# Appendix B

# The Analysis Process

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## Introduction

Appendix B presents a technical discussion of the analysis process used in the Revision planning effort. The appendix focuses on the quantitative methods used to perform the analysis and documents how the analysis was done.

The Forest's major planning goal is to provide enough information to help decision makers and the public determine which combination of goods, services, and land allocations will maximize net public benefits (36 CFR 219.4(a)(1). The regulations (36 CFR 219) developed under the National Forest Management Act (NFMA) provide the analytical framework within which these decisions are to be made.

The NFMA and its regulations also state that the requirements of the National Environmental Policy Act (NEPA) and its regulations (40 CFR 1500-1508) must be applied in this analytic process. The NEPA regulations require that the environmental effects of a proposed action and alternatives to that proposed action must be disclosed in an Environmental Impact Statement (EIS).

Information presented in this appendix supplements the broader and less technical descriptions included in the body of the EIS. Additional information and documents used in the analysis process are contained in the planning records. The planning record in its entirety is incorporated here by reference.

## Overview of the Planning Problem

In reviewing the plan appeal and issues raised by the public and Forest Service employees, it became evident to the interdisciplinary (ID) team that the focus of the revision needed to differ somewhat from the initial planning effort. The analysis that supports the current plan defined issues primarily in terms of goods and services, and measures of the economic efficiency of their production. In response to concerns raised about the current plan, the analyses presented in this revision emphasize comparing supply and demand for recreation on the Forest, and effects of recreation development and use and timber demonstration on wildlife habitats and primary forest.

The FORPLAN computer model was used in the initial planning effort, but was not used in this revision. A simplified economic model was used to estimate net present values of the alternatives considered.

An input-output model (IMPLAN) was used to analyze how National Forest outputs and costs would affect the local economy.

## The Planning Process

Land and resource management planning requires that processes formerly used to make individual resource decisions be combined into integrated management decisions. It also requires that quantitative techniques be used to identify the most economically efficient solution. The small variation in economic measure among alternatives indicate that economic considerations will not be the most important factor in choosing an alternative.

The 10-step process defined in the NFMA regulations was followed. This appendix describes the analysis phase of this process which are steps 3,4,5 and 6. Steps 1,2,7 and 8 are described in Chapters 1 and 2 and Appendix A of this EIS. Plan implementation and monitoring, steps 9 and 10, are discussed in Chapters 3 and 4 of the Revised Forest Plan. A brief discussion of this process follows.

**Step 1. Identification of Purpose and Need and Issues** - Appendix A of this EIS documents this step.

**Step 2. Planning Criteria** - This revision of the Caribbean National Forest Plan is based on the need to change the Plan. If there was no need to change a part of the Plan, this revision does not change it. This idea was key to the formulation of alternatives. To achieve this focus, a potential issue must meet two criteria before it was used to address changes to the Plan: (1) Is the need caused by a change since the Plan was approved? (2) Is the change one that can be made in a forest plan? If the possible change met both of these criteria, then it was considered in the Analysis of the Management Situation (AMS). The AMS indicated potential ways to address through alternatives the potential changes that met these criteria.

**Step 3. Inventory Data and Information Collection** - The kind of data and information needed is determined based on the issues identified and need for change identified in the analysis of the management situation. Existing data is used whenever possible, and supplemented when practicable and necessary to produce an improved analysis.

**Step 4. Analysis of the Management Situation** - This step consists of assessing the existing situation on the Forest, assessing the need for change from current plan direction, and determining opportunities for resolving issues.

**Step 5. Formulation of Alternatives** - A reasonable range of alternatives is formulated according to NEPA procedures. Alternatives are formulated to address need for change identified in Step 4 and to address the issues identified in Step 1.

**Step 6. Estimated Effects of Alternatives** - The physical, biological, economic and social effects of implementing each alternative are assessed.

**Step 7. Evaluation of Alternatives** - Significant physical, biological, economic and social effects of implementing alternatives are used to evaluate each alternative and compare them with one another. Chapter II of this EIS summarizes the comparison of alternatives. Chapter III adds detail to the comparison.

**Step 8. Preferred Alternative** - The Forest Supervisor reviews the ID Team evaluation of each alternative and the public and Forest Service generated issues. Based on this review the Forest Supervisor then recommends a preferred alternative to the Regional Forester. The Regional Forester either selects the Forest Supervisor's recommendation, another alternative, or modifies the alternative recommended by the Forest Supervisor. This alternative is described as the Preferred Alternative in this EIS and is displayed as the Proposed Revised Forest Plan. Public comments are solicited and will be considered in finalizing the draft Revised Forest Plan and EIS.

**Step 9. Plan Approval and Implementation** - After the ID Team has reviewed public comments and incorporated any necessary changes into the EIS or Revised Forest Plan, the Regional Forester reviews and approves the Revised Forest Plan and Final Environmental Impact Statement. A Record of Decision documents this step.

**Step 10. Monitoring and Evaluation** - The Revised Forest Plan establishes a system of measuring, on a sample basis, actual activities and their effects, and compares these results with projections contained in the Revised Forest Plan. Monitoring and evaluation comprises an essential feedback mechanism to ensure the Revised Forest Plan is dynamic and responsive to change. Chapter 4 of the Revised Forest Plan displays the monitoring and evaluation program.

