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Department of
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El Yunque
National Forest

Draft Revised
Land and Resource Management Plan

Forest Service | Region 8 | El Yunque National Forest | R8-MB 148 A | September 2016

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Draft Revised Land and Resource Management Plan

El Yunque National Forest

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1 Introduction

The Forest Service has developed this land and resource management plan (also referred to as the "Forest Plan" or "the Plan") to guide the general management direction of the El Yunque National Forest during the next 15 years. This document, developed under the 2012 Planning Regulations outlined in the 36 CFR 291 2012 planning rule, is a first revision of the original forest plan prepared in 1997 under the National Forest Management Act (NFMA).

In 1997 the Forest Service developed a management plan that considered several issues and management needs. The 1997 management concept focused on conservation, particularly to protect the unique ecological resources. The planning strategy was to develop solutions to nine issues using a "plan components" approach. The idea was to obtain a formal designation for research natural areas, wild and scenic rivers, and wilderness. In addition, primary forest was protected through a series of plan components. The plan addressed the utilization of water, wildlife, and research. Social needs were addressed through recreation and access initiatives.

This Plan revision incorporates new information, addresses evolving issues and trends, accounts for changes in national policy and direction, and includes updated views from the public. The draft revised Forest Plan is the result of a multi-year planning process and collaboration with the public and other Federal agencies and state and local government. This Plan differs from the previous plan by focusing more on an integrated vision of ecological, social, and economic sustainability and connecting to local communities. The Plan describes how we want the national forest to look and function in the future rather than how individual projects would be implemented.

This Plan adopts an adaptive approach to land and resource management that emphasizes the importance of monitoring and learning from management effects and outcomes. Adaptive management is enhanced by partnerships with scientists, practitioners, decision-makers, and other stakeholders who learn and work together to support a management system resilient to changes in social, economic, and ecological conditions.

1.1 Plan Purpose

The purpose of this Plan is to guide future projects, practices, uses, and protection measures to ensure sustainable multiple-use management of the El Yunque. This Plan describes activities that would likely be implemented, as well as the resulting public benefits and long-term improved condition of the El Yunque. Per direction in CFR 219. 2:

> A plan does not authorize projects or activities or commit the Forest Service to take action. A plan may constrain the Agency from authorizing or carrying out projects and activities, or the manner in which they may occur. Projects and activities must be consistent with the plan (CFR 219.15). A plan does not regulate uses by the public, but a project or activity decision that regulates a use by the public under 36 CFR Part 261, Subpart B, may be made contemporaneously with the approval of a plan, plan amendment, or plan revision… The supervisor or district ranger is the responsible official for project and activity decisions, unless a higher-level official acts as the responsible official.

As required by NFMA, all projects and activities that would be authorized by the Forest Service, after the record of decision for the revised Plan, must be consistent with the Forest Plan (16 U.S.C. 1604 (i)) and its applicable plan components, as described at 36 CFR 219.15.

When a proposed project or activity would not be consistent with the applicable plan components, the responsible official shall take one of the following steps, subject to valid existing rights:

- Modify the proposed project or activity to make it consistent with the applicable plan components.
- Reject the proposal or terminate the project or activity.
- Amend the plan so that the project or activity will be consistent with the plan as amended.
- Amend the plan contemporaneously with the approval of the project or activity so that the project or activity will be consistent with the plan as amended (36 CFR 219.15(c)).
- List of proposed and possible actions.

1.2 Plan Components

A land management plan must include components which provide a strategic and practical framework for managing the plan area. Plan components are applicable to the resources and issues of the plan area, and should reflect the unit's distinctive roles and contributions.

The required components of a forest plan (hereafter referred to as "plan components") are the following:

- Desired conditions
- Objectives
- Standards
- Guidelines
- Management areas
- Geographic areas
- Suitability of national forest lands for timber production and for various other uses

These components are defined as follows:

Desired Conditions: A desired condition is a description of specific social, economic, and/or ecological characteristics of the plan area, or a portion of the plan area, toward which management of the land and resources should be directed. Desired conditions must be specific enough to measure progress toward their achievement, but do not include completion dates. As noted above, desired conditions do not commit the Forest Service to take action.

Objectives: An objective is a concise, measurable, and time-specific statement of a desired rate of progress toward a desired condition or conditions. Objectives should be based on reasonably foreseeable financial considerations. Specific objectives and management strategies outlined in this Plan describe our approach for moving the El Yunque's resources toward the desired conditions—they are stepping stones of achievement. Objectives do not commit the Forest Service to take action. Site-specific decisions to implement the Forest Plan are required.

Standards: A standard is a mandatory constraint on project and activity decision-making established to help achieve or maintain desired conditions to avoid or mitigate undesirable effects or to meet applicable legal requirements.

Guidelines: A guideline is a constraint on project and activity decision-making that allows for departure from its terms, as long as the purpose of the guideline is met.

Suitability of Lands: Specific lands within a plan area are identified as suitable for various multiple uses or activities based on the desired conditions applicable to those lands. The plan identifies lands as

not suitable for uses that are not compatible with desired conditions for those lands. Suitability determinations are not made for all uses, but by law, there must be a determination of the lands that are suitable and not suitable for timber production. The fact that lands are considered suitable for a use or uses is not a commitment to authorize such use.

Management Areas or Geographic Area: The plan identifies whether the plan components apply to the entire plan area, to specific management areas or geographic areas, or other areas identified in the plan.

In addition to requiring that a plan have components, the 2012 planning rule requires that a plan have "other required content" (36 CFR 219.7(f)(1)) addressing priority watersheds, the distinctive roles and contributions of the plan area, a plan monitoring program, and proposed and possible actions.

The optional content included in this Plan is:

- Elfin-woods Warbler Management Approach
- Sustain Yield, Forest Products Co-Management Activities for the Community Interface Resource Management Area
- Priority Watersheds

This Plan includes additional information about management strategies and partnership opportunities that can be used to coordinate the achievement of desired conditions and objectives. Management strategies describe how the Forest Service intends to move the Forest's resources toward desired conditions, including objectives and management approaches to implementation.

1.3 Forest Plan Structure

The plan is organized as follows:

1. Introduction. The section provides an overview of the El Yunque and describes the purpose and structure of this draft revised land and resource management plan. This section also describes distinctive roles and contributions of the Plan area, as well as themes generated from public involvement. Finally, it presents the plan's vision and general management strategies.

2. Geographic Management Area Direction. This section outlines the desired conditions and objectives for the geographic areas, management areas, and any associated standard and guidelines. The suitability of various uses is also described.

3. Desired Conditions for El Yunque National Forest. This section provides the Forest-wide desired conditions and objectives, along with the Forest-wide standards and guidelines that establish sideboards for framing management activities and ensuring resource protection as the agency implements projects that move the Forest toward desired conditions. This section points to existing management direction (for example, public laws, regulations, Forest Service manuals and handbooks, and Federal policies) that is generally not restated in this Plan.

4. Monitoring and Evaluation. This section describes the Plan's adaptive management strategy and monitoring program that will provide information to determine whether programs and projects are meeting Forest Plan direction and whether the Plan should be amended or revised.

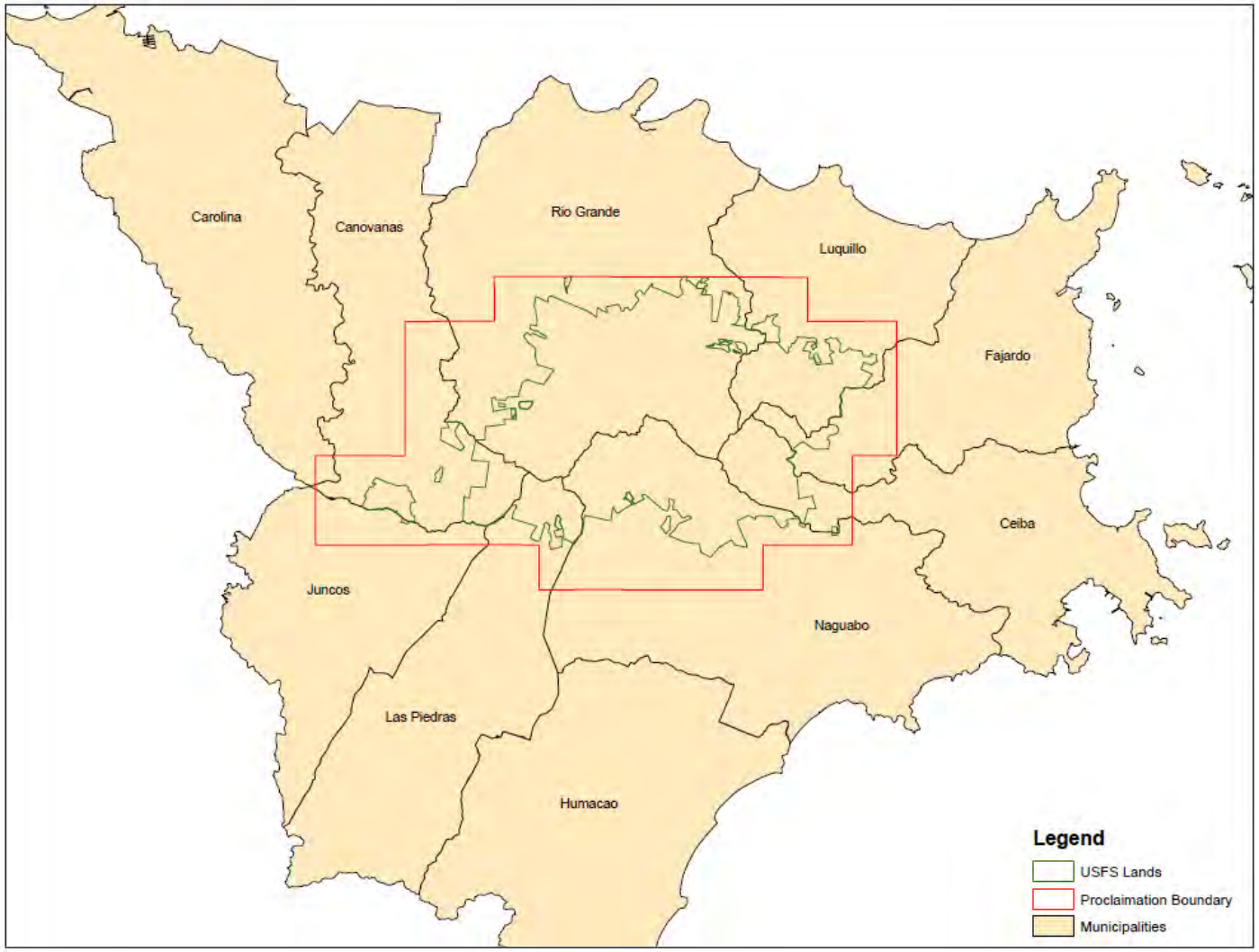
References. This section includes a list of external and internal documents relevant to understanding the plan.

Appendices. Appended materials include:

- Management Situations for the Elfin-woods Warbler in the New Land and Resources Plan for El Yunque National Forest
- Sustain Yield, Forest Products Co-Management Activities for the Community Interface Resource Management Area
- Priority Watersheds

1.4 Location of the Plan Area

The El Yunque National Forest (referred to as the *El Yunque* or the *Forest*) is located in the rugged Sierra de Luquillo Mountains, 25 miles southeast of San Juan, Puerto Rico. The Luquillo Mountains rise abruptly from sea level at Las Cabezas de San Juan on the northeastern tip of Puerto Rico to 3,524 feet in elevation at El Toro Peak. The Forest contains 29,000 acres. Elevation ranges from about 330 to 3,533 feet above sea level. Topography is rugged, with 24 percent of the Forest exhibiting 60 percent slope or steeper. The Forest's steep, wet, and isolated mountains were not traversed by PR Route 191 until 1942.



Map 1-1. El Yunque National Forest and vicinity

The three geographic scales considered are municipal, regional, and Islandwide. In Puerto Rico, a municipality is the smallest division of administrative and electoral government, similar to a county in the U.S. The El Yunque is surrounded by nine municipalities in Eastern Puerto Rico: Canóvanas, Ceiba, Fajardo, Juncos, Luquillo, Naguabo, Rio Grande, Las Piedras, and Humacao. These comprise more than 220,000 acres (about 345 square miles), which is about 8.3 percent of the Island's total area. Stretching over 29,000 acres, the National Forest covers about 15 percent of the total area of the Region.

El Yunque is the only tropical forest in the National Forest System. It is administered by a Forest supervisor and staff. Offices are located at Headquarters and El Portal Visitor Center and adjacent Catalina Work Station on PR Route 191, kilometer 4.4, south of Palmer, Puerto Rico. El Yunque has dual designation as an "Experimental Forest" and research within the Forest is overseen and conducted by the International Institute of Tropical Forestry. The Institute is administered by a director and staffed with research scientists, professionals, and technicians. The Institute's office is located on the grounds of the University of Puerto Rico's Botanical Garden in Rio Piedras, Puerto Rico, and the Sabana Field Research Station in Luquillo, Puerto Rico.

1.5 Plan Relationship to Other Documents

This Plan relates to a series of documents that provide strategic, local government, or regulatory guidance:

- USDA Forest Service Strategic Plan
- Puerto Rican Parrot Recovery Plan
- Flora and Fauna Recovery Plans
- El Yunque National Forest Comprehensive River Management Plan
- Municipal Zoning Plans
- Puerto Rico Department of Natural Resources Wildlife Management Strategic Plan
- Puerto Rico Water Management Plan
- Protected Areas Management Plans
- IITF Research Work Unit Description
- Designation of Natural Reserve "Corredor Ecologico del Noreste"

1.6 Distinctive Roles and Contributions of El Yunque

The Forest provides environmental, social, and economic benefits to local and regional communities, as well as to people across the Nation, making the El Yunque an important and unique part of Puerto Rico.

The unique roles and contribution include:

1. The Forest provides opportunities for local residents and visitors to connect with the land, with each other, and with Puerto Rican history and culture. The El Yunque contributes to human health and well-being, offering unique opportunities for recreation, relaxation, exercise, solitude, stewardship, spirituality, community, and many other socioeconomic and cultural benefits and beneficial experiences.
2. People experience the unique natural setting of the El Yunque through recreation and tourism. Lush and dense tropical vegetation, steep slopes, cascading streams and rivers, wildlife, varying bird diversity and hundreds of tree species make El Yunque an outstanding recreation setting for people seeking outdoor pleasure and adventure. These features make the Forest a special destination.

3. The Forest also contains the largest block of tropical forest essentially unchanged by human intervention in Puerto Rico.
4. The El Yunque is the only tropical rain forest in the National Forest System and is renowned for its natural scenic beauty. There are cascades, pools, and waterfalls throughout the landscape. Immensely diverse vegetation and steep landforms of El Yunque combine to make a distinctive landscape. The water, landform, and vegetation attributes provide for unique and outstanding scenic quality with a variety and vividness provided by lush and diverse vegetation.
5. Popular recreation activities include viewing scenery, nature photography, driving for pleasure, hiking, picnicking, and water play. About 80 percent of visitors participated in viewing natural features or scenery. Over 50 percent use the forest as a undesignated "scenic byway".
6. The Luquillo Mountains are a major source of water for the Island. There are 34 water intakes withdrawing over 46 million gallons per day from the Forest. The mountains supply more than 20 percent of the Island's municipal water each year, with the El Yunque providing an average of 276 cubic hectometers of water per year for municipal uses (Scatena and Johnson 2001).
7. The El Yunque provides habitat for over 180 fauna species, of which five are federally listed species: the Puerto Rican parrot, Puerto Rican broad-winged and sharp-shinned hawks, Puerto Rican boa, and Elfin-woods warbler.
8. The Forest provides habitat for the new category of species of conservation concern which includes: 10 species of coquies, 2 species of anole lizards, 1 bat species, 4 bird species, 5 species of fishes, and 2 species of freshwater shrimp.
9. The El Yunque provides habitat for 636 plant species. The Forest provides habitat for federally listed plants species: *Callicarpa ampla*, *Eugenia haematocarpa*, *Ilex obcardata*, *Lepanthes eltoroensis*, *Pleodendron macranthum*, *Styrax portoricensis*, *Ternstroemia luquillensis*, and *Ternstroemia subsessilis*. Within the plants species, 39 are considered species of conservation concern.
10. The Forest represents innumerable and invaluable economic, social, and cultural contributions to local communities and beyond. The Forest contributes an estimated $25 million in water production per year and more than $3 million per year in wildlife viewing activities. El Yunque directly contributes over $3.5 million to local economies through employment, expenditures, and payments from revenue sharing and in-lieu of taxes. The Forest is located in a major touristic region, while being surrounded by resorts and natural protected areas.
11. The major ecosystem services provided by El Yunque National Forest identified by all stakeholder groups include: clean water, habitat for flora and fauna, air purification, recreation, and scenic value.
12. The Forest has a dual designation as the Luquillo Experimental Forest and El Yunque National Forest. The Luquillo Mountains in Puerto Rico provide an excellent natural research laboratory in which to study the diversity of tropical forest types, because five subtropical life zones are represented within the Wet Forest, Rain Forest, Lower Montane Wet Forest, Lower Montane Rain Forest, and a small tract of land in the southwest portion that falls within the Moist Forest Life Zone. The Forest has a region with a rich tradition of forestry research unique among tropical forests; scientists have been active there since the end of the 19th century.

1.7 Vision and Management Themes

A vision for the Forest Plan was developed through a collaborative process with the public, stakeholders, and Forest employees. The vision on which internal and external stakeholders can rally around and reflect the uniqueness of the Forest is:

> Maintain a healthy, accessible, and sustainable forest that integrates multiple uses; provides economic, ecological, and social opportunities; promotes education, environmental justice, and cultural and environmental identity and awareness for the conservation of its natural resources; and for adaptive forest management that is inclusive and collaborative.

What do we do?

- Help to improve and maintain the quality of life of the Forest and surrounding communities.
- Provide and promote access to the Forest and the sustainably of its resources in collaboration with the multiple socioeconomic sectors that benefit from it.
- Ensure access to scientific and interpretive information available about the Forest, including its cultural resources and Forest services and products.

How will we do this?

- Collaborating in sustainable socioeconomic development and community activities that help in conserving and improving the Forest and its resources.

- Developing sustainable and collaborative projects with the public and private sectors and society at large.
- Conserving, preserving, and restoring Forest habitats and ecosystems through strategic adaptive planning, research, monitoring, and education.
- Promoting and strengthening the co-management and the social and ecological identity and connectivity of the region through improved public participation and involvement in decision-making.
- Using the best science and local knowledge.

For whom will we do this?

- For the welfare of nature and society based on a local focus and global perspectives.

What is Co-management?

> The concept of co-management is a key factor for collaboration within EYNF. This concept arose through conversations with the public and stakeholders. The idea of co-management is culturally developed as a process of collaboration between the Forest Service (as an agency) and the public (as stakeholders and key partners). Co-management takes partnerships a step further into a collaborating process, where the public contributes to land management. Co-management is the strategic and site-specific engagement of FS and active partners working together in general forest operations, conservation and restoration activities with a practical sense of shared responsibilities to achieve the Mission. It goes one step beyond partnering by increasing capacity based actions. It is important to clarify that the public and the stakeholders were clear that this concept did not mean that the forest service as an agency had delegated its authority to make decisions on land management. To the contrary, the public uses this word (co-management) understanding their role to contribute to lands; while knowing who will make decisions on how the land management plan is implemented through our proposed actions as here stated. For example, a community-based co-management approach is a form of collaboration within the relationship that the forest has with the community when developing a specific project. This means that when the forest and the community develop the project together, they do so while complying with the Forest Plan and do so under Forest Service authority.

In order to implement the vision, the following five core management themes where developed.

Management Theme: Promote a stronger regional identity in and around the Forest using an "all-lands approach policy."

- Consider the ecological, social, and economic needs of the broader landscape. An area of community interface for management of resources at the lower elevations of the Forest is sustainably managed in accessible locations suitable for multiple-use management and provides for forest products.

Management Theme: Provide for healthy ecosystems.

- Conserve and restore ecosystems. Protect and conserve the functional wetlands and primary forest and maintain and improve watershed conditions on the Forest while monitoring, adapting, and mitigating the effects of climate change.

Management Theme: Incorporate collaborative adaptive management at the Plan and site-specific levels.

- Sustain and develop partnerships. Continue current regional collaboration efforts engaged in conservation, management, land use and research in a sustainable manner while continuing to explore opportunities for further partnership efforts. Shift priorities from primarily a Forest Service-driven-management to a more collaborative management. Partnership opportunities and collaboration arrangements support the achievement of desired conditions and objectives of the Plan.
- Integrate agencies and stakeholders in conservation efforts. Facilitate and coordinate a collaboration framework by integrating agencies and concerned citizens in the region in processes to request support or funds for programs and promote outreach for incentive programs available for private land owners in the areas adjacent to the Forest.
- Provide opportunities for research. Develop initiatives with agencies and stakeholders such as Government agencies, non-governmental organizations, academic institutions, and citizen scientist groups.

Management Theme: Define a new recreation, access, and tourism system.

- Provide for sustainable recreation. The Forest provides sustainable recreation opportunities that are in harmony and sustainable with the natural setting and where people enjoy and value its unique tropical ecosystem and include the protection and maintenance of historical and cultural resources. Future demands and limited agency resources will require public support and new partnerships to improve recreation facilities and services on the Forest, as well as the capacity to support recreation usage without causing damage to the environment.

Management Theme: Increase regional environmental literacy and educating local communities.

- Connect the surrounding communities to the Forest's natural landscapes. Assist in developing community capacity for participation in various management activities in areas such as interpretation, education, recreation, economic development, conservation, restoration, research, and monitoring. Identify and overcome barriers that inhibit these populations from connecting socially, culturally, and economically to the natural landscapes within and surrounding the Forest.

2 Geographic Management Area Direction

The Planning Rule requires the development of plan components that provide a strategic, practical, and integrated framework for managing the plan area and its array of ecological, economic, and social resources and issues. These plan components guide decisions and activities in and around the Forest and may apply to the entire plan area; to specific parcel(s) of land; and/or to specific land covers, uses, or characteristics. Land management plans must indicate where each plan component applies through the identification of management areas or geographic areas, or both. A management area is "a land area identified within the planning area that has the same set of applicable plan components [but] does not have to be spatially contiguous" (36 CFR 219). A geographic area is "a spatially contiguous land area identified within the planning area [and] may overlap with a management area" (36 CFR 219). Both types of planning tools are proposed for the El Yunque.

2.1 Geographic Areas

Geographic areas typically represent large portions of the planning area that encompass desired conditions that can span a range of resource management emphases. They allow for the place-based development of a long-range vision for that portion of the planning area, which can be adapted to internal and external changes over time.

Given the unique characteristics of the planning area and the surrounding landscape, geographic areas are identified to permit the development of integrated management strategies that recognize the distinct ecological, economic, and social conditions that exist at the sub-regional level around the Forest. For the EL Yunque, these geographic areas will facilitate an "all-lands approach" to planning and management that supports cross-boundary work with neighboring and nearby landowners and communities, as well as with state, Federal, and other land management and governmental agencies. Moreover, the management direction for these geographic areas can be tiered to the differentiated roles that the Forest serves in its interactions with local communities and their economies, cultures, and ecological services, particularly in terms of tourism, recreation, and environmental education.

The geographic areas proposed for the Forest were identified through an interdisciplinary process that considered the range in ecological, economic, and social conditions and trends at the sub-regional level. Input on the development of geographic areas was collected through participatory planning meetings with local communities, protected area managers, recreation outfitters, municipal governments, business representatives, and professional groups. This input was analyzed, alongside information from the planning area assessment and other sources, by the interdisciplinary team in the determination and mapping of three geographic areas of the El Yunque.

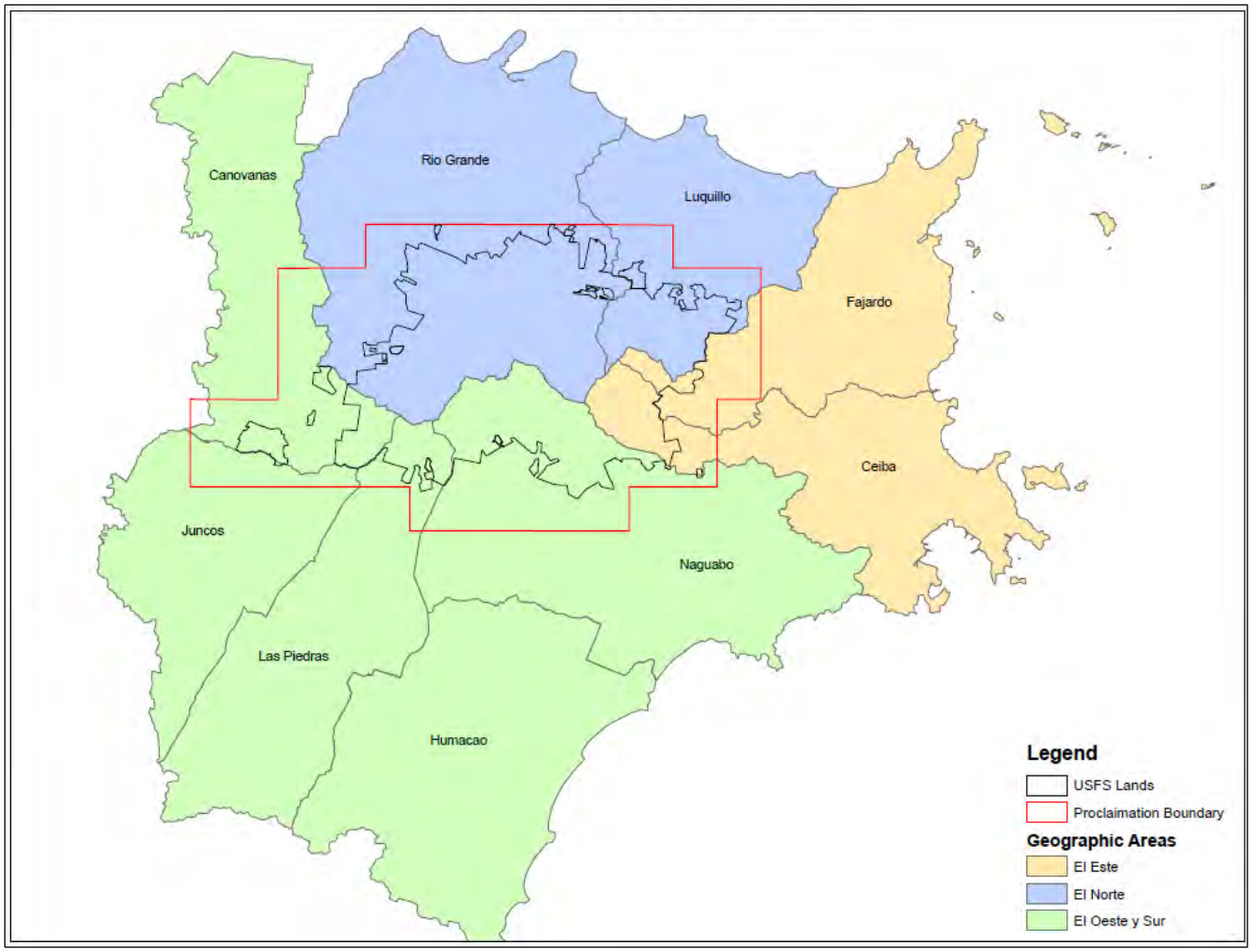
2.1.1 The El Yunque Region: Current Conditions and Trends

The region surrounding the El Yunque is delineated by nine municipalities: Canóvanas, Ceiba, (Map 1-1). Within this region, there is a broad range in community characteristics, environmental conditions, and land ownerships that are well-suited for an "all-lands approach" to resource management and collaboration (Map 1-1). Together, these nine municipalities extend over 347 square miles (about 220,000 acres), which is about 10 percent of Puerto Rico's total area (Table 2-1). Eight of the nine municipalities have some of their land base within the boundaries of the Forest, ranging from less than 1 percent in Juncos to more than 33 percent in Rio Grande. Humacao is the only municipality in the region without land within the Forest boundary.

Table 2-1. Total area and national forest area in the El Yunque Region

	Total Area (square miles)	Total Area (acres)	NF Area (square miles)	NF Area (acres)	% NF Acreage
Canovanas	33.00	21,121	3.19	2,042	9.7
Ceiba	29.26	18,729	3.34	2,135	11.5
Fajardo	30.23	19,348	0.95	608	3.2
Humacao	55.46	35,494	0	0	0
Juncos	26.59	17,017	0.03	21	0.1
Las Piedras	33.89	21,692	1.98	1,268	5.8
Luquillo	25.79	16,503	5.62	3,599	21.6
Naguabo	51.78	33,141	8.38	5,360	16.1
Rio Grande	60.85	38,943	20.26	12,969	33.2
Region	346.86	221,988	43.75	28,002	12.6
Puerto Rico	3,515.00	2,249,600	43.75	28,002	1.2

Of the municipalities surrounding the El Yunque, Humacao is the largest in terms of area (55.5 square miles). Rio Grande encompasses the largest area of national forest land within its borders (20.26 square miles; 33.2 percent of its total land base). Junco is the smallest of the region's municipalities and encompasses the smallest area of national forest land (0.03 square miles, 0.1 percent of municipality).



Map 2-1. Geographic area map

The El Yunque Region comprises coastline, plains, hills, and mountains within a complex matrix of land covers and uses (Gould et al. 2012). In 2010, the forest was the most abundant land cover type in the region (43 percent), followed by pasture, including agricultural lands (36 percent), and urban/built-up areas (10 percent) (López-Marrero and Hermansen-Báez 2011a).[1] At the sub-regional level, forest land cover ranged from 55 percent in Luquillo to 26 percent in Juncos (López-Marrero and Hermansen-Báez 2011a). Pasture and agricultural land cover were most dominant in Las Piedras (54 percent) and urban/built-up land cover was most dominant in Fajardo (16 percent) (López-Marrero and Hermansen-Báez 2011a). From 1998 to 2010, urban/built-up land cover increased by more than 3,000 acres (21 percent) in the eight municipalities adjacent to the El Yunque (López-Marrero and Hermansen-Báez 2011b). Juncos and Canóvanas experienced the greatest increase in the percent of urban/built-up area, while Ceiba experienced the smallest increase in this land cover type (López-Marrero and Hermansen-Báez 2011b).

In 2014, nearly 330,000 people lived in the nine municipalities comprising the El Yunque Region (U.S. Census Bureau 2015). The density of the regional population was about 978 persons per square mile, ranging from 470 persons per square mile in Ceiba to 1,521 persons per square mile in Juncos (U.S. Census Bureau 2015). The region accommodated a growing population and an increasing percent of Puerto Rico's total population through the early 2000s. This led to some of the highest population density rates in the world; extensive expansion in housing, infrastructure, and other built-up areas; and ultimately, more than 95 percent of the regional population being classified as 'urban' by the U.S. Census Bureau (2015). Nevertheless, following the Islandwide trend that began in the mid-2000s, it is estimated that the El Yunque Region also is experiencing a decline in population. Between 2010 and 2014, the regional population is estimated to have decreased by 2.65 percent (0.67 percent decrease per year) (U.S. Census Bureau 2015). Fajardo and Ceiba experienced the highest rates of population loss in this time period (1.99, 1.88 percent drop per year, respectively) (U.S. Census Bureau 2015). The shift from population growth to decline is attributed mainly to emigration from the region spurred by ongoing economic issues, in combination with longer-term declining birth rates.

The age structure of the regional population also demonstrates recent measurable changes. The regional median age has been increasing slowly over the past several decades, ranging from 34.3 to 37.7 years in 2014 (Naguabo, Ceiba, respectively) (U.S. Census Bureau 2015). Through the end of the 20th century, the municipalities surrounding the Forest demonstrated a pyramidal age structure, which is associated with moderate population growth (that is, proportionally more of the population is found in the younger age brackets). However, by 2014 the age structure of the regional population had shifted to a more conical shape, indicating very limited to no growth as the proportion of individuals in each age group is within a small range of variation.

The regional economy is fairly diverse, with the majority of jobs in the education, health, and social services sector (21 percent), followed by retail trade (13 percent), manufacturing (12 percent), and arts, entertainment, recreation, and accommodations (10 percent). The agricultural sector provides slightly less than 1 percent of the jobs in the region, ranging from 0.45 percent in Canóvanas to 2.04 percent in Las Piedras. While the economy is fairly diverse, it has been significantly impacted as the economic crisis affecting Puerto Rico since the mid-2000s continues under increasing government debt and the high costs of doing business on the island (Cohn et al. 2014; Federal Reserve Bank of New York 2012).

