responses of both canopy and understory tropical tree foliage.

There are three warmed and three control plots, each of which is a 4 m diameter hexagon (~12 m<sup>2</sup>). A canopy access tower at the site allows for plant physiological studies in response to warming.

For more details about TRACE see Calaveri et al. (2015), Wood et al. (2012), Reed et al. (2011), and visit: [Forest Warming Website](http://www.forestwarming.org) (<http://www.forestwarming.org/index.html>)



TRACE research plot with associated power lines and control panel in the background. Photo credit: T. Wood.

# LUQUILLO CRITICAL ZONE OBSERVATORY

The Critical Zone Observatory Network is an international community of people and field sites investigating processes in Earth's permeable near-surface layer, from the land-atmosphere interface to the bottom of the groundwater, where rock, soil, water, air, and living organisms interact. The Luquillo Critical Zone Observatory (LCZO) is located in the Luquillo Mountains and includes sampling sites in and around the LEF such as the Río Mameyes and Río Icacos watersheds, East Peak, and nearby urbanized areas in the surrounding coastal plains.



Exposed bedrock at the top of the Luquillo Experimental Forest. Photo credit: [criticalzone.org/luquillo](http://criticalzone.org/luquillo)

A multi-disciplinary team of geoscientists from the Institute, other government agencies, and academic institutions based in Puerto Rico, the U.S., and abroad work at the site to address question such as:

- How do critical zone processes and the flow and transformations of material differ in landscapes with contrasting bedrock, but similar climates, land use, and geologic histories?
- What are the implications of these differences for the long term sustainability of water and soil resources?

The observatory is quantifying and comparing critical zone processes in landforms and watersheds underlain by three different rock types, granodiorites, volcanics, and their associated contact metamorphic rocks. Research projects include studies of deep weathering, soil formation and soil carbon accumulation, riparian zone dynamics and stream chemistry, fluvial geomorphology, and meteorology. Infrastructure includes climate stations, stream gages, and deep groundwater wells. Much of the work of the LCZO is complementary to and done in collaboration with research carried out through the LUQ-LTER program.



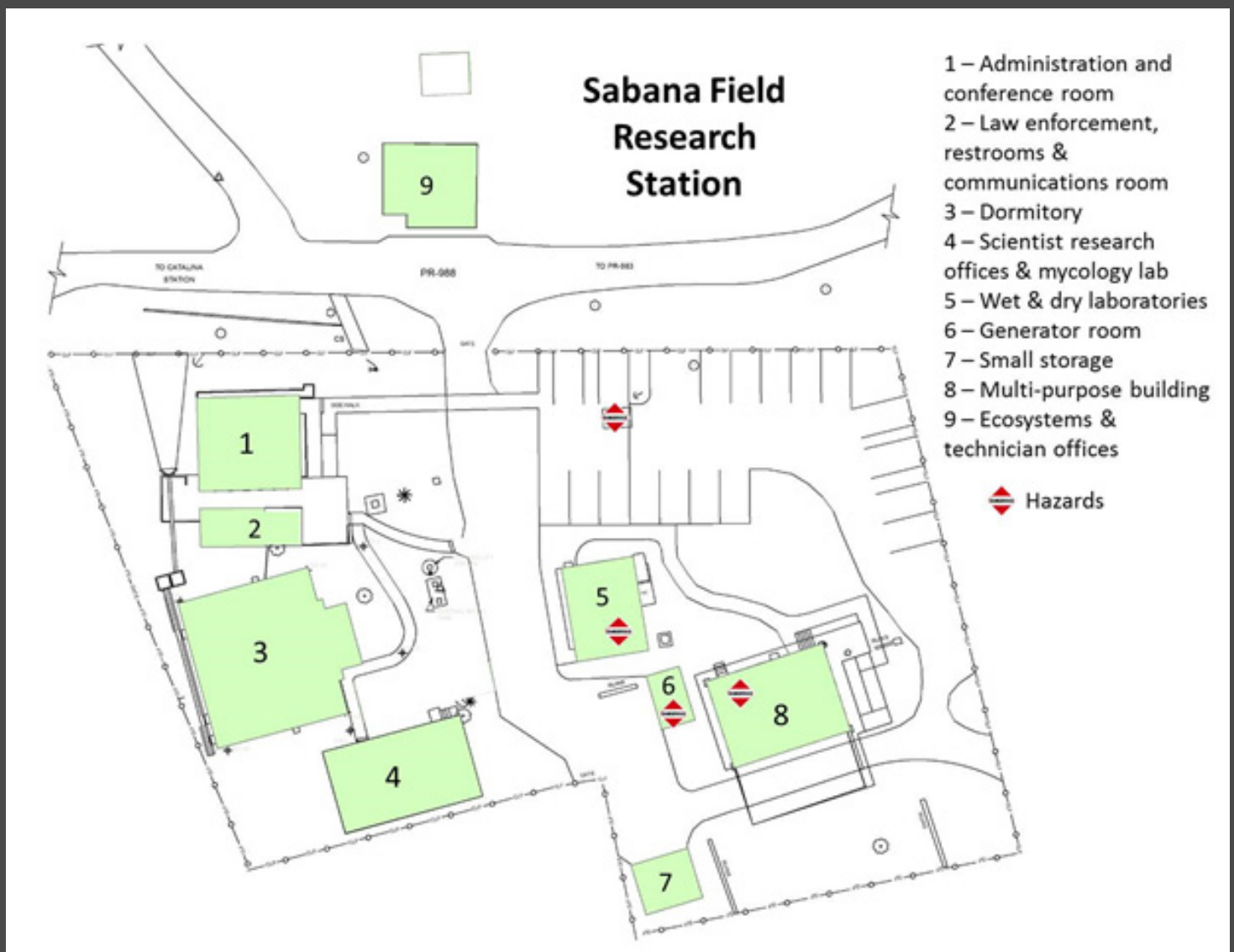
Deep observation well in the Luquillo Experimental Forest. Photo credit: [criticalzone.org/luquillo](http://criticalzone.org/luquillo)

For more information, visit: [Luquillo Critical Zone Observatory Website](http://criticalzone.org/luquillo/) (<http://criticalzone.org/luquillo/>)

# station facilities

The Sabana Field Research Station is comprised of facilities and specialized equipment that support numerous research programs and projects from domestic and international agencies and institutions. There are several buildings in the field station complex, including:

- Administrative building with a conference room;
- Laboratory building for wet and dry analyses;
- Storage building;
- Office buildings for Forest Service scientists and technicians;
- Communications and law enforcement offices;
- Multi-purpose building including office space, laboratory space, oven room, sample preparation room, storage areas, laundry room, and a flammable storage area;
- Dormitory building, with restrooms, kitchen, living and balcony areas; and
- Research offices and a mycology laboratory.