## Inventory Data and Information Collection

The issues discussed in Appendix A were the basis for determining what data needed to be updated or collected and what effects would be evaluated. Both existing data and new information were used in the revision of the Forest Plan.

Key new or updated information used in this revision includes:

1. Primary forest - The International Institute of Tropical Forestry (IITF) provided a location map of primary forest, based on the best current definition.
2. Effects of Hurricane Hugo - Information based on monitoring by the Forest and research by IITF was used to describe initial effects and recovery since the storm in 1989. Effects on physical and biological resources and Forest facilities are described in Chapter III of this EIS.
3. Recreation data - New recreation use data gathered since the current Plan, and recreation user preference/attitude information gathered through user interviews.
4. Social and economic data - Data for Puerto Rico from the 1990 census were used to update social, economic and recreation analyses.
5. Wildlife habitat - The most recent information on wildlife habitats and their use was used to analyze potential effects.
6. Timber suitability - The tentatively suitable lands (5,833 acres) identified in the 1986 Plan (Table 4-4, page 4-56) was considered the same as those existing today. The suitability table, Table B-8 is reproduced at the end of this appendix (page B-27). This assumption is made in light of the following:
   - The Forest suspended any implementation of the commercial timber harvesting program immediately after the Forest Plan was issued in 1986.
   - The effects of Hurricane Hugo, while it destroyed some commercial timber, did not remove any lands from suitability.
   - Only Alternative A ( 1996 Plan direction) reflects any suitable lands. Other alternatives assume no commercial harvesting will be permitted.

## Benchmark Analysis

As a part of the overall analysis of the planning problem, the Caribbean National Forest examined benchmarks. Benchmarks approximate the extreme ends of economic and biological resource production opportunities, are useful in evaluating the compatibility and conflicts between individual resource objectives, and help define the range within which integrated alternatives can be developed (FSH 1909.12 (3.42). Three benchmarks were considered necessary and appropriate to display and analyze for the Caribbean National Forest Plan.

### Minimum Level

This benchmark represents the minimum level of management needed to maintain and protect the unit as part of the National Forest System. We think of this benchmark as the level of management necessary to meet the background outputs and fixed costs associated with maintaining the National Forest in Federal ownership. Because it is only an accounting analysis, we would ignore the phase-in period that would be necessary if this were actually implemented.

This benchmark required that:

- The IDT output levels that would theoretically occur at the "custodial" level of management (e.g. the Forest gates would remain open and some visitors would continue to enter and gain experiences -- so we would claim some RVD's and value and costs associated.) How many RVD's would this result in? The IDT estimated how many visitors would still come into the Forest and at what reduced level they would achieve their experiences (if it would, in fact, be reduced.) If, for example, a campground were to be continually used under this scenario, after a number of years it would likely have to be closed due to safety and health concerns -- what effects would this have? What would be the minimum requirements to manage the Puerto Rican Parrot? The law requires our continued protection of this population and there are associated costs.
- Benefit/Cost Assumptions: Under the basic assumption of minimizing costs over the planning horizon, several additional assumptions were made relative to realized outputs and associated costs and they are documented in the planning record.

**Maximum Present Net Value (with Assigned Values)**

The purpose of establishing this benchmark is to estimate the mix of resource uses and a schedule of outputs and costs that would maximize the present net value of outputs assigned a monetary value. Base dollar values on actual or simulated market prices (willingness to pay) for recreation, water, wildlife and fish, and timber, as appropriate for the Forest. The best way to view this benchmark is to consider it as being the mix of products that are most efficient -- that is provide the most benefits for the dollar of input.

This benchmark required the following steps:

- After the Minimum Level benchmark is developed the team had a good idea about how the FS can influence PNV (i.e. what resource outputs make it go up and what makes it go down.)
- ID Team established the most efficient level of outputs for each resource.
- Dollar values for each unit of output are those that were calculated for the other alternatives.
- The best mix of outputs in terms of Present Net Value will be the Maximum PNV benchmark. This was accomplished by mixing the individual resource output levels of the various alternatives with some adjustments for minimum legal requirements.

Several assumptions were made relative to this benchmark (Max PNV assigned values)

- Since the Forest did not apply a linear programming model to the development of this benchmark, it cannot be called a true maximization of the present net value; however, without such an approach, the assumption is that we have approached a nearly maximum level of outputs by increasing the most efficient resource outputs and lowering others to a minimum level (see Minimum level benchmark).
- Timber harvest was kept at the minimum level (no harvesting). The overriding reason for this is the current (since 1986) societal views in the Commonwealth against harvesting timber from El Yunque. The tentatively suitable lands identified in the 1986 Forest Plan and repeated in this plan are used only to develop Alternative A (Current Direction) and not any other alternative(s) or benchmark.

- Alternative B, due in part to the high level of Wilderness recommended, has the highest PNV (see Table B-2). Developed Recreation costs are high compared with other resources. Only the support costs (Table B-1) are higher than Developed Recreation.

