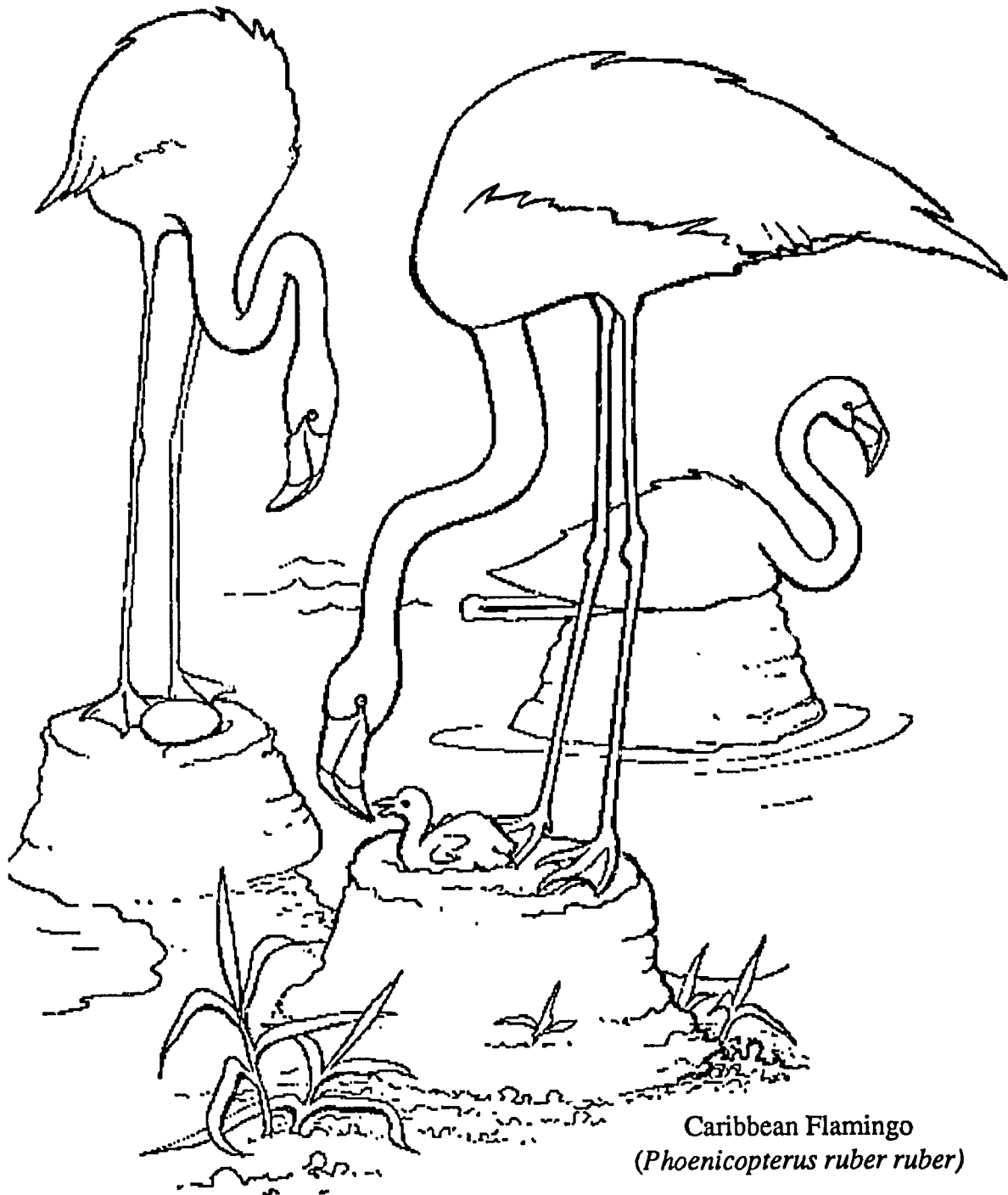


WILDLIFE MANAGEMENT IN THE CARIBBEAN ISLANDS

PROCEEDINGS OF THE FOURTH MEETING OF
CARIBBEAN FORESTERS



Caribbean Flamingo
(*Phoenicopterus ruber ruber*)

A PUBLICATION OF THE INSTITUTE OF TROPICAL FORESTRY
AND THE CARIBBEAN NATIONAL FOREST
RIO PIEDRAS, PUERTO RICO

1989

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TABLE OF CONTENTS

	Page
Introduction, Conclusions, and Recommendations <i>Ariel E. Lugo and Loren Ford</i>	1
Contributors	4
Editorial <i>Ariel E. Lugo</i>	7
Welcome <i>C.A. Maynard</i>	8
Island Reports	
The Status of Antigua's and Barbuda's Wildlife, A Mixed Bag in Habitat <i>John B. Kelley and Eustace Roy</i>	14
Dominica's Wildlife <i>Adolphus Christian</i>	19
What is the Status of Wildlife in Grenada Today? <i>A. Kim Ludeke, George Vincent, Raymond Walker, and Desmond Dumond</i>	24
Wildlife Protection and Wildlife Management in Guadeloupe <i>Michael Vallance</i>	32
Wildlife Management in Jamaica <i>Yvette Strong, Roy Jones, Dianne Gayle and Marcel A. Anderson</i>	37
Wildlife Management in Montserrat <i>Franklin Margetson</i>	42
Wildlife Management by the Department of Natural Resources in Puerto Rico <i>Edgardo González</i>	46
Wildlife Management in Saint Kitts <i>Henry N. Mills</i>	53

	Page
Saint Lucia's Wildlife and its Conservation <i>Gabriel Charles</i>	63
Wildlife of Saint Vincent and the Grenadines <i>Lennox Quammie</i>	68
Contributed Papers	
The Saint Vincent Parrot (<i>Amazona guildingii</i>) and its Conservation <i>Paul Butler</i>	70
Wildlife Management in Central America <i>Víctor González</i>	77
Dominica Multiple Land Use Project <i>Peter Evans</i>	81
Current Status of the Puerto Rican Parrot Conservation Program <i>Gerald D. Lindsey, M.Kelly Brock, and Marcia H. Wilson</i>	89
Wildlife Conservation Concepts and Issues as They Relate to the Caribbean: Some Comments <i>Herbert Raffaele</i>	100
Caribbean Wildlife Trade: An Introduction <i>Andrea L. Gaski</i>	104
People-Centered Conservation: An Introduction to World Wildlife Fund's Wildlands and Human Needs Program <i>R. Michael Wright</i>	110
Forestry and Wildlife Interests of the United States Agency for International Development <i>James S. Hester</i>	114
World Wildlife Fund and the Conservation Foundation Programs for Conservation and Management of Tropical Forests <i>Gerald P. Bauer, Dennis Glick, and J.J. Earhart</i>	118

Appendices

Report on Fourth Meeting
Felix Gregoire

124

Workshop Participants

126

INTRODUCTION, CONCLUSIONS, AND RECOMMENDATIONS

Ariel E. Lugo and Loren B. Ford

Introduction

The fourth meeting of Caribbean foresters was held in Dominica the week of April 4, 1988. This meeting had participants from 11 islands and government and 7 non-government organization. The theme of this workshop was wildlife management, a subject of great importance to small islands with high population densities and rapidly growing tourism industries. A measure of the critical nature of this topic is the size of these proceedings; the written record of the fourth meeting of Caribbean foresters is the most extensive to date. In addition, these proceedings for the first time include an editorial by one of us. The impetus to write an editorial was motivated by island reports that show the status of Caribbean wildlife to be critical. Its survival depends on drastic and concerted protective action by responsible organizations.

The fourth meeting of Caribbean foresters and the publication of these proceedings were jointly funded by the U.S. Man and the Biosphere Program and the U.S. Agency for International Development. The U.S. Forest Service also contributed to the publication of these proceedings. However, the success of the fourth meeting of Caribbean foresters was attributed to the excellent job of planning, coordination, and logistic support of the Commonwealth of Dominica Forestry Division. The offices of the Prime Minister and the Minister of Agriculture and Trade of the Commonwealth of Dominica also supported this meeting and hosted participants in the tradition of Dominican hospitality. We express our appreciation to our hosts and the agencies that made the activity a success.

Below we present the conclusions and recommendations of the fourth meeting of Caribbean foresters. These conclusions and recommendations are the product of an afternoon session where all participants gathered in small groups to discuss ways of solving the problems confronting Caribbean island wildlife.

Conclusions

- Increasing pressure is being exerted on Caribbean wildlife and the environment in general because of demands from populations and because of the need for continued development.
- Policy makers and the general public lack awareness of the importance and potential of natural resources.
- Appropriate technologies are seldom applied and laws are lacking or are enforced inadequately.
- Overzealous pursuit of profit exacerbates the degradation of the environment.

Recommendations

Regional

These recommendations concern initiatives that would include a number of countries in the region:

- A meeting of the Agricultural Ministers of CARICOM should be held to discuss and plan implementation of policy guidelines for forestry, wildlife, and natural resources. In the Caribbean, responsibility for these sectors resides in the Agricultural Ministries.
- Regional cooperation is needed to assure maintenance of habitat needed for certain forms of wildlife, such as marine turtles and migratory birds.
- Regional training initiatives should use local expertise to the extent possible. A list of regional resource people at all levels should be made. In the next twelve months, workshops should be held in environmental education, enforcement of forestry and wildlife laws, and watershed management. Funding agencies should strengthen local institutions, such as ECIAP and UWI.
- Environmental education materials can be shared between islands. A series of posters depicting the region's avifauna should be produced for use in schools.
- Increased exchange of forestry and wildlife information is needed, including a wildlife and forestry database. The Institute of Tropical Forestry should expand its contact with Caribbean resource managers and provide dissemination of materials. Information collected by researchers should be stored and disseminated to host country and neighboring islands.
- Research that is done in the Caribbean on wildlife, forestry, and natural resources should be **applied**. This research should be designed to solve regional needs.
- Economic benefits from wildlife and forests should be documented, and the information distributed. Use of Caribbean species important for folk medicines should be recorded. Other economic uses of indigenous animal and plant life should be documented, sustainable production systems developed, and information disseminated.

National

These recommendations would be applied at the country level, but usually could be applied to all of the countries in the region:

- Critical wildlife habitat and endangered species need to be identified. In many cases, critical habitat can be preserved and still make an economic contribution through development of nature tourism.

- In many cases, new legislation is needed governing wildlife and natural resources. Critical species need to be protected, especially during their breeding seasons. Scientifically based hunting laws should be included. This and existing legislation needs to be strictly enforced. Each nation should ratify international conventions, such as CITES and RAMSAR.
- The national planning process should be strengthened. Land use capability should be considered and followed. Conflicts between sectors should be resolved. As an example, pesticides used in agricultural areas should not affect water systems such as rivers, mangroves and coastal areas. Tourism development should be allowed only in an environmentally compatible manner.
- A commitment from national wildlife and forestry units is needed to train individuals. Attachments, short-term workshops and program development should be encouraged.
- National environmental education campaigns should be developed, along the lines of that of Saint Lucia. These efforts should target both local populations and tourists. Nature tourism can play an important role by involving local people and attracting tourists.
- Close liaison is needed between countries, funding agencies, and visiting researchers, to decide on research subjects and local participation. Research results should be transferred to the countries where the research is done and to other countries in the region.
- Local use of wildlife and forests should be documented and the information distributed.
- Production of fish and invertebrate species from rivers should be maximized for meeting protein needs of local people. Sustainable production of wildlife and plant resources for sale by individuals should be encouraged.
- Collaboration with non-governmental organizations should be promoted for environmental education, local and international fund-raising, expertise for implementation of projects, and local political support.

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Editorial

The papers that follow describe the condition of wildlife and wildlife management in the Caribbean islands. Several items appear common to all islands, and they deserve special attention. The wildlife habitats of the Caribbean islands have been heavily modified by people, and this has had enormous impacts on wildlife. Because of this modification, the abundance of wildlife species has decreased considerably. This is best illustrated by the precipitous decline in the parrot populations of the islands, but many other wildlife species have declined as well. Accompanying the decline of native wildlife populations, exotic wildlife species appear to have increased considerably in terms of diversity and abundance. Some of these species, most notably the mongoose and monkeys, are out of control in many islands and are creating visible negative impacts on native wildlife species. As if these circumstances were not bad enough for Caribbean wildlife, it is obvious from the reports of the different islands that hunting of wildlife is poorly regulated in the region. The time and length of hunting seasons has little to do with the reproductive life cycle of hunted species. Bag limits are not necessarily related to wildlife population abundance nor restricted to certain sized individuals. Wildlife protection laws urgently require updating if this onerous situation is to be reversed. And law enforcement tools and activities require considerable improvement and expansion to give officials an opportunity to cope with the situation.

Illegal trade of wildlife to outside markets further contributes to the dismal conditions facing Caribbean island wildlife species. Foresters at the meeting urged island governments to sign the CITES convention because it provides powerful tools for controlling the illegal trade of wildlife. The wildlife situation in the Caribbean is clearly in crisis. It is ironic that at a time when the world is becoming painfully aware of the importance of tropical biological diversity, the islands that provided Europeans the first glimpse of exotic tropical animals (the parrots traded by Columbus during his first voyage), are now experiencing conditions that if not reversed will soon lead to the loss of a rich and diverse native wildlife. Speaking for all Caribbean foresters at the meeting, I make a call to all governments, interested citizens, and private organizations to make a concerted effort to improve the conditions under which Caribbean wildlife is managed. Let's act before it is too late for the islands!

Ariel E. Lugo
Institute of Tropical Forestry
Río Piedras, Puerto Rico
October 29, 1988

**ADDRESS DELIVERED BY THE HONOURABLE C.A. MAYNARD, MINISTER OF
AGRICULTURE, TRADE, INDUSTRY, AND TOURISM AT THE OPENING CER-
MONY OF THE 4TH MEETING OF CARIBBEAN FORESTERS**

Mr. Chairman, members of the head table, the press: How shall I call you? I cannot call you foresters, because I myself, find there has been some ambiguity about the term. I was talking to one of my ministerial colleagues this morning, and he wanted to find out who were these foresters that we had brought here and I had to tell him it had to do with a very important sector of the economy, and he understood it. So I think I agree with the Chairman that you need to find another term, but for the time being, perhaps we could use forestry officials - pending further inspiration.

I would like to say that the government of Dominica is very pleased to host this conference. We are pleased because for us the forest is a very important resource, and increasingly we come to realize, and are happy to link up with people like yourselves, who realize that there are two things we must do with the forest. We've got to: 1) utilize it, and 2) conserve it.

I would like to focus on a few things that are important for your conference and for us today as we think of how are we going to ensure that the bounty that we are blessed with in Dominica- and in these islands - can be protected and preserved, for future generations, while at the same time utilizing it for the people of today. I would also put in your agenda the question of forests in the context of the forests and industry and talk a little bit about agroforestry, and the linkage between the forests and agriculture. Naturally, I will say something about the forest as an important resource for us in the context of tourism; the forest in the context of conservation; and of course in the context of your own theme, i.e., forestry and wildlife.

It becomes very important for us to understand and realize the contribution that the forest can make to industry in our situation. And particularly of course, I am referring to the question of timber and the timber industry. We were a bit concerned when last year a forest inventory suggested that we had lost some 25% of our forested area in a period of some 10 or 20 years. But the fact remains, it was a significant inroad into the resources of the forest. And I remember a time, when we visited some farmers in an area, and while we were there, the river flooded and you could see the silt coming down, and the farmers had conceded that they had overdone it.

The real question for us, whether we think of charcoal or timber (and we in Dominica have placed a great store on the timber resources that we have), we do have to find some kind of a formula for managing the forest industry, so that it can produce for us today, and can be there tomorrow for future generations. I hope that as a result of your meeting you will be able to present the results in such a way that those young people who are at school and those who are actively involved in logging wood and who vaguely associate the forest with a resource that needs to be preserved and with the environment, would get a clear message, - e.g., that all of us have an important part to play in the business of preserving and protecting the ecosystem. And at the same time we must respect its use for mankind.

I remember listening not too long ago to an address which was being given from Kenya. They were talking about the issues of the environment there. The suggestion was being made that to tell a few hundred of thousand people in Kenya not to cut wood (so that the forest could be preserved because there are serious issues in Kenya in relation to the environment) was to tell them to die. They needed to cut wood to survive. Certainly, we have not reached that situation in our region, nor for that matter in Dominica. At the same time, we have got to find some sort of answer, and some sort of way which we can do those things.

We have two major industries here - the Dominica Timbers Limited and the North Eastern Timbers. We are in active discussion with them regularly about this issue, and I must say that for my own part, I have made the observation not too long ago, that I was very pleased to see the kind of selective cutting which was being done. If you went into the Morne Plaisance area where they were doing this, you certainly could not notice, if there was any logging taking place. That was quite different from a situation we had some years ago, in Dominica, where a Canadian firm came here, and they left a very strong legacy of how **not** to do it. But this is the sort of thing that today has caught up with us in so many countries that we have to be cautious how we do it. At the same time, we have had an issue with the people who are engaged in craft and in furniture telling us that they cannot get enough wood, enough raw material, and it seems to me that there has to be some kind of program worked out among those concerned, so that we can do the right thing, both for those who want to make an industry out of the forest and help jobs to be created, and those who have to be concerned as well to sustain the forest. We must avoid ending up facing the problem we know so many countries have to be faced with.

And perhaps I could move straight on into the question of the forest in terms of our tourism. Maybe I should preface my remarks, by saying we have a very interesting philosophy about tourism in Dominica. And it is well expressed in creole. It's expressed in one of our folk songs - it says "menné tout touris ou lé poumenné pli lajan, me pa kité yo pon Dommik hod nou."

A translation would be "bring as many tourists as you wish, to bring in foreign exchange and money, but don't allow tourism to overwhelm us". I think that is the same context in which we would like to see the relationship between what nature has given to us and the development of tourism in Dominica. As the Chairman was pointing out, we are perhaps, as it were, on a sort of a tourism watershed in the world in the sense that people are shifting from the situation where it was thought that to have a tourism industry, you had to have white sand beaches (and that was the main ingredient) to a stage today where so many people are saying that they don't want to spend all their holidays on a beach. They want to look for new types of destinations. They are looking for unique, unspoiled destinations. I recall, in a survey we did some time ago, when we asked people why did you come, what did you like about Dominica, they said "lack of tourism." So it meant that mass tourism was something that would positively have discouraged them.

Sometime not too long ago, a gentleman who came here to look at the country's development said to me, "you know God has designed the country in such a way, that you cannot spoil it. And I hope you don't interfere too much with his design." And the other thing we have that we are concerned about is the fact that we don't have an international airport. But it appears to me that because of this new trend in tourism, and more and more people have got to know Dominica and want to come here

on a holiday, they are looking at multi-destinations. We are reaching the stage - in fact where often our hotels are full which is like a new phenomenon for us. We have to learn to cope with and manage this changing scene. It is perhaps just a good thing, that at this time, at this particular time, we will get a chance to manage the tourism industry better, from the point of view, of looking after the people who come here, of exposing them to what we have, of giving a good service, and we have to prepare for all that if we get time. The time that we will get is the fact that we don't have an international airport, because we could have been overwhelmed with the tourists, if we had an international airport.

The other linkage that I see is what Mr. Gregoire referred to, the work we expect to do with RARE which we are very encouraged by and happy with, and the whole idea of preserving and protecting the parrot, and having a parrot project in this country, and something that people would want to come to see and be exposed to. The fact that we have got to develop that project, will mean, that we are concerned ourselves to protect and preserve what we have. Whether it is the flora and fauna of the country, or the rivers and lakes, or the wildlife that we have, which I will reflect on in a while.

This takes me straight into the general question of conservation. I think one of the most important things for us is, how we are going to educate ourselves and those who need to know about this question. How we are going to put it in a way that it doesn't appear that those of us who are strong conservationists are sometimes more concerned about conservation, per se, then about human beings. I remember the Prime Minister saying to some people who came to talk to us about the environment, and they were talking about it in the context of garbage disposal, and she was saying to them that it would certainly help us if we could get some equipment to facilitate us in the business of garbage disposal. The general theme that they were taking was that, it does not matter what you do. The important thing is that you must protect the environment. I think the message that we have to get over to people who need to know, through our institutions through the organizations represented here, is a message which will basically enable people to understand that our subsistence and our existence on this earth is a fundamental fact of the type of environment that we have. And that, therefore each one of us in our own way can contribute either positively or negatively to the business of the environment. I think it would be a good thing if we could develop the kind of pamphlets, leaflets, put in a very simple form, which would demonstrate that from the food we eat to the air we breathe and the water we drink depends substantially on having a good and clean environment, and that each of us can contribute to that. And if we could do that and put that literature in the schools, make it available to Teacher's Colleges and so on, I think this would probably be one of the most effective ways of getting the message across. Sometimes such a focus can be much more effective than the impression you get from pressure groups, that put over the message of conservation, and make conservation sound like something that is tedious and difficult, and creates a barrier in communications. I say this, because I have sometimes seen the way that it has been put.

And that takes me to something that I need to say here as well, in relation to conservation. The number of studies that have been done on this country's forests in relation to conservation, frankly, I think we need no more studies. I think we need action. And I will say something about the Tropical Forestry Action Plan in a while. But I really want to emphasize to you, that in whatever you do here in the next few days, I hope you don't come up with another study. Studies are one of our biggest industries, and they don't employ enough people. Certainly not enough of our local people. It employs a lot of outside consultants, but it doesn't employ enough of our people. We have been an

overstudied country, and I would say that conservation for us has been an over studied area. I do not mean over studied in the sense that we haven't got work to do. I mean over studied in terms of the gap between the literature and the documentation about the forest, and what is there, and what needs to be done, and the business of finding the resources to follow up on the problems that have been identified. That is too much of a gap. I'm happy to see that you have taken as your theme, the business of wildlife. I'm sure you're going to end up with some kind of resolution and should we say, some plan as to what needs to be done.

In the Tropical Forestry Action Plan that has been put together by many of the international agencies, that the chairman referred to, there are two or three things in it that I found to be of interest. I found in particular that the whole question about the genetic and material element in the forest, that can be used for medicinal purposes, that we have not began to tap as yet. I would like to say that I feel that one of the things that could usefully be done in this region, and certainly in Dominica is for resources to be provided by international bodies. This would enable us to really get down to understanding and knowing what is there in the forest that could be used for this purposes, so that we ourselves could benefit from it. We would not just be the recipient of the medicines that have been made out of this but we would be able to be there from the beginning tapping this as an important resource. That is one area. The other area in relation to this Tropical Forestry Action Plan is the role of institutions. I think that this is one area where institutions can have a great impact. That is, the area of putting material in a form, whether it's video, whether it's a film or some other media whereby people can understand and get the message which is put in a form that is palatable and can be understood.

To conclude, I will say a few things about forestry and wildlife. First, there are some things that we still need to overcome. And I hope that you will be able, in your analysis in whatever papers you might present, in whatever follow up work you might do again, you will take an approach that is action oriented. I am thinking for example of the fact that as far as I still know (although I gather that somebody had done it, or is on his way to succeeding in doing it) the crapaud that we have cannot breed in captivity. Now if that is a fact, I think it's more than time that we put our minds and scientific armory together to see how we can come up with a result. I really hope that in the general approach that we will take in this conference, we will again close the gap between theory and practice, between what is known and how we tackle the problem. This whole area of a very important resource that we have and we are not sure and able to reproduce. I think the Smithsonian Institute was here some 20 or 25 years ago and they did not succeed. And I think they should come back, we should invite them to come back. Certainly some of you might want to put this high up on the agenda to see how we can tackle that problem.

And the other thing of course for us, continues to be the whole situation with us and the two major species here that we know are endangered - the Jaco and the Sisserou Parrots. The Sisserou, more in that respect, because we know it is much more sensitive in terms of its environment than the Jaco. The problem we are faced with today is an interesting problem. Our main industry is bananas. The banana industry has in the last 2-4 years moved into top gear. We moved from a situation where the industry brought in 34 million dollars (EC) in 1985 to 71 million dollars (EC) last year. And that kind of situation of course is good and is not so good. It's very good for the farmer. It's good for

agriculture. It's bad because it emphasizes a poor tendency - that of a monocrop. But, in the context of the forest, conservation and our endangered species, it means that people are planting bananas wherever they can find land freely. And forestry has a problem. Quite a problem catching up. And it is not a very easy task to persuade people, that as they open up and as they cut trees freely, they are going to destroy something unique in this country that is very important for us.

So, that is another area, why I am particularly happy with this program that we are looking at in relation to wildlife and RARE, which hopefully will be able to help us in that particular respect. It also affects the water catchment. This is a telling point for us. We saw what happened with hurricane David, and the issues of potable water, and what we ought to be doing and how we can deal with this particular problem. All these are linked, and they are interrelated. We need a lot of work to be done again on the parrot; a lot of literature. Our people are very amenable to change, fortunately, by visual aids. I think it is very good for us, that in a small community, people can be persuaded to change in an effective way by a continuing program of education, and particularly visual aids.

I remember when I was growing up, that some people would take pleasure of driving (riding) over a crab. Today, I see people avoiding crabs when they are driving. That's a new thing. I think the work of the Forestry Division in that respect has paid out. And I don't think it's a question of applying fines. It is a question of letting people understand that the period when the crab is allowed not to be hunted, is what has enabled us to still have crabs in some abundance, and particularly with the measures that were taken after hurricane David. Not too long ago, we had a tragedy with regard to turtles, where one person was fined (not heavily enough although next Friday, Parliament will increase the fines quite significantly for people who tamper with the wildlife during the off season). But we hope it will not just be a question of legislation, of taking these measures that are enforceable. We hope we can do this largely by persuading people and by using methods of education. I am glad to see, that we have started again our program in the New Chronicle, and I want to express my thanks to the New Chronicle for carrying this because, the New Chronicle's survival depends on that. There is a very good link between the New Chronicle and the environment program that is taking place in our Forestry Sector.

So once again, on behalf of the Government and people of Dominica, I would like to thank you for coming here. I would like to say we are glad to have you here. We don't have much to offer in this country, except our warmth and our charm, and the beauty of nature which the poet, when he was writing the National Anthem put very well:

"Dominica, God have blessed thee
With a land benign and bright
Pastures green and flowers of beauty
Filling all with pure delight
And a people, strong and healthy
Full of Godly reverend fear".

I think, if we can put all these things together, if one can apply them to the resources that we have to the Forestry Sector, and if we can draw on your knowledge and your experiences, and what you

will share with us in the next few days, then we will be able to join in the very important issue of today, of ensuring that the legacy that we will leave to mankind, will be a legacy of a forest, of a flora and fauna that is intact, that we are able to use for our own benefit, and protect and preserve it for future generations.

I thank you.

THE STATUS OF ANTIGUA'S AND BARBUDA'S WILDLIFE, A MIXED BAG IN HABITAT

John B. Kelley and Eustace Roy

Introduction and Status of Wildlife Activities

Low islands of the Eastern Caribbean are susceptible to great ecological abuse. This is because their flat topography is favorable to agriculture and because the seasonally dry climate makes the natural revegetation process slow. Antigua is an example. The island suffered whole sale deforestation two centuries ago, started many of the environmental problems of today, including degradation of watersheds, soil erosion, and loss of wildlife habitat, are due to the early loss of forest cover..

Environmental problems continue in Antigua because of poor public awareness, weak interministry coordination, lack of approved policies and insufficient enforcement. However, the Government of Antigua and Barbuda is looking for solutions. But resources are limiting to even address the many environmental problems of human health, let alone wildlife habitat. Demands on Antigua/Barbuda's environment is increasing, mostly through tourism and partly through agriculture. Hotels on Antigua plan to increase from 2,600 beds to over 4,000 beds in five to ten years. And plans are on paper for Barbuda to have hotel development. This increased tourism will bring many more pressures to Antigua/Barbuda's environmental systems.

In terms of the amount and quality of remaining natural areas in the low islands, Antigua sits in the mid range, between Barbados and Barbuda. Antigua has had nearly all of it's surface devastated at one or another. Even "preserved" areas are still subjected to some cutting or grazing. Several reasonably preserved natural areas exist, and should be considered for parks or reserves.

The general decline in agriculture seems to be allowing revegetation on the poorer pastures and fields. This is giving rise to some wildlife habitat. How long this will continue is of some question. Land clearing for cattle and farming is taking place for the first time since the decline of sugar cane and cotton, ten years ago. Cattle and farming are partly on the increase this year because of greater rainfall, but also because farmers are meeting food demands by the tourism industry.

Barbuda is mostly undiscovered natural area. Many species of birds thrive there. A very large population of Frigatebirds nests on the north side of the island. Coastal fish and coral are in a mostly undisturbed state. This has remained because of the lack of human presence. However, human activity is slowly increasing. The introduced small deer species is not at the level it once was because of hunting pressures. Some thought has been given to relocating the same species of deer from Guiana Island. This should not be the only approach. A natural area on Barbuda, with protection for this animal, should be compulsory. There is a need for an overall wildlife management program with updated polices, enforcement/compliance, and education. All of these items are essential if a natural resource program is to work.

For the Fisheries Division of Antigua, there is a trend towards this. One offshore park may be created and a boat for fisheries policy enforcement is available. Leaflets on coral reefs are used to educate tourists. While some dive shops actively protect their dive areas, this is not within the laws of Antigua/Barbuda. There is some distance still to go in fisheries management. Unfortunately, the off shore park is rarely patrolled, for the police boat is mostly used for drug enforcement. As a result of habitat alteration much of Antigua's wildlife is limited to coastal areas and offshore islets. These areas remain important, as turtle and seabird nesting sites. Presently, there are two endangered species and six game species reported from Antigua (Faaborg and Arendt 1985).

Amphibians and reptiles

An introduced toad *Bufo* spp and two native species of tree frogs, *Elenthrodactylus* spp along with many common smaller lizard species are present. The larger lizard *Ameiva* spp is rare and *Iguana* spp is most likely extinct. *Typhlops* spp, Antigua's last surviving snake is rare and a subspecies *Alsophis* spp may now be confined to Great Bird Island.

Birds

Antigua is visited by a large number of water birds and shore birds. For example at least seven species of North American migrant warblers have been reported in Antigua (Faaborg and Arendt 1985). Representatives of 87 species of birds have been recorded. The Carib Grackle (*Quisculus lugloris*) has extended its range or was introduced to Antigua) Barbuda since the turn of the century.

Antigua/Barbuda has various water fowl on open season, from September 15 to December 15. There is no open season on bird or egg taking on several surrounding smaller islands of Antigua. However, enforcement of these seasons is light at best.

Fossil remains of birds show a diverse taxa on Antigua such as the Amazona parrot (extinct), Burrowing Owl, and the Greater Flamingo. These once occupied Antigua but were eliminated due to changes in the habitat and/or human hunting.

Despite habitat destruction, the few remaining animals on Antigua seem to be a resilient group and are surviving further disturbance. These species are the White-crowned pigeon (*Columba leucocephala*) and Broad-winged hawk (*Buteo phatypterus*). Their populations are large. Pelicans are fledging and giving rise to larger populations.

Mammals

The mammal fossil record shows that the manatee (*Trichus manatus*) lived here. Its populations are now quite reduced in the West Indies. Mammals are few in species on Antigua and Barbuda. There may be two species of bats. However, the survey at Caribbean Wildlife (Faaborg and Arendt 1985) netted only one. The introduced Small Indian Mongoose (*Herpestes auro-punctatus*) is very abundant and killed mist-netted birds during the survey of Faaborg and Arendt.

A fresh-water reservoir, Potworks Dam serves as a refuge for many wildlife species. Migratory birds are found here at various time of the year. More than 30 species of marsh fowl have been reported through out the wetland habitats. Such wetlands and increasing farming have sustained the spread of the African Cattle Egret (*Bubulcus ibis*).

Fine examples of native habitats occur on the small islands of the northern side of Antigua. One, Guiana Island, has introduced populations of deer while other islands harbor nesting sites for 7 species of terns and gulls.