Per capita and family incomes in the region have risen over the past several decades, but only modestly outpacing inflation. The unemployment rate in the region was 16.8 percent in 2010, ranging from 11.7 percent in Ceiba to 21.0 percent in Luquillo. Poverty rates in the region were high as well, with about 44.2

[1] These statistics refer to all of the municipalities in the El Yunque Region, with the exception of Humacao, which was not part of the study cited.

percent of the regional population living below the poverty level as defined by the U.S. Census Bureau in 2013. Children represent a disproportionate share of the poor, with 56 percent of children living below the poverty level in 2013, ranging intra-regionally from 49.7 percent in Rio Grande to 67.5 percent in Naguabo (U.S. Census Bureau 2015).

The region surrounding the El Yunque is culturally diverse and dynamic. This is reflected in the human values associated with the Forest and its resources and services, which include water conservation, soil protection, recreation, research opportunities, and scenic quality (López-Marrero et al. 2011d). The Forest itself has long-standing, deep, and significant social and cultural meaning for local inhabitants, capital residents, and visitors from around the world (Weaver 2012). With the Forest at its center, the El Yunque Region offers unique and wide-ranging opportunities for recreation, relaxation, exercise, solitude, stewardship, spirituality, community, and many other benefits and beneficial experiences that are critical considerations for land management planning and practice.

2.1.2 Benefits of Identifying Geographic Areas for the El Yunque Region

As described above, the El Yunque Region represents a broad range in ecological, economic, and social conditions and trends suitable for the identification of geographic areas within the Forest. These geographic areas permit the development of specific desired conditions, objectives, goals, and other plan components conducive to effective planning and management that fit the sub-regional context. The management direction for these geographic areas can be designed to promote human health and well-being and community-based economic interests at a sub-regional level. Specifically, identifying geographic areas for the Forest provides opportunities to strengthen connections to communities and other stakeholders through recreation, increase environmental literacy and education, enhance landscape scale conservation efforts, and strengthen relationships and adaptive, collaborative approaches.

Connect with Communities through Recreation

The communities surrounding the Forest represent a broad range in recreation needs and demands. Not all recreation opportunities are accessible to all communities. For example, recreation facilities are concentrated along the PR Route 191 North corridor, deep within the Forest boundary, and at a distance from most local communities. Identifying geographic areas in line with the recreational settings available outside the Forest boundary permits increased integration of access, recreation, and tourism aspects at the sub-regional level. Also, it provides opportunities to better connect urban areas and rural communities to the scenic attractions, historic places, and recreation opportunities located in the lower elevations of the Forest and nearby areas. Moreover, it enables recreation planning and management that consider changes in sub-regional populations and visitation patterns at the local level. Geographic areas also allow for targeted community interaction and assistance, as well as opportunities for collaborative management.

Increase Environmental Literacy and Education

While the regional population has a fairly high level of education, there is a measured gap in knowledge regarding Forest planning and management among neighboring and nearby communities, and among the youth, in particular. Identification of geographic areas at the sub-regional level provides opportunities to increase environmental literacy and education and ultimately, to improve the public's capacity to participate locally in forest conservation and sustainable management. Also, it allows for the expansion of traditional Forest Service programs by integrating schools and municipal governments in planning and projects and adapting educational and interpretation materials to the local context. Additionally, identifying geographic areas permits the identification of and support for targeted volunteer and partnership opportunities related to environmental literacy and education.

Enhance Landscape-Scale Conservation Efforts

Forested areas represent the largest portion of land cover in the El Yunque Region and forested cover has increased over the past several decades. Nonetheless, urbanization is increasing at a much more rapid pace, resulting in landscape fragmentation and negative effects on the Forest and other natural areas in the region. Moreover, many of the negative effects of urbanization are likely to be compounded in the context of global climate change. Identifying geographic areas permits the promotion of landscape scale conservation. In particular, existing collaborative arrangements and partnerships can be maintained and new opportunities for land acquisition and conservation across Forest boundaries can be pursued at the sub-regional level by working with adjacent and interested public and private land managers, landowners, and other stakeholders. The identification of geographic areas also provides opportunities for targeted conservation initiatives, such as for stream corridors, riparian areas, wild and scenic river corridors, connections to the Corredor Ecologico del Noreste Natural Reserve; and integration with conservation easements, donations, and private lands.

Strengthen Relationships and Adaptive, Collaborative Management Approaches

Although the El Yunque has engaged with stakeholders and partners on many successful projects and partnerships for quite some time, large-scale and long-term public participation efforts have been limited. Identification of geographic areas allows the Forest to increase its engagement with local community stakeholders and Forest users as prescribed in the new planning rule. Moreover, it allows the Forest to maintain and build on the rich and extensive collaborative arrangements that have evolved with key stakeholders, local communities, and other actors as part of the land management planning process to date. It also provides opportunities for addressing the new scientific information on and changes in social, economic, and ecological conditions within and around the Forest that have occurred since the 1997 land management plan was put into place. Identifying geographic areas allows the Forest and its partners to maintain and extend open and safe spaces that promote problem-solving, creative solutions, constructive dialogue and deliberation. They can be designed to support a collaborative and adaptive approach to management, which is essential to enhanced interpretation, recreation, economic development, conservation, restoration, research, and monitoring within and beyond the Forest.

2.1.3 El Yunque National Forest Geographic Areas

The Plan contains three geographic areas for the El Yunque. Table 2-2 identifies the Forest geographic areas, while Table 2-3 highlights the key management principles for each one, along with the key associations and relationships.

Table 2-2. Forest Plan geographic areas

Name	Acreage	Description	Management Principles for the Area
El Norte	16,563	Sub-regional landscape covering the municipalities of Rio Grande and Luquillo	▪Provide access to highly developed recreation settings and connect to a regional trail system.
El Oeste y El Sur	8,691	Sub-regional landscape covering the western and southern municipalities of Canovanas, Juncos, Las Piedras, Naguabo, and Humacao	▪Community-based use with emphasis on environmental education and community-based enterprises. ▪Promote appropriate agroforestry/analog forestry initiatives.
El Este	2,745	Sub-regional landscape covering the eastern municipalities of Fajardo and Ceiba	▪Watershed management focused on quantity, restoration, and improvement. ▪Promote appropriate agroforestry/analog forestry initiatives. ▪Promote "Open Space" Conservation. ▪Collaborate with youth groups.

Table 2-3. Geographic area's co-management and relationship plan

Geographic Area	Working Groups	Relationships
North: Rio Grande and Luquillo	Coalición Pro CEN	Protection of the Northeast Ecological Corridor of Puerto Rico
	IDS: Iniciativa de Desarrollo Sustentable	Protection of the Northeast Ecological Corridor of Puerto Rico
	Bahia Beach	Rio Espiritu Santo Watershed Council
	Río Espíritu Santo Natural Reserve Las Picuas Reserve	Rio Espiritu Biological Corridor
	Rio Grande Municipal Planner	Recreation, gateway community, scenic byway
	Luquillo Municipal Planner	Regional trail, all lands recreation
	Geoambiente	Scenery, all lands conservation, and environmental literacy
South and West: Canovanas, Juncos, Las Piedras, Naguabo, and Humacao	La Mina CERT	Co-management Rio Sabana
	Humacao Natural Reserve	Regional trail
	Extension Agricola Las Piedras	Environmental literacy and resource protection
	'Producir'	Recreation
	Canóvanas Municipal Planner	Scenic byway, all lands recreation
East: Fajardo and Ceiba	Las Cabezas de San Juan: Fidecomiso de Conservación	Regional trail
	La Monserrate Public Park Seven Seas Natural Reserve: Fajardo	Protected area management
	Bosque Estatal de Ceiba	Watershed management
	Fajardo Municipal Planner	Watershed management
	Ceiba Municipal Planner	All lands and forest management
	CCP Interamerican University of Puerto Rico, Fajardo	ELAC

Geographic Area: El Norte/North

What is El Norte?

The El Norte (North) Geographic Area is delineated by the portion of the Forest within the boundaries of Rio Grande and Luquillo. Together, these two municipalities encompass 86.64 square miles, including 25.88 square miles of the El Yunque, which is about 30 percent of their combined total area and 59 percent of the total Forest area. Fifty-four percent of their combined area is classified as forest cover, followed by pasture (including agricultural lands) at 28 percent and urban/built-up at 9 percent (López-Marrero and Hermansen-Báez 2011). This sub-region has the highest proportion of forest cover of the three sub-regions and encompasses the largest area and proportion of national forest area.

El Yunque has a long historical relationship with its northern municipalities. Rio Grande and Luquillo are the municipalities with the main accesses to the Forest and its recreation sites. The direct linkage to the municipality of Rio Grande, and this municipality being called "City of El Yunque", shows its close connection with the Forest both for tourism and for land use management, since it is the municipality with the largest amount of forest lands within its borders.

Luquillo is also a main access to the Forest, and its historic scientific relationship with the Forest is vast. The Forest is also known as the Luquillo Experimental Forest, with a research site within the Forest inside Luquillo's municipal borders. Luquillo is also a municipality known for the many environmental organizations and stakeholders that uphold a strong connection with the forest management.

These historical bonds create the need to continue working with these municipalities and their communities as major stakeholders in land use in and surrounding the Forest.

Desired Conditions

Acknowledge the prevailing access system and the regional trail system to facilitate an organized and ordered system of entrances and access to El Yunque through the Rio Grande and Luquillo municipalities.

Goals

- Provide access to highly developed recreation settings of the Forest through the existing roads that are in the geographic region.
- Integrate trail systems that facilitate alternative access from the municipalities of Rio Grande and Luquillo to the recreational settings of the Forest.
- Incorporate appealing features of the cultural and natural resources of the municipalities of Rio Grande and Luquillo to the experience of accessing the Forest through this geographic region.
- Develop projects that will impact the economic and social wellness of Palmer.
- Maintain the scenic forest landscape of the El Norte area.

Objectives

- Identify a trail system that will connect to a regional trail system during the first 3 years of the Plan for the areas of Rio Grande, Luquillo, and the Northeast Ecological Corridor.

Management Strategies

- Develop collaborative, conservation and interpretation initiatives with the municipalities, residents, and organized regional groups through the plan duration.

- Work with partners and/or other agencies to establish environmental flow ranges based on an empirical water budget of the El Yunque for the watersheds that drain toward Northeast Ecological Corridor.
- Work with partners and/or other agencies to apply land conservation programs in forested areas of El Norte Region that include conservation contracts, special state conservation initiatives in private forest lands as "auxiliary forests", and potential land acquisition or conservation easement strategies.
- Expand use of Project Learning Tree, a Forest planning module among middle and high schools.
- Work with the communities in developing recreational alternatives outside the forest and bordering the Community Interface Resource Management Area. Share public outreach and education tools in order to identify potential recreational opportunities on adjacent lands.
- Establish collaborative watershed management strategies with the communities and municipalities of the geographic region.

Geographic Area: El Oeste y Sur/Southwest

What is El Oeste y el Sur?

El Oeste y Sur (west and south) Geographic Area is delineated by the portion of the Forest within the boundaries of Canovanas, Juncos, Las Piedras, Naguabo, and Humacao. Together, these five municipalities encompass 200.72 square miles, including 13.58 square miles of the El Yunque, which is about 6.8 percent of their combined total area and 31 percent of the total Forest area. Forty-four percent of Canóvanas, Juncos, Las Piedras, y Naguabo is classified as pasture (including agricultural lands)—the highest of the three sub-regions, followed by forest at 38 percent and urban/built-up at 10 percent (López-Marrero and Hermansen-Báez 2011).

While these municipalities are less roaded to access the Forest, the recently developing relationships have the great potential of creating a future impact on the concept of broader landscape perspective and fostering more connections with the communities within these municipalities. Canovanas has a roaded access to the Forest through the PR Route 186, which connects to the Rio Grande municipality and hence the forest. This road connection is being further developed by local municipalities and state agencies, which see a potential touristic access to the Forest. Municipalities in the southwest, like Naguabo, Juncos and Las Piedras, have identified the Forest as an important and valued scenic element of their daily life. Important also are the connections with environmental land-use initiatives in municipalities such as Humacao and their connection to the Forests' broader landscape perspective.

Desired Conditions

Community-based use of the Forest focuses on environmental education and community-based enterprises in the western and southern municipalities of Canovanas, Juncos, Las Piedras, Naguabo and Humacao.

Goals

- Provide the opportunity to develop community-based enterprises associated (see Appendix C) with the goods and services available from national forest lands in this geographic area.
- Integrate trail systems that facilitate alternative access and community-based enterprises in the western and southern municipalities of Canovanas, Juncos, Las Piedras, Naguabo, and Humacao.
- Incorporate the appealing features of the cultural and natural resources of the municipalities of Canovanas, Juncos, Las Piedras, Naguabo, and Humacao with the use of the Forest in this geographic region for environmental education and community-based enterprises.

- Support economic and social wellness of municipalities of the area through collaboratively identified projects.
- Maintain the scenic forest landscape of the El Oeste y Sur area.

Objectives

- Apply collaborative initiatives with the municipalities, residents, and organized regional groups for conservation and interpretation in the identified entrance to the Forest and the recreational facilities in the geographic region, with emphasis in educational activities (in open field beside the forested areas) of the region through the plan duration.
- Identify a Forest trail system that will connect to other areas of interest and other trails within the geographic region in the first 3 years of the plan.

Management Strategy

- Assist community-based enterprises associated with recreational opportunities, which are adjusted to the wilderness conditions area in the geographic area.
- Assist community-based enterprises associated with applicable agroforestry and forestry opportunities in the geographic area.
- Work with partners and/or other agencies to develop environmental flow ranges based on a water budget, to protect aquatic life.
- Work with partners and/or other agencies to establish land conservation programs in forested areas of El Oeste y Sur geographic region that include conservation contracts, special state conservation initiatives in private forest lands as “auxiliary forests”, and potential land acquisition or conservation easement strategies.
- Expand use of Project Learning Tree, a Forest planning module among middle and high schools.
- Work with the communities in developing recreational alternatives outside the Forest and bordering the Community Interface Resource Management Area. Share public outreach and education tools in order to identify potential recreational opportunities on adjacent lands.
- Establish collaborative watershed management strategies with the communities and municipalities of the geographic region.

Geographic Area: El Este

What is El Este?

El Este (the East) Geographic Area is delineated by the portion of the Forest within the boundaries of Fajardo and Ceiba. Together, these two municipalities encompass 59.49 square miles, including 4.29 square miles of the El Yunque, which is about 7.2 percent of their combined total area and 10 percent of the total Forest area. Forty-two percent of Fajardo and Ceiba is classified as forest cover, followed by pasture (including agricultural lands) at 28 percent and urban/built-up at 13 percent (López-Marrero and Hermansen-Báez 2011).

The municipal government planners for the municipalities of Ceiba and Fajardo on the eastern area of the Forest have started a dialog with the Forest to better understand the land use practices that are being implemented in the region. The Forest is also working on projects, such as the Rio Fajardo Watershed Restoration programs, which have created more alliances between the Forest and other major stakeholders in this geographic region.

Desired Conditions

The geographic area is a model for integrated watershed management in the eastern municipalities of Fajardo and Ceiba.

Goals

- Maintain the scenic forest landscape of the El Este area. Maintain the watershed connections from the higher elevations of the Forest to the coastal areas of the geographic region in order to produce environmental sustainability throughout the region.
- Incorporate the appealing features of the cultural and natural resources of the municipalities of Fajardo and Ceiba with the experience of using and conserving the forests within this geographic region.

Objectives

- Engage community-based enterprises, groups, and other organizations for rivers, floodplains, and riparian area restoration and conservation efforts.

Management Strategies

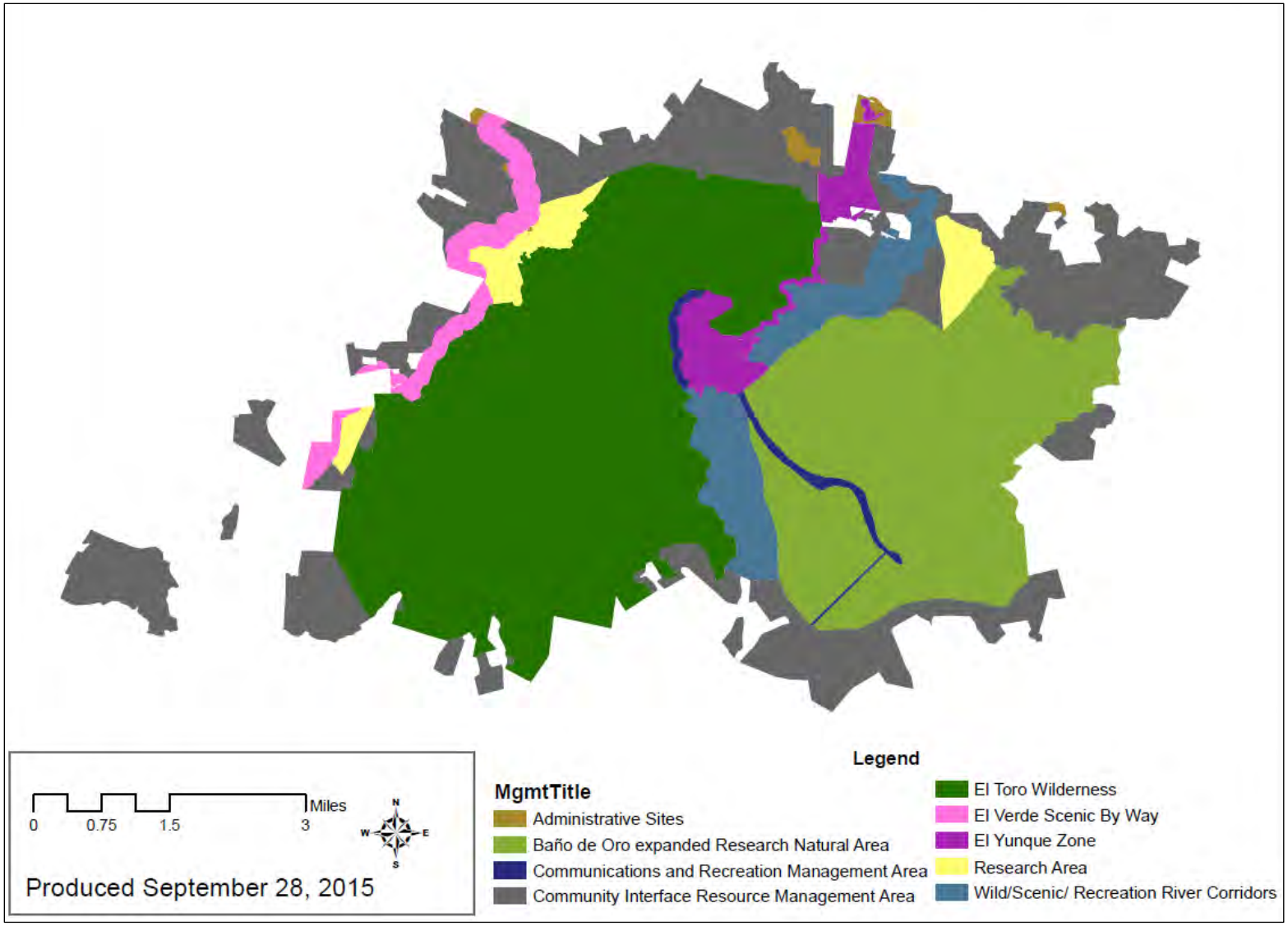
- Coordinate with land conservation programs that would include conservation contracts, special state conservation initiatives in private forest lands as "auxiliary forests", and potential land acquisition or conservation easement strategies.
- Work with the communities in developing recreational alternatives outside the Forest and bordering the Community Interface Resource Management Area. Share public outreach and education tools in order to identify potential recreational opportunities on adjacent lands.
- Establish collaborative watershed management strategies with the communities and municipalities of the geographic region.
- Expand use of Project Learning Tree, a Forest planning module among middle and high schools.
- Explore the possibilities of additional parking areas in private areas and the potential mobilization of trail users as part of municipality and community initiatives (example: El Toro Trail with community group "Producir Inc." from Canóvanas.
- Develop management strategies that include environmental flow ranges based on a water budget through the plan duration.

2.1.4 El Yunque National Forest Management Areas

The El Yunque has delineated nine management areas that extend throughout its land cover. The management areas consist of:

- Management Area 1 as an Administrative Management Area;
- Management Area 2 as El Yunque Recreation Zone;
- Management Area 3 as Communication and Recreation;
- Management Area 4 as Community Interface Resource Management Area;
- Management Area 5 as El Toro Wilderness;
- Management Area 6 as Research;
- Management Area 7 as Baño de Oro Research Natural Area;
- Management Area 8 as Wild and Scenic Rivers; and
- Management Area 9 as Scenic Byway Management Area (PR Route 186).

These management areas were developed to seek social, economic, and ecological sustainability within the Forest lands, while considering human uses. The management areas are organized in accordance to proposed uses as well as the sustainability needs of the Forest. Each management areas has different uses and plan components such as desired conditions, objects, goals, standards and guidelines and management strategies.



Map 2-2. Forest Plan management areas

Table 2-4. Forest Plan management areas

Management Area Number	Name	Acreage	Description	Management emphasis for the Management Area
MA 1	Administrative Sites	141	Areas occupied by El Portal Forest Center, Catalina Work Station, and other Forest Service administrative facilities.	▪ Emphasis is placed on transitioning to green buildings, recycling, use of alternative energy and reducing carbon footprint. Facilities are shared with partners.
MA 2	El Yunque Recreation Zone	844	El Yunque Zone covers El Yunque Trail, Mount Britton Trail, Forest Service Road 10, and Big Tree Trail.	▪ Area where emphasis is on use of existing developed recreation sites managed by capacity with strong emphasis on sustainability.
MA 3	Communication and Recreation Sites	241	Areas on El Yunque Peak and East Peak used for communication facilities, access roads to the communications sites, electrical powerlines and recreation sites.	▪ Communication facility footprint is reduced and facilities are energy efficient. ▪ Access to recreational settings that provide unique scenic and natural experience is maintained.
MA 4	Community Interface Resource Management Area	7,187	This consolidation of lands under one management area provides sections of the Forest where an assortment of resource management practices could be applied to encourage tropical forest management initiatives in the broader landscape of El Yunque.	▪ Management focuses on community-based collaborative management, and improves access to lower lands through improved existing roads and trails.
MA 5	El Toro Wilderness	10,352	Designated area on the southwestern portion of the Forest.	▪ Manage the area to maintain wilderness characteristics.
MA 6	Research Bisley and El Verde Station	789	Research, including long-term watershed studies and treatment/ control studies, is emphasized.	▪ Facilitate tropical ecosystem studies at the landscape scale.
MA 7	Baño de Oro Expanded Research Natural Area	6,441	Existing and proposed expansion of research natural area (RNA). The existing Baño de Oro RNA is expanded to encompass all of the primary forest area in east half of the Forest.	▪ Use for research and development, study, observation, monitoring, and educational activities that do not modify the conditions for which the RNA was established. ▪ Manage the area for natural conditions and maintain the unique features that the RNA was established to protect.
MA 8	Wild Scenic Recreation River Corridors	1,531	Corridor along the Icacos, Mameyes, La Mina, and Upper Mameyes designated as wild and scenic rivers	▪ Where protection of these rivers' outstanding characteristic is emphasized.
MA 9	El Verde-Scenic Byway Management Area	697	A 600-meter band of the PR Route 186 right-of-way from the Community Interface Resource Management Area.	▪ Protect scenery and develop PR Route 186 as a scenic byway.

Table 2-5. Management area acreage

Management Area	Puerto Rico Conservation Trust [1]	Not Recorded	Recorded	Undetermined	Grand Total
Administrative Sites			140.8		141
Baño de Oro expanded Research Natural Area			6,440.8		6,441
Communications and Recreation Management Area			241.0		241
Community Interface Resource Management Area			7,187.1		7,187
El Toro Wilderness			10,351.8		10,352
El Verde Scenic Byway	20	13.9	697.3		731
El Yunque Zone			844.2		844
Research Area			789.1		789
Wild/Scenic/ Recreation River Corridors			1,530.8		1,531
(blank)	35.4	305.8		435.5	777
Grand Total	**55.4**	**319.7**	**28,223.0**	**435.5**	**29,034**

[1] Lands acquired by Puerto Rico's Conservation Trust for future transfer to El Yunque NF.

Management Area 1: Administrative

Desired Conditions

- Public facilities are attractive, clean, safe, well maintained, and provide universal access.
- Administrative facilities support high quality resource protection and public service.
- Interpretive and information services help visitors enjoy the Forest and develop conservation ethics for Puerto Rico and tropical forests worldwide. Highly trained, equipped, and visible Forest personnel and law enforcement officers ensure that visitors have a safe, enjoyable, and enriching experience.
- The needs of people who come to visit and use the Forest are met with services and facilities, which recognize and respect Puerto Rico's unique character. Visitors feel welcome by the service they receive from employees who exemplify Puerto Rico's tradition of hospitality.

Objectives

- Within 4 years of the Plan's approval facilities use alternative sources of energy.

Standards and Guidelines

G1 Maintain or enhance habitats for cavity-associated wildlife, when habitat trees or artificial structures do not compromise the safety of Forest users.

Management Area 2: El Yunque Recreation Zone

Most of the recreation facilities on the El Yunque National Forest are concentrated in this management area locally referred to as the PR Route 191 Recreation Corridor. PR Route 191 is a state road that runs north to south though the center of the Forest. The road and most of the recreation sites and trails were constructed during the 1940s by the Civil Conservation Corps. There are numerous trailheads, parking areas, and primitive campsites located along the Corridor. Also located here is a small pocket of privately owned businesses on private lands which sell food, beverages, and souvenirs to Forest visitors.

The recreation facilities that are located along the Corridor starting at the entrance to the Forest are:

- El Portal Visitor Center
- Las Cabezas Vista Point
- La Coca Falls
- Yokahu Observation Tower
- Palma de Sierra Picnic Area
- Caimitillo Picnic Area
- Palo Colorado Recreation Area
- Baño Grande
- Baño de Oro
- Mt. Britton Observation Tower
- Rio Sabana Picnic Area (2007): Is located on South PR Route 191 beyond a major landslide that occurred in the mid-1970s and is not accessible from the north side of the Forest.
- The Yokahu Observation Tower (1964) and the El Portal Visitor Center (1996) have been the only new recreation facilities added to the Recreation Corridor.

This management area provides the public a variety of recreation opportunities in visually appealing and environmentally healthy settings. Concentrated use and areas of high density recreation activity are found in this management area. Facilities are provided to enhance the quality of the recreational experience and/or mitigate damage to the affected ecosystems.

Desired Conditions

- Area will be managed to meet the recreational opportunity spectrum setting of "rural and roaded natural."
- Constructed facilities are similar to those found in rural areas around the Island and in harmony with the Forest scenery and landscape and are appropriate to the recreational opportunity spectrum class.
- The Forest provides exhibits and general information to help visitors enjoy the Forest and develop a conservation ethic for Puerto Rico and tropical forests worldwide.
- Historic recreational assets are managed and interpreted.

Goals

- Promote recycling and leaving the Forest clean.
- El Portal Visitor Center is recognized as a world-class interpretive environmental education and training facility.
- Provide safe and well-maintained facilities throughout the year especially during high visitation periods on weekends and holidays.
- Manage for high use during weekends, holidays, and high visitation seasons.

Objectives

- Facilities for recreation activities such as hiking, camping, and trail systems are restored where needed.
- Establish and implement "trash-free zones" in all recreation sites within the first 3 years of the Plan's approval.
- Interpretive exhibits at the visitor center are revised and updated within 3 years of the Plan's approval.

Standards and Guidelines

Note: Refer to the Chapter 3.3.2 Recreation, Management Strategies section.

Increase the operational maintenance in the upper zone of this management area.

Management Area-3: Communication and Recreation

The El Yunque communication and recreation sites are located at the top of El Yunque Peak and East Peak mountains. Its key values are radio-electronic communication and scenic recreation, and it possesses cultural resources. Less than 6 acres are subject to development for communication sites use. Both Forest Service roads 10 and 27 function as an access to the communication sites, as well as their use as trail to hike to Pico del Este, and Pico de El Yunque, respectively.

Desired Conditions

- Communication facilities on El Yunque National Peak and Pico del Este serve the needs of the people of Puerto Rico, the U.S. Virgin Islands, and surrounding waters.

- Opportunities for dispersed recreation and research are provided to the extent such use does not conflict with the primary communication facility objective of the management area.
- The Forest protects and interprets heritage resources on this management area.
- Facilities are energy efficient.
- The Forest accommodates communication uses that cannot be met off-Forest; however, communication sites will occupy the same or reduced areas on the peaks.

Goals

- Administer special-use permits for communication facilities, following direction in communication site plans for El Yunque Peak and East Peak.
- Consolidation of facilities and improving technology continues to reduce visual and other environmental impacts, and provide improved communication services. There are fewer buildings and antennas and less electronic interference than at present.
- Visual impact of the sites is reduced by consolidation of facilities, emphasis on blending facilities' profiles into the natural landscape, camouflaging with neutral colors, and a reduction in the use of the exterior lighting.

Objectives

- Eliminate unnecessary facilities and re-establish native vegetation where possible within 5 years of Plan approval.
- Complete special-use compliance inspections annually.
- Remove communication facilities to the extent feasible from the east end of the El Yunque Site and provide for dispersed recreation/vista point uses within 6 years after the Plan's approval.

Standards

S1 No further building permits for this area will be authorized.

S2 No additional developed sites are allowed.

S3 Permit no additional land clearing beyond areas currently under special-use permit.

S4 Permit no additional road construction in this management area.

S5 Do not permit studies which involve manipulations of natural vegetation or soils to extend into Primary Cloud Forest.

Guidelines

G1 Cooperate with Federal and local law enforcement authorities and private security services to provide for public safety and protection of communication facilities.

G2 The Forest should reduce the visual impacts of facilities to improve the existing visual quality level.

G3 Coordinate permission for such studies with the International Institute of Tropical Forestry.

G4 Reduce the visual impact of the communication facilities to improve the visual quality level of the area.

G5 Implement specific technical and administrative direction provided by the El Yunque Peak electronic sites plan. Concentrate similar uses (for example, transmission antennas versus reception antennas) within zones as provided in the site plan.

G6 Consider the effects on scenic quality when conducting any facility modification.

Management Strategy

- Use signing and public information efforts to encourage trail access to El Yunque Peak to minimize hazardous foot traffic on Forest Road 10.
- Cooperate with stated agencies and private stakeholders to re-establish access after tropical storms.
- Develop a plan of technical and administrative direction for the East Peak site.

Management Area 4: Community Interface Resource Management Area

The Community Interface Resource Management Area (CIRMA) merges segments of the Forest that were considered for Timber Demonstration, Developed Recreation and Integrated Management in the 1997 plan. This consolidation of lands under one management area provided sections of the Forest where an assortment of resource management practices could be applied to encourage tropical forest management initiatives in the broader landscape of El Yunque. These lands are under the 600 meters (1,968 feet) elevation mark and represent the transition between Federal lands toward private areas that are within the proclamation boundary of the Forest. The CIRMA embody the most accessible lands for community groups and municipalities that are part of the regional geographical scale considered for the Plan.

The CIRMA is composed by the lower elevation areas of the Forest and by areas where plantations for potential timber projects were established in previous management plans. The absence of timber stand improvements in the planted areas and the impact of natural disturbances have created a mosaic of vegetation in these areas where introduced species, like the mahogany, share the forest composition with native species. The stand dynamics of these forests is different from other mature forest within El Yunque and their succession will create a combination of species identified as an “emerging forest” (Lugo et al. 2004, 2009; Mascaro et al. 2013).

The CIRMA integrates areas that were previously managed as plantations, riparian zones, flatlands, recreational areas, and areas with roads, and other mature vegetation types. The CIRMA provides opportunities for Forest product utilization strategies that are applied in other tropical forests that can be coordinated with community groups and residents that are neighbors of these areas. The application of appropriate agroforestry initiatives and analog forestry practices represent restoration initiatives with potential economic revenues. The process of establishing an analog forestry site can be started with community organizations, local governments, and also in collaboration with local non-governmental organizations or any other person or groups interested in the concept that has an area of degraded land available to be restored by using the analog forestry methodology. This methodology includes:

- Determining the physiognomic formula of the mature or climax forest you want to restore.
- Calculate the physiognomic gaps of the vegetation structure you are interested to restore.
- Determines the objectives of the site. It can be overall restoration with native species or consider alternatives of products for consumption, and even disperse recreation activities.
- Select species that are suited to the site conditions, the objectives for the site, and the physiognomic formula gap, to identify native species that best meet the defined criteria and considering the available species in the area.

