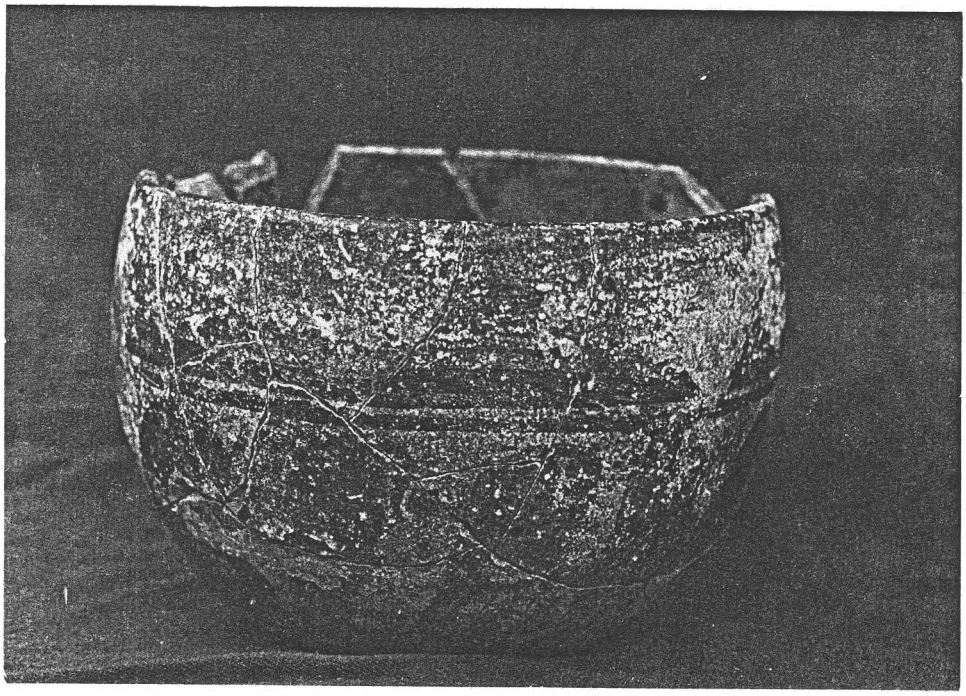
Sharon Matola

THE COLUMBIA RIVER FOREST RESERVE EXPEDITION

9-16 December 1990



CONTENTS

Columbia River Forest Reserve Expedition: 9-16 December 1990

Expedition Participants

Santiago Billy, CONAP, Guatemala	Ecology
Modesto Bol, Forestry Officer, Machaca Forest Sta.	Forestry
Mick Fleming, Chaa Creek Cottages	Ecotourism
Paul Francisco, Dept. of Archaeology	Archaeology
Bill Hasse, Biologist	Bird records; Spelunking
Sharon Matola, The Belize Zoo & TEC Center for Environmental Studies	Expedition Coordinator
Martin Meadows, Forester	Forestry
John Meyer, PhD, Jacksonville Zoological Society	Herpetology
Jim Nations, PhD, Conservation International	Ecology
Tony Rath, Pelican Beach Inn, Dangriga	Bird records; Photography
Paul Walker, PhD	Herpetology
Charles Wright, Botanist, Soils Scientist, Author	Consultant

Acknowledgements

The Columbia River Forest Reserve expedition, with its main objective to assess the ecological importance of this Forest Reserve, was the final field study project under the Critical Habitat Study funded by WWF-US through a grant from USAID.

The logistics involved in the organization of this expedition were complex and without the cooperation of many individuals, both in Belize and abroad, the successful implementation of this important field investigation would not have been possible.

In Belize, special thanks to the Ministry of Natural Resources for their interest in this project and show of support. Valuable consultation was given by the Belize Defense Force, and British Forces Belize provided logistical support. Capt. Richard Chesterfield, British Forces, assisted with ground organization and we are very grateful for his good help.

Personnel at the Center for Environmental Studies, and especially Lou Nicolait, provided helpful input throughout the planning of the Columbia River Forest Reserve expedition.

Invaluable assistance from outside of Belize came from Mr. Bob Sears, pilot extraordinaire, who represented Project LightHawk, and provided excellent overflights to the Forest Reserve.

Funding received from Conservation International, Project LightHawk and the World Wildlife Fund-US was critical to the success of the Columbia River Forest Reserve expedition.

Finally, sincerest thanks to Wildlife Preservation Trust, International. Their financial support of conservation activities throughout the year, undertaken by the expedition coordinator, has made the Columbia River Forest Reserve Expedition possible.

Dedication

The energy and spirit behind the planning and execution of the Columbia River Forest Reserve expedition is dedicated to the Belize Audubon Society, who, in 1968, saw the unique features of this region and lobbied for its status to be declared a Nature Reserve, in order to "conserve mature forest and its wildlife resources". Even though this status is now considered abandoned, it took great foresight to note the importance of this area, over twenty years ago, when "conservation" and "biological diversity" were only concepts in genesis.

And to Mr. ACS Wright, the father of ecology and environmental awareness here in Belize. His fine assistance with this project was greatly appreciated by all who were involved.

Executive Summary

The Columbia River Forest Reserve was investigated as part of the Critical Habitat Study, to attempt to gain some further knowledge about this relic forest type, subtropical wet - subtropical lower montane wet (Holdridge 1967), which has all but disappeared from Central America due to habitat destruction/alteration.

Expedition members divided into various teams, in order to broaden investigation access into different areas of the Forest Reserve.

Ornithology data was obtained from Courtney Conway, a field researcher from the Smithsonian Institute who was studying the avifaunal populations in the Columbia River Forest Reserve during the time of the expedition.

No flora was collected; botanical data should be noted as observations only.

A. Topography

Team observations confirm with Wright et al (1959), that much of the area consists of rugged, limestone hills. There is an abundance of sinkholes, some quite deep, with vertical sides. The terrain was difficult to traverse, and guides were used by all participants to reach various areas in the Forest Reserve.

B. Forestry

Team observations confirm that large hardwood species like mahogany, Swietenia macrophylla, have been logged out of the Forest Reserve. The western portion of the Forest Reserve has a well-defined trail which links together abandoned logging camps, a reflection upon the historical role which was held by the timber industry in Belize.

In general, the areas investigated in the Forest Reserve were rich in lime-loving species. Large chicle trees, Manilkara zapota, were observed. Cycads, Zamia sp., were observed, and

the vegetation showed distinctive changes from the lower regions of the Forest Reserve to the top of "Little Quartz Ridge".

1. The common understory palm in the lower regions was the give-and-take palm, Cryosophila argentea.

2. In the upper reaches of "Little Quartz Ridge", warrie cahune, Astrocaryum mexicanum, and mountain cabbage, Euterpe macrospadix, increased in abundance.

3. Also on the higher elevations was another palm species, Synchanthus fibrosus and Colpothrinax cookii.

4. Species noted which indicated climatic disturbances in the past (hurricanes: 1961, 1973) were:

Trumpet	Cecropia peltata
Polak	Ochroma lagopus

5. Secondary species, Salmwood, Cordia alliodora, hogplum, Spondias mombin, Quamwood, Schizolobium parahybum, and Prickly Yellow, Zanthoxylum spp. were observed.

C. Archaeology

A representative from the department of Archaeology targeted the caves in the area for his investigations. Two caves, two caverns, a large sinkhole, and a Maya ruin, already discovered and documented, were all explored. A polychrome vessel, determined to be from the Late Classic Period, AD 600-900, was found in pieces from cave 11 and later reconstructed (cover photo).

D. Soils

Soils were collected from four sites on "Little Quartz Ridge" and from the southern edge of the Columbia River Forest Reserve. All soils collected were taken to Central Farm for analyses. Analyses showed that all soil samples were very acid with only soils in sample "B" having the ability to store ions.

E. Herpetology

A total of eighteen species were collected including six amphibians, seven lizards, and five snakes. One of the

frogs, of the genus Eleutherodactylus, had never before been described by science. A complete, published description of this new species will be published by the end of the year.

A diverse herpetofauna is suspected to inhabit the Columbia River Forest Reserve, however, it was believed that the overnight low temperatures (in the upper 50's) and the daytime low temperatures (in the 70's), due to constant cloud cover, influenced the herp collecting throughout the week.

F. Ornithology

There were 135 species of birds documented during the expedition. Twenty-five were transient species from north America. The yellow-faced grassquit, Tiaris olivacea, was listed in the Checklist of the Birds of Belize as "1 record". The common woodnymph, Thalurania furcata, was a new record for this species in Belize. Birds noted on the expedition resulted by 1. observations from team members and 2. data supplied by Courtney Conway of the Smithsonian Institute, who was mist-netting birds in the Forest Reserve during the time of the expedition.

G. Ecotourism

Due to the growing role that tourism is playing in the GNP of Belize, in particular, "nature tourism", it was an objective of this expedition to form a basic outline of the tourism potential for the area of the Columbia River Forest Reserve and the nearby Maya village of San Jose.

H. Recommendations

1. The monitoring of hunting activities, especially during the dry season when animals move towards available water, would aid in the revitalization of faunal populations within the Forest Reserve.

2. Agricultural development is not recommended. Soils are too acid and too rocky. Dry season water supply is too uncertain.

3. The Columbia River Forest Reserve should remain intact for its valuable watershed protection to the people and forests

in the lowlands further downriver. Flooding is already a serious problem in this part of the country, increased deforestation in the Columbia River Forest Reserve will further provoke the flooding situations that regularly occur during the wet season.

4. Ecotourism should develop with the expertise and assistance of the Toledo Ecological Association. This group of approximately twenty-five members, including Kekchi, Mopan Maya and Garifuna, are trying to develop Punta Gorda into a possible role model for indigenous people and community ecosystems.

5. The Biosphere concept should begin to be considered in Belize, creating an overall sustainable and wise management plan for the country. Within the scope of this concept, the Columbia River Forest Reserve should remain as a core area, left intact as possible, especially in light of its unique ecological features not repeated anywhere else in the Central American region.

From a report submitted by Martin Meadows, Forester:

"This area is one of very special interest and not represented, to my knowledge, anywhere else in Belize and possibly not anywhere else in Central America. It is an area of scientific interest, tourist interest, and is irreplaceable. It should certainly be placed under protection and not exploited or converted to other use until studies show exactly how the ecotypes and flora and fauna are interdependent. Any change in land use could result in millions of years of tropical forest evolution vanishing forever".....

The Columbia River Forest Reserve Expedition Report

December 9-16th 1990

A. Introduction

Growth of Environmental Knowledge Concerning the Columbia River Forest Reserve.

The area was examined by the Australian L.H. Ower between 1921 and 1926, a very energetic geologist, exploring the mineral resources of British Honduras (Ower, L.H. 1928). D.G. Dixon prepared a geological map of Southern British Honduras from fieldwork carried out from 1950-56, working for several months out of camps located in the vicinity of Quartz Ridge and the Machikilha River. During part of this period, the soil surveyors of the Land Use Survey team joined the geologists Cecil Dixon and da Cunha in these camps.

From the above pioneer work, the basic pattern of the geology and soils gradually emerged, and some of the more obvious relationships between rock-soil-plant communities were placed on record in the Land Use Survey report (Wright et al. 1959). At the time of this survey, 1954, the whole area was gazetted as Crown Land. No forest reserve then existed. Only scanty information about the pattern of the forest plant communities present in the area can be found in some of the field books of Forestry Department officials engaged in recording the exploitation of mahogany and chicle producing trees. An official stock-taking of the timber reserves in the area did not eventuate until 1978 (twenty or more years after the Columbia River Forest Reserve had been gazetted), by which time most of the cedar, Cedrela mexicana, and mahogany, Swietenia macrophylla, rosewood, Dalbergia stevensonii, santa maria, Calophyllum brasiliense, and other secondary timbers, had already been extracted.

During the years of maximum timber and chicle extraction, from 1925-1960, travel through the area was comparatively

easy because there were many timber extraction routes in use during the dry season, and a fine network of mule trails serving the wet-season chiclero camps. With the exception of the old tractor road between the Columbia River and Edwards Central (and its extension to Union Camp), almost all these helpful access routes have now been lost.

It was during these years of comparative accessability that most of the botanical work was done. This consisted mainly in the collection of plant material for herbaria and only broad ecological relationships were remarked upon by the botanical pioneers. The cutting of the boundary line between British Honduras and Guatemala in the 1920-1926 period provided botanists, like the energetic Mr. Schipp of Stann Creek, with a golden opportunity to explore otherwise inaccessible country. Subsequently, valuable other plant collection and taxonomic identifications from the area of the Columbia River Forest Reserve have recently been made by a number of visiting botanists from overseas. A number of rare plants (including palms and Zamia sp.), have been recorded from the area. Even less is known about the mammals, reptiles, insects, etc. living in the Columbia River Forest Reserve.

From the published records alone, it is obvious that there is great scope for ecological research within the Columbia River Forest Reserve. This is of importance internationally because the area lies within the "Subtropical Wet and Subtropical Lower Montane Wet" life zone (Hartshorn et al. 1984), thus is one of the few environments of this category with much of its natural forest cover still intact in all of Central America.

B. Ecosystem Classification

The Columbia River Forest Reserve is an area of tropical forest spanning 103,000 acres, falling within the subtropical wet and subtropical lower montane wet life zones (Holdridge 1967). This classification is cartographically expressed on the enclosed map (Natural History, Nov. 1990, "Vegetation of the

Yucatan"), and represents some of the last remnant forests of this ecotype in Central America.

Lying at Lat. 16 20' N. Long. 89 58'W to the north of the Mopan Maya village of San Jose (pop. approx. 600), the terrain within the reserve varies from 900 - 2,700 meters above sea level. Rainfall over the region is expected to average a little over 100 inches (2,540 mm) per year (Hartshorn et al. 1984), but at the higher elevations, precipitation may be much higher.

The Toledo District rainforests are only marginal to the true tropical rainforests of the western hemisphere: Their climate is too cool during December to March, and too dry during March through to May. Consequently, some of the typical humid tropical species are at an ecological disadvantage when struggling to survive amongst subtropical species during a part of the year, while some of the typical subtropical species are less than happy during other months of the year (Wright 1989). Using the Brazil nut, Bertholletia excelsa, as an example, growing this species in the Toledo District results in young plants going into a state of shock during winter months, presumably due to low temperatures, and those that survive to become mature trees produce very little in the form of flowers, and no fruits are produced.

In Toledo, in an average year, subtropical environmental conditions prevail for about four months, November - February, while the balance of the year more truly approximates to a humid tropical environment.

The Toledo District rainforests express a complex assemblage of different physiological patterns, and it is believed that some of this diversity may be possibly related to the arrival of different species at different periods of geological time, and by different pathways, resulting in on-going competition for desirable ecological niches.

Geologists now agree that Belize may once have consisted of an isolated island or small archipelago which later became linked by land bridges eastwards to Cuba and the Antilles; at a later date, it established links with the North American

land mass, and eventually became linked with South America when it became part of the isthmus of Central America. Belize, may have occupied a crossroads location where species migration could have occurred, intermittently, from different sources, over a long time scale. To date, botanists still argue about which plant species may have come from where (Wright 1989).

A possible example of migration is the palm species, Colpothrinax cookii. Closely-related species of Colpothrinax occur in Cuba; in Belize, this ridge-loving species of palm, unknown until first observed in 1987 (British Forces Belize, Belize Audubon Society, "Maya Topping Expedition", Rogers et al.), and then subsequently reported in 1989 (Doyle's Delight Expedition, August 1989, Matola et al. unpub. report). It is known to also occur on the mountains of Alto Verapaz, 150 miles south of Belize, in Guatemala.

Another example is that of the oak, Quercus sp. Oak trees originated in North America and have migrated southward. Two species of Quercus were noted on Little Quartz Ridge.

C. Some Ecological Characteristics of the Three Main Landscape Categories.

1. Limestone/Karst Landscapes.

The Columbia River Forest Reserve has diverse geological elements. In part, the landscape is strongly karsified, with major cave systems and some of the biggest sink holes in the country (Cornec, pers. comm. 1990). In the geographic sense, this karst area represents the southern foothills of the Maya Mountains. The topography is rugged, and the rock is very hard, composed, usually of almost pure calcium carbonate crystals resulting from three different marine depositional periods covering a time interval of approximately 100 million years. Gradual solution of the limestone, and the development of extensive subterranean drainage systems over this long period has produced the conspicuous karstic features of the foothill landscape.

The oldest of these limestone deposits is thought to have occurred in the mid-to-late Cretaceous geological period, some 150,000,000 years ago. They gave rise to what is now known as the Coban limestone beds. Much of the Coban limestone beds were buried below later limestone deposits but are thought to be the main limestone strate flanking the Permian metamorphosed sediments of the Maya Mountains. Those old limestone beds, adjacent to the Maya Mountains, are deeply fissured and have deep subterranean drainage systems (Hartshorn et al. 1984). Due to the drainage water moving underground, the land has many conspicuous "pot holes". The general relief is "medium to high karst" with "cock-pit" topography (King et al; 1986).

Next in the series of limestones are the Campur beds. This deposition is thought to have occurred primarily during the Jurassic geological period, approximately 100,000,000 years ago. The Campur limestones are the present surface rock of much of the Columbia River Forest Reserve. The Campur limestone surfaces are noted for their very rugged appearance, consisting of innumerable solution depressions separated by steep ridges. The Campur limestone strata overlies the older Coban limestones. Where this is relatively thin, the cock-pit relief is often replaced by a maze of large and small pot holes, some with a subterranean stream meandering across the pot hole floor.

The Coban limestone series and most of the Campur limestone beds are deep-water marine accumulations.

Shallow-water limestone beds were deposited during the Tertiary period, occurring from 1,000,000 to 70,000,000 years ago, and these are amongst the younger limestone deposits in Belize, referred to as the Lacandon beds. They are characterised by hard, sometimes white crystalline limestone beds interlayered with calcareous sandstone and some mudstone. Lancandon limestone beds occur only in the extreme southern reaches of the Columbia River Forest Reserve, including the vicinity of San Jose village. Lancandon calcareous deposits are characterized by a landscape that is hilly to strongly rolling, with a

pattern of abrupt limestone ridges.

Extending over a distance of fifteen kilometers, trending roughly northeast and lying near the northern limit of the karst foothills, is a very distinctive isolated mountainous ridge which is perhaps the most prominent geological feature of the Columbia River Forest Reserve. The "Little Quartz Ridge", so named by chicleros, is a sharp "fin" of quartz-rich porphyritic rocks, which appear to be geologically similar to those recorded from the Doyle's Delight region of the southern Maya Mountains. These rocks are located along the SW-NE crest of the ridge, giving the isolated mountain mass a steep "scarp like" slope facing northwest.

The lower part of the mountain ridge is flanked with limestone, possibly of Coban age. The "dip" slope of "Little Quartz Ridge" is believed to be formed mainly from Paleozoic metamorphosed sediments including indurated shales, altered sandstones, conglomerates, and with intercalated beds of crinoidal limestones.

These latter are exposed in some creeks draining southeast from the crest of "Little Quartz Ridge". They are, in places, almost granular in nature and they erode to form shallow lateral caverns extending like shelves into the rocks on either side of some creeks. These shallow caverns provide suitable breeding habitats for many of the local animal populations.

"Little Quartz Ridge" is in itself an important ecological entity in the northern sector of the Columbia River Forest Reserve. The highest point of the present ridge is only 1,040 meters above sea level, and thus, the ridge may have been buried under Coban and/or Campur limestone for several million years until exposed as a result of solution of the overlying limestone. Further examination of the soils of "Little Quartz Ridge" may help to resolve this speculation.

The vegetation of "Little Quartz Ridge" is markedly different from that of the lower elevations in the Columbia River Forest Reserve. Give-and-Take palms, Cryosophila argentea, abundant throughout the trek to "Little Quartz Ridge", were

non-existent on the ridge at the higher elevations. Instead, there was a more varied flora with local abundance of warrie cahune, Astrocaryum mexicanum, and Euterpe macrospadix. Euterpes spp. in particular, increased in abundance as elevation increased. With increasing elevation, palm species, Synchanthus fibrosus, became prevalent, and two species of tree ferns were noted.

The hemi-epiphyte, Clusia sp. also appeared with an increase in elevation. Clusia, a plant that germinates on a host tree and sends its roots to the ground, appears most frequently in tropical moist and lower-montane wet life zones. When mature, they may be among the tallest trees in the forest. It is believed that an effective dry season may be ideal for seedling establishment (Janzen et al. 1983).

On the windswept summits of "Little Quartz Ridge", the palm species, Colpothrinax cookii is conspicuous. Other species noted were:

- tall, narrow-leaved oak, Quercus sp.
- prop-rooted Moraceae tree species.
- Santa Maria, Calophyllum brasiliense.

The canopy averaged 90-120 meters tall, almost right to the summit.

"Little Quartz Ridge" is a unique ecological entity not found elsewhere in the Columbia River Forest Reserve and not continuing westward into Guatemala or northward to the Maya Mountains, where similar rocks have been noted. Between "Little Quartz Ridge" and the northern limits of the Columbia River Forest Reserve, the landscape has the appearance of an upland plain, dotted with small limestone hills which may be relicts of an old limestone capping, now almost entirely removed by solution.