Table B-1 shows the PNV of each valued resource independent of the others. These PNV's are provided for analytical purposes only and do not represent an integrated approach. Present value of the "other costs" are also shown to demonstrate the background cost that is not assigned to any individual resource. Resource values were determined for all of the various outputs. These units values are available in the planning record of the Forest.

**Table B-1. Present Value of Benefits and Costs by Resource Program and Alternative (thousands of 1991 dollars; assumes 4% discount rate).**

*Protection of primary forest, the recovery of endangered species, and the production of clean water, cannot be readily valued in dollars. Of the benefits that are included in these present net value calculations, most result from recreation.*

| Present Value of | Alternative | | | | Min. Level | Max PNV |
|---|---|---|---|---|---|---|
| Cost and Benefits | A | B | C & C-mod | D | Benchmark | Benchmark |
| Benefits Recreation | 68,520 | 74,080 | 73,990 | 72,950 | | |
| Costs Recreation | 17,820 | 18,710 | 17,300 | 16,680 | | |
| PNV Recreation | 50700 | 55370 | 56690 | 56270 | | |
| Benefits Wildlife | 600 | 600 | 600 | 600 | | |
| Costs Wildlife | 7,180 | 7,180 | 7,180 | 7,180 | | |
| PNV Wildlife | -6580 | -6580 | -6580 | -6580 | | |
| Benefits Timber | 3,350 | 30 | 510 | 510 | | |
| Costs Timber | 2,720 | 1,630 | 2,350 | 2,350 | | |
| PNV Timber | 630 | -1600 | -2860 | -1840 | | |
| Other Costs | 51,970 | 48,090 | 53,410 | 52,900 | | |
| Total Benefits | 72,470 | 74,710 | 75,100 | 74,060 | | |
| Total Costs | 79,690 | 75,610 | 80,240 | 79,110 | | |
| Total PNV | (7,220) | (900) | (5,140) | (5,050) | 32,285 | 32,285 |
| Benefit/Cost Ratio | 0.91 | 0.99 | 0.94 | 0.94 | | |

| Table B-2. Benchmark Analysis - Average Annual Resource Outputs. | | | |
|---|---|---|---|
| **Resource Area/Decade** | **Unit*** | **Max. PNV Benchmark** | **Min. Level Benchmark** |
| Developed Recreation | MRVD | | |
| Decade 1 | | 116 | 116 |
| Decade 5 | | 125 | 125 |
| Back-Country Recreation | MRVD | | |
| Decade 1 | | 8 | 8 |
| Decade 5 | | 8 | 8 |
| Roaded Undeveloped Rec. | MRVD | | |
| Decade 1 | | 42 | 42 |
| Decade 5 | | 54 | 54 |
| Wildlife | WFUD | | |
| Decade 1 | | 588 | 588 |
| Decade 5 | | 725 | 725 |
| Timber | MBF | | |
| Decade 1 | | 0 | 0 |
| Decade 5 | | 0 | 0 |

*Units:
MRVD = thousands of recreation visitor days
WFUD = wildlife and fish user days
MBF = thousand board feet

**Maximum Resource Production**

This is really a Maximum Supply potential benchmark. It normally looks at what a forest could produce in terms of all outputs; however, the regulations say that we must analyze a maximum production level of the "significant resources". For the CNF one way to approach this, given the decision to eliminate commercial timber management and the fact that one of the most important issues is the recreation program, is to look at a "maximum" production level of recreation. What could be supplied in terms of recreation on the Forest? The Maximum supply potential for recreation is displayed in Table B-2.

## Forest Planning Model

The FORPLAN model was used in the analysis for the 1986 Forest Plan. FORPLAN was not used in this revision because:

- FORPLAN was designed primarily to analyze costs and benefits on forests where a large proportion of benefits and costs are associated with timber production. Public benefits on the Caribbean National Forest are overwhelmingly attributable to recreation.
- FORPLAN was used in the development of Alternative A (Current Direction) and the Maximum Timber Benchmark. The Forest Supervisor in consultation with the Regional Office planners determined that analysis using FORPLAN, for additional alternatives, would not contribute as much as analysis using other economic models.

## Analysis of the Management Situation and Effects and Tradeoffs Among the Alternatives

Analysis of the Management Situation - Prior to the formulation of alternatives, the ID Team conducted an analysis of the management situation on the Forest, consisting of the following steps:

- Selection of management area prescriptions.
- Estimation of supply and demand for forest resources and uses.
- Assessment of opportunities to respond to issues and the need to change management direction.

Analysis Techniques Used - The analysis techniques used to describe the Forest in its current condition ("the analysis of the management situation") were the same techniques the ID Team used to describe the outputs and effects of the alternatives to current Plan direction (Chapters II and III of this EIS). Analysis techniques developed by the ID Team that are significantly different from approaches used in the current Forest Plan are summarized here. These include analyses of watershed, wildlife habitat, economics, recreation, wild and scenic rivers, and visual quality.