Progress in Managing Antigua's/Barbuda's Wildlife

A different approach to the administrative structure and financing of national parks is used in the 1984 Antigua and Barbuda National Parks Act . The Antiguan Act creates a corporate body called the National Park Authority as a non-profit organization. The Authority consists of a chairman appointed by the Minister of Economic Development and Tourism. Presently the Authority draws funds from the Nelson's Dockyard National Park, which contains 12 square miles, several villages, two harbors, agriculture and woodlands, and a 200 year old dockyard. The National Park corporate body has the authority to name wildlife sanctuaries within the park or to designate other park locations.

FAO has drafted a modern forestry law and regulations responsible to existing problems (fire, charcoal, grazing, theft). The Canadian International Development Agency (CIDA), is planning on using the above regulations as a prerequisite to reforestation efforts. If the government of Antigua/ Barbuda would pass the FAO Forestry law, it would help greatly in environment matters. For example, CIDA would fund a reforestation project valued at C\$ 2,700,000. As a condition of this project, CIDA requires Antigua/Barbuda to establish a committee on natural resources to coordinate the efforts of all Antigua/Barbuda's agencies involved in the management of natural resources.

In March 1988 Antigua/Barbuda started to look at the formation of such a committee whose members belong to the government and private sector. This committee would promote public awareness, interministerial coordination, assessment of natural resources problems, and discussion of development plans. This committee will also develop a Physical Development Plan for the island

Some basic public environmental education is now starting. The Museum of Antigua has developed a nature trail at the Nelson's Dockyard Park, with hopes that school children will be able to tour it. Also, the current Peace Corps forester produced an Environmental Natural Resources side show, which the Ministry of Education is planning to use in schools. This slide show has photos of Antigua's environmental problems, its wetlands, and wildlife.

Problems Facing Wildlife in Antigua

A major problem facing Antiguan animals is the introduced mongoose. The possible extinction of the *Alsophis* spp snake can be attributed to the mongoose as can the very restricted distribution of the ground lizard (*Ameiva griswoldi*). This lizard is seen only in settlements, where human presence

keeps mongoose populations down. Mongoose densities are very high throughout the island. In most areas mongoose hunt nesting bird life. Many ordinances covering natural resources forest, wetlands, freshwaters, and coastal areas are only lightly enforced. The 1941 forest ordinances are quite out of date. Other acts such as the Fisheries Act of 1983, are recent. However, no marine reserves have been created under this act and authorities do not have the resources for enforcement. Emphasizing compliance through education is definitely one of a number of approaches to follow. And this approach may cost less than law enforcement.

Wildlife legislation is limited to wild birds (Wild Birds Protection Ordinance of 1913), turtles (Turtle Ordinance of 1927) and lobster (Lobster Ordinance of 1953). These laws authorize the seasons for taking of species throughout the year.

It appears that wildlife is under the jurisdiction of the Ministry of Agriculture, Fisheries, and Lands. However it is unclear whether a position for a wildlife officer exists. There is a part-time game warden on Barbuda and one on Antigua.

Solid waste and refuse is other problem to wildlife. Waste is not dealt with correctly and its volume appears to be increasing. No central sewage system exists in the country. And Antigua's environment absorbs about 20 million containers, 1400 scrapped vehicles and 4 million other items each year. Along with a quarter of a million gallons of recorded oil and gasoline spills. Haphazard waste disposal creates a very serious and far reaching health and economic problem. Obviously, this must affect wildlife and human habitat. For example, Friars Hill Power Plant is dumping enough used crank case oil, from diesel engines, to fill a drainage five to six feet wide. This is flowing into McKinons Salt Pond, mangrove area, which is being filled in by hotel construction. This habitat will most likely not support fish and bird life for long. Dredging, construction, filling, and sewer dumping affect eight out of approximately 20 mangrove stands on Antigua.

One other dilemma which will soon affect wildlife is agrochemicals. The Pesticide Control Act of 1973, which establishes a Pesticide Board is in need of updating. However, because Antigua is now the largest importer of agricultural chemicals in the Eastern Caribbean, the resources of the Board are most likely not able to keep up with the activities related to herbicide and pesticides within the country. The largest wildlife habitat most likely to be affected by the use of these chemicals, is the wetlands of Potworks Dam.

Possible Recommendations for Antigua/Barbuda

Public environmental education strengthened legislation, and law enforcement are gravely needed to overcome accelerating waste problems, soil loss, and other environmental problems. Wildlife habitat and Antiguanians will increasingly feel the impact of pollution from uncontrolled waste dumping, wetland loss, use of agrochemicals, and other activities on Antigua and Barbuda.

Therefore, the country needs to:

- Preserve the remaining natural areas listed in US-AID (1988).

- Establish strong mongoose control.
- Update wildlife conservation legislation. Emphasis on habitat preservation, wild fire control, game laws, and enforcement.
- Establish environmental education programs in schools, hotels, and farms.
- Appoint a full-time wildlife biologist who would survey and monitor wildlife habitats and begin public education on wildlife.
- Forestry, fisheries, park and water resources, are all sectors needing increased attention and coordination across several ministries. Perhaps the formation of the CIDA Natural Resource cross-ministerial committee can go beyond the capacity of any single ministry helping to form a natural resource protection policy.
- The bottom line is that Antigua and Barbuda have many wonderful natural resources worth protecting.

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DOMINICA'S WILDLIFE

Adolphus Christian

Introduction

Dominica by its very natural geographical features appears to be well structured and vegetatively covered for providing the type of habitat suitable for wildlife species found living in our lush and rich jungle.

A Brief Geographical Background Account

The island has an area of some 305 square miles, with its two extreme points at the width being sixteen miles apart, while the two extreme points at the length (i.e. from north to south) are twenty-nine miles apart. It is extremely rugged in terrain and is in fact believed to be the second most rugged country in the world. There are some who believe that it is even more rugged than Switzerland, the only country to which it is second in that respect.

The island is volcanic in origin. There are a few mountains which exceed the four thousand foot height e.g., Morne Diablotin which towers to a height of 4,747 ft. There are several mountains which exceed 3000 feet in height. And of course, being so mountainous and so virtually virgin in soil and forests, Dominica is able to boast a continuous supply of fresh and clear water which runs into 365 rivers. No wonder, then, that our annual rainfall ranges from 60 inches in the driest areas in the west to 300 inches in the central section of the island.

Wildlife Status

Unlike hunters from North America, Europe, and Africa for example, who hunt animals for their meat as well as for their valuable hides, tusks and furs, Dominican hunters only hunt for food. That is, the captured animals are either sold by the hunters for food or the animals are themselves eaten by the hunters. Therefore, one can well easily visualize animals which are hunted for food and those that are never hunted at all. There are, of course, a few instances, where animals such as birds (e.g., doves), agoutis, and snakes are captured for pets.

Game Which Are Used for Food

Dominica's mammalian game wildlife comprises agouti, the opossum manicou, and wild pigs. These three are the only mammals hunted for food. The other game animals consist of frogs which are of the amphibian class; three different species of crabs which are locally known as black crab, red or mountain crab (also called cyrique), and coastal habitat crabs (which are called white crab or cobo); and a wide variety of birds.

Birds. The most popularly hunted bird is the ramier, a beautiful bird just a little larger than the ground dove. The ramier resembles the pedigree which is in a way a mountain pigeon. The bird is

also beautiful. Generally, the local names of Dominica's birds will occasionally differ from those of our sister Caribbean islands, though the variety of species found throughout are quite similar. There are also a variety of small birds including the fougou or humming birds, titin, the robin red breast, cecezeb, the junk-mouth and sikiye which though hardly bothered at all by the hunters, do fall victim to the occasional little boys catapults or slingshots. There are also one or two large birds, such as the coucou manyok and the pipirit which are also popular game birds. Doves are either captured for food or for pets. The traditional pastime of holding in captivity certain birds as pets is declining.

Fish. As far as fishing is concerned, it is true to say that while we still have quite a variety of fishes in our fresh waters, fishermen are more and more being restricted to fishing mullet or mullets, and crayfish which is spear fished. The point here is that our other traditionally sought after fish such as coco and teta are rapidly becoming rare and endangered. Even the popular mullusk veo is becoming scarce also. Titiwi, which consists of a collection of small fishes of varying species, is still in demand and continue to produce a variety of tasty Dominican dishes including acra. Crayfish also continues to remain one of the most if not the most popularly sought after fresh water prawns.

Non-game Animals

The balance of our wildlife consists of a variety of amphibians including three species of the house or domestic type lizards commonly seen around, the hedious looking bush lizard-like animals locally called mabuya, and the domestic type mabouia which is found around homes and buildings. The former type is distinguished from the latter by its padded or webb-like limbs and its generally slightly larger in size. The arborlor is very much larger than the lizard and it inhabits bushy areas whether wet or dry. It nevertheless shows a distinct preference for the drier habitat. This animal is very hideous in appearance and members of the public usually demonstrate strong dislike towards this species.

Insects of varying types and species, crustaceans, mollusks, bats of many varieties, and reptiles including the boa constrictor, the couess, and doctor snake all form Dominica's collection of wildlife.

The Iguana. The iguana which is a large lizard-like amphibian, is now being threatened with extinction. No wonder, then, that it is now among the group of wildlife for which hunting is prohibited. This protected animal was once among the most popular animals being hunted for food. The iguana is basically a lover of the dry and semi-dry type habitat.

The Sisserou and Red Neck (Jaco) Parrots. The Sisserou (*Amazona imperialis*) and the Jaco (*A. arausiaca*) are Dominica's two indigenous parrots. They constitute our national pride and joy. In fact, the Sisserou is our national bird. They too are threatened with extinction, though at one time in Dominica's history, they used to fly as near down into the yards of certain villagers (e.g. the villagers of Wesley, Marigot, Calibishie, and Woodford Hill).

The Sisserou, which is the wilder of the two birds, is in greater danger of extinction than its cousin, the red neck. Before hurricane David, its population was about 100 to 150 individuals. However, post hurricane David's preliminary surveys revealed a population count of about 50 to 100. The Jaco had a pre-hurricane David count of about 250 to 300, while the post hurricane David survey revealed

150 to 200. They both inhabit the deep, rugged interior habitat of our forests, though it is normal to see the Jaco visiting the lower ranges of our mountains.

Though much has been said about these two parrots and quite a bit of attention has been given by authoritative parties to them, not much has been done to save them as far as financial support is concerned. There are those who have done some research on the subject, while there are still those who are now involved in carrying out on-going research work in reference to the parrots. The bottom line is, however that in order to save those two birds, positive financial backings and stronger legislation is urgently needed.

The threat to the parrots' existence is being brought about due to the following:

- On account of the aggressive attitudes of the farmer who seeks more and more land for planting and is therefore cutting, clearing, and burning deeper into the forests. The parrots, especially the Sisserou, are finding it more and more difficult to survive in terms of shelter and food.
- It is generally believed that because of the high price being offered through the black market, parrot poaching for trading still remains one of the main threats against the parrots.

Wildlife Act

We in Dominica are fortunate to have a Wildlife Act which provides for the protection, conservation and management of wild mammals, fresh water fishes, amphibians, crustaceans, and reptiles, and for the purpose connected therewith. This Act, No. 12 of 1976, was gazetted on July 1st, 1976.

Shortcoming of the Act

There are a few areas of weaknesses in the Wildlife Act. The Forestry Division has therefore subsequently presented a paper to Cabinet for amendments of those weak sections of the Act. At the time of writing this paper, this author has been informed that Cabinet has so far approved of the amendments and it is just a matter of time before the final stage is completed in Parliament.

The Act as it stands now does not provide for more than EC \$250.00 and/or three months imprisonment as penalty for those who violate the Act. This can be made to seem very ridiculous when one considers the thousands of US dollars which are offered for the illegal sale of the parrots. Also, generally speaking, the penalties do not seem to have a very deterrent effect on the delinquent hunters. The protection of the iguana is also not thoroughly provided for. And, there are a few more areas, needing urgent attention.

Management of Wildlife

The Forestry Division, assisted by the Police whenever requested, is equipped with a trained administrative staff and field officers to manage the wildlife of Dominica. The field officers, who must necessarily be acquainted with the Wildlife Act, engage in systematic patrols of the forests.

Nocturnal, weekend and holiday patrols are also carried out. Special patrols which commence from 3:00 A.M. are also organized in an attempt to both catch parrot poachers and discourage parrot poaching.

The Protection Officer is the general supervisor of the field officers, who all comprise the Protection Section. The Director of Forestry and Wildlife holds the Protection Officer and his staff directly responsible for the routine and general protection of wildlife. The Wildlife Act provides for the protection of game animals during the closed hunting season, which runs from March 1 - August 31 of each year. During that period our animals are allowed a period of rest and peace during which time they can breed and the young ones allowed to thrive unmolested by hunters. During that period too, our officers remain most alert and vigilant and delinquent hunters are quickly charged and taken to court.

As far as the parrots are concerned, the program for their protection must be strengthened. One of our senior officers in the person of Forester Michael Zamore, for example, has been able to erect a parrot lookout in the Syndicate forests. Some effort has also been directed towards the acquiring of private lands in order to maintain those lands as prime parrot habitat.

The situation of public encroachment into the parrots' habitat has escalated. As a result, it has been an unending battle between the Forestry Division and the public, and at times, even against politicians, in a daring effort to save the parrots. One could cite for example, the Morne Plaisance and Syndicate estates, where intense logging is being carried out on the one hand, and aggressive farming is being done on the other, are populated by parrots.

However, on a different note here, it would be fair to note that positive plans are on stream to acquire approximately 200 acres of land in the Syndicate/Dyer Estate area in order to maintain as a nature preserve. The effort is being ably supported by RARE, Center for Tropical Birds, and the International Council for Bird Preservation.

Tourism Potential

More and more people are searching for quiet and peace. And so, it is no wonder that visitors to our nature island are attracted to our scenery and comforting lush forests, and witness our freshwater, boiling and boeri lakes, our beautiful water falls, the Emerald Pool and our almost caressing clear fresh rivers. These are only a few of our natural attractions which charm and enchant the visitors. Consequently, our wildlife, especially our large variety of birds, including the two beautiful and enchanting parrots, and the boa constrictor, present great interest to the scholar, the scientist, and the simple curious observer. It is therefore fair to say that our island attracts a steady flow of visitors and researchers throughout the year.

Rare Dishes of Delicacy

Visitors to our island who have been told about our rare dishes of delicacies such as mountain chicken or crapaud, callalou soup with crabs, and crab backs immediately set out to sample whatever may be available at the time of their visit. It is no secret then that throughout the Western Hemisphere

Dominica is well known for its agouti and manicou.

It would be correct to conclude that some of Dominica's wildlife, when converted to rare dishes of tasty foods and served in our hotels and restaurants, does contribute albeit in a small way, to the island's tourist industry.

Wildlife in Education

For the past seven years or so, the Forestry Division has been involved in a concerted effort towards educating its staff and members of the public. We, of the Division have therefore been able to find out in a very positive way that wildlife exhibitions assist very greatly in the education of the public. Wildlife has therefore played a very important role in primarily attracting the public, especially school children, and encouraging them to ask questions about the various animals, their history, and way of life.

During such wildlife exhibitions, interpretive panels and drawings are displayed. One Forester, Arlington James, for example, was able to design graphic scaled descriptions of the two parrots' habitats as they continue to diminish throughout the past six decades. Up to date, the Forestry Staff has produced a number of wildlife booklets which have been circulated to the schools and the general public.

The Forestry Division is often invited to participate in community and national exhibitions. Whatever such exhibitions may be meant to depict, the wildlife section continues to be one of the greatest attractions there.

Recommendations

In conclusion, I wish only to mention through this forum, that in order for Caribbean people to fully comprehend the true significance of our wildlife in the scope of things, it is imperative to systematically organize an aggressive and thorough wildlife public education programme. We must attack the schools from the pre-school stage to the college level, the general public of all ages, and even more so, our policy makers in governments.

Here at home, there is a growing awareness of our wildlife. And even now as I present this paper, combined efforts from the few truly dedicated ones at home and from dedicated naturalists as far as Germany and Canada are in the process of returning to our country parrots which were illegally taken from our forests. However, it is my dream that our educational programmes will continue to even solicit the greatest levels of awareness from the public.

Presently, we have a six month hunting season which stretches from September 1st of one year and continues till the last day of February of the following year. The non-hunting or closed season therefore lasts from March 1st up to August 31st of the same year. This arrangement appears to be very convenient. However, it is my wish that one day soon research work into the specific periods of the various game animals will commence and will subsequently lead to the proper classification of hunting and non-hunting periods of particular animals.

WHAT IS THE STATUS OF WILDLIFE IN GRENADA TODAY?

A. Kim Ludeke, George Vincent, Raymond Walker, and Desmond Dumont

Abstract

There is a paucity of historical documentation and contemporary research on the wildlife of Grenada. Historically, Grenada has been populated with fauna of both North and South America origins. Humans have been responsible for the introduction of several important species such as the mona monkey and mongoose. Humans have also been responsible for several important extinctions such as the manatee and Grenada parrot. There are two endemic birds in Grenada, the Grenada dove and a subspecies of the hook-billed kite, both of which are severely endangered. There are a number of other birds, as well as mammal and reptiles species considered to be endangered in Grenada. Several endangered species are also listed as game species. Therefore, the only protection they are provided is during the closed season. The laws pertaining to wildlife in Grenada are outdated and poorly enforced. There are two hunter groups in Grenada which do observe the hunting season. One of their objectives is to obtain governmental permission for more guns. There is great need in Grenada for improved legislation pertaining to wildlife, for enforcement of this legislation, for protection of habitat critical to threatened and endangered species, and for scientific study of wildlife population dynamics and habitat requirements.

Introduction

The question "What is the status of wildlife in Grenada today?" is not easily answered. There has been little historical documentation on the status of wildlife in Grenada. Contemporary studies have been limited in time and scope. However, this paper will attempt to provide an answer to this important question. It will first look at the history of wildlife in Grenada. It will then attempt to evaluate the current situation in Grenada. The final section will explore the future prospects for wildlife.

Historical Perspective

Natural arrivals - As a volcanic, oceanic island, Grenada is inhabited by terrestrial fauna which arrived by sea from nearby continental land masses. According to Baker (1929), most of the small flightless animals floated in on vegetation mats from the Orinoco River system of nearby South America. Recent evidence of such arrivals include an Orinoco crocodile (*Crocodylus intermedius*; Swartz and Henderson 1985) which washed ashore in Grenada in 1910, and an alive, but exhausted alligator which made landfall in Carriacou in 1928 (Groome 1970).

The majority of birds and flying insects are of tropical North American origin. They populated Grenada as they moved south through the Antillean chain of islands (Baker 1929). There are, however, several recent South American bird arrivals, all members of more aggressive families (Bond 1948), for example, the glossy cowbird (*Molothrus bonariensis minimus*) which reached Grenada in 1891 (Groome 1970). Several noteworthy species have been introduced by humans.

These include the large opossum or manicoú (*Didelphis marsupialis inularis*), the mona monkey (*Cercopithecus mona denti*), and the mongoose (*Herpestes auropunctatus*). The large opossum is believed to have been introduced into Grenada from South America by the Amerindians. It was part of the "live larder" they brought with them on inter-island journeys in their pirogues (dug out canoes; Groome 1970).

The mona monkey was introduced from West Africa during the slave trade (Groome 1970). Bacon (1978) said that this species was probably brought to Grenada as a pet by the slaves. However, given the condition of the slaves on slave ships (Brizan 1984), we find this scenario unlikely. It was more likely that monkeys were brought over as pets by the planters or slave traders. Given the paucity of native game species on Grenada, another scenario is that it was introduced as a source of wild meat. Freed or escaped, the monkeys readily adapted to life in Grenada's forests.

The mammal most commonly seen in the wild in Grenada is the mongoose. The native of Indo-Asia was brought to Grenada in the 1870's from Jamaica to control rats in the cane fields. It has been very destructive to snakes, lizards, and ground-nesting birds. It is also the only proved vector of rabies in Grenada (Groome 1970).

Historical Extinctions

There is evidence of several extinctions subsequent to the arrival of European settlers in Grenada. These include the manatee (*Trichechus manatus*), the Grenada parrot (*Amazonas* sp.), the agouti (*Dasyprocta albida*), two species of snakes, Neuweid's moon snake (*Pseudoboa neuweidi*) and Shaw's racer (*Liophis melanatus*).

Labat (1742) noted the presence of sea cows or manatees during his visit to Grenada in 1700. DuTertre (1958-59) said that the Caribs did not consider the meat of the sea cow (and sea turtle) edible due to superstition. They considered the meat to be unclean. However, the Europeans and Africans did not share these taboos. Therefore these animals were quickly exterminated after colonization.

Both DuTertre (1958-59), who traveled in Grenada between 1667-1671, and Labat (1742), who visited Grenada between 1693-1705, recorded the presence of parrots in Grenada. It is curious that there is presently no parrot native to Grenada given the presence of the *Amazonas* genus on the islands to the north. "As immigrants from the South it is hardly likely that they would have leap-frogged over Grenada" (Groome 1970, p. 48). Although Devas blamed the French settlers, Groome (1970) suggested that the introduction of the mona monkey subsequent to the travels of DuTertre and Labat led to the extinction of the "Grenada parrot". The predation of birds nests by the mona monkey gives credence to this scenario. In the final analysis, this extinction may have been the result of predation by the monkeys and over-hunting by people. Natural forces such as hurricanes may have played a role, but the only major hurricane to strike Grenada since European colonization was Janet in 1955 — long after the parrot disappeared (Devas 1964).

The Morocoy tortoise was hunted to extinction in Grenada for food. According to Groom (1970) it has been reintroduced through escapes from captive populations.

The agouti population of Grenada was dealt a severe blow by Hurricane Janet in 1955 (Groome 1970). Although legally protected from 1956-72, the agouti is now considered to be extinct in the wild. Hurricane Janet, overhunting for human consumption, and aggressive predation by the mongoose are blamed for the loss of this species. There is interest by naturalists and hunters in reintroducing the agouti to its former habitat.

Two species of snakes are believed to be extinct in Grenada. These are Neuweld's moon snake and Shaw's racer. Snakes in Grenada were given sanctuary protection in all the Forest Reserves from 1957 until 1972. This was to counter the loss due to Hurricane Janet in 1955. Although there are no poisonous snake species in Grenada, humans continue to pose a major threat to the survival of Grenada's remaining snake species.

Endemic Species

Two endemic bird species are found in Grenada. The Grenada dove (*Leptotila wellsi*) was believed to be extinct until it was rediscovered in 1961 (Groome 1970). Based on field studies in 1987, an estimated 105 survive (Blockstein 1987).

A subspecies of the hook-billed kite (*Chondrohierax uncinctus mirus*) is found only in Grenada. It was believed extinct prior to hurricane Janet (Groome 1970). According to Blockstein (1987) 15-40 survive in Grenada. The major threat to both the hook-billed kite and Grenada dove is the loss of habitat in the Grand Anse, Point Saline, and Mount Hartman areas.

Groome (1970) noted the endemic tree boa (*Boa grenadensis*). However, Schwartz and Henderson (1985) listed only one species for Grenada under the Boidae family, *Corallus enydris*, which is also found in Saint Vincent and the Grenadines.

Endangered and Threatened Species

In addition to the above mentioned Grenada dove and hook-billed kite, the Caribbean Conservation Association (CCA) listed 14 species of birds listed as endangered in the wild in Grenada. These include: (1) the blue hooded euphonia (*Euphonia musica*), (2) the blue-tailed emerald hummingbird (*Chlorostill mellisgus*), (3) the broad winged hawk (*Buteo gallinago*), (4) the common snipe (*Gallinago gallinago*), (5) the Everglade kite (*Rostrhamus sociabilis*), (6) the fulvous tree duck (*Dendroncygna bicolor*), (7) the great egret (*Casmerodius albus*), (8) the large-billed seed finch (*Oryzoborus crassirostris*), (9) the lesser elaenia (*Elaenia chiriguensis*), (10) the lesser seed finch (*Oryzoborus angolensis*), (11) the limpkin (*Aramus gaurauna*), (12) the masked duck (*Oxyura dominical*), (13) the scarlet ibis (*Eudocims ruber*), and (14) the swallow tailed kite (*Elanoides forficatus*).

Also the tundra peregrine falcon (*Falco peregrinis tundrius*) is listed as endangered in Grenada (King 1987-1979?).

The mammal listed as endangered by the CCA is the nine-banded armadillo (*Dasypus novemcintu*). The lesser Chapman's marine opossum (*Marmosa fuscata*) is considered to be

vulnerable and the greater Chapman's marine opossum (*Marmosa mitis*) is rare.

According to the CCA four species of snakes in Grenada are rare and their status uncertain. These are: (1) the white-headed Worm snake (*Leptotyphlops margaritae* or *Typhlops tasymicris* (?) in Schwartz and Henderson [1985]), (2) the tree boa (*Boa grenadensis* or *Corallus enydri*, in Schwartz and Henderson [1985]), (3) Boddaert's tree snake (*Drymobius* sp or *Mastigod bruesi* in Schwartz and Henderson [1985]), and (4) *Clelia clelia groomei*.

Iguana iguana is considered threatened in Grenada by the CCA. The fate of the remaining six species of lizards in Grenada is unknown. The mongoose remains a major threat to lizard populations.

Sea turtles found in the water around and on the beaches of Grenada are all endangered. This is largely a result of human predation for their meat and shells and of destruction of the beach habitat required for their nesting (GOG/OAS 1988). The endangered sea turtles are: green turtle (*Chelonia mydas*), hawksbill turtle (*Eretmochelys imbricata*), loggerhead turtle (*Caretta caretta*), Kemp's ridley (*Lepidochelys olivacea*), and leatherback (*Dermochelys coriacea*, GOG/OAS 1988). Sea turtles caught must weight 25 lbs. or more or be returned to sea. Sea turtles and their eggs are absolutely protected.

Game Species

The primary game species in Grenada are listed in Table 1 with the respective hunting seasons.

Table 1. Principal game species and their season

Species	Hunting season	
	Open	Close
Ramier (<i>Columba squamosa</i>)	1 Sept.	1 March
Tatou/Armadillo (<i>Dasypus novemcintus</i>)	1 Oct.	1 March
Mona Monkey (<i>Cercopithecus mona denti</i>)	1 Oct.	1 March
Monicou/Opossum (<i>Didelphis marsupialis insularis</i>)	1 Oct.	1 March
Iguana (<i>Iguana iguana</i>)	1 Oct.	1 March
Sea Turtles		
Green (<i>Chelonia mydas</i>)	30 Sept.	1 May
Hawksbill (<i>Eretmochelys imbricates</i>)	30 Sept.	1 May
Loggerhead (<i>Caretta caretta</i>)	30 Sept.	1 May
Kemp's ridley (<i>Lepidochelys kempī</i>)	30 Sept.	1 May
Leatherback (<i>Dermochelys coriacea</i>)	30 Sept.	1 May

Additional birds covered by the September 1 to March 1 hunting season include the following species (Ordinance 26, Protection of Birds and other Wildlife of 1958): (1) Mallard duck (*Anas platyrhynchos*), (2) Blue-winged teal (*Anas discors*), (3) Green-winged teal (*Anas crecca carolinensis*), (4) American widgeon or baldpate (*Anas americana*), (5) Shoveller duck or sucet (*Spatula clypeata*), (6) Lesser scaup duck (*Athya affinis*), (7) Florida gallinule or waterhen (*Gallinula chlorous cercheris*), (8) Caribbean coot or waterfowl (*Fulica caribae*), (9) Hudsonian curlew or whimbrel (*Numenius phaeopus hudsonicus*), (10) Greater yellow legs (*Tringa melanoleuca*), (11) Willet or tell-bill-willy (*Catoptrophorus s semipalmatus*), (12) Wilson's snipe or common snipe (*Capella gallinage delicata*), (13) Violet-eared dove or Trinidad ground dove (*Zenaida auriculata stenura*), (14) Zenaida dove or mourning dove (*Zenaida aurita*), (15) Broad-winged hawk or chicken hawk or gree gree (*Buteo platypterus anillarum*), (16) Peregrine falcon or duck hawk (*Falco peregrins anatum*), (17) Glossy cowbird (*Molothrus bonariensis minimus*), and (18) Lesser Antillean Grackle or Backbird (*Quisicalus lugubris luminosus*).

The broad-winged hawk and the peregrine falcon prey on fowl (domesticated birds) so may be killed in season. The glossy cowbird and the Lesser Antillean grackle are considered garden pests, hence their inclusion. All other wild birds and their eggs are provided absolute protection.

Wildlife Laws

Laws pertaining to wildlife are both outdated and not effectively enforced. The 1906 Grand Etang Reserve Ordinance (Ordinance No. 5, Cap. 121) designated the area around the Grand Etang Lake as a forest reserve. Protection was provided to certain species of wildlife in forest reserves by the Wild Animals and Birds (Sanctuary; Amendment) Ordinance of 1956. This law gave absolute protection to armadillo (*Dasyus novemcintus loplites*) and to all snakes in all reserves. It also provided colony-wide protection for agouti (*Dasyprocta albida*). Some confusion arises as the scientific names given by this law to the armadillo and to a number of the snake species are not consistent with current nomenclature. As this ordinance only provided protection for six years, it was extended until the end of 1972 by Ordinance No. 3 of 1963. Ordinance No. 34 of 1984 entitled Forest, Soil and Water Conservation (Amendment) Ordinance of 1984 established the forest policy of Grenada to include protection of "such areas as may be required to provide natural and undisturbed habitat for the flora and fauna of Grenada" (p. 143).

The Protection of Birds and other Wildlife Ordinance of 1956 as mentioned above under game species established the hunting season in Grenada.

Grenada's laws pertaining to hunting and protection of game and endangered species need urgent upgrading. These laws should be amended or rewritten to conform to internationally recognized standards, especially with regards to endangered species. Scientific studies need to be undertaken on the population dynamics and habitat requirements of both endangered and game species in Grenada. It is unconscionable that species such as sea turtles are listed as both endangered and game species. Both laws and studies should have as their objective the survival of endangered species. Laws and studies should help to better manage populations of game species (non-endangered) to provide a sustainable harvest.

Hunters Associations

There are two hunter's associations in Grenada. These are the only non-governmental organizations allowed to bear arms in Grenada. Grenada was disarmed in two stages. First, Sir Eric Gairy's 1965 Firearms Act, although applicable to firearm's owners, was primarily designed to remove licensed firearms from his political opposition (Brizan 1984). Second, in 1983 the People's Revolutionary Army appealed to all Grenadians to loan shot guns and air rifles to the militia to train for the defense of the homeland (O' Shaughnessy 1984). The removal of guns, especially shotguns, from the people has undoubtedly allowed populations of some wildlife species to rebound in recent years. However, there is a need for documentation to support this conclusion.

The first of the hunter's associations, now called the Grenada Wildgame and Conservation Association, was founded in 1970. The members are allowed five shotguns by the Government of Grenada. The Grenada Hunting and Fishing Group is a recently established off-shoot of the former group. The members of this group have 3 shotguns approved by the Government of Grenada.

One objective of both groups is the protection of populations of game species by strict observation of the hunting season. A second, but no less important, objective of both groups is to secure governmental permission for more shot guns for their members. The Government is moving cautiously on this latter objective. Another objective is the introduction and reintroduction of wildlife (agouti) for hunting purposes. There is currently concern that the five year ban on hunting in Trinidad may severely stress Grenada's remaining wildlife.

It is recommended that more scientific studies on the population dynamics of game species be undertaken before more gun permits are issued by the government. Further, before exotic game species are introduced to Grenada, extensive research on the effect of these species on the native flora and fauna are essential. The impact of the mongoose on the native fauna of Grenada should serve as a clear reminder to those who would move too fast.

