Appendix E

Environmental Impact Statement List of Proposed, Endangered, Threatened and Sensitive Species for the Caribbean National Forest (July 1996)

Table E-1. Proposed, Endangered, Threatened and Sensitive Species Occurring On The Caribbean National Forest (July 1996).

Taxon *Species scientific namel* common name	Forest Service Status	Federal Status	Other Status* (Natural Heritage)	Common-wealth Status
Mammals *Stenoderma rufum* Red Fruit Bat	S		G3 L4	
Birds *Amazona vittata* Puerto Rican Parrot	E	E	G1 N1	E
Corvus leucognaphalus White-Necked Crow	E	E	G3 NX	
Falco peregrinus tundrius Arctic Peregrine Falcon	T	T	G2 NN	T
Accipiter striatus venator Puerto Rican Sharp-Shinned Hawk	E	E	G5 N2	E
Buteo platypterus brunnescens Puerto Rican Broad-Winged Hawk	E	E	G5 N2	E
Dendroica angelae Elfin Woods Warbler	S		G1G2 N?	
Reptiles *Epicrates inornatus* Puerto Rican Boa	E	E	G1G2 N3	E
Amphibians *Eleutherodactylus eneidae* Mottled Coqui	S		G2G3 N3	T

Legend:

E = Endangered Species
S= Sensitive Species
T = Threatened Species
P= Proposed Species

* See code description on page E-5
** NCN = No Common Name

Table E-1. Proposed, Endangered, Threatened and Sensitive Species Occurring On The Caribbean National Forest (July 1996).				
Taxon ***Species scientific name*** **common name**	**Forest Service Status**	**Federal Status**	**Other Status* (Natural Heritage)**	**Common-wealth Status**
Amphibians *Eleutherodactylus karlschmidti* Web-Footed Coqui	S		G1 N1	T
Eleutherodactylus unicolor Burrow Coqui	S		G1G2 N?	
Eleutherodactylus locustus Warty Coqui	S		G2 N?	
Eleutherodactylus richmondi Ground Coqui	S		G3 N?	
Plants *Brachionidium ciliolatum* NCN**	S		G1 N1	
Brachionidium parvum NCN	S		G1 N1	
Brunfelsia portoricensis NCN	S		G1 N2	
Callicarpa ampla Capa Rosa	E	E	G1 N1	E
Calyptranthes luquillensis NCN	S		G1 N1	
Calyptranthes woodburyi NCN	S		G1 N2	
Coccoloba rugosa Ortegon	S	PT	G2 N2	
Conostegia hotteana NCN	S		G2 N2	
Cordia wagnerorum NCN	S		G1 N1	
Cybianthus sintenisii NCN	S		G1 N1	

Legend:

E = Endangered Species
S= Sensitive Species
T = Threatened Species
P= Proposed Species

* See code description on page E-5
** NCN = No Common Name

Table E-1. Proposed, Endangered, Threatened and Sensitive Species Occurring On The Caribbean National Forest (July 1996).				
Taxon ***Species scientific namel*** **common name**	**Forest Service Status**	**Federal Status**	**Other Status* (Natural Heritage)**	**Common-wealth Status**
Plants *Dichanthelium aciculare* NCN**	S		G4G5 N1	
Eugenia eggersii Guasabara	S		G2 N2	
Eugenia haematocarpa Uvillo	E	E	G1 N1	E
Ilex sintenisii Cuero de Sapo	E	E	G1 N1	E
Laplacea portoricensis Maricao Verde	S			
Lepanthes dodiana NCN	S		G1 N2	
Lepanthes eltorensis NCN	E	E	G1 N1	E
Lindsaea stricta var. jamesoniiformis NCN	S		G1 N1	
Lycopodium tenuicaule NCN	S			
Lycopodium wilsonii NCN	S			
Marlierea sintenisii Beruquillo	S		G1 N1	
Marsdenia elliptica NCN	S			
Maytenus elongata NCN	S		G1 N1	
Miconia foveolata Camasey	S		G1 N1	

Legend:

E = Endangered Species
S= Sensitive Species
T = Threatened Species
P= Proposed Species

* See code description on page E-5
** NCN = No Common Name

Table E-1. Proposed, Endangered, Threatened and Sensitive Species Occurring On The Caribbean National Forest (July 1996)				
Taxon ***Species scientific name*** **common name**	**Forest Service Status**	**Federal Status**	**Other Status* (Natural Heritage)**	**Common-wealth Status**
Plants *Miconia pycnoneura* NCN	S		G1 N1	
Myrica holdridgeana NCN	S		G2 G2	
Pilea multicaulis NCN	S			
Pilea yunquensis NCN	S			
Pleodendrum macranthum Chupacallos	E	E	G1 N1	E
Psidium sintenisii Hoja Menuda	S		G1 N1	
Ravenia urbanii NCN	S			
Solanum woodburyi NCN	S		G1 N1N2	
Styrax portoricensis Palo De Jazmin	E	E	G1 N1	E
Ternstroemia heptasepala NCN	S		G1 N1	
Ternstroemia luquillensis Palo Colorado	E	E	G1 N1	E
Ternstroemia subsessilis NCN	E	E	G1 N1	E
Urera chlorocarpa NCN	S		G2 N2	
Xylosma schwaneckeanum Palo de Candela	S		G1 N1	