**Watershed (Soils, Water)**

Sediment yields for the entire Forest in its current condition were estimated using two methods and 5 data sources:

1. Universal Soil Loss Equation (USLE) using factors adapted for the Caribbean area by the U.S. Soil Conservation Service.
2. Extrapolation from sediment measurements from:

    a. streams on the Forest (Bisley Watershed)
    b. other tropical forests
    c. Río Fajardo downstream of the Forest
    d. Río Loíza/Gurabo off the Forest

Comparison of results generated by these methods/data sources showed wide variability. Based on this variability it was concluded that it would be more useful to estimate changes from current sediment yields under the various alternatives, than to try to estimate total sediment yields.

The USLE was used to estimate increases in sediment yields caused by road, trail and facility construction, and timber harvest demonstration. The constants used and assumptions made in using the USLE are described in detail in the paper *Predicted Sediment Yield and Runoff by Alternative* (Miller, 1992). This paper is available for review in the planning record.

Table III-1 summarizes USLE estimates of maximum annual sediment delivery during Decade 1. These estimates are based on the assumption that all recreation site construction could occur in one year, and that all road and trail construction could occur in the first decade, spread evenly over the decade. Equations used were:

- Sediment from timber harvest = Acres X 8.53 T/Ac X 0.19 Sediment Delivery Ratio
- Sediment from road construction = Acres X 70.5 T/Ac X 0.19(roads assumed to affect strip 36 feet wide)
- Sediment from trail construction = Acres X 70.5 T/Ac X 0.19 (trails assumed to affect strip 6 feet wide)
- Sediment from recreation site construction = Acres X 6.74 T/Ac X 0.19

Sediment delivery was also calculated for the fifth decade, based on the assumption that the only sediment cause by that time would be timber harvest demonstration.

The Forest's water yield was estimated based on stream gage data, and extrapolation from those data for watersheds without gaged streams (approximately 40% of the Forest). These calculations yielded an estimated annual outflow from the Forest of 226,000 acre-feet. This is 59% greater than the water yield estimate calculated for the current Forest Plan (142,000 acres feet per year).

The analysis indicated that management activities far more intensive than any proposed would have to be implemented before significant changes in water yield would occur.

Stream gage data and the regression equation used to estimate yields from ungaged streams are presented in detail in the paper *Predicted Sediment Yield and Runoff by Alternative* (Miller, 1992). This paper is available for review in the planning record.

**Wildlife**

To determine the potential effects of alternatives on wildlife habitat two indices were quantified:

1) The acreage of habitat physically modified by all the management activities proposed by each alternative (road, trail, recreation site and administrative facility construction, and timber demonstration).
2) The area around proposed new and existing facilities (roads, trails, recreation, administrative and electronic sites) potentially affected by human use.

The second index used a fixed radius or band of 0.5 km (0.31 miles) around points and areas of human use (e.g. recreation sites, roads and trails). The actual zone of influence would vary by species and depend on many other factors such as topography and the nature of disturbance(s). The 0.5 km distance was chosen to provide an index that would be small enough to be useful in comparing alternatives (i.e. a larger radius/band of 1.0 km would include virtually the entire Forest in every alternative), but large enough to be realistic for species highly sensitive to disturbance, particularly the Puerto Rican Parrot.

The details of the development and calculation of these indices are described in the paper *Wildlife Environmental Consequences* (García, 1993). This paper is available for review in the planning record.

## Economy

The economic effects of alternatives were assessed using two basic approaches:

1. Present net values (PNV's) and benefit/cost ratios (B/C's) were calculated for the alternatives based on estimated values to the public of Forest goods and service and the costs of Forest budgets. The analysis summarized here is described in detail in the paper *Methodology for Determining Benefits and Costs for the Caribbean National Forest Land Management Plan* (Redmond, 1992).

2. Effects on the Puerto Rican economy were estimated with the use of the IMPLAN input-output model. This model was developed by the Forest Service using data from the U.S., and was modified for Puerto Rico based on data from the Puerto Rican Planning Board. The analysis summarized here is described in detail in the paper *Caribbean National Forest Impact Analysis* (Redmond, 1993).

Present Net Value, Benefit/Cost Analysis - Values were estimated for those outputs for which RPA has estimated a specific unit value, or for those resources that have a documented market value. Cost estimates for producing these benefits were based on the Forest's 1992 budget.

Public benefits accruing from use of the Forest's recreation, wildlife and fisheries, and timber resources were categorized in units of Recreation Visitor Days (RVD's), Wildlife and Fisheries User Days (WFUD's) and Thousand Board Feet of timber (MBF).

Values for RVD's and WFUD'S are classified and valued in Recreation Information Management (RIM) categories. They were converted from the Forest's Recreation Opportunity Spectrum (ROS) classifications by estimating the percentage of each RIM activity occurring in each ROS class. Percentages assigned were used as a weight factor, and a weighted average dollar per RVD was calculated for Forest outputs classified in ROS categories.

Wildlife and fisheries, and timber benefits had no valuation unit conversion. Their values were taken directly from RPA and estimates of Puerto Rican stumpage values, respectively. RPA prices were updated from 1985 to 1991 using the Gross National Product Implicit Price Deflator Index. These 1991 prices were multiplied by outputs of each resource category by alternative, by decade.