Map of facilities in the Sabana Field Research Station building complex. Map by C. Rodríguez. & C. Nythc.

## Laboratories

Within the laboratory building are both wet and dry labs with relevant equipment, including:

- Drying ovens;
- Freezer;
- Chemical hood;
- Balances;
- Micro-centrifuge; and
- Compound microscopes.

A mycology laboratory is located within the area of staff research offices.

### Laboratory Rules

Users of the Sabana laboratory must follow a set of preventive measures designed to ensure the health and well-being of all who labor within. Their observance will help minimize the risks and dangers inherent to a laboratory environment, reduce the probability of an accident or contamination.

**Prior to the beginning of any experiment or process involving the use of the Sabana laboratory facilities, scientists (staff, collaborator or visiting), technicians, graduate students or volunteers are required to consult with Miriam Salgado (Station Manager & Laboratory Coordinator in Sabana; [msalgado@fs.fed.us](mailto:msalgado@fs.fed.us), 787-764- 7949), and Mary Jeane Sánchez (Institute Laboratory Supervisor in Río Piedras; [msanchez01@fs.fed.us](mailto:msanchez01@fs.fed.us), 787-764-7237).**

Each individual must also fill out the [laboratory safety form](#), which outlines the safety rules. Copies of the forms will be kept on file.

# RESEARCH LABORATORIES



Wet laboratory facilities at Sabana Field Research Station. Photo credit: C. Nytch.



Dry laboratory facilities at Sabana Field Research Station. Photo credit: C. Nytch.

# MULTI-PURPOSE BUILDING

## Multi-purpose Building

The multi-purpose building houses both research and domestic facilities. These include:

- Weighing room with analytical balances;
- Sorting room;
- Grinding room;
- Oven room;
- Storage room; and
- Laundry room with complimentary washers and driers, a wash basin, and an ice machine.

With the exception of the laundry amenities, please request permission from the Station Manager to use the multi-purpose building facilities.

Please keep all work areas clean and organized. In the case of any research equipment malfunction, inform the Station Manager as soon as possible.

If you need to make arrangements to store equipment or materials between visits, please consult the Station Manager.



Sabana Field Research Station multi-purpose building. Photo credit: Juan Luis Hernández.



Laundry facilities in the Sabana Field Research Station multi-purpose building. Photo credit: C. Nytch.

# RESEARCH EQUIPMENT



Canopy tower and meteorological station in the Bisley Experimental Watersheds. Photo credit: S. Moya.



Ceilometer. Photo credit: C.R. Estrada Ruíz.

## Weather Stations

The Institute manages two weather station towers in the LEF, a 30 ft tower located at East Peak and an 80 ft tower located in the Bisley Experimental Watersheds. The towers contain the following instrumentation:

- Automated precipitation gauge;
- Pyranometer (solar radiation);
- Licor Quantum (photosynthetic radiation);
- Marine wind vector;
- Wind speed sensor; and
- Temperature and relative humidity sensor.

At each tower, these instruments are connected to a micrologger, from which data are downloadable using radio wave frequency receptor/transmitter in 900 MHz and via cell phone frequency from AT&T.

Additional monitoring equipment in Bisley includes an albedometer for measuring diffuse light, an ozone sensor, and temperature, conductivity and water level pressure sensors in three streams.

At the field station proper there is an automated precipitation gauge that measures rainfall depth and intensity, along with temperature. There is also a ceilometer for measuring cloud base height. **WARNING:** beware of invisible laser radiation danger from the ceilometer. Avoid eye or skin exposure to direct or scattered radiation.

# ADMINISTRATIVE BUILDING & CONFERENCE



Sabana Field Research Station administrative building. Photo credit: C. Nytch.

## Administrative Building

The administrative building contains the main office and receiving area for Sabana Field Research Station guests, as well as an air-conditioned conference room with space for up to 15 persons.

A projector and screen are available for multi-media presentations. Additional equipment includes a copy machine and a telephone for making work-related conference calls.

To schedule use of the conference room, please contact the Station Manager.

Adjacent to the conference room are bathroom facilities, a law enforcement office, and an open-air balcony for staff and visitors to enjoy.



Sabana Field Research Station conference room. Photo credit: C. Nytch.



Balcony common space located outside the conference room. Photo credit: C. Nytch.



# DORMITORIES



Sabana Field Research Station dormitory building.  
Photo credit: J.L. Hernández.



Communal dormitory room with bunk beds and storage lockers.  
Photo credit: C. Nytch.

## Living Quarters

Within the dormitory building are several rooms for guests that can sleep up to 20 persons.

Communal, single-sex rooms are available for male and female visitors, each with eight twin bunk beds.

Separate rooms with a full-sized bed, closet space, and desk are provided for male and female visiting team leaders.

Lockers are available in the bunk rooms for storing personal items.

Male and female bathroom/shower facilities adjoin each of the bunk rooms.

Between the bunk rooms is a common space with couches. External balconies also provide additional space for relaxation.

A fully equipped kitchen, replete with refrigerator, stove, microwave oven, pots and pans, and dinnerware is supplied for meal preparation.

Air conditioning is present throughout the dormitory building.

Washers and driers are available for guest use in the multi-purpose building.



Clockwise from top left: Sabana Field Research Station dormitory building common area, kitchen, project lead bedroom, and bathroom. Photo credits: C. Nytch.