This management area is critical for the identified four pillars for success of the Plan:

- Ecological, Social and Economic Sustainability
- Collaborative Adaptive Management
- Environmental Literacy and Education

- Access, Tourism and Recreation

The CIRMA is the best example of the shift from Forest Service-driven-management priorities to a more collaborative management, and is the identified area where sustainable forest practices could be considered with a community-based co-management approach. This means that this management area opens the door to a day-to-day co-management process with local community, which connects the Forest to the communities in a way where educational, recreational, and other opportunities are developed.

Desired Condition

- To have a healthy and sustainable forest landscape in the El Yunque Region that contributes to providing for economic and social sustainability.
- Provide disperse camping opportunities.
- The public understands and recognizes the links of the regions with the protected areas of the Forest through an all-lands approach and the management strategies applied in the CIRMA.
- A healthy environment is distinguished with an integrated human ecosystem framework where the natural and social systems are acknowledged for the region.
- The CIRMA provides new recreational opportunities providing access to community groups and municipalities that are part of the regional geographical scale considered for the Plan.
- The communities and regional organizations are integrated in the recreation and tourism opportunities considered in the Forest.
- The Forest's regional identity developed through the CIRMA management strategies facilitates the adaptive management initiatives with the participation of community groups that strengthen the monitoring plans at the regional level.
- The region is environmentally literate; communities are educated on Forest management, making them aware of the goods and services received from the conservation strategies in which they participate.

Goals

- Work with local communities and community groups to have their participation in the consideration of initiatives and projects.
- Provide wood products and other forest products to promote local businesses, including local wood products that could be sold by artisans and local artists.
- Develop regional product labels for projects and products in association with the participants of the initiatives.
- Establish and maintain social and natural indicators that monitor the environmental and social wellness.
- Identify areas in the CIRMA that can be considered for recreational collaborative projects in at least three municipalities in the first 5 years of the Plan.
- Increase the recreational opportunities by at least 25 percent with the collaboration or participation of community groups in the region through the Plan period.
- Establish at least two municipal and Forest collaborative initiatives related to recreational activities for the residents.
- Integrate at least one collaborative monitoring strategy by geographic region.
- Use the flora and fauna of the Forest to integrate collaborative management and monitoring with civic groups.

- Develop and integrate an environmental literacy initiative in the region directed to create a network of schools that can share data from monitoring, management, and conservation projects in the region.

Standards

S1 Apply best management practices (under Forest Service regulations and the Natural Resource Conservation Service) for the proposed projects.

S3 Do not remove native trees and native vegetation on the stream bank except at designated crossings or for ecological or stream restoration.

S4 Remove abandoned or non-used structural barriers within rivers and creeks.

Guidelines

G1 Conduct enrichment planting strategies in the riparian zone with native species.

G2 Retain stumps, standing snags, den trees, and coarse woody debris. Exceptions may be made where necessary to control insects or disease outbreaks or to provide public and employee safety.

G3 Retain dead and downed logs or other woody debris in riparian zones unless removal is considered necessary for the protection of human life and property.

G4 Forest product projects should maintain forest canopy coverage of the area. Prevent canopy openings larger than 0.1 acre of the prevailing coverage to permit the retention of trees which are not yet mature.

G5 Tree cutting will be allowed to: (1) salvage trees killed or damaged, (2) control insect and disease outbreaks, (3) protect human health and safety, (4) protect resources, or (5) move toward the desired conditions.

G6 Consider community and participatory initiatives for the application of management activities in the CIRMA.

G7 The Forest access to recreation sites and Forest boundary considers the needs and abilities to produce sustainable use.

Management Strategy

- Promote a closer working relationship with local communities and encourage the Forest Service personnel to ensure the participation of community leaders and stakeholders.
- During trail planning, include discussions and input from other land management agencies (Department of Natural and Environmental Resources), non-profit organizations (CEN-Coalition), special-use permit holders (outfitters), and local municipalities, as well as other interested members of the public.
- Link community and municipal programs with projects in the CIRMA through a collaborative process in which the Forest provides the technical assistance and resources to empower local sustainable projects that could be reproduced through the region.
- Develop projects that encourage Forest management initiatives with special focus on native plant restoration that could be applied to tropical Forests.
- Develop appropriate agroforestry applications in the El Yunque Region.

- Involve community groups to review and categorize potential projects in the CIRMA. Include in the discussion representatives from the commercial stakeholders in the region toward the consideration of sustainable initiatives.
- Work with local communities and community groups to identify activities that improve land conditions (stewardship contracting and agreements).
- Consider increasing the density of native bees and other pollinators in the Forest in areas where this type of practice could benefit the forest succession. Develop agreements with communities that could receive the economic benefits of marketing honey.
- Collaborate and use input from other land management agencies (Department of Natural and Environmental Resources), non-profit organizations (CEN-Coalition), special-use permit holders (outfitters), and local municipalities, as well as other interested members of the public to promote hiking programs within the CIRMA and throughout the Forest.
- Consider municipal collaboration projects to develop low impact recreational sites and cultural resource interpretation programs.
- Consider expanding community outreach education using accessible areas of the CIRMA for education initiatives with open classrooms as a part of the "Children's Forests" initiatives at El Yunque.
- Coordinate Forest product projects with the interpretation and environmental education programs.

Forest Products Strategy

- Use timber sale contracts to accomplish the following:
    - Provide wood products that are post/pole sizes less than 8 inches DBH. Among the limitations to removing these post/pole products would include the requirement that no canopy openings larger than 0.1 acre would be created.
    - The trees removed would include both native and nonnative species.
    - The regrowth of any nonnative species would be discouraged and efforts would be made to promote the regrowth and dominance of native species.
    - Part of the purposes of the timber removals considered is to promote Forest management treatments toward a mature resilient forest dominated by native species.
- Other non-timber forest products would be offered through special forest products permits.

Management Area 5: El Toro Wilderness

The El Toro Wilderness Area is a congressionally designated area characterized by undeveloped Federal lands that retain primitive character without any permanent improvements or human habitation. It is managed to preserve its natural conditions. The Caribbean National Forest 2005 Act officially designated 10,000 acres of the Forest as a wilderness area.

Desired Condition

- El Toro Wilderness area exhibits primitive qualities. Opportunities for research, exploration, solitude, risk, challenge, and primitive recreation are widespread. On the trail system, opportunities for solitude are moderate to high, with few human encounters expected.
- Opportunities for solitude are high when traveling cross-country with almost no human encounters expected. Campsites are limited and are located adjacent to the existing trails. These sites

accommodate moderate use and limited group size. Directional and regulatory signs are found at trailheads outside of the wilderness area, although there are some signs at trail junctions. There are several rain shelters located along the trails.

- Ecosystems are influenced by natural processes with little or no human intervention. Geological and ecological processes operate relatively free from the influence of humans. Any influences upon these processes by humans are intended to protect human life and threatened and endangered plant or animal species or other listed sensitive species. Predominately diverse, native vegetation results from natural succession and disturbance processes; while nonnative vegetation is rare and controlled. The recreation opportunity spectrum is primitive.
- The recreation opportunity spectrum setting will be managed for "primitive" class, except along trails, which will be managed for "semi-primitive non-motorized" vehicles.
- Interpret natural, cultural, and historic features of this area outside of the management area (for example locate interpretive signing of wilderness features outside the wilderness).
- Maintain a scenery management landscape character of "naturally evolving".

The El Toro Wilderness Area

Objectives

- Complete the wilderness plan in 2 years after plan approval.
- Restore and maintain Tradewinds and El Toro Trail.
- Remove undesired structures and signs during planning period.
- Eliminate existing trails shelters.
- Remove other existing facilities (including trail shelters) to the extent practical.

Standard and Guidelines

S1 Use only hand tools and natural materials and native species in watershed improvement projects.

S2 Do not permit salvage of timber.

S3 Implement and maintain habitat improvements, such as Puerto Rican Parrot nest cavities, in a manner compatible with the goals and objectives of wilderness as listed in FSM 2320.

S4 Conduct wildlife and plant habitat and population surveys and monitoring in a manner compatible with the goals and objectives of Wilderness.

S5 Permits for the collection or removal of plants or animal specimens will be reviewed by the Forest biologist to make sure they comply with standards for forest product extraction and will be only considered for nonnative species. Issue permits only for scientific or educational purposes.

S6 Authorize no new special-use permits for facilities (for example, electrical transmission lines) or occupancy, and to the extent practical phase out existing permits. Authorize special-use permits for non-occupancy use (for example, outfitter guides) only to the extent compatible with wilderness character and in the public interest.

S7 Pending the implementation of a “limits of acceptable change” analysis in the wilderness management plan, manage recreation use within the following limits:

- Maximum encounters with other groups along established trails is six per day.
- Maximum encounters with other groups in trailless areas is one per day.
- Limit group size to six people or less, unless otherwise authorized by permit.

S8 See Forest-wide for direction regarding camping.

S9 Implement management actions to control or restrict visitor use when user impacts result in a change in biological resource or social conditions that approach the established limits of acceptable change.

S10 Design, construct, and maintain trails to meet the “most difficult” trail standard.

S11 Permit only hiking use of trails.

S12 Do not construct new trails.

S13 Allow visitors to experience a wilderness environment by not reducing or eliminating personal risk associated with adverse weather conditions, isolation, natural physical hazards, and primitive travel and communications.

S15 Reconstruct and maintain trails to the minimum standard necessary to minimize or prevent resource damage and protect the safety of the wilderness user. Trails will appear to be part of the wilderness environment.

S17 Install and maintain interpretive signs or bulletin board at trailheads to wilderness, providing information on the significance of wilderness, management practices, rules and regulations, and emergency information.

G1 Use regulatory or informational signs, where control of resource damage is needed and other corrective measures have proven unsuccessful.

S19 With the exception of necessary regulatory and informational signs within wilderness, locate signs only at trail interactions. Limit the information on such signs to direction and destination.

S20 Limit facilities to hiking trails and necessary signing.

S21 Coordinate with researchers to ensure that only observation studies occurs in the management area. The "control" facets of treatment versus control studies could occur within the management area, but not the "treatment" facets.

S22 Use only unobtrusive plot markers and do not paint or flag trees.

S23 The forest inventories and protects heritage resources, and provides any interpretation of heritage resources, but only outside this management area.

Management Strategy

- Establish collaborative working groups to maintain the national recreation trails of El Toro and Trade Winds.
- Foster creation of community-based enterprises that provided outfitter services.
- Collaborate with U.S. Fish and Wildlife Service on parrot recovery programs.

Management Area 6: Research

Desired Condition

- Provide opportunities for long-term intensive scientific investigations, including treatment versus control research.
- Contribute to improving understanding, protection, and management of tropical forests worldwide.
- The recreation use is associated primarily with developed recreation sites adjacent to the area, existing trails through or near the area, and scenery viewing from roads.

Standards

S1 Experiments do not detract from future scientific studies or management options by not leaving behind residual equipment or persistent chemical or biological changes.

S2 Construct only those roads or facilities needed to accomplish research objectives.

S3 Interpretation of heritage resources will not occur inside this management area.

Guidelines

G1 Salvage timber cut for experimental use or damaged by natural disasters only if such salvage does not detract from ongoing or future scientific studies. Priority use of such material is for research.

G2 Locate studies so as to efficiently use the management area in such a manner as to maximize the remaining management area available for future research.

Management Strategy

- Coordinate with the International Institute of Tropical Forestry and other cooperators to make the best use of the research opportunities provided by the Forest.
- Coordinate management of recreation use with International Institute of Tropical Forestry.

Management Area 7: Baño de Oro Research Natural Area

Bano de Oro Research Natural Area was originally established in 1968 as 1,840 acres. This management area includes the proposed expansion of the Bano de Oro RNA to 6,441 total acres.

Desired Condition

- The research natural area is a biological reservoir providing protection for rare and endemic ecosystems and species, specifically Lower Montane Rain Forest, Montane Thicket, Palm Brake, Elfin Woodland, Puerto Rican parrot, and rapidly flowing rivers and streams.
- The area provides opportunities for scientific study of Puerto Rico's native forest through non-manipulative research and observation studies.
- The area is essentially undisturbed by man and provides a reference area against which human altered environments in Puerto Rico and elsewhere in the tropics can be compared.
- The mature forest and functional wetlands within this area are maintained or enhanced.
- Non-research related facilities will be removed from the area when feasible to do so.

Objective

- Designate the expanded portion of Baño de Oro as a Research Natural Area within 3 years after the Plan's approval.

Standards

S1 Sign boundaries at entry points.

S2 Authorize no new special-use permits for facilities (such as, electrical transmission lines) or occupancy.

S3 Authorize special-use permits for non-occupancy use only for appropriate research purposes in coordination with the International Institute of Tropical Forestry.

S4 Permit installation of temporary structures, such as a tower for collection of weather data, necessary to accomplish research objective. Coordinate with the International Institute of Tropical Forestry to ensure that such structures do not conflict with other ongoing studies.

S5 Construct and maintain only those administrative trails needed to accomplish research ecological management objectives.

S6 Construct no new permanent facilities.

S7 Interpretation signage of heritage resources will only occur outside the management area.

Guidelines

G1 Discourage recreation use by providing limited access.

G2 Implement only those soil and water improvements necessary to meet the objectives of research natural area, which should be in exceptional circumstances.

G3 Measures to restore soil stability of forest health following natural disturbances will only be those needed to protect the features for which research natural area is established.

G4 Implement and maintain habitat improvements, such as Puerto Rican parrot nest cavities, in a manner compatible with the desired conditions of the research natural areas.

G5 Phase out existing permits.

G6 Scientific studies do not modify the Forest.

G7 Some deliberate manipulation actions may be needed in order to maintain the unique features that the research natural area was established to protect, such as the eradication of nonnative invasive species.

Management Strategy

- Coordinate with the International Institute of Tropical Forestry to ensure that only non-manipulative research and observation studies occur in the management area. The "control" facet of treatment versus controlled research studies should occur within the management area, but not the "treatment" facets.
- Approval of the land and resource management plan, concurrence of International Institute of Tropical Forestry Station Director, and completion of final required documents will establish the expansion of Baño de Oro Research Natural Area to 6,441 total acres.

Management Area 8: Wild and Scenic Rivers

The wild and scenic river segments on El Yunque National Forest were designated by Congress in the Caribbean National Forest Wild and Scenic River Act, December 2002.

Desired Condition

- These river segments will be managed to preserve their outstanding remarkable values and free-flowing conditions.
- River segments designated "wild," "scenic," or "recreation" rivers for the Rio Mameyes, Rio de la Mina, and Rio Icacos Rivers are protected.
- All rivers will remain free of impoundments within the existing Forest boundary.
- Opportunities for treatment versus control research will be provided, as long as such use does not detract from "wild," "scenic," or "recreation" river qualities.
- Access points, such as trailheads and parking lots, are strategically located in the corridor and watershed to aid in the dispersal of recreation use.
- Interpretation of the outstandingly remarkable values of the rivers will be available in various forms to the public, from low-key, off-site interpretive materials and technologies, to interpretive signs at appropriate locations.
- The Forest manages to maintain the unique characteristics and scenic values of the river corridors. Generally allow natural processes to determine the composition and distribution of plant species. Invasive plants and species will be controlled. Streams will be managed for mountain mullet, river shrimp, and goby where conditions are favorable.
- Management may be utilized to maintain the unique feature that the research natural area was established to protect (such as, eradication of nonnative invasive species and the use of prescribed fire).

Desired Condition for the "Wild" Segments

The Rio Mameyes has the only "wild" segment. Management of the "wild" segment of the river corridor will be focused on protecting and preserving natural processes with minimal human influences and have limited access.

Some research trails will be found in this natural area. Management of the "wild" segment will have limited access to persons doing research and all research will need to be properly permitted. The area will be managed to retain its general undeveloped nature. Access is limited via Forest Service Road 27 (East Peak Road) which is outside of the river corridor. The limited access and activity in this area will basically allow nature to run its course without human intervention or interaction.

Desired Conditions for the "Scenic" Segment

The management of the "scenic" segment of the river corridor will be focused on maintaining and enhancing the near-natural environment. Riverbanks will be undeveloped and primitive, but may be accessible in places by trails. Recreation opportunities will be designed to provide a natural-appearing setting. Research activity on or near these segments will be consistent with protecting the rivers free-flowing and scenic values. The Rio Icacos is more diverse than Rio de la Mina and Rio Mameyes because of its length and location. No developed facilities are found near these river corridors. The "scenic" segments are located in isolated areas and are not easily accessible. There natural setting and isolation make them very attractive to those who are willing to hike through challenging terrain. River-oriented recreation opportunities will be emphasized in favoring hiking, viewing wildlife, and nature observation. Use will be managed to provide a level of contact among visitors and impacts to the outstandingly remarkable values that are consistent with the river classification. The "limits of acceptable change" concept will be used to monitor levels of use within the river corridor.

Desired Conditions for the "Recreational" Segment

Management of the "recreational" segment of the river corridor will be focused on providing recreation in natural-appearing or culturally-influenced settings. Puente Roto and La Mina Falls are heavily visited during holidays and summer weekends. Parking areas should be delineated at Puente Roto and Angelito trailheads to establish and manage capacity at these areas. Invasive species (when detrimental) will be controlled and eradicated. River-oriented recreation opportunities will be emphasized favoring hiking, viewing wildlife, and nature observation. Use will be managed to provide a level of contact among visitors and impacts to the outstanding remarkable values that are consistent with the river classification. The "limits of acceptable change" concept will be used to monitor levels of use within the river corridor. Parking layout and access to the river at Puente Roto should be improved. Access for use and enjoyment of the rivers will be provided, consistent with the river classification at Big Tree Trail, Angelito Trail, La Mina Trail, and La Coca Trail.

Goals for Río Icacos

- Improve water quality by reducing sedimentation from landslides and PR Route 191.
- Maintain ditches and culverts on the section of PR Route 191 closed to public traffic to reduce the concentration of water flow onto slopes prone to landslides.
- Stabilize areas of exposed soil caused by landslides.

Goals for Río Mameyes

- Improve recreation opportunities and water quality by providing facilities at Puente Roto.
- Improve the parking layout at Puente Roto. Implement a segment-wide, trash-free zone.

Goals for Río de la Mina

- No trash is left by users.

Wild Rivers: Standards

S1 All water supply dams and diversions are prohibited.

S2 No development of hydroelectric power facilities is permitted.

S3 No flood control dams, levees, or erosion control work is allowed.

S4 No roads or other provisions for overland motorized travel are permitted within 0.25 mile of the riverbank.

S5 Major public-use areas, such as large picnic areas, interpretive centers, or administrative headquarters, are located outside the "wild" rivers area. Recreation developments are limited to trails and unobtrusive bridges and signs, and improvements necessary for resource protection.

S6 A few existing structures could be allowed assuming such structures are not incompatible with the essentially primitive and natural values of the river and its corridor. New structures are not allowed except in rare instances to achieve management objectives (such as, structures and activities associated with fisheries enhancement programs could be allowed).

S7 No hunting or fishing is allowed.

S8 No mining activity to occur. Rock extraction is prohibited.

S8 Manage historic sites consistent with Forest-wide standards. Stabilize and protect existing sites.

S9 No development of hydroelectric power facilities is permitted.

Wild Rivers: Guidelines

G1 Follow the Scenery Management System guidance when conducting any management activity.

G2 Use native plant species where possible when restoring impacted sites.

G3 Allow woody debris to accumulate along river and shorelines to maintain natural character of river.

G4 Cutting of trees is not permitted except when needed in association with a primitive recreation experience (such as clearing for trails and protection of users) or to protect the environment (such as control of fire).

G5 Manage habitat of mountain mullet streams as a first priority.

G6 Remove invasive wildlife species such as feral cats, dogs, and small Indian mongoose.

Scenic Rivers: Standards

S1 All water supply dams and major diversions that would have a direct and adverse effect on the values for which the river area is included in the national system are prohibited. Modest diversions are allowed only if there would be no direct and adverse effect on river values.

S2 No development of hydroelectric power facilities is allowed.

S3 Flood control dams and levees are prohibited. Erosion control treatments can be implemented if they do not detract from river values.

S4 Roads should generally not be visible from the "scenic" river segments. No new road construction is permitted within 0.25 mile of these rivers.

S5 Larger-scale, public-use facilities, such as large picnic areas, public information centers, and administrative headquarters, are well screened from being viewed while on the designated rivers. Modest and unobtrusive recreation facilities are permitted.

S6 New structures that would have a direct and adverse effect on river values are not allowed.

S7 Vegetation management is located at least 0.25 mile away from the designated rivers suitable. Vegetation treatments for wildlife habitat improvement or to control invasive plant species are allowed provided that such practices do not substantially adversely affect the river and its immediate environment. The river should be maintained in its near natural environment.

S8 No mining activity will be allowed. Rock extraction is prohibited.

S9 Control invasive wildlife species such as feral cats, dogs, and small Indian mongoose.

S10 No hunting or fishing is allowed.

S11 Limit land-based permits to groups of no more than 15 (including guides).

S12 Allow access to La Mina site and Rio de la Mina Trail only to guided tours with a special-use permit.

S13 Primitive camping at designated areas by permit only.

S14 No camping within 100 feet of rivers. Evidence of use to be noticeable, but not dominant. No fires or fire rings allowed. Use only commercial cooking apparatus.

S15 Only hikers permitted on trails. No horses, bikes, or off-highway vehicles are permitted on trails.

S16 Tubes and rafts are not permitted in rivers.

S17 No development of hydroelectric power facilities is permitted.

Scenic Rivers: Guidelines

G1 Follow the Scenery Management System guidance when implementing the Forest Plan.

G2 Use native plant species where possible when restoring impacted sites following FSM 2070.

G3 Allow woody debris to accumulate along river and shorelines to maintain natural character of river.

G4 Manage historic sites consistent with Forest-wide direction. Stabilize and protect existing sites.

G5 Implement “Pack-it-in and Pack-it-out” and “Leave No Trace” concepts.

Recreation Rivers: Standards

S1 Vegetation management is located at least 0.25 mile from the designated rivers. Vegetation treatments for wildlife habitat improvement to control invasive plant species are allowed provided that such practices do not substantially adversely affect the river and its immediate environment. Woody debris is allowed to remain along the river bed and its banks.

S2 Low dams, diversion works, rip rap, and other minor structures are allowed provided the waterway remains generally natural in appearance.

S3 No development of hydroelectric power facilities is allowed.

S4 Flood control dams and levees are prohibited. Erosion control treatments can be implemented if they do not detract from river values.

S5 Paralleling roads could occur on one side of the river. There can be several bridges crossings and numerous river access points. New road construction is limited to access and parking for developed recreation sites.

S6 Picnic areas and trails constructed may be in close proximity to the river.

S7 New structures are allowed for recreation use.

S8 Limit land-based permits to groups of no more than 15 persons (including guides).

S9 Allow access to La Mina site and Rio de la Mina Trail only to guided tours with a special-use permit.

S10 No mining activity will be allowed. Rock extraction is prohibited.

S11 Allow primitive camping at designated areas by permit only. No camping within 100 feet of rivers. Evidence of use to be noticeable, but not dominant. No fires or fire rings allowed. Use only commercial cooking apparatus.

S12 Only hikers permitted on trails. No horses, bikes, or off-highway vehicles are permitted on trails.

S13 Tube and rafts are not permitted in rivers.

S14 Conduct site condition inventory to determine use patterns, site conditions, and their specific limits to be monitored. Rehabilitate degraded sites and if necessary, relocate or restrict use at those sites.

S15 Prohibit barbeque grills within full bank stage at all river segments.

S16 Prohibit glass containers within full bank stage at all river segments.

Recreation Rivers: Guidelines

G1 Minimize trash impacts at La Coca and Juan Diego sites.

G2 Implement “Pack-it-in and Pack-it-out” and “Leave No Trace” concept.

G3 New development, bridge replacements, and landslides reconstruction will be designed to minimize disturbance of riparian areas.

G4 Focus wildlife interpretation on highly visible species.

G5 Stabilize dispersed recreation sites that have exposed and/or highly compact erodible mineral soil.

G6 Manage trails in corridors for only that hiking use which is compatible with the outstanding remarkable values of the designated rivers.

G7 No type of watercraft or inflatable water play items will be allowed on the rivers. Horses, mountain bikes, and off-highway vehicles are not allowed in all river segments.

Management Strategy

Management direction for the three rivers consists of the National Wild and Scenic Rivers Act, the designation legislation, the Caribbean National Forest Comprehensive River Management Plan, and all other applicable Federal laws, regulations, and plans.

Table 2-6. Wild, scenic, and recreation rivers (designated December 2002)

River	Classifications	Length (miles)
Río Mameyes	Wild Scenic Recreation	1.6 1.4 1.0
Río de la Mina	Scenic Recreation	1.2 0.9
Río Icacos	Scenic	2.3

- A capacity study should be conducted to establish maximum capacity during high use periods.
- The feasibility of adding other improvements at the Puente Roto recreation area will be studied. Improvements could include sanitary facilities, picnic grills, tables, and picnic shelters.
- Work to improve public awareness and understanding of the outstanding remarkable values of the three wild and scenic rivers and the National Wild and Scenic River System.
- Evaluate ways to address capacity issues at La Mina Falls and Puente Roto.
- Conduct a capacity study for Puente Roto.
- Conduct a capacity study for the La Mina Falls area.

Management Area 9: Scenic Byway Management Area: PR Route 186

The PR Route 186 road is a scenic route within the forest and expands to the broader landscape.

Desired Conditions

- This management area will help disperse the recreation users of the Forest and will help reduce the crowding along the PR Route 191; which in turn will help to improve the sensitive ecosystem affected by crowding.
- The Forest maintains a visual experience through the vistas and natural elements; as well as the human-made or historic features within this management area.
- The Forest maintains the environment in its utmost natural state. The elements such as geological formations, fossils, bodies of water, flora and fauna, which preceded human population, are well maintained along the route.
- The public enjoys the western side of the Forest by accessing it through this Civilian Conservation Corp-era historic route.
- The historically relevant features and spots are interpreted to the public for the purpose of educating their historic context along the route.
- The Forest's historic features associated with cultural heritage are well maintained and properly managed.
- The route allows the public to access recreation opportunities on the western side of the Forest; this will include activities such as camping, hiking through historic trails (Tradewinds), water-play along the rivers and creeks along the route; and other nature activities. It will also give the public a scenic drive enjoyment opportunity to supplement the PR Route 191 scenic drive experience.

Goals

- Partner with the municipal planners and other agencies to promote the official state designation of the PR Route 186 Scenic Byway.
- Promote the historical significance of the cultural resources within this area.
- Improve signage along the route.
- Develop interpretation signage for relevant historic and natural features along the route.
- Improve and maintain security along the scenic byway.
- Work collaboratively to promote the development of recreation opportunities along the route of PR Route 186.
- Improve scenic viewpoints on the PR Route 186 within the Forest such as Quebrada Soñadora, Río Espiritu Santo, Quebrada Grande, Pico El Toro, Rio Grande, Vereda El Toro throughout the planning period.

Objectives

- Improve and maintain the corridors physical condition within the first 3 years of the plans approval.

Standards

S1 All road maintenance and alterations that fall outside the defined categorical exclusions as outlined in the programmatic agreement between the Forest Service and State Historic Preservation Office should follow the stipulations of the State Historic Preservation Office Act and Section 106 Process (36 CFR 800).

2.2 Suitability of Lands

Specific lands within a plan area are identified as suitable for various multiple uses or activities based on the desired conditions applicable to those lands. The plan will also identify lands within the plan area as not suitable for uses that are not compatible with desired conditions for those lands.

The suitability of lands need not be identified for every use or activity. Suitability identifications may be made after consideration of historic uses and of issues that have arisen in the planning process. Every plan must identify those lands that are not suitable for timber production (§ 219.11) (36 CFR 219.7(e)(1)(v)).

Lands Identified as Suitable for Certain Uses or Activities. A plan's identification of certain lands as suitable for a use is not a commitment to allow such use, but only an indication that the use might be appropriate. A specific use or activity may be approved or may be disapproved in an area identified as suitable for such types of use. Management areas and plan components define suitability for recreation, research, water use, communication sites, and general management.

Lands Specified as Not Suitable for Uses or Activities. If a plan identifies certain lands as not suitable for a use, then that use or activity may not be authorized. Public uses for which a special-use authorization is not required, such as biking, camping, and hiking, will not be affected by such a designation in the plan. Such uses can only be restricted by an action such as a closure order (Section 21.8 of the Planning Handbook).

The following uses are not suitable Forest-wide:

- Off-road vehicle use
- Hang-gliding
- Horse riding
- Cable tram system
- Hunting
- Recreational drones
- Military training is addressed in Section 3.3.5, "Special Uses."

2.3 Suitability for Timber Harvesting

Certain areas within El Yunque are not suitable for the utilization or harvesting of forest products due to congressional designation such as wilderness (which should be left undisturbed by these activities). The Forest has not produced any forest products under any program in recent times.

There are no congressional restraints on some lands; however, the vegetation types, wildlife, and physical conditions impose non-suitability of the lands. In the table below, lands outside of the wilderness area, but on slopes greater than 30 percent are identified as "not suited for timber production" because these lands

are easily prone to landslides during heavy rains. The lands in category D (where timber production is not compatible with the Plan's desired conditions) are the lands found within the existing and expanded research natural area. The only acres that are identified as "suited for timber production" are those within the Community Interface Resource Management Area (MA 4).

Table 2-7. Timber production suitability classification

Land Classification Category	Acres
A. Total National Forest System lands	28,223
B. Lands not suited for timber production due to legal availability or technical considerations	17,752
Wilderness	10,352
Slopes over 30% (outside of wilderness)	7,400
C. Lands that may be suited for timber production (A–B)	10,471
D. Lands not suited for timber production because timber production is not compatible with the desired conditions and objectives established by the Plan	3,284
E. Lands suited for timber production (C–D)	7,187
F. Lands not suited for timber production (B + D)	21,036

It needs to be clarified here that lands classified as "suited for timber production" does not mean that they will be managed as "timber plantations". An area is classified as "suited for timber production" when it is identified that an area may be harvested to provide some level of wood products on a regular basis (as opposed to only harvesting trees for salvage following a storm event).

3 Desired Conditions for El Yunque National Forest

Considering El Yunque National Forest's vision to continue improving social, economic, and ecological sustainability and uses of the El Yunque lands; the new Forest Plan provides different sections to guide its management mandates. The Forest-wide desired conditions, objectives, standards and guidelines delineate the management direction for wherever it is applicable across El Yunque National Forest.

The planning process identified the following needs for the management of the Forest:

1. Maintain the Forest in an ecological, social, and economically sustainable manner.
2. Ecologically maintain the Forest throughout the challenges arising from climate change.
3. Sustain the ecological processes.
4. Maintain species and species recovery.
5. Economically provide opportunities to develop a community-based economy.
6. Have a more regionally integrated approach to recreation use and access.
7. Protect, conserve, and recover species of flora and fauna that are federally threatened, endangered, proposed, and species of conservation concern.
8. Maintain the functional wetland and associated vegetation types.
9. Maintain healthy watersheds.
10. Restore riparian areas.
11. Provide recreational opportunities considering demographical changes and visitation patterns during the planning process.
12. Alleviate high visitation use of PR Route 191 by increased recreational opportunity in the lower elevations of the Forest. Lower parts of the Forest may provide more recreational opportunities and settings.
13. Provide for a scenic route along PR Route 186.
14. Provide clean water resources.
15. Provide sustainable forest products.
16. Infrastructure is functional and maintained.
17. Increase the Forest's ecological footprint by acquiring or protecting more stream corridors.
18. Maintain scenic integrity which contributes to the economic condition.
19. Include plan components for invasive species management that allow activities beyond road right-of-ways, recreation areas, and threatened or endangered species habitats, in order to promote management of nonnative species and to restore landscape-level conditions.

These needs were used to develop specific plan components.

3.1 Ecological Sustainability and Diversity of Plant and Animal Communities

3.1.1 Climate Change Response

Desired Conditions

The Forest resources and operational management are resilient to the influences of a changing climate. Management activities reduce the susceptibility of resources to multiple threats, including drought, invasive species, disease, and wildfire. The immediate and long-term resilience of the Forest will be changed by:

- Responding to changes in visitor behavior and mitigating any seasonal increases in use;
- Enhancing landscape connectivity by maintaining natural migration corridors between lowland and upland forests to allow species to move up-slope into cooler environments as climate warms;
- Maintaining piles of natural woody debris and promote wetlands and ponds in areas of high amphibian diversity to supplement habitats that retain cool, moist conditions; and
- Rapidly detecting and eradicating invasive species introductions and new locations, especially following disturbances from hurricane events in high-elevation communities.

