

Cotacavado National Park: a perturbed
rainforest ecosystem

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A report to the World Wildlife Fund

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Summary

We reluctantly summarize this report below. Why reluctantly? Because we feel that much of the problem in Corcovado stems from the very human desire to want to condense a complex problem into a few simple policy statements, thereby ignoring the operational details that truly make the difference between a success and a failure in planning and predicting the behavior of a complex system. 'Evict the gold miners, yes. But the details of how it is to be done are the real story. Declare a state of emergency for the Park Service, yes. But whether eviction succeeds depends not on its declaration but rather what one does with the resources thus made available. Do the gold miners damage the Park? Yes, but not within the details of their understanding of either a national park or the word "damage". Discuss Corcovado, yes. But recognize that it is only a specific case of the general challenge to the entire park system, and therefore details well beyond Corcovado need to be discussed.

1. The gold miners, in the recent past and present, have already come very close to destroying all the aquatic ecosystems in the southern third of the Park. Furthermore, they and their farming/hunting antecedents have eliminated the game animals in this portion of the Park, and the presence of the gold miners and their associates is clearly the major impediment to the return of these vertebrates. For these, and a variety of smaller impact reasons, we feel that the permanent cessation of all mining activity within the Park is imperative within the upcoming few months.

2. The miners and dependents within the Park at present number between 800 and 2200 (1400 being the most likely average) and are by and large hard-working, thoughtful and respectful people. We are confident that the majority will leave voluntarily when requested in a non-antagonistic manner, and that much of their presence over the past 5 years has been analogous to someone parked on a yellow curb, watching for the traffic police to come along and tell them to move on. They work in the Park, rather than the gold-bearing lands outside of the Park, not only because it is a high yield area but because the lands outside the Park have either been already mined by companies or are privately owned by individuals hostile to invasion by gold miners.

3. The kinds of gold miners range from "old time" miners to highly competent modern professionals aided by small groups of apprentices. The modern miners and helpers constitute at least 90% of the miners working in the Park; it appears that at least 50% of these people have other sources of income in addition to their mining activities in the Park. We were struck by the boring and intellectually undeveloped lives led by the miners, and impressed by how little a young person has to show for his time spent as an apprentice to a professional miner. All miners appeared to be attracted by the possibility of "striking it rich", but in fact no more than 1-3% per year earn anything other than what might be called decent labor wages.

4. The "gold miners" of Corcovado are much more than the people knee-deep in mud and cold water. The "gold miners" are also an array of commercial interests that view the cash flow from the miners as the economic salvation of the area (and their stores). They are also the many landowners outside of the Park who are not eager to have the miners from the Park turned loose on their private lands. All of these people will react differently but negatively to the eviction of the miners from the Park. Several months of advanced planning, both inside and outside of the Park, are still needed for the eviction to work well in the face of the various forms of opposition. It is our opinion that one of the most productive, but as yet unexplored, areas is that of providing a good and free transportation system for the miners both to leave the Park and to leave the area, accompanied by an opportunity for purchase of their used equipment at a reasonable price by private firms if they wish to sell it.

5. We were consistently impressed by the desires of the miners (and associated persons) for detailed information on their future, what exactly is a Park, what kind of damage are they causing, can it be avoided, etc. These desires were generally accompanied by statements, often rich in misinformation, that appeared to give a logical or humanitarian base for the presence of the miners in the Park. This is a population ripe for discussion and education, and we feel that much of the potential acrimony over the eviction can be avoided by an intense educational program for several months prior to the eviction.

5. Corcovado National Park was established as a forest within a forest, with little threat other than an occasional hunter. Civilization in the form of gold mining and farming has now marched right up to and beyond its inland boundaries, and the entire concept of protection and development of the Park demands intense educational and economic integration with this community outside of the Park. This requires relocation of ranger stations and the central Park administration, a change in emphasis among the Park Rangers from policing to public relations, and an increase in the number of educable young Park Rangers until invasion is no longer a major threat. It also requires that the Park Service develop a protocol to deal with the continuous upcoming pressure for timber, land and other resources that are being saved within the Parks. The gold in Corcovado is not exceptional as a threat, and in fact the timber in the Park is already worth more than the gold. Within the next 20-30 years, Costa Rica's parks will become storehouses of incredibly valuable resources which will be ever more desired by the commercial inclinations of the country.

6. The present and future preservation of Corcovado lies not only in the Park Service orchestration of the details for a face to face integration within the community, but in the Park as a tourist and educational institution being an integral part of the development plans for the region in the other government agencies. The Park Service is a logical coordinator for such an inter-agency interplay, seeing as how it more than any other single Costa Rican government

institution depends on the good will and support of virtually all major governmental agencies.

7. The central San Jose office of the National Park Service has tended to be distant from the problems in the individual Parks. We explicitly recommend a substantially greater movement of persons from the central office into field circumstances, longer tours of duty for park directors in particular parks (perhaps interspaced with an occasional working leave of absence in the central office), substantial overlap between incoming and outgoing park directors, written management/operational plans specific to individual parks and to be followed by successive directors, and the funding of a position for a person whose explicit task it is to regularly visit all Parks and prepare brief eye-witness reports on major pending problems. There is also a strong tendency for park personnel to deflect decisions upward, to use their superiors as a shield (and therefore to not act when that shield is not in place). Somehow the Park Service has got to become a collection of independent individuals that generally make harmonious decisions because they recognize a common goal rather than simply because they share a master.

8. We recognize that the first-draft suggestions we have offered will often require as much an infusion of resources to the Park Service as a change in direction or attitude about resource use. While the Park Service has built a magnificent start through the generosity of the Costa Rican government, supplemented by international donations from individuals and organizations, it is clear that during the next few decades of pressure on its parks, perhaps as much as a doubling of the resource base will be required just to give high quality maintenance and solidarity to the Parks as already established. It is this kind of maintenance funding that is the hardest to obtain, yet absolutely the most critical. We feel that there are at least two as yet undeveloped sources: private funds within Costa Rica, and the tourist who is quite willing to pay well for quality guide and educational services within the Park system. The latter may to some degree compete with the biological tour industry, but it could use some home-grown competition, and the numerous biologists working in Costa Rican parks might well be drawn on for intellectual contributions.

There is a third source, somewhat less conventional. Those philanthropic institutions that concern themselves with poverty, nutrition, and other seemingly more direct human needs than national parks could perhaps be induced to recognize that in a regional development scheme (such as is the only true long-term solution to the Osa Peninsula) the goal is not to produce a large number of barely literate and self-maintaining human draft animals but rather to support a much smaller number of intellectually well-developed humans with the time, ability and inclination to enjoy the riches of humanity. Such a goal clearly calls for a high-quality naturally diverse counterpoint such as Corcovado to balance the hum-drum dreariness of high quality rice fields, cattle pastures, forest plantations and oil palms. Many a gold miner told us

what he really liked about Corcovado was not the gold but the tranquility. How many of you would choose to place your house in the middle of a cow pasture? Twenty years from now the most valuable hectares in private hands on the Osa Peninsula are going to be within 200 m of the boundaries of Corcovado National Park.

Introduction.

This is a report on the contemporary impact of gold mining in Costa Rica's Corcovado National Park, with suggestions as to how to reduce the threat to the Park, to the Costa Rican National Park Service, and to other conservation efforts within Costa Rica. It deals with more than just the Park and the eviction of the gold miners that occupy it; the problem is clearly inseparable from the larger ecosystem made up of, at the very least, the National Park Service, Costa Rican society, and all Costa Rican wildlands earmarked for present or future preservation or wildland management. The Costa Rican National Park system is the finest in the Neotropics, but it was established, and has evolved, during relatively benevolent years and in a society that was mentally and economically in favor of its existence. Costa Rica is entering a new epoch for this country, a time when resource harvest technology and population growth are becoming almost undefeatable contenders for the every-day-more-valuable resources within her national parks. Today they want Corcovado's gold, tomorrow it will be her timber, and the day after, her land. For the survival of conservation in Costa Rica, and by example, in much of the Neotropics, it is imperative that the National Park service grow until it has the traditions and protocol to deal with these threats by the act of imbedding the Parks as firmly in the hearts and minds of Costa Ricans as are its schools and churches.

Briefly, the problem is the following. Corcovado National Park was established in 1975 as about 36,000 ha of the finest lowland rainforest ever to be preserved in Mesoamerica. At the time, stream deposit gold was known to occur in the southern third of the Park and some placer gold mining had been occurring in the environs of the Park for at least 50 years. However, owing to a booming national economy and the low price of gold, mining in the Park (as originally defined) was conducted by less than 10 "old time" stream bed miners that lived a hermit-like life and were viewed as quaint members of the fauna. They were allowed to stay while the farmers in the Park were bought out and relocated. In 1980, and about the time that the Costa Rican economy collapsed and the price of gold shot up, the Park boundaries were increased (now enclosing about 43,000 ha) to make the Park more of a solid geometrical figure, to include its unique (and tiny) oak-inhabited cloud forest, and to insure that all parts of the Park's major drainage basins were totally inside the Park. At the time of this amplification of the Park, the newly incorporated rivers were well known to be rich in gold (as were those inside the old boundaries in the southern third of the Park) and were occupied by some number less than 50 somewhat "old time" gold miners. During the following five years (through the present), the steeply hilly southern third of the Park (about 75% old Park and 25% new area) was rapidly invaded by an uncensused number of modern placer gold miners (oreros, coligalleros), each one

of which entered relatively independently rather than as part of a syndicate, cooperative or company. The mining intensity per person rapidly evolved upward, and the damage to terrestrial and aquatic systems steadily accumulated. At present, the southern third of the Park (Figure 1) is severely altered by the virtual elimination of its game animals and by the conversion of almost all watercourses to sediment-laden and sterile channels.

The pending perturbation of Corcovado by the gold mining, and the horrible social problem that it posed, began receiving attention by concerned Park Service functionaries from its inception. The Park Service files contain letters and in-house reports, as well as reports by other Costa Rican administrative bodies, that contain a variety of suggestions and worries. Several small-scale abortive attempts were made at dislodging the miners from a few areas of high visibility. The resulting sparks reinforced the traditional view of the Osa Peninsula (the site of Corcovado) as Costa Rica's lawless "outback" and the problem as being too large for the resources of the Park Service to deal with. The result has been a lack of calculated activity by the National Park Service. This inactivity came about through a combination of fear, absence of key administrators, hope that the problem would just go away, a feeling of helplessness against the larger problems besetting the Costa Rican government in general, indecisive administrators at high levels, personal lack of involvement with the specifics of the problem except by a very few local administrators, and a (correct) feeling that Park Service financial and personnel resources were inadequate.