Future Directions

What does the future hold for wildlife in Grenada? Today Grenada is at the threshold of a potentially promising new era of habitat and wildlife protection. The Government of Grenada/Organization of American States (GOG/OAS 1988) has just completed a systems plan for National Parks and Protected Areas in Grenada. A principal goal of this system will be to protect in perpetuity Grenada's natural heritage.

Objectives of this plan directly related to wildlife are: to preserve genetic materials as elements of natural communities, minimize the loss of any plants or animal species and maintain biological diversity, and to protect and manage fish and wildlife resources in view of their important role in environmental regulation, sport, and recreation activities and as producers of protein and other products (GOG/OAS 1988, p. 3).

The plan also outlines the need for improved legislation pertaining to wildlife. The existing legislation does not adequately provide for establishment and management of a system of national

parks and protected areas. Further, there is an urgent need for new legislation to provide protection for endangered and threatened species in Grenada. This legislation must address protection of species by bans and restrictions on their capture and/or killing. It must also address the problem of habitat destruction. The introduction of exotic game and other species is another topic that should be covered by legislation. All legislation should be founded on a strong scientific base. However, urgent action is needed if Grenada is to enter the 1990's without losing such endemics as the Grenada dove and hook-billed kite. The laws once passed must be enforced, perhaps by forest or games wardens.

If Grenada follows the GOG/OAS guidelines by establishing an internationally recognized system of national parks and protected areas and providing protection to its threatened and endangered species, Grenada will attract more tourist revenue. There is a growing demand for nature and scientific tourism globally. This trend is reflected in the increased interest by tourists at the Grand Etang National Parks Visitors Centre in interpretative and hiking trails. Common questions are "Where will we see wildlife?" and "What animals live in the forest?" There has even been talk of reintroducing the manatee for its touristic value.

There is a need for prompt action on habitat protection and for legislation enacted and enforced to protect endangered and threatened species. The alternative is continued loss of the amount and diversity of wildlife in Grenada. Grenadians and all people who love wildlife would be much poorer for the loss. The unknown ecological implications for Grenada of the continuing loss of wildlife are another reason for concern action.

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WILDLIFE PROTECTION AND WILDLIFE MANAGEMENT IN GUADELOUPE

Michael Vallance

Wildlife Species

Visitors often wonder as they walk through the gorgeous vegetation of the rain forest, is why he/she doesn't hear or see wildlife? Indeed, Guadeloupe doesn't support a rich or diverse land vertebrate fauna. Birds are the only vertebrate group with an abundance of species.

The list of mammals is short enough to be detailed:

- Bats - belonging to several species, all small sized.
- Black rat - (*Rattus rattus*) in recession since *Rattus norvegicus* was introduced from Europe by the first trade-ships.
- Mongoose - which was introduced in the XIXth Century from Asia to reduce the rat's population. It failed. The mongoose sealed a safe-life agreement with the rat, which survived by living on trees. The mongoose grows in large number everywhere in Guadeloupe at the expenses of several harmless native species. Its favorite pray are birds nesting on the ground, e.g., the quail dove (*Geotrygon mystacea* - *Geotrygon montana*) and Gallinacea sp. Studies by the U.S. Virgin Islands National Park have demonstrated its negative impact on 14 species of island wildlife species including sea turtles, iguana (eggs) and several ground nesting birds. In Guadeloupe, mongoose is considered as a pest.
- Agouti (*Dasyprocta noblei*) - this rodent is found in many other Caribbean islands and Guyana. Its numbers have decreased dreadfully because of its delicate meat. In addition, establishment of banana plantations have destroyed large areas of its habitat. Nowadays, agouti can be seen mostly on Desirade islet, removed from dwellings, inside a hunting reserve. It is a prohibited game (defined later).
- Racoon (*Procyon minor*) - is the mascot of the National Park, and Guadeloupe is proud to be the only Caribbean island to host this wonderful animal. Another species of the same genus (*Procyon glorallemi*) is reported to be extinct in Barbados. Its population status is difficult to assess. According to certain people, especially poachers who keep on chasing it for meat, it is relatively profuse, to the point of damaging vegetable and fruit crops which are its favorite diet. Its habitat is not precisely defined. Because of nocturnal habits, racoon is not easy to find in the wild. Many individuals are keep in captivity as pets in spite of the law. As a matter of fact, poachers catch babies racoon right in their breeding sites and sell them.

Manatee, a large marine mammal which used to live in riverine mangrove estuaries, has been slaughtered for meat. Manatees were very abundant before European colonization and are now extinct.

Among amphibians and reptiles the most notable one is the iguana. Though defenceless and easily visible during its sun baths (*I. iguana* and *I. delicatissima*), the population of this prehistorical-looking lizard has survived in the dry areas of most of the islets surrounding the main island of Guadeloupe. Legal protection prevents its exploitation by the tourist business.

Wildlife Habitats

The dark and quiet rain forest covers 35% of Basse-Terre island and it is the best hunting area. The upper zone of dwarf forest, where few wildlife species survive, is exempt from hunting. Below the rain forest crops and deforested lands where large amounts of pesticides and herbicides are poured, constitute a patchy habitat. Scattered "berry-trees" throughout the countryside delimit this habitat.

Close to the seashore, one again finds wild areas hosting many individuals of a diverse fauna, e.g., marine birds, water birds (mangrove, swamps), amphibian fauna (sea turtles) and animals of the dry forest. This rich wildlife is well conserved on the few natural or less inhabited islets surrounding Guadeloupe. Hunting is prohibited. Elsewhere, human presence is a permanent threaten.

From the above considerations, it is obvious that the National Forest Service (Office Nationaux des Forêts) who is responsible for managing 2/3 of the rain forest, all mangroves, and the most of the coastal wild areas, has an outstanding responsibility in dealing with Wildlife Protection and Wildlife Management in Guadeloupe. Due to historic tradition, local hunters have always been excluded from private lands, and thus use to frequent almost exclusively state forest lands in search for game.

Hunting and Conservation Laws

In France, wildlife is classified according to an increasing protection status: pest animals, game, prohibited game, and protected species.

Pests

Pests can be exterminated at all times, in all places, by compulsory hunting if necessary, and without permits. Regulated means of destruction can be used against pests. In Guadeloupe, rats and mongoose are examples. The wandering dog is a newer but as worrisome pest.

Prohibited Game

Prohibited game includes species that are protected by hunting moratoriums at anytime. They can't be caught, transferred, sold, or brought. Their nests, eggs, and progeny can't be touched. They are mostly: racoon, agouti, iguana, birds of prey, marine birds, and all sedentary birds smaller in size than the thrush.

Large birds are protected as well: Kio (small heron) *Butorides virescens*, the endemic woodpecker (*Melanerpes iherminieri*), two cuckoos (*Crotophaga ani* and *Coccyzus minor*), water

hens and grebes, several migratory birds (herons, "skylarks",) but most of them are allowed game. The official list is currently under review.

Protected Species

This is the status of species which are considered of special interest, endangered, or both. They are strictly and entirely protected under the Nature Conservation Act of 1976. Even the use or trade of parts of them either frozen or dehydrated is prohibited. Unfortunately no native wildlife of Guadeloupe has been placed under such protection but a list of birds has been ready for approval since 1986. At least iguana, racoon, and agouti should be added.

Game Species and Regulations

Game species can't be caught or shot except by hunters. All are birds. Hunting regulations compel the hunter to be bearer of a hunting permit (after age 16), participate with game caring and surveying (requires an annual fee) and, to own hunting right either directly (land owner) or by rent. In Guadeloupe, hunting rights are mainly provided by the National Forest Service (O.N.F.) which sell personal hunting licenses valid over all state lands (42,000 ha or 30% of the total surface area). The licence fee is low: 70 FF or 10 US\$. Hunting societies, which are enabled to rent and share hunting rights for their members, are very weak and underdeveloped, so there is no private initiative in the management of game territories.

This lead to an under exploitation of game on private lands while state lands are over exploited by 2,200 hunters on 42,000 ha, (5 per km² or 13 per square mile!)

On both the national and local level hunting is regulated. For instance, in Guadeloupe, the hunting season lasts from mid-July until the beginning of January, 3 days per week. This is too long for sedentary birds which are now almost exterminated. Many hunters wait for passing birds and ask for broader hunting season, thinking in terms of ephemeral populations.

Our legislation allows the transfer of live game under special restrictions. No local species can be bred neither for meat or release. Moreover the introduction of game species from abroad is watched over by sanitary inspectors. Lack of adequate habitats appear to be the main constraint facing any introduction or reintroduction program.

Another way of increasing game populations is to establish game reserves inside hunting territories, particularly in well-preserved habitats. At the moment, three (3) large reserves have been established covering the three main wildlife habitats. The objective is to meet the needs of our main game birds as well as other native wildlife. The reserve areas are:

- The Mamel Game Reserve (7,200 ha in the rain forest)
- The Grand Cul de Sac - Mangrove and Marine Nature Reserve (3,000 ha)
- The dry islets Reserve spreading over most of the dry islets surrounding Guadeloupe (Desirade, Les Saintes, Petite Terre, Pigeon).

The protected area within the rain forest will be extended soon, as the National Park Project includes 17,000 ha of the State Forest (containing Big Pond, a unique 17 ha freshwater lake at an elevation of 400 m). Augmenting game populations and conserving protected species depends on efficient control. Patrols are conducted by two National Services:

- The National Hunting Office (9 guards) watch mainly over private territories (Grande Terre, fringe of Basse Terre Forest) and Game reserves.
- The National Forest Service (30 officers) watch only on state lands, which are the most frequented game territories.

The National Park Service will soon be given 9 more wardens. But in spite of this control, arrests are few whereas offences are obviously very numerous. They include hunting before the opening of the season (June), hunting on week days, and shooting prohibited game.

The following species are game birds: ramier (*Colombus squamosa*), dove (*Zenaida aurata*), thrashers (3 bigger species), quail dove (2 species of *Geotrygon*). Hunting is permitted 3 days a week.

Water birds can be hunted every day of the week. They are migratory species and none nest in Guadeloupe, which is easy to understand given the number of guns waiting for them. These birds stop in Guadeloupe on their trip from Northern to Southern America, and rest for a short while in mangrove swamps. They rarely stop on their return journey as it occurs during the dry season which is less favorable. One must add to the list of official game: wild pork, and wild goat which now occur in rain and dry forest.

Game Management Experiment: Dove Monitoring (*Zenaida aurata*)

Hunting limitations have been established for several years to protect the local dove in the French Caribbean. An experiment has been undertaken by M. Maurice Anselme, Fauna Researcher, on the request of O.N.C. and with the support of O.N.F.

First, a call count survey was initiated in 1985. One purpose of the study was to estimate the density of dove living on a defined territory and to make interannual comparison by counting the songs of the male from site to site on a designed path (20 stops). The counting operation takes place in the morning and in the evening (favorite times), 3 minutes per stop, respectively at exactly the same time, once a week within the breeding season (April to July).

There are 6 paths, thus 6 territories were submitted to this experiment (3 in Guadeloupe, 3 in Martinique). They were described from the habitat point of view (flora especially). The flying distance from one stop to the next one is 800 meters, given the hearing distance which is 400 m. The result is a theoretical density of songs because not all individuals sing all the time.

The first conclusions, after 3 years of assessment are:

- significant difference between Guadeloupe and Martinique in terms of birds' abundance

- this is confirmed by a call count made in the same time on Ortolan (*Columbina passerina*) which is not hunted in Guadeloupe and whose call density is 10 times higher
- in all sites call density is very low and reflects thoroughly weakened population of dove (0.2 to 1.7 songs per stop) that is less than 1 song per 100 ha.
- the trend from 1985 to 1987 is a nonsignificant increase in population.

Secondly, the experiment dealt with shot game, brought for examination on a voluntary basis. In 1986, 85 doves were inspected; in 1987, 337 (both in Guadeloupe and Martinique). The shot population analysis gave the following results:

- age ratio 0.6 (one immature for one adult shot)
- sex ratio 1,25 (5 males for 4 females shot)
- breeding season start March
- breeding season end October
- 40 to 50 percent of adults shot were breeding youngsters (dove milk secretion)
- 64 to 72 percent had progeny previous to being shot.

Thirdly, the experiment aimed at precise age determination of game shot (age in number of weeks for youngsters) through the building of a growth chronometric table. This table is based on feathers length assessment and feathers fall. It has been made feasible by captive breeding of doves in cages built by the O.N.F. (National Forest Service). Age of individuals is known by ring-marking on chicks. These experiments help to precise the hunting regulation and to plead with hunters for

WILDLIFE MANAGEMENT IN JAMAICA

Yvette Strong, Roy Jones, Dianne Gayle, and Marcel A. Anderson

Introduction

Jamaica is located in the Greater Antilles, approximately 90 miles south of Cuba and 100 miles west of Haiti. The island's topography consists of a highland interior, formed by a backbone of peaks and plateau running the length of the island, surrounded by flat coastal plains. Its 550 mile long coastline is varied. The south shoreline is edged by long, straight cliffs, mangrove swamps, and black sand beaches. The north coast is very rugged with several white sand beaches.

Forestry and agriculture are the predominant forms of land use in Jamaica. Forestry and other woodlands cover approximately 45 percent of the country. These are found mostly on areas of rugged terrain such as the Blue Mountains, the Cockpit Country, and dry, hilly uplands of poor soils in the southern, western and north western parts of Jamaica. Most of the forests are comprised of secondary growth with the exception of a small area of virgin forest.

These descriptions clearly indicate that Jamaica's ecosystems provide diverse wildlife habitats, the status of which are described in this paper.

Status of Wildlife

Jamaica has a large proportion of wild animals and plants that are endemic to the island. For birds, the ratio of endemic to total species is 27:256 breeding species of birds; for bats 4:23; for lizards 20:24; for frogs and toads 15:19; for orchids 46:200; for ferns 82:379; and for flowering plants 784:3,000. According to Jamaica's Country Environment Profile, at least eight species of vertebrates have become extinct in the last 150 years and many plants and animals are endangered, threatened, or rare. The extinction of these animals has been attributed to the introduction of the mongoose, cats, habitat destruction, and exploitation.

Jamaica's natural forest areas contain a great diversity of species, about 3,000 flowering plants, 5,500 ferns, 300 mosses and many fungi. Indigenous vegetation exists only in the Blue and John Crow Mountains of the northeast, Hellshire and Portland ridge on the south coast, and in small, scattered, uncultivable areas which are inaccessible. The island's forest areas, especially the montane forests, are among the most diverse in the Caribbean, as are the marine ecosystems. The following are examples of major ecosystems: mangroves, dry and wet limestone forests; elfin forests, riverine forests, swamp forests, montane forests, estuarine forests, upper montane forests, coastal forests, offshore and inshore cays, freshwater wetlands, rivers, lakes, turtle grass beds, coral reefs, lagoons, and salinas.

The agencies and institutions with programmes and activities affecting Jamaica's wildlife and wildlife management include government and quasi-government agencies, as well as non-government organizations.

The key agency for wildlife management is the Natural Resources Conservation Division (NRCD) in the Ministry of Agriculture.

The most important law affecting the management of wildlife resources in Jamaica is the Wildlife Protection Act of 1973. In addition, the Beach Control Act of 1955, the Watershed Protection Act of 1963, the Forest Act of 1937, and the Town Planning Act of 1957, also address wildlife or wildlife habitat management and protection.

Progress

The Beach Control Authority was established in 1956 to protect the environment but particularly to protect the coastline zones. However, the consciousness of Jamaicans was aroused after the Stockholm Convention in 1972 which addressed environmental matters. This was enhanced in 1975 when a ministry paper was tabled for the establishment of the Natural Resources Conservation Authority which would improve the island's ability to plan and monitor the environment and to take positive actions against offenders, but the enabling legislation was not enacted. In the absence of a legally constituted Natural Resources Conservation Authority, the Natural Resources Conservation Department was created as a civil service organization but it was empowered to serve and assist the Natural Resources Conservation Authority in carrying out its mandate. The Natural Resources Conservation Department has since been down-graded to a Division in the Science, Technology, and Research Department in the Ministry of Agriculture.

In 1984, Thorsel and Fairbairn acted on a national plan for national park development and selected sites were identified as having national park potential. These sites are: John Crow Mountains, Blue Mountains, Portland Bight and Ridge, Canoe Valley, Black River Lower Morass, Negril Morass, Palisadoes and Port Royal Cays, Cockpit Country, Discovery Bay, Ocho Ríos, and Montego Bay Marine Park. These areas were incorporated in Jamaica's National Physical Plan of 1978-1998 published by the Town Planning Department. However, to date only the Montego Bay and Ocho Rios Marine Parks have been declared protected areas in the Beach Control (Protected Area) Order of 1966 and 1974. In 1988 with the assistance of a US-A.I.D. mission team, a management plan is being developed and will hopefully be implemented to protect the nation's biological diversity by the development of a national parks and protected areas system. In addition, the development and implementation of the national parks and protected areas system is being worked on by a Jamaican National Parks Committee which was set up by the Minister of State in the Ministry of Agriculture. The Committee members are selected from both government and non-government agencies. The objectives of this committee is to assist in drafting a policy document for national parks using a variety of provincial park management planning guidelines. This is progressing well.

In addition, detailed ecological studies will be carried out in three of the areas proposed for national parks by Peace Corps and NRCD personnel within the next two years. These areas are the Blue Mountains, Cockpit Country, and Canoe Valley. National parks will help to preserve our biological diversity as well as increase the number of tourist attractions on the island.

Finally, captive breeding of several species including parrots and Mountain Witch (*Goetrygon versicolor*) birds is being carried out. Captive breeding of Yellow-billed Parrots is being done at the Hope Zoo and of Mountain Witch by a private individual. The Mountain Witch birds will be exported and released in the wild.

Problems

The major problems in the wildlife sector are the following:

Habitat destruction - The clearance of hillsides, primary forests, mangroves, and swamp forests for a variety of agricultural purposes. Agricultural crops are being produced without an environmental impact assessment in areas which should be conserved as wildlife reserves. Certain areas are cleared using a slash and burn technique instead of partial removal of timber. This is done in a number of areas where a slower process would be less harmful to the environment.

Inappropriate land use - Cash crop farming on steep hillsides, indiscriminate illicit burning resulting in degradation of the forest cover and environment, lack of adherence to road construction standards and specifications which increases degradation of the forest environment, and continuing destruction of mangrove forest by charcoal burners and developers.

Urban development - The absence of machinery to ensure the enforcement of conditions and regulations with regards to building and development which are drawn up by NRCD and other agencies to safeguard wildlife and other conservation interests.

Bauxite mining and alumina production - The mining of bauxite has destroyed the terrestrial features of the area mined as well as indigenous orchids and hardwood forest regions. The transportation of bauxite, alumina, and fumes from the processing plants are potential sources of air pollution which reduce plant production in certain areas.

Mining of sand, gravel, and limestone - The mining of beach and river sand, as well as quarrying of limestone and related products are increasing in an uncontrolled fashion. This has led to scarring of our hillsides and creation of dust hazards, and has contributed to beach erosion.

Contamination of wildlife habitat - The dumping of sewage, garbage, chemicals, and industrial and agricultural effluents into streams, rivers, sinkholes, gullies, and harbours also affects the ecology of aquatic systems. The uncontrolled use of pesticides and fertilizers on crops may also contribute to the mortality of birds and aquatic species.

Public education - There is a vital need for public education, as some of the basic causes of the problems in the wildlife sector are due to ignorance, fear, poverty, and greed on the part of offending individuals. There is also a shortage of basic texts on wildlife subjects in the island.

Legislation - The existing laws controlling the exploitation of wildlife requires updating and revision. There is also a need for new legislation for national parks and protected areas, expansion of the capability of law enforcement agencies, and public education concerning these laws.

Staffing and budgetary constraints - The basic problems affecting wildlife management are lack of staff, funds, and institutional support.

Exploitation of wildlife - Over-exploitation for commercial purposes and hunting by sportsmen of our wildlife and wildlife habitats also affects the wildlife sector. The provisions made for the Columbid Hunting Season have been ignored by hunters and this has resulted in a decline in the bird populations (Momot 1985). Commercial harvesting of corals and Donax shells for jewelry, illegal harvesting of tropical marine fish for export, and collections of wild plants, e.g., orchids, are serious threats to the populations of these resources. The orchid exportation policy has been reviewed and recommendations made. The Wildlife Protection Act currently protects some of our indigenous animals and efforts are being made to afford protection to plants as well.

Prospects

In November 1987, the Ministry of Agriculture held three days of consultations on Jamaica's Country Environmental Profile. The profile develops a national overview of the Jamaican environment and identifies opportunities for significantly improving resource conservation and environmental management. All legislation governing the environment is now being reviewed and comprehensive legislation for protection of the environment is being developed. This new legislation will make provisions for the establishment, management and funding of a National Parks and protected areas system in Jamaica.

Conclusions and Recommendations

If Jamaica's scenic beauty, unique plant and animal species and the enormous variety of ecosystems are to be sustained, the following recommendations must be instituted as soon as possible.

- The development and implementation of a network of national parks, wildlife resources and protected areas must be pursued.
- The current laws pertaining to wildlife management should be reviewed and modified, for example by increasing fines, penalties, and sanctions.
- A major national environmental education programme (formal and informal) must be developed and implemented.
- The planning process should encompass all the botanical gardens as centres of conservation of indigenous plants of actual and potential economic value, as these are an important part of our natural heritage.
- The institutional framework and capabilities for monitoring by the government agencies with the portfolio responsibility for the management of wildlife must be strengthened.

- Jamaica should accede and ratify the Convention on Trade in Endangered Species and the Convention on Migratory Animals. This will necessitate changes impacting legislation, especially with respect to the export and import of wild animals and plants.
- Regional cooperation including such processes as this conference must be fostered and encouraged.

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WILDLIFE MANAGEMENT IN MONTSERRAT

Franklin Margetson

Montserrat is a typical small volcanic island, the natural vegetation of which has been largely removed during the last three hundred and fifty years or so, for cultivation of introduced crops. The most environmentally devastating of the crops, sea island cotton, declined some thirty years ago. For the past thirty years, with half the potential population of the island living overseas, there has been a reprieve for some of the island's ecosystems and wildlife habitat. With the exception of some areas in the extreme north and southwest, there has been a slow recovery of the vegetation which once earned for the island the name the "Emerald Isle."

However the fragile environment is threatened by every new development project. Once upon a time development was concentrated near the coast, and the higher elevations, deprived of road access, seemed remote and unattractive. In that era, development was low-impact development. Radio broadcasting, a recording studio, offshore banking, a medical school, low density housing for retirees, seemed to satisfy the needs of the small population. But today here are rumors of intensive agribusiness, high density condominiums, gold mining, the development of an international airport, the return home of the emigrant population, and development has invaded the top of our highest mountain, where TV antennae and micro-wave telecommunication systems dominate the skyline.

Governments of Montserrat have always been preoccupied with houses, jobs, land, foreign exchange, and the basic survival issues. Since 1970, when the Montserrat National Trust (MNT) was conceived, conservation of the cultural and natural heritage has been delegated to that organization.

Since the enactment of the MNT ordinance in 1970, the Trust has actively encouraged:

- the designation of sites for conservation
- the enactment and enforcement of pertinent legislation
- the collection, mainly through visiting researchers and experts, of information on history, culture, vegetation, and wildlife
- awareness programmes, so that people might recognize the value and beauty of their environment.

So with the threat of development looming, the time has come for those concerned to put together these jumbled pieces of the jigsaw puzzle with one of the main objectives being the preservation of wildlife and wildlife habitat. Time does not permit a review of the legislation, documentation and reports. Current legislation pertinent to environmental protection includes: The Town and Country Planning Ordinance (No. 27, 1975), Montserrat Land Development Authority Ordinance (No. 9, 1971), The Pesticides Control Ordinance (No. 4, 1975), Animals (Trespass and Pound) Ordinance (No. 12, 1985), Mongoose (Prohibition of Import) (Cap. 109, 1889), Forestry Ordinance (Cap. 95,

1956), Beach Protection Ordinance (No. 9, 1970), Fisheries Ordinance (No. 18, 1982), Turtle Ordinance (Cap. 112, 1951), Resolution on Water Conservation Areas (SRO 18/1985, Government Notice No 9, 1985), Wild Birds Protection Ordinance (Cap. 113, 1912), Wild Birds Protection (Amendment) Ordinance (No. 6, 1987), Endangered Animals and Plants Ordinance (No. 10, 1976), Endangered Animals and Plants Ordinance (Amendment) Order (No.19, 1982), Convention of Migratory Species of Wild Animals Ordinance (No. 2, 1985).

Publications, reports, and studies covering a wide range of wildlife species have been accumulated over the years, but the information is hardly being applied to wildlife management.

Jay Blankenship in his short paper on Ecodevelopment of Wildlife and Forestry Resources in Montserrat, suggests a classification of wildlife according to value or status, as follows:

Value	Common name	Scientific name
Economic resource	mountain chicken	<i>Leptodactylus fallax</i>
Food source	agouti	<i>Dasyprocta antillensis</i>
	iguana	<i>Iguana iguana</i>
	freshwater shrimp	
	white land crab	<i>Gardisoma guanahumi</i>
	blue land crab	<i>Gewgarcinus ruricola</i>
	zenaida dove	<i>Zenaida aurita</i>
	red-neck pigeon	<i>Columba squamosa</i>
Endangered	bridled quail dove	<i>Geotrygon mystacea</i>
	fruit bat	<i>Ardops nichollsi nichollsi</i>
	slipperyback skink	<i>Mabuya mabouya mabouya</i>
Threatened	galliwasp	<i>Diploglossus montisserrati</i>
	Montserrat oriole	<i>Iceterus oheri</i>
Tourism	all birds	
Ecosystems	all wildlife	
	black snake	<i>Alsophis antillensis manselli</i>
	killyhawk	<i>Falco sparverius</i>
Other values	other wildlife	

Following the receipt of the National Parks report, the MNT received a grant to facilitate the opening of the MNT office in Plymouth. There is a full time secretary and a part time coordinator. Two Committees have been set to monitor the progress of the park and environmental education program.

The profile of the Trust is hopefully being raised by the opening of this office, and the publication, in the local newspapers, of information about the Trust and its activities. A small annual grant from government is being used to maintain selected sites visited by tourists because of their natural beauty or their cultural significance.

The coordinator has resumed discussions with government about the transfer of mountain lands to the Trust. Private landowners will also be approached, where possible. What the Trust wants is to control as much as possible of the land mass as a place where people can go to relax and take photographs and observe and study, but take nothing in and bring nothing out. In the area of forestry, an Officer is three years along on a five year course in New Brunswick, and Forest Rangers whose numbers have been increased, are to be trained, mainly by short attachments with more sophisticated forestry programmes in the subregion.

FAO is currently assisting with the upgrading of antiquated forestry legislation and the drafting of regulations and policy guidelines. Montserrat is participating in the OECS/NRMP based in Saint Lucia, funded by the German Technical Cooperation Agency (GTZ), and listed Physical Planning as their number one priority. This will make it possible to claim, at least on paper, as much land as possible for the proposed "System of Parks and Protected Areas".

Out of that same project should soon come the results of a study on the economic value of natural resources, which will highlight the importance of wildlife to the island, and to tourism.

Other spin-offs from that same project include recommendations for harmonization and upgrading environmental legislation (some of which have already been implemented), recommendations for environmental institution building, self-help activity, and hopefully, watershed management.

Assistance is needed to convert the information contained in these studies, documents and reports to a form which will impact the general public, especially school children of all ages. Short attractive leaflets, bumper stickers, posters, sign boards, badges and pins, color slides, and videos, are urgently needed. The programme needs a "mini zoo" and interpretive centres, to reach out, not only to the local people, but the growing numbers of tourists.

Pests such as the Pearly-eyed thrasher must be controlled, without upsetting the ecological balance. Certain members of the population must be prevented from destroying wildlife habitat for cultivation, charcoal and "inappropriate" timber. Watersheds are attractive to roving cultivators because of remoteness and fertility. The Water Authority should be persuaded to designate more watersheds as protected areas for the purpose of maintaining water supplies.

The Trust will ensure that Government, in order to attract investors, does not embark on destructive land clearing programmes. The Trust must also ensure that Government soon sees wisdom in putting conservation back on its development programme, before large developments get underway.

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WILDLIFE MANAGEMENT BY THE DEPARTMENT OF NATURAL RESOURCES IN PUERTO RICO

Edgardo González

Introduction

The Department of Natural Resources (DNR) of the Commonwealth of Puerto Rico is the government agency responsible for managing wildlife on public lands for conservation and/or preservation purposes, specially in the State Forests, Reserves, and Refuges. The Department administrates 14 state forests, 2 wildlife refuges, 5 reserves, and one Estuarine Sanctuary. State forests, which cover 77,661 acres, are managed under a Multiple Use Policy including the management of wildlife resources.

Since its establishment in 1972, the DNR has been developing and implementing wildlife management techniques and methods. The U.S. Fish and Wildlife Service collaborates with the DNR. The DNR has a Division in charge of all wildlife research. The island's Forest Service never had a Division for wildlife management. The Scientific Research Area is responsible for the development and implementation of programs directed to wildlife management.

Puerto Rican wildlife is dominated by small animals with high ecological value. Insects and birds are the most abundant groups. These groups, as well as reptiles and amphibians receive considerable scientific attention. Negative factors that affects the wildlife of Puerto Rico are increased habitat destruction, introduction of exotic species, flooding, predation, and others.

A summary of some of the management and research projects conducted by the DNR are be presented here.

Availability of Food Resources for the Puerto Rican Parrot (*Amazona vittata*) and the Puerto Rican Plain Pigeon (*Columba inornata wetmorei*) in Río Abajo Forest

Río Abajo State Forest (RASf) is located in the humid region of the northern limestone hills of Puerto Rico. The reintroduction of the Puerto Rican Parrot and the Puerto Rican Plain Pigeon to the RASf has been contemplated for about a decade. The area that cover the RASf was part of the former range of these species.

Widespread deforestation for agriculture, collection of chicks for sale as pets, shooting of adults (both as pets and for food), and the destruction of nest trees both for collecting chicks and for charcoal production, were probably the reasons for the disappearance of parrots from the forest. The pigeon probably suffered fro hunting, and habitat destruction.

The RASf was established in 1935 by the Puerto Rico Reconstruction Administration and has been protected since then. Mature forest is essential habitat for the parrot and to a lesser degree for the pigeon. Should food and adequate nesting resources be available within the forest, the reintroduction of both species may prove to be successful. The desirability of establishing additional

populations of the two species have been recognized in their respective recovery plans as an important measure of protection against natural disasters, and may be a way of promoting genetic diversity.

Because these birds are capable of sustained flight, they may leave the protected forest area. However, the 5620.5 ac of the forest are largely surrounded by cleared land. The possibility of birds leaving the forest may be minimized if an adequate supply of food is available throughout the year.

The study started on July 1, 1983 and ran up to June 30, 1986 to assess if there were periods when a food shortage may force the birds out of the area. Also, because the forest is currently managed for timber production, it became desirable to find out if some of the timber species could be used as food by the parrot and/or pigeon.

Parrots generally feed upon a wide variety of fruits. At the Caribbean National Forest, the Puerto Rican Parrot has been recorded feeding on at least 63 plant species. The Puerto Rican Plain Pigeon also feeds on a variety of fruits, although not quite as diverse as those used by the parrot. Since there is no feeding data from the RASF for the two birds species, it is difficult to predict which plants the parrot or pigeon will feed upon when released in the RASF. Optional foraging theory predicts that the inclusion of an item on an organism's diet depends among other things, on what else is available and on the quantities available. Faced with a new set of dietary possibilities where presently preferred items may be found in smaller quantities, the birds may shift the rank order of their diet items, new items may be added and old ones dropped.

Also, there was intention to assess whether rainfall patterns could be associated with flowering chronology. If such association could be determined from the data, it could serve as a predictive tool for managers.