Legend:

E = Endangered Species
S= Sensitive Species
T = Threatened Species
P= Proposed Species

* See code description on page E-5
** NCN = No Common Name

Appendix F

Guidelines for Forest Activities in Puerto Rican Parrot Habitats: Management Situation Concept

Introduction

The guidelines developed for the Puerto Rican Parrot management situation concept are intended to promote recovery of this endangered species, and to facilitate the planning of Forest activities. The strategy can be used to evaluate risks to the species, for given activities, and to aid in the appropriate timing and placement of Forest developments.

The concept applies to all Federal lands within the Caribbean National Forest/Luquillo Experimental Forest boundary, and describes five distinct management situations. Each of these management situations varies in terms of its existing and potential value as parrot habitat, its sensitivity to management activities, and the direction which guides such activities. In general, as the management situation number increases from 1 to 5, parrot habitat values (these are present day values, and not necessarily potential values) decrease, as do the sensitivity to management activities, the number of management constraints, and the intensity of coordination required. The five management situations are:

Management Situation 1 - Current Breeding Habitat

Management Situation 2 - Current Non-breeding Habitat

Management Situation 3 - Limited Value Habitat

Management Situation 4 - Potential Habitat

Management Situation 5 - Non-"Essential" Habitat

Management Situation areas are discreet and their boundaries are dynamic (*See Puerto Rican Parrot Management Situation Map on page F-14*). They will be re-evaluated annually, and as recovery ensues, will be revised accordingly. Detailed descriptions of each Management Situation area are presented, starting on page F-4.

The concept recognizes that there are critical parrot habitats whose location is regarded as sensitive information, and that knowledge of such locations must be retained for purposes of security, i.e., to prevent theft, vandalism, and other detrimental human incursions. The availability of information will vary then, between the general public, land managers, project leaders, and parrot specialists. Non-sensitive information will be made available in map form for public distribution, information of moderate sensitivity might be available as an overlay or GIS layer with limited access to select administrative users, while the most sensitive information will be described conceptually without actually revealing exact geographic locations. Sufficient information will be made available, however, to assure adequate project coordination while retaining the necessary discretion.

Parrot Recovery

Recovery for this species is defined in the Puerto Rican Parrot Recovery Plan as that point at which a total breeding population of 250 pairs is reached. The achievement of recovery may entail expansion beyond the CNF/LEF boundary, and may involve the establishment of new ofF-Forest populations. The Management Situation concept presented here provides a strategy for managing forest activities to promote recovery of the Luquillo parrot population within the Forest boundary.

The rate of population increase, between 1973 and 1989, when Hurricane Hugo struck, was slow but steady. Reduced by half as a result of that storm, the wild population is currently approaching its pre-Hugo level (see Table F-1).

Table F-1. Summary of Puerto Rican Parrot Recovery: status of wild flock immediately before and after Hurricane Hugo

	Pre-Hugo				Post-Hugo			
	1989	1990	1991	1992	1993	1994	1995	1996
Reproductive Attempts	5	3	6	6	6	6	5	6
Successful Nesting Attempts	5	1	5	6	6	6	5	3
Total Young Produced in the Wild	7	2	8	10	13	13	14	7
Young Fledged into the Wild [1]	4	2	7	11	15	14	15	8
Population Estimate [2]	47	25	32	35	41	42	44	45

[1] *Total young produced in the wild, minus young transferred to aviary, plus young fostered from aviary.*
[2] *Minimum post breeding season estimate based on highest count during census.*

Coordination at its simplest, may entail informing the Forest Biologist of the intent to initiate a low-risk-of-impact project. At its most complicated, it may require the preparation of a detailed biological evaluation (BE), and formal consultation with the U.S. Fish and Wildlife Service (FWS).

In brief, the Management Situation concept is a summation of the coordinating requirements or constraints applied to activities within habitats which vary in value to the parrot. The guidelines presented within, are for the most part not new, and have been used regularly to ensure that Forest activities are legal and in concert with parrot recovery. Refer to Table F-2, at the end of this document for a synopsis of these guidelines.

Current recovery efforts include: research on the species and its habitat; protection; a captive breeding program; habitat improvement; and coordination of Forest activities to promote successful reproduction, improved distribution, and range expansion. The focus of the Management Situation strategy is coordination.