Corcovado National Park was established as a large block of forest within a larger yet block of forest, facing onto the Pacific and centered at Sirena. "Civilization" is gobbling up the forest surrounding the Park along its inland side, and over the past five years, the backside of the Park has become the front side; the Park Service has only recently come to recognize where lie the true problems that confront Corcovado. However, in recognizing this, it has also become obvious that many more resources are needed to maintain the Park than previously anticipated, and that these resources have to be used differently than would be the case were this 1970. The reason why most banks are not robbed by most people is not the presence of a guard with a gun; Corcovado, just as with the other Costa Rican parks, can survive only in like manner.

In one sentence, the belief prevalent among those with the power to act in Corcovado was that the situation could only be resolved with major force or major planning/development by the government as a whole, and both of these have been unavailable. It is also clear that Costa Rica has gotten itself into the curious situation of being very good at attracting support to preserve natural areas, but has not yet developed the kind of hard-nosed managerial drive, budget and policy to preserve those areas in the face of rising social pressures. Lack of activity towards a solution in Corcovado was also exacerbated by a general failure in Costa Rica, from the President's office to the taxi driver, to understand that the very large amount of tourist, research and conservation support received by Costa Rica is as much, if not more, dependent on

international faith in Costa Rica's governmental solidness and secure long term development as it is on Costa Rica's enormous natural biological riches. We now stand at a point where the international conservation community needs to see that Costa Rica's laws and society can in fact protect and sustain that which the world wants to see conserved in the natural environment. It is not enough to just buy the land, but it has to be maintained (which is a much less attractive item to potential donors). This fact has been long understood by the Park Service administration. Corcovado is obviously a test case for this specific need, and it is also a major point in the evolution of a protective protocol for the looming future when it is not gold but timber, land, water, and who knows what other kind of product that a park's neighbors want.

In these months we are at the junction where many forces within the Costa Rican Park and conservation system realize that eviction of the gold miners from Corcovado is necessary, but there is still substantial confusion over how to go about it, how to ameliorate its effects on the miners and the surrounding community, to what degree it is absolutely necessary for Corcovado's survival, and how to maintain the Park relatively free of human influence for the indefinite future. The goal of this field study is to comment on all these things with the hope of increasing the range of choices from which Costa Ricans have to choose. A second goal is to formalize the problem, to promote its elevation from the status of rumor to that of a concrete threat to tropical conservation.

While this is the first report on the problem by an international group, at least six in-house reports have been developed by Park Service committees and other Costa Rican agencies in the past five years. Among the most notable are

- a. Chris Vaughan's "Management and development plan for Corcovado" (published by the National University, 1981). This plan and detailed Park description was oriented toward Corcovado as a wilderness area rather than as an appendage to a large agricultural zone; Vaughan's highly relevant book contains much of the the general information included here (and much more), but in much more detail and lacking a consideration of the consequences of the past five years of conflict with the gold miners.
- b. Goez Schwerholz (F.A.O. consultant), working with the central Park Service office, produced a document (late 1980) "Suggestions for the planning of protected areas in the Osa Peninsula". We have been unable to locate it. This document was however amplified by the Park Service into an undated 1981 report "Plan for the financing of Corcovado National Park", which is essentially a detailed budget justification for an attempt to solve the gold mining problem through increased patrolling. It also contains the first elaborations of plans to connect central Corcovado with the outside world at Dos Brazos, but the stress is on facilitating entry of tourists by land rather than (as is currently the case) by air to Sirena.
- c. Eduardo Acuña Jiménez (Head Park Ranger) produced the next "Protection plan for Corcovado National Park" (1983). Here the stress is on the budget and legal basis for eviction of

the miners, coupled with details of patrolling requirements. Relationships with the surrounding community are not part of the formula other than to stress that the Park must display a very strong presence.

d. In October 1984, various park rangers and other members of the Park Service (José Badilla Orozco, coordinator) submitted a report bluntly indicating the major problem areas in Corcovado and the central NPS office, with brief policy suggestions for their resolution.

e. In March 1985, an "Action plan for the eviction of the gold miners" was prepared and submitted to the Minister of Agriculture and Livestock (letter from Luís G. Méndez). This plan and its budget focused on the logistics and potential timetable of the eviction, and portions of this plan are still in operation. The budget was updated on 6 May 1985 (letter from Juan Carlos Romero).

f. On 21 March 1985, a meeting occurred in the central Park offices that presented alternatives and discussed progress to date.

g. On 6 May 1985, a meeting of Park Directors occurred in which a brief list of policy suggestions with respect to the eviction was prepared; virtually all of these suggestions are present in the current report, albeit in various expanded and modified versions. To emphasize that the Park Service contains a body of concerned and involved personnel, we briefly list the suggestions contained in the May report:

1. Involve all Sections of the National Park Service in the problem, and in this manner make the problem one affecting the entire NPS.
2. Have the Section of Environmental Education institute a program at the national level, using radio, press and television.
3. Accumulate slides and other visual materials and develop them into relevant audiovisual programs.
4. Reinforce the Environmental Education program with the various Park Naturalists, drawn in from the other parks.
5. The Director of NPS should notify the international community and ask for help from the Costa Rican government.
6. The administrators of other parks need to make themselves and their personnel available for participation (in the eviction) if necessary.
7. The Section of Research should initiate a sociological/anthropological study of the problem, and make the necessary contacts for this.
8. Form a working group from the Park Service (Planning Section) that will visit the area and document the environmental impact, as a base for the other programs.
9. Designate a telephone number that gives out information on the situation in the Park.
10. The Park Service must declare what is actually prohibited in the area, especially with reference to gold mining.

11. In case of emergency, the Director will close those areas necessary so as to obtain sufficient and rapid personnel resources for the Park.

12. The Director should obtain a declaration from the Ministry of Agriculture and Livestock, and from the Ministry of Government, that they will aid and if necessary, declare the Park a national emergency zone.

13. Designate a group from the Construction Section to begin construction of the La Leona Guard Station.

14. Reinforce the area with weapons brought from other parts of the Park system, and insure that necessary ammunition is available.

15. Start a program to evaluate the situation in the Sirena, Claro and Madrigal watersheds; we should record names, cedula numbers, location, numbers of persons, and point of origin. At the same time, these people should be notified that they have to leave the Park before 1 July.

16. The Legal Section should obtain an eviction order from the relevant authorities.

17. Hold a meeting with the farmers in Cañaza.

On the one hand, it seems odd that a group composed largely of foreigners has prepared this report; however, it seemed necessary to get an outside opinion because the Park Service itself has been having difficulties developing a clear view of the problem and its solution. On the other hand, conservation biology in Costa Rica has always had a strong international component and it is very reasonable for the Park Service to view the international community as one of its personnel resources. In this sense, the report is still an in-house report, albeit largely prepared by persons under salary to other institutions.

The field study was suggested and supported by a grant from the World Wildlife Fund (US) and by the Fundacion de Parques Nacionales de Costa Rica. Planning began on 1 June 1985, a 38 km field inspection on foot within the Park occurred from 25-30 June, a 1 hour low-altitude inspection flight over very inaccessible areas occurred on 28 June, a public meeting with Puerto Jimenez residents and gold miners was held on the night of 27 June in Puerto Jimenez, and a semi-public meeting was held with government agencies and other interested parties in San Jose on 1 July. In the Park, we examined portions of 11 different river systems on the ground, and 6 more from the air; since much of the damage by gold mining occurs downstream from the workings, we did not feel it to be necessary to examine long lengths of stream bed to obtain a correct impression of what was happening. We also had access to several recent reports prepared by the Park Director and Park Rangers, as well as to a variety of historical documents. However, background preparation was hindered by the absence of a filing system in the central office whereby all materials pertinent to Corcovado National Park could be found in one file.

This report was written by the organizer of the field inspection (D. H. Janzen) from 2-16

July in Costa Rica, and constructively criticized by W. Hallwachs (Cornell University).

The field inspection of the Park and some of its environs was the centerpiece effort of the study. The goals of the inspection were the following:

1. To witness and describe the actual amount, extent and kind of damage done by the gold miners to the biological systems inside of the boundaries of Corcovado National Park; simultaneously, we considered whether they could be allowed to continue to mine on a controlled basis.
2. To make a rough estimate of the number of gold miners (and dependents) in the Park, and to evaluate other estimates that have been made of this number.
3. To discover the attitudes of the gold miners toward the illegality of their activities, toward their understanding of their damage to the Park, and toward their upcoming permanent eviction.
4. To understand the social and geographic ecosystems in which the Park is imbedded, with the intent of being able to evaluate the multiplicity of external processes and potential solutions that are relevant to success at maintaining the Park free of mining and other future degradation by humans.

The field inspection team feels itself moderately successful with respect to all four goals, and the body of this report contains the details. It is a long report and replete with suggestions and comments. A study of longer duration would have been more thorough but we feel would not have arrived at substantially different conclusions; speed is of great importance not only because of the need for cessation of biological damage while there is still opportunity for regeneration, but because it is evident that both the gold miners and the Park Service personnel are favorably primed for immediate resolution of the problem.

We were asked by Costa Ricans, "who is going to implement this report"? Our reply was that the Costa Ricans will, if they wish. Our goal was to increase the number of options and to aid in balancing some against others. The problem and its potential solutions are very complex; like any organism interacting with its environment, the interaction of the Park with its surrounding environment hinges on many small details. Minute differences in these details can drastically alter the direction or survival of the entire organism. We feel that it is folly to attempt to predict or interpret the behavior of an organism without understanding its natural history; Corcovado National Park is no exception. We feel that this report should be required reading for anyone dealing with Corcovado or the development of the Osa Peninsula.

We view this report as one of problem description and constructive criticism. As such, it runs the risk of appearing to be hardly more than a litany of complaints directed at the Park Service. Such is definitely not our intent. The salient feature of the Costa Rican National Park Service is that it grows and survives with a level of efficiency, honesty and purpose that is truly outstanding for a neotropical government agency. It is sufficiently robust and deservedly proud

that it can call for and absorb an external review such as this one, and build on it. Its single most outstanding weakness is responding to too much conservation need with too little resource.

The National Park Service of Costa Rica has taken on an enormous responsibility in caring for a large and complex park like Corcovado. It is the kind of job that must be done well or not at all. To do it well requires an intimate understanding of the Park and its environs. We do not feel that the situation in Corcovado is impossibly complex. We feel strongly that much of the current problem in Corcovado stems from a long history of management decisions that were made either unintentionally or deliberately by persons that were significantly unfamiliar with, or insensitive to, the traits of this particular Park and its resource and defense needs. However, because the problem is of this nature, we are optimistic that it can be resolved by timely, accurately and sensitively placed efforts by the Park Service. These efforts will clearly require substantially more cash and personnel resources than the Park Service can afford with its current budget, and we intend for this report to be instrumental in obtaining those resources both inside and outside of the country.

Composition of the field inspection team.