After consulting the literature, 23 species were chosen for study. Trees of these species were marked and tagged. Monthly visits were conducted to note the reproductive status of the species selected. Phenological studies were completed for these species. Two meteorological stations were established in the RASF, both equipped to record rainfall, relative humidity, and temperature.

The results were presented in terms of a brief description of the species and of its characteristic distribution in the RASF followed by an explanation of the flower and fruit production in the forest together with a discussion of whether the pattern may be explained by climatic factors.

The study concluded that the phenological strategies of the 23 species that were sampled ranged from species fruiting and flowering in distinct pulses one or more times per year, to those flowering in distinct pulses but whose fruits were available much of the year, to those in which flowering and fruiting occurred at low levels with ripe fruit available through the year. Variability in time to attain ripeness may be related to seasonal rainfall. The existence of this plasticity may be advantageous to the parrot and pigeon in that fruits remain in the trees, rather than being aborted or dropped to the ground where they would not be available to the birds.

Eight of the 23 species (34.7%) produced ripe fruits throughout all or most of the 22 month study period. The worst month for potential food items of the Puerto Rican Parrot was November, when only six out of 18 species had ripe fruit. Fruiting peaks are relatively evenly distributed throughout the year for the sets of potential food items for both birds species.

Studies on Resident Gamebirds: Zenaida Dove (*Zenaida aurita*) and the Red-Necked Pigeon or Scaly-Naped Pigeon (*Columba squamosa*)

The objective of the project was to determine the present status and population trends of the two most important gamebirds species in the tree major ecological life zones of Puerto Rico. The life zones included were dry, moist, and wet according to the Holdridge system. A balanced random stratified Design of 5 mile Principal Sampling Units (PSU) was used. The 5 miles PSU were to be sampled once per month in each of the life zones, following as close as possible the standardized Mourning Dove Coo-counts used in the United States.

As expected, Coo-counts in the three major ecological life zones of the island appeared to be log-normally distributed. The Zenaida Doves, in Puerto Rico are "synanthropic" as are Mourning Doves in the United States. They occupy, with discernible differences in relative abundance, the three major ecological life zones of the island. However, they were less common than expected under wet environmental conditions, and more common than expected in environments. They were as common as expected in the moist life zone.

The Scaly-naped pigeon is an arboreal species and contrary to Zenaida doves, they were less common than expected in the dry life zone of the island, and more common than expected in the wet areas. They were as common as expected under moist conditions. Unlike Zenaida dove, Scaly-naped pigeons are not commonly found in urban and agricultural landscapes.

Banding efforts have been largely discontinued due to a prevalent lack of personnel and time constraints during critical periods of the year. During 1986, banding was restricted to the pre-hunting period. Coo-counts in the island are too variable to provide reliable population indexes. Probably, both the number of visits per PSU/month and the number of PSU per life zone need to be increased, in order to attain precision and predictability of calling patterns. Coo-counts did not compensate for differences in area, habitat structure and composition, and detection probabilities of individuals per species during the different periods of the year. Further, it is unknown whether or not Coo-counts are significantly correlated with nesting patterns in the life zones. Therefore, the validity of Coo-counts as a population indexing tool is undetermined yet.

To determine the critical nesting periods of Zenaida dove and Scaly-naped pigeon in the three major ecological life zones of Puerto Rico, eleven localities have been explored to assess their suitability as nesting habitats. From these localities apparently only three are productive enough to provide valuable data concerning nesting patterns on a month by month basis. These three localities are: Guánica Forest (dry zone), Cidra pastureland (moist zone) and Carite Forest (wet zone). Unfortunately, these localities are in areas where hunting is not allowed.

Hunting statistics for the 1986 fall season were obtained from field contacts by DNR biologist, DNR rangers, wing surveys and questionnaires. Although DNR biologists intensively sampled optional hunting localities to attain a complete panorama of the dove-hunter behavior, it was considered impossible to cover pigeon hunting areas in any significant form due to the scarce field personnel.

Study of the Snowy Plover (*Charadrius alexandrinus*) and the Wilson's Plover (*Charadrius wilsonia*) in Puerto Rico

The Snowy plover (*Charadrius alexandrinus*) and the Wilson's plover (*Charadrius wilsonia*) are two resident plovers in Puerto Rico. As with other resident shorebirds species in the island, little is known about their biology and ecology.

The snowy plover is listed as a threatened species (DNR 1985) and it is limited to the southwest tip of Puerto Rico in the vicinity of the Cabo Rojo salt flats, where a small breeding population inhabits the locality year round. The species are not found anywhere else in Puerto Rico. The area of the Cabo Rojo salt flats connects with the Boquerón State Forest on the south and southeast and with the Caribbean National Wildlife Refuge (CNWR) in Boquerón by the northeast.

The destruction of wetlands in Puerto Rico is one of the main factors leading to the endangerment of the island's aquatic fauna. Presently, the Cabo Rojo salt flats and other coastal areas are under pressure for industrial and tourist development. Nesting activities of resident plover species may be susceptible to these activities, since they require flat, sparsely vegetated nesting habitat. The salt flats are used for recreational activities, possibly causing disturbance to their associated avifauna.

Because of the limited information available about the plover's breeding biology, nesting habitat requirements and other factors adversely affecting these species; a study is being conducted to address the information needs. The basic objectives of the study are: to determine population numbers of Snowy and Wilson's plovers at the Cabo Rojo salt flats and at the CNWR, to describe the breeding biology and nest site characteristics, to describe Snowy and Wilson's plovers habitat use, and to determine the geographical distribution and population numbers of the Snowy plovers in Puerto Rico.

From January 1988, population numbers have been obtained by conducting weekly surveys throughout the entire study area and the CNWR. These surveys include monitoring the plover population, estimating hatching success, describing nesting sites, noting the extent and nature of habitat use, and observing behavioral patterns. The habitat types to be surveyed include upland sand, upland vegetation, mud flat, and submerged substrate. The data obtained from these observations will be used to examine: overall activity budgets, activity budgets of non-attending breeding and non-breeding individuals, frequency of occurrence on each major habitat type, and feeding rates. The island-wide distribution of plovers will be determined by visiting all known shorebird habitat areas along the coastal areas of Puerto Rico. Date and presence or absence of the species will be recorded for each area.

Control of Glossy Cowbirds (*Molothrus bonariensis*)

The project to control the population of the Glossy cowbird (*Molothrus bonariensis*) was proposed in 1982 as an integral part of the recovery plan for the Puerto Rican Yellow-Shouldered Blackbird (*Agelaius xanthomus*), an endemic and rare bird of Puerto Rico.

The Glossy cowbird immigrated naturally to Puerto Rico from Brazil and its already in the north coast of Cuba. It is a bird that parasites the nest of Puerto Rican Yellow-Shouldered Blackbird. The chicks of the Glossy cowbird are characterized for their fast growth rate. This characteristic enables them to compete for food with the chicks of the Puerto Rican Yellow-Shouldered Blackbird. Generally, the female of *Agelaius xanthomus* feeds the chicks of the Glossy cowbird and tends to abandon their own chicks.

The project started in 1983 funded by the Endangered Species Act of the United States. Several traps were located within the Boquerón State Forest in the specific sites where both species nest. The idea was to trap both males and females of the Glossy cowbird in reproductive age, as well as the juveniles of this species. The birds were captured and sacrificed. Also, all of the artificial and natural nests were maintained and conditioned in order to provide the best conditions for the Puerto Rican Yellow Shoulder Blackbird to lay their eggs.

The results obtained pointed to an increased reproductive rates as well as hatching success among the Puerto Rican Yellow Shouldered Blackbird.

A similar study was initiated in the Ceiba State Forest during 1980, but was abandoned.

Sea Turtle Hatchery Project with Specific Reference to the Leatherback Turtle (*Dermochelys coriacea*) in Humacao, Puerto Rico

Small numbers of sea turtles, especially the Hawksbill (*Eretmochelys imbricata*) and the Leatherback (*Dermochelys coriacea*) nest yearly in most of the coast of Puerto Rico. Occasional nesting of the Green turtle (*Chelonia mydas*) also occurs. Despite local and federal laws protecting these species, they are actually heavily hunted by means of either nets or spearguns. The majority of nesting females are slaughtered and their eggs collected by poachers. Natural factors such as beach erosion, fresh water runoff, and high surfing activities also contribute to nest destruction.

To meet the need for improved conservation efforts that in some way will increase the reproductive success of this over exploited resource, an experimental project was implemented during 1986 by identifying areas where the sea turtles, specially Leatherbacks still nest. The main objective of this project were: to increase the reproductive success by protecting turtle eggs until they hatched and hatchings were released, to determine nesting localities and numbers of Leatherback and Hawksbill sea turtles around the island, to gain useful information for future conservation programs, and to protect gravid female while nesting.

As an experimental project, a small protected beach hatchery was constructed in a suitable area of the beach shore, about 9 meters from the high level mark at the Humacao beach. Humacao beach

was selected as the best place to construct the small hatchery because of its relative absence of people and its vicinity to the Humacao Wildlife Refuge. Also, this area has a good access to the beach.

The methodology of the experiment consisted mostly in overnight and morning patrols around the coastal areas of Humacao Beach, the section named Paulina's at Luquillo Beach, and the coastal area of Piñones State Forest. Once the sea turtles were detected, a team of observers used to follow their tracts on the humid sand up to the point where the female turtle decide to dig the nest and lay the eggs. The nesting area was identified by means of the fresh tracts found during morning patrols. The search for the eggs was to be initiated immediately by hand digging until the eggs were found. The eggs then were moved to the protected beach hatchery where the chances of survival were enhanced.

During the hatchery process, the hatchery was examined daily for evidence of vandalism or the presence of predators. After 55 days of incubation the primary emergence of hatchling occurred. The nest was excavated after the primary emergence in order to release and trapped hatchling. By doing this, the hatching success was determined. Finally, the hatchling were released at the same beach where the eggs were laid. The hatchling were allowed to make their way to the sea, thus encouraging imprinting to occur.

A total of 354 hatchling have been released from the hatchery since the study began. The mean hatchling success is 52.6%.

More research and conservation efforts are needed to have a more extensive view of what the realities and needs are for sea turtle survival on the mainland of Puerto Rico. Results from this project point to the need of obtaining more information that could be used for future research and management policies. Therefore, this project continues.

Study of the Puerto Rican Frog (*Pelthophrine lemur*)

This endemic specie was considered almost extinct in Puerto Rico for several decades. In 1980 a small population of *Pelthophrine lemur* was rediscovered on a private farm in the municipality of Isabela on the north west coast of the Island. In October 1984 another population was discovered within the Guánica State Forest on the south west coast of the island. *Pelthophrine lemur* is considered a critical species, since individuals buried during eleven months of the year. Individuals surface only during the rainy season and specially when the rainfall exceeds 5 inches in a day. This particular event may take place from May to November, for the dry areas of the island.

A study for this species was designed to describe the general biological characteristics of the species, its reproductive cycle and with the intention of preparing a management plan for the preservation of this frog. It is already known that the Tamarindo Beach, located to the south east of the forest is the only reproductive habitat of this species in the whole world.

The fertilization process of the species occurs in the warm and clear waters of a oligohaline lagoon after males and females in reproductive ages emerge to the surface after a heavy shower. The frogs migrate from their underground caves to the Tamarindo Beach area. The female swims and lay strands of eggs that she ties to the vegetation floating in the lagoon. The male produce masses of

sperms that are spreaded upon the eggs. About twelve hours later, hatching occur and masses of tadpoles are delivered. During the next 14 to 21 days methamorphological changes turn to tadpoles into juvenile frogs. Weeks later, the juveniles grow to reach the adult stage and migration throughout the forest is completed.

The endangerment of *Pelthophrine lemur* is due to habitat destruction. Many wetlands areas have been destroyed. The relative absence of flooded areas interfere with the normal life cycle of the species. Predators like the tiger beetle, plovers, and other aquatic birds have destroyed juveniles during their migration from lagoons to forest land. The adults are not commonly preyed because they produce a poisonous substance when attacked.

Since 1984 some 1,500 juvenile frogs have been released in the Guánica and Cambalache State Forests. In 1985 the DNR signed a cooperative agreement with the Buffalo Zoo. Frogs in reproductive age are sent to Buffalo yearly. In the zoo the frogs are reproduced and juveniles are returned to Puerto Rico to be released to their natural habitats.

In October 1987, the specie was designated an endangered species to be protected by federal and local statutes. Management actions by the DNR have been implemented in order to protect the species. For example, 1) the control of *Bufo marinus*, considered a predator of *Pelthophrine lemur*, and 2) the erection of fences around the reproductive areas. Presently, the biologist in charge of the Guánica State Forest continues to study this important frog.

Program to Control the Population of Caimans (*Caiman crocodilus*) in Tortuguero Lagoon

The Tortuguero Lagoon is located on the north coast of Puerto Rico between the towns of Manatí and Barceloneta. The presence of caimans in the lagoon and bordering wetlands was reported in 1970. Apparently caimans were introduced to the lagoon by furtive people that had purchased the animals from pet-shops. Tortuguero Lagoon supports some of the wintering population of birds in the island and some endangered species of birds have been reported to use the lagoon and its adjacent wetlands. In 1982 the DNR developed a plan to eliminate caimans because of the potential damage they could cause to the ecosystem. In 1984 the subspecie was identify by Dr. F. Wayne King and the project to terminate the population started. The project includes the elimination of the reptiles with rifles, but it did not started until May of 1985 when the Wildlife Law was amended and the use of gunfire was accepted to control harmful species in the island. The purpose of the plan was to control the population and decrease the number of individuals in the reproductive ages.

The diet of the caimans in the lagoon is based on small mammals (mice and rats), insects, gastropods, small fishes (specially benthic species) and frogs. A total of 170 caimans captured in 35 nocturnal trips were reported by February 1987. A plan to increase the captures is ongoing under the supervision of DNR personnel.

WILDLIFE MANAGEMENT IN SAINT KITTS

Henry N. Mills

Introduction

Saint Kitts (17° 15'N, 62° 41'W), a member of the Northern Lesser Antilles, is geographically dominated by intermittently active volcanic peaks. Its twin volcanic mountains, Mount Liamuga and Verchilds Mountain, thrust nearly 3,800 feet into easterly trade winds laden with moisture. As a consequence, heavy rains of up to 144 inches per year, provide many regions of the island with ample water (McGuire et al. 1974).

These vulcanoes are relatively recent (Beard 1949) and although they comprise the largest mass of the island, to the southeast is a narrow low-lying peninsula dominated by much older hills of sedimentary and metamorphic origin. These hills, undulating from the sea like the back of a mythical creature, have been greatly altered, through grazing, cutting of timber, and many fires set by people. In addition, with less rainfall associated with their lower heights, the vegetational result is a combination of savannah and fire-resistant scrub woodlands.

Between the undulations of these hills lies a series of ponds of varying degrees of salinity constituting one of the prime resources of the island.

Forestry and Land Use

The island has an area of 68 square miles and it is generally estimated that about 37% of the land area (16,000 acres) is covered by forest vegetation. The major land-use groupings are summarized in Table 1.

Table 1. Major land-use groupings in Saint Kitts.

Land use	Area (acres)	Percent of total
Agriculture	24,420	56.1
Forest	16,000	36.8
Urban	2,600	6.0
Other	500	1.1
Total	43,520	100

Most of the agricultural land falls within the intensive land-use pattern, about 19,600 acres, or a little over 80% of all the land cleared for agriculture. Practically all of the intensive land-use consists of mechanized sugar cane cropping.

Recently, the steeper slopes, which cannot facilitate mechanization, have been abandoned and allowed to revert to forest or utilized for grazing. As a result of these developments in land-use, the forested area of Saint Kitts is no longer declining but appears to be increasing through secondary growth.

Of the 16,000 acres of forest, about 78% , or 12,500 acres is considered as natural forest. The remaining 3,500 acres of transitional forest consists of either new pioneer succession or secondary forests (Prins 1987).

Wildlife Status

Historically, the island maintained a large population of Agouti prior to arrival of the Spanish in the 15th Century. However the animal is now totally extinct (Ervin 1988). Other indigenous wildlife includes the green turtle (*Chelonia mydas*), Hawksbill turtle (*Eretmochelys imbricata*), Leatherback turtle (*Dermochelys coriacea*) and, the migrant Loggerhead (*Careta careta*).

Monkey

The African Green Monkey (*Cercopithecus aethiops sabeus*), also referred to as Vervets, was introduced to the island in the 17th century by French settlers. They were introduced as pets with Jesuit priests who migrated from Senegal and Gambia in Africa. As the island possessed no natural enemies of the green monkey, they rapidly multiplied and escaped into the rain forest. By the early 18th century they were considered pests and further introduction was banned.

In 1974, a team from the University of McGill conducted a 9 man-month survey on the population status of the green monkey (Ervin 1988). Despite a birth-rate of one offspring per female per year and an average trapping of 3,000-4,000 animals, the population was discovered to be alarmingly increasing. Deductions indicated a population of over 30,000 animals in 1974 and presently (1988) we estimate a population of 35-40,000 animals.

Turtle

Turtles have been indiscriminately hunted for a considerable period for both eggs and meat. To this effect indigenous species are considered as seriously threatened. To date very little research has been conducted on the biology and marine environment of these organisms. In addition, management via the Fisheries Division is limited to the application of occasional regulations concerning harvesting and size limitations. The reptiles tend to nest at discrete sites which include Belle Tete, Conaree, and the South-east peninsula of the island. However, despite the secluded nesting sites, the turtle is still viciously preyed upon.

Existing regulations provide for a closed season effective June 1st through September 30th annually. Generally, catch restrictions state 20 pounds as the lower limit and no product can be marketed during the closed season (Draft Fisheries Regulations 1983).

Caribbean Deer

A colony of small Caribbean Deer was introduced to the island in the 19th century by Mr. Todd. These originated from the Florida Cays (Ervin 1988) and were also introduced as pets. These animals never gained any significant population status and were confined to established ranches. However with the transfer of a small number to the south-east peninsula, a wild herd eventually developed. Presently these animals are restricted to the Canada Hills and the xerophitic scrub lands of the peninsula.

Their numbers have continued to be small due to the indiscriminate hunting by people and wild dogs. In addition, tick-borne diseases are posing a serious threat to the animals. The National Conservation and Environment Protection Act, 1987 now list the Deer as a protected species.

Mongoose

The Indian Mongoose was introduced as a predator for the control of field rats and snakes. There is however very little documented evidence on its historical significance; in addition, the presence of significant numbers of snakes on the island at the time of introduction has been seriously questioned (Ervin 1988). However, no snakes are however to be found on the island and this may be attributed to the presence of the mongoose. The mongoose is presently considered as a pest to wild birds and domestic poultry and is trapped to reduce its pest status.

Avifauna

Local bird-enthusiasts have reported the presence of over 130 species (including migrants) on the island (Table 2, Mallalieu 1988). Recent short-term studies have found and categorized over 70 species. It is estimated that about one-third of these species are migratory (Morris and Lemon 1982). For purposes of discussion five ecological zones have been identified with respect to the avifauna of Saint Kitts. Each will be briefly summarized.

Forests of Mount Liamuga, Verchids Mountain, and Surrounding Areas. These areas were declared a national watershed in 1903 (Beard 1949). Very little cutting has occurred since. Mount Liamuga is still weakly active and lush vegetation exists both inside and outside of the crater. With respect to topographic constraints and historical land tenure, there does not appear to be any immediate threat from development to the forests and their wildlife.

Typical birds of the montane forests are the Scaly-breasted and Pearly-eyed Thrashers, Trembler, Purple-throated Carib, Humming bird, Bananaquit, Rusty-tailed Flycatcher, Red-necked Pigeon, and Red-tailed Hawk (Danforth 1936, Ricklefs and Cox 1977, Morris and Lemon 1982).

Remnants of the rain forest may occur at lower elevations (below 1,000 feet), particularly in areas immediately adjacent to the mountains. These forested fingers extend along the natural drainage valleys even to the coast and consequently many of the forest bird species can be found therein (Morris and Lemon 1982).

Table 2. St. Kitts bird species list.

Common name	Scientific name ¹	Code
Shorebirds		
Great blue heron	<i>Ardea herodias</i>	MO
Little blue heron	<i>Florida caerulea</i>	RO
Green heron	<i>Butorides virescens</i>	UN
Yellow-crowned night heron	<i>Nyctanassa violacea</i>	RO
Snowy egret	<i>Egretta thula</i>	UO
Cattle egret	<i>Bulbucas ibis</i>	RO
Common gallinule	<i>Gallinula chloropus</i>	RO
Caribbean coot	<i>Fulica caribaea</i>	UN
Lesser yellowlegs	<i>Tringa flavipes</i>	UO
Greater yellowlegs	<i>Tringa melanoleuca</i>	UO
Common stilt	<i>Himantopus himantopus</i>	RO
Ruddy turnstone	<i>Arenaria interpres</i>	UO
Willet	<i>Catoptrophorus semipalmatus</i>	MN
Black-bellied plover	<i>Squatarola squatarola</i>	MN
Thick-billed plover	<i>Charadrius wilsonia</i>	RO
Snowy plover	<i>Charadrius alexandrinus</i>	RO
Rufous-naped plover	<i>Pagolla wilsonia</i>	MN
Semipalmated plover	<i>Charadrius semipalmatus</i>	UO
Sanderling	<i>Crocethia alba</i>	UO
Semipalmated plover	<i>Charadrius semipalmatus</i>	UO
Spotted sandpiper	<i>Actitis melanoleuca</i>	UO
Least sandpiper	<i>Calidris minutilla</i>	MN
Lesser scaup	<i>Aythya affinis</i>	MN
Blue-winged teal	<i>Anas discolors</i>	MN
Tree duck	<i>Dendrocygna spp.</i>	MN
Brown pelican	<i>Pelecanus occidentalis</i>	RO
Brown booby	<i>Sula leucogaster</i>	RO
Magnificent frigatebird	<i>Fregata magnificens</i>	RO
Laughing gull	<i>Larus atricilla</i>	RO
Sooty tern	<i>Sterna fuscata</i>	UN
Least tern	<i>Sterna albifrons</i>	RO
Roseate tern	<i>Sterna dougalli</i>	UN
Royal tern	<i>Thalasseus maximus</i>	UN
Brown noddy	<i>Anous stolidus</i>	UN

Table 2. (cont'd)

Common name	Scientific name ¹	Code
Terrestrial birds		
Rock dove	<i>Columba livia</i>	RO
Red-necked pigeon	<i>Columba squamosa</i>	RO
Zenaida dove	<i>Zenaida aurita</i>	RO
Ground dove	<i>Columbina passerina</i>	RO
Bridled qual dove	<i>Geotrygon mustacea</i>	RN
White-crowned pigeon	<i>Columba leucocephala</i>	UN
Peregrine falcon	<i>Falco peregrinus</i>	MN
Kestrel	<i>Falco sparverius</i>	RO
Red-tailed hawk	<i>Buteo jamaicensis</i>	RO
Osprey	<i>Pandion haliaetus</i>	MN
Yellow warbler	<i>Dendroica petechia</i>	RO
Black-whiskered vireo	<i>Vireo altiloquus</i>	RO
Black-and-white warbler	<i>Mniotilta varia</i>	MN
Parula warbler	<i>Parula americana</i>	MN
Prairie warbler	<i>Dendroica discolor</i>	MN
Hooded warbler	<i>Wilsonia citrina</i>	MN
American redstart	<i>Setophaga ruticilla</i>	MN
Veery	<i>Catharus fuscens</i>	MN
Northern waterthrush	<i>Seiurus noveboracensis</i>	MN
Louisiana waterthrush	<i>Seiurus motacilla</i>	MN
Scarlet tanager	<i>Piranga olivacea</i>	MN
Northern oriole	<i>Icterus galbula</i>	MO
Belted kingfisher	<i>Megasceryle alcyon</i>	MO
Lesser Antillean bullfinch	<i>Loxia noctis</i>	RO
Black-faced grassquit	<i>Tiaris bicolor</i>	RO
Caribbean elaenia	<i>Elaenia martinica</i>	RO
Stolid flycatcher	<i>Myiarchus stolidus</i>	RO
Grey kingbird	<i>Tyrannus dominicensis</i>	RO
Bananaquit	<i>Coereba flaveola</i>	RO
Lesser Antillean pewee	<i>Contopus latirostris</i>	RO
Pearly-eyed thrasher	<i>Margarops fuscatus</i>	RO
Scaly-breasted thrasher	<i>Margarops fuscus</i>	RN
Trembler	<i>Cinclocerthia ruficauda</i>	RN
Antillean crested humminbird	<i>Orthorhyncus cristatus</i>	RO
Purple-throated carib	<i>Eulampis jugularis</i>	RO
Green-throated carib	<i>Sericotes holosericeus</i>	RN

Table 2. (cont'd)

Common name	Scientific name ¹	Code
Purple martin	<i>Progne subis</i>	RO
Cliff swallow	<i>Petrochelidon pyrrhonota</i>	MN
Barn swallow	<i>Hirundo rustica</i>	MN
Collared swift	<i>Streptoprocne zonaris</i>	MN
Black swift	<i>Cypseloides niger</i>	UN
Guinea fowl	<i>Numida meleagris</i>	UO
Peacock	<i>Pavo sp</i>	UN

¹ Nomenclature after Bond (1979a, b).

Descriptive code

RO - Species observed by M.M.J. Morris and R.E. Lemon, March 26 - April 29, 1982. Presumed to be year round resident breeding on St. Kitts.

MO - Species observed March 26 - April 29, 1982. Presumed to be migrant or transient.

UO - Species observed March 26 - April 29, 1982. Status unknown.

RN - Species not observed but, on the basis of published accounts (Danforth 1936, Bond 1979b), is presumed to be a resident.

MN - Species not observed but, on the basis of published accounts, is presumed to be a migrant.

UN - Species not observed but previously reported. Current status unknown.

Farmlands - Sugar Cane Fields. Agricultural activity exists from the coastal plains up to elevations ranging from 800 to 1,400 feet. Cropping includes sugar cane as the major crop with small plots of vegetable and root-crops scattered between and above the sugar plantations.

Typical birds of the farmlands include the Gray King bird, which is often found perched on roadside utility poles hunting for insects; the Ground Dove, found along the cane roads and field edges; the Yellow Warbler, in secondary scrub and field edges; the Grassquit; and the Cattle Egret, found in association with farm animals and at land preparation sites. The Bananaquit, Antillean

Crested Humming bird, Lesser Antillean Bullfinch and Kestrel occur in association with human habitation (Morris and Lemon 1982).

Savannah Scrub. The south-eastern peninsula, due to periodic burning and extensive grazing has almost completely lost its original vegetation. It is now covered with a xerophytic association of fire-tolerant grasses, sedges, acacias, yuccas, and various cacti (Beard 1949).

The avifauna of the savannah-scrub is dominated by the Yellow Warbler, the Ground Dove, the Black-whiskered Vireo, the Grassquit and the Lesser Antillean Bullfinch. The sedge savannah towards the southern tip of the peninsula is noticeable lacking in bird life (Morris and Lemon 1982).

Ponds. The island has several freshwater and brackish salt water ponds which are very important centers of bird activity in both summer and winter. These ponds are located at Canada State, Conaree, Frigate and Friars Bays, and the southern tip of the peninsula. Some ponds contain abundant fish life such as Greatheeds and Frigate Bay ponds. Some ponds are heavily vegetated (mangroves) whilst others are of very limited use to birds.

A wide range of resident shore birds and migratory waterfowl are found scattered over these ponds. These include Black-necked Stilts, Lesser Yellowlegs, Ruddy Turnstones, Sandpipers, Plovers, Blue-winged Teal, Willet, Common Gallinule, Little Blue Heron, Yellow-crowned Night Heron, Snow Egret, Great Blue Heron, Brown Pelicans, Frigatebirds, Osprey, Yellow Warblers, Black-whiskered Vireos, Grassquits and the Lesser Scaup.

Coasts. The coast is primarily rugged and rocky, reflecting the volcanic origins of the island. However, there are some areas with sandy beaches. Birds that frequent the coast include the Frigatebird, Brown Pelican, Brown booby, Laughing Gull and a few species of Terns.

Problems of Wildlife Management

There are several problems that significantly affect wildlife management in Saint Kitts. These are listed and briefly summarized below.

- Of a fundamental nature is the inadequate staffing of both the Fisheries and Forestry Division of the Department of Agriculture. The Fisheries Unit has a two-man staff with no professional training except for periodic short-term courses. The Forestry Division is headed by an Agronomist with no wildlife nor forestry training. Three part-time rangers and forest guards (full time) complement the forestry officer. Except for the Forestry Officer, the staff has neither subprofessional nor short-term exposure to training.
- No wildlife parks nor reserves exist on the island. Monkeys roam the island at all elevations and constitute a severe economic pests; the small colony of Caribbean Deer thrives in the peninsula during the wet season and migrates to the north-western hills during the dry season. They are highly susceptible to tick-borne diseases.

- Commercial development and lack of public awareness of conservation measures are dangerously contributing to severe ecological damage. Greatheeds Pond, the primary brackish water pond in the island, is surrounded by a thick mangrove shield. However the mangrove still continues to be cut for charcoal production. The adjacent landfill poses a serious threat by encroachment, toxic leachates into the pond may be the major element causing large-scale of fish mortality. Present ongoing construction of a large masonry plant also adjacent to the pond will further exacerbate the situation.

Construction of a highway through the south-east peninsula will also encroach on two of the major ponds in the area. Developments in Frigate Bay have altered many ponds and have subsequently created a decline in stop-over visits by migratory waterfowl.

- Indiscriminate hunting and lack of law enforcement. During the annual hunting season (October-December), emphasis is placed on wild pigeons, doves and migratory waterfowl. These have been hunted so extensively in both the open and closed seasons that their populations have been seriously threatened. In addition, the large numbers of uncontrolled monkeys are becoming serious predators to nesting sites. Mallalieu (1987), Chairman of the Subcommittee on Wildlife and Natural History, proposed the institution of a hunting ban for the next 5 years. In one area, an established home of the Caribbean Deer (the Dale Mountains), the population has been reduced to one animal. Lack of forestry law enforcement is directly attributed to the grossly inadequate staffing of the Forestry Division.

Prospects and Progress of Wildlife Management

The outlook for forestry and wildlife management is very promising if recommendations suggested by Prins continue to be adopted. Prins (1987) identified two phases in the rebuilding of the Saint Kitts Forestry Division, namely: 1) the development of the Forestry Divisions' administrative capability, and 2) the development of the Forestry Divisions' technical capability. He noted that the development stages will not run in sequence but parallel to each other. It is expected that by 1992, the division will have its full complement of trained personnel.

The National Conservation and Environmental Protection Act #5 of 1987, further enhances the development of the Forestry Division and promotes wildlife management. In summary the Act provides for "the better management and development of the natural and historic resources of Saint Christopher and Nevis for purposes of conservation, the establishment of national parks, historic and archaeological sites, and other protected areas of natural or cultural importance including Brimstone Hill Fortress National Park, the establishment of a Conservation Commission, and for other matters connected thereto."

Activity under the act has already been initiated such as the protection of the Caribbean deer and 28 species of wild birds. In addition, the Conservation Commission is in the process of being established. An environmental working group, under the chairmanship of the Director of Agriculture has already initiated steps towards environmental education, nation wide.

Morris and Lemon (1982) proposed the following recommendations on education and public awareness:

- Development of an educational programme for schools to provide information on, and to promote interest in the islands' wildlife.
- Production of a series of booklets on the natural resources of Saint Kitts.
- Involvement of interested persons in the Christmas Bird Count of the National Audubon Society to accumulate data on local breeding birds.
- Inform the general public of the need for restricted use areas and how the island can benefit from their creation.

In the private sector, three agencies have focused on the harnessing and development of the enormous monkey population as a form of wildlife management. The Behavioral Sciences Foundation, has been active for the past 20 years in studies of the evolutionary biology of the animal. Another agency, the Saint Kitts Biomedical Foundation is utilizing the animal as an experimental tool in research. Recent work includes advanced studies of Parkinsons Disease and testing for the Acquired Immune Deficiency Syndrome (AIDS) virus.