Management Strategy

- Collaborate with International Institute of Tropical Forestry, State and Private Forestry, external partners and surrounding land managers to coordinate management and monitoring efforts related to visitor use, ecological connectivity and flows, and invasive species.

3.1.2 Terrestrial Ecosystem: Vegetation

Desired Conditions

- The Forest continues to provide for areas where mature native species and a closed canopy dominate the landscape.
- Evidence of past human modification of core areas of the Forest remains largely concealed even from visitors who walk the trails.
- Disturbed and altered areas are restored through natural or managed re-vegetation practices.
- The Forest will be conserved, maintained, and restored with native species.
- The Forest's primarily rich biodiversity, including species, genetic, and ecosystem processes, are maintained.
- Healthy, native plant communities dominate the landscape and are resilient given current and projected climate conditions. Invasive species do not disrupt ecological functioning or jeopardize the ability of the national forest to provide habitats for the plant and animal diversity. New invasive species occur only at low levels.
- Primary forest is preserved.
- The Forest protects and maintains the forest's biodiversity and functions, including all native plants and ecological processes. The Forest manages the lands with sustainable practices.
- The Forest maintains a high diversity of native plants in areas visited by the public, through landscaping of developed recreation areas and visitor centers.

- Provide special protection to species-at-risk, and for the most limited and unique forest types (the Montane Rain Forest and the Montane Rain Cloud Forest).

Goals

- Evaluate ecological vegetation composition and ecological functions of the Plantation/Secondary Montane Wet Forest and Plantation/Secondary Submontane Moist Forest, to apply the appropriate management strategy.
- Provide for small forest products.

Objectives

- Within 2 years after storm events, restore, maintain, and procure conservation efforts to avoid introduced species.

Standards

S1 Protect primary forest by limiting recreation use, construction, and re-construction.

S2 Maintain trails for research and Puerto Rican parrot management.

S3 Limit modification of the vegetation, such as from recreation facility construction and sustainable forest product uses, to areas where irreplaceable vegetative resources are not jeopardized.

S4 Require permits for the collection of any plants or plant material (roots, stems, fruits, etc.).

S5 Allow salvage timber cut for experimental or sustainable uses, or where there is damage by natural causes, only where such use does not conflict with specific management goals and objectives of any particular area.

S6 Require a permit for timber salvage.

S7 Require a permit for community, non-profit groups and individual use.

S8 Use only native vegetation in wetland restoration and soils conservation projects.

Guidelines

G1 The use of genetically appropriate native plant materials will receive primary consideration for revegetation, restoration, and rehabilitation. Use nonnative species when native plant material is not available or if soil conditions will improve through the use on nonnatives.

Management Strategies

- Establish the vegetative description and ecosystem functions of the new vegetation classification defined for the El Yunque and inform the public about this change.
- Update existing and potential natural vegetation mapping with partners, researchers, and other interested parties. Use standard vegetation classification systems, where appropriate. Consider ecosystem mapping and associated desired composition, structure, function, and connectivity when developing ecosystem maintenance and restoration projects. Implement a monitoring protocol based on the viable population of native plants to record its conservation and management needs. Implement a monitoring protocol for invasive plant species to record its presence and entrance, and to record any changes in nonnative species existing in the Forest that shows any behavior changes toward an invasive conduct.

- Maintain a record of the forest coverage at different scales to assure the Forest continues to offer an impression of vastness of the essentially unmodified tropical forest. Recommended scales are:
  - Designated areas
  - Proclamation region
  - Regional management area

3.1.3 Functional Wetland

Desired Condition

- The functional wetland within El Yunque National Forest is protected and preserved.
- The lands of the wetlands remain forested, predominantly with native species. The biodiversity and ecosystem processes are maintained. Viable populations of native plants are maintained or achieved.
- The Forest continues to supply the benefits and ecological services delivered by the wetlands to surrounding lands, particularly lowland wetlands connected through the management region.

Goals

- Wetlands are identified and administered in accordance with appropriate management requirements related to Federal legislation and regulations that apply to Puerto Rico.

Objectives

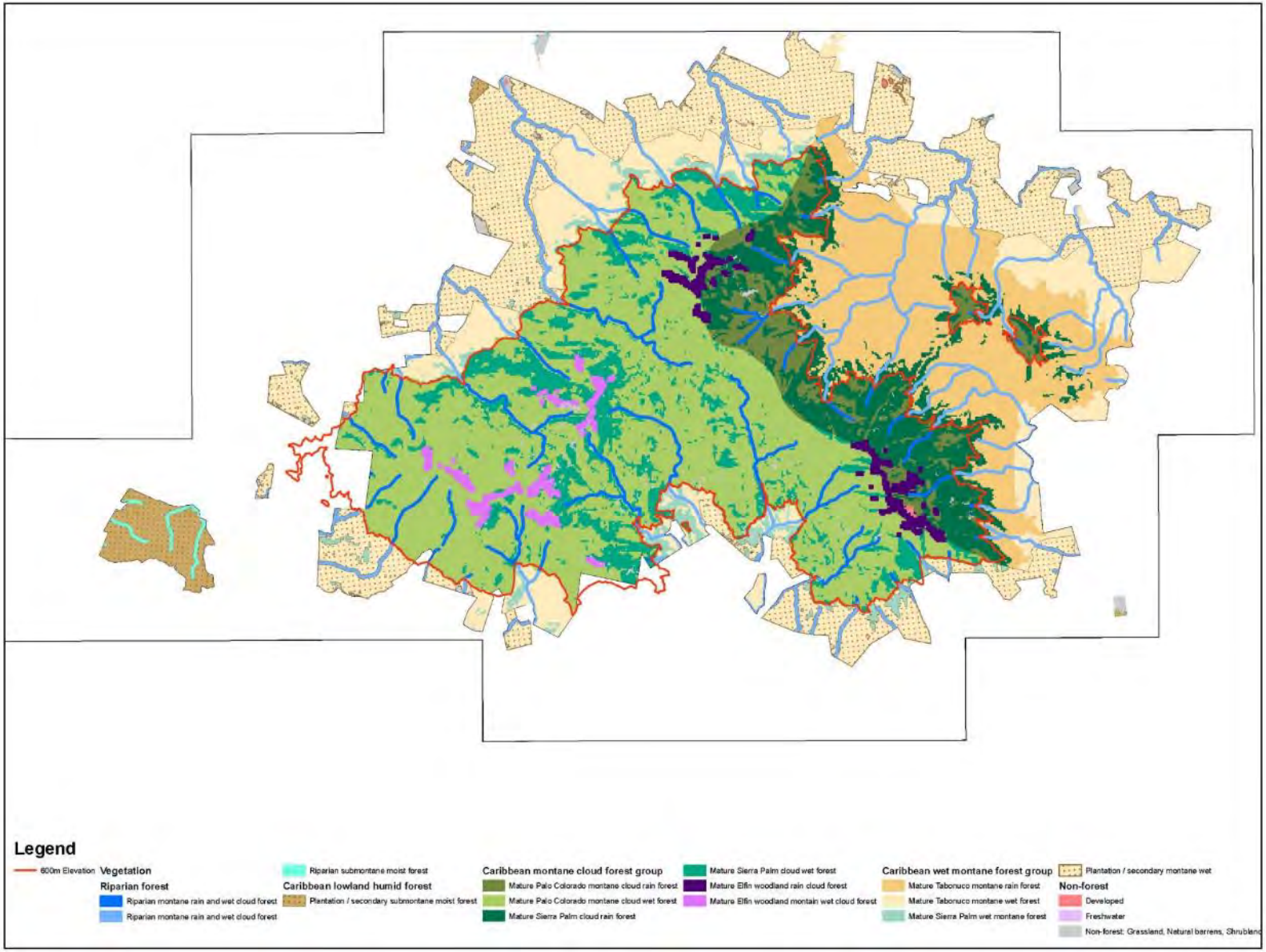
- Maintain or restore 13,335 acres of wetlands lands during the Plan period.
- Propose the inclusion of the Palustrine Montane Wetland (lands above the 600 meters [1,968 feet]) of El Yunque in the National Wetlands Inventory in cooperation with the U.S. Fish and Wildlife Service 4 years after Plan signature.

Guidelines

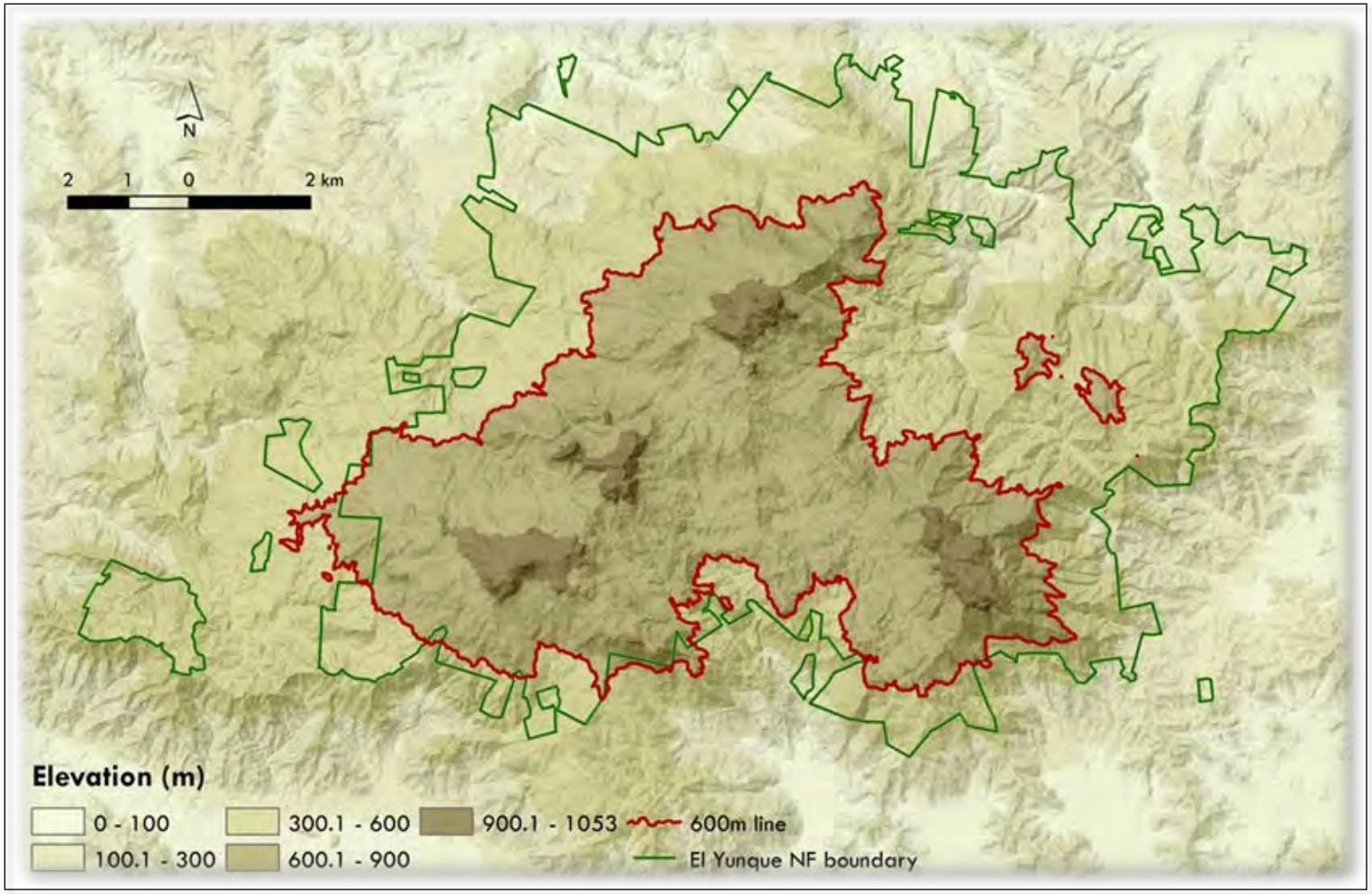
G1 The Forest should delineate the wetlands during site-specific projects.

Management Strategies

- Survey lands to identify the wetland vegetation.
- Develop collaborative agreements with surrounding, protected areas or agencies to establish permanent plots in order to monitor environmental change and its effect on El Yunque wetlands and the broader landscape.
- Include El Yunque wetlands values in the interpretation and education programs.
- Maintain communication with International Institute of Tropical Forestry regarding monitoring and research of the cloud formation level within the Forest, apply the information provided on updates and changes of these conditions, and adjust management practices as needed.



Map 3-1. Forest vegetation types and functional wetland



Map 3-2. Functional wetland at the 600 meter elevation

3.1.4 Aquatic Ecosystems

Desired Condition

- High quality ecosystem services and biodiversity of aquatic ecosystems of the El Yunque National Forest are maintained or restored.
- Provide healthy habitats to aqua-fauna, especially those whose life cycles are interconnected with the surrounding ocean.
- Ensure ecologically sustainable human (anthropocentric) consumption of water is conducted to not adversely affect the ecosystem's long-term functional capacity.

Standards and Guidelines

Note: For Aquatic Ecosystems, please refer to the standard and guidelines section titled "Specific for Fish and Other Aquatic Species".

Management Strategies

- Working through partners and/or other agencies, the El Yunque should contribute towards the need to develop environmental flow ranges based on an empirical water budget of the Forest for all watersheds at an appropriate timetable to better manage aquatic ecosystem functions.
- Provide collaborative approaches for conservation education regarding aquatic ecosystems or a related ecosystem component for at least one priority watershed every 2 years to enhance public awareness and opportunities to better understand scientific land management.
- Through collaboration, there will be a better understanding of the resiliency of aquatic ecosystems and its carrying capacity to aquatic-dependent fauna species in regards to climate change.

3.1.5 Riparian Management Zones

Riparian management zones are defined as being 100 feet from the edges of a river or stream, unless a site-specific analysis is conducted to identify and delineate the riparian management zone.

Desired Conditions

- Restore and maintain riparian zones with native species to sustain its diversity and functions.
- The riparian zones deliver ecological services to the aquatic ecosystems and watersheds of El Yunque and the surrounding regional lands.
- Viable populations of native species are maintained or achieved.
- The riparian zones located inside designated areas (El Toro Wilderness, Baño de Oro Expanded Research Natural Area and Wild Scenic Recreation River Corridors) and the primary forest are preserved.
- The riparian zones are managed to maintain or restore the ecological diversity and functions and to keep serving as abiotic and biotic connectors of the Forest and the sea.
- The Forest has restored the presence of the bloodroot tree (*Pterocarpus officinalis*) in the riparian areas and it has reduced the presence of invasive species.
- The Forest has restored structure, function, and composition based on past land use history.

Goals

- Riparian zones improve their ecological diversity maintaining functional ecological connections through the management region.

Objectives

- Survey the riparian zones in areas of more impacts to determine the application of conservation measures or restoration needs during the next planning period.
- Restore riparian zones impacted by recreational activities within 1 year after implementation.

Standards and Guidelines

S1 Riparian management zones are defined as being 100 feet from the edges unless a site-specific analysis is conducted to identify and delineate the riparian management zone.

S2 No management practice that may cause detrimental changes in water quality, chemical composition, or block the watercourse, or deposits sediment that adversely affects the water conditions and fish habitat, shall be permitted within the riparian management zone.

G1 Ensure the use of best management practices approved by Forest Service when management activities or maintenance practices are taking place close to riparian areas.

Management Strategies

- Work with partners to recover riparian zones outside the Plan area.
- The Forest should consider lands and associated riparian ecosystems in major streams for land acquisition initiatives.
- Evaluate enrichment planting strategies to improve riparian zone vegetation. This initiative could be developed with community groups or special groups like the Boy Scouts. The project could be in phases to extend the enrichment of the riparian zones outside the Forest in collaboration with environmental organizations in the region (for example, Coalition for the Northeast Corridor). In these projects, the Forest Service assists in providing vegetative material and technical help and the community groups provide the volunteers for the planting and monitoring activities.
- Use species such as cedro (*Cedrela odorata*), guanabana (*Annona muricata*), guaba (*Inga* sp), mahogany (*Swietenia macrophylla*) and other species that create a favorable environment including native fruit trees in the restoration projects.
- The inclusion of species adapted to riparian areas like the native *Heliconias* species in accessible ranges provides an economic opportunity for the production and business with tropical flowers.

3.1.6 Air/Resource Quality

Desired Conditions

- Forest visitors experience clean air and clear vistas and recognize that the Forest is affected by man-made pollutant deposition originating from pollution sources outside Forest boundaries.
- Activities on the Forest meet all National Ambient Air Quality Standards designed to protect human health and public welfare.
- Air is clean and contributes to a healthy and a functional environment.
- The Forest continues to contribute to good air quality through its biological processes.

- Forest visitors experience clean air and clear vistas and recognize that the Forest is affected by man-made pollutant deposition originating from pollution sources outside Forest boundaries. Activities on the Forest meet all National Ambient Air Quality Standards designed to protect human health and public welfare.
- Aquatic organisms are monitored for methylmercury loading, and the public is informed where aquatic organisms may be taken and safely eaten.

Objectives

- After signature of this plan, maintain the application of all regulations to protect air quality, avoiding activities that would adversely impact air quality and maintaining a monitoring process to determine pollution level and air quality.

Standards

S1 Apply Federal and Commonwealth air quality regulations in the management of facilities.

S2 Incorporate performance requirements for the protection of air quality in permitted activities and developments.

Guidelines

G1 El Yunque National Forest will avoid any management activity that would adversely impact air quality.

G2 Consult with the Environmental Protection Agency on any proposed major emitting facility that can adversely impact air quality.

Management Strategies

- The Forest provides the local community and visiting public information on air quality when it has been impaired by any natural event.
- Public education and awareness will include air quality.
- Determine locations of high air pollutant concentrations using existing emissions and air quality monitoring data, personal observations, dispersion modeling, and professional consultation.

3.1.7 Soils

Desired Conditions

- Protect and maintain the current soil conditions within El Yunque National Forest.
- Maintaining a healthy watershed considering water quality and quantity, ensure the preservation of productive soils.
- Soil and subsoil and water resources are protected from physical, biological, and chemical contaminants.
- All hydric soils above the 600-meter (1,968 feet) elevational line in El Yunque National Forest are protected.

Objectives

- Measure the stage and conditions of the soils in the different vegetation types of the Forest to determine soil formation stages and if it contributes to appropriate ecosystem services.

Goals

- Soils maintain their functions to sustain the ecological conditions and services from the El Yunque.

Standards

S1 Evaluate landslides for the control or reduction of erosion and sedimentation.

S2 Use vegetation to re-vegetate landslides.

S3 Landslides will be re-vegetated and evaluated within first 2 years of the landslide occurrence.

S4 Soil-disturbing activities and soil removal from projects in El Yunque National Forest are not discarded in such a fashion that it creates sedimentation, loss of soil productivity, and new deposition on productive active soils.

Guidelines

G1 Soil compaction and detrimental impact to soil productivity are minimized.

G2 Control the unauthorized use of off-road vehicles that may severally impair soils and may accelerate erosion.

G3 Evaluate impacts of landslides to wetland condition and develop appropriate restoration activities following those evaluations.

G4 Use best management practices to reduce impacts on soils.

Management Strategies

- Submit the information on hydric soils to the National Wetland Inventory.
- Improve the information of the Forest soil resources to consider the hydric soils characteristics and conditions for their inclusion in the National Wetland Inventory.

3.1.8 Water Resources

Desired Conditions

- Clean water flows from the Forest.
- Use of water for human consumption is balanced with in-stream flow needs for use, recreation, research, and aquatic and terrestrial ecosystem maintenance.

Objectives

- Define instream-flow needs for intakes during the planning period.

Standards

S1 Do not authorize additional water intakes for consumptive uses.

S2 Ensure that all proposed projects that contact or interact with the quality or supply of the resource comply with permitting requirements of the Federal and the Puerto Rican Commonwealth agencies with responsibility over the resource.

S3 Protect surface and sub-surface water resources from physical, chemical, and biological pollutants.

S4 The flow regimes cannot be modified to levels that affect the abiotic functions and biotic needs for viable population in the aquatic ecosystems of the Forest.

Guidelines

G1 Incorporate best management practices into the design of all projects that have potential to affect water resources.

Management Strategies

- Improve the stream water network information to evaluate the quality and supply parameters of the resources.
- Promote the value and influence of the resource in relation to the socioeconomic system or aspects of the region.
- Develop an initiative that could include an adoption program for creeks or rivers that flow from the Forest. The initiative can connect restoration and conservation projects that can be initiated in the Community Interface Resource Management Area, but that are continued from the Forest toward areas outside the Forest as part of agreements with community and environmental organizations of the region. This type of project could include a monitoring component in which the community groups participate in the monitoring protocol developed for their participation.

3.1.9 Wildlife and Fisheries

Desired Condition

- Provide high quality habitats for endemic wildlife and fisheries populations in their existing or historic distributions to be either enjoyed or scientifically studied in their natural habitats.
- Maintain or restore the Forest's rich biodiversity, including ecological processes that may improve resilience to change. To maintain and if possible rehabilitate identified habitats that exhibit special biological characteristics that warrants adaptive management (as defined by the USDA Forest Service) to sustain their conditions.
- Promote appropriately-scaled and compatible land management practices (such as, agroforestry) that may produce benefits to habitats by providing diverse vegetation structure.
- Participate in efforts with other Federal, state, academic or non-governmental entities to address regional and global natural resource management issues that shall improve the management of tropical forests and their ecosystem services.

Objectives

- After a large-scale natural event, such as a tropical storm or hurricane, the wildlife program will provide support to rehabilitate at least 25 percent of known affected terrestrial area in the first 2 years to improve habitat that may pose as shelters for endemic wildlife species and contribute to desired conditions.

Wildlife Operations Standards and Guidelines

S1 Coordinate with the International Institute of Tropical Forestry, the Puerto Rico Department of Natural and Environmental Resources, and U.S. Fish and Wildlife Service in the management of wildlife and fish habitat resources on the El Yunque National Forest.

S2 Require special-use permits for the scientific or education collection of any animal species for any non-Forest Service project.

G1 Maintain the quality and effectiveness of limited, unique, or otherwise important habitat attributes such as cliffs, caves, dead standing trees (snags), wildlife roost sites and reproductive areas during any management, special use, or research activities.

G3 Design and execute wildlife habitat improvement (such as, artificial structures or agroforestry) or watershed restoration plans for endemic wildlife or fisheries species to rehabilitate areas affected by any significant natural event (such as, hurricanes, tropical storms, massive rain events, and landslides).

Fish and Other Aquatic Species Standards and Guidelines

S1 Water withdrawals for human (anthropogenic) uses would not reduce flows below naturally occurring low flows.

G1 Consider collaborative initiatives with the Puerto Rico Department of Natural Resources (PRDNER) or a legitimate non-governmental organization with appropriate PRDNER permits to inform about and establish sustainable use and best management practices for collecting or harvesting of endemic game fish species within an agreement between PRDNER for a wildlife management area on the El Yunque.

G2 Maintain or enhance fish (especially for the freshwater eel) and freshwater shrimp passages in all El Yunque rivers and perennial streams. Identify existing human-made barriers and implement actions to mitigate such barriers.

G3 Viable freshwater eel populations should be a focus for connectivity issues with other Federal and state partners.

G4 During project-level planning, develop mitigation measures for ground/water-disturbing activities when best management practices are not specifically developed for those activities. These mitigation measures should limit impacts to water quality, riparian management zones, and soils, and should be similar to those published by the National Best Management Practices.

Management Strategies

- By the year 2020, special or biological sensitive habitats, such as high-elevation wetlands above 600 meters (1,968 feet) and mature Elfin (*Tabebuia, Eugenia*) woodlands should be geospatially re-mapped, to establish changes to species occurrences of multiple species associated with these habitats.
- Develop environmental flow ranges for all watersheds in the EL Yunque at an appropriate timetable to better manage aquatic ecosystem functions. This will better maintain minimum instream flow needs in all streams to support viable fisheries population levels.
- Conduct collaborative conservation education effort of the El Yunque's unique biological resources, and their relationships with the surrounding ecosystems.
- Develop opportunities through partnerships for conservation education or public viewing of wildlife where low adverse impacts can be assured.
- Continue efforts to support the pollinators' projects.

3.1.10 At-Risk Species: Fauna

Desired Condition

- Maintain robust populations (and metapopulations) of identified at-risk species (federally threatened, endangered, proposed, and species of conservation concern) through managing identified population limiting factors on the El Yunque National Forest to better adapt to any possible change.
- Rehabilitate known habitat (foraging, shelter, and breeding) of at-risk species to improve habitat capabilities to support healthy populations' needs, to the extent of that habitat's resiliency to change.
- Provide special protection for management and research actions to limited and sensitive habitats, such as those wetlands found above 600 meters (1,968 feet) in elevation and mature Elfin woodlands, where multiple at-risk species are associated.
- At-risk species should also be the focus of public awareness and conservation education efforts to improve long-term interagency recovery endeavors to produce positive results.

Objectives

- After a large-scale natural event, such as a tropical storm or hurricane, rehabilitate at least 25 percent of known affected terrestrial area in the first 2 years to improve habitat that may pose as shelters for at-risk wildlife species and contribute to desired conditions.

Standards and Guidelines

S1 Invasive species shall be controlled.

S2 Protect nest and roost sites for the endangered Puerto Rican parrot, Puerto Rican sharp-shinned and broad-winged hawks:

a. Conduct no adverse management activities within 150 meters from an active nest.

b. Any activity with potential to disturb raptors will need to be greater than 150 meters from active nest sites and will have to avoid the nest selection and breeding season (in other words, activities may occur from August to November).

c. Only allow activities near nesting areas that will result in habitat conditions that are favorable to recovery.

G1 Design and execute wildlife habitat improvement (such as, agroforestry) or watershed restoration plans for at-risk species to rehabilitate areas affected by any significant natural occurrence (such as, hurricane, tropical storm, massive rain event, landslides).

G2 When necessary, post and enforce area closure notices in any identified at-risk area (such as, Baño de Oro Natural Area and Puerto Rican parrot area closure) as needed, to ensure protection and population viability.

G3 The use of playbacks for calling birds for any birding purpose should not include any at-risk bird species, unless for official administrative purposes.

G4 For Forest management activities and research studies in existing or potential Elfin-woods warbler habitats, follow the guidelines in Table 3-1 (see also Appendix A for a description of the Elfin-woods warbler management situations).

Table 3-1. Description of management situations, sensitivity levels and guidelines

Situation	Description
	Management Situation 1: Prime Habitat
Guidelines	1. *Site disturbances:* As a rule, adverse site disturbances will not occur within management situation 1. Project proposals that might result in any form of habitat modification *shall* also be notified to U.S. Fish and Wildlife Service and then analyzed through the process required by the National Environmental Policy Act of 1969 (NEPA) and the Endangered Species Act of 1973 as amended for consultation.
	2. *Human disturbances:* All projects with potential to disturb Elfin-woods warbler within prime habitats shall also be notified to U.S. Fish and Wildlife Service. This includes projects that may have acute and high sound amplitude (such as, chainsaws, blastings, aircraft use or other mechanical sources).
	3. *Human disturbances:* Should be timed outside of nest selection and the breeding season, to assure the highest level of habitat effectiveness in these ranges.
	Management Situation 2: Potential Habitat
Guidelines	1. *Site disturbance:* Activities that would result in any adverse physical modification of potential habitats *shall* be notified to U.S. Fish and Wildlife Service and then analyzed through the process required by the National Environmental Policy Act of 1969 (NEPA) and the Endangered Species Act of 1973 as amended for consultation.
	2. *Human disturbances:* All projects with potential to disturb Elfin-woods warbler within prime habitats shall also be notified to U.S. Fish and Wildlife Service. This includes projects that may have acute and high sound amplitude (such as, chainsaws, blastings, or other mechanical sources).
	3. *Human disturbances:* Should be timed outside of nest selection and the breeding season, to assure the highest level of habitat effectiveness in these ranges.
	Management Situation 3: Limited Value Habitat
Guidelines	1. *Site disturbances:* Projects within management area 3 should be coordinated through the Forest biologist and evaluated through NEPA. USDA Forest Service's best management practices should be a component of relevant projects' proposals.
	2. *Human disturbances:* Projects with potential to disturb any possible Elfin-woods warbler should be coordinated through the Forest biologist and evaluated through NEPA. USDA Forest Service's best management practices should be a component of relevant projects' proposals.
	3. No seasonal timing constraint would be indicated unless the amplitude of disturbances could influence the usability of nearby sensitive habitats.

Note: For more information on the management situation description of the Elfin-woods warbler see Appendix A.

Management Strategies

- At least one collaborative conservation education effort should be conducted that includes at-risk species or their habitat needs every 2 years.
- By the year 2020 or the second rendition of the monitoring report, population limiting factors to all federally listed species and any species of conservation concern with drastic declining monitoring trends should be identified and geospatially mapped to share with other Federal and state partners.
- At least once every fiscal year, the El Yunque should meet with other Federal and state partners focusing on population viability of all federally listed at-risk species (threatened, endangered, and proposed). These strategic meetings should identify on-going and future collaborative recovery efforts. Federally listed species such as Puerto Rican parrot, Puerto Rican sharp-shinned and broad-winged hawks, Puerto Rican boa, and the Elfin-woods warbler shall be a priority for management.

3.1.11 At-Risk Species: Flora

Desired Condition

- The El Yunque National Forest El Yunque is the largest remnant of natural vegetation on Puerto Rico.
- The Forest provides habitat that contributes towards the recovery of federally listed threatened or endangered species and the conservation of proposed and candidate species known to occur on the Forest.
- Rare plant communities are maintained and restored.
- Botanical endemic species populations are maintain or improved.

Goals

- Use partnerships with cooperators or pertinent agencies to identify strategies that would increase the population number of those species at-risk.
- The Forest should prepare a herbarium or participate with any interested partner that could keep vouchers of species of conservation concern for future references.

Objectives

- Implement a survey to acquire additional information on the population status of at-risk species, with priority given to the federally listed; in compliance with their recovery plan within 2 years of plan's approval.

Standards and Guidelines

S1 Do not allow collection of all species of orchids, threatened and endangered species, and species of conservation concern, unless approved for scientific and educational purposes.

S2 Incorporate equipment cleaning practices into contracts, special-use permits, and Forest activities to prevent the introduction and spread of invasive and nonnative plants species.

G1 Document with GPS and follow Forest Service protocols of the occurrences of all populations of species of conservation concern encountered during botanical surveys, while documenting them in the TESP-IS database.

G2 Cooperate with U.S. Fish and Wildlife Service in the 5-year review of the flora species federally listed present at EL Yunque.

G3 Follow recommendations for federally listed plant species recovery developed in the individual recovery plans.

G4 Forest management activities are consistent with recovery plans.

3.2 Social and Economic Sustainability and Multiple Use

3.2.1 Social Economic

Desired Conditions

- In balance with its ecological conditions and resilience, the Forest provides a broad range of social, cultural, and economic benefits to individuals and communities at local to global levels. It serves

as a model of an adaptive, sustainable, and resilient social-ecological system to surrounding communities and beyond, and cultivates sustainable resource and land use throughout the region.

- The Forest is shaped by and inextricably linked to humankind. Humans act as Forest stewards, producers, distributors, and users. Their demands on the Forest do not compromise its integrity or resilience, nor do they exceed the Forest administration's capacity or resources for Forest sustainability.
- Through its ecological, social, and economic characteristics and conditions and opportunities for recreation, education, spirituality, historical and cultural preservation, wood and non-wood forest products, and other goods and services, the Forest contributes to a healthy sense of place and way of life for nearby residents, neighboring communities, and visitors from near and far.
- Forest goods and services, including clean air and water, native flora and fauna, recreation, scenic beauty, solitude, and escape from the everyday are utilized by individuals and communities to generate employment and stimulate the economy in and around the Forest.
- Individuals, communities, and businesses that rely on the goods and services provided by the Forest are resilient and adaptive to changes in climate, land use, the economy, and other conditions. They have the capacity to collectively create and pursue ecological and socioeconomic opportunities in and around the Forest that foster sustainability across the landscape.

Goals

- Local residents benefit from jobs and income associated with Forest management activities, and local economies benefit from visitors attracted to the wide variety of goods and services that the Forest offers.
- Businesses at the local level and beyond increasingly offer recreation and other opportunities that benefit the sustainability of the Forest and the landscape in which it is situated.
- Partnerships and other collaborative arrangements with neighboring communities, special interest groups, state agencies, local governments, and others that support and enhance forest conservation, recreation, restoration, education, and other programs and activities continue to grow and thrive.