Not all those invited were able to participate. Criteria for inclusion of a person in the team were some of the following: availability on short notice, familiarity with tropical forest conservation problems, familiarity with Costa Rica, in depth expertise as a biologist in tropical rainforests, familiarity with government agencies, familiarity with Corcovado National Park, familiarity with gold mining. The team consisted of the following persons. In addition, three senior level Park rangers - Gerardo Chaves, Alvaro Bustamante and Bernardo Picado - served as guides and assisted in many ways with data gathering and commentary. The entire inspection was conducted in Spanish, as all members of the team are moderately to fully fluent in this language.

1. Dr. Rodolfo Dirzo. Native of México, 34 years old, professor of biology in the Instituto de Biología, Universidad Autónoma de México (Apdo. Postal 70-233, México 04510 D.F., México). Research and teaching experience as a tropical ecologist specializing on animal-plant interactions, specializing in Yeracruz and Chiapas rainforest. Particularly concerned with the interaction of rural peoples with National Parks and other kinds of preserved areas in the Neotropics. Deeply committed to the development of home-grown strength in biological studies in tropical countries. Participant and faculty in several ecology courses taught in Costa Rica.

2. Ms. Gina C. Green. Native of US, 29 years old, graduate student of Oxford University (Commonwealth Forestry Institute, South Parks Road, Oxford, England) and Área Silvestres, CATIE, Turrialba, Costa Rica. Two years in US Peace Corps in Colombia and 1 year with Merenberg Forest Reserve in Colombia, specializing in the interaction between neotropical national parks and the members of their immediate neighborhoods, with special reference to the

value of the park to the surrounding community.

3. Dr. Daniel H. Janzen. Native of US, 46 years old, professor of biology at the University of Pennsylvania (Department of Biology, UP, Philadelphia, Pa. 19104). 23 years of research and teaching in tropical ecology, focused on Costa Rica; while a half year resident in Santa Rosa National Park, northwestern Costa Rica, he has been sporadically doing research sporadically in Corcovado National Park since its inception in 1975 and had explored a large number of the areas relevant to this report between 1965 and 1984. As his research is on the interactions of plants and animals, and since he has spent a substantial fraction of his life hunting and trapping, as well as doing research, in forests, he feels competent to comment on the impact of humans on such systems. He has been aware of the interaction between the gold miners and the Park from the inception of the problem; in fact, he weighed the first gold confiscated from Corcovado miners (1980) with his scales that are normally used to weigh moths. On 30 May 1985, Sr. Alvaro Ugalde, the Director of the National Park Service of Costa Rica, asked him to organize this commission.

4. Ing. Juan Carlos Romero. Native of Costa Rica, 25 years old, current and recent Director of Corcovado National Park (Servicios de Parques Nacionales de Costa Rica, Apdo. 10094, San José, Costa Rica). 4 years of experience with the National Park Service, as director of Rincón de la Vieja National Park and of Tortuguero National Park before Corcovado. Degree in Forestry from the Instituto Tecnológico. Possessed by strong administrative dedication to resolving Corcovado's problems on both short and long term basis.

5. Dr. F. Gary Stiles. Native of US, 42 years old, professor of biology at the Universidad de Costa Rica (Escuela de Biología, Universidad de Costa Rica, Ciudad Universitaria, Costa Rica). 14 years of teaching and research experience in Costa Rica, with major publication productivity in all areas of bird biology in Costa Rica, as well as extensive research programs with certain plants and insects. Personally familiar with the Corcovado sites and habitats under discussion in this report. It is commonplace to meet Stile's Costa Rican former students from the Universidad in virtually all insitutions and walks of Costa Rican life.

6. Sr. Gerardo Vega. Native of Costa Rica, 35 years old, highly successful professional gold miner inside and outside of Corcovado National Park (Lista de Correos, Canaza, Puerto Jimenez, Peninsula de Osa, Costa Rica). Three years of gradeschool. Hunter, farmer, and woodsman who was a farmer in Corcovado at the time it became a Park. Member of the first generation of Park employees drawn from former residents. Worked as Janzen's research assistant for four years in Corcovado and Santa Rosa National Park. Deeply interested in the evolution of the Corcovado-guard-neighborhood interaction.

7. Dr. Don E. Wilson. Native of US, 41 years old, mammalogist, specializing in Neotropical species that are on the verge of extinction (as well as bat systematics and ecology) for the US Fish and Wildlife Service (US Fish and Wildlife Service, National Museum of Natural History,

Washington, D.C. 20560). 20 years experience with research in Neotropical mammals and in aiding and abetting the development of Parks, Museums and wildlife protection units from Mexico to Paraguay. Began his post-doctoral career doing ecological research in Costa Rica. Very familiar with the pitfalls of harvest and occupation in national parks.

The field team worked as a unit in the field, and only occasionally separated to examine different things or people. Impressions and findings were discussed extensively throughout the field inspection tour and after meetings. Our impressions were also discussed extensively with the three Park Rangers that accompanied the tour. Janzen had access to the copious notes of the other commission members, and to any relevant files in the National Park Service office when preparing this report. Copies of all notes and documents have been deposited in the Park Service files along with this report.

Environmental impact of gold mining in Corcovado National Park

Introduction.

Gold mining, the illegal occupants, and the prior legal occupants of Corcovado National Park are having, and have had, a conspicuous and substantial negative effect on terrestrial and aquatic ecosystems in the southern third of the Park (Figure 1). A several month study that is rich in biological sampling and compares the areas in the northern miner-free portion of the Park with the southern miner-occupied portion of the Park would appear to be more rigorous than is the commentary that follows, but quite frankly, it would come to the same conclusions. The severe damage to the southern third of Corcovado National Park is obvious (and depressing) to anyone who is willing to go there see it.

And going to see it is no casual stroll out of a car. The Park contains virtually all kinds of topography, from great swamps to knife-edge ridges. However, the area of active gold mining (the southern third of the Park) ranges from 10 to 700 m in elevation on extremely dissected terrain that contains almost no mesas and hundreds of kilometers of knife-edge ridges perched 20-400 m above very narrow gorges and streambeds. Trails usually climb very steeply to a ridge top, and then continue along it, and then plunge straight down to a streambed and back up the other side. As the streams and small rivers reach intermediate elevations (10-150 m), they begin to widen and flatten out and after a course of only a few kilometers are on the coastal plain of 1-20 km width. Many of the trails are impassible to pack horses (though with effort, pack trails could be constructed of multiple switchbacks). The soil is rock-latosol mixtures and sustains foot traffic fairly well even under this high rainfall (2-3 m per year), but is turned into rocky red mud quagmire by horse traffic. Most of the trails are still under pristine forest canopies, though the tendency for trails to connect old farms leads to many kilometers of sunny trails as well. Trails generally do not follow riverbeds except in the lower parts, and the reason often given is that water levels can rise several meters in minutes following a heavy rainstorm, leaving the traveler picking his way among boulders in a strong current.

Terrestrial habitats.

The direct and nearly direct impact on terrestrial habitats by the miners and associated people involves primarily the game animals (agoutis, tepezcuintles, armadillos, brocket deer, collared peccaries, white-lipped peccaries, tapirs, monkeys, guans, curasows and tinamous), and the larger plants. Smaller vertebrates and insects have been undoubtedly been affected indirectly, but describing this impact would require more detailed knowledge of this particular ecosystem than is possessed by anyone. Cats and other large predators (snakes, eagles, hawks, owls, etc.) are not discussed here, but it is clear that they have been negatively affected by both

direct hunting and by the removal of their prey.

Game animals. The southern portion of Corcovado National Park is essentially empty of game animals. It stands in striking contrast to the central and northern portions of the Park, areas that have been nearly free of hunters and gold miners since the inception of the Park in late 1975. We offer the following more explicit commentary:

1. The study group, containing four experienced vertebrate watchers (Janzen, Stiles, Wilson and Vega), walked approximately 38 km of forest and forest edge trails during 5 days of relatively rain-free weather. The only larger mammals or birds seen or heard was one troop of howler monkeys (congo) in the distance, a small troop of extremely fearful spider monkeys (mono colorado), and on very rare occasions, a tinamou (gallina de monte). In the northern portion of the Park, the same amount of time and distance traveled in this season would have insured multiple daily sightings of almost all of the game animals in the Park. Tinamous and agoutis (gustusas) would have been heard frequently, and occasionally flushed. Peccaries (sainos) would have been smelled several times per day, and occasionally seen or heard.

2. Owing to a physical disability, Janzen's pace was slow and deliberate, and his attention often on the ground, ground that was rich in surfaces of wet mud. During the entire inspection tour, he encountered not a single track of a larger wild mammal or game bird. He never smelled a peccary troop. He located evidence (chipped up fruits and seeds) of agouti or tepezcuittle feeding on a fallen fruit or seed crop in only one piece of forest, a small forest section crossed by approximately 1 km of trail and containing the only unmined flowing water channel (headwaters of the Quebrada Piedras Blancas) encountered in the southern third of the Park during the inspection tour. See below for an elaboration of the significance of this point.

3. In the past year, the Park has begun to ask the Park rangers to prepare written reports on what they encountered on long inspection tours. On June 5-10, 1985, three alert and experienced Park rangers walked approximately 50 km of forest trails in the southern third of the Park and their report reads: "Fauna, during the tour we did not see a single example. In addition, what is very worrying is that this is a sign of much passage of humans through the area".

4. Janzen has spent a good deal of his professional career examining the fate of seeds and fruits that have fallen beneath the parent tropical tree. In Corcovado National Park, as well as in other protected rainforest habitats, there are numerous species of trees whose seeds and fruits are so highly desired by large rodents, deer, peccaries, curassows, etc. that it is extremely difficult to find intact seeds to use in ecological experiments. This is no longer true for the southern third of Corcovado National Park. For example, the canteloupe-sized fruits of Carapa (Meliaceae: cedro amargo) normally fall beneath the parent, break-open on impact or

are gnawed open, and the 4-cm diameter seeds removed by agoutis, tepezcuintles and peccaries. Janzen has seen the remains of hundreds of Carapa fruit crops in Corcovado rainforest but until this inspection tour has never seen intact Carapa fruits and seeds lying abundantly beneath the parent tree, slowly rotting into the litter (hojarasca) or germinating; for this to occur requires the virtual absence of terrestrial herbivorous mammals. The huge rainforest legume tree Dusia was dropping its large fruits, each containing a single large seed. We frequently encountered large intact crops of these orange fruits, each with a brilliant-red aril inside, beneath the parent trees. However, in the northern part of Corcovado, Janzen has always been frustrated in efforts to obtain more than a handful of intact Dusia fruits; here there were tens of liters of them. Only at the very headwaters of the Quebrada Piedras Blancas, in an unmined piece of forest, did we encounter large rodent attack of one Dusia seed crop. Since Dusia is dispersed by monkeys and (probably) toucans directly from the tree crown, as well as eaten and dispersed by agoutis and tepezcuintles on the ground, it is not possible to know if the presence of large uneaten crops on the ground below the parent tree was solely due to the absence of earth-bound animals or also augmented by a greater-than-normal fruit rain directly below the parent tree owing to the absence of volant or arboreal Dusia dispersers. The southeastern portion of Corcovado is dotted with farmers' homesteads that have been recently purchased by the Park Service; these sites are rich in fruit trees such as avocados and mangos. The ground beneath these fruit trees is now littered with uneaten rotting fruits. Need we say more?