A local enterprise, Caribbean Primates Ltd., exports an average of 8,000 monkeys per year. These are high quality selected animals that are used for vaccine production at various North American pharmaceutical companies. An export levy of E.C. \$20.00 per animal is received by the government.

With respect to Greatheeds Pond, also considered as a mosquito breeding site, the Forestry Division is considering the introduction of a selective species of fish to control the larvae.

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SAINT LUCIA'S WILDLIFE AND ITS CONSERVATION

Gabriel Charles

Having a relatively small land area of only 238 square miles and being isolated from the continental mainlands of North and South America, Saint Lucia, like its neighboring islands of Saint Vincent and Martinique, has a relatively poor avifauna. If we exclude the migrant shore birds and waterfowl as well as some of the vagrants that occasionally appear, Saint Lucia's wildlife comprises 52 species of birds, 4 species of mammals (excluding bats and aquatic mammals such as whales and dolphins), and a handful of reptiles. Despite this, and indeed as a result of geographical isolation, Saint Lucia does have a high proportion of endemics, and almost 10 percent of the nation's land birds are restricted to Saint Lucia. These include:

Saint Lucia Blackfinch (*Melanospiza richardsoni*)

This species is a small, all black (in the male), passerine with characteristic pink legs. It has a broad ecological range being recorded from the interior primary rain forest at La Sorciere to secondary growth and plantation forests at Edmund forest. It has also been recorded in edge habitat at Des Barras and arid sea level scrub at Caille Des. In all cases, it is found in the thick understory vegetation where it feeds predominantly on snails which it searches for amongst the dense leaf litter. Whilst not considered endangered, it is nowhere common and its numbers are not large enough to justify complacency.

Saint Lucia House Wren (*Troglodytes aedon*)

This small brown bird with a characteristic cocked tail and elaborate song is actually a distinct sub-species of the widespread House Wren. Formally more common, this species is now endangered and under continuous threat from habitat destruction and predation by the introduced Mongoose and Brown Rat. The Wren is found along the island's northeast coast between Marquis and Louvet, where it occurs in low density scrub typical of Caille Des and the riverine forests of Petit Anse where they feed on insects living under tree bark.

The Saint Lucia Oriole (*Icterus laudabilis*)

This species, the male of which is easily identified by its black and orange plumage, may be considered widespread but nowhere common, being found in a wide range of habitat types, i.e., primary forest, plantations, agricultural plots, scrub, gardens, and even mangrove. Although not presently endangered, it does face the threat of brood parasitism by the Glossy Cowbird (*Molothrus bonariensis*). The latter is expanding its range and on neighboring Martinique is a serious threat to their endemic Oriole which is the preferred host for this species. At present, the Cowbird is not widespread in Saint Lucia but continuing deforestation and the subsequent increase of open areas and grazing land could rapidly change this situation. Further, Orioles often nest around the edges of banana plantations and they may be adversely affected by the aerial spraying of oil-based fungicides such as Benlate.

Semper's Warbler (*Leucospeza semperi*)

Very little is known about this secretive gray ground-dwelling warbler. Not recorded since 1975, there is no record of its song nor description of its nest. Specimens of this species caught in the Piton Flore area in the early 1900's lie in the Smithsonian Institution, but recent searches for this bird have failed to find it. This bird may indeed have slipped into extinction without our knowing it.

The Saint Lucia Parrot (*Amazona versicolor*)

The Saint Lucia parrot, with its blue head, green plumage, and red breast is without doubt the most beautiful of our wildlife and arguably the most attractive parrot in the Lesser Antilles. Formerly widespread, being found wherever the forest remained undisturbed, today it is scarce and is restricted to the less accessible mountainous interior. Its decline can be attributed to human interference both directly through its being hunted for food and trade and through its being hunted for food and trade and indirectly through the illicit clearing of its forest habitat to produce charcoal and to make way for bananas, ground provisions, and marijuana. By 1950, its numbers had fallen to 1000, by 1977 to 100 and it was widely considered to be a species scheduled for extinction.

Releasing the plight of this species and anxious to conserve all the nation's natural heritage the Forestry Department commenced a progressive conservation programme which has since become a model for similar programmes elsewhere in the Caribbean. Today, arising out of a decade of hard work, the parrot numbers 250 and wildlife is a respected part of Saint Lucia's natural beauty.

Wildlife Conservation Programme

The programme comprised four fundamental components:

Legislation - Wildlife has been legally protected in Saint Lucia since the introduction of the Wild Bird Ordinance on April 25, 1885. It listed 44 species as being absolutely protected, giving them year round protection and a further eight species (principally ducks, pigeons and water birds) were given partial protection during their breeding season. The penalties for offences against the Wild Bird Protection Act were EC\$24.00. Porter in 1929 reported that the Ordinance was proving an effective deterrent and at the turn of the century the parrot population was on the increase. Soon, the penalties became outdated and the 1954 Act that increased them to EC \$48.00 was too little too late. By 1969, Wingate reported that hunting was widespread and that there was little regard for either the closed season or protected species.

From 1975 onwards attempts were made by the Forestry Department to have the 1885 Ordinance completely revised and FAO provided the service of Dr. Swank who had completed a similar ordinance in Dominica. This was subsequently modified by Butler and Charles and was eventually passed on September 19, 1980. This new Act afforded absolute protection to two mammals, four reptiles and eighty species of birds, and increased the penalties to a fine not exceeding EC \$5,000.00 or to a term of imprisonment not exceeding twelve months. The Ordinance also gave forest officers (and other de facto wildlife officers) widespread powers of search and seizure and allowed the Minister of Agriculture to add to or vary the various schedules.

Because of declining wildlife populations and the ravages of Hurricane Allen, the then Minister of Agriculture closed the open season on all species thereby giving absolute protection to all Saint Lucia's wildlife with the exception of rats, mice, mongoose and the poisonous Fer-de-lance.

To compliment its domestic legislation, in December 1982 the Prime Minister of Saint Lucia on behalf of its Government acceded to the Conservation on International Trade in Endangered Species of Wild Fauna and Flora (CITES), becoming the 83rd country to do so.

The purpose of CITES is to ensure that wild fauna and flora be protected for present and for generations to come, and it seeks to ensure international cooperation that is seen as being an essential component for the protection of species against exploitation through international trade. CITES functions on the basis of appendices, for example, Appendix 1 includes all species threatened with extinction which are, or may be, affected by trade. Trade in specimens of these species is subject to particularly strict regulation in order not to endanger further survival, and permits are only authorized under exceptional circumstances. The Saint Lucia Parrot and species of marine turtles are listed in Appendix 1 species.

In Saint Lucia, CITES is managed by the Forestry Department with the assistance of a committee comprising the Customs Department, Plant Quarantine, Veterinary and Fisheries Departments, and Saint Lucia has been well represented at the last three biannual meeting of CITES.

Establishment of reserves - By far the best way of conserving endangered species is to set aside areas of habitat as reserves where the threatened species may feed and breed with the minimum of disturbance. In recognition of this fact the Government of Saint Lucia has designated a number of reserves. The largest is the 17,000 acre Forest Reserve which is prescribed not only to protect endangered wildlife but also to conserve watersheds and areas of steep topography that if cleared would be liable to erosion. Smaller reserves such as the Maria Island Nature Reserve have been set aside for the specific purpose of protecting threatened fauna and flora, in this instance the endemic Maria Island Lizard (*Cnemidophorus vanzoi*) and the Maria Island Snake (*Promicrus ornatus*). In total, the government has declared 22 reserves and Table 1 defines their purpose and administration.

In establishing reserves, in particular those of the central rain forest and Marfa Islands, the government has not adopted a policy of excluding the public. It is strongly believed that to promote conservation, the concept must have grass-roots support, and one method to achieve such support is to encourage local people to visit reserves and to learn more about their natural heritage. Nature trails have consequently been established at several areas throughout the forest and guided walks are organized by the Forestry Department in conjunction with local youth groups and schools. Local people are guided free of charge, although groups of tourists visiting the forest are required to pay a fee of EC\$17.50.

With the assistance of CIDA, a multiple-use Management Plan has been prepared for the forest reserve, and its boundaries have been defined and demarcated on the ground. The newly revised Forest, Soil, and Water Conservation Ordinance provides legislative powers to protect this reserve and the government is presently considering a Crown Lands Policy which will enable the better long

term management of other areas owned by the Crown. Such areas include the "Queen's Chain" coastal mangroves and riverine scrub, all important wildlife habitats.

In the establishment and management of reserves, the Forestry Department maintains close links with other bodies involved in natural resource management including the Fisheries Department, the Saint Lucia National Trust and the Parks and Beaches Commission. It also maintains close links with regional and international conservation organizations and special mention should be made of World Wildlife Fund who provided radio and vehicles to assist in the initial establishment of a "parrot sanctuary" set aside for the conservation of *Amazona versicolor*. They have also assisted in financing a small museum/interpretation centre to focus attention on María Islands.

Environmental education - One of the areas with which Saint Lucia is justifiably proud is in the success of its environmental education programme. At previous meetings of the Caribbean Foresters' both Paul Butler and I have highlighted the various aspects of our work, and participants will be familiar with the production of "Bush Talk", a monthly environmental newspaper that is distributed to schools islandwide and which appears in the newspaper. It is sufficient to say that this programme continues and "Bush Talk" is now in its 80th issue.

To date two issues of the conservation comic "Jacquot" have been published and we continue to produce regular radio and television programmes, and school visits. Today I believe, Saint Lucia can proudly boast that the overwhelming majority of its people are aware of the parrot and support the Department's on-going conservation programme. With the assistance from CIDA, the Department's work in this field will continue. We plan to construct an interpretative center at Union Forest Nursery, to produce further issues of "Jacquot" and at this moment work continues on producing "Bush Talk" in booklet format.

Research and captive breeding - The forth cornerstone of work is to promote research into our wildlife species, the Department encourages visiting research teams to study and report on endemic species and in the last year, work has been carried out on the Saint Lucia Wren, Rufous Night Jar and White-breasted Thrasher. These reports help us to design conservation programmes, and to recommend to government areas to be set aside to ensure the long-term conservation of all our wildlife.

The Department continues to maintain close links with captive breeding organizations such as the Jersey Wildlife Preservation Trust. The latter is the centre for a breeding programme for *Amazona versicolor*. In 1975, a total of 9 young birds were held on loan there and in 1982, the first ever successful breeding of this species occurred. Almost yearly since then additional chicks have been raised and ultimately it is hoped that young birds will be returned for release into the wild.

Table 1. Designated natural reserves in Saint Lucia, their purpose, and administration.

Reserve	Administered by	Noted for
Marquis Mangrove waders/wildfowl	Fisheries Department	Migratory birds and fish nursery
Esperance Mangrove	" "	" "
Grande Anse Mangrove	" "	" "
Marigot Mangrove	Fisheries Department/ National Trust	" "
Savannes Bay	" "	" "
Praslin Mangrove	Fisheries Department	" "
Fond D'Or Mangrove	" "	" "
Choc Mangrove	" "	" "
Cas en Bas Mangrove	" "	" "
Mankote Mangrove	" "	" "
Louvet Mangrove	" "	" "
Bois D'orange	" "	" "
Fous Island	National Trust	Seabird colonies
Lapin Island	" "	" "
Ramier Island	" "	" "
Roche Island	" "	" "
Bateaux Island	" "	" "
Dennery Island	" "	" "
Frigate Island	" "	Seabird colonies/Colony of Frigate bird
L'islet Island	" "	" "
María Island	National Trust/Forestry Department	Endemic María Island, Lizard/María Island, Snake and Seabird Colony
Pigeon Island colony	National Trust	Historical importance and seabird

WILDLIFE OF SAINT VINCENT AND GRENADINES

Lennox Quammie

Vegetation

Saint Vincent and the Grenadines comprise of group of islands with an area of 150 square miles located in the southern sector of the Eastern Caribbean, and bounded to the south by Carriacou and Grenada, and to the north by Saint Lucia. For the most part, mainland Saint Vincent and the larger islets of the Grenadines, Linion, Bequia, Canouan and Mustique, are volcanic in origin, whilst the smaller cays are coralline in makeup. This variety of geological formation together with topography and climate has ensured that whilst we are a smaller nation, we have a good cross section of habitat types. The peaks of Richmond, Morne Garu and the Central ridge that run north to south on the mainland are covered with stunted growth characterized by Elfin Woodland, whilst the lower steep slopes are predominantly covered with Palm Brake and Scrub. The sheltered valleys of the central mountain range still remain under lush tropical rain forest, dominated by Santinay (*Sloanea caribaea*) and Gommer (*Dacryodes excelsa*). In the past much of this vegetation zone has been cleared to make way for agriculture, which today remains the predominant source of employment and foreign exchange. The coastal strip of the mainland is greatly undulating, with agricultural crops such as bananas, root crops, coconuts, and citrus. Where agricultural plots have been abandoned, secondary succession has taken place and scrubby regrowth dominates the landscape. To the extreme north of Saint Vincent is the highest mountain in the island, La Soufriere. This still active volcano, exceeds 4,000 feet in height and has a cover of Elfin Woodland. However, much of this forest cover was destroyed during the last eruption of 1979.

The Grenadines extend in an arc from the southern tip of Saint Vincent to Grenada and are generally less mountainous and covered with a climax vegetation of Naked Indian (*Bursera simaruba*) and white cedar (*Tabebuia pallida*). In the drier areas more xerophic vegetation occurs, including cactus and *Acacia*. Much of the dry vegetation has been disturbed by the grazing of livestock and the problem is accelerated with the "let go season" when goats and sheep roam freely. In the coast, several good stands of mangrove remain, especially in Mustique and Union Island. Black and red mangrove are in evidence. This wide variety of vegetation has ensured that Saint Vincent and the Grenadines, although small in size, support a diverse fauna.

Wildlife

Over 90 species of birds have been recorded within the boundaries of St. Vincent, although this includes about 30 that are strictly migratory species, such as waders and ducks.

The Saint Vincent Parrot (*Amazona guildingii*) is without doubt the most beautiful of the four remaining Lesser Antilles parrots and is still fairly widespread in the central forested areas of mainland Saint Vincent.

The Whistling Warbler (*Catheropea bishopi*) a small passerine, is found in the dense undergrowth of the high mountain forest. It has black upper parts, throat, and chest band, and the remainder

of its plumage is white.

The Hooded Tanager (*Tangara cucullata*) is a species whose range is restricted to Saint Vincent and neighboring Grenada. It is one of our most spectacular birds, being highly iridescent in coloration. Its upper parts are pale gold with blue-green wings and tail. Its head and undersides are buff with violet wash. This species is not uncommon, being found in secondary growth.

In Saint Vincent mammalian life is confined to exotic species such as the mongoose, Armadillo, and rats, as well as native species of bats and the Oppossum.

Saint Vincent has three snakes, the endemic black snake (*Chironius vincenti*) the white snake (*Elastigodyras bruesi*) which is also found on Grenada, and the congo snake.

Wildlife Management

Saint Vincent wildlife has recently received greater protection through the passage of the 1987 Wildlife Protection Act. This provides for three schedules or levels of protection. The first schedule, which includes most species and all endemics, comprises those that are absolutely protected year round. Hunting of these is liable to a EC \$2,000 fine. Schedule two includes species of dove, duck, and some wading birds as well as iguana and mammals. These species may be hunted during the open season. Schedule three includes unprotected pest species such as rats, mice, and mongoose.

The national bird (Saint Vincent Parrot) is given special protection, and any person who is found illegally capturing or exporting this species may be fined EC \$4,000. All captive parrots must also be registered.

The government of Saint Vincent and the Grenadines has also declared several wildlife reserves, including a large block of forest which is important parrot habitat. Other reserves include Kings Hill, Government House Grounds, and the Falls of Ballene. Another twenty islets or islands have been declared reserves principally to protect nesting colonies of sea birds.

Since independence in 1979 the Forestry Division of the Ministry of Trade, Industry, and Agriculture sustained protection of all of our wild fauna and flora. This was accomplished with assistance from World Wildlife Fund - U.S., The Wildlife Preservation Trust International, and the RARE Center for Tropical Birds. Not only have we declared reserves and enacted legislation but we have also constructed an aviary in our world famous Botanical Gardens. The aviary holds 12 parrots (*A. guildingii*). I am delighted to report that they are presently showing signs of breeding. Further, we are now actively engaged in an intensive and wide ranging education programme.

I would like to conclude by thanking all those agencies, some of whom are present today, for their generous support which has been essential in helping the government and people of Saint Vincent and the Grenadines to protect our Wonderful National Heritage.

THE SAINT VINCENT PARROT - (*AMAZONA GUILDINGII*) AND ITS CONSERVATION

Paul Butler

Saint Vincent is one of the Southern most islands of the Eastern Caribbean chain being situated at 13°15'N and 60°56'W. Although small in size (18 x 11 miles) its topography is extremely rugged, with central mountain chain running South/North and rising out of the sea on either side of the capital (Kingstown). This ridge runs north-east to Mt. St. Andrew, on through Grand Bonhomme and on northwards becoming more disjointed as it passes through Richmond Peak (1075) in the west and Mt. Brisbane (933 m) in the east. Soufriere at 1220 m lies on the Northern tip of the island and is an active volcano last erupting in 1979.

This central mountainous chain and the lateral ridges and spurs leading off from it remain forested being covered with palm break and in the more sheltered areas a climax vegetation of *Dacryodes/Sloanea* rain forest. It is here that the St. Vincent Parrot (*Amazona guildingii*) survives.

The St. Vincent Parrot is arguably the most beautiful of the four remaining lesser Antillean parrots with a body plumage of mostly golden brown, washed with green and with a white head flecked with yellow and violet and a green and violet blue tail broadly tipped with yellow. Nichols and Nichols (1973) points out that there are two major color morphs which they called the "yellow-brown" morph and the "green" morph. The green morph differing from the above description by having predominantly dusky green upper parts. *Amazona guildingii* is endemic to St. Vincent, being found nowhere else in the world.

The St. Vincent Parrot inhabits the humid forest principally in the ridges and sheltered valleys at lower elevations and where there are suitable large trees for nesting. It has also been recorded as occurring in partially cultivated areas where they come into contact with people. Andrie and Andrie (1973) encountered small numbers of parrots in forested areas at elevations from 350-600 m and extrapolated from aerial photographs that the potential breeding area is approximately 30 km². Lack (1971) reported finding parrots to be fairly common high up in the rain forest occurring in those valleys that lead up to the central mountain mass if although not present on the higher mountains which tended to be covered in palm break and dwarf forest.

Nichols (1977) claims that there are approximately 450 parrots on St. Vincent and that the rate of decline has been significantly less than that of *A. versicolor* on St. Lucia, and *A. arusiaca* and *A. imperialis* on Dominica. In the past and to a lesser extent today *A. guildingii* is under threat from a variety of factors, principal amongst which is habitat loss. Habitat loss can be attributed to a variety of factors not all of which are the actions of man. Indeed hurricanes and volcanic activities have in some areas caused more damage to parrot habitat than deforestation for charcoal and agricultural expansion.

There have been five volcanic eruptions of Mt. Soufriere since 1717 with 3 occurring this century in 1902, 1976, and 1979. In the last and most violent habitat destruction was confined to the slopes of Soufriere and adjacent areas, although the Morne Garu mountains and the northern slopes of

Richmond Peak were probably affected to some degree and the extensive development of poor secondary forest on the latter is defacto evidence of this. Nichols (1980) reported that the hot ash and toxic gases associated with volcanic eruptions have a direct detrimental affect on wildlife and said that individual parrots as far south as Buccament died as a result of the 1979 eruption.

Hurricane Allen also had an adverse effect. In neighboring St. Lucia some 56% of trees in parrot areas were affected either to the extent of major structural damage or the loss of leaves and fruit. Comparatively its effect on St. Vincent were less dramatic although subsequent to its passage in August 1980 forest officers reported a number of large trees having been damaged particularly in the Colonaire area. Parrots are cavity nesters and such structural weaknesses in trees make them especially prone to hurricane damage, and this combined with the loss of fruit (wind blown) makes hurricanes a serious threat to this and other endangered pasticipines in the region.

Encroachment of permanent agriculture and the common practice of shifting agriculture extends to the periphery of all the forested areas and has undoubtably caused much habitat destruction in the past. The pressure is most intense in the windward areas and as new roads open up areas for agricultural development the forest come under continued pressure. In part the problem lies with the definition of forest reserve, that all lands above 1000 feet are forest reserve, although the areas are not defined on the ground and in reality farmers have little way of knowing whether or not they are in reserve. This problem will shortly be addressed with the arrival of a CIDA team since part of their terms of reference will be to assist in the survey and demarcation of forest reserves.

Charcoal production like shifting agriculture is a very common practice particularly in the upper Buccament, Cumberland, Colonaire and Locust Valley. Typically hardwoods are utilized and their clearing contributes to the overall problem of habitat destruction and the demise of the *A. guildingii*.

Natural predation is probably limited and restricted primarily to the odd chick which may be taken from the nest by the Manicou (Common opossum) *Didelphis marsupialis* and the Broad-winged hawk (*Buteo platypterus*). The threat of nest site competition is likely also to be minimal. In Puerto Rico, St. Lucia, and Dominica the Pearly-eyed thrasher is an aggressive nest site competitor and has been recorded ousting parrots from their nest. This species is not found in St. Vincent.

Likewise it would appear that hunting is a negligible threat and the species is not one of those that has traditionally been used for food. However it is conceivable that occasionally a parrot may be shot accidentally if it flies over whilst hunters are out in search of the Red-necked pigeon (*Columba squamosa*) which is still hunted in some forested areas. Of far greater significance is the taking of young birds from the nest for sale to tourists and locals alike. Lambert et al (1982) reports talking to a "hunter" who claimed to have caught 27 nestlings during a 2-3 years period. He apparently sold birds to tourists by approaching them on the street and got \$50-100 EC for each.

In recent registration programme over 80 birds were found to be held in captivity on island and a further 48 are known to exist outside St. Vincent in Europe and America. The recent parrot registration programme, the confiscation of young birds by the Forestry Division, and tougher legislation should curb this serious problem.

According to Kirby breeding takes place towards the end of the dry season in April, the nest being in a hollow of a tree often *Dacryodes excelsa*. In April 1983 Nichols found two nests, one at 300 m in an *Ormosia monosperma* about 13 m up in the trunk and another at 470 m in a *Dacryodes excelsa* about 25 m up the trunk. The parrot lays two all white eggs which hatch in late April, early May and the young fledge 67 days after hatching.

Kirby (1972) warns that estimates of the present population of *A. guildingii* on St. Vincent can be very inaccurate, due primarily to the difficulty in counting birds when groups move so freely between valleys, ridges, and mountain slopes. At times the birds appear plentiful, while at other times few are seen. Estimates of "several hundred", "up to several hundred", and "about 200" have been made by various observers. Nichols (1978) determined the population to be about 525 and having the following distribution:

Buccament	80
Cumberland-Wallilabou	110
Linley-Richmond-Wallibou	130
Locust Valley-Colonaire Valley	150
Mesopotamia	30
Scattered elsewhere	<u>25</u>
	525

In July/August 1982 a team from East Anglia University spent two months censusing the parrot population utilizing parrot census techniques developed and employed by Butler et al. (1978) in neighboring St. Lucia. This methodology involves recording "sightings" of birds, the term "sighting" being defined as the individual movement of one bird. Each team member or observer positions himself at one of a fixed number of vantage points which are chosen to give as good a coverage of the area being surveyed as possible. Each time a sighting is made, the time, flight path and position were sketched and at the end of the observation period (two hours at dawn and two hours at dusk) all observations are collated and recorded. This census takes place island-wide and arising out of their study Lambert et al. estimated the parrot population to be approximately 421 ± 52 and having the following distribution:

Buccament	85 ± 20
Cumberland-Wallilabou	186 ± 12
Linley-Richmond-Wallibou	50
Locust Valley-Colonaire Valley	100 ± 20
Mesopotamia	0
Scattered elsewhere	0

Of the six areas where the St. Vincent Parrots were recorded in 1978 only four had parrots in 1982. Two of these localities had fewer and two more. It was believed that although the passage of Hurricane Allen in 1980 destroyed a substantial number of the parrots preferred nesting trees, the overall decline may be attributed mainly to shifting agriculture - this being the case in Mesopotamia.

Since the mid 1970's and the early prophosies of decline and possible extinction of this species the Forestry Division of the Ministry of Trade, Industry, and Agriculture has shown its concern. Operating with few personnel and financial resources its ability to patrol and protect parrots was severely restricted. Nevertheless over the years under the direction of its Deputy Chief Agricultural Officer, Mr. Calvin Nicholls, continuing efforts have been made to promote its conservation and encourage public awarenenses to the plight of this beautiful species.

This first bore fruit during the independence celebration when the Government of St. Vincent and the Grenadines declared the St. Vincent Parrot as the nation's National Bird. This was quickly followed with the Forestry Division confiscating seven *A. guildingii* which had been taken illegally from the forest. The programme was assisted with the generous donation of Posters by the Jersey Wildlife Preservation Trust (JWPT), these depicted the parrot and were distributed island-wide.

In 1982 Butler and Charles who were successfully forging ahead with a conservation programme for *A. versicolor* on neighboring St. Lucia visited St. Vincent and assisted the Forestry Division there to draw up a funding proposal, and to make recommendations as to conservation requirements for *A. guildingii*. Butler and Charles recommended a number of measures:

- The need to review and update the existing Wildbird Ordinance.
- The need to define and demarcate in the field all boundaries of the forest reserve.
- The need to set aside prime areas of forest as reserves to ensure the long-term habitat protection for not only the parrot but all other forms of forest fauna and flora.
- To strengthen the division's environmental education programme.
- To register and band all captive St. Vincent Parrots held on island and to construct an aviary complex in the Botanical Gardens to house confiscated captive birds and to eventually serve as an on-island Captive Breeding Centre.
- To census the wild population of *A. guildingii*.

Arising out of their visit a funding proposal was made to World Wildlife Fund US requesting financial assistance to cover the cost of a 4WD vehicle to assist in patrol work, radio communications equipment, funds to repair a ranger station, and to train forest officers in Wildlife Management techniques. World Wildlife Fund generously came to the assistance of St. Vincent and all items are now in place. JWPT was approached for funds to establish the recommended aviary and with supplementary assistance from Los Palmitos this aviary is complete and currently houses 12 birds, several of which have now paired and we hope will breed in the not too distant future.

In 1987 with St. Lucia's conservation programme showing remarkable signs of success (the population of that species rising from 100 in 1977 to 250 a decade later), the RARE Centre for tropical bird conservation offered to pay for technical assistance services to try to replicate the methodology used in St. Lucia on St. Vincent.

My terms of reference and that of the project in general were as follows:

- To question the public as to their perceptions of the parrot and forest in general.
- To design and distribute environmental education materials.
- To register and band all captive parrots held on the island.
- To provide advise and assist in the revision of the Wild Bird Protection Ordinance.
- To provide an overview and management guidelines for a proposed Parrot Sanctuary to be established by the Government of St. Vincent and the Grenadines.

I arrived in St. Vincent on January 6th, 1988 and whilst only three months have elapsed I am able to report on some of our work to date.

Wildlife Legislation

The Government of St. Vincent and the Grenadines repealed the Wildbird Ordinance and replaced it with a Wildlife Protection Act, this legislation not only includes mammals and reptiles but it is far more comprehensive giving Forestry Officers much greater powers and stiffer penalties (EC \$2,000 for the illicit hunting of protected wildlife and special provisions to protect *A. guildingii*). This law was passed and is now enacted. Several workshops have been held for both Forest and Extension Officers to appraise them of its content and implications.

Questionnaire Survey

One thousand questionnaires were distributed island-wide and a total of 804 responses were returned. These came from all parts of the country from Owia in the North to the Grenadines in the South, from Layou and Chateaubelair in the West to Georgetown in the East. The results of the Survey clearly showed that whilst the vast majority (95%) of Vincentians knew the parrot was their National Bird, far fewer realized that it was endemic to St. Vincent (55%) and fewer still realized that it was extremely rare (35%) numbering only some 450 and restricted to the forested interior, and only six persons accurately quoted the penalty for hunting or capturing a parrot.

What was especially encouraging was that the vast majority of these sampled felt that the parrot was a good choice as a National Bird (either because of its beauty, intelligence, or uniqueness) and that an overwhelming 69% of those questioned believed it to be "very important" to spend time and money protecting their National Bird. The fact that the majority of the people knew the parrot to be their National Bird was indicative of the past work of the Forestry Division which has highlighted this fact through the JWPT posters and media presentation.

The Production of Environmental Education Materials

One of the corner stones of the new conservation trust has been the strengthening of the Division's environmental education programme which uses the parrot, nick-named Vincie to promote the conservation island wildlife and the preservation of critical habitats. The Center for Tropical Bird Conservation (RARE) has produced a new parrot poster which has been welcomed and is now being distributed throughout the island, as are a quantity of badges/buttons depicting the parrot and the slogan "I love Vincie". These were also funded by RARE are given out at schools. The school programme is being supplemented by visits and to date 8 schools have received illustrated talks and with the kind assistance of St. Vincent Brewery an initial 12 issues of Vincie's Nature Notes are to be produced. This will follow a similar format to St. Lucia's successful Bush Talk and will appear in the National Newspaper, The Vincentian, as well as to be distributed free to schools island-wide. The first issue of Vincie's Nature Notes is to appear at month end. The text for a booklet entitled A-Z of St. Vincent's Wildlife is now completed and work has commenced on securing an artist to illustrate the production which is scheduled to be printed in August by the Government Printery.

The public education programme has been supplemented by newspaper articles (11 to date), radio programmes (12 to date), and TV programmes (2 features) as well as with the production of Bumper Stickers which are in the process of being distributed. Fifteen thousand of these have been produced again with the kind assistance of St. Vincent Brewery and will depict a color picture of the parrot together with the slogan: One love, One bird, One beer, Hairoun. April will also see the production of 4 colorful billboards which will be placed in prominent positions island-wide.

A song about Vincie has been written and a music video is being prepared. This will feature children dressed as parrots and is being sponsored by the Caribbean Banking Corporation. This will be played on SVG TV and audio cassettes will be given free to all schools courtesy the St. Vincent Chamber of Commerce. An essay competition has been planned and the winner will be taken on a flight over the island courtesy Mustique Airways.

Registration of Captive Parrots

All captive parrots on St. Vincent have now been registered and banded and some 80 birds are now listed. The custodians have signed an agreement not to sell or give away "their" birds and to care for them in a manner laid down by the Forestry Division. The birds themselves have all been inspected and unique numbered steel bands placed on the leg. Custodians were given two months to come forward and notices of the registration programme were posted island-wide and the exercise was covered by the media. There will be no further registration and no further birds will be removed from the wild.

Parrot Reserve

In the new Wildlife Protection Act the Government has made provision for the establishment of a number of reserves and has declared part of the forest reserve to be a preserve.

Parrot Census

Last month field work commenced on an updated parrot census again following the methodology developed in St. Lucia. Twelve days were spent in the field and later this month all the data will be analyzed and a revised population figure will be given.

The project has only just begun but it is already showing signs of success and I should like to take this opportunity to thank Mr. Nicholls, Mr. Johnson, and all the staff of the Forestry Division, for it is only with their help and dedication that we can proceed.

I should like to conclude by stressing that whilst the passage of legislation and the declaration of reserves are important aspects of any species conservation programme, education and the stimulation of awareness is the key to success. With species such as the Caribbean Parrots flickering on the edge of extinction it is easy to become despondent. However, with a well planned and throughout programme that has education as its cornerstone and dedication and hardwork these species can be saved. We've seen it work in St. Lucia, its working in St. Vincent, and there is no reason for it not to work elsewhere in these beautiful islands that we call home.