Coordination entails communicating the intent to initiate a project with the Forest Biologist, who then conducts an analysis of compatibility between the proposed activity and the maintenance of parrot habitat quality and effectiveness. Depending on the level of complexity and risk associated with the project, the biologist may involve other experts in the analysis.

During coordination, the reviewing biologist looks at the juxtaposition of the project to seasonal habitats; estimates potential primary, secondary, short-term, long-term, and cumulative effects; makes recommendations to promote positive effects and mitigate negative effects; and communicates with the necessary internal and external departments and agencies, as prescribed by Forest direction, and Commonwealth and Federal law.

Constraints placed on activities to encourage parrot recovery will impact programs increasingly as parrot numbers and their ranges expand into currently unoccupied parts of the Forest. As the recovery goal is approached, however, our understanding of parrot habitat requirements, parrot/human tolerance, and parrot tolerance to each other, will improve. As this occurs, there may be opportunities to build greater flexibility into the management guidelines, reducing the overall impact to Forest programs.

Description of Management Situations, Sensitivity Levels, and Guidelines

Management Situation 1 — Current Breeding Habitats

Description

These areas contain parrot breeding sites, foraging areas, and other habitat components essential to successful reproduction and species recovery. Management Situation 1 contains the areas within a 1 km radius of all known nest trees. Additionally, the Luquillo Aviary is also designated as Management Situation 1.

Sensitivity Levels

Site Disturbance - Our understanding of parrot sensitivity to human -induced physical or site disturbances within breeding habitats is very 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 effect will be acceptable.

The effects of natural site disturbances brought on by Hurricane Hugo appeared to be short-term but severe, in terms of alteration of stand structure and composition, concealment cover, and food availability. The ultimate effect that these changes may have on parrot recovery in the long-term is unknown.

Human Disturbance - Sensitivity to disturbances from human presence and human-generated noise during the nest selection and breeding seasons, is extremely high.

The nest selection season is that critical pre-breeding period, usually between the middle of December through about the middle of March, when parrots are seeking suitable nest sites. Potential sources of human disturbance include recreational and administrative uses, research, aircraft use, and the use of chainsaws or explosives (blasting).

Guidelines

1. Site disturbances: As a rule, site disturbances will not occur within Management Situation 1. Project proposals which might result in any form of habitat modification should be reviewed by the Puerto Rican Parrot Interagency Technical Committee (consisting of representatives of Puerto Rico Department of Natural Resources {captive breeding program}, U.S. Fish and Wildlife Service {management and captive breeding program}, National Biological Survey {research}, and U.S. Forest Service {research and management}), analyzed through the processes required by the National Environmental Policy Act (NEPA) and the Endangered Species Act (ESA), and undergo U.S. Fish and Wildlife Service (FWS) consultation.

2. Human disturbances: All projects with potential to disturb parrots within breeding areas, or the captive breeding facility, should be coordinated with the Forest Biologist. This includes projects which might occur outside of these areas but whose sound amplitude could penetrate breeding areas (e.g., helicopter flights, chainsaws, blasting). In general, a 1 km (0.6 mile) radius describes what is considered the area of influence around a parrot nest tree. The 1 km distance was formally established as a guideline by the Puerto Rican Parrot Recovery Team based on the observation that no successful nests have been located closer than that distance to human disturbances. This distance may be tempered by topographical influences, the nature of potential disturbances, and other factors.

3. Human disturbances: Should be timed outside of nest selection (December 15 - April 15) and the breeding season (January 1 - July 15), to assure the highest level of habitat effectiveness in these critical areas. Any proposed exception to the timing guidelines will be reviewed by the Puerto Rican Parrot Interagency Technical Committee, analyzed through the NEPA and ESA processes, and also undergo FWS consultation.

Management Situation 2

Current Non-breeding Habitat

Description

Management Situation 2 areas contain high quality, effective habitats which are currently occupied by parrots, exclusive of breeding habitats and occupied Management Situation 3 areas. They contain feeding areas, movement corridors, and other components that may be important to the recovery of the species.

Of all management situations, Management Situation 2 is the most dynamic. It has areas with tremendous potential to become future breeding habitats, and its boundaries should be expected to expand steadily as recovery ensues.

Sensitivity Levels

Site Disturbance - Parrot sensitivity to physical disturbances within habitats used for feeding, movement, etc. are also not well understood. It can be assumed, however, that activities which would diminish the quality, abundance, or effectiveness of parrot feeding or potential breeding components in Management Situation 2 areas, would not promote recovery goals, and from that perspective, would be undesirable and not recommended.

Human Disturbance - Human disturbances in areas used exclusively for feeding and movement are less disruptive than in breeding areas. However, human disturbances could be significant prior to the breeding season, when birds are known to explore non-traditional use areas for potential nest sites. If parrot recovery, i.e., the growth of populations and expansion into new habitats, is to be encouraged, then the effectiveness of potential breeding habitats should be ensured during the nest selection period.