In sum, the southern third of the Park is a giant experiment - what would happen to crops of large fruits and large seeds (e.g., guapinol or Hymenaea courbaril, Dusia, cedro amargo or Carapa, jobo or Spondias mombin, canelo or Ocotea spp.) if the large vertebrates were removed from a rainforest? However, it is a kind of experiment that seems inappropriate for a National Park.

5. During the interviews we were repeatedly told by the gold miners in the Park that they did not hunt, that their meat was beef or pork, purchased on provisioning expeditions to the outside or from traveling merchants (which were, incidentally, the agents of very substantial trail destruction by horses that were illegally entering the Park from Río Rincón). As early as 1981 the list of requests drawn up by a now defunct miners' syndicate (Francisco Badilla, president) asked permission to keep some animals, such as chickens, in the Park, since meat was so hard to get. Equally, we were told that there was nothing to hunt. No indirect or direct evidence suggested that the interviewees were lying. Additionally, however, they often commented that an hour's walk in this or that direction would put you into an area where there still were animals of the kinds and sizes suitable for hunting. Sadly, we saw no evidence that they were correct except when the game animal paradise referred to was the Corcovado basin (central Park, Pacific side), an area that is largely lacking hunters and gold miners. Our inspection tour often

took us into areas reputed to have game remaining, but the occupants of these areas likewise thought the absent game could be found elsewhere. This information has to be relegated to the status of information that the miners derived through out-of-date and second-hand stories about areas they had themselves never personally worked or lived in (much as is the case with their estimates of the number of miners in the Park).

Large plants. It is obvious that the miners cut firewood, construction poles for houses and mining operations, and make small clearings for houses. However, their house roofs are almost all made of plastic; we were told by several miners that they "had agreed with the Park not to hurt by Park by cutting palm trees for roof thatching and water pipes". This "agreement" was also of the items mentioned in the request made up by the miners' syndicate (Francisco Badilla) in 1981 when the Director Maria Elena Mora was attempting to negotiate with them and produce some kind of organized statement of demands and needs. However, we note that such thatch roofs are time-consuming to build, require artisan knowledge not possessed by many of the miners, and require palm species that we observed to be very scarce. The use of palm trunks for pipes has been replaced with 5 cm diameter flexible plastic pipe. Such an understanding certainly has not stopped the miners from killing virtually all of the large palms to eat the "palm cabbage" or succulent shoot tip.

By mining and undermining ravine, creek and river banks, the miners topple trees. In a fit of conservationist hopefulness, we were told in the Puerto Jimenez meeting that it does not matter if a miner cuts a few trees, since within 6 months another tree has grown up to take its place. Mining-induced landslides on the incredibly steep slopes of the area are frequent (see below). While this damage is spectacular, it is of relatively minor importance to most populations of large trees in any given year; however, accumulated over many years, it is quite easy to imagine that a widespread mining operation such as the one occurring now will gradually convert all of the high forest on steep slopes over streams into young primary succession, thereby eliminating major portions of the populations of many species of trees. And in much of the southern third of the Park, easily 50% of the vegetation is perched on a steep slope over a watercourse.

Additionally, in the areas where mining is extensively practiced, the vegetation made up of small plant species that are specialized for life on fairly stable ravine and creek banks, as opposed to the species specialized for the unstable beds and banks of large rivers, is simply obliterated. These streambank species are quite different from the professional colonists of unstable river banks and gravel bars (e.g., Heliconia, Cecropia, Piper, Ochroma, etc.). Furthermore, as will be discussed below, the physical environment of small forest streams is grossly altered by the direct sunlight that is let in by removing trees along stream banks; the

water gets hotter, there is lower oxygen content, and the banks dry faster when the stream is exposed to direct sunlight.

There is, however, a much more insidious kind of damage caused by populations of people in a rainforest, a kind of damage that is only rarely appreciated by conservationists and only dimly perceived by esoteric ecologists. As the populations of game animals are removed, and kept out, a major force in seed dispersal and seed predation is removed. These twin processes are a major part of why Corcovado rainforest is as it is (high species richness with many species scattered among each other) rather than as rainforests on tropical islands; island rainforests are characteristically free of vertebrate seed dispersers and seed predators, and tend to have both low species richness and highly patchy distributions of large plants. There is no doubt that if the game-animal-free status of the southern portion of Corcovado National Park is maintained for decades, there will be rapid and dramatic changes in the species composition and demography of the rainforest trees and large vines. These changes will occur because competitive and invasive abilities of the large trees will no longer be impeded or aided by seed predation and seed dispersal. While the directions and details of such changes in competitive relationships will vary among species, it is safe to say that the direction will be that of reduced species richness and more thorough occupation of certain sites by certain species than is presently the case. In short, guns and hunting dogs drastically alter rainforest without ever touching a chainsaw. And once the mammal populations have been severely reduced, the lightest hunting pressure and human disturbance will keep them at zero even if there is a nearby source area for reinvasion.

But why are the game animals absent? It was obvious to all concerned with the inspection tour, as well as repeatedly stated by gold miners who were quite willing to admit to other illegal acts, that the gold miners at the present time are not generally hunting for wild game. There were no traces of animal remains (scraps of bone, teeth or skin) around the gold miners houses, they did not have hunting dogs, they did not have the demeanor nor field experience to be competent hunters, we did not encounter spent cartridges or hear shots, and no firearms were in evidence in gold miners' houses inside or outside of the Park.

However, hunting still does occur in the Park. Certainly the old time placer gold miners were inveterate hunters; Janzen has eaten Park tepalcuinte served on their tables. Park rangers have shot hunting dogs in the vicinity of the Los Patos ranger station in recent weeks, and gold miners living near the southeastern boundary of the Park (La Torre, Río Agujas, Río Rincón) stated firmly that hunters enter the Park from the semi-farmed land near the Park. If there is so little game in the southern third of the Park, where do they hunt? Central and northern Corcovado still has substantial populations of game, as well as there must be some residual animals in the least occupied portions of the southern portions of the Park.

It is our opinion that the game-free southern portion of Corcovado National Park has a major historical component that is older than the Park, as illustrated by the following scenario. Prior to the initial Park establishment there clearly was hunting by scattered farmers and gold miners. From 1975 to 1980, this hunting may have abated, but we doubt it since that portion of the Park was virtually unknown to Park personnel and unpatrolled by them. The area newly incorporated into the Park (in 1980) was obviously hunted by the homesteading farmers and gold miners that lived there. After its incorporation, hunting obviously continued until the farmers were bought out, mostly in 1983-1985. However, shortly after the amplification of the Park, a rapidly growing body of gold miners provided a ready market for any meat that anyone was willing to go to the effort to shoot, and among the many hundreds of miners, there were surely some with the technical ability to become part-time hunters as well. We suspect that by the very early 1980's, the southern portion of Corcovado was already as free of game animals as it is at present. Once the game was obliterated, the motivation for hunting was reduced to near zero. I suspect that farmers now entering the Park to hunt all move into the more central and even northern portions of the Park and do not bother with the areas occupied by the gold miners.

If they are not at present hunting, do the miners play any role in the failure of game animals to re-establish in the southern portion of the Park? When a game animal wanders into that area, it is met by human presence (odors, sounds, passing people); such game animals will be individuals that have already been shot at or around, and will be very shy of people. They will not stay. If one does stay, or even passes through slowly, it is very likely that someone will procure a fire-arm and put it in the pot, despite the fact that in general the miners do not hunt. Indeed, in June, Park Rangers caught a gold miner with a freshly killed currasow near Esperanza. As they told us on numerous occasions (and most vocally during the public meeting in Puerto Jimenez), what is the harm if an occasional tepezcuittle or peccary finds its way into dinner; we are not barbarians - we eat what we shoot and do not shoot for market. The miners appeared to be quite unaware of the argument that "if every miner shot just one peccary, then there are quite enough miners in the Park to exterminate the peccaries". Even more indirectly, the miners' traffic provides well established and well known trail systems that allow maximally rapid movement of hunters to more interior and less accessible areas, even if the hunter is new to the area.

When Janzen and Stiles first started studying animals in the area of Sirena-Llorona-Marenco-Cedral-Los Chiles in central Corcovado, the game animals had been subjected to many years of hunting and were extremely shy and occurred in low numbers. In the following ten years, after all the farmers were relocated out of the area, they gradually became both abundant and much less shy of humans. Today, peccaries, brocket deer and tapirs in the Sirena area are likely to pass within 5-10 meters of a human observer without taking flight;

this is not the reaction of a population of game animals from which individuals are being harvested. It is a clear and unambiguous prediction that when the human presence (both miners and hunters from outside the Park) is removed from Corcovado, the same changes will occur with the game animals as occurred in the past ten years in central Corcovado (though it will take longer because the density of animals is even lower in the southern portions of the Park, *an area* where the game populations are little subsidized by the large stands of highly edible secondary successional vegetation and abandoned orchards that characterized the central portions of the Park when it was established).

In sum, the general absence of game animals in southern Corcovado National Park does not appear to be due to contemporary daily hunting by the gold miners, but rather is most likely due to earlier heavy hunting by settlers (and earlier gold miners). The contemporary density is maintained very low by hunters entering from outside of the Park and equally by the human presence of the gold miners. The impact of the lack of game animals is not only their direct absence but the steady ongoing alteration of forest structure through the absence of game animals as seed predators and seed dispersers. This alteration will persist for many decades, long after the direct human influence has been removed. We do not discuss the interaction of hunters and gold miners with game animals around scarce water holes during the last months of the dry season, because the details of such an interaction depends on a dependency on dry season water in Corcovado, a dependency that has never been studied. However, it is easy to guess that a riverbed under 1-2 m of silt offers a very different pattern and amount of dry season water than does its pristine rocky ancestor.

Aquatic systems.