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WILDLIFE MANAGEMENT IN CENTRAL AMERICA

Víctor González

Looking across the Central American landscape, one can see the scars left by deforestation due to human and economic pressures. This deforestation is accompanied by loss of soils, fisheries and other resources. Secondary problems such as erosion, sedimentation, and pollution may also be initiated. Deforestation is considered to have reached such a level in most Central American countries that future economic activities, based on forest utilization, can never provide the returns they had in the past. In Central America, the destruction of forests is perhaps the major threat to the wildlife in the region. The acquisition of wildlife species as pets and the practice of hunting, augment the threat to wildlife.

Several causes can be found that contribute to deforestation. These causes are often complex and interrelated. More forest destruction results from the demand for the land on which the forests lie than results from commercial or non-commercial demand for the timber in the forest. In Central America land utilization is primarily for cattle ranching and for slash and burn agriculture, the fields of which are later converted to cattle pastures.

Belize is fortunate in not having yet experienced major deforestation. The reason for this situation can be attributed to the small population and the habitation of a significant portion of the population along coastal regions of the country. The lack of significant agricultural activities has also safeguarded wildlife habitat.

However, it is thought by many people that today, Belize is on the brink. In the jungles of Belize, the jaguar restlessly paces the forest floor; the scarlet macaw perches motionlessly with a look of apprehension; the red brocket deer sniffs danger in the gentle breeze. The wildlife of our forests seem to be waiting. They await the decisions regarding the development of agribusiness projects that would replace the forests. They await the sound of falling trees that would indicate where the next site of slash and burn agriculture is being established by incoming refugees, both legal and illegal.

The present economic situation in Central America points to continued use of forest resources. In Belize, the development of agricultural projects is seen as the key to our further economic development. This can only mean that forested areas will be destroyed. Sound ecological management of our resources and maximum productivity of cleared land is essential if a halt is to be made in the careless destruction of our forests and if some assurance is to be given to the continued presence of our wildlife.

In 1944, the Wildlife Protection Ordinance was enacted in Belize. This ordinance was later replaced by the Wildlife Protection Act of 1981. Both these pieces of legislation reflect the interest and commitment of the Government of Belize to preserve and protect the natural patrimony of the nation. In many instances, the Wildlife Protection Act is ignored by local people in rural areas. Some small-time sport hunters can also be accused of negligence when it comes to observing the law. Nevertheless some measures of success have been achieved by the Forestry Department in halting the

exportation of animals from Belize for the international pet trade. Many species of animals, that are considered endangered or threatened in other Central American countries can still be found abundant in Belize. These include: howler monkeys, brocket deer, jaguar, puma, and tapir. Reasons for their abundance can be attributed to the small population of the country and the low level of forest habitat destruction. We would further like to think that the abundance of Belizean wildlife is attributed to the fullment and observance of the Forest Policy of the government which was established in 1954 and which states specifically that one of its purposes is to bring about an increased appreciation of the need for, and aims of, forest conservation amongst the public.

The aforementioned act serves as the legal basis for wildlife protection in Belize. The Ministry of Agriculture, Forestry, and Fisheries is cognizant of the need to encourage conservation practices throughout the country and has indicated its intent in providing the leadership in this area and in the coordination of institutions involved in all aspects of wildlife management, research and dissemination of information.

The Government of Belize, through the Ministry of Agriculture, Forestry, and Fisheries, has decided to produce a National Tropical Forestry Action Plan along the lines of similar efforts now underway in more than 40 other tropical nations. The plan will include conservation as a major component, and priorities for wildlands protection, wildlife management, and training of Belizeans, will be identified as an important part of the process.

Recently the "Programme for Belize" was established. This programme is a private non-governmental initiative of a group of conservation organizations working with Belizeans and the Belize Government. The programme covers a variety of projects in land conservation, biological inventories, wildlife management, professional level training, and conservation education. A technical advisor has been assigned to the Government of Belize with the responsibility of helping to establish a new Department of Conservation. This new department would begin the work of identifying national conservation priorities and identify needed amendments or additions to existing legislation for parks and wildlife. While it is clear that the Government of Belize is committed to the pursuit of a conservation strategy, it is equally clear that such a strategy will be done within the general philosophy of sustainable development. In both the Wider Caribbean and Central America, non-governmental organizations have a crucial part to play in promoting appropriate wildlife management in their respective countries. Several organizations in Belize are involved in some way with the wildlife protection effort. The Belize Environmental Center serves as a documentation and research organization. The Belize Zoo and the Belize Audubon Society are both involved in conservation education by way of slide presentations, publications, and public lectures.

The Belize Zoo has been carrying out and continues to carry out a campaign aimed at bringing the attention of the Belizean public to the plight of the manatee. While Belize is said to have a healthy population of manatees, the constant hunting of the manatee as a food source could threaten the availability of the existing population. Zoo personnel have also been carrying out breeding programs aimed at restocking threatened populations. One such project had to do with replenishing the number of iguanas in the wild. The iguana serves as a food source for many rural communities.

The Belize Audubon Society has been entrusted with the interim management of several of the protected areas of the nation. It is the responsibility of the society to provide the resources required for the development and maintenance of these protected areas. Each of the protected areas has its own unique characteristics. Half Moon Caye Natural Monument, established in 1982 as a reserve under the National Parks System Act of 1981, is a sanctuary for the colony of red footed booby birds that inhabit Half Moon Caye. Part of the surrounding sea is also included in the protected area. Over 90 species of birds have been recorded on the cayes of which some 75 are migrants. Three members of the lizard family are found on the cayes. Loggerhead turtles and hawks-bill turtles lay their eggs on the sandy shores. Both these turtles are exploited for their meat and the hawksbill's shell is used to make jewelry and other items for the tourist trade.

The Government of Belize established the Crooked Tree Wildlife Sanctuary in November of 1984. The sanctuary, consisting of a network of inland lagoons and swamps, serves as the habitat for thousands of birds, both migrants and residents. These include the boat-billed herons, the chestnut-billed herons, the bare-breasted herons, the muscovy and the shistling ducks and many more. The sanctuary also provides a home for the black howler monkeys, Morelet's crocodile, the coatmundi and several species of turtles and iguanas. Jabiru Storks, the largest flying birds in the New World, with a wing span of 10 to 17 feet can be found in the sanctuary and two nesting sites have been located there. Belize has the largest nesting populations of these birds in all of Central America.

The Community Baboon Sanctuary was established in 1985 to protect one of the few healthy black howler monkey populations in Central America. This monkey is considered an endangered species. It has a very limited range that includes Belize, southern Mexico, and isolated areas of Guatemala.

The sanctuary is a unique exercise in conservation. It is a completely voluntary programme made possible by private landowners within active farm communities. Most of the landowners in the 18 square mile sanctuary on the Belize River have signed voluntary conservation pledges. This pledge is a commitment to protect forests along the riverbanks, to leave food trees of the howler monkey standing when clearing land and also to maintain corridors of forest around farmed areas. These measures have the effect of reducing erosion, preventing river siltation and allowing for more rapid replacement of forests after slash and burn clearing. The establishment of the sanctuary can be considered most timely in light of reports that Guatemala and El Salvadoran immigrants have been hunting them as a source of meat.

In 1984, the Government of Belize declared the Cockscomb Basin Region of the country a forest reserve. This area of 154 square miles is located in the southcentral part of the country. In 1986, some 3600 acres of this reserve was set aside as a wildlife sanctuary. Cockscomb Basin Wildlife Sanctuary has the highest density of jaguars yet recorded. The Cockscomb Basin protects a goodly percentage of the flora and fauna of Belize. In this region can be found the endangered Ocelot, the Margay, Baird's Tapir and the Scarlet Macaw. The lush jungle of the region also provides a refuge for over two hundred and ninety (290) species of birds.

In its efforts at providing the necessary resources for the maintenance of these nationally protected areas, the Belize Audubon Society is making its mark in wildlife management. As

indicated, Belize is unique in tropical America in having most of its natural resource base still intact. Although the forests have been exploited for timber resource, a relatively large forest estate exists both on government and private lands. Other ecological life zones are also undisturbed, e.g., wetlands and most mangroves.

The efforts mentioned reflect the commitment of both governmental and non-governmental agencies in promoting wildlife management. From all indication, Belize is on its way to becoming a model in its efforts at combining conservation with its economic development.

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DOMINICA MULTIPLE LAND USE PROJECT

Peter Evans

Overall Objectives

To find ways in which agriculture and forestry in Dominica may develop without detriment to conservation interests, since the primary natural resource of the country is rain forest trees. This involves identifying precisely those areas likely to give the greatest economic productivity but also determining the consequences of different forms of disturbance and their effects on species diversity and stability of the complex food webs of the forest ecosystem, so that an integrated management plan may be developed.

Background

Dominica is a small economically poor country. With an average income per person of 370 US dollars, it is in the bottom quartile of national incomes in the world. Its economic situation was made worse recently by two crippling hurricanes in the autumns of 1979 and 1980 which destroyed virtually all the houses on the island, made roads impassable, destroyed much of the banana crop, and killed or uprooted an estimated five million trees in the southern third of the island. Dominica has no mineral resources, no light industry, and tourism is little developed. It depends primarily upon agriculture (particularly bananas) and with between 60 and 75% of the land surface covered by forest, there is increasing pressure in these areas either for timber or land clearance for agriculture. Indeed, with the recent improvement of the road systems through foreign aid and subsidies towards agriculture and lumbering, more forest has been destroyed in the last ten years than the previous thousand. Despite its small size and isolated position in the centre of an island chain, Dominica has a natural vegetation comprising some thousand species of flowering plant, probably closer to its original state than the vegetation of any other island in the region. Its rain forests are considered amongst the finest in the Caribbean with around sixty tree species of greater than 10 cm girth in an area of 1,000 m² (Evans, 1986a). This rich natural resource is fast disappearing and it is urgent that an enduring balance is sought between conservation and development.

Objectives

Community Diversity and Structure

The criterion we use to reflect a healthy ecosystem is a variety of sustainable communities of animals and plants. Within these communities there should be a wide assemblage of species with representatives from a range of families. In each natural habitat, we have determined the diversity of species, their densities and species composition for woody plants, birds, mammals, reptiles, and butterflies. We shortly hope to extend this to amphibians and to other insect groups. We have then collected the same information from adjacent lands that have been modified either by natural disturbance (hurricane damage), by logging for timber, or by clearance for various forms of agriculture. This has involved an enormous amount of work using different census and sampling techniques, making comparisons between different seasons of the year, replicating results within

each habitat, and comparing the effects of different forms of agriculture. We can now make a number of important conclusions:

- The hurricanes of 1979 and 1980 had effects on all parts of the island. Even on the northern slopes of Morne Diablotin, gaps were created in the forest, and our vegetation quadrats indicate in all but the most sheltered areas, a greater presence of secondary plant species than would be expected without such disturbance. In those northern areas of the island, the minor disturbance caused has probably actually promoted species diversity, and since hurricanes are regular, this may help to explain the unusual richness of the forests in that region. Nevertheless, minor disturbance can have detrimental effects on particular species. Notable amongst these have been the two species of parrots whose population sizes were reduced following the hurricanes. Although the red-necked parrot is showing some signs of recovery, the Imperial parrot remains at perilously low numbers. South of the Layou river, the damage has been much heavier and more extensive. Besides killing an estimated five million trees, many others suspended sexual reproduction, and the absence of fruit has had an important effect on various frugivorous birds (parrots, forest thrush, and trembler). Loss of roosting sites has probably also been a major cause of the decline of bat species like *Molossus* and the absence in the south of the rain forest species *Eptesicus*.
- Growing of the two tree crops banana and citrus is compatible with conserving the native animals if certain rules are followed (Evans 1986a, b, c). They serve conservation interests best when grown together at not too high densities, and in relatively long and narrow plantations. This provides a high ratio of edge to centre which benefits a greater diversity of animal species. It is important for many forest birds (e.g. parrots, ruddy quail dove, forest thrush, trembler and thrashers, and Lesser Antillean flycatcher) and mammals (e.g. agouti and bat species such as *Eptesicus*, *Ardops*, and *Monophyllus*) that corridors of forest at least 10 m (preferably 20 m) broad are left standing between plantations. This simple policy would conserve the great majority of native species. A few species do require large areas of intact forest to be able to survive. This is clear when comparing density-diversity curves for natural vegetation with those modified by various forms of agriculture. It is always the rare species which are lost from the community, and our observations (including radio tracking studies) reveal that these require the largest home ranges. The most obvious examples are the two parrots and the forest thrush. For their long term safety, we recommend the protection of those forests on the sloping lands that rise to the peak of Morne Diablotin. Much of this already has some protection as a Forest Reserve but certain regions (e.g. forests within the Dyer, Syndicate, Morne Plaisance, and Hampstead Estates) do not, and where they protect the watershed or occur along ridges, they should be reserved.
- Coconuts, coffee, and cocoa are tree crops which can also be grown without great detriment to wildlife so long as plantations are mixed with trees such as mango, pawpaw, and citrus, and/or with other pioneer native species. On their own they cannot support more than a very few species. They should also always have undisturbed tracts of forest nearby. Root crops such as dasheen and tannia, and shrubs such as guava and bayleaf support little wildlife, and so cause least harm where grown beneath or alongside trees.
- Cultivated tree crops such as banana, citrus, and coconut are not by themselves favoured by more than a few species (bananaquits, bullfinches and hummingbirds amongst birds, and frugivorous

and nectar-feeding bats amongst mammals). On the other hand, if the plantations are in seasonally dry areas and have some leaf litter (particularly in coconut plantations), they can support a reasonable biomass of reptiles, and similarly a variety of butterfly species. Bats are almost certainly attracted to plantations with fruit crops and they cause some damage. This could be reduced if stands were mixed non-food plants.

- Rain forest is not the only important natural habitat which needs protection. The coastal woodlands and swamp support a number of species rare or absent elsewhere. They are now represented by only isolated patches and these require urgent protection. The most important wetland areas are Cabrits Swamp, Indian River flats (including Glanvillea Swamp), North Coast Swamps, and Canefield Pool and adjacent meadows. During late summer and autumn these form feeding grounds for many species of migrating North American waders, and for a variety of egrets, herons, and waterfowl. They also attract various North American passerines such as northern waterthrush, ovenbird, and American redstart. Cabrits and Glanvillea also support large populations of crabs and their vegetation includes large patches of *Pterocarpus officinalis*. The North Coast Swamps are of particular botanical interest, possessing the only mangrove species present on Dominica - *Avicennia germinans* and *Laguncularia racemosa*.

The coastal woodlands are the most important habitats for reptiles, and notable amongst these are the endemic ground lizard *Ameiva fuscata*, the very rare *Iguana delicatissima* and the snakes *Clelia* and *Typhlops*. They also support most of the 53 butterfly species recorded on the island. Those bird species which occur primarily in the dry coastal woodlands include American kestrel, Zenaida dove, common ground dove, mangrove cuckoo, red-legged thrush and streaked saltator. Most bat species have catholic habitat preferences but *Artibeus* in particular favours coastal trees such as *Calophyllum*, *Ficus*, and *Tabebuia*. The most important areas that need protection include Morne Espagnol, Plat Coubaril, Plat Ma Pierre, Gabriel, Morne Raquette, Deux Jardins, and Crabier (dry scrub woodland areas on west coast), and Temple, Bagatelle, Bellevue, and Belvedere (littoral woodland on the east coast).

Plant-Animal Interactions

Animals and plants depend upon one another in many ways so that if one group is affected in some way, it is likely to have an impact upon the other. We find that six of the seventeen mammal species are dependant upon fruit or nectar. Nearly 70 percent of the Dominican avifauna feeds at least partly upon fruit, with a further four species taking nectar. Many insect species are pollinators of flowers. Most frugivorous and nectarivorous species have generalist diets, feeding opportunistically on whatever is in flower or fruit within certain constraints. Radio-tracking and color-marking of several bird species show that they have shifting home ranges which strongly overlap one another both within and between species. Indeed, at least fifteen individuals of a particular species may feed at a single fruiting trees over a short period. Those birds most vulnerable to loss of habitat have the largest home ranges, and when this becomes fragmented they are probably forced to their energetic limits. The important implications of this is that if rain forests and coastal woodlands become too fragmented, they will not sustain population of birds which are crucial for the dispersal of their seeds. Studies of various tree and shrub species show clearly that their distributions are usually determined

by animals which disperse their seeds. Within a plant species, the distribution is generally clumped. Radio-tracking studies showed also the importance of edge habitats for many frugivorous birds, and the same applies even more to the nectar-feeding species.

Mist-netting and radio-tracking of frugivorous bats highlighted the use they make of plantations where presumably it is energetically more efficient to feed. Although banana plantations are visited, particularly by the smaller frugivorous and nectarivorous bats, citrus groves (particularly if they include guava, mango, wild almond, and sapodillas) receive the greatest attention. These bats have the potential to damage a significant portion of fruit crops although it is likely that most of the damage is done to fruit which is already too ripe for picking. This will form the subject of a special study in the near future.

Although many bat species feed extensively in plantations, some of these are thought to use forest trees as roosting sites, and may depend upon certain fruiting forest trees at times when other tree crops are not in fruit. The long term requirements of these bats are not yet clearly known and in future we shall be concentrating upon the seasonal uses they make of different food resources. Trees may not only be important to frugivorous bats, but could provide the habitat for many insects upon which other bat species feed. Many insectivorous bats occur along the edges of forest and plantation, and particularly over streams. So far, we have little information on their insect prey, and none on the distribution and abundance of these prey. One species, *Eptesicus fuscus*, is restricted to rain forest areas, and we have yet to determine what habitat requirements limit its distribution thus.

Agoutis are rodents of the rain forest. They feed upon fruit and seeds that fall to the forest floor, and often gather these together into food caches. Many local Dominicans hunt them for their meat and there is some potential for either farming them in captivity or stocking the forests with higher densities as a much-needed additional source of protein. We hope to investigate the practicalities of these two proposals. In the case of the latter, this will require determining the existing population levels of agoutis, their food requirements, and the ecological consequences of increased stocking of the forests for a sustained harvest.

Endangered Species

The presence of extensive forests until recently has meant that few terrestrial species are endangered. With the exception of one reptile, all are bird species. The most notable are the two endemic parrots, red-necked and Imperial. These have formed a special study (Evans 1987a) where we have attempted to determine their population sizes, distribution, and habitat requirements as well as monitor changes in numbers since before the hurricane. Our current estimates are of total populations of about 200 red-necked parrots but only sixty Imperials. Although the former is showing some signs of recovery, and is returning to areas previously occupied before the hurricane, the latter has shown little change in status over the last seven years. The future of the Imperial parrot clearly requires urgent attention. We have identified some unprotected areas which are important to both species, and are presently attempting to raise funds to set up a reserve here, together with the infrastructure for conservation, education, and research (see Evans 1987a, b for details). If successful, our project should not only safeguard the parrots but also some of the most important areas of rain forest in Dominica. At the same time, we shall then be able to develop a program of research

into the best combinations of agricultural crops to cause minimum impact to the forests.

Some other bird species are either endangered or very rare, although all of these may be found on other islands. The bridled quail dove has only been recorded twice in the last few years, and the forest thrush is undoubtedly rare. Of marine birds, the most notable is the black-capped petrel, a seabird once thought to be extinct until rediscovered in the Greater Antilles. Although breeding has not been proved, a small population almost certainly exists and the species has been recorded on three occasions over the last five years.

The other endangered animal is a reptile, *Iguana delicatissima*, which occurs in very small numbers in isolated fragments of coastal woodland. We believe that habitat destruction has played a major role, along with hunting by humans. Another endemic reptile is the ground lizard, *Ameiva fuscata*, which though not endangered is certainly vulnerable to further loss of coastal woodland habitat (Bullock and Evans 1988).

No mammals are thought to be endangered. The nectarivorous bat *Glossophaga longirostris* has not been recorded for fifty years, but it is not clear whether this was an isolated occurrence or a former population which may now be extinct. Of other bats, *Eptesicus fuscus* is rare and confined to rain forested areas, though this species was only discovered six years ago (Hill and Evans 1985). The frugivorous bat *Ardops nichollsi* and the insectivorous *Myotis dominicensis* are both confined to the Lesser Antilles and are rare in Dominica.

We have little information on the status of the great number of insect species present on the island. No insect species is known to be endemic, although there is a local race of the Hercules beetle *Dynastes hercules hercules* in the montane forests of Dominica. None of the 53 species of butterfly that we have recorded is endangered.

There are six endemic plant species that we have recorded in Dominica (Whiteford 1987). One of these, *Sabinea carinalis*, with its brilliant red flowers, is designated the National Flower of Dominica. The others include *Inga dominicensis*, a large montane shrub with scented white flowers, *Besleria petiolaris*, a yellow-flowered succulent shrub of montane thicket, two small composite shrubs with white flowers, *Chromolaena impatioides* and *C. macrodon*, both found only in elfin woodland on Morne Diablotin, and *Pitcairnia micotrinensis*, a yellow-flowered terrestrial bromeliad occurring in the Valley of Desolation. None of the plants are considered endangered, although some of the above with distributions restricted to isolated montane regions are obviously vulnerable.

Agricultural Productivity

The significance of forests for the maintenance and improvement of agricultural productivity is rarely appreciated by local farmers. They see the forests as an obstacle to development, and readily use their chain saws to remove that obstacle whether or not they intend to grow crops underneath. However, the forests serve three important functions to the farmer: (1) they are crucial for the cycling of water. Once destroyed, the entire local climate is affected, the watersheds lose protection, and there is ensuing loss of soil and nutrients by erosion during heavy rains; (2) most of the nutrients are bound up in the trees and once removed, the soils quickly lose their fertility, requiring expensive

inputs in the form of fertilizers; and (3) they serve as important windbreaks during the annual hurricane season when high winds can blow down large numbers of bananas.

We have started carrying out nutrient analyses of soil samples within different vegetation types, and in different plantations of varying age. These indicate the importance of rain forest trees for the input of nitrogen and phosphorus, and suggest that some tree species may be more important than others in the amounts of nutrients that they contribute. This is an area of research we hope to develop in particular in the future, despite the time and expense required for such analyses. We also intend to set up experimental plots with various crop species to determine the best planting schemes for maximum productivity. It is likely that certain forest tree species should be favoured within windbreaks for nutrient input, although the effects of shade and root competition will also need to be examined. We envisage that the best scheme shall be a mosaic of forest and plantation, the latter intersected by corridors of forest which act as both windbreaks and nutrient sources. The experimental studies referred to above should identify which tree species are important within these windbreaks, and the best shapes and sizes for the plantations for maximum productivity.

The results of our research on the best ways to maximize agricultural productivity without detriment to conservation interests will be of little use unless they are widely disseminated amongst government and farmers. We therefore intend to prepare a series of leaflets on various aspects and complement this with taped programs for broadcast on radio.

Conservation Education and Nature Tourism

Rain forests can be viewed not only as a resource protecting watersheds and providing nutrients and soil stability for agriculture; they may also be used for recreation and educational purposes. This is an aspect that has scarcely been developed anywhere in the world and yet they have an important role to play at the same time providing much needed revenue. Rain forests in many tropical regions are relatively inaccessible. This is notably not the case for the forests of Dominica which can be readily reached from any part of the island within a half hour car journey. To date, attention has focused upon the Morne Trois Pitons National Park in the southern half of the island. Unfortunately this does not contain the richest forests, and the effects of hurricane damage are always much greater to this more exposed region. There are no resident parrots in the National Park and many of the typical forest birds and mammals (bats) are rare here.

Working together with the Forestry Division, we hope to establish the infrastructure for visitors to observe and learn about the fauna and flora of rain forests and conservation issues. If we can raise sufficient funds, this would be set up within the proposed reserve on Morne Dyer estate, on the slopes of Morne Diablotin. Our plans will be to construct a visitors' centre for the purpose, with facilities for visual displays, audio-visual slide programs, and viewing platforms. By planting selected fruiting and flowering species, we hope to attract a range of attractive forest birds (e.g. parrots and hummingbirds) around the vicinity of the centre. Other food sources will be provided to attract various butterflies. We hope the viewing platforms may be sited to overlook the Picard valley, which contains some of the finest undisturbed forest in the Caribbean where parrots and other forest birds can readily be observed. Picnic and toilet facilities would also be provided within the centre.

From the visitors' centre to the proposed research/guard station, a network of nature trails would be set up. An accompanying leaflet would also be produced to help guide visitors in what animals and plants they can expect to see.

We already have collected much of the material for use in visual and audio displays, but still need to design and draw suitable graphics. Alongside such materials, it is hoped to have a regular educational newspaper for school children which would be organized by the Forestry Division but with help from ourselves and other sources. The future of Dominica's forests and the wildlife within them obviously lies ultimately with future generations, and it cannot be stressed too greatly the role that education can play here.

For the development of nature tourism, it is important that visual material and information on Dominica's wildlife are available to tourist agencies both within Dominica and abroad. We have started working towards this aim in conjunction with the Dominica Tourist Board and a company (called Traveller's Tree) has been set up to run regular Nature Tours to the island. There are also plans for a film to be made about Dominica and its wildlife for release to the American and European television markets.

Support to Local Personnel

Dominica's Forestry Division is unusual in the world in comprising a group of foresters very dedicated to conservation. Many have received more intensive training than is usual amongst Forestry personnel in other West Indian countries. Nevertheless, there is always a need for further training particularly of the younger officers and guards. We hope to help by organizing workshops and seminars that bring together persons with a variety of expertises both from outside and within the Caribbean.

Like other sections of the Civil Service, the Forestry Division has to work with limited resources, particularly with respect to transport and equipment. Most of these needs are answered by donating the necessary items or providing the funds to purchase them. This requires separate fund raising with support from outside agencies.

The management and conservation of Dominica's forests lie ultimately with the Forestry Division and not with the efforts of external bodies such as ourselves. We therefore hope to cement close links with the Forestry Division over the coming years so that there may be an easy transition when eventually we may have to withdraw our participation.

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CURRENT STATUS OF THE PUERTO RICAN PARROT CONSERVATION PROGRAM

Gerald D. Lindsey, M Kelly Brock, and Marcia H. Wilson

Historical Perspective

At the time of Columbus's discovery of Puerto Rico in 1493, the island was completely forested and the Puerto Rican parrot (*Amazona vittata*) was abundant and widespread. Wiley (1981) estimated that up to 1 million parrots inhabited Puerto Rico and 3 of its offshore islands.

In the 18th century, Europeans began clearing large tracts of forest in Puerto Rico. By the latter half of the 19th century, 1 million people inhabited the island and 75% of the land was cleared for agriculture (Wiley 1981). By 1912, Wadsworth (1949) estimated that less than 1% of the virgin forest was left. The parrot, dependent on the forest for food and nest sites, suffered at the expense of this habitat destruction to the point of disappearing from all offshore islands and from all but 5 mainland sites by 1920. By about 1940, the only remaining population was located in the Luquillo Mountains, the largest area of virgin vegetation left on the island (Snyder et al. 1987).

Although loss of habitat was the primary factor responsible for the historical decline of the parrot, they were also used as food and pets, and shot as crop pests. Once their numbers were low, severe hurricanes in the early part of the twentieth century undoubtedly took their toll as well.

In 1937, Wadsworth (1949) estimated that about 2,000 parrots still existed in the Luquillo Mountains. But by 1954, Rodríguez-Vidal (1959) found only about 200 birds. Snyder et al. (1987) suggested that the reason for this decline was primarily the result of 2 management policies: 1) encouragement of timber removal and charcoal making, and 2) opening up the forest with trails and roads. As a result, large nest trees were selectively removed and many people gained access to nesting sites of the parrots.

From 1953 to 1956, food habits, nesting habits, movements, and predators of the parrot were examined by the Fishery and Wildlife Section of the Puerto Rico Department of Agriculture and Commerce (Rodríguez-Vidal 1959). By 1966, Victor Márquez counted 70 birds and in 1968 only 24 parrots remained (Snyder et al. 1987).

The drastic decline in the 1960's was attributed to a combination of poor reproduction and high mortality. The major factors were nest-robbing, nest site scarcity and inadequacies, nest predation by pearly-eyed thrashers (*Margarops fuscatus*), predation of young and adults by red-tailed hawks (*Buteo jamaicensis*), and parasitism of nestlings by warble flies (*Philornis pici*) (Snyder 1978; Snyder and Taapken 1978; Wiley 1981, 1985a; Snyder et al. 1987).

In 1967, the Puerto Rican parrot was listed as an endangered species, and in 1968 a cooperative program to save the only extant native parrot species in U.S. territory began. Initially, the program was supported by the World Wildlife Fund, the U.S. Fish and Wildlife Service, and the U.S. Forest

Service. Today, the U.S. Fish and Wildlife Service leads the effort with substantial support from the U.S. Forest Service and the Puerto Rico Department of Natural Resources (formerly the Puerto Rico Department of Agriculture).

In order to guard against extinction of the species, a captive breeding program was initiated in 1971 with the acquisition of 2 females donated by the Mayaguez Zoo. These birds and a wild-caught parrot were placed in captivity at the Patuxent Wildlife Research Center in Maryland. But, because of an outbreak of Asiatic Newcastle disease in Puerto Rico and the prospect of an indefinite continuation of rigorous quarantine requirements, plans were developed for a field aviary in the Luquillo Mountains (Snyder et al. 1987). In 1973, 5 birds were taken as eggs or chicks from the wild and placed in a renovated 2-story cement building located near El Yunque Peak. By 1979, the captive flock consisted of 15 parrots.

Recently, 2 important documents were published: a monograph entitled "The Parrots of Luquillo: Natural History and Conservation of the Puerto Rican Parrot" (Snyder et al. 1987) and the second Recovery Plan (U.S. Fish and Wildlife Service 1987). The monograph was a compilation of the data collected on the research and management of the parrot. The Recovery Plan provided a step-down outline for accomplishment of the recovery objectives: the establishment of an effective population of 500 parrots in both the Luquillo Mountains and in the Río Abajo Forest.

Wild Population

Status

Population Trends. Between 1968 and 1975, the number of parrots in the Luquillo Mountains continued to decline, reaching an all-time population low of 14 in 1975 (Snyder et al. 1987). Through an intensive conservation program (Wiley 1981), the wild flock then stabilized and began a gradual increase. By 1987, the wild flock had increased to a minimum of 33 parrots representing a mean annual rate of increase of at least 1.6 parrots since 1975 (Fig. 1).

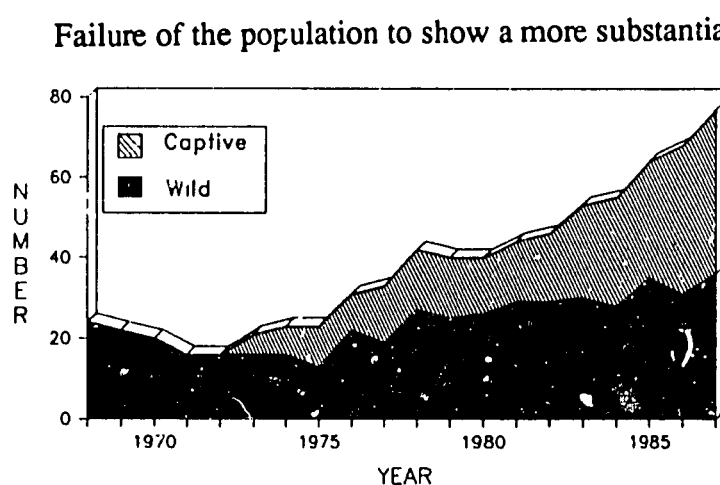


Fig. 1. Numbers of wild and captive Puerto Rican parrots in the Luquillo Mountains, Puerto Rico, 1968-1987.

Nest Success

Before 1973, nest success rate was 11-26% (Snyder et al. 1987). Since 1973, with intensive management, nest success has increased to 68%. Of 37 known nesting attempts between 1980 and 1987, 25 produced fledglings (1.7

fledglings per nesting attempt and 2.4 fledglings per successful nest).