The southern Department of the Peten in Guatemala thus shares a same ecology with its neighbor to the east, Belize. With regard to the Columbia River Forest Reserve, this is easily seen on the enclosed map (Natural History, Nov. 1990), as this subtropical moist forest extends into Guatemala.

The Machikilha River, crossing the far northern limits of the Columbia River Forest Reserve, begins its course in Belize and heads into Guatemala, joining the Rio de la Pasion. Part of the headwaters of the Machikilha River is an upland alluvial plain which extends south toward "Little Quartz Ridge" (Dixon 1955).

The Machikilha upland plain has soils which are of much lower fertility than elsewhere in the Columbia River Forest Reserve due to the accumulation of siliceous alluvium deposited by slow-moving acid drainage waters from the adjacent Maya Mountain highland.

It is believed that the present plant cover here has undoubtedly been modified by fire, both of natural origin and fires caused by timber extraction or associated with former chicle camps (Wright, pers. comm.).

The present plant cover has a high proportion of "cutting grass", Scleria bractea, in the understory, and a few larger patches of evergreen seasonal forest of medium height in which the canopy is broken by emergent yemeri, Vochysia hondurensis, nargusta, Terminalia amazonia, and locally by rosewood, Dalbergia stevensonii.

Approaching the Guatemalan border, near the point where the Machikilha River passes into Guatemala, patches of pine forest and grass savanna appear. This area is believed to have been traversed by Cortez on his expedition from Mexico to Honduras in 1524.

While the quality of chicle, Manilkara zapote, is believed to be inferior to that found in forests further north, both in Belize and in the Department of the Peten in Guatemala (Martin Meadows, Santiago Billy, pers. comm. 1990), chicleros from Guatemala travelled frequently across the border to take advantage of the chicle resources in the Columbia River Forest Reserve during the years of maximum chicle extraction, 1925 - 1960 (Alfredo Sho, pers. comm. 1990). Today, chicle is no longer harvested from the Columbia River Forest Reserve.

SUMMARY

A large portion of the Columbia River Forest Reserve remains fairly intact. The lack of evidence for the presence of mammals and large birds (ie cracids), is due to hunting pressures, however, the control of this activity would assist in the rejuvenation of the faunal populations within the Reserve.

With regard to agriculture in the Columbia River Forest Reserve, there is no valid potential for this type of development. Campur and Coban karst foothills are too rugged, the soils too rocky, and the dry season water supply too uncertain to such a degree that even the traditional slash and burn techniques of the Maya indians are proving unprofitable.

Permanent access roads through "cock-pit" landscape is extremely costly, and water and power services would not be feasible due to the difficulties defined by the same karst topography. Thus, the Columbia River Forest Reserve is not an "ecologically friendly" environment for farming endeavors.

Similarly, the soils of "Little Quartz Ridge" are totally unsuited for farming. The Machikilha upland plain is unsuited for traditional Maya farming activities, as well. And due to its isolated location, it is unlikely to attract investment by large, modern farm operations.

The Columbia River Forest Reserve cannot be regarded as a potential agricultural asset. It is, however, a very important forestry asset, providing valuable watershed protection to the lowland farmer of the Columbia and Rio Grande Rivers. Nine months out of every year, flood problems plague local agriculturalists. The Columbia River Forest Reserve provides watershed protection, and further cutting of these forests could not only result in flood inundations of great severity, but the drying up of valuable spring waters during the dry season.

The karst foothills function like a sponge, accepting much of the heavy rainfall during June and July, partially

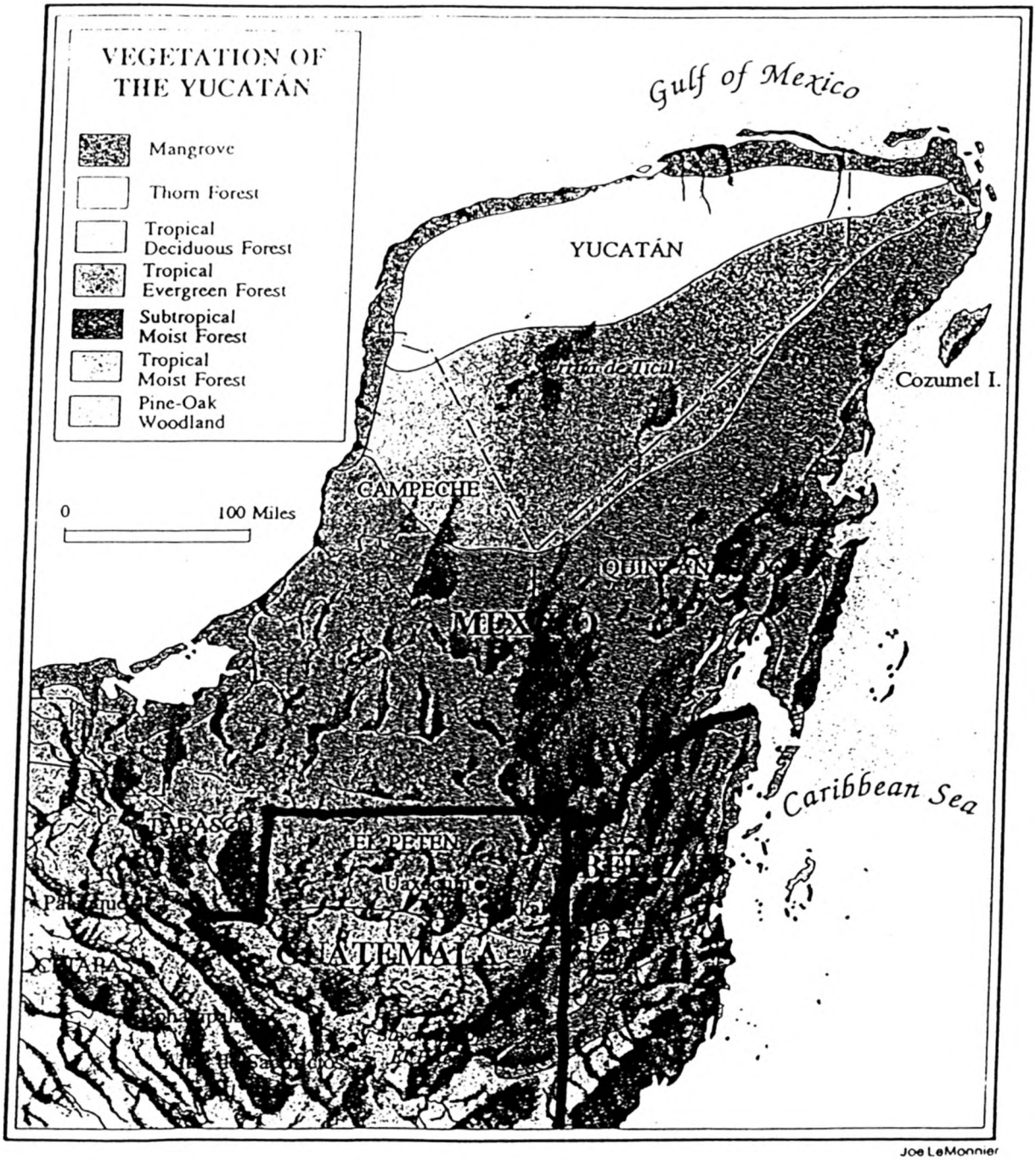
storing this water in fissures and underground caverns and slowly releasing this stored water during the months with lighter rainfall, or no rain at all.

Forest cover is essential for the efficient operation of this "sponge" system. Forest destruction causes most of the heavy rains to sluice directly off exposed rock surfaces producing flash floods which may last only a few days or even hours, but they do great damage to roads, bridges, homes and livestock on the lowlands beyond the limits of the Columbia River Forest Reserve.

The Big Falls road bridge on the Rio Grande has been under observation since 1962 (D. Owen-Lewis, Pers. comm. 1990), and the annual pattern of flooding shows a steadily increasing maximum flood level ("top gallon" conditions), a steady increase in the number of floods submerging the highway bridge, and only a slight decrease in the number of days of each flood when the road is impassable.

The landscape of the Columbia River Forest Reserve has a story to tell and future ecological research may disclose an exciting tale of very ancient land surfaces with soil development processes continuing for many millions of years; and a tale of similar rocks and soils buried under thick layers of limestone, reappearing again in some localities as the covering limestone beds slowly dissolved away.

And while all these landscape-forming processes were going on, plants and animals from diverse sources east, north, and south were invading the landscape resulting in the present patchwork of plant and animal communities. From Baldy Beacon to the north, southwards through Cockscomb and the high plateau of "Doyle's Delight", to "Little Quartz Ridge" of Columbia River Forest Reserve, there may be a great ecological continuum awaiting research by botanists, zoologists, soil scientists, archaeologists, and for future scientists whose disciplines are still evolving. Belize is indeed favoured to be the sole custodian of this unique phenomenon, certainly unique in Central America and perhaps unique in all the world. The Columbia River Forest Reserve is an essential part of this fascinating regional mountainous ecosystem.


VEGETATION OF THE YUCATÁN
Mangrove
Thorn Forest
Tropical Deciduous Forest
Tropical Evergreen Forest
Subtropical Moist Forest
Tropical Moist Forest
Pine-Oak Woodland
0
100 Miles
Gulf of Mexico
YUCATÁN
Cozumel I.
CAMPECHE
QUINTANA
MEXICO
Caribbean Sea
EL PETEN
GUATEMALA
Joe LeMonnier

METHODOLOGY

All expedition participants flew over the Columbia River Forest Reserve in a STOL Maule aircraft before undertaking any field investigations. It was agreed by all participants that overflights permitted a valuable perspective into the terrain, and led to clear planning with regard to the best executed methods in order to obtain a maximum amount of data.

Expedition participants divided into teams to pursue areas of investigation in the Forest Reserve. Each team was accompanied by at least two Maya guides from San Jose village.

Six expedition participants made the trek to "Little Quartz Ridge"; observations were noted along the way and notes compared each evening at the campsite.

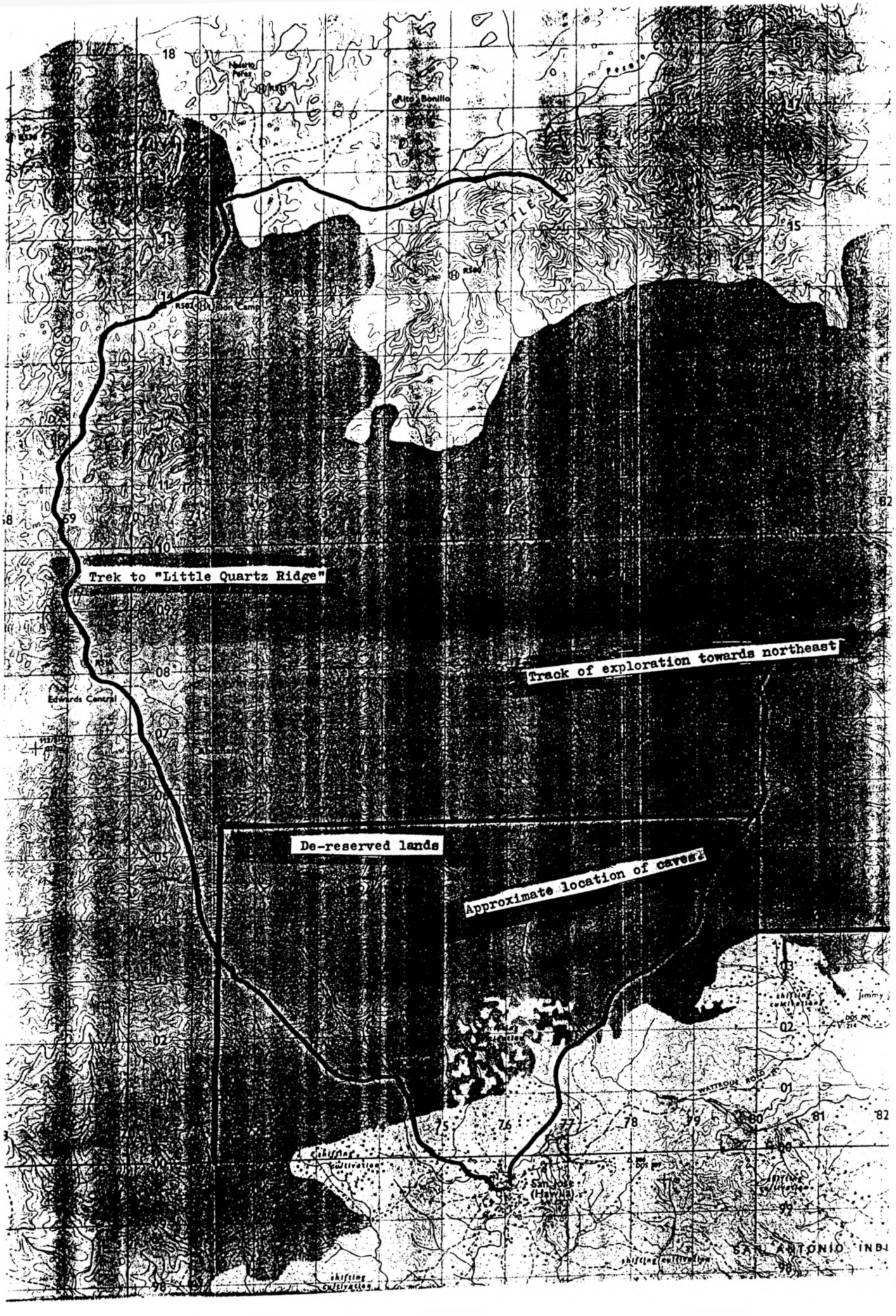
The five other expedition participants made their base camp in San Jose village and did primarily day treks from there. They, too, compared notes every evening, and on the final evening, 15 December, in San Jose village, all expedition participants had a regroup and meeting to compare findings, observations, and to discuss recommendations.

The following map (1:50,000; #37 Lands and Survey Department) shows the basic routes of investigation into the Forest Reserve.

Although the track to Guatemala was found, it was not followed completely to the border.

The Wattrous road, which was the main access road into the eastern part of the Forest Reserve, was travelled approximately seven km to the north, and the route, with ample sinkholes and caves, was considered to be very rugged.

The trek to "Little Quartz Ridge" passed by shifting cultivation, secondary growth forest, forest with discontinuous then continuous canopy, and continued on to the top of the ridge. The ruggedness of the terrain, very cool temperatures in the night, and meager rations were collective factors that caused this part of the expedition to be termed difficult.


Trek to "Little Quartz Ridge"
Track of exploration towards northeast
De-reserved lands
Approximate location of caves
LITTLE
Rita Bonilla
Edwards Canyon
San Jose (Hawila)
SAN ANTONIO IND

1. Forestry

The forest type is described as subtropical wet - subtropical lower montane wet (Holdridge 1967). This forest ecotype is considered a "relic" in Central America. Similar habitat in the region has been altered or destroyed during the past thirty years (Wright, Howell, pers. comm. 1991).

A. American Camp to Abraham Camp.

Most of this area lies outside the Forest Reserve and is a region showing a gradual increase in altitude from 400 - 700 meters with a significant amount of metamorphic/sedimentary rocks present amongst karst limestone.

The dominant secondary tree species noted were Quamwood, Schizolobium parahybum, and Cotton, Ceiba pentandra. Prickly Yellow, Zanthoxylum kellermanii, was noted but in patchy distribution.

The ground cover included many herbs, ferns, and fishtail palms with the higher Calyptrogyne palms only scattered among warrie cahune, Astrocaryum mexicanum. Also present, but not in abundance, were Piper spp. Cahune palms, Orbygnia cahune, tended to decrease with altitude.

B. Abraham Camp to Edwards Central to Union Camp.

This route follows an old logging trail and is approximately 700 meters in altitude. The terrain is all karst limestone.

The tree species, in general, appeared to be more abundant than those species of the dryer northern forests. Large Sapodilla, Manilkara sp, and Nargusta, Terminalia amazonia, appeared along this route. Younger Mahogany, Swietenia macrophylla, and Cedar, Cedrela mexicana, were seen. Older trees of the two latter-mentioned species were most likely logged out of the Forest Reserve in the 1950's or earlier. Observed were a fair number of old large mahogany stumps.

Secondary hardwood species observed along this trek include Salmwood, Cordia alliodora, Hogplum, Spondias mombin,

Quamwood, Schizolobium parahybum, and Prickly Yellow, Zanthoxylum kellermanii. The discontinuous canopy noted along parts of this trek, as well as species of Trumpet, Cecropia peltata and Polak, Ochroma lagopus, were indications of past climatic disturbances.

Approaching Union Camp, there was a gradual predominance of a four foot palm appearing to be Calyptrogyne donnell-smithii, noted by its central orange, unbranched fruiting spike. Warrie cahune, A. mexicanum, were common along this route and less common were the Give-and-Take palms, Cryosophila argentea. These two palm species partly replaced the afore-mentioned ground cover. Uncommon but repeatedly noted were tree ferns and one species of cycad. A few cyclanthus sp. were also noted.

C. Union Camp to Little Quartz Ridge

Initially, this route followed a level, poorly-drained area which merged into a well-drained karst topography.

The poorly-drained area had medium-to-tall forest, the canopy was discontinuous in places, and the species noted were the butress tree, Kaway, Pterocarpus officinalis, and Santa Maria, Calophyllum brasiliense. Beginning to appear in greater abundance were cabbage palms, Euterpes macrospadix, and prolific numbers of bromiliads.

As the drainage increased, the topography becoming more karsified, the canopy was notably taller, 60 - 80 feet. Again, warrie cahune, A. mexicanum, was present.

This highly-karsified area proved interesting. The forest was tall - over 50 feet, and the Calyptrogne palm cover was dense. Strangler fig, Ficus spp. were evident, and bromiliads, as well as the Give-and Take palm, C. argentea, were abundant. Due to the continuous canopy, very little light reached the forest floor.

The vegetation noted indicated that the soils varied from slightly alkaline in the crevices to acid soils in the deeper leached soils in the bottom. Give-and-Take palm, C. argentea,

and Warrie cahune, A. mexicanum, were often observed alongside one another. C. argentea prefers alkaline soils, while A. mexicanum prefers soils that are neutral to acid.

D. "Little Quartz Ridge"

There was an obvious soil change as the route approached "Little Quartz Ridge", leaving karst behind and becoming soils of metamorphic type. Give-and-Take palms, C. argentea, were not present. A few Warrie cahune, A. mexicanum, were seen but far more abundant were Cabbage palms, Euterpes macrospadix, and the appearance of Synechanthus fibrosus. There were abundant numbers of tree ferns (two species) present.

As the route approached the top, tiger claw ferns, tree ferns, and Clusia sp. were noted.

Atop "Little Quartz Ridge", the dominant tree species became the palm, Colpothrinax cookii. Other species noted were a tall, narrow-leaved oak, Quercus sp., Clusia sp, a prop-rooted tree of the genus Moraceae, Santa Maria, Calophyllum brasiliense, Miconia sp. and Cephaelis sp. shrubs, and abundant numbers of Synechanthus palm (shrub layer to 15 feet). The Euterpes palm canopy was approximately 30 - 40 feet high.

The soils varied depending on the bedrock which varied from quartz to schist types.

E. The High Plateau: Northeast of Union Camp towards Burgos and across to "Little Quartz Ridge".

This area was extremely variable, possibly depending on the depth and types of soil and the drainage. Seen here were potato holes with cutting grass, Scleria bracteata, to deep, well-drained soils with isolated karst remnants appearing.

Of extreme interest were two species of Quercus with enormous acorns; one cup was five cm across, and the other was three cm across.

F. Summary

The trek from San Jose to "Little Quartz Ridge" was

of great forestry interest due to the diversity of tree species found in the area. From observations, it appeared that tree species diversity was richer than that of the northern dryer forests.

The presence of cycads, Zamia sp. was also of interest, as was the vegetation on top of "Little Quartz Ridge", due to the abundance of the palm species, Colpothrinax cookii, and the unusual species of oak tree, Quercus sp.

The highly-karsified topography of the area indicates its importance as a watershed, accepting much of the year's heavy rainfall like that of a sponge, and storing this water in fissures and underground caverns.

Further forestry and botanical investigations into the Columbia River Forest Reserve are warranted. A Rapid Environmental Assessment over the period of one week resulted in observations of great interest indicating that this relic-ecotype of forest holds within it species of flora that may not be represented anywhere else in Central America.

11. Soils

The degree of development of soils is directly related to slope, the most severe slopes being occupied by skeletal soils with abundant coarse sand.

A large part of the Columbia River Forest Reserve is occupied by skeletal soils (Belize Government Forestry Inventory 1976). On karst limestone, these are very extensive. Some areas support high forest, but most have been extensively reduced by hurricane. Wright (1959) recommended the retention of such areas as protection forest.

Skeletal soils on the non-calcareous rocks of the Maya Mountains are also extensive. They are of low fertility and do not generally support high forest. In the soil deriving from the Bladen Volcanics member of the Santa Rosa series, the fertility is very low and only a poor "low-bush" assemblage is found (Wright 1959). ACS Wright (1959) advised retention of all such areas as protection forest and speculated that

regeneration after logging would be unlikely. Such soils are seen as highly erodible and the formulation of alignments for logging tracks would be problematic (Bze. Gov. Forestry Inventory 1976).