To keep the kitchen, dormitories, and common areas clean and organized, visitors are asked to observe the following rules:

- Clean, dry and put away in its designated space any kitchen equipment after its use.
- Dispose of any food leftovers or inform the Station Manager regarding any items you may wish to donate to the field station at the end of your stay.
- Keep all doors closed at all times to prevent access of mice and other pests.
- **REFRAIN FROM BRINGING, FEEDING, OR ATTRACTING ANIMALS TO THE STATION.**
- Close, remove and replace any trash bags that become full during weekends, holidays, or after working hours.
- Refrain from putting research materials in refrigerators or freezers designated for food storage, as well as using kitchen items for research purposes.
- Observe quiet hours from 10:00 p.m. to 8:00 a.m.
- Keep restrooms clean and organized.
- Refrain from entering into dormitories of the opposite sex.
- Avoid hanging clothes on the ramp in front of the laboratory and dormitory. There are dryers available in the laundry room, as well as space for air-drying clothes next to the lab and behind the dorms.
- **DO NOT THROW TOILET PAPER INTO THE TOILETS.** They are connected to a local septic system, and clog easily. Used toilet paper should be deposited in the trash.
- **KEEP YOUR KEYS WITH YOU AT ALL TIMES.** Many doors lock automatically when they close.

# ACCESSIBILITY

All of the buildings and facilities within the Sabana Field Research Station premises are accessible to accommodate a diversity of needs.

# REMEMBER!

Smoking is prohibited on the station premises, per USDA policy. Smoking outside must occur a minimum of 25 feet away from entrances to enclosed areas, common points of ingress and egress to Sabana Field Research Station facilities, windows, and all types of HVAC air handling and circulation systems.

Consuming alcohol is prohibited within all of the station buildings and surrounding areas that are designated as work spaces.

The consumption of illegal controlled substances is prohibited on the station premises altogether.

Keep in mind that the station is a work environment for several Forest Service personnel and fellow visitors. Please behave in a respectful and considerate manner toward others.

During quiet hours, please move loud conversations away from the dormitory area.



Access ramps leading to dormitory building. Photo credit: C. Nytch.



Image credit: safetysign.com

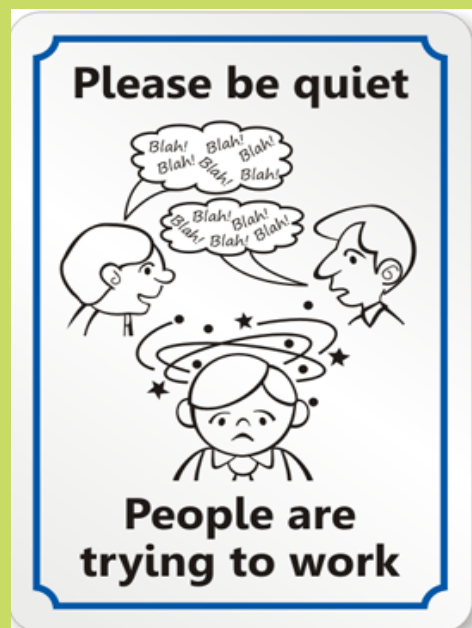


Image credit: mydoorsign.com

# check-in & check-out

## RESERVATIONS

Making reservations at Sabana Field Research Station is a two-step process:

1. For information about availability or general inquiries about the Sabana Field Research Station facilities, contact **Miriam Salgado (Station Manager) via email at [msalgado@fs.fed.us](mailto:msalgado@fs.fed.us) or by phone at 787-764- 7949.** Please provide information regarding:
  - The dates of your visit;
  - The number of people in your party (male/female);
  - The purpose of your visit;
  - Your institutional affiliation.

Reservations must be made at least two weeks before arrival. Any further advanced notice you can provide is greatly appreciated.

2. After your dates have been corroborated, the second step is to **confirm your reservation by contacting Rosa Ávila via email at [ryavila@fs.fed.us](mailto:ryavila@fs.fed.us) or by phone at 787-764- 7275** and provide the following payment information:
  - Name(s) of the person(s) responsible for the payment;
  - Social Security or Tax ID;
  - Address;
  - Phone number.

Reservations will be confirmed ONLY after all the payment information is received. It will be used to prepare the Bill for Collection.

## ARRIVAL TO THE STATION

- The Check-In process occurs during business working hours (Monday – Friday) from 7:30am-4:00pm. If your flight arrives to Puerto Rico during non-working hours, please make other arrangements for lodging prior to arriving at Sabana Field Research Station.
- Payment is expected during Check-In. The cost is **\$20/person/night**.
- Payment should be made by check or money order to: **U.S. Forest Service**.

**We do not process credit card transactions nor accept cash.**

- At Check-In, you will be asked to fill out forms regarding:
  - [Temporary Quarters Registration](#)
  - [Laboratory Safety Rules](#)(<http://www.fs.usda.gov/detail/iitf/research/?cid=FSEPRD496010>)
  - [Report of Property Transfer](#) (e.g., keys, sheets)
  - [Volunteer Service Agreement](#) (if applicable)
- All visitors (including researchers, students, contractors, volunteers, etc.) must **sign the visitor's logbook**, regardless of whether or not you are staying in the dormitory.

# THINGS TO BRING

The station provides bed sheets and laundry detergent. Guests must provide their own towels and toiletries, food, and dishwashing soap, and launder their own clothes and sheets.

Guests and visiting researchers should also provide their own rain gear, hiking boots, insect repellent, and field research materials/equipment. If you need to send materials in advance of your arrival or require access to specialized laboratory equipment, please contact the Station Manager to discuss space availability and shipping options.



Image credit: qualitycustomessays.

# COMMUNICATIONS

## Internet

The Sabana Field Research Station is equipped with wireless internet throughout the station premises. Hard-wired connection ports are available in the dormitories, conference room, and laboratories. To access the internet, a Forest Service guest account and password must be requested from the Station Manager. Please keep in mind that internet service is provided by the U.S. Government, and some websites may not be permitted.



Image credit: dg-wanshengmen.com

## Telephone

Telephones are present in the conference room, dormitories, and laboratories. Unless otherwise authorized, they are strictly for work related purposes and emergencies.

Wireless cell phone coverage is not available at the field station via any service providers. The closest location with signal is about  $\frac{3}{4}$  kilometer ( $\frac{1}{2}$  mile) north at the junction of Rt 983 and Rt 9983, and signal strength varies depending on the service provider.

## Fax

A fax machine is available in the administration building. To send or receive documents, please coordinate with the Station Manager.

## Mail & Packages

Mail can be sent and received at the post office in Luquillo, using the [MAILING ADDRESS](#) provided in the Quick Look section of this document. For package delivery (Fed-Ex, UPS, etc.), use the [PHYSICAL ADDRESS](#). Carrier pickups can be arranged for sending packages directly from the station. Visitors can also coordinate sending and receiving mail with the Station Manager.