Corcovado gold is in stream-bed placer deposits, rather than in ore. Gold mining in the Park is dependent on, and thoroughly integrated with, gravity-feed stream and river flow off the steep slopes of what appears to have been an old and severely eroded mountain (volcanic?) whose current height is about 700 m and is located in the south central portion of the Park (Figure 1). After this very steep flow comes more horizontal flow into the central western parts of the Park (Corcovado basin and lowlands of Río Claro and Río Madrigal) and along the southern and southeastern boundaries to the agriculturalized flatlands between the Park and the Golfo Dulce. The water comes from 2500 to 4000 mm of annual rainfall, most of which falls between April and January. This seasonal rainfall cycle, as well as daily or weekly strong fluctuations in rainfall, has a strong effect on how and where gold mining occurs, as well as on the impact of that mining on aquatic ecosystems. The miners follow the water seasonally, and sediment loads move and consolidate in response to seasonal pulses in rainwater. Water that is sediment-loaded or diverted during the dry season has a potentially larger impact on much of the aquatic life than

does water manipulated in the rainy season.

Virtually all gold mining in Corcovado involves placing loose gold-bearing soil, gravel, sand and decomposing rock in a water current, and collecting the dense gold fragments from some kind of riffle box or other sediment catchment device. The simple byproduct is a heavy pulse of fine- to coarse-grained sediment into the water flow. Most of this section of the report is devoted to the detailed way in which this sediment and its input patterns interact with the rainforest aquatic environment. Needless to say, there is virtually no formal ecological literature on this subject, and therefore what follows is entirely based on what we saw and logical extrapolation from other kinds of perturbations of aquatic habitats that have been studied in the tropics and elsewhere. While there may be known technologies for gold extraction that might not have these or some other major impact on the environment, they are simply irrelevant to the situation at hand because the type of miners that have and would invade the Park do not and could not use them. Our goal is to understand what damage these kinds of gold miners are doing to the Park and how to eliminate that damage (as well as other environmental insults in the future); we are not concerned with whether a big-money dry-dirt gold mining company could mine Corcovado National Park, as we assume that to be a given negative.

It is a striking historical comment that as recently as 1981, an undated report by the President of the College of Biologists of Costa Rica, Lic. Sergio Salas, states that the aquatic environmental damage done by the gold miners in Corcovado is trivial and will remain that way as long as miners are restricted to using only gravity feed pipes for water movement and remain in low numbers. No biologist viewing the current aquatic chaos in the southern third of Corcovado could make such a statement. Two modern miners and helpers, working continually for a year or less at washing creekbank and causeway sediments with gravity feed hoses, will destroy the aquatic life in any small to medium-sized stream (riachuela) for 2-10 kilometers downstream. Since each Corcovado river is at best fed by several dozen such streams, it takes no imagination to determine that the entire aquatic system is severely threatened by as few as 100 modern miners working for only a year. In fact, it has been virtually destroyed by a much larger number of miners working intensely for at least 4 years.

Kinds of gold mining in Corcovado.

1. Panning. The long time ("old time") resident gold miners in and near Corcovado, present long before the area became a national park, worked almost entirely by panning stream and small river sediments ("panning" is washing small amounts of gold-bearing sediment in a circular basin, with the dense gold accumulating in the bottom). They occasionally diverted parts of the stream. Their direct impact on aquatic systems were negligible owing to the very small amount of sediment introduced into the stream or stirred up into the water flow by each miner, because they occurred in just a few locations on the margins of the Park, because they

tended to work just in rocky riverbeds (and their activity therefore put less silt into the stream), and because their absolute numbers were well less than 50 (and still are) over the entire area of the present-day Park. Even where they altered stream channels, they usually worked in those unconsolidated portions of the stream bed that were occasionally reformed by natural heavy stream flow following spells of very rainy weather. On a few occasions, such miners also moved water through tree-trunk pipes or sqaeducts to reach water-poor deposits.

Such miners were somewhat reasonably viewed as quaint semi-natural portions of the habitat (witness the somewhat poetic account of their activities on pages 241-242 in the 1981 book on the National Parks of Costa Rica (M. A. Boza and R. Mendoza, INCAFO, Madrid). This view was reinforced by the fact that their forced eviction from the Park at that time (with or without compensation) would have been substantially more traumatic than was the purchase of the farms in the Park. These truly old time and highly independent miners probably did more direct damage to the Park by hunting for meat for the table than they did in actual gold mining. However, it is our opinion that their real damage was in offering an informal moral legitimization to the first members of the new wave of gold miners that moved into the Park (both the original Park and the part newly added during the amplification). "If the Park can tolerate a little gold mining, if a little gold mining is OK, then, well (pues), just a little more cannot be all that bad....." And now, they are a major thorn in the side in that they are moral nuclei for the newcomer miners, and some do not hesitate to draw these newcomers to themselves for support as well. On the other hand, we encountered one miner who viewed the newcomers as a competitive nuisance that gave gold mining a bad name.

While such "old-time" gold miners still occur in the Park, their primary importance at present is not in the damage they do so much as in generating a strong feeling among many social levels of Costa Ricans that they are people that would be badly hurt by an eviction and would have no where else to go or to work. If some reasonable employment circumstance could be located for these "characters", a giant step would be taken in eliminating social resistance to the eviction (or so conversations in Puerto Jimenez and in the central office of the National Park Service have led us to believe). In the current population of gold miners, the old time miners grade imperceptably into the class of middle-aged yet more modern gold miners who maintain that they have no other potential occupation (yet somehow managed to survive to middle-age before becoming a gold miner).

On the other hand, there is a strong temptation to attempt to return to the "good ole days" and think up a plan where just "old time miners" would be allowed to remain in the Park. We view this as simply impossible for the following reasons:

- a. The evicted modern gold miners would not view this as fair, and each would say "if he can mine in the Park, why can't I"?

b. The "old time miners" are really no longer distinct as a species. The causeways that they used to so easily mine have by and large been thoroughly mined (they have to turn to more destructive methods of mining to continue to obtain enough gold to live). Furthermore, the possibility of their former isolationist life in the pristine wilderness ("living off the land") is not compatible with the Park (the "outback" of the Park, where these people once lived, is now a combination of the front of the Park and farmland (or farmland to be). Cerro de Oro is no longer in the wilderness, but rather on the well-mined boundary between a rainforest park and cornfields; an old-time gold miner hunting just one peccary for dinner is likely to be shooting one of the last white-lipped peccaries in the Costa Rica.

2. Stream bed and bank miners without pumps. Better than 80% of the mining in Corcovado National Park is done by moving unconsolidated to semi-consolidated causeway sediments into major stream flows to wash it, or by using gravity feed 2-3 inch (5-8 cm) diameter flexible pipes to get water into sediment deposits up to several hundred meters distant from natural stream flows. A small creek is dammed and a pipe intake is placed in the bottom of the resultant pond; the water flows by gravity feed to the mined area. When the causeway is mined near water, the deposit is dumped into a sluiceway and washed. Such deposits are rich in lateritic old soils as well as sands and gravels. Additionally, many cubic meters of overburden are shoveled or washed down hill into natural flows to expose gold-rich strata, or in exploratory diggings.

All such mining results in a continuous and heavy flow of sediment into the causeway. The water is red to yellow with suspended lateritic sediments and the bottom is covered with fine sand and gravel deposits. Following a rain, the sediment load is exceptionally heavy, owing to heavy surface runoff from mine till that is fully exposed to rain drops and surface erosion on the stream banks. As one moves down the stream from its headwaters, the recent sediments become deeper and the rocky original stream bed is even more thoroughly buried. However, as the stream enlarges to a small river (2-5 m in width in normal rainy season flow), there is less new sediment input per meter of bank and the sediment deposits in the causeway are less thick. Also, the lessening rate of flow as the river enlarges clearly results in ever more sediment settling out of the moving water column, to be picked up and moved again only after a very rainy spell. When such waters finally hit the clear and relatively calm waters of the Golfo Dulce, they generate a red clay delta and plume that stretches up to several kilometers into the sea before settling out (e.g., the mouth of the Rio Tigre just north of Puerto Jimenez).

There are a number of detailed considerations of the above general description that are pertinent to the impact of this type of mining on aquatic life.

1. Numerous miners in the Park and in the Puerto Jimenez meeting observed that what they are doing is "natural", since on the steep slopes (45 to 80 degrees above horizontal) in the

gold-rich stream headwaters, landslides are conspicuous and do occur. An earthquake occurred in 1982 which produced a pulse of such landslides within the memories of many gold-miners in the area; several large mines at La Torre had been tunneled into slope faces that had been exposed by these earthquake-generated landslides. However, mining and landslides differ in two very important respects. First, as a rough estimate from an overflight we made on 28 June, at least 80% of the landslides that we observed (fresh dirt on the surface, less than 1-2 years of invasive vegetative regrowth) in the upper headwaters of the Río Claro, Río Rincon, Río Termo, Río Sirena, etc. had readily visible mining activity at their bases - that is to say, they were largely if not entirely the result of undercutting steep banks either in pursuit of gold-bearing old sediments or to cause them to fall away and expose other deposits. The impact of landslide originating sediments on aquatic life is obviously a function of how often it occurs, and gold mining greatly increases the rate of landslides on steep slopes. Second, virtually all of the mining operations put a charge of sediment into the water flow on a daily basis. This means that instead of the aquatic life having to endure an occasional pulse of sediment-rich water during a time of heavy rains when streams are at their fullest and when most natural landslides occur, the aquatic life has to endure a water column that is continuously rich in sediments and a bottom substrate continually receiving new layers of sediment. This continuity of insult is not even broken by the dry season, and in fact is imposed on aquatic systems even at the time when water is scarcest.

In short, mining a causeway and its banks is not analogous to a natural landslide because of both the larger and more continuous sediment input from mining.

2. In a highly seasonal habitat such as Corcovado, the liquid extent of the stream network over the landscape shrinks substantially during the dry season and then expands during the rainy season (and expands even more in very rainy weather). The practical significance of this cyclic change is that the majority of the gold miners retreat from the Park or at least from the small streambeds during the dry season, and mine primarily in the beds of the larger rivers where there still is water and at a time of year when the large river beds are not threatened with dangerous floods during a storm. Unfortunately, the fish, shrimp, crabs and other aquatic life of Corcovado's smaller rivers and streams are obviously required to migrate up and down the waterflow with the seasons in order to remain in suitable habitat. This need results magnifies the damage done by mining and actually causes the damage to extend upstream from the last mine at the head of a stream. If, as is the case with the Quebrada Piedras Blancas, the uppermost 1000 meters of rainy season flowing streambed has no gold miners, this refugium is in severe danger of extinction as the dry season comes on. As the river shrinks, the aquatic animals will be forced downhill into the mined area, an area of stream with no leaf packs, no crevices in rocks, no deep pools, and no clear water. Furthermore, the deeper pools in the

lower portions of the river (fed by undersurface flow) will be filled with sediments during washing of soils and not recharged during the course of the dry season. In addition, their temperature and oxygen regimes, as stagnant evaporating pools in the hot sun, will be very different from those of the flowing pools that they replace.