Soils classified as erodible (Wright 1959) are well represented in the Forest Reserve. These, too, are recommended for retention as protection forest. The skeletal soils and the erodible soils comprise over half of the Columbia River Forest Reserve.

Developed soils within the Forest Reserve are mainly colluvial soils found in basins between the limestone hills occupied by skeletal soils. The better colluvial soils are loams, clay loams and sandy clay loams of the Xpicilha and Cumbre soil sets (Wright 1959). The poorer soils which are found on hills not occupied by skeletal soils are the stony and boulder clay loams.

Developed soils of the Toledo series take the form of shallow brown-grey clay loams, often impoverished due to leaching and sometimes truncated by erosion which Wright el al (1959) have named Aquacate sandy clay and Manfredi fine sandy clay. Both sets have an associated shallow, stony and boulder facies found on hill sides.

Developed soils of the Santa Rosa series are found on gentle terrain within the Forest Reserve, but forms only a small proportion of the area in this category (Bze. Gov. Forestry Inventory 1976).

Soils of the granite areas are referred to as Stopper soils and are comprised of loams and gritty loams. These soils are of moderate fertility but are easily eroded when cleared.

In general, a high proportion of the Columbia River Forest Reserve is occupied by unstable soils. These are largely confined to the more inaccessible and remote areas of karst limestone and the Maya Mountains (Bze. Gov. Forestry Inventory 1976).

Soils were collected from the southern edge of the Forest Reserve, approximately 300 meters in altitude in a herb understory. Soils were also collected from "Little Quartz Ridge". All samples were taken to Central Farm for analyses, and the results -

Samples	Lab.#	Ph	N%	Kppm.	Organic content%	C.E.C.*
A1	8860	4.1	1.06	196	3.09	leaf/humus top layer, no mineral particles.
A2	8861	3.9	.22	45	2.82	33
A3	8862	4.5	.14	29	.96	23
B	8863	4.3	.11	33	1.05	134
C	8864	4.9	.37	351	3.06	78

All soils tested were very acid which is thought to be from frainfall leaching away minerals (Meadows, pers. comm. 1991). Normal acid soils are usually 5.5-6.5.

Samples A, B, are taken from "Little Quartz Ridge. A1 has all of the nitrogen and potassium in the top humus/leaf layer.

A2 has little nitorgen or potassium in the top soil layer, and low C.E.C.* (*C.E.C. is the Cation Exchange Capacity, or the ability to store ions/plant food).

A3 had a low mineral layer, was poorer than A2. This sample had rock filaments - metamorphic schist/slate type.

B is more equivalent in position to A2, but the parent rock was different - quartz. This sample was very poor in nitrogen and potassium, yet, had a high C.E.C.

C sample came from the southern edge of the Forest Reserve, the Ph was slightly less acid, but the percentage of nitrogen was low, the potassium was high and the C.E.C. would be considered medium.

In general, from the soils collected and tested by Central Farm, it would appear that most nutrients are in the humus/fine root/leaf layer. They appear to be very prone to soil disturbance, especially burning and only sample B had the abilitiy to store ions.

111. Archaeology

Paul Francisco of the Department of Archaeology in Belmopan, directed archaeological activities from 10 - 15 December. Due to the karst topography of the Forest Reserve, cave formations were prevalent, and Mr. Francisco concentrated his efforts towards the exploration of caves within the reserve. An objective was to document any historic Maya occupation/ activities that may have occurred in these caves.

Mr. Francisco was joined by Mr. Bill Hasse, an experienced spelunker who has lived in Belize for over twenty years. Two guides from San Jose village, Candido Coh and Emeterio Pop accompanied Paul Francisco and Bill Hasse.

The location of the caves investigated by Francisco and Hasse were in a northeast direction from San Jose village, and were reached after four hours of steady hiking.

A. Cave 1

In archaeological terms, Cave 1 was a shelter only. It showed a minimum degree of occupation. Pot sherds were present.

B. Cave 11

Discovered four years ago during a hunting journey by Mr. Emeterio Pop, Cave 11 had a small entrance measuring approximately one meter which then led into three chambers.

The southern chamber yielded a large number of smashed sherds, including many large rim sherds. A few were collected for samples and dating purposes.

The second chamber, the northeastern chamber, was entered by a small exit, approximately forty cm. in diameter and fifteen meters long. This chamber was approximately twenty meters long, and showed a greater degree of occupation. It yielded a large rim of what appeared to be a storage jar and many pieces of sherds, some of which were polychrome. Among the sherds retrieved were: half of a small dish of a rim diameter of approximately twenty cm, the base or upper rim of a polychrome drum, and the main body of a beautifully decorated polychrome jar.

The southeastern chamber measured twenty-five meters in length and showed little evidence of activity. However, an opening of approximately fifty cm in diameter at the end of the chamber led to another chamber, approximately thirty-six meters long. In this chamber, a complete rim of a large pot was found.

The cave was very wet. All of the sherds were covered with thick red clay. Numerous tracks of the paca, or gibnut, Agouti paca, were found throughout the cave. An entire skeleton of a paca was found, and due to this find in the southeastern chamber, the name "U-Actun-Jale" was given to the cave, which means in the Maya language, "The Gibnut's Cave".

Within the same general area of the above-mentioned caves, a cavern was explored which consisted of a shelter approximately ninety meters long and a tributary of approximately eight meters long. In this tributary extension, a number of smashed sherds were sighted. Some of these sherds were polychrome and showed a pattern which suggested that the vessel could be restored (cover photograph).

A "kill hole" was noticed on the vessel, meaning that it had been used in association with a buriel. After minimal excavation, bones were found, including some teeth. Six teeth were unearthed and brought to the Department of Archaeology.

For identification purposes, the cavern was named "U-Actunil-Cha-Hum", meaning "The Youth's Cave". Based on the

size of the teeth, it was suspected that a Maya of youthful age had been buried there.

In a northeast direction from "U-Actunil-Cha-Hum", a search was undertaken for a large sinkhole. The sinkhole was found and approximate measures revealed it to be forty meters wide and sixty meters deep. Entering the sinkhole was difficult, due to its steepness, but a careful search led to a possible entrance and a descent was made.

Once within the sinkhole, two large pot sherds were found. What was notable about the sinkhole was the large number of cycads, Zamia sp. found growing there. This was not the common Zamia reported from other parts of the country, but an uncommon species. Photographs of the plants were taken to aid in further identification.

Caves 1, 11, the caverns and the sinkhole were all documented during the first two days of the expedition. The third day, 12 December, led to the finding of another cavern approximately thirteen meters long. This included a shelter approximately two and one half meters wide and one meter high, and another chamber approximately three and one-half meters long and one meter wide. The longest chamber measured approximately three and one-half meters by one meter.

This cavern was littered with buriel fragments including human bones and teeth. It also appeared that animals used the cavern for shelter.

On the 13th of December, our group headed towards American camp, again, in search of more caves. The area that we came to was an area of high, rugged limestone and this was named, "Bel-Ich Kizin" or in Maya Mopan, "The Rugged Place". This limestone had a multitude of large fissures which appeared to be cave entrances, but after investigation, the fissures were no more than a mass of limestone ridges and openings.

On the 14th of December, not far from Abraham camp, another cave was discovered. After entering the cave, it was found to be approximately thirty meters long, containing two chambers. It showed no evidence of Maya occupation.

On the 15th of December, a Maya ruin already discovered and named, "Ich K' K'hil", or "Wild Cacao Plants", was investigated. It lies two hours walking to the west of San Jose, and is a minor ceremonial precinct with four low mounds bordering a plaza measuring approximately twenty-five meters.

"Ich K'K'hil" is built somewhat like Uxbenka, Santa Cruz. Ich K'K'hil was raised to a level of approximately thirty-two meters before the mounds and the plaza were erected. The highest mound at Ich K'K'hil measures approximately eight to ten meters.

Lying in the plaza is a huge chunk of rock which could have served as a stelae, or which eventually a stelae would have been carved. This site appeared to have been looted, and a search yielded no artifacts which could have been brought to the Department of Archaeology.

The Columbia River Forest Reserve should be visited again for further archaeological investigations. Within a short period of time, less than one week, our searches revealed significant finds which strongly indicate that there was a great deal of activity by the Maya in this area. Future and more thorough explorations could yield valuable finds and possible new data about the ancient Maya in southern Belize.

Specimen Description (cover photo)

A small restored polychrome bowl with a well-defined flat base measuring 7.3 cm, with out-curving medium thick sides forming a flat to a slightly rounded rim.

This vessel is approximately 14.1 cm in diameter and 10.3 cm high. Its exterior as well as the interior is slipped. However, only the exterior is glazed and is slightly eroded at the rim. Immediately below the black rim, is a one inch band of red painted on an orange slipped background, and separating the remainder of the bowl are two black bands of

different thickness, the upper being 0.3 cm. and the lower 0.25 cm.

The larger base section of the bowl is painted cream and is decorated by a set of three equidistant long orange-red units resembling "flower receptacles". Each set of "receptacles" is separated by a meandering black curved line, as if to say that the vessel had contained some kind of liquid beverage before it was smashed. Looking at the vessel from a three dimensional perspective, and taking into consideration the "receptacles", it would appear that the vessel with its content is being held by a stalk of some sort.

Near the base is a kill-hole. A kill-hole, as the word indicates, is a hole punctured on a vessel to make it non-unctional, and, is associated with internments. After seeing the kill-hole, preliminary excavations were undertaken and a few toe bones and other deteriorated bone fragments were unearthed. The remains were not enough indication to a human internment. Further excavation continued until six human teeth were found. They included two incisors, two premolars, and two molars.

The teeth were believed to be from a youth. Based on this observation, the cavern was thus named, "U-Actunil-Cha-Hum", which means in the language of the Maya, "The Youth's Cavern".

The vessel was shattered on a limestone protrusion which measured approximately thirty inches high by ten inches. There were other large sherd fragments in the cavern, as well. Some of them were brought into the Department of Archaeology for dating purposes.

U-Actunil-Cha-Hum is a small cavern about four hours of hiking in a northwesterly direction from San Jose village. It measured approximately fifteen meters in length, four meters deep, and one meter wide, and was utilized in the Late Classic Period (AD 600-900).

IV Herpetology

John R. Meyer, PhD, provided the data resulting from field investigations into the Columbia River Forest Reserve. A preliminary flyover provided the herpetology team with a comprehensive look at the terrain, and provided the basis of which habitats would be chosen for subsequent field work. The areas of American Camp and Black Creek were chosen for study, the former considered to be of limestone bedrock, while the latter towards the east was an area consisting of shale and mudstone. The guide for the herpetology team was Rosario Pop.

Herpetological records from the Columbia River Forest Reserve are scarce, and a herpetology rapid assessment was considered an important exercise during the duration of the expedition.

Also, an alarming decline in populations of many species of frogs and salamanders worldwide adds an extra degree of urgency in requiring herpetological records for this area of Belize.

Reports of dramatic drops in populations of frogs, toads, salamanders or their relatives have been recorded from at least sixteen countries, including every continent. The decline appears vast but unpredictable, inexplicably hitting some of the world's estimated 5,100 amphibian species but missing others (Philips 1990).

Acid rain, metallic pollutants and pesticides have been indicated by reports from the First World Congress of Herpetology at the University of Kent, as plausible causative factors in these decreases (Rabb 1990). The skin of frogs and salamanders is extremely permeable and these animals could serve as barometers indicating a decline in the health of our environment, as they are particularly sensitive to atmospheric disturbances.

While herpetologists have agreed that more solid data is needed relative to these existing theories, the present and very real situation of declining amphibian populations needs to be considered.

A. Habitats Investigated

1. American Camp

The elevation of the American Camp study area was approximately 350 meters above sea level.

American Camp was on the edge of a cultivated area with undisturbed forest west and to the north. This area, according to sources in San Jose village, is going to become land used for shifting cultivation/agriculture in the near future.

American Camp is located at the top of a ridge west of the stream and the stream bedrock alternated between limestone and shale/mudstone. The feeder streams exhibited heavy lime load, which was shown by the deposits on the rocks. The area had not been logged since the 1940's and had never been clear-cut.

Observations and collections of the herptofauna in this area were meager. It is believed that the weather may have influenced "herp" activity, as the overnight low temperatures were in the upper 50's, while daytime highs remained only in the 70's due to the continual cloud cover.

2. Black Creek

Black Creek is located approximately two km to the northwest of Salamanca. The camp was located in an area of shifting cultivation and the elevation was approximately 175 meters above sea level.

At the time of the field investigations, both Black Creek and its tributaries were without water. The forest around Black Creek appeared to be much younger than that of American Camp and according to guide Rosario Pop, the area was clear-cut about twenty years ago.

There was no evidence of surface water. The area had extensive limestone outcroppings and sinks, some of which were almost 100 feet deep.

Other than use by British forces and local hunters, there appeared to be little pressure on the area.

B. Summary

The survey undertaken was not able to document a large number of amphibians and reptiles but the Columbia River Forest Reserve is potentially inhabited by a diverse herpto-fauna. Based upon known distibutions, both geographically and ecologically in northern Central America, the list in Appendix 1 indicates those species that may inhabit the Forest Reserve.

Additional collecting during the summer will be necessary to document the presence of certain species, particularly the amphibians, as the existence of adequate aquatic breeding sites is problematical due to the topography and geology.

This rapid herptofaunal investigation did reveal some elements that indicate an affinity with the lower montane zones that are found on the north slopes of the mountains in Chiapas, Mexico, Alto Verapaz, Guatemala, and the Caribbean slopes of the mountains in northern Honduras.

However, most of the forest in these above-mentioned areas has been destroyed or will soon be for various land-use projects. Any large tract of forest that can be preserved will not only protect a very special array of flora and fauna, but will also allow for continuing studies of the herptofauna of the region, particularly with respect to the ecology and historical biogeography of the species in Central America.

The Columbia River Forest Reserve presents an unspoiled area, virtually uninhabited, with relatively easy access for natural history oriented tourism, tropical ecology studies, and further scientific field work that would be invaluable to the need for further understanding the interdigitation of neotropical and nearctic fauna that occurs in this critical area of nuclear Central America.

C. Species List - See Appendix 1

V. Ornithology

Literature review before the start of the Columbia River Forest Reserve Expedition revealed little ornithological information about this region of Belize. Both resident and migratory bird species were of great interest to the expedition, and recordings were accomplished in two ways: first, each expedition member kept records during their respective journeys in each part of the Forest Reserve. Second, Mr. Courtney Conway of the Smithsonian Institution provided a list of bird species which he had netted within the boundaries of the Forest Reserve.

One of the species captured in Courtney Conway's mist nets was the Yellow-faced Grassquit, Tiaris olivacea, previous information about this species in Belize yields only one official record. Another species, the Common Woodnymph, Thalurania furcata, has not been recorded in Belize and represents a new species for the country's Checklist of the Birds of Belize.

Recordings of migratory bird species in tropical forests of Central and South America are important due to a prevailing theory that the steady decrease in migratory songbird populations between the years 1978 through 1987 may be due to the widespread destruction of these rainforests (Nat'l Geo. Oct. 1990).

Approximately sixty species of US birds winter in mature tropical forests. These include twenty-nine species of warblers, five flycatchers, five vireos, plus assorted thrushes, cuckoos, tanagers, orioles, and grosbeaks. Of these, a few, such as the worm-eating warbler, Helmitheros vermivorus, and Swainson's warbler, Limnothlypis swainsonii, occur almost exclusively in mature forests, and for them, deforestation is an indisputable problem.

Migratory bird species not only spend the winter months in tropical forests, but some play a vital role in the healthy ecology of these forests. For example, the male Orchard Oriole, Icterus spurius, is the only effective pollinator of the

of the large and abundant tree, Erythrina fusca. While other birds obtain nectar from the tree's flowers, it is only the male Orchard Oriole that does so in a manner that also fertilizes them (Wilcove 1990).

The importance of recordings of migratory bird species becomes very apparent when taken into consideration the following: these birds are losing their breeding habitat in North America because of steady land alteration, atmospheric pollution that is damaging the forests in which they live, and the fact that animals that prey upon them, i.e. raccoons, squirrels, blue jays, and crows, are all thriving. These factors, in addition to the continual destruction of tropical forests that is reducing their wintering grounds to fragmented regions of habitat, are all to be considered in the recent studies that show that migratory songbird populations are decreasing (Wilcove 1990).

A. Species List - See Appendix II

VI. Ecotourism Profile of San Jose Village

Ecotourism or nature-tourism can be defined as, "Tourism that consists in travelling to relatively undisturbed or uncontaminated natural areas with the specific objective of studying, admiring, and enjoying the scenery and its wild plants and animals, as well as any existing cultural manifestations (both past and present) found in these areas. In these terms, nature-oriented tourism implies a scientific, aesthetic, or philosophical approach to travel, although the ecological tourist need not be a professional scientist, artist, or philosopher. The main point is that the person who practices ecotourism has the opportunity of immersing himself/herself in nature in a manner generally not available in the urban environment" (Ceballos-Lascurain 1987).

The ecotourism potential of San Jose village and the surrounding Columbia River Forest Reserve was seen as an important component in the field investigations due to the dynamic growing role that this industry is playing in the country's GNP.

Between the years 1980 to 1987, tourist arrivals in Belize increased by fifty-five percent. The contribution of tourism to foreign exchange earnings grew from US$41.0 million to an estimated 47.3 million in 1987 (Miller 1988), and it has been projected that tourist spending will increase approximately seven percent annually (Tourism Report 11 1990).

The Columbia River Forest Reserve could become a nature-tourism destination for a growing number of travellers who are interested in tropical flora and fauna.

The ecotourism profile and overview was assessed by Mr. Mick Fleming who has founded and developed Chaa Creek Cottages in the Cayo District on the Macal River.

A. Profile of San Jose Village

Location -	Thirty-five miles west of Punta Gorda town and seven miles east of the Guatemalan border.
Population -	Approx. 600 people (50 families).
Ethnic Group -	Mopan Maya.
Language -	Mopan Maya or English.
Religion -	Five churches: Mennonite, Baptist, Nazarine, Pentacostal, Catholic.
Sources of Income -	Agriculture.
Principal Crops -	Corn, beans, rice grown in traditional milpa farming.
Av. Family Income -	BZ$500 - $1000 per annum.
Transportation -	Bus leaves San Jose twice weekly at 3:00 am. Wed. and Sat. for Punta Gorda. Returns from PG at 12:00 pm.

B. Benefits to be Derived from Eco-Tourism

1. Injection of cash flow into village society.

2. Could lead to gradual change from dependancy on milpa farming practices as the preservation of forested lands would be tied into ecotourism activities.

3. The preservation of the Maya culture would be encouraged through the interest shown by visitors to the village who are wanting to observe traditional life-style of the Maya.

4. Growth of local arts and crafts trades, ie woven baskets and embroidery for sale to visitors.

C. Attractions of San Jose Village as a Tourist Destination

1. The opportunity to interact with the Mopan Maya in English, a unique attraction for foreign tourists.

2. The opportunity to stay in a traditional Maya village and observe the cultural lifestyle.

3. Experiencing the traditional foods of the village and the preparation of these local dishes.

4. Participation in discussions with the villagers about their traditional milpa farming ways, leading to a clearer understanding of these methods, i.e. different crops, their rotation, and the reasons that these methods have been solidly ingrained into their society for hundreds of years. Examples of these farms are in the immediate area.

5. An insight into the Alcalde system of leadership, and how this form of governing has worked in the past; why it is still effective today.

6. Given that the ecological life zone of the Columbia River Forest Reserve is special in Central America, the vegetation found here would provide visiting botanists and naturalists an area of extreme interest. Unusual flora such as the palm, Colpothrinax cookii, the cycad, Zamia sp. and assorted orchids and other epiphytes could make the Forest Reserve a highly-desirable botanical destination.

7. For those visitors having an interest in geology or earth sciences, the limestone karst formations and conspicuous sink holes, probably some of the best examples of these geological features in the country, can be observed and studied in the Forest Reserve.

8. Bird watchers can also enjoy both secondary forest and high forest birding, and may be able to add quite a few species to their checklists (see Appendix 11).

9. Travellers interested in an introduction to rain-forests and the flora and fauna found in these environs, the Columbia River Forest Reserve could provide a worth-while experience. Local guides are available for forest journeys, and their knowledge of the area and the local plants and animals would provide a unique and memorable experience.

10. Visits to San Jose Village and the adjacent Forest Reserve could be part of an adventure travel itinerary which could include other activities such as:

- river trips down Golden Stream or Rio Grande.
- trips to some of the southern caves off the coast of Punta Gorda such as Sapadillo Caye.

D. Present Tourism Profile

A visit to San Jose Village can presently be undertaken by hiring a charter from Punta Gorda to the village, which costs approximately BZ$155, or by arriving to the village by bus, which leaves PG for all villages west on Wednesdays and Sundays.