# DIRECTIONS TO SABANA FIELD RESEARCH STATION FROM LUIS MUÑOZ MARÍN INTERNATIONAL AIRPORT

- As you leave the airport terminal, take the exit on the overpass toward Carolina. This puts you going east on Rt. 26, which becomes highway 66 (stay left at exit 0).
- Remain on Rt. 66 (toll road) until the very end where you bear right onto Rt. 3 and begin heading east toward Luquillo/Fajardo.
- Stay on Rt. 3 for about 20 minutes until you reach the town of Luquillo. You will pass signs for El Yunque National Forest along the way (don't follow them). At the light in the center of Luquillo you will see a Total gas station and a Walgreen's on the right hand side.
- After you pass this light, take the next exit toward Sabana.
- Turn right off the ramp and follow Rt. 992 for about 1¼ kilometer (¾ mile), at which point the road will branch. Bear left around the curve and now you are on Rt. 991. Follow Rt. 991 and pass a cemetery on your right.
- A ½ kilometer (¾ mile) after the cemetery the road bears left and you will cross a small bridge, and immediately afterward you will see a triangle intersection. Turn right on to Rt. 983 at this intersection.
- Follow Rt. 983 for about 10 minutes, with the Sabana River on your right. You will slowly go uphill around several winding curves. Be careful as the road is narrow with no shoulder.
- Eventually you will pass the turn-off for Rt. 9983 on the left. About ¾ kilometer (½ mile) afterwards that intersection you will come to another one where the road goes straight and there is a bridge painted yellow to your right. Turn right onto Rt. 988 and cross the bridge.
- Sabana field station is immediately on your left. A code is required to open the gate. Please contact the Station Manager for this information.

## TRANSPORTATION / PARKING

Visitors must provide their own transportation to and from Sabana Field Research Station. There is no public transportation available, and taxis do not provide service in the vicinity of the field station either. The most common option is to rent a personal vehicle from one of the agencies near the airport.

Please park your vehicle in the designated parking spaces, facing outward to be prepared to leave in an emergency situation. Daytime guests should park outside the main gate. Longer-term guests should pull into the parking lot and position vehicles toward the fence, away from the buildings. Do not park directly in front of or block access to the dormitory, research offices, or laboratory facilities.



Road map of northeastern Puerto Rico showing locations of the international airport, Institute headquarters, and Sabana Field Research Station. Map adapted by O. Ramos.



Image credit: munduslingua.com

## DEPARTURE FROM THE STATION

- Check-Out should occur during business working hours (Monday – Friday) from 7:30 a.m. – 4:00 p.m.;
- Be sure to clean your living and work areas;
- Leave clean sheets in the bed/bunk bed (laundry machines are available free of charge at the Sabana Field Research Station);
- Return keys to the Station Manager;
- Please do not remove from the station any of its supplies (kitchen utensils or appliances, pillows, bedding, etc.)

RULE OF  
THUMB: IF  
YOU DID NOT  
BRING IT,  
PLEASE DO  
NOT TAKE IT.



# conducting research in the LEF

In the LEF/EYNF, we strive to foster an environment of exploration that will extend the scientific body of knowledge for years to come. In the interest of both protecting this rich natural resource and ensuring future research in the forest, forest management requires some documentation from the project's lead researcher or entity. The starting point for every project in the LEF is to **submit a Study Plan** to the Institute Project Leader, Grizelle González ([ggonzalez@fs.fed.us](mailto:ggonzalez@fs.fed.us)). The purpose of the Study Plan is to provide a comprehensive description about the proposed research activity. At a minimum, Study Plans should include the following components:

1. Project identification -- title, PI(s), institutional affiliations & collaborators, and contact information;
2. Objectives of the research;
3. Review of relevant literature (and accompanying literature cited section);
4. Methods -- what will be measured, how it will be measured, and how it will be evaluated with respect to the stated objectives. Please include details about:
  - Location with exact coordinates and detailed map of the study area(s)
  - Temporal duration of the investigation
  - Physical materials that will be used (e.g., plot markers, flagging)
  - Anticipated disturbance (e.g., removal of specimens, digging of soil pits);
5. Intellectual merits/application of research results; and
6. Potential health and safety implications of the research.

If your investigation involves laboratory work, you must also **submit a study plan to the Institute Laboratory Supervisor** (Mary Jeane Sánchez; [msanchez01@fs.fed.us](mailto:msanchez01@fs.fed.us)) and the Sabana Field Research Station Manager (Miriam Salgado; [msalgado@fs.fed.us](mailto:msalgado@fs.fed.us)) describing laboratory components, anticipated methods, and chemical reagents to be utilized, so as to be sure that the chemicals can be used and disposed of properly, and to assess the potential dangers of fume hood gases for the nearby offices and dorms.



Submitted Study Plans will be reviewed by Institute staff in consultation with EYNF personnel to determine if the proposed research is consistent with:

- Laws, regulations, orders and policies establishing or governing National Forest System lands;
- Other applicable federal law, such as the National Environmental Policy Act (NEPA)
- Applicable state and local health and environmental laws.

During the review process, applicants may be contacted by Forest Service personnel for additional information. If it is determined that the proposed research will have a significant environmental effect, an Environmental Assessment (EA) or Environmental Impact Statement (EIS) may need to be prepared, the costs of which will be discussed on a case by case basis.



## PERMITS

Depending on the nature of the proposed activities, and whether the research will be conducted in conjunction with the Institute as a collaborator, there may also be additional local and federal permits and fees that apply. For scientists visiting the Sabana Field Research Station, the permitting process begins with research personnel associated with the Institute, and may also entail approval from El Yunque National Forest management staff and Puerto Rico Department of Natural Resources and Environment.

In addition, as a visiting researcher you will be responsible for the following:

1. Have a safety briefing and orientation by the Station Manager;
2. Geo-locate your research plots with GPS or by precise description (compass bearing and distance) relative to marked reference points in the research area;
3. Clearly mark and identify sampling plots. Remove from the field at the end of your research any equipment you used;
4. Refrain from entering other researchers' field plots as you walk in the forest;
5. Be respectful of other people's space and equipment, and keep your own field equipment and materials clean and organized;
6. Publications resulting from work conducted at the station should include acknowledgement. Please identify the station as "Sabana Field Research Station, Luquillo Experimental Forest" and provide copies of publications to Gisel Reyes ([greyes@fs.fed.us](mailto:greyes@fs.fed.us)) at the Institute's library.