Although management efforts significantly improved nesting success, a major disappointment has been the lack of an increase in breeding pairs despite a slowly increasing total population. For the past 15 years (1973-1987), the number of breeding pairs has fluctuated annually between 2 and 5 (average of 3.7 pairs). Since 1979, only 3 new egg-laying pairs have become established in the breeding population while 2 traditional breeding pairs have become reproductively inactive.

Between 1973 and 1987, the number of territorial pairs observed annually in the Luquillo Mountains has fluctuated between 5 and 9 (average 7.3). Of a cumulative total of 109 territorial pairs observed, 51% laid eggs and 49% did not breed. While a portion of those territorial pairs not laying eggs undoubtedly consisted of members which were not fully mature, other unidentified factors may be inhibiting egg laying.

Management

Conservation Program. The current conservation program, directed toward improving reproductive success, evolved through the years as research identified limiting factors. Management techniques included: 1) guarding of active nests from observation blinds throughout the breeding season, 2) improvement and maintenance of existing nest sites, 3) establishment of additional parrot nest cavities, 4) establishment of alternative nest sites for the pearly-eyed thrasher, 5) removal of eggs and chicks from nests during periods of endangerment, 6) "evening-out" of broods and clutches among nests for maximum overall survival, 7) control of rats around active nests, 8) protection of parrot nests against honeybee takeovers, 9) quarterly inventories of the population, 10) increasing production of eggs using replacement clutching, 11) sexing of wild nestlings, and 12) marking of wild nestlings with individually numbered steel leg bands. Snyder and Taapken (1978), Wiley (1981, 1983, 1985a), and Snyder et al. (1987) provide descriptions of management techniques 1-10. In 1986, we began sexing all wild nestlings using a feather pulp karyotyping method (Avian Sexing Lab, Memphis, Tenn.).

Nest Watch Program. Nest guarding, a time-intensive management technique that has proven invaluable in detecting and correcting problems at active nests (Wiley 1981), requires that all nests be monitored daily from before dawn until after dark. Biologists, located in nearby blinds, can periodically examine the nest, eggs and chicks for problems as well as monitor the reproductive behavior of the adult parrots. Before 1987, because of a lack of personnel, only 18 to 60% of the nest days were monitored. A nest day represented 1 day that a nest contained eggs or chicks. In 1987, the U.S. Fish and Wildlife Service and the National Audubon Society initiated a volunteer "nest watch" program, and National Audubon Society volunteers, along with project personnel, increased nest coverage to 89% (MacPherson 1987). To evaluate the benefits of this program, intensive nest coverage will continue for at least 2 more years.

Current Threats to the Success of Nests. During "nest guarding" of wild nests in 1986 and 1987, we encountered 10 types of problems that threatened the survival of eggs and chicks (Table 1). In past years each type of problem has been implicated in nest failure, embryonic mortality, or the death of chicks (Snyder et al. 1987).

Table 1. Number of incidents and types of problems encountered at wild Puerto Rican parrot nests, Luquillo Mountains, Puerto Rico, 1986 and 1987.

Problem	1986	1987	Total
Soldier fly infestation of nest material	9	4	13
Water entered nest cavity	5	6	11
Warble fly parasitism of nestlings	4	1	5
Poor growth of nestlings	1	3	4
Poor parental care	2	1	3
Nest desertion	1	1	2
Member of breeding pair died	1	0	1
Puerto Rican boa attack on nest	0	1	1
Pearly-eyed thrasher entered nest cavity	0	1	1
Natural deterioration of nest cavity	0	1	1
Total	23	19	42

Soldier fly (*Hemetic illucens*) larval infestations of nest material, warble fly parasitism of nestlings, and wet nest cavities were the problems most frequently encountered. In both 1986 and 1987, nest material in 2 of the 4 active nests were infested with soldier fly larvae. One nest during each year experienced multiple infestations.

In 1986, 2 chicks from a nest were parasitized on 2 different occasions by warble flies. Parasitism retarded body growth and feather development in these chicks preventing normal fledging. One chick eventually died of complications resulting from infestations and the other chick is now part of the captive flock. During 1987, 1 chick was infested with 1 warble fly larva, but did not show any harmful effects.

Lack of suitable nest sites, a major cause of nest failures in earlier years, has been overcome with intensive conservation efforts (Viley 1981, Snyder et al. 1987). However, water entering nest cavities continues to be a problem. Three of 4 active nests in 1986 and all 4 nests in 1987 became wet at least once during the breeding season. Water entry resulted in wet nest bottoms, which can affect adult attendance, egg hatchability and chick survival.

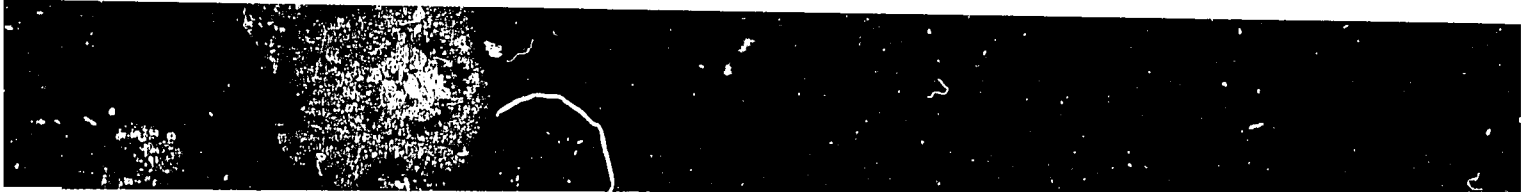
Current Research

Besides intensive management of the wild flock, several research studies (described below) are currently being conducted by the U.S. Fish and Wildlife Service. Other research relating to the Puerto Rican parrot within the Luquillo Mountains includes a long-term phenological study of actual and potential food trees (Wayne Arendt, U.S. Forest Service, pers. commun.). Also, Cardona et al. (1985, 1986) evaluated habitat within the Río Abajo Forest of northwestern Puerto Rico as a potential reintroduction site for the Puerto Rican parrot.

measures have the effect of reducing erosion, preventing river siltation and allowing for more rapid replacement of forests after slash and burn clearing. The establishment of the sanctuary can be considered most timely in light of reports that Guatemala and El Salvadoran immigrants have been hunting them as a source of meat.

In 1984, the Government of Belize declared the Cockscomb Basin Region of the country a forest reserve. This area of 154 square miles is located in the southcentral part of the country. In 1986, some 3600 acres of this reserve was set aside as a wildlife sanctuary. Cockscomb Basin Wildlife Sanctuary has the highest density of jaguars yet recorded. The Cockscomb Basin protects a goodly percentage of the flora and fauna of Belize. In this region can be found the endangered Ocelot, the Margay, Baird's Tapir and the Scarlet Macaw. The lush jungle of the region also provides a refuge for over two hundred and ninety (290) species of birds.

In its efforts at providing the necessary resources for the maintenance of these nationally protected areas, the Belize Audubon Society is making its mark in wildlife management. As



Survival, Movement, and Behavior of Puerto Rican Parrot Chicks. Survival, causes of mortality, movement patterns and integration into the wild flock of chicks fledging from wild nests in 1985-1987 were studied using radio telemetry. Miniature 7 g transmitters with an average field life of 5 months were attached to the chicks 1 week before fledging. Attachment was by a stainless steel neck collar tied at the top with cotton thread. When the cotton thread became rotten, the collar separated allowing the transmitter to fall off the parrot. Data is presently being analyzed from 3 chicks in 1985, 4 chicks in 1986, and 8 chicks in 1987.

Distribution and Territorial Behavior of Nonbreeding Parrots. In 1988, we will begin a multi-year study of the nonbreeding, territorial Puerto Rican parrot pairs residing in the Luquillo Mountains. The territory of each pair will be plotted on maps. Pair bond stability and territorial tenacity will be evaluated by identification of individual members of each pair using voice analysis and direct observations. Activity patterns of nonbreeding pairs in relation to breeding pairs during the reproductive season will be determined.

Developing Release Strategies for Captive-raised, Free-flying Parrots. Introduction of large numbers of captive-raised, free-flying parrots into the wild flock could substantially increase population growth. A release technique is needed to optimize survival and integration of released parrots into the wild population of the Luquillo Mountains and to eventually establish additional wild populations elsewhere in Puerto Rico. Initial release methods will be patterned after the slow-release technique described by Wiley (1983) and Snyder and Wallace (1987) and first tested on a surrogate species.

Captive Population

Preservation of the remnant wild population is the major emphasis of the Puerto Rican parrot conservation program. If it is lost, the recovery effort for the species will become ever more arduous. Besides insurance against a catastrophe, the captive flock serves to support the wild population by guarding against nest failures and as a cornerstone for population growth by fostering and reintroduction efforts (Wiley and Gee 1981; Wiley 1983, 1985b).

Status

Puerto Rican Parrots. A founder flock of captive Puerto Rican parrots, established between 1973 and 1979, consisted of 15 parrots representing all known genetic lines (Wiley 1981). Since 1979, the captive population growth rate has been slow but steady (Fig. 1). A total of 39 fledglings has been produced; 18 have been fostered into wild nests, 3 have been released into the parrot range of the Luquillo Mountains (Snyder et al. 1987) and 18 have been retained in captivity. Three first-generation, captive-produced parrots are now part of the captive breeding population. The current population consists of 41 parrots, including 9 additional birds from wild stock.

The sex ratio of the population is nearly equal (21M:20F). However, the subadult group of parrots (less than 4 years of age) consists of 11 males and 3 females, and the adult group (4+ years) consists of 10 males and 17 females.

Hispaniolan Parrots. While efforts were made to establish the captive flock of Puerto Rican parrots, a captive flock of the closely related, nonendangered Hispaniolan parrot (*Amazona ventralis*), native to Hispaniola, West Indies, was also established (Wiley 1983, Snyder et al. 1987). Hispaniolan parrots are used as a model species for the Puerto Rican parrots in developing husbandry techniques such as incubation and artificial insemination and in studying the nutritional requirements of captive parrots. They also have a vital role in incubating Puerto Rican parrot eggs and serving as foster parents for raising Puerto Rican parrot young. Currently, 60 Hispaniolan parrots are maintained at the Luquillo Aviary.

Captive Production

Captive propagation of Puerto Rican parrots began in 1978 with the production of 3 fertile eggs by 1 pair of parrots. In 1979, the first chick hatched and fledged. Since then, the productivity rate has improved slightly but still remains low (Table 2).

The low biotic potential of the captive flock is attributed to many factors, including the natural delayed sexual maturation of the species and a skewed sex ratio of mature parrots. Because of the latter, 26% (72/281) of all the eggs laid between 1980 and 1986 have been produced by females without mates.

The ineffectiveness of more than 2 pairs in producing fertile eggs between 1981 and 1986 was due primarily to abnormal reproductive behavior of the males. It appeared that the 2 reproducing males initiated disputes with neighboring males when the latter attempted to copulate with their mates. As a result, the neighboring males aborted copulation attempts in order to contend with the challenging males. Over time, this domination scheme may have led to the inability of the subordinate males to achieve or maintain reproductive condition (although their mates continued to produce eggs). In 1987, visual barriers were installed, and 4 pairs of Puerto Rican parrots produced fertile eggs.

Table 2. Captive production of Puerto Rican parrots, Luquillo Aviary, Puerto Rico, 1980-1987.

Year	No. females laying eggs	No females producing fertile eggs	No. eggs	No. fertile eggs	No. chicks fledged
1980	5	1	23	4	2
1981	5	2	22	7	2
1982	7	2	59	10	5
1983	7	2	43	10	7
1984	6	2	34	11	7
1985	8	2	49	13	8
1986	7	2	53	11	3
1987	8	4	37	13	4

Although the number of pairs producing fertile eggs doubled in 1987, the total number of fertile eggs and the overall productivity (number of chicks produced) was not proportionately improved (Table 2). The reasons for this were that only 2 of 4 pairs were double-clutched, only 1 of these pairs produced fertile eggs in both clutches, and only 1 of 6 clutches yielded 100% clutch fertility (Table 3).

Table 3. Egg production by four pairs of captive Puerto Rican parrots, Luquillo Aviary, Puerto Rico, 1987.

Pair	Clutch no.	No. of eggs	No. fertile eggs
1 1	4	0	
	2	4	3
2†	1	4	2
3 1	3	1	
	2	0~	0
4 1	4	3	
	2	4	4

† Females was not double-clutched.

√ 1 egg broke and fertility was not determined.

~ Female did not recycle to lay a second clutch of eggs.

The overall hatching rate (the number of captive-produced eggs that hatched from the total number of fertile eggs) between 1980 and 1987 was 55% (43/78). The primary factor suspected for such a low rate was the incubation mode under which the Puerto Rican parrot eggs were managed. In order to manipulate clutches, a large portion of the fertile eggs were artificially incubated for a part or for the entire incubation period. Clutch manipulations included double-clutching and the removal of eggs to prevent breakage in the nest by nervous parrots.

It has been demonstrated in other avian species that artificially incubated eggs have a greater chance of hatching if they receive some form of natural incubation in the first 5-10 days (Heck and Konkel 1983). This trend has been noticed with the Puerto Rican parrot eggs. For example, in 1987 the hatch rate was 0% (0/2) for fertile eggs entirely artificially incubated, 29% (2/7) for eggs which received less than the first 7 days of natural incubation, and 50% (2/4) for eggs incubated naturally for at least the first 7 days. Although the 1987 sample size was small, the same trend was indicated in previous years.

More subtle factors may be responsible for the poor production by captive Puerto Rican parrots. Parrots may be maintained in an outwardly healthy appearance on a diet with an imbalance of vitamins, calcium to phosphorus ratios, essential amino acids, trace elements, or protein to energy ratios. However, these parrots may not attain or maintain reproductive condition on such a diet, and developing embryos may be weak and die (Brown 1979).

Secondly, the Puerto Rican parrot went through a severe genetic bottleneck in 1975. As a result, a decreased gene pool and a potentially high level of inbreeding may account, in part, for low fecundity of the parrots and high embryonic mortality of the eggs produced by the captive flock (Brown 1979, Schonewald-Cox et al. 1983).

Management

The Puerto Rican parrot is a monomorphic species, making individual recognition of the sexes difficult. Each member of the current flock has been sexed by reproductive performance (egg or semen production), steroid analysis (Bercovitz et al. 1983), or feather pulp karyotyping. All the parrots are marked with individually numbered steel leg bands. Records are maintained on each parrot for breeding and medical histories, vital statistics, parentage, and other pertinent information. A computerized inventory of the captive flock is maintained at the Patuxent Wildlife Research Center on the International Species Inventory System's Animal Record Keeping System (ISIS - Minnesota Zoological Gardens, Apple Valley, Minn.).

Both the Puerto Rican and Hispaniolan parrot pairs are housed in breeding cages 1.2 m wide x 1.8 m long x 1.2 m high, which stand 1.1 m above a cement pad. The cages are exposed to the environmental elements; however, weather protection is provided for the parrots, their nestboxes, and food and water. Cages are 1 m apart and each holds 1 pair of parrots. Visual obstructions are placed between cages so that each pair has a sense of security in their own territory. Subadult and extra adult parrots are housed in 1 of 2 flight cages, which are 2.4 m wide x 16.5 m long x 4.6 m high (L-shaped cage), or 3 m wide x 6.1 m long x 4.6 m high (rectangular-shaped cage).

In the morning, the parrots receive a mixture of rice, beans, sprouted corn, and oats; a fruit (such as bananas); and a vegetable (usually carrots). A second mixture containing vitamin-mineral supplements, peanuts, alfalfa sprouts, sprouted corn and fruit juice is also given. In the afternoon, the morning trays are removed, the cage areas are rinsed down, and the parrots are left with an *ad libitum* supply of a pelleted diet formulated for large parrots (Dr. D's, Avi-Sci Inc., Okemos, Mich.). Fresh water is provided daily.

Current Research

Several investigations are being conducted at the Luquillo Aviary in order to increase the propagation success of the captive Puerto Rican parrots.

Nutritional Requirements of Captive Parrots. In an effort to eliminate inadequate diet as a possible impediment to productivity of the Puerto Rican parrots, a nutrition study is being conducted with the Hispaniolan parrots. In 1987, 4 groups of parrots (juveniles and adults) were fed pelleted diets differing in protein to energy ratios. Food consumption was measured on a daily basis. Parrot excrement was collected and body condition was monitored at regular intervals. Crude protein, gross energy, calcium, and phosphorus from the 5 different diets and excreta samples will be determined. The final report will include a formula for an appropriate maintenance diet that can be supplied in the form of natural foodstuffs or manufactured into pelleted form.

Genetic Diversity. To evaluate the degree of genetic depression, the genetic variability of the Puerto Rican parrot population will be monitored using indices at the individual and population levels. Feather pulp samples from Puerto Rican and Hispaniolan parrots will be collected and analyzed by gel electrophoresis in 1988 for heterozygosity, percent polymorphic loci, and mean number of alleles.

The actual relatedness of a captive population in the absence of direct lineage information (e.g., the ancestry of the founder flock) will be determined using a technique called DNA "fingerprinting" (Wetton et al. 1987). In 1988, a study of the captive Puerto Rican parrot flock will be conducted in order to develop a genetic management plan for insuring maximum genetic diversity of the species.

Artificial Insemination. Artificial insemination is an effective means of overcoming infertility in nondomestic avian species (Gee and Temple 1978). In 1986, research with the Hispaniolan parrots was initiated, and in 1987 a fertile Hispaniolan parrot egg was obtained by artificial insemination. Although artificial insemination is a relatively simple procedure, several critical steps are involved. These steps include the collection of good quality semen samples and the timely insemination of the females. Research with the Hispaniolan parrots will continue in 1988 to refine the artificial insemination technique.

Artificial Incubation. To overcome the hatching rate of Puerto Rican parrot eggs, 2 studies will be conducted using Hispaniolan parrot eggs. In the first study, a small flock of bantam hens will be tested for their reliability and effectiveness in incubating parrot eggs. In other captive propagation programs, chickens have been used successfully as surrogate incubators for exotic bird eggs (Robert Berry, Houston Zoo, pers. comm.).

In the second study, different artificial incubation regimes will be examined for obtaining a maximum hatch of parrot eggs. There is a relatively wide range in temperature (for example up to 2°C) and humidity in which eggs can effectively incubate and hatch. However, the critical temperature range for the maximum hatch may be very small, perhaps a fraction of 1°C (Brown 1979). Because successful hatching of eggs depends on ambient conditions, the appropriate adjustments to incubator settings (temperature and relative humidity) must be adapted to particular site locations.

Outlook

Although the Puerto Rican parrot population is now slowly increasing, the parrot is still very vulnerable to extinction. In spite of the doubling of tree-covered area in the Luquillo Mountains since 1940 and the reduction of several important threats to the parrot, reproduction in the wild population has not increased. Possible introductions of large flocks of captive-raised Puerto Rican parrots by direct releases may bolster reproduction. Prior to this stage, however, we need to concentrate on establishing a self-sustaining captive flock capable of producing parrots for future releases and to develop/improve release techniques on a surrogate species.

In addition, a second population will be established on the western side of the island as an insurance against catastrophes. A captive propagation program will be established by the Puerto

Rican Department of Natural Resources at the Río Abajo Forest in 1989. Eventually, parrots will be reintroduced into the surrounding Commonwealth forest, part of the parrot's former range.

In order to reach the expressed recovery goal of an effective wild population of 500 parrots at each site, time and the continued commitment of qualified and dedicated personnel from the cooperative agencies are necessary.

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WILDLIFE CONSERVATION CONCEPTS AND ISSUES AS THEY RELATE TO THE CARIBBEAN: SOME COMMENTS

Herbert Raffaele

Reserve Size and Minimum Population Numbers

There has been much discussion in the scientific literature in recent years concerning the optimum size and shape of nature reserves. These arguments primarily are based on the premise of "all other things being equal." However, we all know that the concept of "all other things being equal" is an oversimplification, and this is particularly the case for many island situations.

To look briefly at this issue, a basic conclusion of these scientists is that one large reserve is better than several smaller ones which, combined, would protect the same amount of area. The arguments supporting this contention revolve around the increased ability of organisms within the reserve to avoid inbreeding and other negative effects of small population size. On the other hand, what is completely ignored is that survival in many areas, and I believe this is particularly true on islands, is highly dependent upon the broad distribution of species, even if this distribution is patchy as would be the case if the species were spread among several reserves. This is more important than the integrity of the reserve as a single unit. I have little doubt that this is the case because of the tremendous impact that hurricanes appear to have on island faunas, an impact that is all too often overlooked.

In Puerto Rico, the island which I know best, the distributions of several bird species have evidently been affected by hurricanes. The Troupial (*Icterus icterus*), a bird locally common around Quebradilla before the turn of the century, was wiped out in that area apparently as a result of San Ciriaco, the great hurricane of 1899. More recently, the Puerto Rican Flycatcher (*Myiarchus antillarum*), a much more broadly distributed bird than the Troupial, but still confined to only a portion of the island, almost became extinct as a consequence of hurricane San Felipe II of September 13, 1928. Furthermore, it has been well documented that the extensive destruction of specific age classes of trees in the Sierra de Luquillo is one of a number of factors that has negatively affected the status of the Puerto Rican Parrot (*Amazona vittata*).

As a final example, on the island of Saint Kitts I believe it was again San Ciriaco, that played a major role in the extinction of the Mountain Blacksmith (*Loxigilla portoricensis grandis*), rather than the impact of introduced monkeys as has been sometimes claimed. It should be noted that at the time of San Ciriaco it appears that the Mountain Blacksmith had the most limited distribution of any bird species on Saint Kitts.

Looking at island avifaunas from another perspective, they have a particularly fascinating characteristic which puzzles many scientists. This is that unlike continental species which are quite limited in the habitat types they occupy, island forms commonly range from mangrove swamps on the coast to cloud forests on the mountain tops. What is the reason for this?

The typical explanation for the substantially broader distributions of island species is described by the term “ecological release.” This phrase refers to the concept that island species, because of their isolation, are exposed to less competition than are continental forms. As a consequence, they are able to occupy broader niches which include spanning across different habitat types. This explanation is logical and has merit, but I believe another important factor may be at play. The factor is that species confined to one or a few habitat types will automatically have narrower distributions than species which occupy many habitats. Consequently, in areas where intensive local perturbations frequently occur, such as those resulting from hurricanes, species with limited distributions are at a distinct disadvantage. If their limited range is struck by a storm, they could be eliminated.

I suggest that “ecological release” may not be just a reflection of reduced competition, but partially be a phenomenon which represents an adaptive response to the threat of hurricanes. Broad ranges, even if patchy, provide security. Limited distributions, even if the species is abundant locally, are in jeopardy.

This brings me to another concept which is widely discussed—minimum population size. There is tremendous interest in the concept that there is a minimum threshold below which a population cannot survive. Or for that matter, there is a second threshold above which a population is safe from extinction. I personally do not believe that such thresholds exist. Too many factors play a role in species survival. Furthermore, species are distinctive and what may be the case for one species is not necessarily so for another.

Using an example to sum up my points, let us return to the Puerto Rican Parrot. Are we better off aiming for one large reserve in the Luquillo where we have 500 interbreeding pairs of birds, or would the birds be better off in two small reserves, quite separated, each of which supports only 100 pairs. There is no doubt in my mind that the latter choice is superior. Finally, could we get by with only 50 pairs in a reserve or only 25 pairs? There is no real answer to this. You are really playing with probabilities here. The Laysan Teal (*Anas laysanensis*) was apparently down to one individual (I presume a pregnant female) and survived. There is no way to tell the minimum number of pairs that will be required for a species to survive a year of food shortage, a drought, a viral epidemic—or a hurricane.

Exotic Species

The introduction of exotic wildlife to the West Indies has been extensive and is only prone to increase with time whether by accidental or intentional introductions. This will be the case despite the evidence that most past introductions have been failures. I do not wish to go into detail here concerning the negative impacts of introducing exotic species. Suffice it to say numerous potential problems can occur as a result of predation, competition, hybridization, disease, crop depredations, or simply being a pest. What I do want to touch upon is why islands are more susceptible than ever before to colonization by exotic species, whether intentionally brought to the islands or naturally expanding their ranges from elsewhere.

Generally speaking, the islands of the West Indies were primarily forested for eons prior to the European colonization. As a consequence, the avifaunas of these islands included primarily forest

dwelling species while sustaining a relative paucity of grassland birds. The effect of the land clearing that has occurred over the past few centuries on endangering some of the native forest birds is of great concern to many. Certainly the destruction of a major habitat should be expected to have major impacts upon associated animal communities. At the same time, little attention is given to the habitat that has replaced forests as the principal vegetative community. This now predominant habitat might loosely be termed "grasslands" and would include primarily agricultural lands as well as pastures. This greatly expanded habitat supports very few native species and is relatively depauperate considering its relative size.

How does this relate to exotic? Well, we have here an expansive habitat with ample grass seed as a food resource. The habitat is scarcely inhabited. Furthermore, the few avian species which do occupy this community are territorial and poorly utilize the vast food resources often available. Such conditions create an idyllic situation for colonization.

Most revealing are some of the natural colonizations and major range expansions which have occurred in the West Indies during this century. Again using Puerto Rico as an example, colonization by the White-winged Dove (*Zenaida asiatica*) and the Morning Dove (*Z. macroura*) illustrate large seed eaters that have filled a new niche. In the Virgin Islands establishment of the Mockingbird (*Mimus polyglottos*) and the Lesser Antillean Bullfinch (*Loxigilla noctis*) are evidence of species that have benefited from an increase in the availability of scrublands.

Since the international pet trade has a major component of small, hardy seed-eating species, we can expect that as these arrive in increasing numbers as cage birds to the West Indies they will ultimately become more and more common among the islands. Ultimately we may expect a situation not unlike that in Puerto Rico where there are five species of exotic grassland seed eaters on the island for each native form.

Biological Diversity

A true buzz-word throughout the conservation community nowadays is "biological diversity." Everyone talks about it rather sacredly, but I am not convinced that many people have given the term significant thought. Basically, conservation of biological diversity suggests that the fundamental aim of local conservation efforts should be conserving the maximum number of species possible, or places where the greatest diversity of species occur. I personally have a reasonable amount of concern with this concept in any but the most general terms. This is particularly the case if one considers islands and especially if one compares islands to continents. As an example, what if an international conservation organization is considering the provision of funds to support protecting an important forest habitat in Guatemala versus one in Jamaica. Guatemala's forest might well have an avian species list of over 400 birds while that of Jamaica fewer than 150. Based on biological diversity considerations alone, it is clear where the funds would be directed. At the same time, despite the species diversity in the Guatemalan forest, not a single one of those bird species is endemic—they can all be found somewhere else. On the other hand, the Jamaican forest, though low in diversity, is high in endemism—many species in it occur nowhere else in the world. Does this account for something? It should!

Islands are notorious for having low biological diversity. They are not easily colonized. Yet is it this same circumstances that makes them so unique. Generally, the more impoverished their avifauna, or other taxon for that matter, the more unique it is. An after all, isn't it the uniqueness of species that makes them so particularly alluring?

CARIBBEAN WILDLIFE TRADE: AN INTRODUCTION

Andrea L. Gaski

Introduction

Along with the loss of habitat and increased exploitation by local human populations, international trade is a major threat to many species' survival. Because of this threat, the primary goal of the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), since its entry into force in 1975, has been to ensure that international trade does not threaten wild animals and plants around the world.

CITES regulates wildlife trade through a worldwide system of import and export controls. CITES accords varying degrees of protection depending on the biological status of the animal or plant and the effect that international trade has on it. When a country becomes party to CITES, it designates one governmental department to issue permits and another to provide the scientific expertise on which permit approvals are based. Finally, CITES provides guidelines for domestic legislation to regulate wildlife trade.

In the western hemisphere, all countries of the Americas, except Mexico, are parties to CITES. But in the Caribbean, only the Bahamas, Dominican Republic, and St. Lucia have joined CITES. Some island dependencies are subject to CITES regulation under the legislation of other CITES parties, e.g., the Cayman Islands to the United Kingdom, Guadeloupe and Martinique to France, and the U.S. Virgin Islands to the United States.

The following information, compiled by Traffic (U.S.A.), is not intended as a complete review of Caribbean Wildlife trade but as an introduction to certain aspects of Caribbean Wildlife trade. Most of the discussion is focused on commercial and/or CITES trade since non-commercial (tourist, zoological, scientific) or non-CITES trade in most countries is generally either not reported or reported only as weights and dollar values. One exception is the United States, which is required to regulate some non-commercial, non-CITES trade. The United States Endangered Species Act regulates trade of threatened or endangered native and exotic wildlife that may or may not be CITES species. The United States Lacey Act regulates trade in animals and plants protected in other countries.

Sea Turtle Trade

The import of sea turtle products into the United States is strictly forbidden by United States law and CITES, which has prohibited such trade since 1981. Japan, although party to CITES, now has a legal exemption or "reservation" to the listing of two species of sea turtle and continues to trade in these species. One of those species, the hawksbill turtle (*Eretmochelys imbricata*), is heavily exploited by the Japanese because of its "tortoiseshell."

And in spite of national legislation in several Caribbean countries, the region supplied almost one half of the raw hawksbill turtle to Japan in 1987 and doubled its exports over the four year period,

1984-1987 (Table 1). During this time, almost 46,000 kilos of Caribbean hawksbill shell were exported to supply the Japanese tortoiseshell industry. This represents the harvesting of almost 43,000 Caribbean hawksbill turtles (based upon Milliken and Tokunaga's [1987] estimates of 1.06 kilo of shell per turtle). Yet even before 1984, populations of the hawksbill turtle in the Caribbean were reportedly declining around many islands (Groombridge 1982).

Table 1. Caribbean exports of hawksbill turtle shell to Japan, 1984-1987.

Country of origin	Shell weight (kg)			
	1984	1985	1986	1987
Antigua	286	221	293	317
Barbados	-	-	116	14
Cayman Islands	115	-	-	-
Cuba	4,200	7,816	5,688	5,640
Dominica	-	174	219	142
Dominican Republic	636	203	569	492
Haiti	1,988	2,203	2,767	2,867
Jamaica	474	170	2,182	4,504
St. Vincent	242	191	470	510
Total	7,941	10,978	12,304	14,486
Percent of Japanese imports	25.9	32.7	44.7	48.6

Source: Japanese Customs Statistics; Milliken and Tokunaga 1987.

Other Marine Species in Trade

Because the Caribbean depends on the sea's bounty, it naturally follows that much of the wildlife traded originates there. The United States is a major importer of raw coral and shells and only a small part of that is from the Caribbean. From a regional perspective, however, this trade is substantial. In the four year period of 1984 to 1987, over 464,000 kilos of raw shells (Table 2) and about 48,000 kilos of raw coral were exported to the United States (Table 3).

Little information is available on the actual shell species in trade, although some Caribbean shells, such as the Triton's trumpet in Haiti (*Charonia variegata*) and the queen helmet (*Cassis madagascarensis*), are uncommon around many islands because of over collecting (Abbott 1980). Less is known of the species involved in coral trade but most are assumed to be reef-building corals.

In addition to the hard corals, Caribbean black corals (*Antipatharia*), a CITES protected taxon, are brought into the United States as non-commercial tourist items. Some Caribbean black coral beds have reportedly been overfished (Anonymous 1983).

Table 2. Caribbean exports of marine shells (crude) to the United States, 1984-1987.

Country of origin	Shell weight (kg)			
	1984	1985	1986	1987
Bahamas	859	-	340	49,247
Dominican Republic	9,202	4,900	3,009	-
Haiti	131,641	69,242	94,089	77,244
Jamaica	-	-	4,091	-
Turks and Caicos Islands	-	-	20,624	-
Total	141,702	74,142	122,152	126,491
Percent of United States imports	8.1	9.7	5.6	7.7

Source: United States Department of Commerce, Custom Service Statistics.