Guidelines

1. Site disturbances: Activities which would result in any physical modification of existing or potential parrot habitats within Management Situation 2, should be coordinated through the Forest Biologist, be evaluated through the NEPA and ESA processes, and, if needed, undergo FWS consultation.
2. Human disturbances: Projects with potential to disturb parrots should be planned outside the nest selection period (December 15 through April 15) to promote expansion of breeding areas and parrot numbers. Proposed exceptions should be coordinated through the Forest Biologist.

Management Situation 3

Limited Value Habitat

Description

Management Situation 3 contains areas which may or may not be occupied, but which have limited current or potential habitat value. These include Forest areas which have been heavily developed, such as the Highway 191 North Recreation Corridor, which is used by parrots for feeding and movement but due to the amount of human use, may have reduced effectiveness as feeding habitat, and will probably remain ineffective as breeding habitat.

Management Situation 3 also contains areas which because of intrinsic physical limitations, have little potential to serve as important parrot habitats, such as the dwarf forest zone. These areas are sometimes used by parrots as movement corridors, are rarely used for feeding, and are not known to have ever been used for breeding.

Sensitivity Levels

Site Disturbance - Due to the reduced level of habitat quality or effectiveness of these areas, parrot 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 areas used exclusively for feeding or movement, appears to be considerably less than than in nesting areas and other more optimal occupied habitats. Support for this contention lies in the fact that it is not uncommon to encounter parrots feeding within some of the Forest's most heavily used recreation areas.

Guidelines

1. Site disturbances: Projects proposed within Management Situation 3 areas should be coordinated through the Forest Biologist, and be evaluated through the NEPA and ESA processes. Projects would be designed to retain feeding components as far as practicable. In general, habitat modifications in the Dwarf Forest zone would not occur.

2. Human disturbances: Projects with potential to disturb parrots should be coordinated through the Forest Biologist. No seasonal timing constraints would be indicated unless the amplitude of disturbances could influence the usability of nearby sensitive habitats. In general, the provision of habitat effectiveness would not be an objective in areas already heavily-disturbed.

3. Secondary impacts to more sensitive management situations from land uses originating in Management Situation 3 areas should be carefully considered during project planning, i.e., providing human access from Management Situation 3 areas to nearby and otherwise inaccessible sensitive parrot areas, could have severe detrimental effects.

Management Situation 4

Potential Habitat ("Essential Habitat")

Description

The Management Situation 4 designation includes those areas within the Puerto Rican Parrot "Essential Habitat" delineation exclusive of occupied habitats (designated as Management Situations 1, 2, or 3). These areas were historically used by parrots and have potential to once again become breeding or non-breeding habitats.

By definition, "essential habitats" are those designated by the U.S. Forest Service as necessary for the future recovery of the species. The criteria which were used to designate these areas were: (a) that they included all currently-occupied habitats (e.g., primary palo Colorado and tabonuco forest types) and (b) that they included all potential parrot habitats (e.g., unoccupied Palo Colorado, and unoccupied primary and secondary tabonuco types).

Sensitivity Levels

Site Disturbance - Parrot sensitivity to site disturbances in areas not currently occupied, is probably low. However, projects which would permanently reduce the habitat potential of these areas, or preclude their eventual use by parrots, could adversely influence the recovery of this species.

Human Disturbance - Sensitivity to disturbances from noise and human presence in Management Situation 4 areas would be non-existent, provided the amplitude of disturbances originating from these areas (including recreational access points) did not reach more sensitive management situation areas, and as long as the Management Situation 4 areas remained unoccupied by parrots. Once parrots entered these areas, the potential for human disturbance would become real, unless its associated impacts were mitigated.

Guidelines

1. Site disturbances: Projects proposed within Management Situation 4 areas should be coordinated through the Forest Biologist, and be evaluated through the NEPA and ESA processes. Projects with potential to permanently preclude area use by parrots (e.g., high-investment developments whose disturbances cannot be timed outside of critical parrot use periods) should be planned outside of "essential" habitats.

2. Human disturbances: Projects with potential to disturb parrots should be coordinated through the Forest Biologist. No seasonal timing constraints would be indicated unless parrots re-entered the area. In which case, such projects should be timed to occur outside the nest selection period (December 15 through April 15), and if necessary, during the breeding season (January 1 through July 15).

3. Secondary impacts to more sensitive management situations from land use originating in Management Situation 4 areas should be carefully considered during project planning, i.e., recreation developments such as trails within Management Situation 4 areas should consider the maintenance of habitat effectiveness in nearby sensitive habitats through appropriate trail location, and the use of topography during trail placement.