Image credit: [lrrpublic.cli.det.nsw.edu.au](http://lrrpublic.cli.det.nsw.edu.au)



## Wilderness Area Restrictions

A large portion of the LEF is designated as the El Toro Wilderness Area (see [map of research sites](#) in the Quick Look section of this document).

In accordance with the Wilderness Act of 1964, Wilderness areas are “designated for preservation and protection in their natural condition.” Therefore, there is a stricter set of rules regarding the types of activities that are permitted in the Wilderness.

**Motorized equipment and equipment used for mechanical transport is generally prohibited on all federal lands designated as Wilderness, as are research activities that degrade the wilderness character (e.g., removing large quantities of organisms or abiotic elements).**

Activities that typically do not pose a concern include:

- Observing and recording, with instruments that are temporarily used only while the scientists are inside the Wilderness, and nothing is left in the Wilderness when the scientists leave;
- Accessing a site inside the Wilderness using non-motorized or non-mechanical means; and
- Establishing temporary plots inside the Wilderness.

**Some activities with adverse impacts may be justified under special circumstances, if the same research objectives cannot be achieved outside of the Wilderness.**

**A detailed Study Plan (see previous page) is required for all research proposed within the El Toro Wilderness Area. It will be reviewed by Institute and EYNF personnel.**

For additional information about Wilderness area law and policy, permitting processes, training and education opportunities, please see the [Wilderness Website \(http://www.wilderness.net\)](http://www.wilderness.net)

# emergency procedures

Potential hazards in the Sabana Field Research Station include, but are not limited to, chemical spills, fire, explosion, power generators and their fuels, the laboratory facilities, the electrical equipment in the multi-purpose building and associated with the TRACE project, and electricity transformers from the local power grid. In the event of a severe weather event involving prolonged and intense rainfall, flooding could represent a dangerous natural hazard. The locations of several potential hazards are shown in the [map of station facilities](#).



Image credit: safetysign.com

## Luquillo

- Emergency Management: 787-889-3193, 0481
- State Police Station: 787-889-2020, 2727
- Fire Department: 787-889-2330/2490
- Municipal Police Station: 787-889-5500, 5501
- Life Link Ambulance Corp.: 787-366-7577

## Río Grande

- Emergency Management: 787-888-5590
- State Police Station: 787-887-2020
- Fire Department: 787-887-2330/1170/1190
- Municipal Police Station: 787-887-5710, 5715
- Río Grande Ambulance, Inc.: 787-887-0865

## San Juan

- Emergency Management: 787-765-0480

## State

- Emergency Management: 787-724-0124;  
[AEMEAD Puerto Rico website \(http://www2.pr.gov/agencias/aemead/Pages/default.aspx\)](http://www2.pr.gov/agencias/aemead/Pages/default.aspx)

## Federal

- USDA Forest Service Law Enforcement Officers
  - Derek Ortíz, Patrol Captain: 787-888-5658; 787-220-6138;
  - Carmelo Ortiz, stationed in Sabana: 787-764-7973; 787-549-0071
  - Aymat Verdejo: 787-888-5658; 787-690-8759

## American Red Cross

- 787-758-8150  
[Cruz Roja Americana website \(http://www.cruzrojapr.net\)](http://www.cruzrojapr.net)

## During an emergency

The State Agency for Emergency and Disaster Management, along with other government agencies will be issuing bulletins with important information. Be sure to listen to the official bulletins and ignore comments and rumors. In addition to Sabana Field Research Station personnel, the local Office of Emergency Management is your primary contact for help before, during, and following emergency situations.

## Chemical Laboratory Emergency

The Station Manager serves as the Laboratory Supervisor and maintains a list of hazardous chemicals present in the laboratory. In the event of a spill, **contact the Station Manager immediately**, who will arrange for the necessary information, personnel or materials needed to contain the spill.

Do not participate in the containment activities without proper training to do the task.

In the event evacuation of the laboratory facilities is necessary, proceed to evacuate to the designated **Assembly Area**. All exits are identified with posted signs and must remain clear of obstructions.

## Medical Care

**If you are not trained in First Aid, do not try to do it.**

Minor cuts and injuries should be treated and controlled before further treatment is sought.

In the event of a medical emergency, follow these guidelines:

- Notify the Station Manager of the emergency.
- **CALL 911.**
- Do not try to move an injured person unless you are sure that moving him will not worsen the injury.

## Medical Treatment Facilities

NAME	ADDRESS	CONTACT INFORMATION
Luquillo Emergency Room / Centro Diagnóstico y Tratamiento	159 Calle 14 de Julio, Luquillo, PR 00773	Tel: 787-500-7755
Río Grande Emergency Room / Centro Diagnóstico y Tratamiento	200 Calle Pimentel, Río Grande, PR 00745	Tel: 787-909-4738
Caribbean Medical Center (Hospital)	151 Ave. Osvaldo Molina, Fajardo, PR 00738	Tel: 787-801-0081 <a href="#">Caribbean Medical Center Website</a>
Hospital HIMA San Pablo	404 General Valero, Fajardo 00738	Tel: 787-653-6060 <a href="#">Hospital HIMA San Pablo Website</a>

## Field Station Emergency Equipment

### Fire extinguishers

- In the wet laboratory, on the wall on the left when accessing the main entrance
- In dormitory kitchen and on the balcony

### First aid kits

- All of the buildings have a first aid kit

### Emergency eye rinses

- In the dry laboratory next to the research freezer
- In the wet laboratory sink

### Fire blanket

- In the dry laboratory, on the wall, next to the door exiting to the parking lot

## Tropical Storm/Cyclone Emergency

Sabana Field Research Station facilities are located less than 50 m to the west of the Sabana River. The station is not in an official FEMA flood zone, but in a severe weather event with high winds and/or torrential rains, the public rights of way could be inundated, or blocked with fallen trees.