Once in the village, a simple inquiry to the Alcalde about available accommodations can be made and local homes would be available for simple lodging.

The following men, living in San Jose Village, are available for guide services:

Antonio Sho	Candido Coh
Francisco Pop	Hermando Pop
Pablo Sho	Andres Coh
Mario Pop	Lucas Pop
Luciano Pop	Alfredo Sho
Catarino Pop	Emetario Pop

The standard guide fee, at this writing, is BZ$20.00 per day.

E. The Toledo Ecological Association

A local organization, the Toledo Ecological Association, has formed and is active in developing and promoting eco-tourism in the Toledo District. Mr. Chet Schmidt of Nature's Way Guesthouse, 65 Front St, P.O. Box 75, is a moving force behind the Toledo Ecological Association and is a contact for them in Punta Gorda.

The Association consists of twenty-five members representing Kekchi and Mopan Maya and the Garifuna in this area of Toledo. The principal villages represented are Barranco, Santa Cruz, Laguna and Silver Creek.

The goal of the Association is to try and develop PG as a possible role model for indigenous people and community ecosystems.

A possible ecotourism strategy is for each village to develop a trail system which would incorporate the sites of special interest within that particular village area.

Standardizing basic accommodations throughout the villages involved in this plan is also being addressed.

VII. Other Observations

A. Mammals

The presence of mammals detected from tracks or other signs were scant during the five day trek up to "Little Quartz Ridge". However, spent shot gun shells were abundant and this area has served as a hunting ground for the surrounding villages for many years.

Explorations further east/northeast from San Jose yielded more animal tracks than what was found in the western part of the Forest Reserve along the trail to Union Camp. The following tracks were reported from expedition members:

Jaguar, Panthera onca

Ocelot, Felis pardalis

Jauaroundi, Felis yagouaroundi

Tapir, Tapirus bairdii

Collared peccary, Dicotyles tajacu

Also, a troop of fifteen coatimundis, Nasua nasua, was observed eight km northeast of San Jose.

During the trek to "Little Quartz Ridge", the call of the Black Howler monkey, Alouatta nigra, was heard on three different occasions.

B. Examples of Land Use in San Jose Village

An intervidw with one of the village health workers gives an idea of the amount of land needed per family. He believes the average family plants six acres of corn, four acres of rice, one acres of beans and about two acres of a mix of everything else (peanuts, cacao, bananas, etc). The corn and bean fields need to move every year, leaving the

land fallow for five years until they can once again return and plant. Therefore, conservatively speaking, each family needs about fifty acres of land for shifting cultivation. With 110 families in the village, this relates to a need of approximately 5500 acres or 8.5 square miles.

A TAMP/VITA Project located in the village is encouraging the villagers to try permanent cropping.

C. Recommendations

The following were recommendations suggested by various expedition participants:

1. Further exploration is needed to describe the forests to the northeast of the village, in the eastern section of the Forest Reserve. Esperanza Camp has been repeatedly mentioned by the villagers in San Jose as a beautiful spot with bountiful wildlife (frequented by hunters). The forest is reportedly high, sink holes are prevalent. This area should be explored in the dry season.

2. The hunting of wildlife within the Forest Reserve needs to be monitored or controlled; the clearing of primary forest for farming purposes must be monitored...(from a report submitted by Mr. Modesto Bol, Forest Officer, Machaca Forest Station).

3. "This area is one of very special interest and not represented, to my knowledge, anywhere else in Belize and possibly not anywhere else in Central America. It is an area of scientific interest, tourist interest, and is irreplaceable. It should certainly be placed under protection and not exploited or converted to other use until studies show exactly how the ecotypes and flora and fauna are interdependent. Any change in land use could result in millions of years of tropical forest evolution vanishing forever".... (from a report submitted by Mr. Marten Meadows, Forester).

While no legislation exists in Belize with regard to the establishment of Biosphere Reserves, it was unanimously

agreed upon that the region known as the Columbia River Forest Reserve should serve as a core area within a larger Forest Reserve plan encompassing the entire Maya Mountains.

The Biosphere Reserve concept was developed by UNESCO and UNEP in cooperation with the FAO and IUCN. First launched in 1971, it is a worldwide program dealing with people-environment interactions.

Research under the Biosphere Reserve program is designed to provide the information needed to solve practical problems of resource management. It also aims to fill the still significant gaps in the understanding of the structure and function of ecosystems, and the different types of human intervention.

At this writing, there are 243 Biosphere Reserves in 65 countries around the world.

The Biosphere Reserve concept does not mean that large tracts of land are "locked up" and left unused. The concept provides a zoning plan whereas areas would be assigned a status that is practical to that respective territory. Controlled logging, hunting, and agricultural practices are all possible activities that can be carried out within a Biosphere Reserve.

However, "core areas", as is suggested as an assigned status to the Columbia River Forest Reserve, is due to the presence of special characteristics such as genetic richness or features of exceptional scientific interest.

People are an important part of the Biosphere Reserve concept. This is not a plan specifically targeting the strict control of plant and animal resources. People constitute an essential component of the landscape and their activities are fundamental for its long-term conservation and compatible use. People and their activities are not excluded from a Biosphere Reserve; rather they are encouraged to participate in its management and this insures a stronger social acceptance of conservation activities (Action Plan for Biosphere Reserves 1983).

APPENDIX 1

Potential Herpetofauna of the Columbia River Forest Reserve

AMPHIBIA

Dermophis mexicana
Bolitoglossa dofleini
B. mexicana
B. occidentalis
B. rufescens
Oedipina elongata
Bufo cavifrons
Bufo marinus
Bufo valliceps
Eleutherodactylus chac
E. laticeps
E. rugulosus
Leptodactylus melanonotus
Syrrhopus leprus
Centrolenella fleischmanni
Agalychnis callidryas
A. moreleti
Hyla ebraccata
H. loquax
H. microcephana
H. picta
Ololygon staufferi
Phrynohas venulosa
Smilisca baudini
S. phaeota
Gastrophryne elegans
Rana berlandieri
R. vaillanti

REPTILIA

Claudius angustatus
Kinosternon leucostomum
Staurotypus triporcatus
Chelydra serpentina
Trachemys scripta
Celestus rozellae
Coleonyx elegans
Gonatodes albogularis
Sphaerodactylus millepunctatus
Thecadactylus rapicaudus
Lepidophyma flavimaculatum
Norops biporcatus
N. capito
N. lemurinus
N. limifrons
N. pentaprion
N. sericeus
N. tropidonotus
N. uniformis

Basiliscus vittatus
Corytophanes cristatus
C. hernandezi
Iguana iguana
Laemanctus longipes
Sceloporus variabilis
Eumeces sumichrasti
Mabuya unimarginata
Sphenomorphus cherriei
Ameiva festiva
A. undulata
Gymnophthalmus speciosus
Boa constrictor
Adelphicos quadrivirgatus
Amastridium veliferum
Clelia clelia
Coniophanes bipunctatus
C. fissidens
C. imperialis
Dendrophidion nuchalis
Dryadophis melanolomus
Drymarchon corais
Drymobius margaritiferus
Elaphe flavirufa
Imantodes cenchoa
Lampropeltis triangulum
Leptodeira annulata
L. septentrionalis
Leptophis ahaetulla
L. mexicanus
Ninia diademata
N. sebae
Oxybelis aeneus
O. fulgidus
Oxyrhopus petola
Pliocercus elapoides
P. euryzonus
Pseustes poecilonotus
Scaphiodontophis annulatus
Sibon nebulata
S. sanniolas
Sibon sartori
Spilotes pullatus
Stenorrhina degenhardti
Tantilla cuniculator
T. schistosa
Tantillita lintoni
Thamnophis proximus
Tretanorhinus nigroluteus
Xenodon rhabdocephalus
Micrurus diastema
M. hippocrepis
M. nigrocinctus

Bothrops atrox
B. nasuta
B. nummifer
B. schlegeli

Herpetofauna Collected/Observed in the Forest Reserve

Species	Location	Specimens Preserved
Bufo cavifrons	American Camp	Yes
Eleutherodactylus chac	Edwards Central	Yes
Eleutherodactylus laticeps	American Camp	Yes
Eleutherodactylus rugulosus	American Camp	Yes
Eleutherodactylus sp.	Black Creek Camp	Yes
Rana vaillanti	American Camp	No
Ameiva festiva	American Camp	No
Basiliscus vittatus	American Camp	No
Norops lemurinus	American Camp	No
Norops limifrons	American Camp	Yes
Norops uniformis	American Camp	Yes
Norops sp.	San Jose Village	Yes
Sphaerodactylus millipunctatus	3 km NW of San Jose	No
Boa constrictor	Edwards Central	No
Bothrops nummifer	Abraham Camp	No
Drymobius margaritiferus	5 km E of Salamanca	No
Imantodes cenchoa	American Camp	No
Tantilla schistosa	American Camp	Yes

APPENDIX II

Bird Species recorded from the Columbia River Forest Reserve*
(species marked with * indicate those captured in mist nets)

Great Tinamou	Tinamus major
Slaty-breasted Tinamou	Cryptoturellus boucardi
American Kestrel	Falco sparverius
Crested Guan	Penelope purpurascens
Great Curassow	Crax rubra
Plain-breasted Ground-Dove	Columbina minuta
Ruddy Ground-Dove	Columbina talpacoti
Blue Ground-Dove	Claravis pretiosa
Gray-chested Dove	Leptotila cassinii
Olive-throated Parakeet	Aratinga nana
Brown-hooded Parrot	Pionopsitta haematotis
White-fronted Parrot	Amazona albifrons
White-crowned Parrot	Pionus senilis
Mealy Parrot	Amazona farinosa
Groove-billed Ani	Crotophaga sulcirostris
Spectacled Owl	Pulsatrix perspicillata
White-collared Swift	Streptoprocne zonaris
Long-tailed Hermit	Phaethornis superciliosus
Little Hermit	Phaethornis longuemareus
Violet Sabrewing	Campylopterus hemileucurus
White-bellied Emerald	Amazilia candida
Rufous-tailed Hummingbird	Amazilia tzacatl
Stripe-tailed Hummingbird	Eupherusa eximia
Black-headed Trogon	Trogon melanocephalus
Collared Trogon	Trogon collaris
Slaty-tailed Trogon	Trogon massena
Tody Motmot	Hylomanes momotula*
Blue-crowned Motmot	Momotus momota
Green Kingfisher	Chloroceryle americana
White-whiskered Puff	Malacoptila panamensis
Emerald Toucanet	Aulacorhynchus prasinus
Collared Aracari	Pteroglossus torquatus
Keel-billed Toucan	Ramphastos sulfuratus
Golden-olive Woodpecker	Piculus rubiginosus
Lineated Woodpecker	Dryocopus lineatus
Pale-billed Woodpecker	Campephilus guatemalensis
Buff-throated Foliage-gleaner	Automolus ochrolaemus*
Plain Xenops	Xenops minutus
Scaly-throated Leaftosser	Sclerurus guatemalensis*
Tawny-winged Woodcreeper	Dendrocincla anabatina
Ruddy Woodcreeper	Dendrocincla homochroa
Olivaceus Woodcreeper	Sittasomus griseicapillus*
Wedge-billed Woodcreeper	Glyphorynchus spirurus
Ivory-billed Woodcreeper	Xiphorhynchus flavigaster
Barred Antshrike	Thamnophilus doliatus
Russet Antshrike	Thamnistes anabatinus

Plain Antvireo	Dysithamnus mentalis*
Dusky Antbird	Cercomacra tyrannina
Black-faced Antthrush	Formicarius analis*
Paltry Tyrannulet	Zimmerius vilissimus
Yellow-bellied Elaenia	Elaenia flavogaster*
Ochre-bellied Flycatcher	Mionectes oleagineus*
Slate-headed Tody-Flycatcher	Todirostrum sylvia*
Eye-ringed Flatbill	Rhynchocyclus brevirostris*
White-throated Spadebill	Platyrinchus cancrominus
Royal Flycatcher	Onychorhynchus coronatus
Ruddy-tailed Flycatcher	Terenotriccus erythrurus
Sulphur-rumped Flycatcher	Myiobius sulphureipygius
Yellow-bellied Flycatcher	Empidonax flaviventris*
Least Flycatcher	Empidonax minimus*
Bright-rumped Attila	Attila spadiceus
Boat-billed Flycatcher	Megarynchus pitanqua*
Social Flycatcher	Myiozetetes similis
Tropical Kingbird	Tyrannus melancholicus
White-winged Becard	Pachyramphus polychopterus*
Masked Tityra	Tityra semifasciata
Rufous Piha	Lipaugus unirufus
Thrushlike Manakin	Schiffornis turdinus
White-collared Manakin	Manacus candei
Red-capped Manakin	Pipra mentalis
Barn Swallow	Hirundo rustica
Green Jay	Cyanocorax yncas
Brown Jay	Cyanocorax morio
Spot-breasted Wren	Thryothorus maculipectus
White-breasted Wood-Wren	Henicorhina leucosticta
Nightengale Wren	Microcerculus philomela
Long-billed Gnatwren	Ramphocaenus melanurus*
Tropical Gnatcatcher	Polioptila plumbea
Slate-Coloured Solitaire	Myadestes unicolor
Wood Thrush	Hylocichla mustelina
White-throated Robin	Turdus assimilis
Gray Catbird	Dumetella carolinensis
Philadelphia Vireo	Vireo philadelphicus*
Tawny-crowned Greenlet	Hylophilus ochraceiceps
Lesser Greenlet	Hylophilus decurtatus
Blue-winged Warbler	Vermivora pinus*
Tennessee Warbler	Vermivora peregrina*
Yellow Warbler	Dendroica petechia
Magnolia Warbler	Dendroica magnolia
Black-throated Green Warbler	Dendroica virens
Black-and-white Warbler	Mniotilta varia
American Redstart	Setophaga ruticilla
Worm-eating Warbler	Helmitheros vermivorus*
Ovenbird	Seiurus aurocapillus*
Northern Waterthrush	Seiurus noveboracensis
Louisiana Waterthrush	Seiurus motacilla
Kentucky Warbler	Oporornis formosus
Common Yellowthroat	Geothlypis trichas*
Hooded Warbler	Wilsonia citrina

Wilson's Warbler	Wilsonia pusilla
Golden-crowned Warbler	Basileuterus culicivorus
Yellow-breasted Chat	Icteria virens
Bananaquit	Coereba flaveola
Red-legged Honeycreeper	Cyanerpes cyaneus*
Olive-backed Euphonia	Euphonia gouldi
Black-throated Shrike-Tanager	Lanio aurantius
Red-crowned Ant-Tanager	Habia rubica
Red-throated Ant-Tanager	Habia fuscicauda
Crimson-collared Tanager	Ramphocelus sanguinolentus
Scarlet-rumped Tanager	Ramphocelus passerinii
Grayish Saltator	Saltator coerulescens*
Buff-throated Saltator	Saltator maximus*
Black-headed Saltator	Saltator atriceps
Black-faced Grosbeak	Caryothraustes poliogaster
Rose-breasted Grosbeak	Pheucticus ludovicianus*
Blue-black Grosbeak	Cyanocompsa cyanoides
Indigo Bunting	Passerina cyanea
Orange-billed Sparrow	Arremon aurantiirostris
Green-backed Sparrow	Arremonops chloronotus
Blue-black Grassquit	Volatinia jacarina
White-collared Seedeater	Sporophila torqueola
Yellow-faced Grassquit	Tiaris olivacea*
Melodius Blackbird	Dives dives
Great-tailed Grackle	Quiscalus mexicanus
Orchard Oriole	Icterus spurius
Northern Oriole	Icterus galbula
Yellow-billed Cacique	Amblycercus holosericeus
Montezuma Oropendola	Psarocolius montezuma
Common Woodnymph	Thalurania furcata*

*New species record for Belize.

APPENDIX 111

Maximum and Minimum Temperatures in degrees F

10 - 15 December

Date	Low	High	Location
10/12	59	74	San Jose
11/12	59	75	Milpa Camp
12/12	64	80	Milpa Camp (NE of San Jose)
13/12	68	78	American Camp
14/12	68	82	American Camp
15/12	69	84	San Jose

References Cited

1. Action Plan For Biosphere Reserves, 1983. Coordinating Council of the Programme on Man and the Biosphere, eighth session, Paris, 3-8 December.

2. Belize Government Forestry Inventory, 1976. Columbia River Forest Reserve, D.F.O. Belmopan.

3. Boo, Elizabeth, 1990. Ecotourism: The Potentials and Pitfalls; Vol. II. Country Case Studies. WWF-US. Washington, DC.

4. Ceballos-Lascurain, Hector, 1987. "Estudio de Prefactibilidad Socioeconomica del Turismo Ecologico y Ante Proyecto Arquitectonico y Urbanistico del Centro de Turismo Ecologico de S'ian Ka'an, Quintana Roo". Study made for SEDUE, Mexico.

5. Dixon, D.G., 1955. Geology of Southern British Honduras. Her Majesty's Printing Authority.

6. Harshorn, G.S.L., Nicolait, L. et al. 1984. Belize: Country Environmental Profile: A Field Study. Robert Nicolait and Assoc., Ltd. Belize City, Belize.

7. Holdridge, L.R., 1967. Life Zone Ecology. Tropical Science Center, San Jose, Costa Rica. Rev. ed. 206 pp.

8. Janzen, D. et al., 1983. Costa Rican Natural History, University of Chicago Press.

9. King, et. al., 1986. Land Resource Survey of Toledo District, Belize. Land Resources Dev. Centre, Tolworth Tower, Surbiton, Surrey KT6 7DY, England.

10. Miller, Juther Gordon 1988. "The Development of a Tourism Sector Policy for Belize", Paper presented at a meeting of Belize Embassy's inter-agency Contact Group, Washington, DC May 20.

11. National Geographic Magazine, October 1990. Earth Almanac.

12. Natural History Magazine, November 1990. "Vegetation Map of the Yucatan", pg. 4.

13. Phillips, Kathryn, 1990. "Frogs in Trouble", in International Wildlife, Vienna, VA. pp. 4-10.

14. Wilcove, David, 1990. "Empty Skies" in: The Nature Conservancy Magazine. Jan/Feb 90.

15. Wright, ACS, DH Romney, RH Arbuckle, 1959. Land Use in British Honduras. Col. Research Publication No. 24 Her Majesty's Stationery Office, London.

16. Wright, ACS. 1989. "Some random thoughts about the rainforests of southern Belize". in Rainforests. Compiled by Brett Blosser.

COLUMBIA FOREST RESERVE COMPLETES CRITICAL HABITAT SURVEY

An expedition to assess the ecological importance of the Columbia Forest Reserve completes a critical habitat survey of Belize conducted by the Belize Centre for Environmental Studies (BCES) during the last eight months.

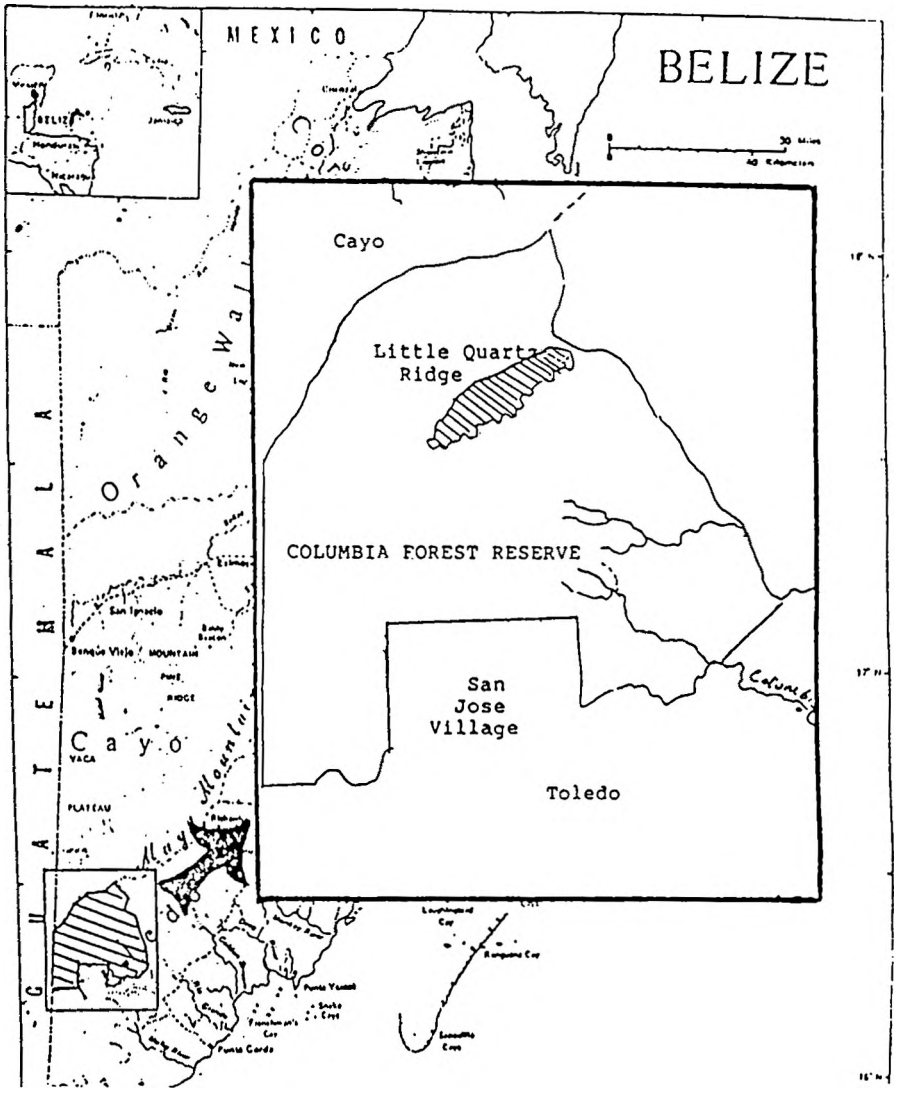
The expedition team of scientists, Department of Forestry personnel, farmers, Department of Archaeology personnel, and Belize Tourism Industry Association (BTIA) members spent a week exploring and documenting features of the reserve. The Columbia Forest Reserve includes forest not known to exist in any other part of Belize.