Management Situation 5

Non-"Essential" Habitat

Description

Management Situation 5 areas consist of the remainder of the Forest. They include the lower elevation, primarily disturbed fringe lands which lie outside of the "Essential Habitat" designation.

Sensitivity Levels

Site Disturbance - Sensitivity to site disturbances is believed to be lowest in Management Situation 5 areas, relative to other management situations.

Human Disturbance - Sensitivity to disturbances from noise and human
presence in Management Situation 5 areas would again be non-existent, provided the amplitude of disturbances (e.g., noise and human access) which generate from these areas did not reach more sensitive management situation areas, and as long as the Management Situation 5 areas remained unoccupied by parrots. If parrots were to enter these areas, conservation measures could be warranted to reduce the likelihood of human disturbances and their associated adverse effects.

Guidelines

1. Site disturbances: Projects proposed within Management Situation 5 areas should be coordinated through the Forest Biologist, and be evaluated through the NEPA and ESA processes. Projects with potential to permanently preclude area use by parrots would be best planned in this management situation or within currently developed areas within Management Situation 3.
2. Human disturbances: Projects with potential to disturb parrots should be coordinated through the Forest Biologist. No seasonal timing constraints would be indicated in Management Situation 5 areas unless parrots re-entered the area. In which case, such projects should be timed to occur outside of the nest selection period (December 15 through April 15), and if necessary, during the breeding season (January 1 through July 15).
3. Again, secondary impacts to more sensitive management situation areas from land uses originating in Management Situation 5 areas should be carefully considered during project planning.

Table F-2. Summary of the Puerto Rican Parrot Management Situation Concept					
Management Situation	**Description**	**Sensitivity to Physical Disturbance**	**Sensitivity to Human Disturbance**	**Management Standards**	**Coordination Requirements**
1	Breeding Habitat	VH	VH	No physical disturbance Time projects outside nest selection period and breeding season (12/15-7/15).	Forest biologist PRP Tech. Committee [1] USFWS ESA NEPA
2	Non-breeding Habitat	H	M-H	No physical disturbance. Time projects outside of nest selection period (12/15 - 4/15). No timing constraints for activities, except high intensity activities, such as blasting, aircraft use, during breeding season, unless parrots enter the area.	Forest biologist USFWS ESA NEPA
3	Limited value Habitat	M-L	L	Physical disturbances should protect parrot food plants. No activity timing constraints, except for high intensity activities, unless parrots enter area during nest selection (12/15 - 4/15) or breeding season (1/1 - 7/15).	Forest biologist ESA NEPA

L = low
M = moderate
H = high
VH = very high
VL = very low

ESA = Endangered Species Act
NEPA = National Environmental Policy Act
PRP = Puerto Rican Parrot
USFWS =US Fish and Wildlife Service