3. The sediments themselves damage a tropical stream course in a way not anticipated by those familiar with extra-tropical streams. The streams in Corcovado's rainforest are very poor in aquatic plants. Nearly all of the food chain is based on vegetative and animal matter that falls into the stream. As the sediment load on a stream builds up, it plugs the cracks between the rocks used as hiding places by the detritus feeders and their predators, it coats the rock surfaces with underwater mud which in turn makes the substrate unsuitable as perch sites for filter-feeding insects, it buries the stream bed leaf pack so as to make it unavailable to aquatic decomposers at the bottom of the food chain, it smooths out the stream bed contour so that incoming plant material floats further downstream before lodging on the bottom, it obstructs vision for those animals that hunt by sight, and it plugs the gills and other breathing organs of aquatic animals. We are not here speaking of a stream meandering through a marshy meadow (where a certain amount of sediment fertilizer leads to increased primary production) nor even a rocky mountain brook bubbling through moss and algae covered rocks. Corcovado's high velocity mountain streams under forest canopies are nearly free of green plants, apparently due to the relatively low nutrient content of the water, the heavy shade to which most are subject, and the continuous grazing by aquatic insects. The sediment-enriched waters do damage even the sparse aquatic plants on the rocks by covering them with a layer of sediment and obstructing light passage to them.

4. Rich sediment deposits in Corcovado's streams will disappear at different rates in different streams once the mining is stopped. In the highest and steepest parts, perhaps only a few good wet years will be needed to return the streams to their original condition as a substrate. In the intermediate flow and slope areas, it is clear that we are talking in terms of 10s to 100s of years, depending on the luck of how many really strong storms occur. In the lower and more horizontal (flood plain) parts of the rivers, the recovery will be extremely slow, likely of the order of thousands of years. Once a 2-10 m deep layer of sand and laterite sediments is laid down on the otherwise rocky river bed, it will take exceptionally rainy periods to create the stream flow needed to really scour out such river beds. With continued mining, it is clear that low flat rivers like the Río Sirena and the Río Corcovado will suffer this fate.

5. Biological recovery of the streams currently being mined for gold will depend very much on which and how many branches (tributaries) of the particular stream were mined. Each of the small rivers flowing from inside of the Park to either the Golfo Dulce or the Pacific is very

much an aquatic island. All are separated at their mouths by large expanses of higher and well-drained soils or even rocky promontories. Owing to the steepness of the sides of the canyons, stream capture appears virtually non-existent. This means that biological recovery will be dependent on

- a. overland transport of those organisms that can do so,
- b. how thoroughly each of the aquatic habitat types (feeder streams, deep dry season pools, shallow flat rapids, etc.) is eliminated from a river system, and
- c. how long a population of this or that aquatic organism can persist in a continuously sediment laden stream.

It is clear that some of the rivers do have branches that are still unaffected. The Rio Rincon has the Río Pavón as a major tributary, and the Río Pavón is still deep, crystal clear, rich in fish and arthropods (it flows, almost at sea level, into the muddy drainage ditch known as the Río Rincón at the eastern-most point of the eastern Park boundary). The uppermost 500-1000 m of Quebrada Piedras Blancas during the rainy season is unaffected. The upper 1-2 km of the Río Agujas is subject at present almost entirely to hard-rock mining (see below), with the consequence of less severe sedimentation until it reaches intermediate size.

There are obviously some species of aquatic organisms that can survive substantial and continuous doses of sediment-rich waters. In the stream side pools of the lower Río Agujas and Río Tigre, whose beds had been grossly relocated and churned by the heavy machinery of mining companies working outside of the Park, we encountered small numbers of poeciliid fishes (top minnows, surface or even air breathers capable of living in extremely stagnant water) and in the same pools, thick stands of algae growing up through the bottom lateritic sediments.

6. Public appreciation, in the tropics, of the preservation of aquatic biota lags far behind that for terrestrial trees and game animals. There have been discussants both in the field and in San Jose that have spoken of stream and river regeneration following gold mining as a "yes-no" process, with the "yes" represented by virtually any kind of living organisms present in the stream. However, it is clear that a major perturbation has already occurred in all of the watercourses in the southern portions of Corcovado National Park, and the simple presence of living organisms in the rivers does not constitute the aquatic equivalent of wildland reforestation. When the mining is stopped, it is obvious that some sort of aquatic community will reappear. Two depressing predictions are, however, 100% certain.

- a. The aquatic communities will be more different from river to river 10 years from now than they were before the mining began, largely owing to the luck of the draw as to which river got hit in what way and with what intensity.
- b. All of the communities will be different from what they were before the mining began. Even if no local species extinction has occurred (a highly doubtful if), demographics have been

so grossly altered along with the alterations of the physical substrate that we are still talking of tens to hundreds of years before previous population structures will return. There are not even any undamaged rivers within the southern portion of the Park to serve as controls in this giant experiment. While those in the mountainous central and northern portions of the Park may serve as a base of comparison, their streams are based on a different rainfall pattern, different soil types (whatever geological processes have resulted in the low or negligible amounts of gold in these areas are undoubtedly associated with other geomorphological differences from the southern portions of the Park), different slopes, and different vegetation (there is even a small and unique patch of oak-rich cloud forest perched on the very top of the mountain massif at the point of divergence of the auriferous streams in the southern part of the Park).

7. As recently as 1984, an environmental impact statement prepared for mining concession 1653 (Rancho Quemada, outside of the Park in the direction of Rincón) commented that the streams had an "extremely poor aquatic fauna, and were prone to drying up in the dry season...only small crabs and aquatic insects were observed...in general, all the streams that form the upper drainage basin of the Río Riyito have an extremely poor fish fauna" (p.55); the implication in the report was then that such a fauna was not something to bother about and that after the disturbance it would slowly return. We feel that it is precisely these streams with small faunas that require protection within the Park. Furthermore, as biologists we are confident that such habitats will contain peculiar species, low density species and local species that will some day be of great pertinence to the question of species evolution.

8. As the sediment load accumulates in the lower (more level) stretches of the river, rivers such as those in Corcovado simply disappear more extensively and more thoroughly during the dry season. The Río Cedral shows this very clearly. Before the Park was established this river flowed through sections of forest cleared for farmland and sections of intact forest. Where there is farmland, the rocky riverbed is covered with a 30-200 cm thick layer of sandy erosional sediments. As the dry season comes on and the stream flow lessens, the river becomes eventually small enough that it flows entirely below the surface, leaving all the drying pools with dead fish and arthropods. A few hundred meters down stream, where it returns to forest, the river reappears, flowing over the original rocky bed and strung with variously deep pools along its course. The river banks are 50-200 cm high and tree-covered. How many years of severe flooding will be required to clean out such a sediment-filled portion of river bed is unclear, but if the entire river is filled with sediments - as is happening at present with the Río Claro, Río Tigre, Río Rincón, Río Aguji~~as~~as, etc. - it will be a very, very slow process. Removing the sediments from such a river is like trying to use cold water to wash grease down a pipe.

In the case of the Río Sirena, which flows directly into the Laguna Corcovado (which can

safely be labeled as the last pristine large swamp in Central America), the silt load will be deposited directly in the lake basin with the highly predictable consequence of filling the open water.

8. While the absolute number of trees removed by stream bank mining is small, the effect is locally very heavy with respect to the aquatic ecosystem. The stream bed and water is exposed to more hours of direct insolation, and to more direct impact from rainfall. This in turn results in more rapid drying of stream-bank interfaces in dry weather and more severe erosion during rainy spells. Furthermore, water temperatures are raised during sunny weather, small pools of non-flowing water heat up, and herbaceous (weedy) vegetation has more opportunity to grow on the stream banks. The detailed outcome of these changes is unknowable without a direct experiment, but it clearly alters the watercourse and its physical-biological properties. Whether this is a "good" or "bad" change is irrelevant; the goal of the Park is the preservation of natural streams (among other things) and a sunny and silt-laden stream flowing along an opened corridor of rainforest is certainly not the same, biologically or hydraulically, as is a silt-free stream flowing under an intact forest canopy.

3. Miners with gasoline-driven pumps (apparently Honda is the best). A miner with a pump is freed from the obvious topographic limitations of gravity-feed water movement, and can move and wash an enormous volume of sediments per day. Not only is he then able to dissect and wash away entire hillsides, but the sediment load put into the river may be up to tens of cubic meters per day. Below a pump-facilitated mine in a causeway bank, it is commonplace to find the original rocky creek bed buried 1-3 m deep in lateritic and light sand sediments (e.g., upper Quebrada Piedras Blancas). Entire hills 50-70 m high have been cut in half and washed into the headwaters of the Río Claro through pump-facilitated mining in the past three years. Furthermore, a miner with a pump can afford to wash lower-grade deposits (larger volume per hour) and thus may stay more in one place, grinding very substantially into a hill that would be largely ignored by more old-fashioned technology.

While both gold mining and gold mining with a pump are unambiguously illegal in Corcovado, somehow the mystique has developed that mining with a pump is more illegal. Pumps can be, and apparently in several cases have been, confiscated by Park Rangers. Their use in the Park at the present is almost negligible (except for the Río Claro), but they are commonplace on the borders. They are clandestinely used in the Park (especially in border areas), and their popularity is increasing; if the mining is allowed to continue in the Park, it is clear that a steady increase in pump population density is the next natural step in gold miner community evolution. A pump with all of its associated pipes sells for about \$1000 (45,000 colones),

which in fact is a very reasonable investment considering the great increase in the amount of mining that can occur with one. However, it is generally difficult for an individual miner to have that much cash in his pocket at one time. This sets up the system for evermore complex and deeply involved outside interests who are willing to invest such a sum for an almost guaranteed high return on the investment. Outsiders who have so invested in the miners are likely to be as vocal (or more so) as are the miners themselves in resisting the miner's eviction from the Park. In addition, such outsiders will be among the middle to upper economic classes in Costa Rican society and therefore annoyingly more competent at influencing the politics of the decision to evict the miners than will be the miners. While we did not encounter this kind of commercial complexity (unless it was behind some of the intensity of noise at the Puerto Jimenez meeting), it is very easy to imagine it evolving if the situation continues as it is. We were surprised not to encounter the argument, "well, the miners have already destroyed the aquatic systems, so why not let them continue their work"; outside investors are one obvious source for such a blind and self-serving argument.

Pumps have another weakness in addition to being easily confiscated. They are noisy and therefore easily located by a Park Ranger who is patrolling along ridge-top trails rather than struggling up the rocky (and deafeningly roaring river-filled) riverbed. In sum, their threat appears to be primarily in the future, should the gold mining persist, rather than in the immediate present.