Timber benefits have a commercial (sale) value only in Alternative A. The other alternatives would have no sales or revenue reverting to the Forest, but the timber would still have value to recipients who use the wood for artistic efforts after the wood has been sawn. For this reason harvested timber is assigned value in Alternatives C and D as if it were sold on the open market.

Present values of benefits and costs were obtained by discounting the expected values for each decade by 4 percent from the mid-point of each decade. Thus, decade 1,2,3,4, and 5 were discounted at 5, 15, 25, 35, and 45 years, respectively. From the preceding calculations PNV's were obtained by alternative and by decade. They were derived by subtracting present value of costs from present value of benefits.

Benefit/cost ratios were calculated for the Forest by alternative, by decade, by dividing present value of benefits by present value of costs.

Effects on the Puerto Rican Economy - The Forest Service uses an econometric model called IMPLAN, which is based on input-output theory, to estimate impacts on a local economy. The IMPLAN model which was developed for the U.S. mainland was modified for use in Puerto Rico based on economic data from the Puerto Rico Planning Board.

IMPLAN is based on projections of what levels of expenditures (outputs) are generated in the local economy by Forest expenditures and Forest provided goods and services (inputs). Three inputs were considered significant enough to track in this analysis: recreation use, Forest personnel salaries, and non-salary Forest expenditures. Other potential inputs, such as the timber demonstration program, were considered insignificant in comparison to these three inputs.

Direct Forest expenditures (salary and non-salary) and Forest-generated expenditures (by recreation users) are re-spent within the Puerto Rican economy. This is known as the "multiplier effect". The size of the multiplier effect was estimated based on interactions among various sectors of the local economy. These relationships (or production functions) are based on 1981 data (the most recent available) from the Puerto Rico Planning Board.

IMPLAN response coefficients developed through IMPLAN are as follows:

| Table B-3. Response Coefficients - Forest-Related Expenditures. | | |
|---|---|---|
| **Activity** | **Response per $MM** | **Expenditure $MM** |
| | Jobs | Income |
| Recreation | | |
| Foreign Visitor | 67.3 | 2.08 |
| Domestic Visitor | 33.8 | 1.03 |
| Forest Service | | |
| Salary | 140.8 | 2.08 |
| Non-Salary | 40.7 | 1.47 |

Of the three inputs, recreation use is by far the most significant contributor to the local economy. Recreation users were classified as either local or off-island visitors. Number of visitors to the Forest was estimated at 635,000 in 1989, of which 46% were local and 54% off-island. The only expenditure attributed to local visitors in this analysis was an estimate of gasoline purchased for travel to and from the Forest. For off-island visitors, a part of expenditures for airline tickets, hotel, food, and car rental/tour bus was attributed to recreation opportunities afforded by the Forest. The proportion attributed was based on estimates of how time the average off-island visitor to the Forest spent in Puerto Rico, and how much of the total time in Puerto Rico was spent on the Forest.

Forest salary and non-salary expenses were based on the Forest's 1991 operating budget. These expenditures were not assumed to vary by alternative.

**Recreation**

The Recreation Opportunity Spectrum (ROS) as described in *Recreation Opportunity Spectrum Users Guide* (Forest Service Handbook 2309.13) was used to assess supply and demand for various types of recreation experiences on the Forest.

While the ROS was also used to assess the same variables in the current Plan, its application in this revision has some key differences. The recreation analysis process summarized here, is described in detail in the papers *Recreation Opportunity Spectrum in the Management of the Caribbean National Forest* (Valenzuela, 1993), and *Recreation Supply and Demand Analysis for the Caribbean National Forest* (Valenzuela, 1992), which are available for review in the planning record.

Supply - An ROS inventory map was prepared based on the Forest's current (1992) condition. From this map acreage and capacities were determined by ROS class (Table III-6). The ROS map and acreage were determined based on ROS class definitions and characterizations summarized in Tables B-4, B-5 and B-6.

**Table B-4. Recreation Opportunity Spectrum Caribbean National Forest Activity Characterization.**

| Activities / ROS Class | Land Based Recreation | Water Based Recreation | Compatible Management Activities |
|---|---|---|---|
| Primitive | Viewing Scenery<br>Hiking on trails<br>Cross-country Hiking<br>Primitive Camping<br>Nature Study<br>Mountain Climbing | Swimming in stream | Monitoring<br>Critical wildlife habitat improvements<br>Primitive trails<br>Observational research |
| Semi-Primitive Non- Motorized | Viewing Scenery<br>Hiking on trails<br>Cross-country Hiking<br>Primitive Camping<br>Nature Study<br>Mountain Climbing | Swimming in stream | Monitoring<br>Critical wildlife habitat improvements<br>Developed trails<br>Observational research |
| Semi-Primitive Motorized | Viewing Scenery<br>Hiking on trails<br>Bus touring<br>Bicycling<br>Camping at nondeveloped sites<br>Nature Study<br>General Information | Swimming in streams | (Above Plus)<br>Manipulative research<br>Timber stand improvements<br>Timber Harvest<br>Special uses<br>Road Construction |