Table 3. Caribbean exports of coral (crude) to the United States, 1984-1987.

Country of origin	Shell weight (kg)			
	1984	1985	1986	1987
Bahamas	11	-	-	-
Haiti	953	-	-	17,993
Dominican Republic	-	8,900	7,123	-
Turks and Caicos Islands	-	-	12,993	-
Total	964	8,900	20,116	17,993
Percent of United States imports	0.1	0.8	1.6	1.6

Source: United States Department of Commerce, Custom Service Statistics.

United States imports of Caribbean ornamental fish for the aquarium trade has remained fairly constant in the last four years based upon the declared value of shipments (Table 4). A 1982 analysis of import records indicated that the Caribbean exported about 1.9 million marine fish to the United States, or about 1.5 percent of all fish imported in that year (Hemley and Gaski, unpublished). In 1987, the United States imported marine and freshwater fish valued at over US \$29 million and less than one percent of these were Caribbean. All are presumed to be wild-caught marine species (Hemley and Gaski, unpublished).

Table 4. Caribbean exports of ornamental fish to the United States, 1984-1987.

Country of origin	Declared value (U.S.\$)			
	1984	1985	1986	1987
Bahamas	-	5,100	-	1,218
Cayman Islands	-	-	-	1,004
Dominica	-	-	3,009	-
Dominican Republic	-	-	2,855	1,007
French West Indies	-	121,200	51,472	39,966
Haiti	131,200	99,600	137,358	181,875
Jamaica	61,200	17,900	-	-
Netherland Antilles	-	2,500	-	2,155
Total	192,400	246,300	389,388	227,225
Percent of United States imports	0.7	0.9	1.3	0.9

Source: United States Department of Commerce, Custom Service Statistics.

Live Reptile Trade

Caribbean lizards and snakes are popular and inexpensive pets in the United States—over 59,000 were imported in 1985 alone. The tiny anole lizards, often called American chameleons (*Anolis* spp.), and curly-tail lizards (*Leiocephalus* spp.) occur frequently in United States trade records as do Mabuya skinks. And many species of CITES protected Caribbean ground boa (*Epicrates* spp.) are also exported to the United States (Anonymous 1987).

Parrot Trade

Some of the world's most endangered psittacines are found in the Caribbean. These include the Imperial amazon (*Amazona imperialis*) in dominica, the St. Lucia amazon (*A. versicolor*) of St. Lucia, and the Bahama amazon (*A. leucocephala bahamensis*) of Abaco. In spite of domestic trade bans and international protection through CITES, individuals of some of these species are still being

traded on international markets. In 1987, for example, six young Bahama amazons were stolen from a breeding area on Abaco (Gnam 1988). Through cooperation between government officials and non-governmental organizations in Nassau, Bahamas, three of the missing parrots were recovered and returned to the wild. The remaining three, however, disappeared through illegal trade channels.

For very small island populations, like amazon populations in the Caribbean, any trade may further endanger the future survival of these species.

Non-Commercial Trade

Non-commercial trade, specifically tourist souvenirs, is probably the area of most concern to those monitoring wildlife trade in the Caribbean since, as discussed above, it is largely unreported. Every year hundreds of thousands of tourists return from the Caribbean with exotic wildlife souvenir, or live wildlife. Caribbean markets abound with wildlife items and curios, but the United States Endangered Species Act, the legislation of some Caribbean countries, as well as the CITES, virtually prohibit import of many of these items into the United States. Many of these souvenirs then are subject to seizure by United States officials.

Sea turtles, such as hawksbill turtle, green turtle, Kemp's ridley turtle, and olive ridley turtle, are internationally considered endangered, yet their parts and products are often sold openly in markets and stores throughout the Caribbean, in defiance of national legislation prohibiting such sale. Besides sea turtle products, other items such as certain crocodilian products are not allowed into the United States. Since some Caribbean countries protect corals, shells, and sponges from collection, sale, and/or export, it is also illegal to bring many of these items back into the United States.

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TRAFFIC (U.S.A.) is one of eleven offices in the international TRAFFIC Network and monitors trade in wildlife and wildlife products. While much of TRAFFIC (U.S.A.)'s work revolves around CITES, it also helps to monitor trade in non-CITES species both from a United States and regional perspective.

PEOPLE-CENTERED CONSERVATION: AN INTRODUCTION TO WORLD WILDLIFE FUND'S WILDLANDS AND HUMAN NEEDS PROGRAM

R. Michael Wright

Since its establishment in 1961 World Wildlife Fund (WWF), a private, nonprofit organization, has sought to protect the world's biological diversity, identifying critical habitats and threatened species and safeguarding them by supporting national and international systems of protected areas. Much of the earth's remaining biological wealth, however, is in rural areas of the tropics where the poorest of the poor struggle to draw their livelihood from the land. These areas are far from centers of economic activity and their inhabitants often lack the political power or financial resources to improve the quality of their lives. the driving imperative of the poor to over-exploit otherwise renewable resources is perhaps the most direct threat to wildlife and wildlands. Furthermore, the degradation of entire ecosystems on which the poor directly depend—a coral reef that shelters marine life to feed a fishing community, a tropical forest that provides villagers with essential fuelwood, building materials, and medicines—threatenes the survival of the poor themselves.

In response, WWF created the Wildlands and Human Needs Program to improve the quality of life of rural people through field projects which integrate the management of natural resources with grassroots economic development. With projects from Mexico's tropical forests to African savannas and cool Himalayan slopes, it is the most comprehensive effort yet launched by a conservation organization to join community in 1985 with a matching grant from the U.S. Agency for International Development's Office of Private and Voluntary Cooperation, which continues to support the core field projects in Latin America and Africa.

Field Projects

By experimenting with innovative techniques and demonstrating workable approaches, WWF is transforming the ideals of grassroots development into practical field-tested solutions that help the rural poor and protect biological diversity. Through technical, financial, and onsite assistance as well as project planning, over twenty Wildlands and Human Needs Projects work with local populations in areas of critical biological significance, where activities include:

Latin America and the Caribbean

- assisting a cooperative in St. Lucia with a facility to market fish, establishing an aquaculture program, and protecting endemic species in a nature reserve
- encouraging a furniture business based upon high employment and low-impact use of Dominica's tropical forest
- enhancing the productivity of an income-producing lobster fishery in Sian Ka'an, Mexico, as well as providing alternatives to the use of a threatened palm species

- providing legal assistance to help local farmers in Costa Rica obtain land title as part of an integrated program of nurseries, agricultural diversification, and local management of a wildlife refuge
- developing a sustainable use strategy for the harvesting of the paiache fish in the Peruvian Amazon and the iguana in Guatemala.

Africa

- providing health care and employment to BaBinga pygmies as part of the first multiple-use protected area in the Central African Republic
- supporting village development projects and employment through a revolving fund financed through wildlife utilization and Zambia's safari hunting industry
- working with CARE's agroforestry and soil conservation programs to create buffer zones protecting Uganda's Impenetrable Forest and its endangered mountain gorillas.

Asia

- supporting a program which provides limited agricultural credit to relieve debt pressure causing farmers to encroach on many of Thailand's national parks
- promoting ecologically sound tourism in the Annapurna Conservation Area of Nepal to support the concurrent development of reforestation projects along with alternative energy sources (kerosene, solar, micro-hydro), family planning, women's health care, and clean water supplies.

Project Design

In developing and conducting projects, the Wildlands and Human Needs Program puts to use WWF's 27 years of experience in implementing conservation throughout Latin America, Africa, and Asia, as well as the experience of development professionals and citizens of these regions. While knowledge about resource-sensitive community development is constantly evolving, Wildlands projects reflect a number of principles which WWF has found to be factors for success. Among the most important are these:

- Improvements in quality of life—better health, increased child survival, greater opportunities for women, and assurance of resource ownership—are preconditions for the population stabilization necessary to diminish competition over a deteriorating resource base.
- Local leadership is irreplaceable and must be encouraged to come to the fore. Few projects can succeed without responsive and motivated leaders who understand the importance of consensus. Local nongovernmental organizations can play a catalytic role in getting projects started, although government concurrence is often necessary for longer term stability.

- Community participation is critical. The use of modest local contributions (labor, in-kind, or locally raised cash) can test whether projects address perceived local needs and priorities and can increase commitment to maintaining an activity over the long term.
- Flexibility and creativity are watchwords for effective projects. Projects must engage in a continuing dialogue with participants and be able to adjust and grow with experience and changing needs.
- Projects should rely on small scale, simple measures that encourage regular participation, can be tailored to local cultures, markets, and microclimates, and provide long term solutions. Complex imported solutions should be avoided in favor of those that employ or resemble locally proven techniques or institutions.
- Participants in projects should be asked to make incremental improvements rather than radical changes. Incremental changes carry less risk than quantum leaps or multiple innovations. They also increase prospects for early success, which in turn instills self-confidence and enthusiasm. Furthermore, incremental steps can more easily balance the need for change with respect for tradition.
- Technology used by a project should be appropriate. It should be repairable locally to avoid reliance on foreign experts. To keep expenditures with local means, it should require minimal upfront cash while providing a near term payoff-thus limiting the participants' risk. Agricultural and other productive technologies should have low recurrent cost and generate products with a reliable market, in this way encouraging self reliance and avoiding dependence on external donors.
- Sensitivity to issues of gender is vital. In particular, attention must be paid to role of women in the community and how a project may affect their quality of life.
- As projects seek to empower local communities and promote a sense of local responsibility, they must be fully cognizant of the impact of national government policy on local resource decisions.

These guidelines are by no means complete or absolute. Above all, WWF has found that sustainable rural development is not a project or collection of activities that adhere to a fixed set of rules, but rather a process of people solving their own problems. As rural people around the world strive to earn a livelihood in harmony with their environment, WWF continues to learn from them and seeks to apply their lessons elsewhere.

Collaborating Institutions

In all its activities, WWF's Wildlands and Human Needs Program seeks to provide leadership, critical technical and financial resources, and a framework for collaborative action. Through its Wildlands Advisory Committee, the program draws upon the experience and counsel of a dozen private development organizations, including Catholic Relief Services, Save the Children, the National Women's Law Center, and the Inter-American Foundation. Joint projects have been

initiated with Cultural Survival in Ecuador, with CARE in Uganda and Africare in Zambia, with the U.S. Peace Corps in Malawi, Sierra Leone, and Honduras. It has also collaborated with the Ford Foundation in Indonesia and Zimbabwe.

WWF's conservation and development network is nowhere more evident than in the field. The primary organization implementing virtually every Wildlands project is a local institution, including, for example, Amigos de Sian Ka'an in Mexico, Asociación de los Nuevos Alquimistas (ANAI) in Costa Rica, the Eastern Caribbean Natural Areas Management Program (ECNAMP) in St. Lucia, the Ministre des Eaux et Forêts in the Central African Republic, the National Parks and Wildlife Service in Zambia, and the King Mahendra Trust for Nature Conservation in Nepal.

When all is said and done, conservation is about people. It is about the balance which must be struck between humans and nature and between generations. And if it is to be relevant in the developing world, it must address the needs of the poor and the dispossessed who ironically share their rural frontier with the earth's biological wealth. For WWF, the Wildlands and Human Needs Program is a first step inspired by the Spanish poet Antonio Machado, "Traveller, there is no path. Path are made by walking."

FORESTRY AND WILDLIFE INTERESTS OF THE UNITED STATES AGENCY FOR INTERNATIONAL DEVELOPMENT

James S. Hester

How A.I.D. Projects are Selected

The United States Agency for International Development (A.I.D.) is that part of the United States government's executive branch which provides economic assistance to selected developing countries. Exactly which countries receive assistance and how much they get is decided in a complicated fashion by the United States government's legislative branch, the Congress. The decision as to which particular projects will be supported is even more complicated and involves Congress, A.I.D., and the government of the recipient country.

Congress defines broad programmatic sectors that it wants to see supported. A.I.D. headquarters in Washington refines these mandates into an array of priorities and develops policies to guide the A.I.D. field offices, which are called missions, in their programs. These missions, in conjunction with appropriate host government officials decide on common priorities by comparing A.I.D.'s list with their own. The list of mutually agreed priorities is put into A.I.D. programming documents called Country Development Strategy Statements and Action Plans.

When Congress gives A.I.D. its budget, it is allocated to the projects highest on the list and a line is drawn where the money runs out and no more projects can be funded. With limited funds, not all of the desirable projects or even priority areas can receive attention. This is a greatly simplified explanation of the actual process but it gives a general overview.

Environmental Legislation for A.I.D.

Over the past several years Congress has passed several pieces of legislation that direct A.I.D. to recognize the importance of tropical forests and biological diversity in achieving sustainable development. A.I.D. was already undertaking programs in these areas but this legislation gave added strength to our earlier decisions. Specifically, Section 118 of the Foreign Assistance Act directs A.I.D. to:

- place a high priority on conservation and sustainable management of tropical forests,
- engage in policy dialogues and information exchanges with recipient countries which stress the importance of conserving and sustainably managing forest resources for the long-term economic benefit of those countries, and which identify and focus on policies of those countries which directly or indirectly contribute to deforestation,
- support projects which offer employment and income alternatives to those who would otherwise cause destruction of forests, and which help countries identify and implement alternatives to colonizing forests,

- support training programs and strengthen institutions which improve the wise management of forests,
- help end destructive slash and burn agriculture and support agroforestry and other non-destructive agricultural practices,
- help conserve forests which have not yet been degraded, and support reforestation and restoration of productivity on already degraded lands,
- support watershed management programs making sure to involve local people in design and implementation of the programs,
- support training and research in soil conservation and reforestation which will lead to more sustainable and environmentally sound practices for timbering, and which will identify agricultural alternatives to reduce and prevent forest destruction,
- conserve biological diversity in forest areas by identifying, establishing, and maintaining a network of important protected forest ecosystems; making the establishment of such protected areas a condition for support for projects that clear or degrade forests; and identifying forest ecosystems and both floral and faunal species in need of protection and then establishing and maintaining protected areas for those species,
- increase public awareness about the importance of managing and protecting forest resources,
- that unless a full environmental impact study shows otherwise, A.I.D. may not support programs which significantly affect tropical forests, buy logging equipment, convert forest lands for livestock, build or upgrade roads through relatively undegraded forests, colonize forests or build dams or water impoundments in relatively undegraded forests,
- A.I.D. may not support any activity that would significantly degrade national parks or protected areas that contain forests, or introduce exotic plant or animal species into such areas.

Section 119 of the Foreign Assistance Act contains parallel directions to A.I.D. to preserve and maintain floral and faunal biological diversity.

A.I.D.'s Environment and Natural Resource Policy

A.I.D. has developed a Policy Paper on Environment and Natural Resources to implement its legislation. In this Policy Paper forestry and wildlife management are woven into the fabric of the broader need to wisely manage the natural resource base. The purpose is to promote environmentally sound, long-term economic growth by assisting countries to conserve and protect the environment and manage their natural resources for sustainable yields.

This policy identifies the constraints to achieving sustainable development as:

- the short-term perspective spawned by needs to meet immediate, critical human needs, political exigencies of delaying hard decisions, and economic pressure to increase production,
- the limited natural resources base in relation to the demand. This coupled with sometimes insecure land tenure or skewed distribution along with increasing populations results in ever more land coming under intensive use, especially those marginal lands that would best be left in less intensive uses such as forest production or watershed management,
- inefficient resource use unnecessarily worsens the problem. Not using all of a tree when it is cut and inefficient charcoal production are just two examples,
- a need for increased education of decision makers and the general public to ensure that wise policies are developed and that new programs are approved and adequately implemented.

To address these constraints A.I.D. will consider activities that:

- promote sound land use planning and increase cooperation among key ministries and departments,
- promote reforestation, natural forest management, watershed management and agroforestry,
- conserve biological diversity, including protection of wildlife and plants in preserves and parks while creating alternative sources of income to reduce pressures to develop these areas,
- improve water quality, and
- encourage private sector participation in profit-generating programs that conserve natural resources.

Special Policy Concerns

Tropical forests and biological diversity are special concerns of the policy. It is A.I.D. policy to:

- engage in policy dialogues to create positive incentives for sustainable forest management and conservation,
- promote the management of existing forests for long-term yields
- provide alternatives to forest destruction
- conserve natural forests through establishment of forest reserves
- restore lost or degraded forest resources

- support resource inventories and development of conservation strategies
- encourage establishment and maintenance of wildlife reserves and parks and promote anti-poaching measures
- support buffer zones around protected areas
- support training and public awareness and increase participating country's capacity to preserve and manage their wild plant and animal resources, and
- encourage policies to increase the host countries commitment and ability to protect biological diversity.

A.I.D.'s Latin American and Caribbean Objectives

A.I.D.'s Bureau for Latin America and the Caribbean has developed 15 priority development objectives for its missions, one of which, "natural resource management", directly applies to forestry and wildlife management. However, in that there are limited resources, each A.I.D. mission is expected to select only a few of the 15 priority objectives, which means not all A.I.D. countries will have natural resource management in their list of priorities. If it is not, and a government would like to see it there, negotiations will have to be undertaken to decide how it can be included. This will usually include a decision on which priority currently on the list will have to be dropped to make room for the new one. This is necessary because there are only so many dollars for a particular country. An alternative approach is to find a way to include forestry and wildlife management into a priority already on the list, such as under agricultural production or export promotion.

Conclusion

A.I.D. does place a high priority on forestry and wildlife management. However, the decision as to whether we join with a particular host country in undertaking such an activity depends largely on where it falls within that particular country's shopping list of projects it would like to have

WORLD WILDLIFE FUND AND THE CONSERVATION FOUNDATION PROGRAMS FOR CONSERVATION AND MANAGEMENT OF TROPICAL FORESTS

Gerald P. Bauer, Dennis Glick, and J.J. Earhart

The Organization

The World Wildlife Fund (WWF) is an independent, nonprofit organization working worldwide to protect endangered wildlife, wildlands, and forests. Its top priority is conservation of the tropical forests of Latin America and the Caribbean, Asia, and Africa. The organization has a broad range of programs in such areas as wildland and wildlife conservation and management, tropical forest management, environmental education and training, scientific research, and resource policy.

The WWF is action oriented, supporting individuals and institutions who carry out practical, rigorously planned, and scientifically based conservation projects on the ground. Since its founding in 1961, WWF has worked in 104 countries to implement more than 1,300 projects involving a comprehensive array of conservation methods.

The WWF network includes national organizations in 23 countries across five continents. Among United States conservation organizations WWF-U.S. is unique because of its affiliation with the international WWF network. In addition to this, in 1985 WWF-U.S. formally affiliated with the Conservation Foundation, a non profit environmental research organization founded in the United States in 1948. The Conservation Foundation brings to the affiliation expertise in social sciences and policy analysis, as well as expertise in U. S. environmental law. This perspective, and particularly the Foundation's skill in economic analysis, enhances WWF's ability to aid conservation in developing countries.

The Need

Tropical forests, which support more than 50% of all plant and animal species on earth, are neither used well, nor managed to provide for the future. This biome has a tremendous capacity to produce timber, food, fiber, medicine, clean water, and other cultural heritage. Unfortunately, rather than being utilized as a valuable storehouse of natural capital for future economic development, this rich biological resource is for the most part being exploited in a wasteful and destructive fashion as a nonrenewable resource. Worldwide, an estimated 10-12 million hectares of primary tropical forests are deforested every year, and nowhere is this more apparent than in the new world's tropics.

These problems are not due to forest management that is poor. Rather it is absent. The Food and Agricultural Organization of the United Nations reported in 1963 that less than 3 percent of the world's tropical forests were managed under management plans. In the last 25 years the situation has not significantly improved. In a more recent assessment, FAO (1981) reported that only small areas of tropical forests were under intensive management. In addition to this, Lanly (1982) reported that in tropical America only about 14 thousand hectares of secondary forests are managed on a sustained yield basis.

Much of the tropical forest clearing is due to the expansion of ranching and agricultural lands, in which trees are simply cut and burned in place. Additionally, timber exploitation in tropical forests employs a highly selective extraction system, removing only a few commercially valuable species. This causes a great deal of damage to the residual stand and opens the forests to increased expansion. In these two cases, there is little or no effort to ensure long-term sustainable productivity of the ecosystem. Regeneration of these valuable forests is slowed by the extent of land degradation that ensues and serious environmental problems such as changes in local climatic conditions and reduced water quality can result. Furthermore, the loss of biological and genetic diversity as well as the complete impoverishment of one of the world's richest ecosystems are serious consequences of short sighted forest exploitation. Therefore, there exists an urgent need to develop economically viable systems of forest management which enhance rather than harm the natural resource base.

The Programs

In response to this need, the WWF/CF have established two programs aimed at conservation and management of tropical forest resources and the integration of sustainable use of these resources by local populations. The initiation of these programs by the WWF/CF is unique in the sense that it emphasizes a major shift from a traditional purist or preservationist attitude to that of economic, sustainable use, integrated with recognized development needs.

The Tropical Forestry Program

Goals and Objectives - The Tropical Forestry Program (TFP), which began in 1986, is designed to promote ecologically sound and economically sustainable tropical forest management practices. The goal of the TFP is to support projects that, by introducing improved techniques for management of tropical forests, produce economic benefits without damaging the productive capacity of the ecosystem.

The economic benefits of improved forest management will be both direct—timber, fuelwood, nuts, rubber, palm oil, etc.—and indirect or secondary—watershed protection, hunting, recreation and tourism, conservation of biological diversity, maintenance of climatic stability both regionally and globally, etc.

The TFP will focus on forest management systems which, while producing direct economic benefits, also maximize secondary benefits, in particular preservation of biological diversity. The initial efforts of this program will be directed towards the Neotropics, which contain the largest area of remaining tropical moist forest on earth, as well as one of the highest numbers of species in the world.

From a strictly technical point of view, sustainable management of tropical forests is challenging but feasible. The greatest obstacles to its implementation are usually socio-economic. Thus, consideration of social, economic, political, and institutional factors will be an integral part of project design and execution.

Program Criteria and Structure - Selection of projects for support will be based on two key criteria: 1) the promise of a positive rate of economic return, and 2) location in, or proximity to, priority conservation areas. Projects will originally be selected for a one year period, and may be extended after receiving a positive evaluation from the TFP review committee. The TFP recognizes that in most cases investments in forest management programs require long-term commitments, and the program is designed to meet these commitments when necessary.

The TFP will support projects in four major areas:

- **Field Research** - This activity will include research in several areas of natural forest management, including: recovery of abandoned pastures or heavily degraded forests, silvicultural techniques in secondary and primary forests, utilization of native timber species, and analysis of natural forest dynamics and regeneration.
- **Policy Research** - This activity will include studies of social, economic, and institutional factors which limit the application and effectiveness of sustainable forest management practices. These studies will seek to elucidate direct and indirect effects of government policies on forest resources. The goal of this work is to understand and overcome socio-economic constraints on implementation of sound forest management practices.
- **Model Projects** - Small-scale, socially feasible, model projects will be supported to test the findings of forest management and policy research. These projects will serve as pilot projects, with the goal of demonstrating the feasibility of recommended management practices and catalyzing their widespread adoption. Preference will be given to those projects involving critical habitat areas facing imminent destruction as well as those producing strong conservation benefits. These benefits may include reestablishing forest cover on deforested land or stabilizing land use in the buffer zone around priority wildland conservation units. Local communities which live in and manage the forest resources will be intimately involved in setting project objectives, designing the management strategy, and implementing the project. Projects will also be income producing, supported by rigorous economic analysis.
- **Training** - This activity includes support for local institution personnel to attend conferences and workshops in order to strengthen their capacity to formulate sound forest management policies, engage in land use planning, and otherwise improve the management of their forests.

Current Status - Presently the TFP is supporting 7 projects in 6 countries in Latin America and the Caribbean regions. These projects include: natural forest management and the development of an indigenous forest management cooperative in the Central Selva region of Peru, policy analysis, as well as natural forest management in Costa Rica, research on natural regeneration in Brazil, and support for training of host country nationals.

The Wildlands and Human Needs Program

Goals and Objectives - The Wildlands and Human Needs Program (WHNP), which began in October 1985, is designed to integrate the conservation of biological resources with the sustainable

utilization of these natural ecosystems by rural peoples. This program is a cooperative venture between the WWF-U.S. and the U.S. Agency for International Development (AID). The primary goal of the WHNP is to improve the management of critical wildlands to assure that they can be used sustainably in support of development needs while preserving ecological values. This program is based on the fact that natural areas such as tropical forests, savannahs, coastal mangroves, estuaries, and inshore fisheries often provide critical resources for human development; yet many of these fragile ecosystems deteriorate through overuse. Field projects supported by this program will demonstrate that in many cases wildland resources can be preserved while still responding to the development needs of local populations.

This program has many specific objectives closely related to the central goal. These include:

- Strengthen the institutional capacity of host country governmental and private agencies to adequately manage wildlands for biological, economic, and social goals.
- Improve awareness of the relationship between managed wildlands and human needs.
- Develop techniques for involving local resource users directly in the rational management of wildland areas and for educating communities about the benefits of these actions.
- Improve the exchange of information among professionals concerned with wildland and development issues.
- Replicate the successful wildland management approaches perfected in this program on a broad scale throughout the developing countries.

Program Criteria and Structure - The WHNP is primarily a field effort focusing on selected countries in Latin America and the Caribbean and Africa. Projects are divided into two general categories: model projects, and small projects. Model projects are the principal focus of the program and will eventually be implemented in seven to ten priority sites. These comprehensive pilot projects will include: 1) an assessment of resource management needs as they relate to the environment and local populations, 2) preparation of resource management plans, 3) implementation of project activities, 4) training for local counterpart agencies and resource users, and 5) project evaluation.

The small project activities will be carried out in ten to fifteen sites. These will include innovative experimental or pilot projects or components of projects. They may also include training, and interproject exchange of information and resource-related publications. These projects will complement the pilot projects and broaden the scope of the program by permitting WWF-U.S. to test and document different approaches in a wide range of settings. This aspect of the program is designed to be flexible and will enable the WWF-U.S. to respond to special targets of opportunity for integrating resource conservation and development.

Selection of projects for support will be based on the following criteria:

- All projects must demonstrate a direct link between improving the quality of life of local human

populations and the maintenance of an important natural or wildland ecosystems (forests, wetlands, lakes and wild rivers, shallow marine zones, coral reefs, swamps, etc.). Emphasis will be placed on protected wildlands (as in National Parks, Forest Reserves, Biosphere Reserves, etc.), although they can be unprotected, also. They must, however, be naturally occurring and demonstrate some degree of wildness.

- Projects can be ongoing efforts or new initiatives, but they must involve local people in their planning and execution.
- Model projects will represent a comprehensive or multifaceted approach to linking conservation and development. Small projects can represent one component of a larger effort but must be well integrated into a complete conservation strategy.
- Projects must fall within the Latin America and the Caribbean or African regions, and they must be in countries where an AID mission is active. Projects in areas of biological importance will be given the highest priority.
- Projects must have the endorsement of relevant officials; however, they do not have to be government-sponsored projects. The WWF-U.S. must receive AID mission approval within the country before the project can be initiated.
- All projects must be presented using WWF project proposal format (available from WWF). These will be reviewed by WWF-U.S. project review teams.

Current Status - Since program initiation, the WHNP has supported 14 projects in the Latin American and the Caribbean regions and 5 projects in the African region. Countries with projects include: Bolivia, Costa Rica, Ecuador, Guatemala, Honduras, Mexico, and Peru in Latin America; Barbados, Dominica, and Saint Lucia in the Caribbean; and Central African Republic, Cameroon, Malawi, Sierra Leon, and Zambia in Africa.

Model projects have ranged from the implementation of a multi-use resource management plan for the giant two-and-a-half-million-hectare Pacaya Samiria National Reserve in the Peruvian Amazon, to the development of an integrated coastal management project on nearby Saint Lucia. Small projects have supported training opportunities, such as the participation of a Central American wildlife refuge manager in a workshop on coastal resource management in the U.S. Virgin Islands, and financial assistance to an anthropologist studying the wildland utilization characteristics of the Cabecar Indians living in La Amistad Biosphere Reserve in Costa Rica. Other program projects focus on agroforestry in wildland areas, artesanal fisheries in coral reef ecosystems, mangrove forest management, sustainable utilization of wildlife, management of the recently discovered wild perennial corn, land titling for forest farmers, small scale commercial forest utilization, ecotourism, and integrated land use planning.

Conclusion

The initiation of the TFP and the WHNP by the WWF/CF may be looked upon as a new approach to the wise use and conservation of the World's tropical resources. These programs outline an approach that will integrate people with their environment, while at the same time provide long-term economic benefits on a sustainable basis. The WWF/CF fully recognizes the need for a long-term commitment to these programs, and they are prepared to meet this commitment. These programs are still relatively new, and are just now becoming established. To date, they both have created a great interest, and a new enthusiasm for management of tropical forest resources. Inquires about how to receive support for a specific project can be made to the WWF/CF, 1250 24th St NW 3500, Washington D.C., United States 20037.

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REPORT ON FOURTH MEETING OF CARIBBEAN FORESTERS

Felix Gregoire

Introduction

The fourth meeting of Caribbean foresters or forestry officials took place in Dominica during April 5-9, 1988. The meeting was funded jointly by the United States Agency for International Development (USAID) and the United States Man and Biosphere Program (MAB), and was hosted by the Government of the Commonwealth of Dominica.

Representatives of the following countries attended the meeting: Antigua and Barbuda, Belize, Dominica, Saint Lucia, Saint Vincent, Grenada, Saint Kitts/Nevis, Martinique, Montserrat, Guadeloupe, Jamaica and Puerto Rico. The meeting was held at the Castaways Hotel, just outside the village of Saint Joseph.

The theme of the meeting was wildlife management and a copy of the agenda is attached.

Official Functions

The official opening of the meeting took place the evening of April 5, and the feature address was delivered by the Honourable Charles Maynard, Minister for Agriculture, Trade, Tourism and Industry. A cocktail party hosted by the same Minister and attended by the President and Prime Minister was held at the Old Mill Cultural Centre later that evening.

The sponsors hosted a banquet, which was attended by the Permanent Secretary of the Ministry of Agriculture and his wife, on the evening of April 7 at the Castaways Hotel.

Proceedings

After introductory remarks, the meeting started with an overview of the Caribbean Wildlife Programme of US-AID and the World Wildlife Programme. These were followed by country presentation. Each country discussed its wildlife programme and highlighted achievements, constraints and recommendations.

A number of presentations were made by representatives of World Wildlife Fund, US Fish and Wildlife Service, RARE Centre for Tropical Birds, International Council for Bird Preservation and CEER. Presentations were made on the parrot recovery programme in Saint Vincent and Puerto Rico. During these presentations each organization explained how assistance could be obtained for conservation programmes.

A field trip to the Syndicate/Dyer/Morne Pleasance Forest and Cabrits National Park was conducted by the staff of the Dominica Forestry Division. Delegates were fascinated by the forest, the wildlife, including the two species of endemic and endangered parrots which they saw, and the fortification at the Cabrits.

A meeting of the Caribbean Chapter of the International Society of Tropical Foresters, ISTF, was also held. Officers appointed to the Executive Committee were: Felix Gregoire, President; Roy Jones, Vice-President; and Loren Ford, Secretary.

On Friday April 8, three working groups were formed to discuss and formulate recommendations on various topics. The groups worked diligently and speedily which resulted in the closing of the meeting on Friday evening.

Group I dealt with Wildlife Policy, Management, and Governmental/Non-Governmental Liaison. Group II dealt with Wildlife Interaction with Economic Sectors and Wildlife Trade (CITES). Group III dealt with Wildlife Training, Education, Research and Funding. The list of persons in the various working groups is attached.

Conclusion

The fourth meeting of Caribbean forestry officials was a tremendous success. It is now left to the various Departments of Forestry in the Region to implement the recommendations of the meeting.

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