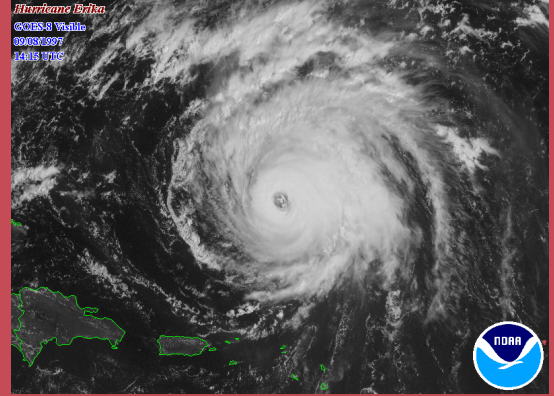


Image credit: nhc.noaa.gov

### *Evacuation*

When advanced warning of a tropical storm/cyclone is available, the primary Sabana Field Research Station response procedure is to evacuate the station.

Upon arrival to the field station, guests will be informed of evacuation procedures. Visitors will be advised to secure lodging in a safe location outside of the station premises. The Station Manager will help coordinate lodging for U.S. and international visitors who do not have the means to leave the island.

- **Look for Sabana Field Research Station personnel for guidance during an emergency event.**
- Be alert for announcements and instructions regarding evacuation.
- Secure materials with personal identification information.
- Turn off all electrical equipment and lights if it is safe to do so.
- Close windows and doors as you exit.
- Remember personal belongings.

### *Shelter-in-Place*

When evacuation is not a viable option, e.g., due to the imminent onset of emergency conditions, the secondary response procedure is to shelter-in-place within the protected confines of the Sabana Field Research Station facilities, moving to the permanent structure farthest from the river and at the highest elevation, i.e., the **dormitory building** (see [map of station facilities](#)).

- Be prepared with several days' worth of food and water provisions.
- Be alert for announcements and instructions regarding shelter-in-place.
- Remain at the assigned location until otherwise directed.
- Be aware that electric power may be lost from the municipal grid for several days to weeks. In this case electric power will be provided by the station's emergency generator.
- Telecommunications may also be lost during storm events. In this case, communication via Forest Service radios is advised.

## Forest Closures

Prior to and during severe weather events, the El Yunque National Forest Supervisor may restrict access to the entire forest or zones of the forest. Sabana Field Research Station visitors should pay close attention to official communications and road signs indicating forest closures. Follow the Twitter feeds for EYNF (@ElYunqueNF) and the Institute (@USFS\_IITF).

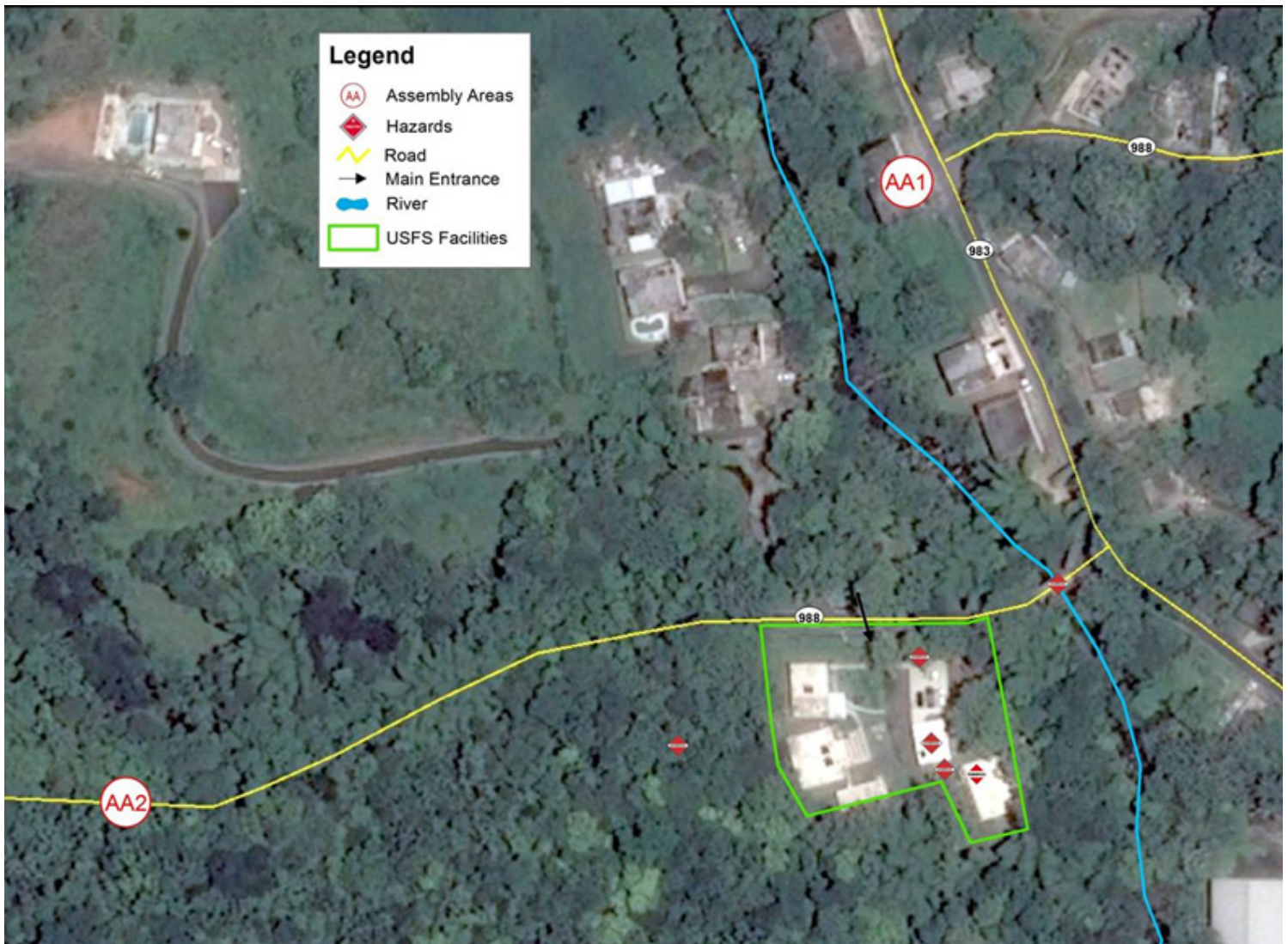
# EMERGENCY ASSEMBLY AREAS

Sabana Field Research Station has two emergency **Assembly Areas**, shown in the figure below. These Assembly Areas were chosen based on locations of potential hazards present at the station.