** Some of these activities may be prohibited in some portions of a specific classes due to other special management concerns.*

| Table B-4. Recreation Opportunity Spectrum Caribbean National Forest Activity Characterization. | | | |
|---|---|---|---|
| **Activities / ROS Class** | **Land Based Recreation** | **Water Based Recreation** | **Compatible Management Activities** |
| Roaded Natural undeveloped | Viewing Scenery<br>Hiking on trails<br>Camping at nondeveloped sites<br>Nature Study<br>General Information<br>Automobile<br>Bus touring<br>Bicycling<br>Road side picnicking | Swimming in streams | (Above Plus)<br>Manipulative research<br>Timber stand improvements<br>Small scale timber Harvest<br>Special uses<br>Road construction |
| Roaded Natural Developed | Viewing Scenery<br>Hiking on trails<br>Camping at developed sites<br>Automobile<br>Bus touring<br>Bicycling<br>Horseback riding<br>General Information<br>Nature Study<br>Viewing interpretive signs<br>Developed picnicking<br>Recreation Cabin use | Swimming in modified streams<br>Swimming in developed pools | (Above Plus)<br>More extensive manipulative research<br>More extractive management of natural forest. |
| Rural | (Above plus)<br>Viewing complex interpretive exhibits<br>Developed picnicking<br>Commercial Services | Swimming in developed pools | (Above plus)<br>Administrative sites<br>Storage and work centers<br>Extensive agriculture |

** Some of these activities may be prohibited in some portions of a specific classes due to other special management concerns.*

| Table B-5. Recreation Opportunity Spectrum, Caribbean National Forest, Setting Characterization*. | | | | |
|---|---|---|---|---|
| **Activities ROS Class** | **Physical Setting** | **Social Setting** | **Managerial Setting** | **Evidence of Humans Criteria** |
| Primitive | An area designated at least 1.5 miles from all roads or trails with motorized use. Areas must be at least 2,000 acres, the areas may be smaller when adjacent to Semi-Primitive areas. | Usually less than 6 groups a day encountered on trails and less than 3 parties visible at campsites. Very low frequency of contact off trails. | On-site regimentatio n is low with controls off-site. | Essentially an unmodified natural environment. Evidence of human would not be noticed by an observer wandering through the area. Structures are extremely rare and trails primitive. |
| Semi-Primitive Non-Motorized | An area designated at least 1/4 mile from primitive or limited access roads or trails used by motor vehicles; but not further than 2 miles. Areas at least 2,000 acres | Usually 12-30 parities per day encountered on trails and 10 or less visible at campsites | On-site regimentatio n and controls present but very subtle. | Essentially an natural environment. Evidence of human would be noticed but not draw the attention by an observer wandering through the area. Structures are rare and isolated and trails with natural surfaces. |
| Semi-Primitive Motorized | An area designated within 1/4 mile from primitive or limited access roads or trails used by motor vehicles;but not closed than 1/4-mile from developed roads. Areas are at least 1,500 acres. | Low to moderate contact frequency on roads and trails. | On-site regimentatio n and controls present but subtle. | Natural setting may have moderately dominant alterations but would not draw the attention of motorized observers. Structures are rare and trails may be surfaced with man made materials, roads may be surfaced. |

** These setting criteria differ from mainland standards to conform to local topographic relief and vegetative cover and to account for local perceptions of wildness and crowding.*

| Table B-5. Recreation Opportunity Spectrum, Caribbean National Forest, Setting Characterization*. | | | | |
|---|---|---|---|---|
| **Activities ROS Class** | **Physical Setting** | **Social Setting** | **Managerial Setting** | **Evidence of Humans Criteria** |
| Roaded Natural Undeveloped | An area designated within 1/4 mile from better than primitive roads. No size criteria. | Frequency of contact is moderate to high on roads; low to moderate on trails and away from roads | On-site regimentation and controls are noticeable,but harmonize with the natural environment. | Natural setting have modifications which range from being easily noticed to strongly dominant to observers with in the area. From sensitive viewpoints these alterations would remain unnoticed.. Structures are generally scattered and visually subordinate. Trails and roads well developed.. |
| Roaded Natural Developed | A developed area within 1/4 mile from better than primitive roads. No size criteria. | Frequency of contact is moderate to high in developed sites, on roads and trails, and water surfaces; moderate away from developed sites. | On-site regimentation and controls are obvious and numerous largely in harmony with the man-made and natural environment. | Natural setting have modifications that are dominant to observers with in the area. However from sensitive viewpoints these alterations are visually subordinate. Structures are scattered to small dominant clusters. Trails and roads well developed.. |
| Rural | A highly developed area adjacent to roads. No size criteria. | Large numbers of users on site and in nearby areas. High level of interactions occurring including organized activities. | Regimentation and controls are obvious and numerous largely in harmony with the man-made environment. | Natural setting is culturally modified so as to be dominant to the observer, May include pastoral, agricultural, intensively managed forests. There is strong evidence of roads and highways. Structures apparent and may include dominant clusters, power lines, and major recreation sites. |