Management Strategies

- Develop multiple-use resource management opportunities, particularly in accessible locations in the lower elevations of the Forest, that consider the ecological, social, and economic conditions of the broader landscape and that provide opportunities for economic development and diversification.
- Promote increased participation of local landowners, land management agencies, and other key stakeholders in conservation efforts at the landscape scale through an all-lands approach to conservation that identifies key areas for connectivity, multiple-uses, and ecosystem services and related opportunities for conservation.
- Maintain and increase partnerships and other collaborative relationships that support and provide for sustainable recreation in and around the Forest.
- Maintain and increase partnerships and other collaborative arrangements with local communities, schools, government agencies, and other key stakeholders that enhance environmental education, literacy, and interpretation, and that strengthen the regional identity and capacity for co-management.

3.2.2 Broader Landscape and Lands

Desired Conditions

- All lands destined to conservation efforts should include conservation easements and other land conservation and restoration programs.
- Land dedicated to farms in the region surrounding the El Yunque increase. Agricultural lands represent an opportunity for conservation for growing food, providing for wildlife, and providing employment through recreation.

Objectives

- Acquire lands that promote conservation initiatives for protection of surrounding hills, stream corridors, riparian areas, wild and scenic river corridors, and connections to the Reserva Natural Corredor Ecologico del Noreste (Noreast Ecological Corridor, Natural Reserve), Rio Espiritu Santo Natural Reserve, Las Picuas Reserve, La Monserrate Public Park, Las Cabezas de San Juan Natural Reserve, Seven Seas Natural Reserve, Reserva Natural Corredor Ecologico del Noreste (Northeast Ecological Corridor, Natural Reserve), Natural Areas in Roosevelt Roads, Ceiba State Park (Bosque Estatal de Ceiba) and Humacao Natural Reserve (Refugio Natural de Vida Silvestre de Humacao) over the planning period.

Goals

- Develop additional guidance for managing the Forest within the context of the larger landscape and for addressing local land use changes and the associated impacts on the Forest. For example, develop management strategies to find opportunities to include partnerships, collaborative efforts,

and coalitions of support to promote sustainability and to solve existing and future challenges at the landscape level.

- Develop strategies for continued land ownership adjustments giving priority to lands that:
  - Help consolidate large blocks of existing National Forest System lands (as opposed to adding onto small or isolated blocks) and inholdings;
  - Protect resource values on adjacent, existing National Forest System land;
  - Contribute to the recovery of threatened or endangered species or aid in the protection of diverse species;
  - Enhance recreation, public access, and protection of aesthetic values, especially those that provide public access to waterways; and provide for the protection of important cultural resources; and
  - Complement a designated special area such as a wilderness area or wild and scenic river.
- Collaborate with municipalities' territorial plan and Puerto Rico land use plans by fostering an all-lands regional perspective.
- Incorporate strategies which promote the reduction of urban expansion surrounding El Yunque.

Standards

S1 Do not authorize land acquisition of contaminated sites.

Guidelines

G1 Acquire abandoned agricultural lands.

Management Strategies

- Promote the maintenance of existing arrangements and the pursuit of new opportunities for land acquisition and conservation across Forest boundaries by working with adjacent and interested public and private land managers, landowners, and other stakeholders.
- Pursue new opportunities for land acquisition and conservation across Forest boundaries by working with adjacent and interested public and private land managers, landowners, and other stakeholders within a landscape approach during the Plan period.

3.2.3 Environmental Education

Desired Conditions for Interpretation, Environmental Education, and Literacy

- The Forest has comprehensive and complementary interpretive and educational programs that are relevant to local populations and support the conservation of the Forest, promote ecological and socioeconomic sustainability, increase interest in collaborative resource management, and address the learning needs of a diverse audience.
- Partnerships are created with local communities, schools, special interest groups, and government agencies to develop and support interpretive and educational efforts and to strengthen regional identity and capacity for co-management.
- Interpretive and educational efforts and materials contribute to increasing environmental literacy, especially among youth and underserved populations, through the development of pro-environmental thinking, decision-making, and ethical commitment. Programs are interdisciplinary, collaborative, problem-based, and promote research and action in favor of the environment.

- Environmental education topics include human-environment interactions and sustainability, climate change, ecosystem services and diversity, collaborative and adaptive planning and management; conservation principles and techniques.

Goals

- El Yunque National Forest develops and supports interpretation and educational activities in partnership with interested groups and individuals.
- Recreational sites and facilities, and designated areas, beyond El Portal, are suitable for the integration of community-based interpretive and educational efforts, training, and demonstration in accordance with management area direction.
- El Portal Tropical Forest Center and El Yunque National Forest's website serve as the main outlets to inform and orient visitors and other customers to the interpretive, environmental education, and recreational opportunities available in the Forest, the surrounding region, and Puerto Rico.
- El Yunque fosters professional development and skills-based training to staff, volunteers, outfitters, and collaborators who are responsible for providing interpretive and environmental education programs within the Forest.
- Research on education and interpretation efforts in and around the Forest is promoted and incorporated into the development and implementation of educational and interpretive programs.

Objectives

- Develop an interpretation and environmental education strategy within 2 years of Plan approval to be implemented within a 3- to 5-year timeframe that builds upon current standards and guidelines, and measures the effectiveness of programs and initiatives in partnership with surrounding communities, government agencies, special interest groups and organizations.
- Develop an interpretation and environmental education training plan within 3 years of Forest Plan approval that fosters professional development and enhances employee and volunteer learning opportunities in the areas of interpretation and environmental education. This includes (1) listing existing successful examples and best practices for employees and partners to incorporate into their practices, (2) opportunities such as national training workshops, web-based learning, live broadcasts, and programs offered by partners and universities, and (3) materials to introduce staff to the special opportunities and challenges of interpreting natural, historical, and heritage resources of El Yunque National Forest and its broad landscape.
- Develop a communication strategy to deliver key environmental and interpretive messages to different stakeholders including continued outreach activities and events.
- Develop, collaboratively, at least one educational project in each of the municipalities surrounding the Forest each year of the planning period.

Guidelines

G1 Interpretive and educational materials incorporate local knowledge and perspectives, as well as a variety of current educational and interpretive technologies, theories, and methodologies that consider the broad range of visitors and audiences interested in the Forest.

G2 Interpretive and educational activities should be designed and implemented in collaboration with a network of partners—such as local schools, planners, scientists, community members, tourism providers, and the general public—and provide for development for Forest personnel and collaborators.

G3 Interpretive and education programs and materials are universally accessible through the Forest website.

G4 Activities and materials provide students and visitors with information on the wise use of the Forest's natural and cultural resources as well as tropical forests in general, and encourage action towards their conservation.

G5 Interpretive and educational activities are assessed to gather feedback, and monitor the effectiveness of programs, and to identify future needs and directions.

G6 Materials developed for interpretive and educational programs should integrate messages and design and be compliant with Forest Service standards.

3.3 Multiple Uses

3.3.1 Ecosystem Services

Desired Conditions

- El Yunque National Forest provides a collection of goods and services that are critical to human health and livelihood for the region and Puerto Rico.
- The Forest continues the provision and delivery of continuous ecosystem services.
- The Forest creates a higher understanding and recognition of the goods and services provided by the Forest in the region.
- The Forest sustains ecosystem services across public lands and coordinates with the private lands in the region.

Goals

- Maintain and improve, according to the available resources, the level of yield from the ecosystem services of the Forest.
- Promote the regional plan as a contribution to moderate and inform of the impacts from land-cover changes over the ecosystem services of the Forest.
- Promote research in relation to the economic value of ecosystem services provided by El Yunque National Forest at a regional scale.
- Develop a monitoring protocol for ecosystem services of the Forest with potential application in the region by interest groups and stakeholders.
- Promote and increment the knowledge of ecosystems services in the community, with visitors and residents of ecosystem services in the region provided by the Forest.
- Promote research and development of the ecosystem services that will create economic benefits now and in the future from the Forest.

Guidelines

G1 Minimize impacts of all considered projects and activities within the Forest to maintain the ecosystem services.

Management Strategies

Through ecosystem services, the Forest would encourage natural resource managers to consider the classification of multiple use to include a broader array of services or values, such as managing for water,

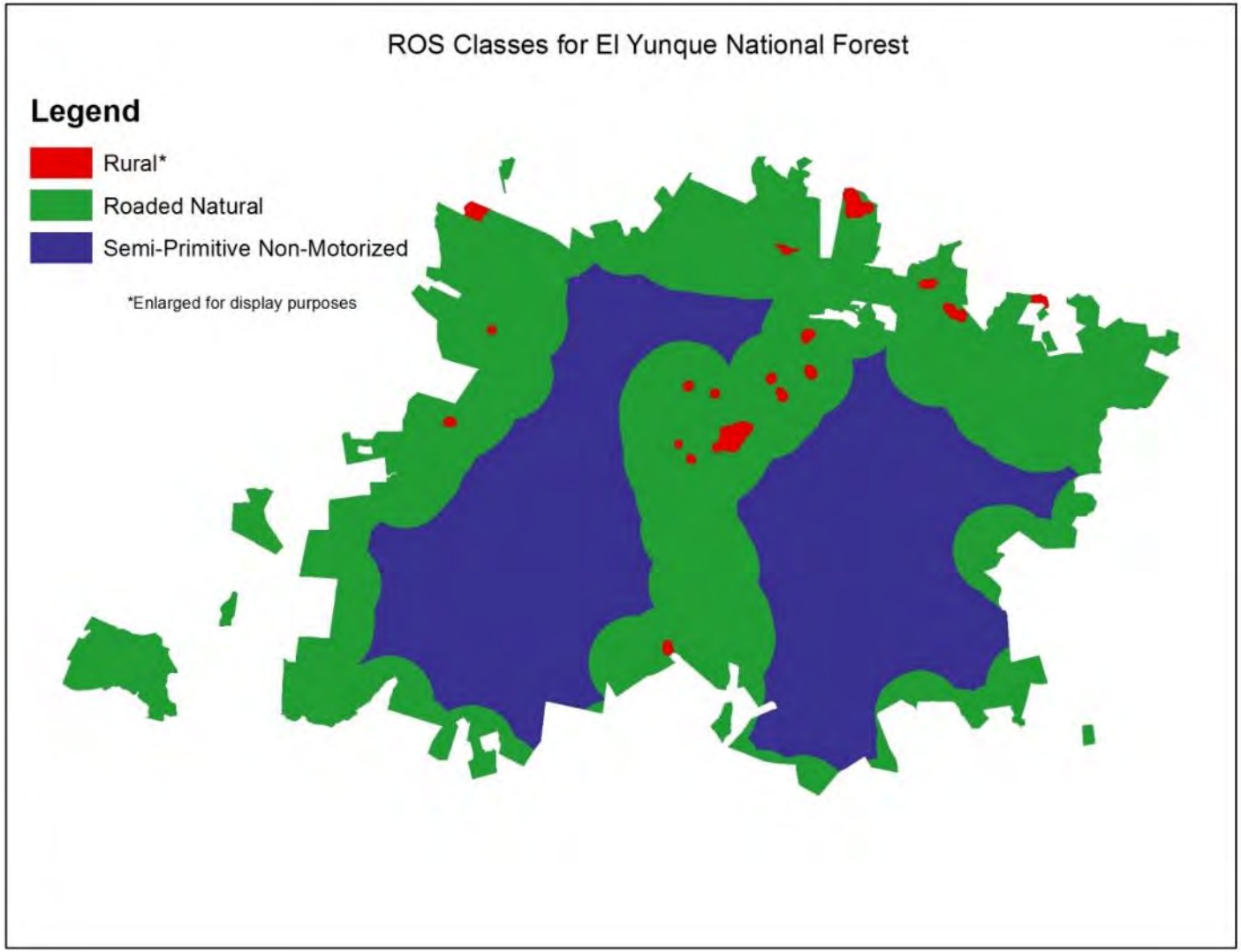
wildlife, forest products and recreation, to address the need to sustain "provisioning" services, while also being stewards of regulating, cultural, and supporting services. The benefit to people (that is, the goods and services provided) is what differentiates ecosystem services from the ecosystem itself. The assessment of the El Yunque National Forest identifies the following key ecosystem services provided by the Forest:

- Water quality and quantity and flood control
- Clean air
- Outdoor recreation
- Scenery
- Fish and wildlife (specifically, habitat for these species)
- Cultural/heritage values, inspiration, spiritual values and solitude
- Hunting, trapping, fishing, and wildlife viewing
- Research and education
- Carbon sequestration and climate regulation
- Forest products such as wood products

3.3.2 Recreation

Recreation Opportunities

The recreation opportunity spectrum (ROS) classes that are found in the El Yunque are "rural/roaded natural," "semi-primitive motorized," "semi-primitive non-motorized," and "primitive." Most recreation areas are found in ROS class "rural/roaded natural." A high percentage of the Forest land is classified "primitive" (El Toro Wilderness Area) and research natural area (Baño de Oro Natural Area) (see Appendix D).



Map 3-3. Recreation opportunity spectrum (ROS) classes found in the El Yunque

Desired Conditions

- Recreation opportunities connect visitors to their natural and cultural heritage, which are in harmony with preserving and conserving the Forest ecosystems.
- The Forest provides a range of locations for opportunities both on the main PR-191 corridor and at lower elevations.
- Recreation opportunities are managed to promote long-term ecological, cultural and historic, social, and economic sustainability.
- The Forest provides a variety of recreational opportunities ranging from non-motorized recreation to water play.
- The Forest manages recreation opportunities considering the carrying capacity at major Forest recreation destinations in a "roaded natural" setting.
- The Forest maintains recreational settings ranging from "rural" to "roaded natural" with opportunities for its visitors to enjoy outdoor recreation activities in a tropical forest.
- The Forest provides recreational settings at remote sites at lower forest elevations along existing roads and trails.
- Visitor centers and interpretive sites are attractive, clean, safe, well maintained and provide universal access in a rural setting. Adequate signage helps users enjoy and learn about the Forest.
- Recreation demands are balanced with the ability of the land to sustain use, the capacity of the Forest staff to manage its use, and the resources available to manage recreation opportunities.
- The Forest protects the scenic integrity and sense of place that make each recreation setting special, especially in "primitive" areas.
- The Forest maintains recreation settings by considering use and possible impacts to ecology, scenic character values, social encounters and economic sustainability.
- The Forest maintains the desired recreation settings and opportunities by mitigating the impacts from climate change and/or unsustainable use.
- The Forest manages and interprets historic recreational assets.
- Management of trash throughout the Forest promotes recycling and leaving the Forest clean.

Goals

- Develop a Forest access strategy and a transportation plan integrated with regional tourism and recreation.
- Diversify access and alleviate high use on PR 19, without negatively impacting sensitive resources and existing protected areas.
- Address waste management issues at developed recreation sites as well as along trails and other popular Forest recreation destinations.
- Improve barrier-free accessibility opportunities.
- Restore the condition and function of the recreation facilities and settings, expanding and adapting them to reflect the diversity of the culture, the abilities, family structure, and activities in our ever-changing society.
- Develop a trail system that is based on demand, safety, administrative operation, maintenance and ecological constraints, and co-management opportunities.
- Identify existing, abandoned, or segmented trails that can connect into other recreational areas located along the lower elevations of the Forest for future use and management by adjacent community groups.

- Identify new recreation opportunities at lower Forest elevations and near local communities.
- The Forest provides updated interpretive exhibits and general information to help visitors enjoy the Forest and develop a conservation ethic for Puerto Rico and tropical forests worldwide.
- Develop and update recreation opportunity guides for all visitor information centers, picnic areas, observation towers, Civilian Conservation Corps sites, and trails.
- Connect urban areas and rural communities to the scenic attractions, historic places, and recreation opportunities.
- Evaluate community and state parks, and other Federal and local open-space lands for connections with Forest lands to help meet the outdoor recreation and tourism demands for the region.
- The Forest implements place-based recreation opportunities using collaborative work with adjacent communities and other outdoor recreation and tourism providers within regional destination areas.
- Partnerships are created with surrounding Forest communities, special interest groups, and municipal governments to support and enhance recreation programs, considering the broader landscape.
- Cultivate coalitions of recreation interest groups that will help provide recreational experiences, service activities, and environmental education for youth and adults that promote fitness, appreciation of nature and history, and citizen stewardship.
- The Forest uses citizen stewardship and partnerships as well as field presence to provide quality recreation experiences while reducing the effects of visitor use on the landscape setting.
- Evaluate infrastructure investments and program costs. Those costs will be considered alongside available resources such as appropriations, fee revenue, partnerships, volunteers, and other service provider options to seek a sustainable and integrated base for the program.

Objectives

- Establish and implement trash-free zones at high use and isolated undeveloped recreation sites by 2018.
- Establish and implement trash-free zones at dispersed recreation sites along recreation segments of wild and scenic rivers by 2018.
- Complete a new camping area plan to address current demands and practices while protecting Forest resources within 1 year following plan approval.
- Interpretive exhibits at the visitor center are revised and updated within 5 years of the Plan's approval.
- Provide new recreation area(s) located along the lower elevations of the Forest that are either not being used or are underutilized, but have a potential for reuse or expanded use within 3 years following Plan approval.
- Reduce the maintenance backlog of historic and iconic structures by 25 percent in the first 3 years following plan approval.
- The Forest carrying capacity study is completed and implemented 3 years following plan approval.
- Develop a corridor management plan for El Yunque Zone 4 years following Plan approval.
- Develop recreation opportunity guides for the two most visited recreational sites.

Standards and Guidelines

S1 The Forest's Visitor Services and Enjoyment Management (VSEM) Team coordinates with Forest and commonwealth law enforcement and with input from special-use tour guide permittees and

private landowners within the Forest (inholdings) on the traffic control operation during high visitation periods.

S2 Monitor maximum vehicle capacity within the Forest during high visitation periods to secure minimal impact to sustainable recreation use of the resources.

G1 The Forest encourages the practice of "Pack-it-In and Pack-it-Out" throughout the Forest and implements Forest trash-free zones at recreation segments of the Forest wild and scenic rivers.

G2 Incorporate barrier-free access into recreation facility design and construction, where practical.

G3 Incorporate administrative capacity elements such as bathroom, parking facilities, carrying capacity, and monitoring in providing for recreational opportunities.

G4 Reduce environmental footprints and serve as a model for our visitors and other providers by incorporating sustainable travel industry best practices in our operations and using "green technology" for facility and trail construction.

G5 Develop noise reduction level at communication sites located near observation sites.

G6 Develop new program improvement criteria and evaluate where the capacity levels are to sustain existing facilities.

Trails

S1 Limit use of trails to hiking, and where appropriate, wheel chairs. Other potential trail uses, such as motorcycles and horseback riding, are not provided for because of the Forest's steep slopes, wetland conditions, and incompatibility with other uses and values.

Camping

S1 Where camping is causing resource damage or conflicts with other uses, implement closure orders to prohibit or limit use where it causes such damage or use conflicts.

S2 Require a permit for camping in the Forest in order to provide users better information, minimize impact to the resources, and comply with safety standards. Include the following information in the camping permit:

- Length of stay is limited to 5 days
- Group sizes are limited to six persons or fewer. Larger groups of 18 persons or less may be accommodated at the Old Nursery site.
- Tents must be located at least 30 feet from trails and streams, and at least 50 feet from roads and developed campsites.
- Open campfires are not permitted. Build fires only in fire rings, self-contained grills, or camp stoves.
- Cutting of trees, shrubs, branches or other vegetation is not permitted.
- Do not wash cooking and eating utensils in streams. Use a bucket or wash pan away from streams.
- Do not dispose of human waste in streams. Bury waste ("cathole method" 6- to 8-inches deep and 4- to 6-inches wide) and at least 100 feet from streams.
- Pack out all litter for proper disposal off Forest Service lands.

- Use of audio devises and instruments is highly discouraged. If used it should be kept at a low volume so as not to disturb other Forest visitors, in designated primitive camp site:
  - La Coca Trail
  - El Pabellon
  - Dos Quebradas
  - La Lomita
  - Molindero
  - Old Nursery

Management Strategies

- Promote outdoor physical activities, especially among youth, due to the trends in demographics which expect a decrease in the 10 and under age group for total population.
- Manage and interpret recreational settings in relation to historical sites, archeological assets, and cultural resources.
- Review the underutilized and abandoned facilities on the Forest to see if any could be suitable as camping areas or other co-management alternatives.
- Develop two historic/cultural recreation opportunity guides that focus on a specific location or Forest destination with detailed information about its value and importance to the Forest.
- Develop and implement place-based recreation opportunities using collaborative processes to work with communities and other outdoor recreation and tourism providers within our regional destination areas.
- Provide local organizations support in creating a regional recreation destination agenda where the Forest is not the only nature attraction.
- Create co-management recreation access opportunities throughout the Forest region.
- Work with communities and state parks as well as other Federal and local open space lands to help meet outdoor recreation and tourism demands for the region.
- The Forest continues to work with adjacent communities and tourist providers by providing information relevant to their commercial offerings. Meanwhile the adjacent communities and tourism providers supply the Forest with information on their commercial offerings as well as general information on the Forest they might possess.
- The Forest encourages regional connection through communities to promote scenic attractions, historic places, and recreation opportunities.
- Develop citizen stewardship and partnerships with existing community groups.
- The Forest should improve the existing trail system through collaboration and co-management by:
  - Linking existing trails to local communities located at lower elevations adjacent to the Forest boundary.
  - Improving trail routes which currently require or encourage users to walk along roads open to vehicle use through use of trail construction, relocation, or closures, etc.
  - Signing trailheads and trail intersections with interpretive environmental and cultural resources information.

3.3.3 Forest Products

Desired Conditions

- Protect vegetation types at EL Yunque as classified by the National Vegetation Classification System, due to the many endemic species it contains and matured forest vegetation.
- Provide and conserve a reliable supply of forest products in a sustainable manner.
- Products contribute to social conditions and quality of life of people and communities within the management region. Forest products contribute to economic conditions through individual employment, small businesses, and for potential demonstration uses.
- Forest products include non-timber forest products such as (1) foods, like wild edible mushrooms, fruits, and nuts; (2) medicinal plants and fungi; (3) floral greenery and horticultural stock; (4) fiber and dye plants, lichens, and fungi; (5) oils, resins, and other chemical extracts from plants, lichens, and fungi; (6) potential food sources like sustainable harvesting of fisheries, (7) small-diameter wood used for poles, posts, carvings and other biological material that are harvested from within and on the edges of natural, manipulated or disturbed forests.
- Contribute to economic conditions such individual employment, small businesses, and personal income, through the provision of potential financial benefits from the sustainable use of forest products.

Goals

- Forest products will be offered within the resource limitations and considering land suitability.
- Promote partnerships of sustainable forest products utilization.

Objectives

- Issue forest products permits during the planning period.

Standards

S1 Do not authorize vegetation treatments without silvicultural examinations and prescriptions adapted for tropical forests.

S2 Do not create canopy openings larger than 0.1 acre.

S3 Remove no more than one-third of canopy forming trees or no more than one-third of total basal area in any one treatment or forest product initiative.

S4 Salvage and dead tree extraction will be allowed and considered case by case and will require a special permit.

S5 Special forest product permits can only be used for products that can be managed on a sustainable basis, and the amounts offered are limited to the amount that can be harvested annually in perpetuity.

S6 Special-use permits cannot authorize the harvest or free use of special forest products in an amount exceeding known sustainable harvest levels.

S7 No harvest for the purposes of timber production will occur on lands identified as not suited for timber production.

S8 Any timber removal operations will only occur where soil, slope, or watershed conditions would not be irreversibly damaged.

S9 Timber will be harvested only where the harvesting system is not selected primarily because it will give the greatest dollar return or greatest output of timber.

S10 The volume of timber sold will be limited to the quantity equal to or less than the quantity that can be removed annually in perpetuity on a sustained-yield basis (see Appendix B).

S11 Timber will be removed only where there is assurance that such lands can be adequately restocked within 5 years after harvest.

S12 No planned timber harvest sales will occur within a riparian management zone. The removal of dead or dying trees following a natural disturbance, however, could occur within a riparian management zone if such activity would not irreversibly damage the riparian resources.

S13 Enhance traditional native forest products through implementation of Forest Service Manual policies.

Guidelines

G1 Mark boundaries of timber production areas.

G2 Tree cutting will be allowed to: (1) salvage trees killed or damaged, (2) control insect and disease outbreaks, (3) protect human health and safety, (4) protect resources, or (5) move toward the desired conditions.

Management Strategies

- Consider as a priority the local needs for the products, but within the limits of what can be offered in a sustainable manner.
- Identify economic, social, and ecological barriers for special forest products use.
- Update the vegetation map to delineate and inventory the suitable forest production areas within 2 years of plan signature.
- The Forest product utilization programs should be based on a sustainable utilization or harvesting plans.
- The Forest considers the benefits that the forest products provide to the public and visitors as part of the utilization or harvesting plan.
- Consider projects with the application of analog forestry and agroforestry opportunities.
    - Analog forestry restores the productivity of degraded land and provides new sources of food and income to local people. In essence, an analog forest imitates the original native forest and has similar (analogous) structures and ecological functions. Analog forestry restores the productivity of degraded land and provides new sources of food and income to local people. In essence, an analog forest imitates the original native forest and has similar (analogous) structures and ecological functions. Analog forestry adds certain crops and trees which provide food and marketable products. The process (adapted from the Analog Forestry Practitioner's Guide) includes:
        - Physiognomic formula of the original forest ecosystem and the area to be treated. For this step the structure of the ecosystem is evaluated through an analysis of the seral stage and physiognomic status of the vegetation.
        - After the analysis of the structure of the ecosystem, a gap analysis is conducted between what exists in the treated area and what is missing according to the reference of the original forest.

- Next, an ecological evaluation to assess the degree of impact of different types of land use on the area to be treated is applied. To place a value on these areas, three variables are accounted: soil, structure, and biodiversity. A scale is defined where 1 is the most degraded land, and 8 is the most mature ecosystem. The following figure presents the criteria's for the considered variables.
- Develop a map of the area to be treated considering the hydrological flow, the topography, direction of winds, and the movement of the sun, as these factors influence the area to be treated. In the map divide the area into different patterns of actual or traditional land use. This map will show the attributes of degraded areas that needs to be restored.
- Identify and prioritize treatment areas:

  1) Identify locations that border a natural forest patch in order to extend the size of the natural forest, thus providing a greater range for both plant and animal species.

  2.) Identify the need for the formation of an analog forest corridor to link two or more natural forest patches and to facilitate gene flow and the interaction of gene pools.

  3.) Identify patches of barren land where analog forestry interventions can be used to restore the ecological resilience of the patch and landscape.

  4) Prioritize areas for analog forestry interventions. This applies especially to areas that need further protection or special management, such as watersheds, landslides, and other areas susceptible to erosion are all suitable landscape patches for analog forestry.
- Mimicking a natural forest structure through the use of socio-economically valuable species requires a thorough knowledge of the various desirable species available in order to select plants that will complement rather than compete with each other. The selection of the species will be done according to the rules and policies, and a database for the El Yunque National Forest will be developed to facilitate the selection of species.
- Maintain a monitoring scheme to assess whether the analog forestry plan is implemented as planned and to assess whether the analog forestry interventions will lead to the desired results. Monitoring can help identify difficulties at an early stage, so the strategies and activities can be adjusted to reduce problems and avoid later failures.

- The strategy in El Yunque will consider native crops and traditional crops. (For more information go to http://www.analogforestrynetwork.org.)
- Create a strategy to promote the health of honey bees and other pollinators. Consider areas of honey production and areas to increase the pollinator's density.
- The use of designated areas for honey bees and the production of honey with a market strategy of designation of origin to promote the forest products from El Yunque as a market label.

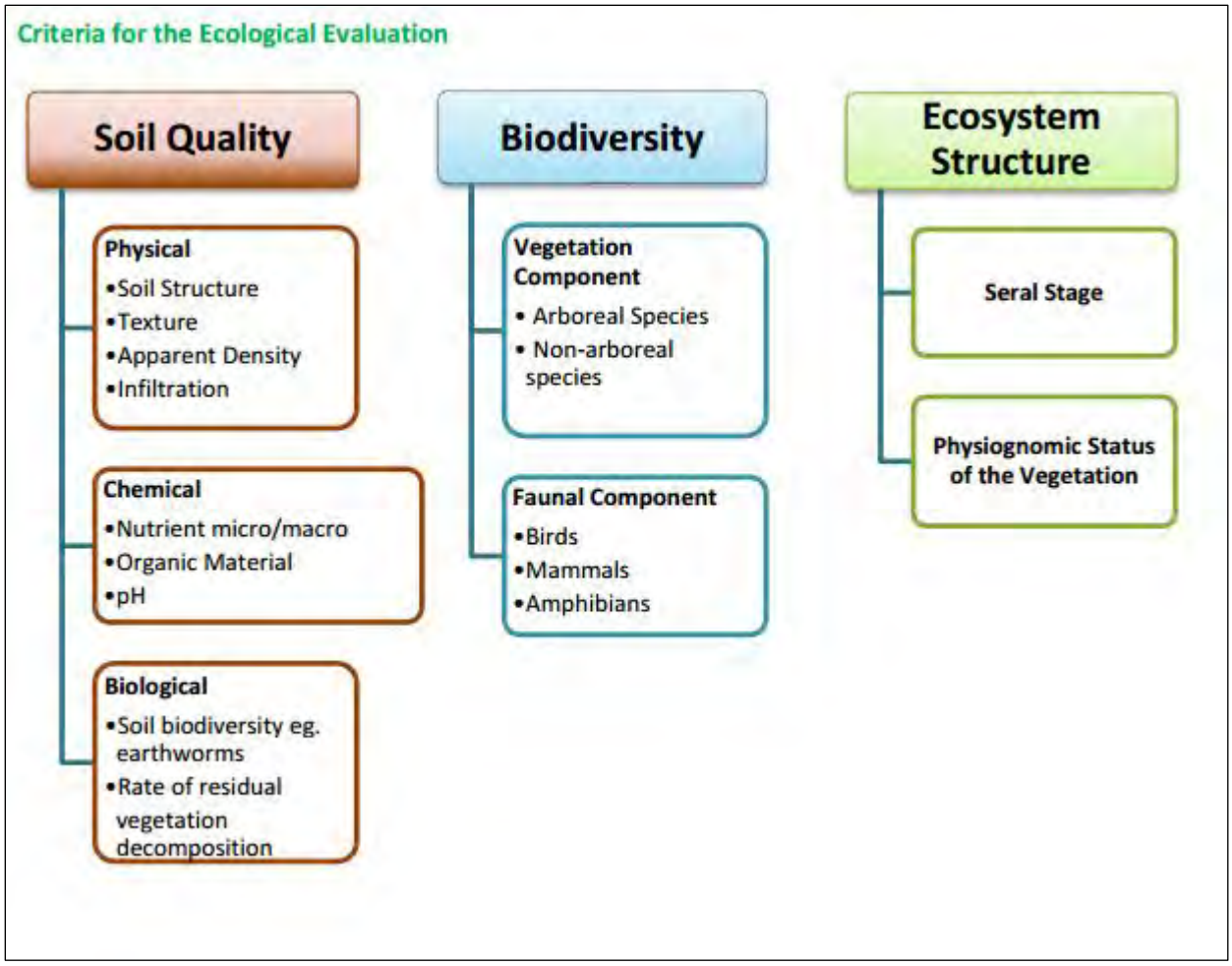


Figure 3- 1. Criteria for the ecological evaluation

- Study forest farming initiatives applicable for local markets and products.
- *Forest farming* is the cultivation of high-value specialty crops under the protection of a forest canopy that has been modified to provide the correct shade level. Special consideration will be given to native crops or traditional crops used as food, medicinal, or ornamental businesses. Encourage and produce viable non-wood products such as mushroom cultivation, medical plants stocks, or other products considered under an agreement with artisans or community organizations for its marketing. The management of the correct shade level can be used to establish areas for the cultivation of native vines that can be used for craftsmanship.
    - The consideration of demonstration parcels with understory crops can be used to promote the forest coverage with economic revenues from the cultivation of crops under forest shade in the region. This type of initiative could link to other state programs in the Department of Agriculture and the Department of Natural an Environmental Resources to encourage private forest management, especially in the lands under the proclamation designation that border the Community Interface Resource Management Area.
    - Additional information available at the following links: http://nac.unl.edu/forestfarming.htm, http://hwwff.cce.cornell.edu/, http://www.fao.org/docrep/n8595s/n8595s00.htm

3.3.4 Watershed

Desired Conditions

- Maintain healthy watershed conditions within the Forest considering water quality, water quantity, soil productivity, and vegetation. Healthy watersheds support important ecological and social services such as productive soils, biological diversity, wildlife habitats, water supplies, and flood control benefits.
- Waterways are important attractions for tourism connecting the health of these systems with important economic influence in the region.
- Conserve a functional linkage for the aquatic wildlife from inside of the Forest to the ocean.
- Watersheds within the Forest are restored and conserved where needed considering connection between EL Yunque and the Rio Fajardo (river).