4. Hard rock miners. The uppermost reaches of many of the creeks and rivers have numerous tunnels cut straight into the banks between 1 and 10 m above the rocky and narrow causeway. The tunnels may penetrate as deeply as 10-50 m, and are usually about 1.5 m wide and 1.5-2 m high at the mouth. The more successful (persistent) ones, at least as defined by their depths, tend to be following very old and long ago buried rocky river beds covered by thoroughly consolidated and conglomerated boulder-rich large-gravel alluvium. Many miners appear to be following or transecting such ancient stream-bed deposits without understanding what they represent. It appears that many of the really spectacular gold finds (large nuggets, concentrations of small nuggets) come from these fossil river beds either when mined or when dissected and exposed by erosion from contemporary streams. Since the Osa Peninsula is an area of recent geological uplift, these fossil riverbeds were at one time at a lower elevation and analogous to the contemporary intermediate-sized creeks and rivers. Upon being uplifted, the fossil river beds are now being eroded and dissected by contemporary rainfall.

The volume of rock from hard rock mines is usually small, the sediment coarse, and the daily input into rivers low (1 to several wheelbarrow loads per day). While such mining does generate sedimentation, more damage is done to the river in removing overburden in search of mineable layers than by the material from the tunnel mine itself. Such rocky mine till goes

primarily into the uppermost streams in a river system, areas with very high velocity stream flow and nearly pure rock causeways. As a consequence, it tends not to accumulate in such spectacular amounts in the river bed as does the clay and sandy sediment somewhat lower down, in the stream. It appears that the major damage done to date directly by the tunnel mine is the scouring of the rock surfaces by the increased grit load, and the sedimentation of deep pools and crevices below the general water rapid flow. Such pools and crevices are very important biological refugia during the dry season in the uppermost streambeds; the more filled with sediment, the more shallow they are and the more likely to dry out before the end of the dry season.

5. Mining companies. Fortunately, the mining companies have all stopped at the Park boundaries (except in the case of the Río Rincón where the river itself is the boundary and the company has simply mined all the river bed or diverted the river channel further into the Park so that they could then say that they were mining outside of the Park (the center of the river is the boundary)). They also do not appear to be a direct immediate threat to the Park since in theory they can be easily controlled through their concession licenses by the Ministerio de Energía y Minas (in addition, many have simply ceased operation after having thoroughly destroyed the river bed). On the other hand, there is a 1983 report by two geologists (B. M. Mora and J. F. C. Muñoz) and a 1984 report by two biologists (H. Soto and B. Gutierrez) that makes it very clear that the companies are and have committed a large array of infractions of the concession regulations without any real threat of government action at the time (we do not know what government actions were taken as a consequence of the Mora and Muñoz or Soto and Gutierrez reports). The point is that many kinds of mining damage have to be avoided in the first place; fines or "reclamation" is generally just whitewash to quiet some vocal critic. We also saw sufficiently severe alterations of riverbeds by companies to make it clear that either siltation and damage to the causeway is not prohibited, or their activities are in fact unregulated. We witnessed the attempted first steps at placing a floating mining dredge in the Río Riyito (outside of the Park); when a large dredge is allowed to work the causeway of a small river, there are no other possible consequences than total destruction of the causeway and major siltation downstream.

The companies are of course a major indirect component of the problem in that their concessions and previous mining activities make it virtually impossible to reasonably suggest that a future solution for more than a few of the gold miners in the Park would be to shift their location to the larger flatland riverbeds outside of the Park. These riverbeds have already been heavily mined, and the deposits that remain are buried under many meters of overburden. This point will be discussed later in this report with respect to the legislation currently under consideration by the Legislative Assembly to create a band of terrain around the Park in which

the individual miners have priority.

We should make it abundantly clear, however, that the company-level mining of the rivers originating in the Park (Río Rincón, Río Tigre, Río Agujas, the only ones we examined) has totally destroyed them from the Park boundary to the ocean. Not only have the river beds been strip-mined in the worst and sloppiest sense, but the beds are now rich in flood- and erosion-prone low banks, totally unconsolidated sediments in piles and eskers many meters deep, and undercut high lateritic banks. Pools that may serve as dry season and floodwater refugia for aquatic animals have been eliminated (of course there are depressed areas filled with water, and even some of the characteristic river-bar plant species are beginning to colonize, but these are in no sense the equivalents of what was once there). We should also make it clear, however, that these watercourses were amply helped to extinction by the overall clearing of all the lowland relevant forest for high-grade rice fields and pastures during the past 20 years. In the immediate future they will be subject to continuous assault from agricultural chemicals. We are here concerned with the question of how do we keep Corcovado intact, rather than is it possible or even desirable to use the lowlands near the Park for anything other than high yield agriculture and pastureland. When Janzen first walked up to the Río Rincón 20 years ago at a point halfway between what was to become Corcovado National Park and the Golfo Dulce, the site was a crystal clear shade-dappled rainforest river rich in large fish, crabs and crayfish, aquatic mammals, aquatic birds and insects; that day, it was also decorated with a 3.80-m long crocodile. Today it is a sun-baked sterile muddy ditch through a 10 km long gravel pit through large scale and productive rice and corn fields.

This is probably also the best place to mention that Costa Rican law requires that an environmental impact study be conducted and reported before a gold mining concession can be worked by a company. We have read three such studies produced by the Tropical Science Center in San Jose, and as we are certain the writers must have realized, they are absolutely meaningless except in providing salary to someone. Here we only mention a telling quote from the environmental impact statement on mining concession 1653 on Rancho Quemada (northeast of the Park, in the Río Ruyito drainage). After and before a naive rationalization as to how mining up to 10 m on each side of the streams would have little effect on the environment, it is stated (p. 53) that there is little to worry about since "observations on the vegetation in the zone to be affected by the gold mining show a forest characteristic of the protected forests of the Osa Peninsula, containing species that are not considered rare or in danger of extinction, and are well represented in Parque Nacional Corcovado". We must admit that this rationalization is a new use for a National Park, one that had not occurred to us. This is not the place for a head-on attack of ritual environmental impact studies of gold mining companies, but it seems clear to us that a very different formula than a traditional environmental impact statement is needed to

place the value and costs of company-level gold mining in the context of regional development plans in Costa Rica. Thorough water-based gold mining destroys the river bed and the river, and that is the end of the matter. While there may be places and river types to which this statement does not apply, they are not the small rivers of the Osa Peninsula. But then again, if the surrounding area is to be converted to simple agriculture and animal husbandry, then equal conversion of the river to a drainage ditch may not be out of order.

In closing, on biological impact

Gold mining has caused and is still causing very severe damage to the aquatic habitats in the southern portion of Corcovado National Park. If it continues, even at its contemporary non-pump levels, virtually all of these aquatic habitats will be irreversibly destroyed. The longer it continues, the fewer tiny surviving aquatic refugia there will be that are maintaining species that can colonize the watercourses once reclamation begins, and the more species there will be that will become locally extinct rather than just exist at a low density. Additionally, we should observe that there are undoubtedly numerous local species populations in the fast-flowing Park streams that occur only there because a) that is the only place they are found, and/or b) their equivalent habitats in other parts of Costa Rica have been extinguished (or are scheduled for elimination).

However, there is an important and delicate matter of timing that needs to be discussed, despite the fact that it is susceptible to misinterpretation. It appears to us that the damage will be approximately the same, if the mining remains at its current levels for the next 1-2 months, as if it is halted tomorrow. The streams are already severely damaged and the few remaining undamaged streams are highly significant refugia within each independent river system. We saw no evidence that mining intensity is undergoing any significant increase at the moment, assuming that the presence of pumps is maintained at its current very low level. The rainy season has another 4 months at least to run, so that the next pulse of dry-season threat to the aquatics will not occur immediately (this is not a trivial consideration: it appeared to us that a number of very small creeks, creeks that could be refugia, are being mined this rainy season for the first time). In short, the long-term protective advantage and the minimization of social disruption to be gained from 1-2 months of explicit planning and action before the eviction will far outweigh the ecological consequences of permitting the mining to continue at its present level for that period.

How long will it take for the aquatic systems in the southern parts of the Park to recover? The faster the stream flow, the rockier the sediment input, the more rain, the fewer the miners, the steeper the slopes, the faster the stream will return to hydraulic similarity to the pre-miner state. We also suspect that the rate of return of biological systems will

approximately mirror this progression. We suspect that we are talking of 2-10 years for the smallest and highest streams, 10-50 years for the intermediate streams, and 50-1000 years for the lowest and most slow-flowing rivers. However, where a species of animal has been extinguished from a river system, the time to re-establishment is at present unknowable and depends as much on the dispersal and colonization abilities of the animal as on the details of hydraulic recovery of the stream. What we can say is that the stream has to be at least partly recovered before colonization is likely, and reasonably complete biological recovery will always lag well behind hydraulic recovery.

In sum, the rivers and creeks in the southern third of the Park have been converted from clear-water conduits rich in detritivore-based food chains to liquid deserts by the sediment inputs from the mining operations. A beautiful photograph of a clear rainforest river and waterfall, such as adorns the cover of the 1984 Annual Report of the National Parks Foundation of Costa Rica, is simply impossible to take in the southern third of Corcovado National Park at present. Costa Ricans, foreign tourists, and biologists will flock to an intact rainforest to enjoy and study and understand. They won't go at present to the southern third of Corcovado for any of these purposes. In the two clear-water streams we encountered, conspicuous populations of shrimp (freshwater crayfish), fish, crabs, aquatic insects and algae remained. These appeared to be entirely absent from the 11 sediment-filled major streams and small rivers that we examined downstream from the gold mines and at the gold mines. Yes, thorough sampling with toxic chemicals (e.g., rotenone) might turn up an occasional surviving member of a fish or crustacean population, but that seems a high price to demonstrate quantitatively the obvious difference between, for example, the Río Rincon and the Río Pavón.

We do not know how long it takes for continuous sediment discharge into a river to eliminate most of its aquatic life, but suspect 1-12 months to be a reasonable figure. Likewise, recovery rates, once gold mining has stopped, will range from a few years to as much as a thousand, depending on the slope of the stream bed and the amount of water it carries. It should also be emphasized that allowing mining (or any other kind) of destruction of just one of the river systems (e.g., Río Claro, Río Madrigal) will slow the rate of recolonization of the neighboring river systems by eliminating colonization propagules. It is even possible that for complete recuperation, some human-aided transfer of fish and crustaceans among the Corcovado rivers may be necessary (though very difficult because we will never know if the absence of a particular species is natural or caused by the damage to the river).

The population of miners.

It is easy to sit in San Jose and speak of "the gold miners" as if it were one homogeneous group, but only a few hours travel in the Puerto Jimenez-Corcovado region makes it obvious that there are many species of gold miners and other kinds of people directly involved with the gold miners. For the purposes of generalization, I will divide them approximately into "old time gold panners", modern resident miners (professionals and apprentices), farmers, and commercial mutualists with the miners. Each of these groups, and numerous other smaller groups, produce somewhat different social and biological pressures with respect to both their eviction from the Park and future possibilities of maintaining the Park free of gold mining (as well as other impacts).