The seven day expedition was part of a rapid Environment Assessment (REA) of habitat in Belize considered critical to the survival of threatened and endangered species and to maintaining biodiversity.

The field team, headed by Sharon Matola, Director of Protected Lands Research at the Centre and Director of the border, and north to Little Quartz Ridge. Vegetation types, birds, reptiles, mammals, and insects were recorded. Caves containing Maya artifacts were explored by the archaeology and caving team members. Soil conditions were investigated and their suitability for agriculture or other uses was assessed. Two frog species, one perhaps never described before, were recorded for Belize for the first time.

The field assessment, which ended on the December 16, was one of about ten such investigations conducted during the critical habitat survey. It was determined by the team that the area was definitely unique and should be further explored during the dry season.

The critical habitat survey, funded by World Wildlife Fund - US with assistance from USAID, will be concluded at the end of December. During the survey, more than a dozen sites were identified by the Centre for Environmental Studies as needing



CONTENTS

Columbia River Forest Reserve Expedition: 9–16 December 1990

Expedition Participants

Santiago Billy, CONAP, Guatemala	Ecology
Modesto Bol, Forestry Officer, Machaca Forest Sta.	Forestry
Mick Fleming, Chaa Creek Cottages	Ecotourism
Paul Francisco, Dept. of Archaeology	Archaeology
Bill Hasse, Biologist	Bird records Spelunking
Sharon Matola, The Belize Zoo & TEC Center for Environmental Studies	Expedition Coordinator
Martin Meadows, Forester	Forestry
John Meyer, PhD, Jacksonville Zoological Society	Herpetology
Jim Nations, PhD, Conservation International	Ecology
Tony Rath, Pelican Beach Inn, Dangriga	Bird records Photography
Paul Walker, PhD	Herpetology
Charles Wright, Botanist, Soils Scientist, Author	Consultant

Acknowledgements

The Columbia River Forest Reserve expedition, with its main objective to assess the ecological importance of this Forest Reserve, was the final field-study project under the Critical Habitat Study funded by WWF-US through a grant from USAID.

The logistics involved in the organization of this expedition were complex and without the cooperation of many individuals, both in Belize and abroad, the successful implementation of this important field investigation would not have been possible.

In Belize, special thanks to the Ministry of Natural Resources for their interest in this project and show of support. Valuable consultation was given by the Belize Defense Force, and British Forces Belize provided logistical support. Capt. Richard Chesterfield, British Forces, assisted with ground organization and we are very grateful for his good help.

Personnel at the Center for Environmental Studies, and especially Lou Nicolait, provided helpful input throughout the planning of the Columbia River Forest Reserve expedition.

Invaluable assistance from outside of Belize came from Mr. Bob Sears, pilot extraordinaire, who represented Project LightHawk, and provided excellent overflights to the Forest Reserve.

Funding received from Conservation International, Project LightHawk and the World Wildlife Fund-US was critical to the success of the Columbia River Forest Reserve expedition.

Finally, sincerest thanks to Wildlife Preservation Trust, International. Their financial support of conservation activities throughout the year, undertaken by the expedition coordinator, has made the Columbia River Forest Reserve Expedition possible.

Dedication

The energy and spirit behind the planning and execution of the Columbia River Forest Reserve expedition is dedicated to the Belize Audubon Society, who, in 1968, saw the unique features of this region and lobbied for its status to be declared a Nature Reserve, in order to “conserve mature forest and its wildlife resources”. Even though this status is now considered abandoned, it took great foresight to note the importance of this area, over twenty years ago, when “conservation” and “biological diversity” were only concepts in genesis.

And to Mr. A.C.S. Wright, the father of ecology and environmental awareness here in Belize. His fine assistance with this project was greatly appreciated by all who were involved.

Executive Summary

The Columbia River Forest Reserve was investigated as part of the Critical Habitat Study, to attempt to gain some further knowledge about this relic forest type, subtropical wet — subtropical lower montane wet (Holdridge 1967), which has all but disappeared from Central America due to habitat destruction / alteration.

Expedition members divided into various teams, in order to broaden investigation access into different areas of the Forest Reserve.

Ornithology data was obtained from Courtney Conway, a field researcher from the Smithsonian Institute who was studying the avifaunal populations in the Columbia River Forest Reserve during the time of the expedition.

No flora was collected; botanical data should be noted as observations only.

A. Topography

Team observations confirm with Wright *et al.* (1959), that much of the area consists of rugged, limestone hills. There is an abundance of sinkholes, some quite deep, with vertical sides. The terrain was difficult to traverse, and guides were used by all participants to reach various areas in the Forest Reserve.

B. Forestry

Team observations confirm that large hardwood species like mahogany, *Swietenia macrophylla*, have been logged out of the Forest Reserve. The western portion of the Forest Reserve has a well-defined trail which links together abandoned logging camps, a reflection upon the historical role which was held by the timber industry in Belize.

In general, the areas investigated in the Forest Reserve were rich in lime-loving species. Large Chicle Trees, *Manilkara zapota*, were observed. Cycads, *Zamia* sp., were observed, and

the vegetation showed distinctive changes from the lower regions of the Forest Reserve to the top of "Little Quartz Ridge".

1. The common understory palm in the lower regions was the Give-and-take Palm, *Cryosophila argentea*.

2. In the upper reaches of "Little Quartz Ridge", Warrie Cohune, *Astrocaryum mexicanum*, and Mountain Cabbage, *Euterpe macrospadix*, increased in abundance.

3. Also on the higher elevations was another palm species, Synchanthus fibrosus and *Colpothrinax cookii*.

4. Species noted which indicated climatic disturbances in the past (hurricanes: 1961, 1973) were:

Trumpet *Cecropia peltata*
Polak *Ochroma lagopus*

5. Secondary species, Salmwood, *Cordia alliodora*, Hogplum, *Spondias mombin*, Quamwood, *Schizolobium parahybum*, and Prickly Yellow, *Zanthoxylum* spp. were observed.

C. Archaeology

A representative from the Department of Archaeology targeted the caves in the area for his investigations. Two caves, two caverns, a large sinkhole, and a Maya ruin, already discovered and documented, were all explored. A polychrome vessel, determined to be from the Late Classic Period, AD 600–900, was found in pieces from cave II and later reconstructed (cover photo).

D. Soils

Soils were collected from four sites on "Little Quartz Ridge" and from the southern edge of the Columbia River Forest Reserve. All soils collected were taken to Central Farm for analyses. Analyses showed that all soil samples were very acid with only soils in sample "B" having the ability to store ions.

E. Herpetology

A total of eighteen species were collected, including six amphibians, seven lizards, and five snakes. One of the

frogs, of the genus *Eleutherodactylus*, had never before been described by science. A complete, published description of this new species will be published by the end of the year.

A diverse herpetofauna is suspected to inhabit the Columbia River Forest Reserve; however, it was believed that the overnight low temperatures (in the upper 50's) and the daytime low temperatures (in the 70's), due to constant cloud cover, influenced the herp collecting throughout the week.

F. Ornithology

There were 135 species of birds documented during the expedition. Twenty-five were transient species from north America. The Yellow-faced Grassquit, *Tiaris olivacea*, was listed in the *Checklist of the Birds of Belize* as "1 record". The Common Woodnymph, *Thalurania furcata*, was a new record for this species in Belize. Birds noted on the expedition resulted by: 1. observations from team members; and 2. data supplied by Courtney Conway of the Smithsonian Institute, who was mist-netting birds in the Forest Reserve during the time of the expedition.

G. Ecotourism

Due to the growing role that tourism is playing in the GNP of Belize, in particular, "nature tourism", it was an objective of this expedition to form a basic outline of the tourism potential for the area of the Columbia River Forest Reserve and the nearby Maya village of San Jose.

H. Recommendations

1. The monitoring of hunting activities, especially during the dry season when animals move towards available water, would aid in the revitalization of faunal populations within the Forest Reserve.

2. Agricultural development is not recommended. Soils are too acid and too rocky. Dry-season water supply is too uncertain.

3. The Columbia River Forest Reserve should remain intact for its valuable watershed protection to the people and forests

in the lowlands further downriver. Flooding is already a serious problem in this part of the country; increased deforestation in the Columbia River Forest Reserve will further provoke the flooding situations that regularly occur during the wet season.

4. Ecotourism should develop with the expertise and assistance of the Toledo Ecological Association. This group of approximately twenty-five members, including Kekchi, Mopan Maya and Garifuna, are trying to develop Punta Gorda into a possible role model for indigenous people and community ecosystems.

5. The Biosphere concept should begin to be considered in Belize, creating an overall sustainable and wise management plan for the country. Within the scope of this concept, the Columbia River Forest Reserve should remain as a core area, left intact as possible, especially in light of its unique ecological features not repeated anywhere else in the Central American region.

From a report submitted by Martin Meadows, Forester:

"This area is one of very special interest and not represented, to my knowledge, anywhere else in Belize and possibly not anywhere else in Central America. It is an area of scientific interest, tourist interest, and is irreplaceable. It should certainly be placed under protection and not exploited or converted to other use until studies show exactly how the ecotypes and flora and fauna are interdependent. Any change in land use could result in millions of years of tropical-forest evolution vanishing forever." …

The Columbia River Forest Reserve Expedition Report

December 9–16th 1990

A. Introduction

Growth of Environmental Knowledge Concerning the Columbia River Forest Reserved

The area was examined by the Australian L.H. Ower between 1921 and 1926, a very energetic geologist, exploring the mineral resources of British Honduras (Ower, L.H. 1928). D.G. Dixon prepared a geological map of southern British Honduras from fieldwork carried out from 1950–56, working for several months out of camps located in the vicinity of Quartz Ridge and the Machikilha River. During part of this period, the soil surveyors of the Land Use Survey team joined the geologists Cecil Dixon and da Cunha in these camps.

From the above pioneer work, the basic pattern of the geology and soils gradually emerged, and some of the more obvious relationships between rock–soil–plant communities were placed on record in the Land Use Survey report (Wright *et al.* 1959). At the time of this survey, 1954, the whole area was gazetted as Crown Land. No forest reserve then existed. Only scanty information about the pattern of the forest-plant communities present in the area can be found in some of the field books of Forestry Department officials engaged in recording the exploitation of Mahogany and chicle-producing trees. An official stock-taking of the timber reserves in the area did not eventuate until 1978 (twenty or more rears after the Columbia River Forest Reserve had been gazetted), by which time most of the Cedar, *Cedrela mexicana*, and Mahogany, *Swietenia macrophylla*, Rosewood, *Dalbergia stevensonii*, Santa Maria, *Calophyllum brasiliense*, and other secondary timbers, had already been extracted.

During the years of maximum timber and chicle extraction, from 1925 to 1960, travel through the area was comparatively

easy because there were many timber-extraction routes in use during the dry season, and a fine network of mule trails serving the wet-season chiclero camps. With the exception of the old tractor road between the Columbia River and Edwards Central (and its extension to Union Camp), almost all these helpful access routes have now been lost.

It was during these years of comparative accessibility that most of the botanical work was done. This consisted mainly in the collection of plant material for herbaria and only broad ecological relationships were remarked upon by the botanical pioneers. The cutting of the boundary line between British Honduras and Guatemala in the 1920–1926 period provided botanists, like the energetic Mr. Schipp of Stann Creek, with a golden opportunity to explore otherwise-inaccessible country. Subsequently, valuable other plant collection and taxonomic identifications from the area of the Columbia River Forest Reserve have recently been made by a number of visiting botanists from overseas. A number of rare plants (including palms and *Zamia* sp.), have been recorded from the area. Even less is known about the mammals, reptiles, insects, etc. living in the Columbia River Forest Reserve.

From the published records alone, it is obvious that there is great scope for ecological research within the Columbia River Forest Reserve. This is of importance internationally because the area lies within the "Subtropical Wet and Subtropical Lower Montane Wet" life zones (Hartshorn *et al.* 1984); thus it is one of the few environments of this category with much of its natural forest cover still intact in all of Central America.

B. Ecosystem Classification

The Columbia River Forest Reserve is an area of tropical forest spanning 103 000 acres, falling within the subtropical wet and subtropical lower-montane wet life zones (Holdridge 1967). This classification is cartographically expressed on the enclosed map (*Natural History*, Nov. 1990, "Vegetation of the

Yucatan"), and represents some of the last remnant forests of this ecotype in Central America.

Lying at Lat. 16°20' N., Long. 89°58'W, to the north of the Mopan Maya village of San Jose (pop. approx. 600), the terrain within the reserve varies from 900–2700 meters above sea level. Rainfall over the region is expected to average a little over 100 inches (2540 mm) per year (Hartshorn *et al.* 1984), but at the higher elevations, precipitation may be much higher.

The Toledo District rainforests are only marginal to the true tropical rainforests of the western hemisphere: their climate is too cool during December to March, and too dry during March through to May. Consequently, some of the typical humid tropical species are at an ecological disadvantage when struggling to survive amongst subtropical species during a part of the year, while some of the typical subtropical species are less than happy during other months of the year (Wright 1989). Using the Brazil Nut, *Bertholletia excelsa*, as an example, growing this species in the Toledo District results in young plants going into a state of shock during winter months, presumably due to low temperatures, and those that survive to become mature trees produce very little in the form of flowers, and no fruits are produced.

In Toledo, in an average year, subtropical environmental conditions prevail for about four months, November – February, while the balance of the year more truly approximates to a humid tropical environment.

The Toledo District rainforests express a complex assemblage of different physiological patterns, and it is believed that some of this diversity may be possibly related to the arrival of different species at different periods of geological time, and by different pathways, resulting in on-going competition for desirable ecological niches.

Geologists now agree that Belize may once have consisted of an isolated island or small archipelago which later became linked by land bridges eastwards to Cuba and the Antilles; at a later date, it established links with the North American

land mass, and eventually became linked with South America when it became part of the isthmus of Central America. Belize may have occupied a crossroads location where species migration could have occurred, intermittently, from different sources, over a long time scale. To date, botanists still argue about which plant species may have come from where (Wright 1989).

A possible example of migration is the palm species, *Colpothrinax cookii*. Closely related species of *Colpothrinax* occur in Cuba; in Belize, this ridge-loving species of palm, unknown until first observed in 1987 (British Forces Belize, Belize Audubon Society, "Maya Topping Expedition", Rogers *et al.*), and then subsequently reported in 1989 (Doyle's Delight Expedition, August 1989, Matola *et al.* unpub. report). It is known to also occur on the mountains of Alto Verapaz, 150 miles south of Belize, in Guatemala.

Another example is that of the oak, *Quercus* spp. Oak trees originated in North America and have migrated southward. Two species of *Quercus* were noted on Little Quartz Ridge.

C. Some Ecological Characteristics of the Three Main Landscape Categories.

1. Limestone / Karst Landscapes.

The Columbia River Forest Reserve has diverse geological elements. In part, the landscape is strongly karsified, with major cave systems and some of the biggest sink holes in the country (Cornec, pers. comm. 1990). In the geographic sense, this karst area represents the southern foothills of the Maya Mountains. The topography is rugged, and the rock is very hard, composed, usually, of almost pure calcium-carbonate crystals resulting from three different marine depositional periods covering a time interval of approximately 100 million years. Gradual solution of the limestone, and the development of extensive subterranean drainage systems over this long period has produced the conspicuous karstic features of the foothill landscape.

The oldest of these limestone deposits is thought to have occurred in the mid-to-late Cretaceous geological period, some 150 000 000 years ago. They gave rise to what is now known as the Coban limestone beds. Much of the Coban limestone beds were buried below later limestone deposits but are thought to be the main limestone strate flanking the Permian metamorphosed sediments of the Maya Mountains. These old limestone beds, adjacent to the Maya Mountains, are deeply fissured and have deep subterranean drainage systems (Hartshorn *et al.* 1984). Due to the drainage water moving underground, the land has many conspicuous “pot holes”. The general relief is “medium to high karst” with “cock-pit” topography (King *et al.* 1986).

Next in the series of limestones are the Campur beds. This deposition is thought to have occurred primarily during the Jurassic geological period, approximately 100 000 000 years ago. The Campur limestones are the present surface rock of much of the Columbia River Forest Reserve. The Campur limestone surfaces are noted for their very rugged appearance, consisting of innumerable solution depressions separated by steep ridges. The Campur limestone strata overlies the older Coban limestones. Where this is relatively thin, the cock-pit relief is often replaced by a maze of large and small pot holes, some with a subterranean stream meandering across the pot-hole floor.

The Coban limestone series and most of the Campur limestone beds are deep-water marine accumulations.

Shallow-water limestone beds were deposited during the Tertiary period, occurring from 1 000 000 to 70 000 000 years ago, and these are amongst the younger limestone deposits in Belize, referred to as the Lacandon beds. They are characterised by hard, sometimes white crystalline limestone beds interlayered with calcareous sandstone and some mudstone. Lancandon limestone beds occur only in the extreme southern reaches of the Columbia River Forest Reserve, including the vicinity of San Jose village. Lancandon calcareous deposits are characterized by a landscape that is hilly to strongly rolling, with a

pattern of abrupt limestone ridges.

Extending over a distance of fifteen kilometers, trending roughly northeast and lying near the northern limit of the karst foothills, is a very distinctive isolated mountainous ridge which is perhaps the most prominent geological feature of the Columbia River Forest Reserve. The "Little Quartz Ridge", so named by chicleros, is a sharp "fin" of quartz-rich porphyritic rocks, which appear to be geologically similar to those recorded from the Doyle's Delight region of the southern Maya Mountains. These rocks are located along the SW-NE crest of the ridge, giving the isolated mountain mass a steep "scarp-like" slope facing northwest.

The lower part of the mountain ridge is flanked with limestone, possibly of Coban age. The "dip" slope of "Little Quartz Ridge" is believed to be formed mainly from Paleozoic metamorphosed sediments, including indurated shales, altered sandstones, conglomerates, and with intercalated beds of crinoidal limestones.

These latter are exposed in some creeks draining southeast from the crest of "Little Quartz Ridge". They are, in places, almost granular in nature and they erode to form shallow lateral caverns extending like shelves into the rocks on either side of some creeks. These shallow caverns provide suitable breeding habitats for many of the local animal populations.

"Little Quartz Ridge" is in itself an important ecological entity in the northern sector of the Columbia River Forest Reserve. The highest point of the present ridge is only 1040 meters above sea level, and thus, the ridge may have been buried under Coban and/or Campur limestone for several million years until exposed as a result of solution of the overlying limestone. Further examination of the soils of "Little Quartz Ridge" may help to resolve this speculation.

The vegetation of "Little Quartz Ridge" is markedly different from that of the lower elevations in the Columbia River Forest Reserve. Give-and-Take Palms, *Cryosophila argentea*, abundant throughout the trek to "Little Quartz Ridge", were

non-existent on the ridge at the higher elevations. Instead, there was a more-varied flora with local abundance of Warrie Cohune, *Astrocaryum mexicanum*, and *Euterpe macrospadix*. *Euterpe* spp., in particular, increased in abundance as elevation increased. With increasing elevation, palm species, *Synchanthus fibrosus*, became prevalent, and two species of tree ferns were noted.

The hemi-epiphyte, *Clusia* sp. also appeared with an increase in elevation. *Clusia*, a plant that germinates on a host tree and sends its roots to the ground, appears most frequently in tropical-moist and lower-montane-wet life zones. When mature, they may be among the tallest trees in the forest. It is believed that an effective dry season may be ideal for seedling establishment (Janzen *et al.* 1983).

On the windswept summits of "Little Quartz Ridge", the palm species, *Colpothrinax cookii* is conspicuous. Other species noted were:

— tall, narrow-leaved oak, *Quercus* sp.;

— prop-rooted Moraceae tree species;

— Santa Maria, *Calophyllum brasiliense*.

The canopy averaged 90–120 meters tall, almost right to the summit.

"Little Quartz Ridge" is a unique ecological entity not found elsewhere in the Columbia River Forest Reserve and not continuing westward into Guatemala or northward to the Maya Mountains, where similar rocks have been noted. Between "Little Quartz Ridge" and the northern limits of the Columbia River Forest Reserve, the landscape has the appearance of an upland plain, dotted with small limestone hills which may be relicts of an old limestone capping, now almost entirely removed by solution.