Goals

- Protect the watershed systems of the Forest by implementing practices designed to maintain or improve watershed conditions.
- Proceed with the application of the Watershed Condition Framework by developing restoration action plans for priority watersheds within the Forest.
- Promote the use of watershed delineations when considering planning and land use.
- Participate in cooperative and community watershed management activities.
- The Forest fosters the development of an ecological corridor between the mountains to the ocean within the municipality of Rio Grande.

Objectives

- Develop a restoration action plan for Rio Blanco Watershed to improve its condition within 5 years of the Plan's signature.
- Apply best management practices (under Forest Service regulations and the Natural Resource Conservation Service) each year of the planning period.
- Stabilize landslides to minimize soil erosion and stream sedimentation by establishing at least 85 percent ground cover within 2 years of slides.

Standards

S1 Incorporate best management practices (under Forest Service regulations and the Natural Resource Conservation Service) design of all projects that affect watershed resources.

S2 Ensure that there is no net loss of riparian areas and wetlands on the Forest.

Management Strategy

- Rio Blanco is the watershed with highest priority within the Forest management to be improved according to the Watershed Condition Framework. This watershed will be managed to supply appropriate ecological services.
- Do a rapid assessment of the watersheds classified as "functioning properly" according to the Watershed Condition Framework to consider the need to apply the 12 indicators required in the Framework.

3.3.5 Special Uses

Desired Condition

- Public lands are easily accessible. The Forest administers special uses that contribute to the public's benefits from the Forest.
- Permitted outfitter services within the capacity of the resources available on the Forest are maintained.
- El Yunque National Forest is respected as a tourist and recreation destination for local residents and visitors to Puerto Rico.
- Local community-based jobs and services are supported.
- Non-recreation special-use authorizations are administered properly and in accordance with Federal regulations and Agency protocols for the benefit of the people.

Objectives

- Ensure outfitter/guide permit standards continue to address critical issues such as number of permits, quality of information conveyed to tour passengers, safety requirements, and conflicts with other recreational uses of the Forest.

Standards

S1 Require special-use permits for all commercial use of the Forest.

S2 Require a special-use permit for any military exercise that is approved. Include the following limitations:

- Limit group size to 15 persons.
- Use only existing roads and trails (no cross-country travel).
- No uniforms, weapons, military vehicles, or chanting.
- Avoid interacting with other visitors.
- Location will be designated within the permit.

S3 Authorize only special-use applications that propose a use which is consistent with: The laws, regulations, orders and policies establishing or governing the Forest, the land management plan, other applicable Federal laws, and with applicable state and local health and sanitation laws.

S4 Applicable special-use applications will only be approved if they obtain the required state, county, municipality, or other federally required licenses, permits, certificates or other approved documents as outlined on 36 CFR 251.56(a)(2).

Guidelines

G1 To the maximum extent feasible, locate new transportation or utility proposals with existing corridors.

G2 Coordinate with the International Institute of Tropical Forestry on all special-use applications for research activities on the Forest.

G3 Minimize use of the Forest for military.

G4 Cooperate with the appropriate Federal and commonwealth agencies to ensure that oil and gas leasing, exploration, and extraction remain inactive.

Management Strategies

- Evaluate special-use permit applications against the following priorities: public safety, health and welfare, and general public benefit associated with National Forest resources.

3.3.6 Scenic Character

Currently about 60 percent of the Forest has natural scenic character, and 40 percent has a naturally appearing scenic character. Forest visitors and adjacent landowners are sensitive to noticeable changes in the landscape whether they are human-caused, extreme weather events or the result of natural process.

Scenery is an integral component of all forest settings, and contributes to the quality of the users' experience. Providing a natural appearing landscape for these visitors is important since Forest visitors rank scenery and attractiveness of the forest landscape as very important (USDA Forest Service 2012a, 2012b).
Scenic integrity indicates the degree of intactness and wholeness of the landscape character. Human alteration can sometimes raise or maintain integrity. More often it is lowered depending on the degree of deviation from the character valued for its aesthetic appeal (Handbook for Scenery Management, 701).

Desired Condition

- The Forest provides high scenic integrity considering the varied elements valued by visitors and nearby community; and promotes the natural forest.
- Human-induced alterations to the vegetation or construction of facilities are designed to blend with the characteristic of the landscape.
- Visitors are drawn to the El Yunque for its natural scenic beauty comprised of immensely diverse vegetation, steep landforms, clear streams, and waterfalls.
- Roads off-forest as well as most Forest roads, trails, and recreation sites, have a high scenery viewing.
- The natural scenic beauty of the Forest stands out, making it a major local and international recreation destination.
- Large areas of the Forest contain naturally evolving landscapes where processes occur with very little human intervention.
- Communication sites, major utility corridors, and administrative facilities are areas that have a moderately altered scenic character, where the activities dominate the valued scenic character, but borrow from valued attributes such as color, shape, edge effect, and pattern of natural openings, vegetative type changes, or architectural styles outside the landscape being viewed.
- Most of the remaining Forest area has a naturally appearing scenic character. Deviations in the scenic character borrow from elements in the landscape. Roads and trails are a part of the naturally appearing landscape, offering opportunities to view scenery. Historic structures, such as Mount Britton or Yokahu Tower, are noticeable, but borrow from landscape elements and are positive cultural elements in the landscape adding to the valued scenic character. Changes to scenic condition across the landscape mostly occur through natural processes such as hurricanes, tropical storms, tree falls, and landslides with naturally evolving landscapes within the Plan period.
- Evidence of human activities and management is noticeable along roads and trails where administrative facilities and recreation developments such as visitor centers, parking areas, trailheads, and picnic areas are noticeable, but remain subordinate to the scenic character being viewed. The landscape has a slightly altered scenic character from these activities.

- The landscapes of the Forest have a wide variety of features providing for some of the most spectacular scenery in the world. People are drawn to El Yunque for its diverse vegetation, tranquility, inspiring scenery, and cool, clear water that provides an escape from the tropical heat. The Forest area has a variety of scenic settings from dense, enclosed rain forest picnic areas and trails to cloud covered peaks and observation towers, which on clear days have vistas of both the Atlantic Ocean and the Caribbean Sea. The Forest also has many prehistoric and historic sites adding richness of character and culture.

Standards

S1 Management activities are designed to meet or exceed the following scenic integrity objectives:

Inventoried Scenic Class	1	2	3
Scenic Integrity Objectives	H	H	M

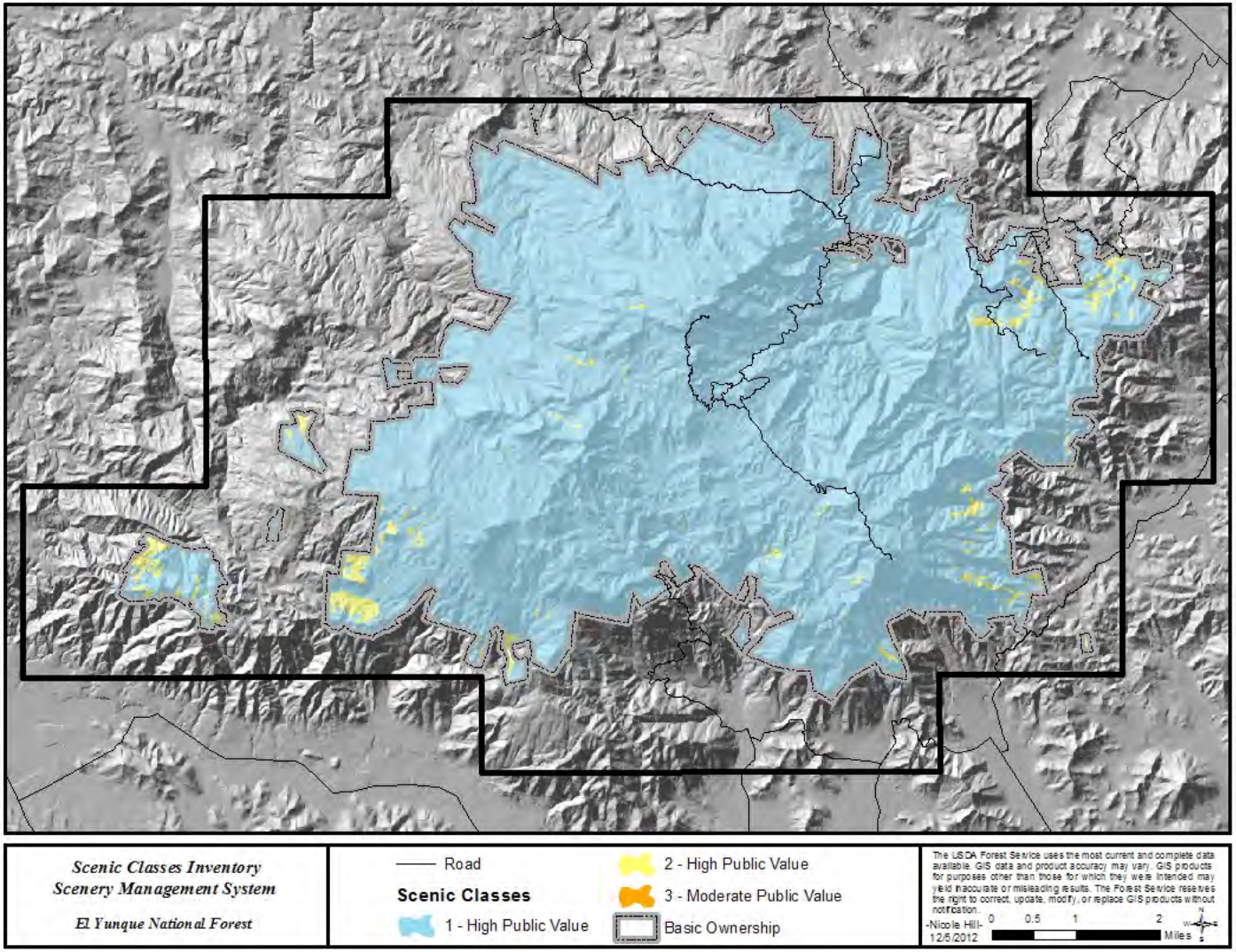
Note: El Yunque has scenic class 1, 2, and 3 (EL Yunque National Forest Scenery Management System Inventory Report, December 2012).

Guidelines

G1 The scenic character is intact with only minute if any deviations, such as non-motorized trails. These areas include El Toro Wilderness Area and Research Natural Area.

Management Strategy

The Forest's natural scenic beauty is comprised of immensely diverse vegetation, steep landforms, clear streams, and waterfalls. Most Forest roads, trails, and recreation areas provide opportunities for viewing scenery. Mountain slopes and ridges, rugged canyons and ravines, floodplains, stream terraces, and mountain peaks and summits provide a range of topography. Landscapes have lush, continuous canopy, forested mountains with every shade of green imaginable, remarkable rock formations and picturesque waterfalls. The vegetation mosaic varies across the Forest with towering ancient Tabonuco and Palo Colorado trees, giant tree ferns, diverse palms, and trees stunted by constant rain and cloud cover at the highest elevations. There are many streams and rivers that originate in the upper elevations. The steep gradient of many streams, rocky streambeds with boulders, and high rainfall amounts result in many scenic rapids, pools, cascades and waterfalls throughout the Forest.



Map 3-4. Scenic classes within the El Yunque National Forest

3.3.7 Cultural and Historic Resources

Desired Condition

- Cultural resources are one of the valuable assets managed by the agency, and thus are fully integrated in the management of the Forest. Proper monitoring, stewardship, and preservation of the cultural resources is carried out in accordance with the best Federal practices and regulations. For the purpose of proper management, a full and effective heritage program is implemented. The program assures effective and efficient care and management of the resources. It fosters the linking of past and present peoples by expanding the knowledge and understanding of history, and also permits scientific and academic engagement with the available resources.
- Existing predefined protocols and agreements facilitate the process of consultation and implementation of projects in the national forest.
- The program supports the proper stewardship and protection of existing historic infrastructure by means of effective management and partnerships. Where feasible, the preservation and reuse of existing historic structures is encouraged and practiced, reducing the need for the construction of new infrastructure, decreasing deferred maintenance costs, and fostering co-management and economic opportunities for the community and economic enterprises.
- The program provides the public with learning and engagement opportunities with the past. The resulting increase in knowledge and awareness helps highlight the importance of the resources in the public's mind, aiding in the appreciation and enjoyment of the resources. It also helps foster the ideals of protection, preservation, and sustainable use.

Goals

- Develop broader engagement and understanding of the cultural resources in the Forest via education, interpretation activities, and new offerings.
- Develop and implement alternatives to reuse historic properties within the El Yunque.

Objectives

- Reduce the backlog of "legacy sites" needing formal evaluation by 20 percent within 10 years.
- Evaluate for the National Register of Historic Places (NRHP) eligibility at least 35 percent of properties included in the "Puerto Rico Forest Reserves New Deal Multiple Property Study," and nominate at least half of those deemed eligible within the Plan's validity period.
- Evaluate known prehistoric petroglyph sites reported and nominate at least 50% of those which are determined eligible for inclusion to the NRHP within 6 years of the Plan implementation.
- Maintain the monitoring of all "priority heritage assets" up to date throughout the Plan's validity period.
- Within a 3-year period, review and update the Forest cultural resources overview.
- Develop and implement a systematic survey strategy aimed at surveying national forest land considered likely to contain historic properties per year within 5 years after the Plan implementation.
- Revise the existing programmatic agreement with the State Historic Preservation Office by 2020.
- Develop broader educational and interpretative offerings presented to the public that highlights historical and heritage information within the first 6 years.
- Reduce the backlog of deferred maintenance needs on "priority heritage assets" by 75 percent within the next 10 years.
- Restore and reuse at least two neglected existing historic structures under Forest Service jurisdiction within the next 10 years.

Standards

S1 All heritage management work carried out in the Forest or under the jurisdiction of the Forest must comply with all Federal laws, regulations, Executive orders, and Forest Service policy related to the protection of archaeological sites, cultural resources, and historic properties.

S2 All undertakings in the Forest must comply with NEPA analysis and/or Section 106 consultation (following CFR 36 800) prior to implementation, except in the cases in which the undertaking falls under one of the previously defined "categorical exclusions" defined on an active programmatic agreement agreed upon by the Forest Service and State Historic Preservation Office.

S3 Decision documents (record of decision, decision notice or decision memo) will evidence compliance with the National Historic Preservation Act, 36 CFR 800, and other heritage-related regulations, as appropriate. A project (or undertaking) not in compliance will be suspended by the Forest supervisor until compliance is documented.

S4 The development of a survey and inventory plan for the Forest must comply with the stipulations of the National Historic Preservation Act, Forest Service Manual 2300, and Chapter 2360–Heritage Program Management and Forest Service Handbook 2309.12-Heritage Program Management.

S5 The Forest Service will maintain confidentiality of the location, character, and ownership of all historic resources by not divulging their location to the public, in accordance to the stipulations of Section 304 of NHPA and 36 CFR 296.18.

S6 Antiquities Act and Archaeological Resources Protection Act permits should only be granted to qualified academic institutions, other organizations, or individuals for the study and research of sites.

Guidelines

G1 Site protection law enforcement protocols should be in place to prevent damage or loss of cultural resources.

G2 Cultural resources should be managed according to their Forest Service management use allocation category, including preservation, enhancement-public use, or scientific investigation.

G3 All priority heritage assets should have condition assessments completed every 5 years or less.

G4 The Forest should avoid disturbance of known cultural resources until evaluated and determined not significant.

G5 The maintenance of historic properties must be coordinated with the Forest archaeologist to ensure that the interventions and activities on them are in compliance with cultural resources management regulations and that the activities will not have unmitigated adverse effect on the properties.

G6 If additional evidence or information regarding a “not significant” property becomes available, it should be re-evaluated.

G7 Priority heritage resources assets are protected, preserved, and maintained.

G8 Cultural resources are protected from loss. Significant sites are stabilized, treated, managed, and preserved for their historical research value.

G9 Heritage sites are managed to preserve the integrity of scientific data that they contain, for the benefit of the public and scientific communities.

G10 All land use permits, contracts, and other Forest use authorizations should contain adequate stipulations and provisions for protection of significant heritage resources.

G11 Heritage Program, public education and outreach should be fostered in agreement with FSM 2360–Heritage Program Management; 2365–Public Education & Outreach and 36 CFR 296.20–Public Awareness Programs stipulations.

Management Strategies

- Promote a broader engagement of the public with existing cultural resources (outfitters, excursions, religious use, replicas at accessible locations, etc.).

3.3.8 Facilities and Transportation

Desired Condition

- Public facilities are attractive, harmonizing with the natural and cultural environment, and are clean, safe, well maintained, and provide universal access.
- The Forest facilities program consists of a variety of structures and associated utilities across the Forest that are used for recreation, administration, research, maintenance, storage, and other general

management purposes, which are well maintained considering the services offered by the Forest and safety of the visitors.

- Administrative facilities reduce their carbon footprint.
- Traffic and parking are orderly.
- Roads blend into the landscape and contribute minimal amounts of sediments to streams.
- The physical access is integrated with the regional context of tourism and recreation.
- Existing roads and facilities are maintained to a high standard to enhance public service protect natural resources, and protect capital investments.
- Recognizing that the Forest has a greater capacity for people (picnicking, hiking, sightseeing, etc.) than it has for private vehicles, the Forest's transportation system facilitates the public's access to the Forest, not necessarily by people's cars, and balances the Forest's heavy visitation with the restricted access that is provided by narrow mountain roads and a sensitive environment.

Goals

- Reduce the operating and maintenance costs of facilities.
- Cooperate with the Puerto Rico Department of Transportation and Public Works (PRDOT) to develop a regional transportation plan.
- Construct only those road segments necessary to service the limited timber demonstration program and recreation facilities.
- Maintain the Forest road system in cooperation with the PRDOT.
- Provide water and sewage systems to meet Federal and commonwealth clean water and pollution abatement standards.
- Support the recovery effort for the Puerto Rican parrot by providing facilities to support the Luquillo Aviary.
- Find alternative uses for vacant facilities which would meet current and future needs and allow the reutilization of existing infrastructure
- Conduct annual maintenance and safety inspection on major structures on the Forest.
- Design, construct, and maintain roads to the minimum service level consistent with public safety, resource protection, and intended traffic levels.

Objectives

- Reduce the backlog of accrued facility deferred maintenance, particularly those items associated with health and safety, within the first 5 years of the plan.
- Match the facility inventory with current management needs, including decommissioning and disposing of those facilities which are no longer required, within 2 years.

Standards

S1 Unauthorized travel ways are decommissioned or left to naturally re-vegetate.

S2 Close Soñadora road to public access during parrot breeding season and habitat management periods.

S3 The following roads are designated for administrative vehicular use only, and closed to general public vehicular use. They are open to foot travel, but such use may be discouraged though signing and providing alternate trail access because of safety concerns during the planning period.

- Sonadora
- Bisley
- East Peak
- El Yunque Peak
- Forest Road 10
- PR 191 between gates at kilometer 13.3 and kilometer 21.0

Guidelines

G1 Consider the needs of physically challenged persons in the design of facilities.

G2 Design of new and renovated facilities responds to the Forest Service image guidelines and cultural and tropical themes.

G3 Minimize electric power needs and water consumption in new and renovated facilities through application of daylighting, natural ventilation, and low-volume plumbing fixtures.

G4 Select materials with low energy production requirements, and emphasize use of recycled products.

G5 Use signed gates or other closure devices to implement seasonal or year-round closures as necessary to protect public safety, resources, and facilities.

G6 Test potable water supplies to meet or exceed Federal and commonwealth standards.

G7 Coordinate the maintenance of historic facilities with Forest archaeologist.

G8 Maintain Forest roads open to public motorized use unless there is a specific safety or resource- or facility-protection reason to limit use.

Management Strategy

- Maintenance priorities include bridge safety, adequate signage, suitable stream crossings and any resurfacing or reconstruction needed to provide an overall road system that is useable and safe.
- Provide opportunities for private investment and utilization of abandoned facilities.
- Consider all means of access, including mass transportation systems to best meet customer service needs, limit traffic problems, and minimize environmental effects.

3.3.9 Minerals

Desired Condition

- Mineral exploitation remains a topic of historical interest rather than a current use.

Goals

- Cooperate with the appropriate Federal and commonwealth agencies to ensure that mineral exploration leasing and extraction remain inactive.

Standards

S1 Use small amounts of salable minerals (soil, sand rock) for administrative purposes only, when such material needs disposal as a result of landslides or facility construction or maintenance.

Other than this incidental on-Forest use, dispose of such material off-Forest, in compliance with applicable Federal and commonwealth regulations. Do not permit removal of salable minerals by the public.

4 Monitoring and Evaluation

Monitoring is continuous and provides feedback for the planning cycle by testing relevant assumptions, tracking relevant conditions over time, and measuring management effectiveness. The purpose of monitoring in an adaptive management framework is to facilitate learning to support determinations on whether changes are needed. The plan monitoring program consists of a set of monitoring questions and associated indicators to evaluate whether plan components are effective and appropriate and whether management is effective in maintaining or achieving progress toward desired conditions and objectives for the Plan area.

The monitoring program includes plan-level and broader-scale monitoring. The plan-level monitoring program is informed by the assessment phase; developed during plan development, plan amendment, or plan revision; and implemented after plan decision.

The plan-level monitoring program sets out the plan monitoring questions and associated indicators. Monitoring questions and associated indicators must be designed to inform the management of resources on the Plan area, including by testing relevant assumptions, tracking relevant changes, and measuring management effectiveness and progress toward achieving or maintaining the Plan's desired conditions or objectives. Questions and indicators should be based on one or more desired conditions, objectives, or other plan components in the Plan, but not every plan component needs to have a corresponding monitoring question.

This monitoring program must contain questions associated with the following:

1. The status of select watershed conditions.
2. The status of select ecological conditions including key characteristics of terrestrial and aquatic ecosystems.
3. The status of focal species to assess the ecological conditions required under 36 CFR 219.9.
4. The status of a select set of the ecological conditions required under 36 CFR 219.9 to contribute to the recovery of federally listed threatened and endangered species, conserve proposed and candidate species, and maintain a viable population of each species of conservation concern.
5. The status of visitor use, visitor satisfaction, and progress toward meeting recreation objectives.
6. Measurable changes on the plan area related to climate change and other stressors that may be affecting the Plan area.
7. Progress toward meeting the desired conditions and objectives in the Plan, including for providing multiple use opportunities.
8. The effects of each management system to determine that they do not substantially and permanently impair the productivity of the land (16 U.S.C. 1604(g)(3)(C)); 36 CFR 219.12(a)).

Monitoring questions should focus on providing the information necessary to evaluate whether Plan components are effective and appropriate and whether management is being effective in maintaining or achieving progress toward the desired conditions and objectives for the Plan area.

Indicators are quantitative or qualitative variables that can be measured or described and, when observed periodically, show trends in conditions that are relevant to the associated monitoring questions.

Table 4-1. Monitoring questions and indicators by selected plan components

Selected Plan Components	Monitoring Questions	Indicators
Climate Change		
Desired Conditions The Forest resources and operational management are resilient to the influences of a changing climate. Management activities reduce the susceptibility of resources to multiple threats, including drought, invasive species, disease, and wildfire. Promote the immediate and long-term resilience of the Forest to change by: ▪ Responding to changes in visitor behavior and mitigate any seasonal increases in use; ▪ Enhance landscape connectivity by maintaining natural migration corridors between lowland and upland forests to allow species to move up-slope into cooler environments as climate warms; ▪ Maintain piles of natural woody debris and promote wetlands and ponds in areas of high amphibian diversity to supplement habitats that retain cool, moist conditions; ▪ Rapidly detect invasive species introductions especially following disturbance from hurricane events in high-elevation communities; ▪ Collaborate with partners and surrounding land managers to coordinate management and monitoring efforts related to visitor use, ecological connectivity and flows, and invasive species. **Goals** ▪ Create collaboration initiatives for monitoring climate change at a broader landscape level, considering partnerships that will be appropriate for such projects.	Is climate change, including changes in variability, influencing maintenance and restoration of ecosystems, including the ability to respond to increases in visitor use and associated impacts on ecosystems?	▪ Trends in climate, including extremes, disturbance patterns, cloud-base elevation, and long-term ecological processes ▪ Trends in Forest health status and risk ▪ Status and trend of functional wetlands ▪ Focal species

Selected Plan Components	Monitoring Questions	Indicators
Status of Select Watershed Conditions		
Desired Condition Use of water for human consumption is balanced with in-stream flow needs for use, recreation, research, and aquatic and terrestrial ecosystem maintenance. Rio Blanco was identified as the watershed with highest priority within the Forest management to be improved according to the Watershed Condition Framework. This watershed will be managed to supply appropriate ecological services. *Desired Condition from Aquatics Ecosystems:* Ensure ecologically sustainable human (anthropogenic) consumption of water is conducted to not adversely affect the ecosystem's long-term function. **Standard** ▪ Monitor climate change factors to determine supply of water within the Forest. The flow regimes cannot be modified to levels that affect the abiotic functions and biotic needs for a viable population in the aquatic ecosystems of the Forest. **Guidelines** ▪ The monitoring protocols of the resources should provide opportunity to evaluate the regional scale to consider management recommendation that improve the watershed conditions in their connection from headwaters to coastal regions.	Are the priority watershed conditions functioning properly? Are riparian buffers and best management practices providing for increased diversity of riparian vegetation species to avoid bank erosion and improve filtering of nonpoint and point source sediments? Is the functional wetland supplying its expected flow of water? Is the 600 meter of altitude boundary of the functional wetland sustaining or changing based on climate conditions? How is the Plan meeting the objectives of the Forest Watershed Condition Assessment?	▪ Percentage of or amount of forest cover, riparian area tree and shrub distribution, aquatic biota composition, aquatic habitat continuity, disturbed area condition (roads, trails, slides), and area of unstable soils. In-stream flows are revised based on scientific data updated based on environmental changes produced by climate change or any other environmental stressor.

Selected Plan Components	Monitoring Questions	Indicators
Status of Select Ecological Conditions Including Key Characteristics of Terrestrial Ecosystem		
Desired Condition The land of the Forest remains forested. El Yunque National Forest will be conserved, maintained, and restored primarily with native species. The Forest's primarily rich biodiversity, including species and genetic and ecosystem processes are maintained. Viable populations of native plants are maintained or achieved. Primary forest is preserved. **Standards** ▪ S2. Limit modification of the vegetation, such as recreation facility construction and sustainable forest product uses, to areas where irreplaceable vegetative resources are not jeopardized. ▪ S6. Use native vegetation as much as possible in watershed restoration and other rehabilitation projects. **Guidelines** ▪ G1. The Forest should develop and maintain a map of the ecological classification (National Vegetation Classification System) in the Forest's GIS. o Identify the Mature Forests to maintain the condition or preserve all Primary Forest. o The Plantation/Secondary Forest should maintain a monitoring protocol for all the applied management activities to keep a record the forest dynamics.	Are projects or management actions utilizing native species in their reforestation/restoration mitigations? Are projects or management actions that impair the Primary Forest allowed? Has the ecological classification map for El Yunque been incorporated to the Forest Service GIS data base? Has the Plantation/Secondary Forest been characterized and plots established to monitor its long term dynamics? What is the effect of climate change on the planning area? Are the riparian ecosystems being affected by management or outside the Forest? What is the status of the key characteristics of the terrestrial and aquatic ecosystems? What is the status of climatic conditions and cloud evaluation shifts? What are the effects on the forest stands because of timber removals?	▪ Terrestrial ecosystems identified using the National Vegetation Classification System are maintained or adjusted based on botanical, vegetation diversity or forestry inventories performed, published, reported or incorporated into local or national data bases by Forest Inventory Analysis, International Institute of Tropical Forestry, Long-Term Ecological Research, University of Puerto Rico Terrestrial Ecology Research area, independent researchers, and other academic institutions.

Selected Plan Components	Monitoring Questions	Indicators
Ecological Conditions that Contribute to the Recovery of Federally Listed Plants Species and Species of Conservation Concern		
Desired Condition All plant species, particularly those on the species of conservation concern list, are protected and managed so as not to become endangered or extinct. **Objective** ▪ Design a survey strategy to determine the population status of the plant at-risk species and to have a numerical update of all species, with priority given to the federally listed; in compliance with their recovery plan. ▪ Use partnerships with cooperators or pertinent agencies to develop plans and strategies to increase the population number of those species at-risk.	Has the Forest conducted botanical surveys (minimum 5 years period) to determine location and status of populations of plant at-risk species? Has El Yunque prepared agreements with cooperators to survey and maintain data bases accessible to Forest Service of plant species at-risk? What is the status of the key ecological conditions that contribute to the recovery of threatened and endangered species? What is the status of the key ecological conditions that help to conserve proposed and candidate species? What is the status of the key ecological conditions that help to maintain or enhance the populations of the species of conservation concern?	▪ Survey strategies are developed and implemented. ▪ Plants species at-risk populations are located, documented, and reported. ▪ A GIS layer with population's location is prepared and available to managers to consult when projects are designed. ▪ Agreements established with institutions for the purpose of botanical surveys of plant species at-risk and vegetation types of the El Yunque.

Selected Plan Components	Monitoring Questions	Indicators
Status of Select Set of the Ecological Conditions Required to Contribute to the Recovery of Federally Listed Species and Maintain Viable Populations of Each Species of Conservation Concern		
	Is El Yunque implementing watershed restoration action plans in order to get all watersheds into the class 1 Watershed Condition Framework category? Are ecosystem services being supplied in a sustainable manner? Is El Yunque being conserved, maintained, and restored primarily with native species? Is the Forest's primarily rich biodiversity, including species, genetic, ecosystem processes, and unique forest types, being protected and maintained? Are viable populations of native plants, including species at-risk, being maintained or achieved? Has the Plantation/Secondary Forest been characterized based on vegetation, structure, and ecological functions?	▪ Developed and implemented Watershed Condition Framework action plan. ▪ Assessments of ecological services conditions. ▪ Monitoring reports of management activities impacts and effects on ecosystem processes and forest vegetation. ▪ Reports of species of conservation concern surveys and population status, including reintroduced populations reproduced in nurseries to the field. ▪ Reports and/or publications on Plantation/Secondary Forest vegetation status and ecological functions.

4.1 Wildlife and Fisheries Resources

Outside of the El Yunque National Forest, consideration and coordination with broad-scale monitoring strategies, multi-party monitoring collaboration, and cooperation with state agencies (where practicable), should increase efficiencies and help track changing conditions beyond the Forest boundaries to improve the effectiveness of the Plan monitoring program. In addition, project and activity monitoring may be used to gather information for the Plan monitoring program if it will provide relevant information to inform adaptive management.

The following monitoring programs are not intended to depict all monitoring and data gathering for activities undertaken on the Forest; nor are they intended to limit monitoring to just the questions and indicators listed in the following tables.

4.1.1 Focal Species for Monitoring

Under chapter 30 part 32.11 of FSH 1909. 12 of the new 2012 planning directives, the Forest Service has been given the opportunity to address uncertainty. An important criteria is thus stated: "if research has shown that the effects of current practices are known, there is no need to select questions and indicators to verify such impacts". The El Yunque National Forest sees this as an opportunity to build the foundations towards species occurrences models. Through past and present data collection, many past and new focal species may benefit from the use of these models for answering the why, what, and how survey questions of EL Yunque's adaptive management contributions towards desired conditions.

Key ecosystem characteristics can also be combined in different ways to assess habitat for specific focal species, using species occurrences models and detections based upon Gallardo (2015). Species-specific or group-species habitat models would be used at the project scale to assess potential effects of forest plan implementation. For example, project-level monitoring can assess availability of multistoried habitat for future Elfin-woods warbler analysis or assess spatial distribution of known habitat patch size and connectivity within a sub-watershed.