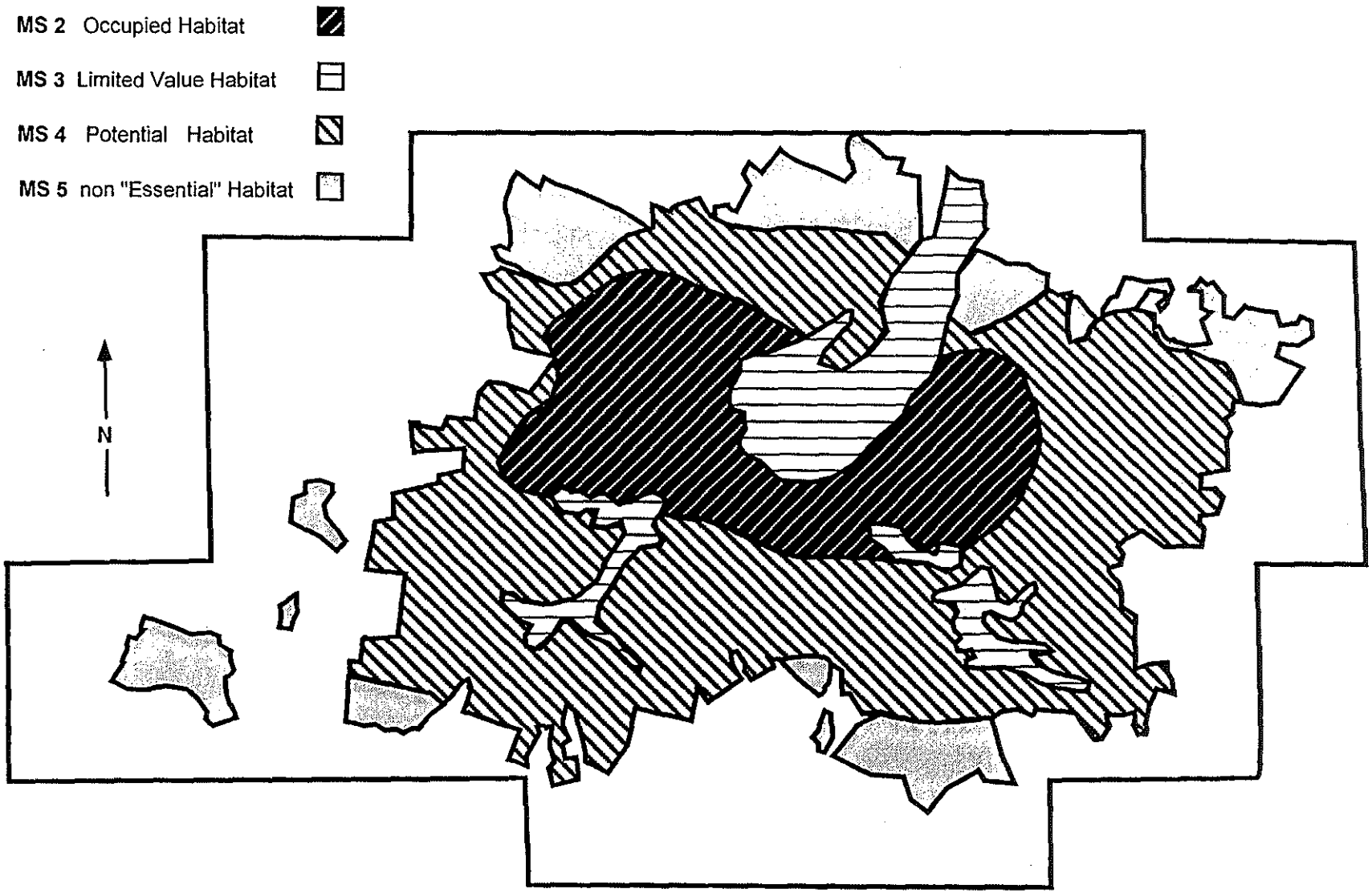
Table F-2. Summary of the Puerto Rican Parrot Management Situation Concept.					
Management Situation	**Description**	**Sensitivity to Physical Disturbance**	**Sensitivity to Human Disturbance**	**Management Standards**	**Coordination Requirements**
4	Potential Habitat	L	L	Physical disturbances should retain habitat components. No activity timing constraints, except for high intensity activities, unless parrots enter the area during nest selection (12/15 - 4/15) or breeding season (1/1 - 7/15).	Forest biologist ESA NEPA
5	Non-essential Habitat	VL	VL	Physical disturbances should retain habitat components. No activity timing constraints, except for high intensity activities, unless parrots enter area during nest selection (12/15 - 4/15) or breeding seasons (1/1 - 7/15).	Forest biologist ESA NEPA

L = low
M = moderate
H = high
VH = very high
VL = very low

ESA = Endangered Species Act
NEPA = National Environmental Policy Act
PRP = Puerto Rican Parrot
USFWS =US Fish and Wildlife Service

[1] Puerto Rican Parrot Technical Committee; consists of representatives from US Fish and Wildlife Service (Management and Captive Breeding Program), National Biological Survey (Research), US Forest Service (Management and Research), and the Puerto Rico Department of Natural Resources (Captive Breeding Program).

Figure F-1. Puerto Rican Parrot Management Situations (MS).



Appendix G

Management Indicator Species Caribbean National Forest/ Luquillo Experimental Forest

Purpose

Management indicator species (MIS) are animal or plant species whose population changes are believed to indicate the effects of land management activities. The MIS concept was developed in response to Forest planning requirements contained in the National Forest Management Act of 1976 (16 USC 1600). The concept is a planning tool to promote more effective management of habitats, both terrestrial and aquatic, on National Forest lands. . Through the MIS concept, the total number of species that occurs within a planning area is reduced to a manageable set of species that collectively represents the complex of habitats, species, and associated management concerns. MIS are used to meet the requirements of the National Forest Management Act for maintenance of population viability and biological diversity and to establish management goals for species in public demand.

Management Indicator Species in National Forest Planning

Application of the MIS concept offers land managers more opportunity to integrate terrestrial and aquatic wildlife, and rare plant resources into National Forest management than has previously been available. Planning and management efforts may be focused on a few species that are linked to identified planning issues, without neglecting any of the whole assemblage of species that depend on National Forest habitats. Information about MIS is applied in Forest planning through measuring changes in habitat condition and MIS responses to changing habitat quality. The goal is rapid and consistent evaluation of biological resources throughout the planning process.

MIS also provide a means to establish population objectives that are responsive to public demand for wildlife and plant resources. A key requirement of the National Forest Management Act regulations is that population trends of management indicator species will be monitored. Monitoring is a means of testing whether projected responses of MIS are accurate, and of measuring attainment of wildlife and rare plant objectives. The MIS which occur within a specific area of a Forest are used to monitor projects which are likely to affect that area. The needs of these MIS species can also be considered in treatment design and layout, timing of activities, monitoring, and other aspects of project planning, so that the needs of other wildlife and rare plants are met.