**Assembly Area 1** is the primary assembly area. It is located about 150 m north of the station at the abandoned building and parking area that used to be known as Colmado El Cruce, where Rt. 983 intersects with Rt. 9983.

**Assembly Area 2** is a secondary option in case the primary site proves to be inadequate and depending on the specific emergency. It is located inside the LEF, 150 m west of the station along Rt. 988, at the gravel access road to La Finca de Los Corcino.

Occupants should move to the farthest assembly area from where the emergency is happening, using exit gates that are a safe distance from any hazards. Follow instructions from the Station Manager and other Forest Service personnel. **Building monitors will be wearing orange helmets\***. **Assembly area coordinators will be wearing blue helmets\***.



Map of Sabana Field Research Station premises showing overview of facilities, hazards, and Assembly Areas. Map by C. Rodríguez.

# safety & security

## SAFETY AND SECURITY ARE TOP PRIORITIES.

The field station is a very safe environment. Nevertheless, there are a few rules to observe that will ensure the well-being of all visitors and station personnel:

- Please keep all station access doors and gates closed and locked after working hours, and during weekends and holidays.
- Visitors should also ensure that all doors are locked even during working hours if they are the only ones present when they leave, for example to go into the field.
- All station doors and hallways must be kept free of obstacles.
- Do not invite additional persons to the station; only authorized guests will be allowed.



Image credit: [debtroundup.com](http://debtroundup.com)

## SIGN IN / SIGN OUT!

Upon arrival, all visitors (researchers, students, contractors, volunteers, etc.) must sign the visitor's logbook, located in the conference room outside the Station Manager's office.

For those staying at Sabana Field Research Station and conducting research in the forest, it is important that you let Forest Service staff know where you will be in the field and when you will be back.

There is a sheet located on the bulletin board in the common area outside the conference room for you to sign out, record where you are going, and the time when you expect to be back.

Please remember to record the date, and don't forget to sign in when you return!



# WORKING ALONE

It is better to work at least in pairs, in case of an emergency, but this may not always be practical. If you are working alone in areas where others are conducting research, you can try to coordinate your schedules so that you will be within earshot of others if you need help. Forest Service protocol advises against traveling or working alone in isolated areas without preparing and discussing a detailed Job Hazard Analysis that includes a communication plan, recommended protective equipment/clothing, safety practices, and emergency evacuation procedures. Remember that terrain and weather may make aid and rescue an impossibility for several days. A minor accident can have serious consequences due to time and exposure, so plan ahead.

**If you must work alone in the field, be sure to tell the Station Manager, who can advise as to additional safety preparations that may apply.**

# TAKE A RADIO

There is no cell reception in the forest around Sabana Field Research Station. If you are working far from others, you can request the use of a Forest Service radio from the Station Manager. The radios are for emergency communications only.\* Receivers that will pick up Forest Service radio transmissions are located at the station, on top of El Yunque, and Forest Service staff in the field with mobile radios. If you are working in the bottom of a narrow watershed, your radio may not be heard except when someone with a mobile unit crosses your transmission path. Remember that someone may be trying to contact you or need help, so leave your radio on\*. Please remember to put the radios in the rechargers when you return.



Image credit: en.wikipedia.org

# SATELLITE EMERGENCY NOTIFICATION DEVICES



Image credit: gpstrackersandmore.com

The Sabana Field Research Station has satellite emergency notification devices available that can help station personnel and visitors access help when they are in remote locations. The primary purpose of these personal communication devices is to ensure the safety of field-going crews. They are tools intended for use in emergency situations where two-way communication devices such as radios and cell phones are unavailable to employees. The emergency devices function via GPS satellites that provide signals about your GPS location and send your location and a preselected message to communication satellites, which in turn relay your message via email, text message, or emergency notification to appropriate personnel. By Forest Service policy, such devices are not a replacement for a radio or phone, nor a replacement for a field partner.\* For additional information about using these devices, please contact the Station Manager.

## DISTRESS SIGNALS

A whistle can be heard at a greater distance than a voice, and takes less energy than yelling. The international distress signal is three blasts on a whistle (or other loud noises) followed by a pause; this sequence is repeated until help arrives.



Image credit: lifeguardmaster.com

# PERSONAL PROTECTIVE EQUIPMENT

The Forest Service Health and Safety Code Handbook identifies a list of required and recommended personal protective equipment (PPE) for employees engaging in back-country travel. Many of these same items are relevant for researchers working in the LEF, and visitors should consider bringing the following equipment into the field:

- First aid kit;
- Map and compass;
- Matches or fire starter in weatherproof container;
- Water or water purifier;
- Food for 1 to 3 days;
- Flashlight with extra batteries and bulb;
- Two-way radio, cellular phone, or similar personal communications device;
- Eye protection and sun-screen;
- Lightweight shelter and appropriate clothing for climatic conditions;
- GPS receiver;
- Multi-purpose belt tool; and
- Whistle and signal mirror.



Image credit: oshatraining.com

Additional field gear that is useful for doing research in the LEF includes:

- Elastic bandage (for sprained ankles);
- Rain gear, umbrella or large plastic bag;
- Hard-hat / sun-hat;
- Bee headnet, if you are climbing;
- Anti-sting salve;
- Light-weight gloves, knee & shin pads (to protect from falls); and
- Tractionized footwear (felt or nylon soles, lace-on over-soles, or bonded carpeting) for stream work.

# SCAFFOLD TOWER CLIMBING

There are numerous walk-up canopy towers located throughout the research areas in the LEF. The Forest Service regards safety and health as the primary consideration in any task, and is committed to preventing job-related accidents and illnesses, in part by establishing and adhering to a Tower Climbing and Fall Protection Program (TCFPP). Specified within this program are guidelines regarding management responsibilities, personal protective equipment, anchorages, for aerial and fixed climbing devices, fall protection requirements, pre-climb and rescue procedures, training and certification.

According to the TCFPP, observers/visitors shall not enter canopy tower work areas or drop zones unless authorized by Forest Service personnel, and will be equipped with personal protective equipment dictated by the hazards present.

If you would like to access the canopy towers for research purposes, you must first discuss your investigation plans and receive approval from the Institute Project Leader.



Bisley Experimental Watersheds canopy tower. Photo credit: S. Moya.

# FOREST SAFETY



Image credit: cartoonstock.com

The Luquillo Mountains have relatively benign tropical ecosystems in which to work, but there are a few hazards you need to consider before heading into the field. The following paragraphs outline the most prominent dangers and suggest some strategies for preventing accidents and mitigating their harmful effects.