The monitoring plan focuses on focal species. As stated in chapter 30 part 32.13c of FSH 1909.12 of the new 2012 planning directives:

> The purpose for tracking the status of these focal species over time is that they are indicators of ecological functions and they provide insight into the following:
>
> 1. Risk to ecological systems on which focal species depend or influence, as in the case of keystone species of ecological engineers.
>
> 2. Effects of management on those ecological systems, their conditions, and risk factors.
>
> 3. Effectiveness of the plan components to provide for ecological functions and maintain or restore ecological conditions.
>
> 4. Progress towards achieving desired conditions, including population levels and objectives for the plan area.
>
> Focal species are not selected to make inferences about other species. Focal species are selected because they are believed to be responsive to ecological conditions in a way that can inform future plan decisions. Categories of species that could be included under the term "focal species" and could serve this ecological purpose include indicator species, keystone species, ecological engineers, umbrella species, link species, species of conservation concern, and others. (32.13c of FSH 1909.12)

Focal species represent a part of the monitoring requirements for ecological sustainability and diversity of plant and animal communities. "It is not expected that a focal species be selected for every element of ecological conditions" (77 *FR* 21233; April 9, 2012). Monitoring focal species is intended to address situations where they provide more useful information or are more efficiently monitored than monitoring other potential indicators. Focal species are not selected to make inferences about other species. Focal species are selected because they are believed to be indicative of key characteristics of ecological function (ecological functions) and are responsive to ecological conditions in a way that can inform plan decisions.

Table 4-2 provides the justification for these species to be considered under the focal species category.

The ecological niches that the focal species comprises in the neo-tropical rainforest exhibit direct relationships that can be interpreted to provide information towards reaching the desired conditions.

The Elfin-woods warbler is an umbrella and "at risk" species that specifically indicates overall ecological functioning or changes of its preferred Elfin woodland and Palo Colorado habitats. Monitoring should be conducted annually.

Both Puerto Rican broad-winged hawk and Puerto Rican sharp-shinned hawk are "at-risk" raptors (apex predators) known to be affected by new ecological components such as disease. Monitoring should be conducted every 2 years.

All of the coquies species—ground coqui, tree-hole coqui, burrow coqui, and warty coqui—are insular "at-risk" amphibians whose occurrences in the ecosystem directly shows changes to biodiversity in their respective preferred habitat and trophic level. Monitoring should be conducted annually.

The spinning basket shrimp is an aquatic keystone species where its presence or absence have conspicuous effects on physical elements of stream conditions. This filter feeder is very common and has been known to directly correlate water quality conditions. Monitoring should be conducted annually.

The Puerto Rican parrot is another insular "at risk" species that requires special habitats to continue its existence. Through new scientific information that the El Yunque is not its preferred habitat, it still plays an important ecological function within the Palo Colorado habitat type. Monitoring should be conducted annually.

Table 4-2. Focal species for the EL Yunque

Scientific Name	Common Name	Group[1]	Southern Region's Ecological Sustainability Evaluation Crosswalk[2]	"At Risk" Category
Birds				
Setophaga angelae	Elfin-woods warbler	B, C	2, 3, 4	Yes
Buteo platypterus brunnescens	Puerto Rican broad-winged hawk	B, C	3, 4, 7	Yes
Accipter striatus venator	Puerto Rican sharp-shinned hawk	B, C	3, 4, 7	Yes
Amphibians-Coquies				
Eleutherodactylus richmondi	Ground coqui	C	2, 4	Yes
Eleutherodactylus hedricki	Tree-hole coqui	C	4, 6	Yes
Eleutherodactylus unicolor	Burrow coqui	C	2, 4	Yes
Eleutherodactylus locustus	Warty coqui	C	4, 7	Yes
Fisheries Species				
Atya lanipes	Spinning basket shrimp	D	1	No
Special Endangered Species				
Amazona vittata	Puerto Rican parrot	A, C	Special endangered species recovery, 4	Yes

1 The following lists those categories that are relevant to the El Yunque.
Group:
- A) Specific vegetation type dynamics
- B) Endemic interior forest birds
- C) Terrestrial ecosystem trophic dynamics
- D) Aquatic ecosystem trophic dynamics

2 Focal species groups that have been identified through the EL Yunque interdisciplinary team and Southern Region's Ecological Sustainability Evaluation Tool:
1) Freshwater crustacean
2) Mature Tabebuia/Eugenia Woodland associate
3) Novel (forest) associates
4) Palo Colorado associates
5) Rio Mameyes associates
6) Sierra Palm associates
7) Tabonuco associates

Other species that are not included, such as insects, freshwater eels, other birds, bats and reptiles, requires considerable resources from the wildlife and fisheries program, which would be beneficial to have as options for future partnerships with other Federal, State or non-governmental organization to conduct feasible surveying.

Key ecosystem characteristic related to climate change and wildlife is measured at very large scales (not the forest scale), but are important to some wildlife species on the El Yunque National Forest. Links between particular wildlife species and phenology may also be important (for example, coqui species physical condition in relation with the chytrid fungus and their environment, which is currently being researched).

Table 4-3. Monitoring the desired conditions for wildlife and fisheries resources

Selected Plan Component	Monitoring Questions	Indicators[1]
Desired Condition ▪ Provide high quality habitats for endemic wildlife and fisheries populations in their existing or historic distributions to enjoy and scientifically study in their natural habitats. ▪ Maintain or restore the El Yunque National Forest's rich biodiversity, including ecological processes that may improve resilience to change. ▪ To maintain and if possible rehabilitate identified habitats that exhibit special biological characteristics to sustain their conditions. ▪ Maintain robust populations (and metapopulations) of identified at-risk species (federally threatened, endangered, proposed and species of conservation concern) through managing identified population limiting factors on the El Yunque National Forest to better adapt to any possible change. ▪ Rehabilitate known habitat (foraging, shelter, and breeding) of at-risk species to improve habitat capabilities to support healthy populations' needs, to the extent of that habitat's resiliency to change. **Desired Condition (**from aquatic ecosystems) ▪ Maintain or restore high quality ecosystem services and biodiversity of aquatic ecosystems of the El Yunque National Forest. Using best available science to provide benefits of healthy habitats to aquafauna whose life cycles are interconnected with the surrounding ocean.	Are focal species (that are not at-risk species) habitat and communities of the El Yunque National Forest being maintained or restored? What is the status of the key ecological conditions that contribute to the recovery of threatened and endangered species? What is the status of the key ecological conditions that help to conserve proposed and candidate species? What is the status of the key ecological conditions that help to maintain or enhance the populations of the species of conservation concern?	▪ Targeted focal species presence or absences. ▪ Status and trends of habitat components associated to focal species population viability. ▪ Trends from species occurrences models on the El Yunque National Forest.

Focal species to select from: All species from Table 4-2.
Scale: Plan area wide; except for the Puerto Rican parrot

Table 4-4. Monitoring desired conditions

Selected Plan Component	Monitoring Questions	Indicators*
Community Interface Resource Management Area		
Desired Condition ▪ To have a healthy and sustainable forest landscape in the El Yunque region, with a mosaic of vegetation that contributes to the economic and social wellness without affecting mature forests, through resource management alternatives applicable to the tropical forests in areas below 600 meters of elevation. ▪ To have a management area that contributes to the economic and social wellness of the regional geographic scale. **Objectives** ▪ Apply restoration practices promoting collaborative, science-based ecosystem restoration in prospective corridors that could connect the Community Interface Resources Management Areas with natural protected areas identified in the regional geographical scale considered for the Plan. ▪ Maintain a bidirectional working relationship with local communities and community groups taking into account activities that improve land conditions during the planning period.	Are the forests in the Community Interface Resource Management Area maintaining the goods and services expected from a healthy and sustainable landscape? Are the projects and activities conducted in the Community Interface Resource Management Area contributing to the economic and regional geographic scale? Has El Yunque improved or enhanced the terrestrial or aquatic habitats that connect or link the forest to other natural protected areas. Are the agency and the stakeholders developing projects that improve desired conditions?	▪ Changes in percent of forest canopy coverages. ▪ Instream flow. ▪ Number of projects and activities completed or under an agreement annually. ▪ Census data for economic indicators. ▪ Number of projects and activities done. ▪ Kilometers and/or acres of habitat under management strategies related to the connection of the forest to other natural protected area. ▪ Number of projects related to land improvement. ▪ Acres under improvement projects with the participation or collaboration of local community groups.

Selected Plan Component	Monitoring Questions	Indicators*
Social Economic		
▪ In balance with its ecological conditions, state, and resilience, the Forest provides a broad range of social, cultural, and economic benefits to individuals and communities at local to global levels. ▪ Forest goods and services are utilized by individuals and communities to generate employment and stimulate the economy in and around the Forest. Local residents benefit from jobs and income associated with Forest management activities; local economies benefit from visitors attracted to the wide variety of goods and services that the Forest offers; and local and other businesses increasingly offer recreation and other opportunities that benefit the sustainability of the Forest and the landscape in which it is situated. ▪ Partnerships and other collaborative arrangements with neighboring communities, special interest groups, state agencies, local governments, and others that support and enhance Forest conservation, recreation, restoration, education, and other programs and activities continue to grow and thrive. ▪ Education, interpretive, and information programs and activities connect people to the Forest environment and foster a sense of place and stewardship.	To what extent is Forest management providing sustainable and predictable levels of goods and services for communities? To what degree does the Forest provide opportunities to connect people, including youth, with nature? To what extent is Forest management contributing towards desired conditions for a stable and functioning local economy? To what degree do communities benefit from the Forest socioeconomically and from a cultural diversity standpoint? To what degree are Forest-related partnerships and other collaborative arrangements increasing with and around the Forest?	▪ Levels of production of multiple uses including Forest products; water outputs; camping, special-use and other permits; recreation opportunities; etc. ▪ Number and type of education and youth programs. ▪ Number of individuals, and youth in particular, participating in Forest education and youth programs. ▪ Number, type, and total dollars for direct employment with the El Yunque. ▪ Number, type (conservation, recreation, restoration, education, etc.), and funding (total, Forest Service, matching) of partnerships around Forest resources, within and across forest boundaries. ▪ Number and type of Forest-based special-use permits. ▪ Number and type of licensed Forest operators/concessions. ▪ Number, type (conservation, recreation, restoration, education, etc.) and funding (total, Forest Service, matching) of partnerships and other collaborative relations around Forest resources, within and across Forest boundaries. ▪ Number of partnerships specializing in interpretive and education programs for visitors and communities. ▪ Number of staff and volunteers participating in trainings and learning opportunities. ▪ Number of training opportunities offered or attended in the area of interpretation and environmental education. ▪ Results of the Environmental Literacy Survey for Middle School.

Selected Plan Component	Monitoring Questions	Indicators*
Cultural Resources		
Desired Condition ▪ Proper monitoring, stewardship, and preservation of the cultural resources is carried out in accordance with the best Federal practices and regulations. **Standard** ▪ Heritage management work must comply with all Federal laws, regulations, and Forest Service policy related to the protection of archaeological sites, cultural resources, and historic properties. **Desired Condition** ▪ The program provides the public with learning and engagement opportunities with the past. **Objective** ▪ Develop educational and interpretative offerings that highlight historical information.	Are historic properties been assessed and managed accordingly to Federal law and agency regulations? Have potentially reusable historic structures been assessed and refurbished for active use? Are the interpretation and recreation offerings that promote engagement with the history of the Forest and its cultural resources in place? Are the desired conditions being met through the integration of cultural/historic interpretation?	▪ Number of sites evaluated and nominated. ▪ Annual heritage program target score. ▪ Number and status of new or updated interpretative and education offerings related to cultural resources and historic sites.
Desired Condition ▪ The program supports the proper stewardship and protection of existing historic infrastructure.	What progress has been made to maintain and reuse existing historic infrastructure?	▪ Number of historic structures reused.
Objectives ▪ Reduce the backlog of deferred maintenance needs on Priority Heritage Assets and reuse at least two neglected existing historic structures.		▪ Number of sites with deferred maintenance needs met.
Ecosystem Services		
Desired Condition ▪ El Yunque National Forest provides a collection of goods and services that are critical to human health and livelihood for the region and Puerto Rico. **Goal** ▪ Maintain and improve, according to the available resources, the level of yield form the ecosystem services of the Forest.	What are the primary goods obtained from the Forest? What are the primary services provided by the Forest? What quantities of good and services are produced? How is the Plan facilitating ecosystem services production?	▪ Acreages of soil and water improvements, water produced, number of special-use permits, research publication, number of conservation educational activities, and number of visitors and scenery inventories. ▪ Number of maintenance, restoration, or improvement activities.

Selected Plan Component	Monitoring Questions	Indicators*
Infrastructure		
Desired Condition ▪ The transportation system is well planned, built, and maintained. ▪ Traffic and parking are orderly even on busy summer weekends.	What is the status of the travel management system? What is the road maintenance and deferred maintenance for the Forest? How are the people accessing the Forest? Is access connected to adjacent natural areas? How are infrastructure objectives contributing to desired conditions?	▪ Approved transportation analysis and road safety plans. ▪ Percent of maintenance accomplished. ▪ Road connectivity index, number of touristic routes, regional trails.
Lands		
Goals ▪ Collaborate with Municipalities' Territorial Plan and Puerto Rico Land Use Plans by fostering an “all lands regional” perspective.	How many acres of land within the proclamation boundary are dedicated to agriculture or forestry? How do we collaborate with municipal planning?	▪ Land use and land cover. ▪ Number inputs sent to Puerto Rico Planning Board. ▪ Acres under conservation agreement. ▪ Acres of land ownerships
Recreation		
Desired Condition ▪ Use the recreation sustainability framework as a guide to manage recreation sites. **Objective** Establish a process to accurately determine visitor impact to recreation areas.	Are Forest recreation sites being impacted by high visitation and use?	▪ Annual site visit to recreation areas and trails.
Desired Condition ▪ Provide visitor information services that address the ecological, social, economic and cultural background of the Forest. **Objective** Continually provide visitors with current and accurate information about the Forest	Are visitors being provided adequate and current interpretive and heritage information related to the Forest?	▪ Number of recreation opportunity guides that are produced. ▪ Website hits. ▪ Visitors hosted at El Portal Visitor Center and Reception area. ▪ Number of materials produced.

Selected Plan Component	Monitoring Questions	Indicators*
Desired Condition ▪ Identify recreation opportunities at the lower elevations of the Forest. **Objective** ▪ Alleviate the high concentration of visitor activity along the main Forest recreation corridor.	Is there a potential to create recreation opportunities in the lower elevations (Community Interface Resource Management Area) of the Forest?	▪ Number of trails and existing sites identified which have recreational value.
Desired Condition ▪ Forest works with local communities and municipalities as well as Federal and state agencies in addressing regional recreation and tourism demands. **Objective** ▪ Create partnerships with surrounding Forest communities, special interest groups, and municipal governments to enhance recreation opportunities.	Are current regional recreation and tourism needs being addressed?	▪ Number of outreach meetings held with neighboring communities and municipalities.
Desired Condition ▪ Recreation demands are balanced with the ability of the land to sustain use and the capacity of the Forest to manage its use. **Objective** ▪ Monitor recreation sites to evaluate visitor use and impacts to the resource.	How does the Forest manage current recreation use and demands?	▪ Visitor use numbers.

Selected Plan Component	Monitoring Questions	Indicators*
Wilderness		
Desired Condition ▪ Manage and protect wilderness area flora and fauna and its undisturbed character. **Objective** ▪ Protect wilderness character.	Is the wilderness area being properly managed to program standards?	▪ Area and number of sites impacted by use.
Desired Condition ▪ Provide for primitive recreation opportunities and solitude. **Objective** ▪ Provide for the wilderness recreation opportunities that provide solitude.	Are recreation activities meeting wilderness recreation guidelines?	▪ Visitor use rates and number of encounters.
Wild and Scenic Rivers		
Desired Condition ▪ Manage the rivers' free-flowing condition, water quality, and outstanding remarkable values which made them wild and scenic rivers. **Objective** ▪ Wild and scenic river standards are protected and perpetuated.	Are the Comprehensive River Management Plan guidelines being implemented?	▪ Seasonal monitoring of water quality of wild and scenic rivers and connecting streams data.
Desired Condition ▪ Implement Forest trash-free zones in "recreation" segments of wild and scenic rivers. **Objective** ▪ Reduce the amount of time currently dedicated to trash removal at wild and scenic river "recreation" areas.	Is the trash-free zones initiative being implemented?	▪ Trash collection visits by Forest Service teams to wild and scenic river "recreation" segments. ▪ Pounds of trash collected.

Selected Plan Component	Monitoring Questions	Indicators*
Environmental Literacy and Education		
Desired Condition ▪ Partnerships are created with local communities, schools, special interest groups, and government agencies to develop and support interpretive and educational efforts and to strengthen regional identity and capacity for co-management. **Objectives** ▪ Develop an interpretation and environmental education strategy within 2 years of Plan approval to be implemented within a 3- to 5-year timeframe that builds upon current standards and guidelines, and measures the effectiveness of programs and initiatives in partnership with surrounding communities, government agencies, special interest groups and organizations.	Is the environmental literacy in the region improving?	
Collaboration		
▪ The Vision and Management Strategy asks for a collaborative process to achieve the vision on which internal and external stakeholders can rally around and reflect the uniqueness of the Forest.	How effective are the collaboration activities in helping to implement the Forest Plan? Is the Plan's implementation facilitating shared understanding and collaboration? How is the collaboration process required as part of the vision and management strategy of the Forest progressing through the Plan period?	▪ Number of collaborative projects. ▪ Number of new partnerships originated by communities or local and state government organizations in coordination with the Forest that caters to outdoor recreation opportunities. ▪ Number of regional environmental literacy initiatives and education projects with local communities to promote and strengthen a collaborative and participatory management approach required in the Vision and Management Strategy.

Selected Plan Component	Monitoring Questions	Indicators*
Geographic Area: El Oeste y Sur		
Desired Future Condition ▪ To have a community-based use of the forests of the region with emphasis on environmental education and community-based enterprises in the western and southern municipalities of Canovanas, Juncos, Las Piedras, Naguabo, and Humacao. **Objective** ▪ Maintain alternatives of community-based enterprises associated with agroforestry and analog forestry opportunities in the region of the geographic area through the plan duration.	How many environmental education and community-based enterprises have been developed in the municipalities of the geographic region? How many projects related to agroforestry and analog forestry opportunities in the region have been established?	▪ The number projects for environmental education. ▪ The number projects associated with community-based enterprises. ▪ The number of agroforestry and analog forestry projects. ▪ The number of acres associated with agroforestry and analog forestry projects in the geographic region.

5 References

Caughley, G. Gunn, A., 1996. Conservation Biology in Theory and Practice. Blackwell Science, Inc. 238 Main Street, Cambridge, MA 02142

Cohn, D., Patten, E., Hugo Lopez, M. 2014. Puerto Rican Population Declines on Island, Grows on U.S. Mainland. Pew Research Center. Hispanic Trends. August 2014.

Gould, W.A., M Sartinuzzi y I. K. Parés-Ramos 2012. Land Use, Population Dynamics, and Land-Cover Change in Eastern Puerto Rico. Chapter B of Water Quality and LKandcscape Processes of Four Watersheds in Eastern Puerto Rico. Ed. Sheila F. Murphy and Robert F. Stallard. US Department of Interior. US Geological Survey.

Huey, R. B., 2009. Why tropical forest lizards are vulnerable to climate warming. Proc. R. Soc. B published online 4 March 2009. doi: 10.1098/rspb.2008.1957

Kwak, T. J., P. B. Cooney, y C. H. Brown. 2007. Fishery Population and Habitat Assessment in Puerto Rico Streams: Phase 1 Final Report. Federal Aid in Sport Fish Restoration Project F-50 Final Report. Marine Resources Division, Puerto Rico Department of Natural and Environmental Resources. San Juan.

López-Marrero, T.; Hernández -Báez, L.A. 2011. Participatory Listing, Ranking, and Scoring Ecosystems Services and Driver of Changes. [Guide]. Gainesville, FL: USDA Forest Service Southern Research Station. 8 p.

López-Marrero, T.; Hernández -Báez, L.A. 2011. Participatory Mapping of Land Cover Change [Guide] Gainesville, FL: USDA Forest Service Southern Research Station. 8 p.

Lugo, A. E. 2009. The Emerging Era of Novel Tropical Forests. BIOTROPICA 41(5): 589–591 2009

Lugo, A.E. & Helmer, E. (2004). Emerging forests on abandoned land: Puerto Rico's new forests. For. Ecol. Manage. 190, 145–161

Lugo, A.E. 2009. The emerging era of novel tropical forests. International Institute of Tropical Forestry, USDA Forest Service, 1201 Ceiba St. Jardín Botánico Sur, Río Piedras, Puerto Rico. Biotropica 41(5): 589–591.

Mascaro J.; J.A. Harris; L. Lach; A Thompson; M.P. Perring; D.M. Richardson and E.C. Ellis. 2013. Origins of the novel ecosystem concept. In Novel Ecosystems, Intervening in the New Ecological World Order. Eds. R.J. Hobbs; E.S. Higgs and C.M. Hall. Wiley-Blackwell Publication.

Mascaro J, Hughes RF, Schnitzer SA. Novel forests maintain ecosystem processes after the decline of native tree species. Ecol. Monogr. 2012; 82: 221–228.

Quinn, J. H., 2004. Spatial ecology of the small Indian mongoose (*Herpestes auropunctatus*) in a subtropical rainforest: the influence of human activity and management implications-Thesis. University of California, Davis, One Shields Avenue Davis, CA 95616.

Quinn, J. H., 2004. Spatial ecology of the small Indian mongoose (*Herpestes auropunctatus*) in a subtropical rainforest: the influence of human activity and management implications-Thesis. University of California, Davis, One Shields Avenue Davis, CA 95616.

Scatena, F. N., and S.L. Johnson. 2001. Instream-flow analysis for the Luquillo Experimental Forest, Puerto Rico: Methods and analysis. General Tech. Report IITF-GTR-11, San Juan, PR: U.S. Department of Agriculture Forest Service.

USDA Forest Service, 1996. The Southern National Forest's Migratory and Resident Landbird conservation Strategy: Program guidance for most neo tropical, migratory, temporate migratory and resident birds. Southern Region Office, Atlanta, GA.LUGO, A. E., AND E. HELMER. 2004. Emerging forests on abandoned land: Puerto Rico's new forests. For. Ecol. Manage. 190: 145–161.

United States Census Bureau (USCB). American Fact Finder. U.S. Census Bureau's American Community Survey Office. 30 December 2013 [http://factfinder2.census.gov].

Weaver, P.L. 2012. The Luquillo Mountains: Forest resources and their history. General Technical Report IITF-44, USDA Forest Service, International Institute of Tropical Forestry, San Juan, Puerto Rico. 159 p.

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.Appendix A: Management Situations for the Elfin-woods Warbler in the New Land and Resources Plan for El Yunque National Forest

Introduction

The guidelines developed for the Elfin-woods warbler (*Setophaga angelae*) management situation concept is a part of the candidate conservation agreement between the U.S. Forest Service and U.S. Fish and Wildlife Service and are intended to promote recovery of this candidate species and improve its status (thus leading away from the species being listed as endangered). These guidelines (which are found in the Plan in Section 3.1.10) will better coordinate El Yunque National Forest activities and better evaluate risks to the species to aid in the appropriate timing and placement of any developments.

The concept applies to all Federal lands within the El Yunque boundary, and describes three distinct management situations. Each of these management situations varies in terms of its existing and potential value as Elfin-woods warbler habitat, its sensitivity to management activities, and the direction that guides such activities. In general, as the management situation number increases from 1 to 3, Elfin-woods warbler habitat values (these are present day and not necessary potential values) decrease, as do the sensitivity to management activities, the number of management constraints, and the intensity of coordination required. The three management situations are:

Management situation 1: **Prime habitat**

Management situation 2: **Potential habitat**

Management situation 3: **Limited value habitat**

Management situation definitions are found in the following description sections. As noticed in the columns that give a value from effects of physical and human disturbance, the mechanism to arrive to the designations is as follows:

High = Where actions and/or direct, indirect, or cumulative effects negatively contribute to the viability of the species; thus leading to endangered species designation by the U.S. Fish and Wildlife Service. Viability is as defined under viable population in the zero code for the proposed Forest Service Handbook.

Moderate = Where actions and/or direct, indirect, or cumulative effects increases biological stressors or limiting factors for the viability of the species.

Low = Where there is little or no direct, indirect, or cumulative impacts to the species.

Table A-1. Description of management situations, sensitivity levels, and guidelines

Situation	Description
Management Situation 1: Prime Habitat	
Description	These areas contain scientifically known Elfin-woods warbler breeding and foraging occurrences that are essential to successful reproduction and species recovery.
Sensitivity Levels	*Site Disturbance:* Present understanding of Elfin-woods warbler sensitivity to human induced physical or site disturbances within prime habitats is limited. However, due to the intrinsic value of these areas, the potential for damage from uncontrolled habitat modification is extremely high, and little risk of adverse effects will be acceptable. *Human Disturbance:* Sensitivity to disturbances from human presence and human-generated noise during the nest selection and breeding seasons is extremely high. Potential sources of human disturbance include recreational and administrative uses, research, aircraft use, and use of chainsaws or explosives.
Management Situation 2: Potential Habitat	
Description	These are specific areas that contain habitat criteria such as slope, vegetation type, tree species basal area, and foraging resources that may in any future state may provide preferred Elfin-woods warbler habitat. These areas may or may not be occupied by Elfin-woods warbler. These spaces may be accessible for Elfin-woods warbler and studied through continued scientific analysis, which their results can be applied for improved habitats and prospective prime habitat.
Sensitivity Levels	*Site Disturbance:* Elfin-woods warbler sensitivity to physical disturbances within these habitats are not completely understood. It can be expected, however, that activities which would diminish the habitat's quality, abundance, or effectiveness for Elfin-woods warbler use would not promote recovery goals and avoidance for further Federal protection designation. *Human Disturbance:* Human disturbance in these areas may be less disruptive. However, human disturbances could be significant prior to the breeding season when birds are known to explore non-prime habitats for potential nest sites. If Elfin-woods warbler recovery, that is, the growth of populations and expansion into new occurrence zones, is to be encouraged, then the effectiveness of potential areas should be ensured during nest selection period.
Management Situation 3: Limited Value Habitat	
Description	These areas that have less preferential habitat components for Elfin-woods warbler needs. Most may be buffer zones from one forest type to another at certain elevations. Continuing findings are noting areas in much lower elevations, such as the Palo Colorado forest types, due to unknown factors.
Sensitivity Levels	*Site Disturbance:* Due to the reduced level of habitat quality or effectiveness of these areas, Elfin-woods warbler sensitivity to physical disturbances in management situation 3 areas might be expected to be moderate to relatively low. *Human Disturbance:* Sensitivity to disturbances from noise and human presence in these areas appears to be considerable less than in management areas 1 and 2.

Table A-2. Summary of the Elfin-woods warbler management situation concept

Management Situation	Description	Sensitivity to Physical Disturbance	Sensitivity to Human Disturbance	Management Guidelines
1	Prime habitat	High	High	Time projects outside nest selection period and breeding season. Through NEPA analysis and consultation under the Endangered Species Act, projects may require significant changes.
2	Potential habitat	High to Moderate	High to Moderate	Time projects outside nest selection period and breeding season. Through NEPA analysis and consultation under the Endangered Species Act, projects may require significant changes.
3	Limited value habitat	Moderate	Moderate	Physical disturbance will be in compliance with Forest Service regulations and Elfin-woods Warbler Candidate Conservation Agreement. No timing constraint unless amplitude of disturbance influences nearby sensitive areas or further scientific findings provide more information on Elfin-woods warbler biological needs within limited value habitat.

Appendix B: Timber Suitability and Sustained Yield

Forest products within the Community Interface Resource Management Area. The production of wood products can play an important role in the attainment of desired ecological conditions for the area, as well as contributing to local social and economic sustainability.

There is a local, non-commercial demand for wood products within the arts and crafts community. There are more than 600 artisans certified by the Puerto Rico Economic Development Administration. Most of the Island's practicing artisans that work with wood use mainly locally available lumber resources that are harvested for that purpose, and milled in private sawmills (Kicliter 1997). Artisan's state that the supply of wood is very scarce, difficult to maintain, and expensive (Kicliter 1997).

The type of wood products that might be considered to be produced from the Community Interface Resource Management Area would be small-diameter timber (less than 8 inches [or 20.3 centimeters] DBH) used mainly as poles, posts, carvings and other biological material harvested from within and on the edges of forests that regenerates naturally on lands abandoned after none forested uses and, manipulated or disturbed forests.

Methodology

The silvicultural applications considered in the Community Interface Resource Management Area will recognize tree species that should be treated as "conservation trees", or species important to maintain forest structure with genetically appropriate plant material. The application of a tree spacing guide applied in Puerto Rico (Wadsworth 1997) that considers the tree diameters and distances (D + d) for spacing of the conservation trees will be determined. The silvicultural applications will be based mostly on low thinning or thinning from below, but the action is not intended to produce stands of evenly distributed trees.

The diameter growth by functional groups has been studied in Puerto Rico, and several studies will be used as guidelines for the management strategies applicable (Adame et al. 2014; Brandeis 2009; Weaver 1979; Wadsworth 1977). Plant functional types are non-phylogenetic groupings of species that show close similarities in their resource use and response to environmental and biotic controls (Wilson 1999). To classify species into groups or guilds imposes a degree of simplification which reduces information content, but reveals general patterns and facilitates predictions about forest dynamics processes.

The trees removed would include both native and nonnative species, but would emphasize removal of nonnatives to facilitate better development of native species that already exist according to the spacing guidelines. The regrowth of nonnative species would be discouraged and efforts would be made to promote the healthy regrowth of native species**.** The use of persistent, nonnative, non-invasive plant materials will be restricted only to those situations when timely reestablishment of a native plant community, either through natural regeneration or with the use of native plant materials, is not likely to occur, as defined in the polices of the FSM 2070. Native species are defined as a plant species which occurs naturally in a particular region, state, ecosystem, and habitat without direct or indirect human actions (FSM 2070).

Forest Yield

Most of the CIRMA forest is dominated by secondary stands in a process of separating a canopy structure. Typically this forest integrates three canopy levels at its mature stage. About 32 species of the 150 species identified in secondary stands are recognized as species with timber use value. The other species have added potential uses in relation to special forest products and are important for the ecological settings that these forests provide in EYNF. To establish a sustainable yield capacity, the growth rate of the species that dominate the CIRMA need to be considered as part of the wood utilization initiatives. Growth rate in the

subtropical wet, subtropical rain, lower montane wet, and lower montane rain forest life zones of the Luquillo Mountains of Puerto Rico has been studied (Crow and Weaver 1977, Schmidt and Weaver 1981, Weaver 1979, Weaver and Birdsey 1990). In 2009, Brandeis published a report titled "Diameter Growth of Subtropical Trees in Puerto Rico" in which the growth among trees measured in the forest inventories of Puerto Rico were calculated by annual increase for the period considered in the Forest Inventory Analysis (FIA). The document presents the periodic annual increment or PAI in tree diameters at breast height (DBH). The CIRMA include forests in a small area of subtropical moist forest and most of it is in the subtropical wet forest according to Ewel and Whitmore (1973). Table B-1 from Brandeis (2009) report shows the mean increment by life zones documenting similar PAI in the Subtropical moist and wet/rain forests.

Table B- 1. DBH (1.4 meters) periodic annual increments (PAI) by Holdridge life zone with number of trees measured, standard error of the mean, standard deviation of the mean, and maximum observed PAI increase from Puerto Rico forest inventory data in centimeters per year

Life Zone	N	Mean	SE	SD	Max
Subtropical Dry	307	0.20	0.03	0.45	5.74
Subtropical Moist	2,315	0.37	0.01	0.48	4.30
Subtropical Wet/Rain	1,292	0.36	0.01	0.51	5.84
Lower Montane	112	0.20	0.02	0.24	1.28
All life zones	4,026	0.35	0.01	0.49	5.84

Note: N = number of trees measured; SE = standard error of the mean; SD = standard deviation of the mean; Max = maximum observed (Brandeis 2009).

Brandeis (2009) also provides the PAI measured by species as part of the appendix of the document. This information will be used in the evaluation of potential silvicultural applications to sustain the potential growth of selected species according to the Community Interface Resource Management Area management parameters.

Timber Suitability and Sustained Yield

Planned harvests would only occur on lands "suited for timber production". The identification of lands as "suitable for timber production" does not mean that timber production is the primary purpose of management on those lands. It means that the production of wood products is compatible with the achievement of desired conditions and objectives established by the plan for those lands (36 CFR 219.11(a)(1)(iii)), and some regular flow of wood products may be expected.

Following natural disturbance events the removal of dead or damaged trees could also occur on lands identified as "not suited for timber production because timber production is not compatible with the desired conditions" (see table below).