MIS on the Caribbean National Forest / Luquillo Experimental Forest

Management indicator species for the Caribbean National Forest / Luquillo Experimental Forest (Forest) were selected as part of the Forest planning procedure, as required in 36 CFR 219.19(a)(1). They were selected to be a focus of management attention for the purpose of resource production, population recovery, maintenance of population viability, or ecosystem diversity. They are the species which will be used to: quantify wildlife and plant diversity and resource production; evaluate specific management practices, opportunities, and tradeoffs; and monitor implementation success of the Forest Plan for wildlife and plant resources. The Forest Service has a responsibility to manage the Forest to:

- Maintain or improve habitat of management indicator species,
- Estimate the effects of changes in forest conditions and of management practices on habitat capability for management indicator species, and
- Monitor population trends of management indicator species and determine relationships to habitat changes.

These requirements place management indicator species at the center of all land management activities with regard to wildlife, plants and their habitats.

The 30 species of sensitive plants and the 144 species of vertebrates and macroinvertebrates which occur on the Forest were evaluated for their potential as MIS. This included 16 mammals, 77 birds, 19 reptiles, 15 amphibians, 7 fish, 9 shrimp, and 1 crab species. The following evaluation procedure was used:

Step 1
Categories of potential MIS

All species were reviewed to determine whether they belonged to one or more categories of potential MIS. MIS categories and definitions (Table F-1) were taken from national direction on MIS and supplemented by additional elements, such as insular (island) populations, to meet situations encountered on the Forest. Species that could not be placed in one or more categories were dropped from further consideration.

Step 2
Diversity and productivity issues

Species were evaluated to determine whether they are representative of a significant diversity or productivity issue at the local, Forest, or Regional level. This step in the process involved careful consideration of the issues associated with the species and the level (local, Forest-wide, or Region-wide) of concern. Species that were not determined to represent a significant diversity or productivity issue were dropped from further consideration.

Step 3
Factors affecting population abundance

An assessment was made of the principal factors that affect population abundance of the species identified above, and whether these factors are under the control of National Forest management. Species whose populations are controlled primarily by factors extrinsic to forest management were dropped from further consideration.

Step 4
Monitoring feasibility

The feasibility of monitoring was then evaluated. Assessments were based on species characteristics that influence the efficacy of population estimation, rather than on levels of personnel and funding that may be available for monitoring. A rating scale of 1 to 3 was used to characterize the relative difficulty of population estimation. Species given a rating of 1 are relatively well suited to estimation of absolute population size or density. For species rated as 2, estimation of absolute abundance is problematic, such that monitoring will likely be placed on relative indices of abundance. Species given a rating of 3, are very hard or impossible to monitor at this time due to difficulty in locating or enumerating, or because the current state of the art has not as yet provided monitoring protocols. In such cases monitoring will be restricted to presence/absence surveys, and if possible, the detection of trends based on population indices. Monitoring ratings of 3, due their inability to be adequately monitored at this time, were eliminated from consideration as candidate MIS. Such species (e.g., the Puerto Rican Boa) will be reconsidered for MIS designation once effective monitoring techniques are developed.

Step 5
Habitats

Habitats used by candidate species were considered to ensure that distinct habitats were represented by MIS. Habitat categories were of necessity broad due to a general lack of specific knowledge regarding habitat requirements of numerous species.

Table G-1. Categories and Definitions of Potential Management Indicator Species for the Caribbean National Forest / Luquillo Experimental Forest.	
Selected Caribbean NF/Luquillo EF Management Indicator Species .	
Category	Definition
1.Endangered species	A plant or animal species listed as endangered on Commonwealth and Federal lists; i.e., that is in danger of extinction throughout all or a significant portion of its range (FSM 2670).
2.Threatened species	A plant or animal species listed as threatened on Commonwealth and Federal lists; i.e., that is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range (FSM 2670)
3.Sensitive species	A species for which population viability is a concern as evidenced by (a) significant current or predicted downward trends in population numbers or density; or (B) significant current or predicted downward trends in habitat capability that would further reduce a species' existing distribution . (FSM 2670.5).
4.Rare species	A species for which population viability is a concern because the species exists at extremely low numbers over the Forest or is highly restricted in its distribution within the Forest.
5.Insular species	A species that occurs as one or more small, reproductively isolated populations on an island or group of islands.
6.Keystone species	A species whose presence and effect in an ecosystem are major factors affecting the structure, diversity, and function of the system (FSH 2609.12).
7.Emphasis species	A species for which there is high public demand (FSM 2600). Normally, these species are those commonly hunted, fished, or trapped, and are often of significant economic value.
8.Special interest	A species having high value for non-consumptive species recreational, cultural, educational, religious or scientific values (FSH 2609.12).
9.Species requiring special habitats	Habitats having productivity, rareness, or importance to a wildlife community such that the habitat itself is an important component of wildlife or fish diversity and may be used to focus planning and management (FSH 2609.12). Examples are dead standing trees (snags), nest trees, and large woody debris on land or in streams. Species requiring these special habitats or habitat components may be used to establish management goals and monitor effects of management on associated wildlife and fish.
10.Ecological indicator	A species whose population dynamics reflect significant changes in the condition or productivity of and ecosystem (FSM 2600). These species may be used to indicate changes in the populations of other species with similar habitat relationships, or with similar susceptibility to environmental change.