## Slippery When Wet

The rocks in the forest are covered with algae and are especially slippery when wet, which is most of the time. Bad encounters between researchers and rocks in the LEF have resulted in many twisted ankles, a broken arm, a shattered kneecap, and a dislocated shoulder (the rocks suffered no damage). Consider wearing protective equipment like gloves and knee pads.



Image credit: safetysign.com



## Lightning

Although thunderstorms are not very common in the Luquillo Mountains, they do occur. If caught in one, get off of metal towers and bridges, and do not stand in streams.

## Falling Objects

Although branch falls can occur at any time, they are most frequent when windy conditions follow rains. Trees also fall during droughts. Mahogany fruits are woody and about the size of a small coconut; they drop from the canopy in the fall. USDA Forest Service regulations say that hard-hats should be worn in the field. There are plenty available for your use (inquire of the Station Manager).



Image credit: discountsafetygear.com

## Flash Flooding

Flooding occurs seasonally when torrential rains associated with tropical storms drain into small tributaries and fill river basins with too much water, too quickly. Flash flood waves can roll boulders, tear out trees, destroy buildings and bridges, and create new channels.

Be aware of the weather conditions in the watershed above you. There are several stream crossings on trails in the Bisley Experimental Watersheds and El Verde Research Area. If there is a hard, sustained rainfall upslope of you, you may not be able to cross the streams safely. Local residents have been drowned by walls of water, sometimes when they were swimming under sunny skies, but there was heavy rain upslope on the mountain.

When a flash flood is imminent, act quickly:

- Do not park your vehicle along streams and washes, particularly during threatening conditions;
- Avoid areas subject to flooding. This includes dips, low-lying areas, canyons, and washes;
- Avoid already flooded and high velocity flow areas;
- Do not attempt to cross a swift flowing stream on foot where water is above your knees;
- Follow the Rule of 10:
  - If a stream is 1 foot (1/3 m) deep and flowing at 10 ft/sec, it is too hazardous to wade
  - If a stream is 2 feet (1/2 m) deep and flowing at 5 ft/sec, it is too hazardous to wade.
- Exercise caution when the travel route becomes muddy and slippery. If there are flash flood conditions, the water will be muddy and you will not be able to see the bottom;
- Avoid crossing streams on logs. If necessary, cross by straddling rather than walking on a log.
- Use lifelines securely anchored on the bank for hazardous water crossings.
- If the stream proves too dangerous when wading, back out using a wading pole for balance; turning around exposes a broader body surface to the current and increases the chances of losing footing;
- Do NOT cross bridges if the water is coming over the road or bridge. The road bed may not be intact under the water.
- If your vehicle stalls, abandon it immediately and seek higher ground. Be especially cautious at night when it is harder to recognize flood dangers.



Photo credit: [criticalzone.org/luquillo](http://criticalzone.org/luquillo)

## Invertebrates

None of the invertebrates in the LEF are dangerously toxic (unless you are allergic to them), but their stings or bites can hurt. **Fire ant** stings are common. Grabbing tree trunks with bare hands to catch one's balance can elicit a bite from orange **crab spiders** or a sting from a **scorpion** or **whip scorpion**. In the understory, **wasps** often nest on the underside of leaves, but they have small colonies and are easily escaped. There are many plastic and metal pipes in the forest that are used as plot markers, and these are favored retreat sites for **tarantulas**. Giant **centipedes** are relatively rare, but have a nasty bite.



Photo credit: fs.usda.gov

Visitors with a history of allergic reactions to insect stings should carry an appropriate emergency kit prescribed by a physician and wear medical identification tags. Such persons should also inform colleagues and the Station Manager of their situation and what assistance, if any, is appropriate for an allergic reaction.



Photo credit: dailymail.co.uk

**Africanized bees** are also in the LEF. They are no more toxic than the European bee, but they are much more aggressive in defending their colonies, with a tendency toward mass attack following minimal provocation. Look and listen for bee activity in your work area. If you encounter a hive, do not disturb it. Report it to the Station Manager.

**Mosquitoes** can also be abundant in the forest at certain times of year. Dengue Fever (or Bone-Break Fever) is a viral disease transmitted by day-flying mosquitoes. It is accompanied by high fever, headache, aching joints, red skin splotches, and sensitivity of the eyes to strong light. It is more common in low-lying areas where standing water accumulates. The illness is unpleasant, but not usually dangerous, although in a small proportion of cases the disease develops into the life-threatening Dengue Hemorrhagic Fever. If you suspect that you have dengue, seek medical attention.

## Poisonous plants

The most common poisonous plant is the giant stinging nettle (*Urtica dioica*, ortiga brava). It has thin, large, ovate, toothed leaves borne on long petioles. The plant is covered in spines and stinging hairs that break off and inject acetic acid. For most people, the pain disappears after 10-20 minutes.



Photo credit: biogeodb.stri.si.edu

*Sapium* trees usually grow near streams, and when cut they exude a copious white latex that is highly irritating, causing a reaction similar to poison ivy. *Sapium* has simple, shiny, ovate leaves with a pointed tip, and a pair of glands on the petiole just below the leaf blade.

*Comecladia* bushes grow near streams, and are highly toxic members of the Anacardiaceae family. These have holly-like, shiny leaves with bristle tips that can cause an allergic reaction lasting several weeks.

Saw grass is especially common in the Bissley Experimental Watersheds, and lives up to its name. Long sleeves and gloves provide adequate protection.



to credit: fs.usda.gov

For more information about how to identify these plants inquire of station personnel.

## Vertebrates

There is only one mildly toxic snake here - *Alsophis*. Introduced rats and mongooses are common, but are not dangerous unless they have rabies. Be wary of rats or mongooses that act strangely. If you get bitten, you should advise the Station Manager and seek medical attention.

Remember to not feed any animals, especially stray dogs and cats.

Most visitors to the forest stay along the roads or walk up streams, and most are benign. If you are in the forest and away from streams, you are unlikely to meet anyone other than researchers and technicians. Your vehicle is fairly safe if you can park it behind a locked Forest Service gate rather than along the road. Do not leave valuables in unattended vehicles, and store other items so they are not visible from the outside. Communicating on your radio is probably your best defense/deterrent in a threatening situation.



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