The southern Department of the Petén in Guatemala thus shares a same ecology with its neighbor to the east, Belize. With regard to the Columbia River Forest Reserve, this is easily seen on the enclosed map (*Natural History*, Nov. 1990), as this subtropical moist forest extends into Guatemala.

The Machikilha River, crossing the far northern limits of the Columbia River Forest Reserve, begins its course in Belize and heads into Guatemala, joining the Rio de la Pasion. Part of the headwaters of the Machikilha River is an upland alluvial plain which extends south toward "Little Quartz Ridge" (Dixon 1955).

The Machikilha upland plain has soils which are of much lower fertility than elsewhere in the Columbia River Forest Reserve due to the accumulation of siliceous alluvium deposited by slow-moving acid-drainage waters from the adjacent Maya Mountain highland.

It is believed that the present plant cover here has undoubtedly been modified by fire, both of natural origin and fires caused by timber extraction or associated with former chicle camps (Wright, pers. comm.).

The present plant cover has a high proportion of "cutting grass", *Scleria bractea*, in the understory, and a few larger patches of evergreen seasonal forest of medium height in which the canopy is broken by emergent Yemeri, *Vochysia hondurensis*, Nargusta, *Terminalia amazonia*, and locally by Rosewood, *Dalbergia stevensonii*.

Approaching the Guatemalan border, near the point where the Machikilha River passes into Guatemala, patches of pine forest and grass savanna appear. This area is believed to have been traversed by Cortez on his expedition from Mexico to Honduras in 1524.

While the quality of Chicle, *Manilkara zapote*, is believed to be inferior to that found in forests further north, both in Belize and in the Department of the Petén in Guatemala (Martin Meadows, Santiago Billy, pers. comm. 1990), chicleros from Guatemala traveled frequently across the border to take advantage of the chicle resources in the Columbia River Forest Reserve during the years of maximum chicle extraction, 1925 – 1960 (Alfredo Sho, pers. comm. 1990). Today, chicle is no longer harvested from the Columbia River Forest Reserve.

SUMMARY

A large portion of the Columbia River forest Reserve remains fairly intact. The lack of evidence for the presence of mammals and large birds (i.e. cracids), is due to hunting pressures; however, the control of this activity would assist in the rejuvenation of the faunal populations within the Reserve.

With regard to agriculture in the Columbia River Forest Reserve, there is no valid potential for this type of development. Campur and Coban karst foothills are too rugged, the soils too rocky, and the dry season water surely too uncertain to such a degree that even the traditional slash-and-burn techniques of the Maya indians are proving unprofitable.

Permanent access roads through "cock-pit" landscape is extremely costly, and water and power services would not be feasible due to the difficulties defined by the same karst topography. Thus, the Columbia River Forest Reserve is not an "ecologically friendly" environment for farming endeavors.

Similarly, the soils of "Little Quartz Ridge" are totally unsuited for farming. The Machikilha upland plain is unsuited for traditional Maya-farming activities, as well. And due to its isolated location, it is unlikely to attract investment by large, modern farm operations.

The Columbia River Forest Reserve cannot be regarded as a potential agricultural asset. It is, however, a very important forestry asset, providing valuable watershed protection to the lowland farmer of the Columbia and Rio Grande Rivers. Nine months out of every year, flood problems plague local agriculturalists. The Columbia River Forest Reserve provides watershed protection, and further cutting of these forests could not only result in flood inundations of great severity, but the drying up of valuable spring waters during the dry season.

The karst foothills function like a sponge, accepting much of the heavy rainfall during June and July, partially

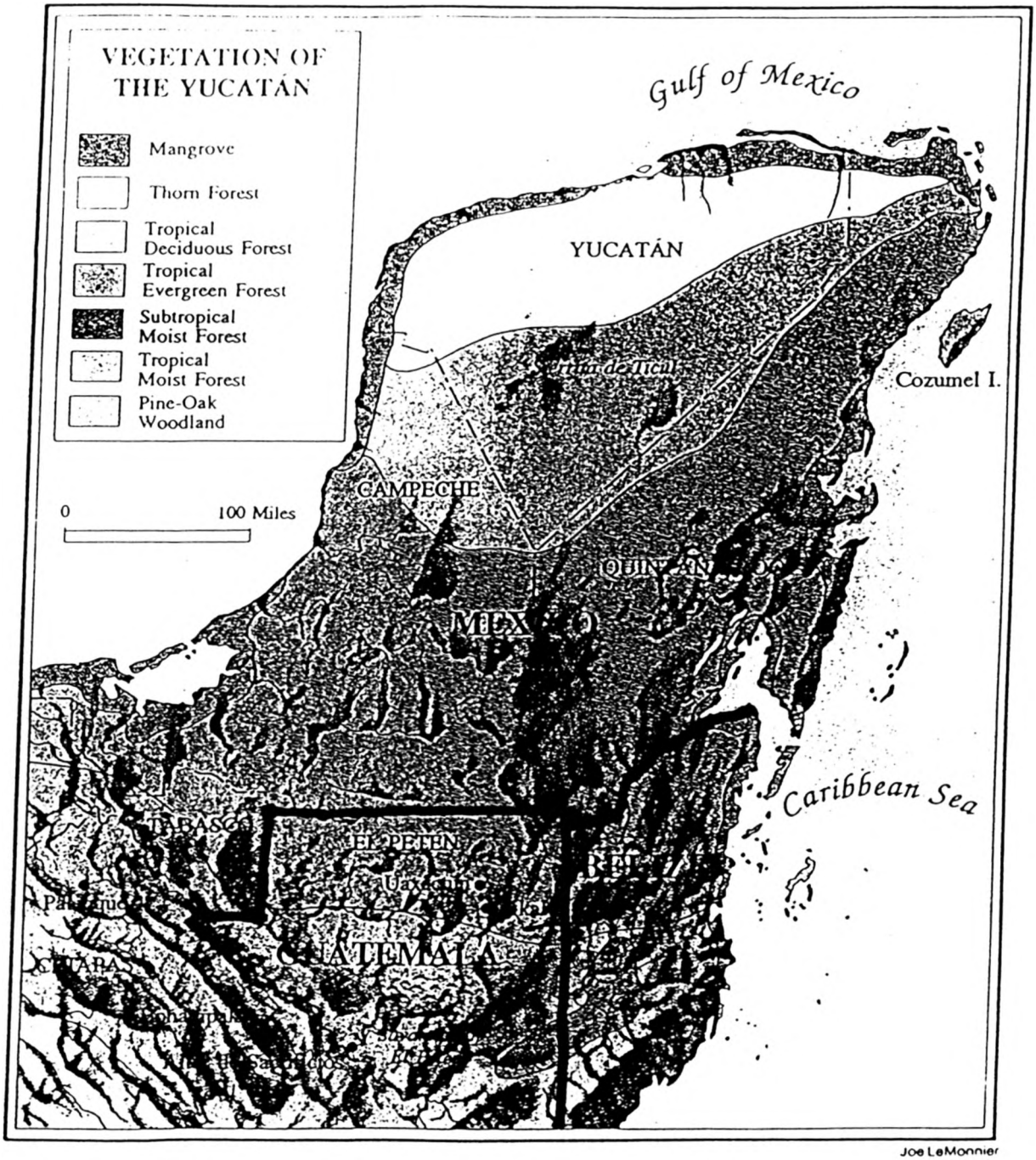
storing this water in fissures and underground caverns and slowly releasing this stored water during the months with lighter rainfall, or no rain at all.

Forest cover is essential for the efficient operation of this "sponge" system. Forest destruction causes most of the heavy rains to sluice directly off exposed rock surfaces producing flash floods which may last only a few days or even hours, but they do great damage to roads, bridges, homes and livestock on the lowlands beyond the limits of the Columbia River Forest Reserve.

The Big Falls road bridge on the Rio Grande has been under observation since 1962 (D. Owen-Lewis, pers. comm. 1990), and the annual pattern of flooding shows a steadily increasing maximum flood level ("top-gallon" conditions), a steady increase in the number of floods submerging the highway bridge, and only a slight decrease in the number of days of each flood when the road is impassable.

The landscape of the Columbia River Forest Reserve has a story to tell and future ecological research may disclose an exciting tale of very ancient land surfaces with soil-development processes continuing for many millions of years, and a tale of similar rocks and soils buried under thick layers of limestone, reappearing again in some localities as the covering limestone beds slowly dissolved away.

And while all these landscape-forming processes were going on, plants and animals from diverse sources east, north, and south were invading the landscape, resulting in the present patchwork of plant and animal communities. From Baldy Beacon to the north, southwards through Cockscomb and the high plateau of "Doyle's Delight", to "Little quartz Ridge" of Columbia River Forest Reserve, there may be a great ecological continuum awaiting research by botanists, zoologists, soil scientists, archaeologists, and for future scientists whose disciplines are still evolving. Belize is indeed favored to be the sole custodian of this unique phenomenon, certainly unique in Central America and perhaps unique in all the world. The Columbia Fiver Forest Reserve is an essential part of this fascinating regional mountainous ecosystem.


VEGETATION OF THE YUCATÁN
Mangrove
Thorn Forest
Tropical Deciduous Forest
Tropical Evergreen Forest
Subtropical Moist Forest
Tropical Moist Forest
Pine-Oak Woodland
0
100 Miles
Gulf of Mexico
YUCATÁN
Cozumel I.
CAMPECHE
QUINTANA
MEXICO
Caribbean Sea
TABASCO
EL PETEN
BELIZE
GUATEMALA
Joe LeMonnier

METHODOLOGY

All expedition participants flew over the Columbia River Forest Reserve in a STOL Maule aircraft before undertaking any field investigations. It was agreed by all participants that overflights permitted a valuable perspective into the terrain, and led to clear planning with regard to the best-executed methods in order to obtain a maximum amount of data.

Expedition participants divided into teams to pursue areas of investigation in the Forest Reserve. Each team was accompanied by at least two Maya guides from San Jose village.

Six expedition participants made the trek to "Little Quartz Ridge"; observations were noted along the way and notes compared each evening at the campsite.

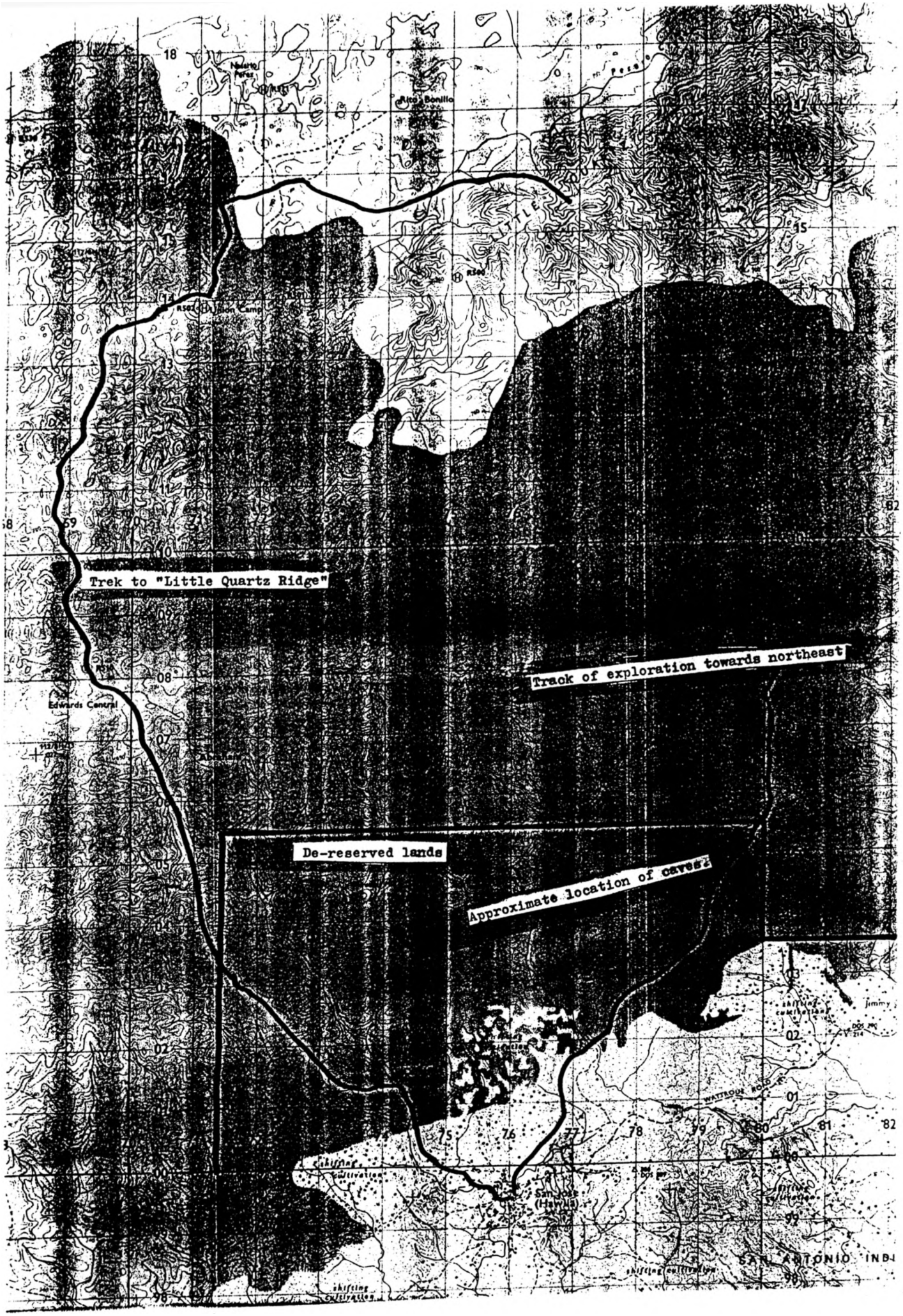
The five other expedition participants made their base camp in San Jose village and did primarily day treks from there. They, too, compared notes every evening, and on the final evening, 15 December, in San Jose village, all expedition participants had a regroup and meeting to compare findings, observations, and to discuss recommendations.

The following map (1:50 000; #37 Lands and Survey Department) shows the basic routes of investigation into the Forest Reserve.

Although the track to Guatemala was found, it was not followed completely to the border.

The Wattrous Road, which was the main access road into the eastern part of the Forest Reserve, was traveled approximately seven km to the north, and the route, with ample sinkholes and caves, was considered to be very rugged.

The trek to "Little Quartz Ridge" passed by shifting cultivation, secondary-growth forest, forest with discontinuous then continuous canopy, and continued on to the top of the ridge. The ruggedness of the terrain, very cool temperatures in the night, and meager rations were collective factors that caused this part of the expedition to be termed "difficult".


Trek to "Little Quartz Ridge"
Track of exploration towards northeast
De-reserved lands
Approximate location of caves
Edwards Central
San José (Hawilla)
SAN ANTONIO

I. Forestry

The forest type is described as subtropical Wet — subtropical lower-montane-wet (Holdridge 1967). This forest ecotype is considered a "relic" in Central America. Similar habitat in the region has been altered or destroyed during the past thirty years (Wright, Howell, pers. comm. 1991).

A. American Camp to Abraham Camp

Most of this area lies outside the Forest Reserve and is a region showing a gradual increase in altitude from 400 to 700 meters, with a significant amount of metamorphic / sedimentary rocks present amongst karst limestone.

The dominant secondary tree species noted were Quamwood, *Schizolobium parahybum*, and Cotton, *Ceiba pentandra*. Prickly Yellow, *Zanthoxylum kellermanii*, was noted but in patchy distribution.

The ground cover included many herbs, ferns, and Fishtail Palms with the higher *Calyptrogyne* palms only scattered among Warrie Cohune, *Astrocaryum mexicanum*. Also present, but not in abundance, were Piper spp. Cohune Palms, *Orbignya cohune*, tended to decrease with altitude.

B. Abraham Camp to Edwards Central to Union Camp

This route follows an old logging trail and is approximately 700 meters in altitude. The terrain is all karst limestone.

The tree species, in general, appeared to be more abundant than those species of the drier northern forests. Large Sapodilla, *Manilkara* sp, and Nargusta, *Terminalia amazonia*, appeared along this route. Younger Mahogany, *Swietenia macrophylla*, and Cedar, *Cedrela mexicana*, were seen. Older trees of the two latter-mentioned species were most likely logged out of the Forest Reserve in the 1950's or earlier. Observed were a fair number of old large Mahogany stumps.

Secondary hardwood species observed along this trek include Salmwood, *Cordia alliodora*, Hogplum, *Spondias mombin*,

Quamwood, *Schizolobium parahybum*, and Prickly Yellow, *Zanthoxylum kellermanii*. The discontinuous canopy noted along parts of this trek, as well as species of Trumpet, *Cecropia peltata* and Polak, *Ochroma lagopus*, were indications of past climatic disturbances.

Approaching Union Camp, there was a gradual predominance of a four-foot palm appearing to be *Calyptrogyne donnell-smithii*, noted by its central orange, unbranched fruiting spike. Warrie Cohune, *A. mexicanum*, were common along this route and less common were the Give-and-Take Palms, *Cryosophila argentea*. These two palm species partly replaced the aforementioned ground cover. Uncommon but repeatedly noted were tree ferns and one species of cycad. A few *Cyclanthus* sp. were also noted.

C. Union Camp to Little Quartz Ridge

Initially, this route followed a level, poorly drained area which merged into a well-drained karst topography.

The poorly drained area had medium-to-tall forest, the canopy was discontinuous in places, and the species noted were the buttress tree, Kaway, *Pterocarpus officinalis*, and Santa Maria, *Calophyllum brasiliense*. Beginning to appear in greater abundance were Cabbage Palms, *Euterpes macrospadix*, and prolific numbers of bromeliads.

As the drainage increased, the topography becoming more karsified, the canopy was notably taller, 60 – 80 feet. Again, Warrie Cohune, *A. mexicanum*, was present.

This highly karsified area proved interesting. The forest was tall — over 50 feet, and the *Calyptrogyne*-palm cover was dense. Strangler Figs, Ficus spp. were evident, and bromeliads, as well as the Give-and Take Palm, *C. argentea*, were abundant. Due to the continuous canopy, very little light reached the forest floor.

The vegetation noted indicated that the soils varied from slightly alkaline in the crevices to acid soils in the deeper, leached soils in the bottom. Give-and-Take Palm, *C. argentea*,

and Warrie Cohune, *A. mexicanum*, were often observed alongside one another. *C. argentea* prefers alkaline soils, whereas *A. mexicanum* prefers soils that are neutral to acid.

D. "Little Quartz Ridge"

There was an obvious soil change as the route approached "Little Quartz Ridge", leaving karst behind and becoming soils of metamorphic type. Give-and-Take Palms, *C. argentea*, were not present. A few Warrie Cohune, *A. mexicanum*, were seen but far more abundant were Cabbage Palms, *Euterpes macrospadix*, and the appearance of *Synechanthus fibrosus*. There were abundant numbers of tree ferns (two species) present.

As the route approached the top, Tiger Claw ferns, tree ferns, and *Clusia* sp. were noted.

Atop "Little Quartz Ridge", the dominant tree species became the palm, *Colpothrinax cookii*. Other species noted were a tall, narrow-leaved oak, *Quercus* sp., *Clusia* sp., a prop-rooted tree of the family Moraceae. Santa Maria, *Calophyllum brasiliense*, *Miconia* sp. and *Cephaelis* sp. shrubs, and abundant numbers of *Synechanthus* palm (shrub layer to 15 feet). The *Euterpes* palm canopy was approximately 30 – 40 feet high.

The soils varied depending on the bedrock, which varied from quartz to schist types.

E. The High Plateau: Northeast of Union Camp towards Burgos and across to "Little Quartz Ridge"

This area was extremely variable, possibly depending on the depth and types of soil and the drainage. Seen here were potato holes with Cutting Grass, *Scleria bracteata*, to deep, well-drained soils with isolated karst remnants appearing.

Of extreme interest were two species of *Quercus* with enormous acorns; one cup was five cm across, and the other was three cm across.

F. Summary

The trek from San Jose to "Little Quartz Ridge" was

of great forestry interest due to the diversity of tree species found in the area. From observations, it appeared that tree-species diversity was richer than that of the northern drier forests.

The presence of cycads, Zamia sp. was also of interest, as was the vegetation on top of "Little Quartz Ridge", due to the abundance of the palm species, *Colpothrinaxtcookii*, and the unusual species of oak tree, *Quercus* sp.

The highly karsified tonography of the area indicates its importance as a watershed, accepting much of the year's heavy rainfall like that of a sponge, and storing this water in fissures and underground caverns.

Further forestry and botanical investigations into the Columbia River Forest Reserve are warranted. A Rapid Environmental Assessment over the period of one week resulted in observations of great interest indicating that this relic-ecotype of forest holds within it species of flora that may not be represented anywhere else in Central America.

II. Soils

The degree of development of soils is directly related to slope, the most severe slopes being occupied by skeletal soils with abundant coarse sand.