[1] National direction on Management Indicator Species(FSH 2609.12) recognizes the uncertainty surrounding use of vertebrates as ecological indicators. Any species selected as ecological indicators should have these characteristics: (1) limited adaptability to different environments; (2) population parameters that are highly related to local habitat conditions; (3) key population parameters that may feasibly and reliably be measured; and (4) habitat requirements that are affected by management. Any species selected to serve as an ecological indicator should be supported by a description of how its population trends are assumed to reflect trends in species richness or abundance of other species or biological communities(FSH 2609.2).

Table G-2. Management Indicator Species of the Caribbean National Forest/Luquillo Experimental Forest, 1988.									
Species Common Names	STEP 1 Potential MIS Category	STEP 2 Diversity or Productivity are Issues	STEP 3 Effect of Mgmt. on Species	STEP 4 Monitor Feasibility	STEP 5 HABITAT USED				
					Dwarf Forest	Palm Forest	Colorado Forest	Tabonuco Forest	Aquatic
Amazona vittata Cotorra de Puerto Rico Puerto Rican Parrot	1,5,7,8,9	X	X	2		X	X		
Accipiter striatus striatus Falcón de Sierra Sharp-Shinned Hawk	5,8,10	X	X	2			X	X	
Buteo platypterus brunnescens Guaraguao de Bosque Broad-Winged Hawk	5,8,10	X	X	2			X	X	
Dendroica angelae Reinita de Bosque Enano Elfin Woods Warbler	3,5,8,9	X	X	2	X				
Dendroica caerulescens Reinita Azul Bk-throated Blue Warbler	8	X	X	2			X	X	
Anolis gundlachi Lagartijo de Ojos Azules Yellow-bearded Anole	10		X	2				X	
Eleutherodactylus hedricki Coqui de Hedrick Tree-hole Coqui	8,9	X	X	2		X	X	X	
Eleutherodactylus locustus Coqui Martillito Warty Coqui	3,8,9	X	X	2		X	X	X	X
Eleutherodactylus unicolor Coqui Duende Burrow Coqui	5,8,9	X	X	2	X				X
Sicydium plumieri Chupa Piedra Goby (fish)	9,10	X	X	2					X
Agonostomus monticola Dajao Mountain Mullet	9,10	X	X	2					X
Macrobrachium carcinus Camaron de Rio River Shrimp	7,8,9	X	X	2					X

Table G-2. Management Indicator Species of the Caribbean National Forest/Luquillo Experimental Forest,1988.

Species Common Names	STEP 1 Potential MIS Category	STEP 2 Diversity or Productivity are Issues	STEP 3 Effect of Mgmt. on Species	STEP 4 Monitor Feasibility	STEP 5 HABITAT USED				
					Dwarf Forest	Palm Forest	Colorado Forest	Tabonuco Forest	Aquatic
Lepanthes eltorensis NCN (orchid) Orchidaceae	1,4,5,9	X	X	1	X				
Coccoloba rugosa Ortegon (tree) Polygonaceae	2,4,5	X	X	1				X	
Eugenia haematocarpa Uvillo (tree) Myrtaceae	1,4,5	X	X	1				X	
Ternstroemia subsesillis NCN (tree) Theaceae	1,4,5	X	X	1			X		
Ternstroemia luquillensis Palo Colorado (tree) Theaceae	1,4,5	X	X	1			X		
Styrax portoricensis Palo de Jazmin (tree) Styracaceae	1,4,5,8	X	X	1			X		
Callicarpa ampla Capa Rosa (tree) Verbenaceae	1,4,5	X	X	1			X		
Ilex sintenisii Cuero de Sapo (tree/shrub) Aquifoliaceae	1,4,5,9	X	X	1	X				
Pleodendron macranthum Chupacallos (tree) Canellaceae	1,4,5	X	X	1				X	
Solanum woodburyi Woodbury's Nightshade (shrub) Solanaceae	3,4,5	X	X	1			X		
Miconia foveolata Camasey (shrub) Melastomataceae	3,4,5	X	X	1	X				