*These setting criteria differ from mainland standards to conform to local topographic relief and vegetative cover and to account for local perceptions of wildness and crowding.*

| Table B-6. Recreation Opportunity Spectrum, Caribbean National Forest, Experience Characterization*. | |
|---|---|
| **ROS Class** | **Experience Characterization** |
| Primitive | Solitude for long periods of time.<br>Extreme challenge and moderate risk in exploration.<br>Closeness to nature, feelings of tranquillity, of being isolated deep in the forest away from the developed world.<br>Feelings of self-reliance through the use of outdoor skills.<br>Interaction with natural environment, exercise and climatic stress high.<br>Moderate learning feeling, self-interpretation, no information or orientation. |
| Semi-Primitive Non- Motorized | Solitude for moderate periods of time, small group affiliation.<br>Moderate challenge and risk in exploration.<br>Closeness to nature, feelings of tranquillity, of being isolated deep in the forest away from the developed world.<br>Feelings of self-reliance through the use of outdoor skills.<br>Interaction with natural environment, exercise and climatic stress high.<br>Moderate learning feeling, self-interpretation, no information little orientation. |
| Semi-Primitive Motorized | Solitude for short periods of time, small group affiliation.<br>Moderate challenge and low risk in exploration.<br>Closeness to nature, feelings of tranquillity.<br>Feelings of self-reliance through the use of outdoor skills.<br>Interaction with natural environment, exercise and climatic stress moderate.<br>Moderate learning feeling, self-interpretation, little orientation able to observe research activities. |
| Roaded Natural Undeveloped | Affiliation with individuals and groups is prevalent.<br>No challenge and low risk in use or access.<br>Aesthetic appreciation of Nature, feelings of tranquillity.<br>Interaction with natural environment, exercise and climatic stress moderate.<br>Moderate learning feeling, on-site interpretation, information and orientation, able to observe research activities.<br>Family bonding feeling common. |

** These share common elements with similar ROS classes in other areas but modified to more closely describe the special experiences in this forest.*

| Table B-6. Recreation Opportunity Spectrum, Caribbean National Forest, Experience Characterization*. | |
|---|---|
| **ROS Class** | **Experience Characterization** |
| Roaded Natural Developed | Affiliation with individuals and groups is prevalent and important.<br>Safe feeling, challenge unimportant.<br>Aesthetic appreciation of Nature, feelings of tranquillity.<br>Interaction with natural environment is mediated, exercise and climatic stress low.<br>High learning feeling, on-site interpretation, often staffed, information and orientation, able to observe research activities.<br>Family bonding feeling common.<br>Consumer behavior minor |
| Rural | Highly social with large groups and individuals and observing others may be important.<br>Safe feeling, challenge unimportant.<br>Aesthetic and analytical appreciation of Nature.<br>Interaction with natural environment minimized, and the visitor is comfortable.<br>Very high feeling of learning information processing and orientation with complex staffed on-site interpretation, able to understand off-site research activities.<br>Consumer behavior common. |

** These share common elements with similar ROS classes in other areas but modified to more closely describe the special experiences in this forest.*

Theoretical maximum recreation capacities (PAOT's) and potential annual use (MRVD's) by ROS class were determined based on ROS class acreage and an inventory of existing facilities. Practical capacities were determined to be 40% of theoretical maximums based on the fact that demand is not spread evenly over the day or year.

Practical capacities were further adjusted based on limiting factors (or the concept of "recreational affordance"). This analysis indicated that parking is a major limiting factor for both developed and dispersed recreation on the Forest. For example, there is more picnic table capacity than parking at the Forest's developed picnic grounds. Similarly, there is more back-country (P, SPNM) and trail capacity than there is parking at trailheads accessing these areas and trails.

ROS maps/acreage and adjusted PAOT and MRVD figures were estimated for each alternative following the same process used to determine existing levels.

Demand - Demand for various types of recreation experiences on the Forest was estimated by ROS class. These estimates were compiled based on the following information:

- Historic recreation use data for the Forest (RIM).
- Past and projected future population trends for Puerto Rico.
- Past and projected future tourist visitation trends for Puerto Rico and the Forest.
- Surveys of Forest users.

Based on this information the Forest user population was divided into user groups, four of which were described and analyzed in detail: local rural users, San Juan Metropolitan Area users, international visitors, and nature tourists. Projections were made for each group separately, and then aggregated by ROS class, based on professional judgment.

"Demand" in this recreation analysis refers to the public's desire for various recreation experiences as would actually be expressed as use on the Forest. Demand was estimated by ROS class for the Forest's current situation, and for each alternative after 10 and 50 years.

Recreation use data indicate increasing use of the Forest since data began to be collected in the 1930's. The largest increases occurred during the 1960's and 1970's. During the 1980's increase in recreation use was less than population growth in Puerto Rico. Similar demographic and economic trends on the mainland during the same period produced greater increases in recreation use on national forests.

Based on analysis of use data, surveys of forest users, and observations of use far exceeding nominal capacities on the Forest on most summer weekends, it was inferred that the Forest essentially reached capacity by the 1980's, and that as a result there is considerable "suppressed" or "latent" demand. This is demand that would be expressed in use if more facilities were available. The projected use figures in the ROS analysis assume that this latent demand is equal to the difference between observed use, and that which would have been expected if use had continued to follow population growth. This assumption of latent demand accounts for the large proportional increases seen in the Recreation Supply vs. Demand charts between "current demand" and "first decade demand", as expanded and new facilities permit latent demand to be expressed. Demand, as well as supply, for roaded undeveloped recreation are exhibited in Figure II-5a in the Alternatives Chapter of this EIS.