A large part of the Columbia River Forest Reserve is occupied by skeletal soils (Belize Government Forestry Inventory 1976). On karst limestone, these are very extensive. Some areas support high forest, but most have been extensively reduced by hurricane. Wright (1959) recommended the retention of such areas as protection forest.

Skeletal soils on the non-calcareous rocks of the Maya Mountains are also extensive. They are of low fertility and do not generally support high forest. In the soil deriving from the Bladen Volcanics member of the Santa Rosa series, the fertility is very low and only a poor "low-bush" assemblage is found (Wright 1959). A.C.S. Wright (1959) advised retention of all such areas as protection forest and speculated that

regeneration after logging would be unlikely. Such soils are seen as highly erodible and the formulation of alignments for logging tracks would be problematic (Belize. Gov. Forestry Inventory 1976).

Soils classified as erodible (Wright 1959) are well represented in the Forest Reserve. These, too, are recommended for retention as protection forest. The skeletal soils and the erodible soils comprise over half of the Columbia River Forest Reserve.

Developed soils within the Forest Reserve are mainly colluvial soils found in basins between the limestone hills occupied by skeletal soils. The better colluvial soils are loams, clay loams and sandy clay loams of the Xpicilha and Cumbre soil sets (Wright 1959). The poorer soils which are found on hills not occupied by skeletal soils are the stony and boulder clay loams.

Developed soils of the Toledo series take the form of shallow brown-gray clay loams, often impoverished due to leaching and sometimes truncated by erosion, which Wright *et al.* (1959) have named Aquacate sandy clay end Manfredi fine sandy clay. Both sets have an associated shallow, stony and boulder facies found on hill sides.

Developed soils of the Santa Rosa series are found on gentle terrain within the Forest Reserve, but forms only a small proportion of the area in this category (Belize Gov. Forestry Inventory 1976).

Soils of the granite areas are referred to as Stopper soils and are comprised of loams and gritty loams. These soils are of moderate fertility but are easily eroded when cleared.

In general, a high proportion of the Columbia River Forest Reserve is occupied by unstable soils. These are largely confined to the more inaccessible and remote areas of karst limestone and the Maya Mountains (Belize Gov. Forestry Inventory 1976).

Soils were collected from the southern edge of the Forest Reserve, approximately 300 meters in altitude in a herb understory. Soils were also collected from "Little Quartz Ridge". All samples were taken to Central Farm for analyses, and the results:

Samples	Lab. #	Ph	N %	K ppm	Organic content %	C.E.C.*
A1	8860	4.1	1.06	196	3.09	leaf / humus top layer, no mineral particles.
A2	8861	3.9	0.22	45	2.82	33
A3	8862	4.5	0.14	29	0.96	23
B	8863	4.3	0.11	33	1.05	134
C	8864	4.9	0.37	351	3.06	78

All soils tested were very acid, which is thought to be from rainfall leaching away minerals (Meadows, pers. comm. 1991). Normal acid soils are usually 5.5–6.5.

Samples A, B, are taken from "Little Quartz Ridge". A1 has all of the nitrogen and potassium in the top humus / leaf layer.

A2 has little nitrogen or potassium in the top-soil layer, and low C.E.C.* (*C.E.C. is the Cation Exchange Capacity, or the ability to store ions / plant food).

A3 had a low mineral layer, was poorer than A2. This sample had rock filaments — metamorphic schist / slate type.

B is more equivalent in position to A2, but the parent rock was different — quartz. This sample was very poor in nitrogen and potassium, yet, had a high C.E.C.

C sample came from the southern edge of the Forest Reserve; the pH was slightly less acid, but the percentage of nitrogen was low, the potassium was high and the C.E.C. would be considered medium.

In general, from the soils collected and tested by Central Farm, it would appear that most nutrients are in the humus / fine-root / leaf layer. They appear to be very prone to soil disturbance, especially burning and only sample B had the ability to store ions.

III. Archeology

Paul Francisco of the Department of Archeology in Belmopan, directed archeological activities from 10 – 15 December. Due to the karst topography of the Forest Reserve, cave formations were prevalent, and Mr. Francisco concentrated his efforts towards the exploration of caves within the reserve. An objective was to document any historic Maya occupation / activities that may have occurred in these caves.

Mr. Francisco was joined by Mr. Bill Hasse, an experienced spelunker who has lived in Belize for over twenty years. Two guides from San Jose village, Candido Coh and Emeterio Pop accompanied Paul Francisco and Bill Hasse.

The location of the caves investigated by Francisco and Hasse were in a northeast direction from San Jose village, and were reached after four hours of steady hiking.

A. Cave I

In archeological terms, Cave 1 was a shelter only. It showed a minimum degree of occupation. Pot shards were present.

B. Cave II

Discovered four years ago during a hunting journey by Mr. Emeterio Pop, Cave II had a small entrance measuring approximately one meter, which then led into three chambers.

The southern chamber yielded a large number of smashed shards, including many large rim shards; a few were collected for samples and dating purposes.

The second chamber, the northeastern chamber, was entered bu a small exit, approximately forty cm in diameter and fifteen meters long. This chamber was approximately twenty meters long, and showed a greater degree of occupation. It yielded a large rim of what appeared to be a storage jar and many pieces of shards, some of which were polychrome. Among the shards retrieved were: half of a small dish of a rim diameter of approximately twenty cm; the base or upper rim of a polychrome drum; and the main body of a beautifully decorated polychrome jar.

The southeastern chamber measured twenty-five meters in length and showed little evidence of activity. However, an opening of approximately fifty cm in diameter at the end of the chamber led to another chamber, approximately thirty-six meters long. In this chamber, a complete rim of a large pot was found.

The cave was very wet. All of the shards were covered with thick red clay. Numerous tracks of the Paca, or Gibnut, *Agouti paca*, were found throughout the cave. An entire skeleton of a Paca was found, and due to this find in the southeastern chamber, the name “U-Actun-Jale” was given to the cave, which means in the Maya language, “The Gibnut’s Cave”.

Within the same general area of the above-mentioned caves, a cavern was explored which consisted of a shelter approximately ninety meters long and a tributary of approximately eight meters long. In this tributary extension, a number of smashed shards were sighted. Some of these shards were polychrome and showed a pattern which suggested that the vessel could be restored (cover photograph).

A “kill hole” was noticed on the vessel, meaning that it had been used in association with a burial. After minimal excavation, bones were found, including some teeth. Six teeth were unearthed and brought to the Department of Archeology.

For identification purposes, the cavern was named “U-Actunil-Cha-Hum”, meaning “The Youth’s Cave”. Based on the

size of the teeth, it was suspected that a Maya of youthful age had been buried there.

In a northeast direction from "U-Actunil-Cha-Hum", a search was undertaken for a large sinkhole. The sinkhole was found and approximate measures revealed it to be forty meters wide and sixty meters deep. Entering the sinkhole was difficult, due to its steepness, but a careful search led to a possible entrance and a descent was made.

Once within the sinkhole, two large pot shards were found. What was notable about the sinkhole was the large number of cycads, *Zamia* sp. found growing there. This was not the common *Zamia* reported from other parts of the country, but an uncommon species. Photographs of the plants were taken to aid in further identification.

Caves I, II, the caverns and the sinkhole were all documented during the first two days of the expedition. The third day, 12 December, led to the finding of another cavern approximately thirteen meters long. This included a shelter approximately two-and-one-half meters wide and one meter high, and another chamber approximately three-and-one-half meters long and one meter wide. The longest chamber measured approximately three-and-one-half meters by one meter.

This cavern was littered with burial fragments including human bones and teeth. It also appeared that animals used the cavern for shelter.

On the 13th of December, our group headed towards American Camp, again, in search of more caves. The area that we came to was an area of high, rugged limestone and this was named, "Bel-Ich Kizin" or in Maya Mopan, "The Rugged Place". This limestone had a multitude of large fissures which appeared to be cave entrances, but after investigation, the fissures were no more than a mass of limestone ridges and openings.

On the 14th of December, not far from Abraham Camp, another cave was discovered. After entering the cave, it was found to be approximately thirty meters long, containing two chambers. It showed no evidence of Maya occupation.

On the 15th of December, a Maya ruin already discovered and named, "Ich K' K'hil", or "Wide Cacao Plants", was investigated. It lies two hours walking to the west of San Jose, and is a minor ceremonial precinct with four low mounds bordering a plaza measuring approximately twenty-five meters.

"Ich K'K'hil" is built somewhat like Uxbenka, Santa Cruz. Ich K'K'hil was raised to a level of approximately thirty-two meters before the mounds and the plaza were erected. The highest mound at Ich K'K'hil measures approximately eight to ten meters.

Lying in the plaza is a huge chunk of rock, which could have served as a stela, or from which eventually a stela would have been carved. This site appeared to have been looted, and a search yielded no artifacts which could have been brought to the Department of Archeology.

The Columbia River Forest Reserve should be visited again for further archeological investigations. Within a short period of time, less than one week, our searches revealed significant finds, which strongly indicate that there was a great deal of activity by the Maya in this area. Future and more thorough explorations could yield valuable finds and possible new data about the ancient Maya in southern Belize.

Specimen Description (cover photo)

A small restored polychrome bowl with a well-defined flat base measuring 7.3 cm, with out-curving medium-thick sides forming a flat to a slightly rounded rim.

This vessel is approximately 14.1 cm in diameter and 10.3 cm high. Its exterior as well as the interior is slipped. However, only the exterior is glazed and is slightly eroded at the rim. Immediately below the black rim, is a one-inch band of red painted on an orange slipped background, and separating the remainder of the bowl are two black bands of

different thickness, the upper being 0.8 cm and the lower 0.25 cm.

The larger base section of the bowl is painted cream and is decorated by a set of three equidistant, long, orange-red units resembling “flower receptacles”. Each set of “receptacles” is separated by a meandering black curved line, as if to say that the vessel had contained some kind of liquid beverage before it was smashed. Looking at the vessel from a three-dimensional perspective, and taking into consideration the “receptacles”, it would appear that the vessel with its content is being held by a stalk of some sort.

Near the base is a kill-hole. A kill-hole, as the word indicates, is a hole punctured on a vessel to make it non-functional, and, is associated with internments. After seeing the kill-hole, preliminary excavations were undertaken and a few toe bones and other deteriorated bone fragments were unearthed. The remains were not enough indication to a human internment. Further excavation continued until six human teeth were found. They included two incisors, two premolars, and two molars.

The teeth were believed to be from a youth. Based on this observation, the cavern was thus named, “U-Actunil-Cha-Hum” which means in the language of the Maya, “The Youth’s Cavern”.

The vessel was shattered on a limestone protrusion which measured approximately thirty inches high by ten inches. There were other large shard fragments in the cavern, as well. Some of them were brought into the Department of Archeology for dating purposes.

U-Actuni1-Cha-Hum is a small cavern about four hours of hiking in a northwesterly direction from San Jose village. It measured approximately fifteen meters in length, four meters deep, and one meter wide, and was utilized in the Late Classic Period (AD 600–900).

IV. Herpetology

John R. Meyer, PhD, provided the data resulting from field investigations into the Columbia River Forest Reserve. A preliminary flyover provided the herpetology team with a comprehensive look at the terrain, and provided the basis of which habitats would be chosen for subsequent field work. The areas of American Camp and Black Creek were chosen for study, the former considered to be of limestone bedrock, whereas the latter towards the east was an area consisting of shale and mudstone. The guide for the herpetology team was Rosario Pop.

Herpetological records from the Columbia River Forest Reserve are scarce, and a herpetology rapid assessment was considered an important exercise during the duration of the expedition.

Also, an alarming decline in populations of many species of frogs and salamanders worldwide adds an extra degree of urgency in requiring herpetological records for this area of Belize.

Reports of dramatic drops in populations of frogs, toads, salamanders or their relatives have been recorded from at least sixteen countries, including every continent. The decline appears vast but unpredictable, inexplicably hitting some of the world’s estimated 5100 amphibian species but missing others (Philips 1990).

Acid rain, metallic pollutants and pesticides have been indicated by reports from the First World Congress of Herpetology at the University of Kent, as plausible causative factors in these decreases (Rabb 1990). The skin of frogs and salamanders is extremely permeable and these animals could serve as barometers indicating a decline in the health of our environment, as they are particularly sensitive to atmospheric disturbances.

Although herpetologists have agreed that more-solid data is needed relative to these existing theories, the present and very real situation of declining amphibian populations needs to he considered.

A. Habitats Investigated

1. American Camp

The elevation of the American Camp study area was approximately 350 meters above sea level.

American Camp was on the edge of a cultivated area with undisturbed forest west and to the north. This area, according to sources in San Jose village, is going to become land used for shifting cultivation / agriculture in the near future.

American Camp is located at the top of a ridge west of the stream and the stream bedrock alternated between limestone and shale / mudstone. The feeder streams exhibited heavy lime load, which was shown by the deposits on the rocks. The area had not been logged since the 1940's and had never been clear-cut.

Observations and collections of the herpetofauna in this area were meager. It is believed that the weather may have influenced "herp" activity, as the overnight low temperatures were in the upper 50's, whereas daytime highs remained only in the 70's, due to the continual cloud cover.

2. Black Creek

Black Creek is located approximately two km to the northwest of Salamanca. The camp was located in an area of shifting cultivation and the elevation was approximately 175 meters above sea level.

At the time of the field investigations, both Black Creek and its tributaries were without water. The forest around Black Creek appeared to be much younger than that of American Camp and according to guide Rosario Pop, the area was clear-cut about twenty years ago.

There was no evidence of surface water. The area had extensive limestone outcroppings and sinks, some of which were almost 100 feet deep.

Other than use by British Forces and local hunters, there appeared to be little pressure on the area.

B. Summary

The survey undertaken was not able to document a large number of amphibians and reptiles but the Columbia River Forest Reserve is potentially inhabited by a diverse herpeto-fauna. Based upon known distributions, both geographically and ecologically in northern Central America, the list in Appendix I indicates those species that may inhabit the Forest Reserve.

Additional collecting during the summer will be necessary to document the presence of certain species, particularly the amphibians, as the existence of adequate aquatic breeding sites is problematical due to the topography and geology.

This rapid herpetofaunal investigation did reveal some elements that indicate an affinity with the lower montane zones that are found on the north slopes of the mountains in Chiapas, Mexico, Alto Verapaz, Guatemala, and the Caribbean slopes of the mountains in northern Honduras.

However, most of the forest in these above-mentioned areas has been destroyed or will soon be for various land-use projects. Any large tract of forest that can be preserved will not only protect a very special array of flora and fauna, but will also allow for continuing studies of the herpetofauna of the region, particularly with respect to the ecology and historical biogeography of the species in Central America.

The Columbia River Forest Reserve presents an unspoiled area, virtually uninhabited with relatively easy access for natural-history-oriented tourism, tropical-ecology studies, and further scientific field work that would be invaluable to the need for further understanding the interdigitation of Neotropical and Nearctic fauna that occurs in this critical area of nuclear Centra] America.

C. Species List — See Appendix I

V. Ornithology

Literature review before the start of the Columbia River Forest Reserve Expedition revealed little ornithological information about this region of Belize. Both resident- and migratory-bird species were of great interest to the expedition, and recordings were accomplished in two ways. First, each expedition member kept records during their respective journeys in each part of the Forest Reserve. Second, Mr. Courtney Conway of the Smithsonian Institution provided a list of bird species which he had netted within the boundaries of the Forest Reserve.

One of the species captured in Courtney Conway's mist nets was the Yellow-faced Grassquit, *Tiaris olivacea*; previous information about this species in Belize yields only one official record. Another species, the Common Woodnymph, *Thalurania furcata*, has not been recorded in Belize and represents a new species for the country's *Checklist of the Birds of Belize*.

Recordings of migratory-bird species in tropical forests of Central and South America are important due to a prevailing theory that the steady decrease in migratory-songbird populations between the years 1978 through 1987 may be due to the widespread destruction of these rainforests (*Nat'l Geo.*, Oct. 1990).

Approximately sixty species of US birds winter in mature tropical forests. These include twenty-nine species of warblers, five flycatchers, five vireos, plus assorted thrushes, cuckoos, tanagers, orioles, and grosbeaks. Of these, a few, such as the Worm-eating Warbler, *Helmitheros vermivorum*, and Swainson's Warbler, *Limnothlypis swainsonii*, occur almost exclusively in mature forests, and for them, deforestation is an indisputable problem.

Migratory-bird species not only spend the winter months in tropical forests, but some play a vital role in the healthy ecology of these forests. For example, the male Orchard Oriole, *Icterus spurius*, is the only effective pollinator of the

of the large and abundant tree, *Erythrina fusca*. Although other birds obtain nectar from the tree's flowers, it is only the male Orchard Oriole that does so in a manner that also fertilizes them (Wilcove 1990).

The importance of recordings of migratory bird species becomes very apparent when taken into consideration the following; these birds are losing their breeding habitat in North America because of steady land alteration, atmospheric pollution that is damaging the forests in which they live, and the fact that animals that prey upon them, i.e. raccoons, squirrels, Blue Jays, and Crows, are all thriving. These factors, in addition to the continual destruction of tropical forests that is reducing their wintering grounds to fragmented regions of habitat, are all to be considered in the recent studies that show that migratory-songbird populations are decreasing (Wilcove 1990).

A. Species List — See Appendix II

VI. Ecotourism Profile of San Jose Village

Ecotourism or nature-tourism can be defined as, "Tourism that consists in traveling to relatively undisturbed or uncontaminated natural areas with the specific objective of studying, admiring, and enjoying the scenery and its wild plants and animals, as well as any existing cultural manifestations (both past and present) found in these areas. In these terms, nature-oriented tourism implies a scientific, esthetic, or philosophical approach to travel, although the ecological tourist need not be a professional scientist, artist, or philosopher. The main point is that the person who practices ecotourism has the opportunity of immersing himself / herself in nature in a manner generally not available in the urban environment." (Ceballos-Lascurain 1987).

The ecotourism potential of San Jose village and the surrounding Columbia River Forest Reserve was seen as an important component in the field investigations due to the dynamic growing role that this industry is playing in the country's GNP.

Between the years 1980 to 1987, tourist arrivals in Belize increased by fifty-five percent. The contribution of tourism to foreign-exchange earnings grew from US$41.0 million to an estimated 47.3 million in 1987 (Miller 1988), and it has been projected that tourist spending will increase approximately seven percent annually (Tourism Report II 1990).

The Columbia River Forest Reserve could become a nature-tourism destination for a growing number of travelers who are interested in tropical flora and fauna.

The ecotourism profile and overview was assessed by Mr. Kick Fleming who has founded and developed Chaa Creek Cottages in the Cayo District on the Macal River.

A. Profile of San Jose Village

Location —	Thirty-five miles west of Punta Gorda town and seven miles east of the Guatemalan border.
Population —	Approx. 600 people (50 families).
Ethnic Group —	Mopan Maya.
Language —	Mopan Maya or English.
Religion —	Five churches: Mennonite, Baptist, Nazarine, Pentecostal, Catholic.
Sources of Income —	Agriculture.
Principal Crops —	Corn, beans, rice — grown in traditional milpa farming.
Av. Family Income —	BZ$500 - $1000 per annum.
Transportation —	Bus leaves San Jose twice weekly at 3:00 am. Wed. and Sat. for Punta Gorda. Returns from PG at 12:00 pm.

B. Benefits to be Derived from Ecotourism

1. Injection of cash flow into village society.
2. Could lead to gradual change from dependency on milpa-farming practices as the preservation of forested lands would be tied into ecotourism activities.
3. The preservation of the Maya culture would be encouraged through the interest shown by visitors to the village who are wanting to observe traditional life-style of the Maya.
4. Growth of local arts and crafts trades, i.e. woven baskets and embroidery for sale to visitors.

C. Attractions of San Jose Village as a Tourist Destination

1. The opportunity to interact with the Mopan Maya in English, a unique attraction for foreign tourists.
2. The opportunity to stay in a traditional Maya village and observe the cultural lifestyle.
3. Experiencing the traditional foods of the village and the preparation of these local dishes.

4. Participation in discussions with the villagers about their traditional milpa-farming ways, leading to a clearer understanding of these methods, i.e. different crops, their rotation, and the reasons that these methods hove been solidly ingrained into their society for hundreds of years. Examples of these farms are in the immediate area.

5. An insight into the Alcalde system of leadership, and how this form of governing has worked in the past; why it is still effective today.

6. Given that the ecological life zone of the Columbia River Forest Reserve is special in Central America, the vegetation found here would provide visiting botanists and naturalists an area of extreme interest. Unusual flora such as the palm, *Colpothrinax cookii*, the cycad, *Zamia* sp. and assorted orchids and other epiphytes could make the Forest Reserve a highly desirable botanical destination.

7. For those visitors having an interest in geology or earth sciences, the limestone-karst formations and conspicuous sink holes, probably some of the best examples of these geological features in the country, can be observed and studied in the Forest Reserve.

8. Birdwatchers can also enjoy both secondary forest and high forest birding, and may be able to add quite a few species to their checklists (see Appendix II).