The "sustained yield limit" for the amount of timber volume that can be removed off of the El Yunque is based on the "lands that may be suited for timber production", and determined based on the amount of annual growth on those lands. The sustainable limit is the amount of timber that can be removed without exceeding the established level of annual growth (on an annual basis). Silvicultural treatments in the Forest with structure and composition similar to the Community Interface Resource Management Area forests in Puerto Rico has shown possibilities for a significant increase in the representation of promising tree species (Wadsworth 1986). The annual growth documented in this type of forests is 3 to 4 cubic meters per hectare per year (or 1.6 cubic meters per acre per year) (Wadsworth 1986), and these numbers will be used to limit the amount of timber removal per area.

Table B- 2. Timber production suitability classification

Land Classification Category	Acres
A. Total National Forest System lands	28,223
B. Lands not suited for timber production due to legal availability or technical considerations	17,752
Wilderness	10,352
Slopes over 30% (outside of wilderness)	7,400
C. Lands that may be suited for timber production (A – B)	10,471
D. Lands not suited for timber production because timber production is not compatible with the desired conditions and objectives established by the Plan	3,284
E. Lands suited for timber production (C – D)	7,187
F. Lands not suited for timber production (B + D)	21,036

Planned Wood Product Sale Program

The amount of wood products expected from the Community Interface Resource Management Area will fluctuate, depending on the previous silvicultural treatments that may have been applied in the area. After a review of several compartment examination and prescription reports prepared in the El Yunque, extreme variation from Secondary Forest to climatic Tabonuco-type forests was evident. In Tabonuco-type forests the understory density was generally lower with reports of 49 trees per acre in the DBH range of 4 to 16 inches (10 to 40 centimeters) (stand 12, compartment 1; Sabana) and in stands with Secondary Forests, the immature commercial species were reported at a rate of 100 trees per acre in the 4 to 12 inches (10 to 30 centimeter) DBH range.

The specific volume of production of stands throughout the CIRMA will also vary depending on the forest structure, previous treatments, site quality and the response of the areas to natural disturbances. The level of harvest in the 1997 Plan was estimated to be 22 acres per year for the first decade with 23 MCF (651m^3) per year of yield (Table II-3 1997 Plan FEIS). The number of acres per year was based on a scaled down demonstration of forest products on 1,100 acres (about 4% of the Forest). For this draft revised forest plan, even though there are 7,187 acres in the CIRMA where scheduled timber harvesting activities could occur, for the first two decades it has been determined that the level of harvesting activity from the 1997 Forest Plan is the level that should be continued within the CIRMA. The silvicultural prescription considered for stands in the CIRMA would plan for a stand to be entered every 50 years. So 1,100 acres/50 = 22 acres to be treated per year. The yield of 1.045 MCF/acre (10.45 CCF/acre or 29.57 cubic meters/acre [where 1 cubic foot = .0283 cubic meters]) from the 1997 Forest Plan will also be used for the yield projections under this draft revised plan. This will result in a total projected yield of 23 MCF/year (22 acres x 1.045 = 23 MCF [651 cubic meters]) or 230 MCF per decade. The ten year projections are presented in Table B-3. The integration of other forest products from agroforestry activities are incorporated into these yields and a review of the projected harvest acres per year and yields will be conducted after the first 5 years of implementation (see section on Special Forest Products).

If timber removal is considered and allowed, it is expected that there would be an established method for administration of the system of removal considered, either by permit or contract (FSH 2409.15 and FSH 2409.18).

Table B- 3. Planned timber sale program; decadal volume outputs for the first and second decade

Sustained Yield Limit (SYL) = 591.6 MCF/year	First Decade	First Decade	Second Decade	Second Decade
	MCF	Tons	MCF	Tons
Timber Products Volumes other than salvage or sanitation volumes that meet timber product utilization standards				
Lands suitable for timber production				
A1. Sawtimber	0		0	
A2. Other products (total for the decade)	230		230	
Lands not suitable for timber production				
B1. Sawtimber	0		0	
B2. Other products (total for the decade)	0		0	
C. Projected Timber Sale Quantity (PTSQ) (A1+A2+B1+B2)	230		230	
Other Estimated Wood Products Fuelwood, biomass, and other volumes that do not meet timber product utilization standards				
D. Fuelwood	0	0	0	0
E. Projected Wood Sale Quantity (PWSQ) (C + D)	230		230	

Note: Sustained Yield Limit (SYL) = 35.2 CM/year
NA = Products not convertible to MBF; MCF = Thousand Cubic Feet

Estimated Vegetation Management Practices

Land management planning direction (36 CFR 219.7(f)) states that forest plans will "Contain information reflecting proposed and possible actions that may occur on the plan area during the life of the plan, including: the proportion of probable methods of forest vegetation management practices expected to be used." These estimates are displayed in Table B- 4 below.

Table B- 4. Estimated vegetation management practices, annual average per decade (acres)

Vegetation Management Practice	1st Decade	2nd Decade
Uneven-aged Management/Thinning	22	22
Invasive Plant Control, Mechanical	5	10[1]
Invasive Plant Control, Herbicide	0	0

[1] As needed according to the monitoring strategy applied in the Forest.

Sustain Yield Limit

The sustained yield limit (SYL) is an estimate of the quantity of timber that can be removed annually in perpetuity on a sustained-yield basis (see 36 CFR 219.11(d)(6)). The SYL is also determined based on the total "lands that may be suited for timber production", which from Table B-2 is 10,471 acres. For El Yunque NF, the sustainable limit is the amount of timber that can be removed without exceeding the established level of annual growth. Silvicultural treatments in the forest with structure and composition similar to the CIRMA forests in Puerto Rico has shown possibilities for a significant increase in the representation of promising tree species (Wadsworth 1986). The annual growth documented in this type

of forests is 3 to 4 cubic meters per ha/yr. or 1.6 cubic meters per acre/yr. (Wadsworth 1986). Where 1 cubic meter = 35.3 cubic feet, this converts to 56.5 cubic feet per acre/year (or 0.565 CCF/ac./yr.).. The SYL for El Yunque is therefore 56.5 cubic feet/acre x 10,471 acres = 591,612 cubic feet per year or 591.6 MCF/year.

Long-term Sustained-yield Capacity

The long-term sustained-yield capacity (LTSYC) should be based on the flow of timber that can be reasonably planned and scheduled on a predictable basis under the considered characteristics and management zones of the Forest. The 1,100 acres considered for the wood utilization process in the Community Interface Resource Management Area represent the suitable area where the sustainable-yield parameters will be applied. The LTSYC is based on the flow of wood utilization that can be reasonably planned and scheduled on a predictable basis under the circumstances and parameters considered in the Community Interface Resource Management Area. The harvest activities in these suitable areas will be maintained within the limit of 22 acres per year representing that any given stand will be revisited every 50 years. The maximum yield considered to maintain a LTSYC is 1.6 cubic meter per acre per year.

Special Forest Products (Non-Timber)

Different definitions are used for products that originate from the forests that are not timber-based, but are of biological origin. The regional strategy embraces the use of the term “special forest products” (SFPs) to provide consistency (Chamberlain 2003). These products can be organized into four major product categories: culinary, wood-based crafts, floral and decorative, and medicinal and dietary supplements.

There are several plants products (non-timber forest products) that are requested year-around in the Forest and managed via “free use permits” These products are mostly for personal consumption. Those products that are requested for commercial use are managed via a “special forest product permit.” Usually, these products include native *Heliconia* flowers and dead tree fern stems of *Cyathea arborea*.

During Christmas season there are many requests for yams (*Dioscorea* spp.), yautia (*Xanthosoma* spp.) (tanier), malanga (*Colocasia* spp.) (taro) and bananas (*Musa* spp.) which occurs naturally in a particular zones of the Forest. These crops have been historically and traditionally used and consumed at a small scale from the lower elevations of the Forest. All of these consumption products are vegetation persistent from past agricultural practice or from home gardens from previous dwellers of the acquired lands since the 1920s. These products are harvested yearly from the same location. This is mainly the root crops with the regeneration parts planted back in the same location for next year harvest.

For home decoration and Christmas tree manufacture, the fallen leaves of the *Cecropia* tree are solicited during the season. Occasionally, dead and downed trees are permitted to artisans or for firewood.

Other non-timber special forest products that could be provided from the Community Interface Resource Management Area include such products as (1) foods, like wild edible mushrooms, native fruits, and nuts; (2) medicinal plants and fungi; (3) floral greenery and horticultural stock; (4) fiber and dye plants, lichens, and fungi; (5) oils, resins, and other chemical extracts from plants, lichens, and fungi.

While these products will be provided through the use of a special forest product permit, there are strict limitations with the use of these permits. Special forest product permits can only be used for products that can be managed on a sustainable basis, and the amounts offered are limited to the amount that can be harvested annually in perpetuity (see 36 CFR 223.219).

There is not much information to accurately assess the current situation and to make informed decisions concerning management of non-timber forest resources in the CIRMA. An assessment and inventory of

these products is recommended in the first five years of the plan to review the yields and products from the CIRMA. By year 6 of the Plan, the Forest will reassess the yields and products from SPFs and agroforestry projects within the CIRMA using the following parameters:

Four strategic goals and associated actions within a framework of ecosystem management will be used to assess the ecological, economic and social aspects of SFPs as defined by Chamberline (2003). These goals and selected actions are:

1. Provide knowledge and information to sustain levels of SFPs

    a. Inventory the species or groups of species in the CIRMA

    b. Assess ecological impacts of SFP harvesting on the SFP and associated species

    c. Determine sustainable harvest practices and levels for selected SFPs

2. Provide knowledge and information to ensure the economic sustainability of SFP Markets.

    a. Determine the value and volume of the major commercial SFPs

    b. Define the scope and scale of established and emerging markets

    c. Determine the economic impacts to local people and communities

3. Produce and provide information on the different aspects of human interaction with SFPs and incorporate an understanding of the human dimension into policy, planning and management decisions

    a. Identify SFP collectors, the SFPs they collect, and their functional and livelihood uses of these products

    b. Examine compliance with existing SFP regulations, and implications for management strategies and law enforcement

    c. Establish a process of collaborative planning with collectors, and other agencies and interested publics

4. Promote public understanding of SFP uses, users, conservation, and future potential.

    a. Determine methods to create public understanding of SFPs

    b. Develop education and outreach programs that target harvesters, land managers, school groups and others.

References

Adame P.; Brandeis, T.J.; Uriarte, M. 2014. Diameter growth performance of tree functional groups in Puerto Rican secondary tropical forests. Forest Systems 23(1): 52–63. [www.inia.es/forestsystems]

Birdsey R.A.; Weaver, P.L. 1982. The forest resources of Puerto Rico. USDA Forest Service Resource Bulletin SO-85. New Orleans, LA. 59 pp.

Brandeis, T.J. 2009. Diameter growth of subtropical trees in Puerto Rico. Research Paper SRS–47, USDA Forest Service, Southern Research Station, Asheville, NC. 39 p.

Chamberlain J. 2003. A Strategy for nontimber forest products research and technology transfer for southern United States. *In:* Sustainable production of wood and non-wood forest products. Proceeding of the IUFRO Division 5 Research Groups 5.11 and 5.12; New Zealand, March 11-15, 2003.

Crow, T.R.; Weaver, P.L. 1977. Tree growth in moist tropical forest of Puerto Rico. Research Paper ITF–22, USDA Forest Service, Institute of Tropical Forestry, Río Piedras, PR. 17 p.

Donoghue, E.M.; Benson, G.L.; Chamberlain, J.L.; (technical coordinators). 2004. General Technical Report PNW-GTR-604, USDA Forest Service Pacific Northwest Research Station, Portland, OR.

Ewel, J.J.; Whitmore, J.L. 1973. The ecological life zones of Puerto Rico and the U. S. Virgin Islands. Research Paper ITF-18, USDA Forest Service, Institute of Tropical Forestry, Rio Piedras, PR. 72 p.

Hutchinson, I.D.; Wadsworth, F.H. 2004 Efectos de la liberación en el bosque secundario de Costa Rica 2005/6. Recursos Naturales y Ambiente 46–47: 152–157.

IUFRO. 2003. Sustainable Production of Wood and Non-Wood Forest Products. Proceeding of the IUFRO Division 5 Research Groups 5.11 and 5.12; New Zealand, March 11-15, 2003.

Kicliter, V. 1997. Forest products of Puerto Rico: An overview of trends in forest products use. Report El Atlantico RC&D Area. In coordination with USDA Forest Service International Institute of Tropical Forestry and Natural Resources Conservation Service, Arecibo, PR. 61 p.

Killmann, W.; Ndeckere, F.; Vantomme, P.; Walter, S. USDA Forest Service. 2004. Developing methodologies for the elaboration of national level statistics on NWFP: Lessons learned from case studies and from a global assessment. IUFRO. Proceedings from IUFRO Division 5, Research Groups 5.11 and 5.12, number 17; Pacific Northwest Research Station General Technical Report PNW-GTR-604.

Schmidt, R.; Weaver, P.L. 1981. Tree diameter increment in the subtropical moist life zone of Puerto Rico. Turrialba 31: 261–263.

Wadsworth, F.H. 1987. A time for secondary forestry in tropical America. *In:* Management of forests of tropical America: Prospects and technologies. ITF Southern Forest Experimental Station.

Wadsworth, F.H. 1997. Forest production for tropical America. USDA Agriculture Handbook 710, Washington, DC. 563 p.

Wadsworth, F.H.; Zweede, J. 2006. Liberation: Tropical forest timber production. Forest Ecology and Management 233: 45–51.

Wadsworth, F.H.; Bryan; B.; Figueroa, J.C. 2009. Cutover tropical forest productivity potential merits assessment. Document draft, unpublished.

Weaver, P.L. 1979. Tree growth in several tropical forests of Puerto Rico. Research Paper SO-1 52, USDA Forest Service, Southern Forest Experiment Station, New Orleans, LA. 15 p.

Weaver, P.L.; Birdsey, R.A. 1990. Growth of secondary forest in Puerto Rico between 1980 and 1985. Turrialba 40: 12–22.

Weaver, P.L.; Pool, D.J. 1979. Correlation of crown features to growth rates in natural forest of Puerto Rico. Turrialba 29(1).

Wilson J.B. 1999. Guilds, functional types and ecological groups. Oikos 86: 507–522.

Appendix C: Priority Watersheds

El Yunque National Forest has evaluated its watersheds and their current conditions according to the new forest planning directives, which state:

> The Planning Rule requires land management plans to:
>
> > **(i) Identify watershed(s) that are a priority for maintenance or restoration;** (36 CFR 219.7(f)(1)).
>
> Identification of priority watersheds is done to focus effort on the integrated restoration of watershed conditions in these areas.
>
> The Responsible Official should identify an appropriate number of watersheds in the plan for maintenance or improvement that corresponds to reasonable and achievable plan objectives for a 5-year period and within current budget levels. Priority watersheds in the plan are the watersheds where plan objectives for restoration would concentrate on maintaining or improving watershed condition.

What exactly are "priority watersheds" as referenced in FSH 1909, Section 22.31?

"Priority watersheds," as referenced in Chapter 20 of the Land Management Planning Handbook, are those 12-digit hydrologic unit watersheds specifically identified as the focus for investments in maintenance or improvement of watershed conditions (soil and hydrologic functions supporting aquatic ecosystems) that have been established under the agency's Watershed Condition Framework (WCF) process. An overview of the WCF and reference materials can be found here: web link.

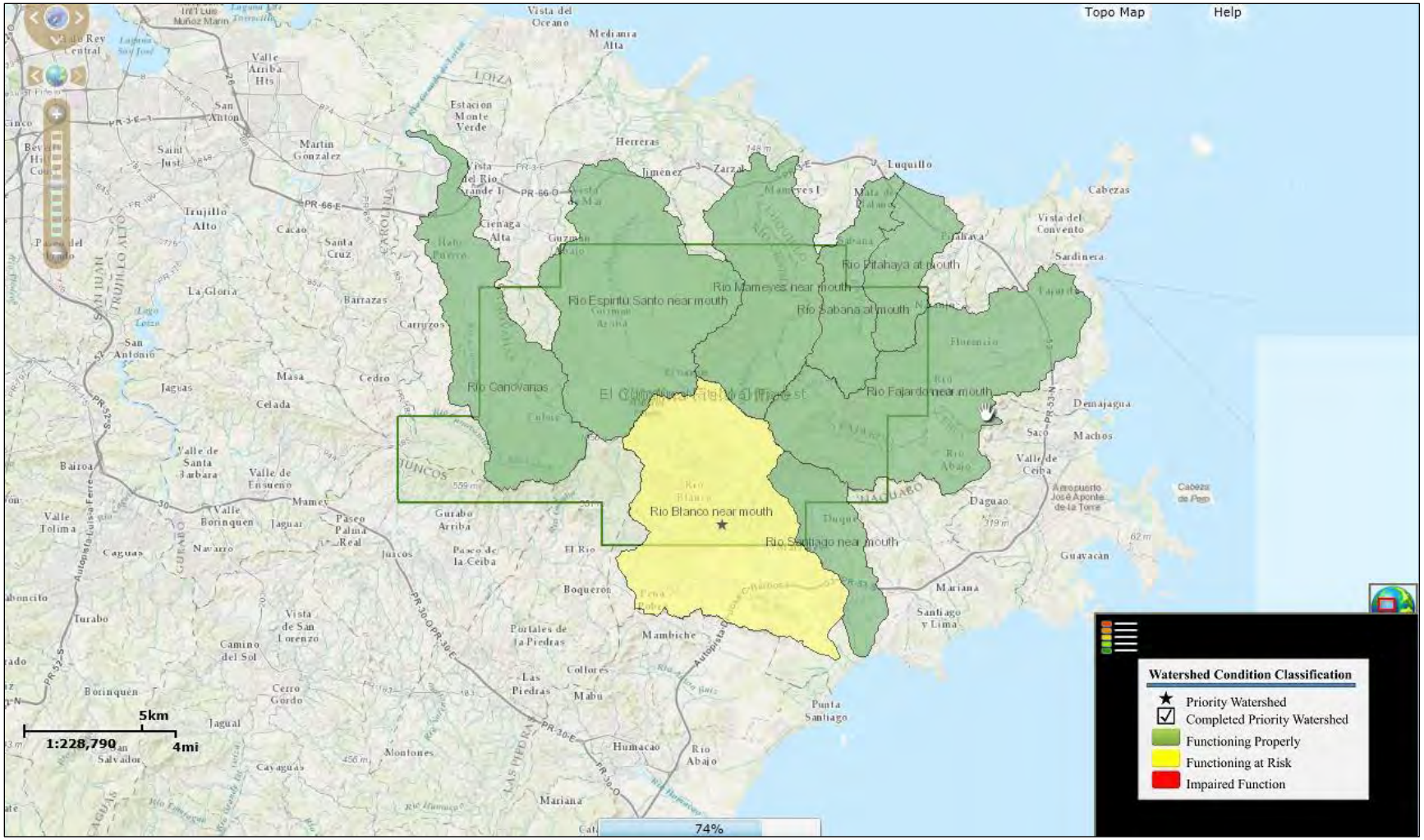
Once a WCF priority watershed is selected, a watershed restoration action plan (WRAP) is developed. The WRAP identifies specific projects necessary to achieve the watershed condition improvement or maintenance goals. By design, WCF priority watersheds are not intended to be permanent designations—when all needed work is completed, a new priority watershed is to be identified using the same process and criteria described above. Occasionally, a change in a priority watershed designation may be needed for other reasons, including significant condition degradation (such as after a wildfire), loss of a critically important restoration partner, or to attain better alignment with active unit priorities.

What is the best way to include WCF priority watersheds in land management plans?

The plan should incorporate by reference the information contained in the website at the WCF map viewer web link. That website will always contain the current WCF priority watersheds and associated information. However, before changing priority watersheds and the information on the WCF map viewer web link, the responsible official shall give public notice 36 CFR 219.13(c)(2)). See question "How is a priority watershed designation changed once it is included in a plan?"

Table C-1. Watershed condition classes and management strategies

Watersheds	Watershed Condition Classification April 2016	Management Strategy
Rio Blanco near mouth	Functioning At-Risk	▪ Meet standards developed by FERC. ▪ Reduce fragmentation. ▪ Impaired functioning: Highly erodible soils, high sand content. Upper watershed flat and funnels water into channels and causes erosion. Landslides have impacted channel shape. ▪ Reduce deferred maintenance of trails and roads.
Rio Santiago near mouth	Functioning Properly	▪ Reduce erosion and sedimentation.
Rio Fajardo near mouth	Functioning Properly	▪ Reduce erosion and sedimentation.
Rio Pitahaya at mouth	Functioning Properly	▪ Reduce erosion and sedimentation.
Rio Sabana at mouth	Functioning Properly	▪ Reduce erosion and sedimentation.
Rio Mameyes near mouth	Functioning Properly	▪ Remove abandoned dams. ▪ Reduce deferred maintenance of trails and roads.
Rio Espiritu Santo near mouth	Functioning Properly	▪ Manage insteam flows. ▪ Reduce deferred maintenance of trails and roads.
Rio Canovanas	Functioning Properly	▪ Support domestic intakes.



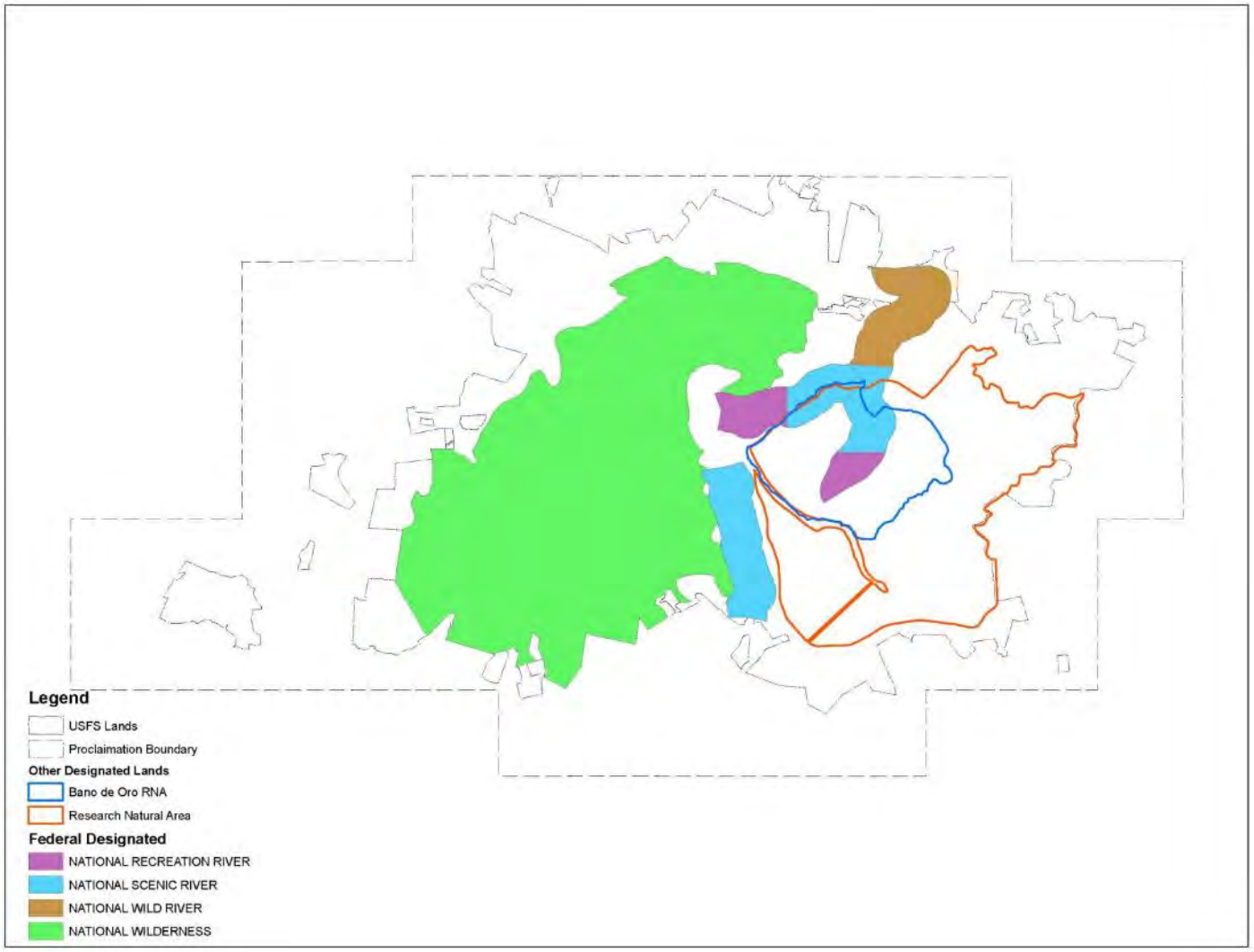
Map C-1. Watershed condition classification

Appendix D: Forest Designation Area Maps

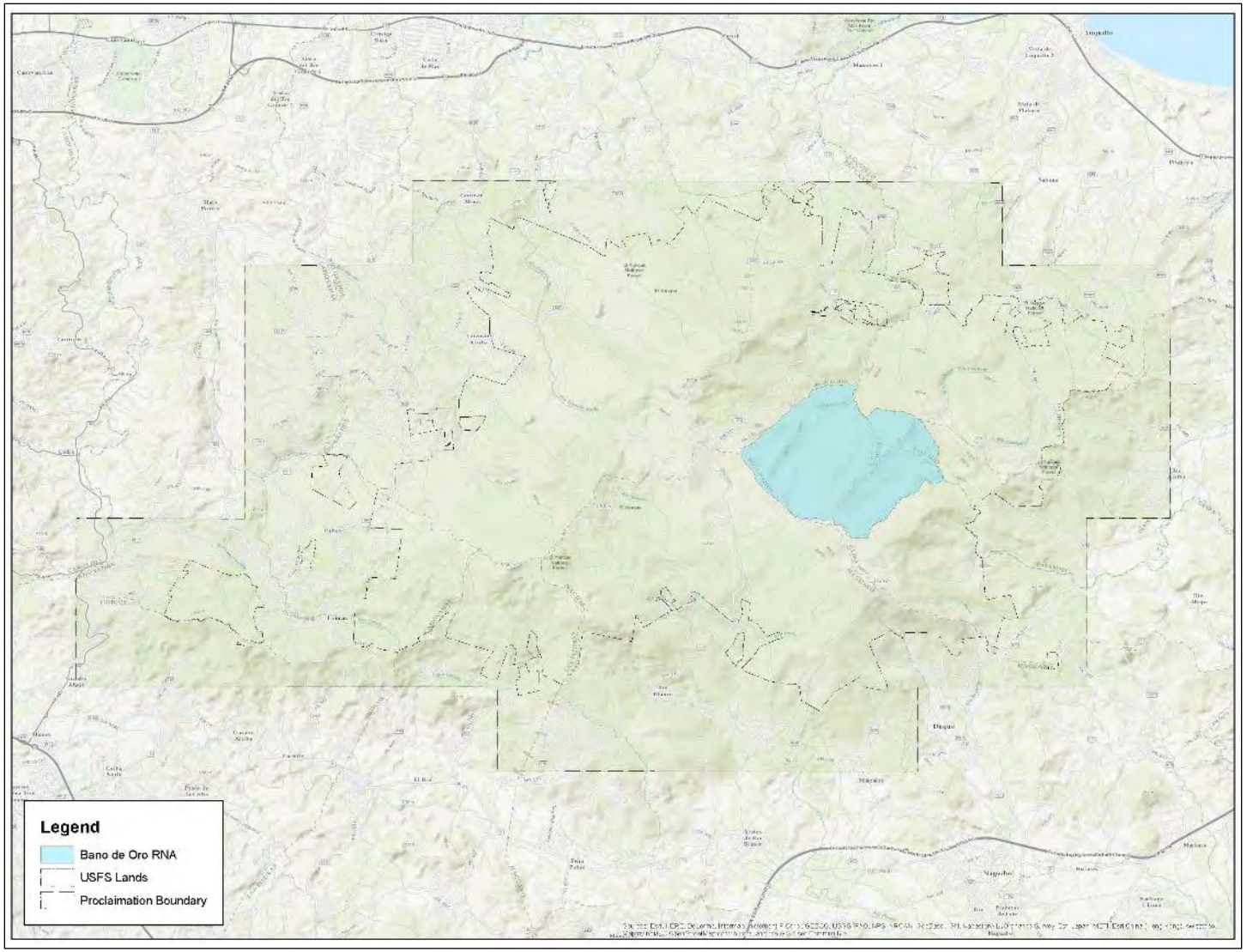
Map D-1: All Designated Areas

Map D-2: Bano de Oro Research Natural Area

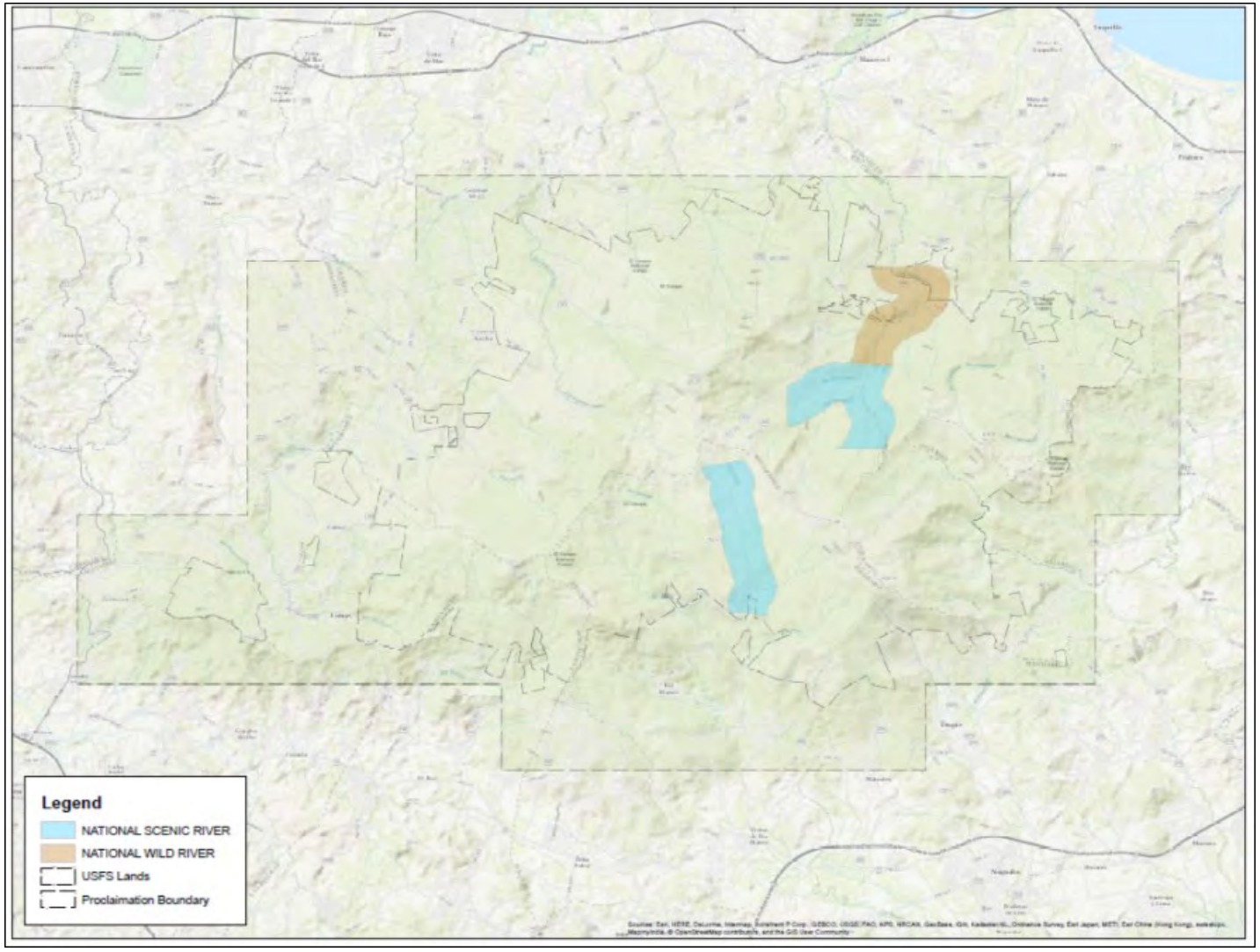
Map D-3: Wild and Scenic River



Map D-1. All designated areas



Map D-2. Bano de Oro Research Natural Area



Map D-3. Wild and scenic rivers