## Visual Quality

The Visual Management System (VMS) developed by the Forest Service as explained in Agricultural Handbook Number 462, National Forest Landscape Management, Volume 2, was used to estimate the visual effects of alternatives.

Each management area was assigned visual quality level(s) (VQL's) based on professional judgment of the visual effects of the management activities permitted in the management area. These VQL's were then multiplied by the acreage of different management areas in each alternative, and the products summed to show estimated VQL totals by alternative. The following assumptions and rationales were used in these calculations:

| Table B-7. Visual Quality Level(s) by Management Area. | | |
|---|---|---|
| MANAGEMENT AREA(S) | VISUAL QUALITY LEVEL(S) | RATIONAL |
| Wilderness<br>RNA<br>Primary Forest<br>Wilderness/Primary<br>Wilderness/RNA | Preservation | These areas are to be left to their natural processes, except for very low level and rustic access trails. |
| Administration Sites | Partial Retention | These sites, although manmade, have some measure of screening, plus materials used for construction are to simulate form, line color and texture of the natural surrounding area. |
| Developed Recreation | 50% Retention<br>50% Partial Retention. | These areas will have trails and facilities at varying degrees of development levels. In most cases trails will be well screened from view but at times their existence will be noticeable. Recreation facilities will be harder to screen but materials used should simulate form, line color and texture of the natural surrounding area. |
| Integrated | 75% Retention<br>20% Partial Retention<br>5% Modification | The activities here will include research, small areas of timber mgt., and dispersed recreation, each potentially having varying degrees of visual disturbance. |

| Table B-7. Visual Quality Level(s) by Management Area. | | |
|---|---|---|
| MANAGEMENT AREA(S) | VISUAL QUALITY LEVEL(S) | RATIONAL |
| Research | 40% Retention<br>40% Partial Retention<br>15% Modification<br>5% Maximum Modification. | This area is set aside to allow some manipulative research that may have negative effects on the visual resource. Most however, should result in minimal visual degradation due to the good screening characteristics of the Forest. |
| Electronic Sites | Modification | These sites will benefit from rehabilitation to reduce the impact of visually dominating elec. communication apparatus. The sites should eventually be upgraded from its present state of Unacceptable Modification to Modification. |
| Timber Management | 50% Retention<br>40% Partial Retention<br>10% Modification | This area will be subject to timber activities for the purpose demonstrating tropical forestry techniques. No clearcutting will be implemented. Harvest treatments will not exceed removal of 1/3 of the canopy in any one entry. It is anticipated that most negative visually impacting activities will be carried out away from publicly seen areas. |
| Dispersed Recreation | 50% Preservation<br>40% Retention<br>10% Partial Retention | The recreation facilities and activities in this area will be very rustic and unobtrusive in nature. The effects on visual quality should be very minimal, especially when viewed from within heavily forested areas. |

These calculations are presented in detail in a paper titled Visual Resources (Villalvazo, 1993). This paper is available for review in the planning record.

## Tradeoffs Among Alternatives

In discussing the differences between alternatives, the focus was upon the resolution of the issues (EIS Appendix A) and the overall tradeoffs incurred in attempting to address the issues. The outputs and effects of the alternatives are presented in detail in Chapters 2 and 3 of this EIS. There is no need to repeat or summarize that information here. The reader is encouraged to review the results of the alternative analyses presented in these chapters.

## Suitability Analysis

The Forest was analyzed for its ability to produce timber on a sustainable yield basis. This timber suitability analysis is required by regulation (36CFR 219.44). The timber suitability analysis is summarized in Table B-8.

**Table B-8. Forest Land Classification.**

| | Classification | Acres 1986 Plan | Acres Revised Plan |
|---|---|---|---|
| 1. | Non-Forest land (includes water) | 0 | 0 |
| 2. | Forest land | 27,890 | 27,890 |
| 3. | Forest land withdrawn from timber production | 1,210 | 12,983 |
| 4. | Forest land not capable of producing crops of industrial wood | 13,740 | 13,740 |
| 5. | Forest land physically unsuitable: irreversible damage likely to occur; not restockable within 5 years | 0 | 0 |
| 6. | Forest land, inadequate information * | 0 | 0 |
| 7. | Tentatively suitable forest land (item 2 minus items 3, 4, 5, and 6) | 12,940 | 1,167 |
| 8. | Forest land not appropriate for timber production | 7,063 | 1,167 |
| 9. | Unsuitable forest land (items 3, 4, 5, 6, and 8) | 22,013 | 27,890 |
| 10. | Total suitable forest land (item 2 minus item 9) | 5,877 | 0 |
| 11. | Total National Forest land (items 1 and 2) | 27,890 | 27,890 |

* Includes management areas which have no timber production objective, but which would be physically capable of commercial timber production.