9. Travelers interested in an introduction to rain-forests and the flora and fauna found in these environs, the Columbia River Forest Reserve could provide a worth-while experience. Local guides are available for forest journeys, and their knowledge of the area and the local plants and animals would provide a unique and memorable experience.

10. Visits to San Jose Village and the adjacent Forest Reserve could be part of an adventure-travel itinerary, which could include other activities such as:

- river trios down Golden Stream or Rio Grande.
- trips to some of the southern cayes off the coast of Punta Gorda such as Sapadillo Caye.

D. Present Tourism Profile

A visit to San Jose Village at present can be undertaken by hiring a charter from Punta Gorda to the village, which costs approximately BZ$155, or by arriving to the village by bus, which leaves PG for all villages west on Wednesdays and Sundays.

Once in the village, a simple inquiry to the Alcalde about available accommodations can be made and local homes would, be available for simple lodging.

The following men, living in San Jose Village, are available for guide services:

Antonio Sho	Candido Coh
Francisco Pop	Hermando Pop
Pablo Sho	Andres Coh
Mario Pop	Lucas Pop
Luciano Pop	Alfredo Sho
Catarino Pop	Emetario Pop

The standard guide fee, at this writing, is BZ$20.00 per day.

E. The Toledo Ecological Association

A local organization, the Toledo Ecological Association, has formed and is active in developing and promoting eco-tourism in the Toledo District. Mr. Chet Schmidt of *Nature's Way Guesthouse*, 65 Front St, P.O. Box 75, is a moving force behind the Toledo Ecological Association and is a contact for them in Punta Gorda.

The association consists of twenty-five members representing Kekchi and Mopan Maya and the Garifuna in this area of Toledo. The principal villages represented are Barranco, Santa Cruz, Laguna and Silver Creek.

The goal of the Association is to try to develop PG as a possible role model for indigenous people and community ecosystems.

A possible ecotourism strategy is for each village to develop a trail system which would incorporate the sites of special interest within that particular village area.

Standardizing basic accommodations throughout the villages involved in this plan is also being addressed.

VII. Other Observations

A. Mammals

The presence of mammals detected from tracks or other signs were scant during the five-day trek up to "Little Quartz Ridge". However, spent shotgun shells were abundant and this area has served as a hunting ground for the surrounding villages for many years.

Explorations further east / northeast from San Jose yielded more animal tracks than were found in the western part of the Forest Reserve along the trail to Union Camp. The following tracks were reported from expedition members:

Jaguar, *Panthera onca*
Ocelot, *Felis pardalis*
Jaguarundi, *Felis yagouaroundi*
Tapir, *Tapirus bairdii*
Collared Peccary, *Dicotyles tajacu*

Also, a troop of fifteen Coatimundis, *Nasua nasua*, was observed eight km northeast of San Jose.

During the trek to "Little Quartz Ridge", the call of the Black Howler monkey, *Alouatta pigra*, was heard on three different occasions.

B. Examples of Land Use in San Jose Village

An interview with one of the village health workers gives an idea of the amount of land needed per family. He believes the average family plants six acres of corn, four acres of rice, one acre of beans and about two acres of a mix of everything else (peanuts, cacao, bananas, etc). The corn and bean fields need to move every year, leaving the

land fallow for five years until they can once again return and plant. Therefore, conservatively speaking, each family needs about fifty acres of land for shifting cultivation. With 110 families in the village, this relates to a need of approximately 5500 acres or 8.5 square miles.

A TAMP/VITA Project located in the village is encouraging the villagers to try permanent cropring.

C. Recommendations

The following were recommendations suggested by various expedition participants:

1. Further exploration is needed to describe the forests to the northeast of the village, in the eastern section of the Forest Reserve. Esperanza Camp has been repeatedly mentioned by the villagers in San Jose as a beautiful spot with bountiful wildlife (frequented by hunters). The forest is reportedly high, sink holes are prevalent. This area should be explored in the dry season.

2. The hunting of wildlife within the Forest Reserve needs to be monitored or controlled; the clearing of primary forest for farming purposes must be monitored … (from a report submitted by Mr. Modesto Bol, Forest Officer, Machaca Forest Station).

3. "This area is one of very special interest and not represented, to my knowledge, anywhere else in Belize and possibly not anywhere else in Central America. It is an area of scientific interest, tourist interest, ana is irreplaceable. It should certainly be placed under protection and not exploited or converted to other use until studies show exactly how the ecotypes and flora and fauna are interdependent. Any change in land use could result in millions of years of tropical-forest evolution vanishing forever." … (from a report submitted by Mr. Martin Meadows, Forester).

While no legislation exists in Belize with regard to the establishment of Biosphere Reserves, it was unanimously

agreed upon that the region known as the Columbia River Forest Reserve should serve as a core area within a larger Forest Reserve plan encompassing the entire Maya Mountains.

The Biosphere Reserve concept was developed by UNESCO and UNEP in cooperation with the FAO and IUCN. First launched in 1971, it is a worldwide program dealing with people-environment interactions.

Research under the Biosphere Reserve program is designed to provide the information needed to solve practical problems of resource management. It also aims to fill the still significant gaps in the understanding of the structure and function of ecosystems, and the different types of human intervention.

At this writing, there are 243 Biosphere Reserves in 65 countries around the world.

The Biosphere Reserve concept does not mean that large tracts of land are "locked up" and left unused. The concept provides a zoning plan whereas areas would be assigned a status that is practical to that respective territory. Controlled logging, hunting, and agricultural practices are all possible activities that can be carried out within a Biosphere Reserve.

However, "core areas", is suggested as an assigned status to the Columbia River Forest Reserve, is due to the presence of special characteristics such as genetic richness or features of exceptional scientific interest.

People are an important part cf the Biosphere Reserve concent. This is not a plan specifically targeting the strict control of Plant and animal resources. People constitute an essential component of the landscape and their activities are fundamental for its long-term conservation and compatible use. People and their activities are not excluded from a Biosphere Reserve; rather they are encouraged to participate in its management and this insures a stronger social acceptance of conservation activities (Action Plan for Biosphere Reserves 1983).

APPENDIX I

Potential Herpetofauna of the Columbia River Forest Reserve

AMPHIBIA

Dermophis mexicana
Bolitoglossa dofleini
B. mexicana
B. occidentalis
B. rufescens
Oedipina elongata
Bufo cavifrons
Bufo marinus
Bufo valliceps
Eleutherodactylus chac
E. laticeps
E. rugulosus
Leptodactylus melanonotus
Syrrhonus leprus
Centrolenella fleischmanni
Agalychnis callidryas
A. moreleti
Hyla ebraccata
H. loquax
H. microcephana
H. picta
Ololygon staufferi
Phrynohas venulosa
Smilisca baudini
S. phaeota
Gastrophryne elegans
Rana berlandieri
R. vaillanti

REPTILIA

Claudius angustatus
Kinosternon leucostomum
Staurotypus triporcatus
Chelydra serpentina
Trachemys scripta
Celestus rozellae
Coleonyx elegans
Gonatodes albogularis
Sphaerodactylus millipunctatus
Thecadactylus rapicaudus
Lepidophyma flavimaculatum
Norops biporcatus
N. capito
N. lemurinus
N. limifrons
N. pentaprion
N. sericeus
N. tropidonotus
N. uniformis

Basiliscus vittatus
Corytophane cristatus
C. hernandezi
Iguana iguana
Laemanctus longipes
Sceloporus variabilis
Eumeces sumichrasti
Mabuya unimarginata
Sphenomorphus cherriei
Ameiva festiva
A. undulata
Gymnophthalmus speciosus
Boa constrictor
Adelphicos quadrivirgatus
Amastridium veliferum
Clelia clelia
Coniophanes bipunctatus
C. fissidens
C. imperialis
Dendrophidion nuchalis
Dryadophis melanolomus
Drymarchon corais
Drymobius margaritiferus
Elaphe flavirufa
Imantodes cenchoa
Lampropeltis triangulum
Leptodeira annulata
L. septentrionalis
Leptophis ahaetulla
L. mexicanus
Ninia diademata
N. sebae
Oxybelis aeneus
O. fulgidus
Oxyrhopus petola
Pliocercus elapoides
P. euryzonus
Pseustes poecilonotus
Scaphiodontophis annulatus
Sibon nebulata
S. sanniolas
Sibon sartori
Spilotes pullatus
Stenorrhina degenhardti
Tantilla cuniculator
T. schistosa
Tantillita lintoni
Thamnophis proximus
Tretanorhinus nigroluteus
Xenodon rhabdocephalus
Micrurus diastema
M. hippocrenis
M. nigrocinctus

Bothrops atrox
B. nasuta
B. nummifer
B. schlegeli

Species	Location	Specimens Preserved
Bufo cavifrons	American Camp	Yes
Eleutherodactylus chac	Edwards Central	Yes
Eleutherodactylus laticeps	American Camp	Yes
Eleutherodactylus rugulosus	American Camp	Yes
Eleutherodactylus sp.	Black Creek Camp	Yes
Rana vaillanti	American Camp	No
Ameiva festiva	American Camp	No
Basiliscus vittatus	American Camp	No
Norops lemurinus	American Camp	No
Norops limifrons	American Camp	Yes
Norops uniformis	American Camp	Yes
Norops sp.	San Jose Village	Yes
Sphaerodactylus millipunctatus	3 km NW of San Jose	No
Boa constrictor	Edwards Central	No
Bothrops nummifer	Abraham Camp	No
Drymobius margaritiferus	5 km E of Salamanca.	No
Imantodes cenchoa	American Camp	No
Tantilla schistosa	American Camp	Yes

APPENDIX II

Bird Species recorded from the Columbia River Forest Reserve
(species marked with * indicate those captured in mist nets)

Great Tinamou	*Tinamus major*
Slaty-breasted Tinamou	*Crypturellus boucardi*
American Kestrel	*Falco sparverius*
Crested Guan	*Penelope purpurascens*
Great Curassow	*Crax rubra*
Plain-breasted Ground-Dove	*Columbina minuta*
Ruddy Ground-Dove	*Columbina talpacoti*
Blue Ground-Dove	*Claravis pretiosa*
Gray-chested Dove	*Leptotila cassinii*
Olive-throated Parakeet	*Aratinga nana*
Brown-hooded Parrot	*Pionopsitta haematotis*
White-fronted Parrot	*Amazona albifrons*
White-crowned Parrot	*Pionus senilis*
Mealy Parrot	*Amazona farinosa*
Groove-billed Ani	*Crotophaga sulcirostris*
Spectacled Owl	*Pulsatrix perspicillata*
White-collared Swift	*Streptoprocne zonaris*
Long-tailed Hermit	*Phaethornis superciliosus*
Little Hermit	*Phaethornis longuemareus*
Violet Sabrewing	*Campylopterus hemileucurus*
White-bellied Emerald	*Amazilia candida*
Rufous-tailed Hummingbird	*Amazilia tzacatl*
Stripe-tailed Hummingbird	*Eupherusa eximia*
Black-headed Trogon	*Trogon melanocephalus*
Collared Trogon	*Trogon collaris*
Slaty-tailed Trogon	*Trogon massena*
Tody Motmot	*Hylomanes momotula**
Blue-crowned Motmot	*Momotus momota*
Green Kingfisher	*Chloroceryle americana*
White-whiskered Puffbird	*Malacoptila panamensis*
Emerald Toucanet	*Aulacorhynchus prasinus*
Collared Aracari	*Pteroglossus torquatus*
Keel-billed Toucan	*Ramphastos sulfuratus*
Golden-olive Woodpecker	*Piculus rubiginosus*
Lineated Woodpecker	*Dryocopus lineatus*
Pale-billed Woodpecker	*Campephilus guatemalensis*
Buff-throated Foliage-gleaner	*Automolus ochrolaemus**
Plain Xenops	*Xenops minutus*
Scaly-throated Leaftosser	*Sclerurus guatemalensis**
Tawny-winged Woodcreeper	*Dendrocincla anabatina*
Ruddy Woodcreeper	*Dendrocincla homochroa*
Olivaceous Woodcreeper	*Sittasomus griseicapillus**
Wedge-billed Woodcreeper	*Glyphorynchus spirurus*
Ivory-billed Woodcreeper	*Xiphorhynchus flavigaster*
Barred Antshrike	*Thamnophilus doliatus*
Russet Antshrike	*Thamnistes anabatinus*

Plain Antvireo	*Dysithamnus mentalis**
Dusky Antbird	*Cercomacra tyrannina*
Black-faced Antthrush	*Formicarius analis**
Paltry Tyrannulet	*Zimmerius vilissimus*
Yellow-bellied Elaenia	*Elaenia flavogaster**
Ochre-bellied Flycatcher	*Mionectes oleagineus**
Slate-headed Tody-Flycatcher	*Todirostrum sylvia**
Eye-ringed Flatbill	*Rhynchocyclus brevirostris**
White-throated Spadebill	*Platyrinchus cancrominus*
Royal Flycatcher	*Onychorhynchus coronatus*
Ruddy-tailed Flycatcher	*Terenotriccus erythrurus*
Sulphur-rumped Flycatcher	*Myiobius sulphureipygius*
Yellow-bellied Flycatcher	*Empidonax flaviventris**
Least Flycatcher	*Empidonax minimus**
Bright-rumped Attila	*Attila spadiceus*
Boat-billed Flycatcher	*Megarynchus pitangua**
Social Flycatcher	*Myiozetetes similis*
Tropical Kingbird	*Tyrannus melancholicus*
White-winged Becard	*Pachyramphus polychopterus**
Masked Tityra	*Tityra semifasciata*
Rufous Piha	*Lipaugus unirufus*
Thrushlike Manakin	*Schiffornis turdinus*
White-collared Manakin	*Manacus candei*
Red-capped Manakin	*Pipra mentalis*
Barn Swallow	*Hirundo rustica*
Green Jay	*Cyanocorax yncas*
Brown Jay	*Cyanocorax morio*
Spot-breasted Wren	*Thryothorus maculipectus*
White-breasted Wood-Wren	*Henicorhina leucosticta*
Nightingale Wren	*Microcerculus philomela*
Long-billed Gnatwren	*Ramphocaenus melanurus**
Tropical Gnatcatcher	*Polioptila plumbea*
Slate-Colored Solitaire	*Myadestes unicolor*
Wood Thrush	*Hylocichla mustelina*
White-throated Robin	*Turdus assimilis*
Gray Catbird	*Dumetella carolinensis*
Philadelphia Vireo	*Vireo philadelphicus**
Tawny-crowned Greenlet	*Hylophilus ochraceiceps*
Lesser Greenlet	*Hylophilus decurtatus*
Blue-winged Warbler	*Vermivora pinus**
Tennessee Warbler	*Vermivora peregrina**
Yellow Warbler	*Dendroica petechia*
Magnolia Warbler	*Dendroica magnolia*
Black-throated Green Warbler	*Dendroica virens*
Black-and-white Warbler	*Mniotilta varia*
American Redstart	*Setophaga ruticilla*
Worm-eating Warbler	*Helmitheros vermivorum**
Ovenbird	*Seiurus aurocapilla**
Northern Waterthrush	*Seiurus noveboracensis*
Louisiana Waterthrush	*Seiurus motacilla*
Kentucky Warbler	*Oporornis formosus*
Common Yellowthroat	*Geothlypis trichas**
Hooded Warbler	*Wilsonia citrina*

Wilson's Warbler	*Wilsonia pusilla*
Golden-crowned Warbler	*Basileuterus culicivorus*
Yellow-breasted Chat	*Icteria virens*
Bananaquit	*Coereba flavedo.*
Red-legged Honeycreeper	*Cyanerpes cyaneus**
Olive-backed Euphonia	*Euphonia gouldi*
Black-throated Shrike-Tanager	*Lanio aurantius*
Red-crowned Ant-Tanager	*Habia rubica*
Red-throated Ant-Tanager	*Habia fuscicauda*
Crimson-collared Tanager	*Ramphocelus sanguinolentus*
Scarlet-rumped Tanager	*Ramphocelus passerinii*
Grayish Saltator	*Saltator coerulescens**
Buff-throated Saltator	*Saltator maximus**
Black-headed Saltator	*Saltator atriceps*
Black-faced Grosbeak	*Caryothraustes poliogaster*
Rose-breasted Grosbeak	*Pheucticus ludovicianus**
Blue-black Grosbeak	*Cyanocompsa cyanoides*
Indigo Bunting	*Passerina cyanea*
Orange-billed Sparrow	*Arremon aurantiirostris*
Green-backed Sparrow	*Arremonops chloronotus*
Blue-black Grassquit	*Volatinia jacarina*
White-collared Seedeater	*Sporophila torqueola*
Yellow-faced Grassquit	*Tiaris olivacea**
Melodious Blackbird	*Dives dives*
Great-tailed Grackle	*Quiscalus mexicanus*
Orchard Oriole	*Icterus spurius*
Northern Oriole	*Icterus galbula*
Yellow-billed Cacique	*Amblycercus holosericeus*
Montezuma Oropendola	*Psarocolius montezuma*

Common Woodnymph	*Thalurania furcata**

*New species record for Belize.

APPENDIX III

Maximum and Minimum Temperatures in degrees F

10 – 15 December

Date	Low	High	Location
10/12	59	74	San Jose
11/12	59	75	Milpa Camp
12/12	64	80	Milpa Camp (NE of San Jose)
13/12	68	78	American Camp
14/12	68	82	American Camp
15/12	69	84	San Jose

References Cited

1. Action Plan For Biosphere Reserves, 1983. Coordinating Council of the Program on Man and the Biosphere, eighth session, Paris, 3–8 December.

2. Belize Government Forestry Inventory, 1976. Columbia River Forest Reserve, D.F.O. Belmopan.

3. Boo, Elizabeth. 1990. Ecotourism: The Potentials and Pitfalls; Vol. II. Country Case Studies. WWF-US. Washington, DC.

4. Ceballos-Lascurain, Hector. 1997. "Estudio de Prefactibilidad Socioeconomica del Turismo Ecológico y Ante Proyecto Arquitectónico y Urbanistico del Centro de Turismo Ecológico de S'ian Ka'an, Quintana Roo". Study made for SEDUE, Mexico.

5. Dixon, D.G. 1955. Geology of Southern British Honduras. Her Majesty's Printing Authority.

6. Hartshorn, G.S.L., Nicolait, L. et al. 1994. Belize: Country Environmental Profile: A Field Study. Robert Nicolait and Assoc., Ltd. Belize City, Belize.

7. Holdridge, L.R. 1967. Life Zone Ecology. Tropical Science Center, San José, Costa Rica. Rev. ed. 206 pp.

8. Janzen, D. *et al.* 1983. Costa Rican Natural History, University of Chicago Press.

9. King, *et al.* 1996. Land Resource Survey of Toledo District, Belize. Land Resources Dev. Centre, Tolworth Tower, Surbiton, Surrey KT6 7DY, England.

10. Miller, Luther Gordon. 1988. "The Development of a Tourism Sector Policy for Belize". Paper presented at a meeting of Belize Embassy's Interagency Contact Group, Washington, DC May 20.

11. *National Geographic* Magazine, October 1980. Earth Almanac.

12. *Natural History* Magazine,November 1990. "Vegetation Map of the Yucatan". pg. 4.

13. Philip, Kathryn. 1990. "Frogs in Trouble." *In*: International Wildlife, Vienna, VA. pp. 4-10.

14. Wilcove, David, 1990. "Empty Skies." *In*: *The Nature Conservancy Magazine*, Jan/Feb 1990.

15. Wright, A.C.S., D.H. Romney, R.H. Arbuckle. 1959. Land Use in British Honduras. Col. Research Publication No. 24 Her Majesty's Stationery Office, London.

16. Wright, A.C.S. 1989. "Some random thoughts about the rainforests of southern Belize." *In*: *Rainforests*. Compiled by Brett Blosser.

COLUMBIA FOREST RESERVE COMPLETES CRITICAL HABITAT SURVEY

An expedition to assess the ecological importance of the Columbia Forest Reserve completes a critical habitat survey of Belize conducted by the Belize Center for Environmental Studies (BCES) during the last eight months.

The expedition team of scientists, Department of Forestry personnel, farmers, Department of Archaeology personnel, and Belize Tourism Industry Association (BTIA) members spent a week exploring and documenting features of the reserve. The Columbia Forest Reserve includes forest not known to exist in any other part of Belize.

The seven-day expedition was part of a Rapid Environment Assessment (REA) of habitat in Belize considered critical to the survival of threatened and endangered species and to maintaining biodiversity.

The field team, headed by Sharon Matola, Director of Protected Lands Research at the Center and Director of the border, and north to Little Quartz Ridge. Vegetation types, birds, reptiles, mammals, and insects were recorded. Caves containing Maya artifacts were explored by the archaeology and caving team members. Soil conditions were investigated and their suitability for agriculture or other uses was assessed. Two frog species, one perhaps never described before, were recorded for Belize for the first time.

The field assessment, which ended on the December 16, was one of about ten such investigations conducted during the critical habitat survey. It was determined by the team that the. area was definitely unique and should be further explored during the dry season.

The critical habitat survey, funded by World Wildlife Fund — US with assistance from USAID, will be concluded at the end of December. During the survey, more than a dozen sites were identified by the Centre for Environmental Studies as needing