How many are there?

There has never been a thorough census of the gold miner population in Corcovado National Park, and one would be a waste of time unless of intrinsic interest to an academic human demographer. However, numerous partial censuses and our inspection tour allow us to bracket a range of values. Speaking of all persons and their dependents in the Park at the present (late June 1985), the actual number lies between 800 and 2200 (including turnover). Furthermore, we feel that it is very likely that the real number lies at about 1400 persons. Of these, approximately 900 should be counted as actual working miners. If we err in any significant sense in these figures, it is in being too high, rather than too low. At this point we ignore the amounts and sizes of gold mining companies both because there were none actually working at present on the rivers we examined, and because all of their activities have been outside of the Park and they presently pose no direct threat to the Park.

There are many details of what these numbers actually count and how one arrives at them that are directly pertinent to the problem.

1. Whether the number is 800, 1200 or 2000, the evacuation, preparation for it, and its aftermath will be essentially the same, and therefore a detailed census is not critical to the problem.

2. During interviews of miners at their residences or mines in the Park, the following scenario invariably occurred.

"How many miners are there working in this section of several kilometers of river"?

After some thought, the reply was "2 up there, 3 here, 1 down there, 4 over there", with a total of, let's say, 13 miners and 2 wives and 3 children; the total was then given as 18.

"And how many miners do you think are working in the Park"?

"Oh, 2,000 to 3,000". (The range of numbers given in response to this question varied from 2,000 to 40,000 over about 30 interviews, but better than 90% of interviewees put the

number between 2,000 and 3,000). (The June 1985 planning report for the Osa Peninsula by the Ministry of National Planning and Economic Policy gives the resident population of the Peninsula as about 6,000 persons plus another 1,500-3,000-person "floating population" of miners, a large fraction of which we suspect are inside the Park).

"And where are all these other miners"?

"Oh, over in river such and such". One then goes over to river such and such, the interview is the same, and the large body of miners is then declared to be over in some other river drainage, sometimes including the one where the previous interview occurred.

The simple point is that the miners have no idea how many miners there are in the Park. The causes are due to a) general incompetence at understanding the relevance of samples (where they live) to the overall population in the Park, and b) unfamiliarity with the areal extent of the Park and many parts of it. When many miners speak of "Corcovado National Park", they know that they are "inside" of it (although two miners told us they were mining in the Park but in fact were well outside of it), but have no clear idea of what the Park is in relation to the entire Osa Peninsula. However, the miner's statements (estimates is an incorrect word for their figures) of how many miners there are in the Park is an important ingredient in the situation because what they say bolsters the opinions of outside persons and agencies as to the magnitude of the personnel problem.

3. Statements by the miners (as well as by others) as to the numbers of miners in the Park is the first datum to be discussed here that has the property of appearing to be a fact in nature and use, but in fact is simply a statement that can be manipulated consciously and unconsciously by anyone concerned. However, the "number of miners" datum is somewhat unusual in that it is virtually to the advantage of all concerned to either believe that it is large (irrespective of how many miners are actually there, if the number is greater than trivial) or to have it be large:

a. The miners want the estimate to be large because it gives them the sense of security of both belonging to a large group and being morally correct, since a substantial portion of the definition of being morally correct is that many people believe in it. They also want the estimate to be large because, as they can see quite clearly, a large group has had the power to paralyze the Park system long enough for a quite substantial extraction of gold and long enough to get dangerously close to being able to claim the land because of duration of occupancy.

b. The commercial interests in the vicinity of the Park want the estimate to be large because that promises a larger volume of profits, because the longer the miners stay the greater their short-term profits, because they feel they have more political leverage in their arguments "on behalf of the miners" if there are many miners, and because the more miners there are the more the outside community of miners and landowners will resist their expulsion from the Park.

c. Various members of the National Park Service have wanted to think or feel that it is large because the greater the population of miners, the greater the threat to the Park and therefore the more legitimate some sort of total eviction; if the number were minute, the miners could be ignored (as they were when the Park was established) but if the numbers are to be significant, then the greater the better, since intermediate numbers seem to make more acceptable some sort of intermediate solution (and see d. below). However, what is consistently forgotten in the numbers game is that even a very small number of gold miners working intensively over a number of years will do an enormous amount of damage over what has already been done, and finalize that which has already occurred.

d. Various members of the National Park Service want it to be large (as well as fierce) because a large number of gold miners legitimizes their failure to resolve the matter during the past 5 years that the number has been growing as well as progressively destroying the Park. However, we must make it emphatically clear that in reality, today, virtually all members of the Park Service fervently wish that the actual number of gold miners in the Park was extremely small to non-existent.

e. Many government agencies want it to be large (as well as dangerous) simply because it reinforces the long-established stereotype of the Osa Peninsula as a lawless outback, which in turn legitimizes the (until very recently) virtually total disinterest in the central government in developing this part of Costa Rica. Ten docile law-abiding citizens are not much different from 50 in terms of cooperation with the government, but 50 "undesirables" are 5+ times worse than are 10 "undesirables".

4. There is strong seasonal fluctuation in the numbers of miners in the Park for two reasons. During the dry season, water levels fall in the upper (smaller) streams so low that mining is virtually impossible and the miners move down into the larger river beds (which are also then less in danger of destructive flooding during actual work). The resulting dry season crowding and worsening of working conditions results in numerous miners going outside of the Park to other kinds of employment or activities. Second, as many as 30% of the miners have farms outside of the Park (at least five miners suggested the figure to be 50%), and the time and season that they spend mining gold is therefore in part dictated by the harvest, etc. demands of those farms (fincas). In addition to these two seasonal causes in fluctuations of numbers of miners, there is a more uniform movement in and out of the Park as miners leave to visit families in nearby towns and farms at biweekly to monthly intervals.

These three processes working together mean that any snapshot of the actual numbers of persons working and living in the Park will always give a significantly lower number than the total number of miners that are mining in the Park. However, our estimate of 800-2200 is

intended to represent that true total at present.

5. The composition of miners presently working in Corcovado (not counting family members) is, we feel, divided into about 50 "old time miners", about 600 modern miners, and 250 miners who regularly enter from some other occupation (usually a farm or city employment). If there is an error in this figure, it is most likely in an underestimate of the number of part-time miners that are still in the process of entering from time to time.

6. When people outside of the Park mention the "gold miners in Corcovado" and estimates of how many there are, they are commonly confused in their own minds as to what proportion are actually in the Park and what proportion are mining elsewhere in the Peninsula. While such people, especially the local merchants, may understand fairly well where the Park boundaries lie in the immediate vicinity, they do not have a clear idea of what fraction of their customers are truly from inside the Park. Furthermore, as mentioned above, it is very much to their advantage to declare that there is a very large body of miners within the Park, with the dual goal of scaring authorities into fearing action against the miners in the Park and making those outside of the Park all the more emphatic about not wanting all of "that" turned loose on the remainder of the community as gold mining competitors.

8. In measuring the effects of the miners, the numbers may not be relevant so much as how many mines there are of what size (though the number of miners is clearly relevant to the "eviction"). For example, we discovered that an incoming miner may purchase mining "rights" from previous miners, and that some persons may actually prefer to open up a mine (or mine tunnel) and then sell the rights and move on in search of better sites. An ordinary mining area yielding perhaps an average of a half a gram of gold per day might be worth 10,000 to 15,000 colones, while a very good site might be worth as much as 150,000 colones. A given mine then may support a succession of miners over time, but have the same impact as if only one person was working it.

What sort of people are the miners?

Leaving aside the "old time miners", there are two conspicuously overlapping kinds of miners in the Park - the full time miners and the part time miners that enter from time to time. I will discuss these two overlapping groups sequentially.

The full-time miners. This very large group is the majority of miners in the Park. It may be approximately divided into two subgroups - professionals and apprentices. We define the professionals as those individuals who have been mining in the Park (or in similar circumstances) for 1 to 3-5 years and really know what they are doing. They live in a house constructed of a plastic roof and relatively open walls near the work area, and often have a family in some outside place (Golfito, Puerto Jimenez, San Isidro del General, Palmar, Uppala,

or even further away) that they visit at several week to several month intervals. They maintain that the family is greatly or totally dependent on the money made by the gold mining. They tend to be 25 to 40 years of age, alert, well-mannered, soft-spoken, intelligent, capable of carrying on logical and complex verbal discussions, friendly, and frequently back up their opinions with rationalizations or seemingly factual observations. They repeatedly mentioned how pleasant were the tranquil and boss-free working conditions within the Park. While "adventure" and the lure of "striking it rich" is definitely and admittedly a part of their conceptualization of what they are doing, they also appeared to be quite reconciled to the obvious fact that the kind of gold mining they were practicing was neither adventurous nor likely to lead to a major find.

In most workings of such persons, a person can perhaps average (over a year) a gram of gold per day of hard work (equal to 500 colones at the Banco Central in Puerto Jimenez, or 450-490 colones in a general store, or \$10.00). To this seemingly low income figure needs to be added that they pay no rent, but are paying 20-100% higher prices for food purchased in the pulperias available to them near the Park as compared with "outside prices" (to purchase minimal foods from a general store (pulperia) requires approximately 85 colones per day, to eat very well requires approximately 140 colones per day). Additionally, a week's food must be carried 1-6 hours on foot (one way), this trip often destroys the better part of one working day. The traditional schedule for such persons is to mine from about 6 am to 2 pm, with an occasional day off to explore or relax. By way of contrast, an unskilled laborer (ditch digger, machete swinger) in Costa Rican society receives a daily salary of 150-250 colones per day at present.

We were left with the distinct impression that such professional gold miners had survived for substantial periods at quite some other kind of employment prior to being gold miners. At least five interviewees had worked for the large banana companies in the Golfito-Palmar region before they closed down over the past 2-4 years. Others had been bus drivers, taxi drivers, factory workers, farmers, fishermen, coffee pickers, and ranch hands.

The professional full-time miners were almost invariably accompanied by apprentices, substantially younger men who had been mining gold from 1 day to several months. They had in effect apprenticed themselves to the experienced miners, and it was also clear that the size and extent of the workings of the experienced miners was substantially dependent on the labor of these helpers. While it was stated that they "divided" the gold, the proportional shares were not discussed. Several experienced men stated that they were quite willing to teach newcomers the basic technology of gold mining in these rivers.

These apprentices had clearly come to be gold miners because of the "adventure", because they knew someone (relative or neighbor) who was already doing it, because they "could not

find a job at home" (home being from all over Costa Rica), and because they were frustrated with the long hours and congested conditions of city life. These apprentice miners were in general quiet and polite, and listened to the interviews with interest, but they had little opinion to offer other than factual items such as from what town they came from and how long they had been there. What was conspicuously different about this kind of apprenticeship from that occurring in other trades was that after several years of doing it, the person actually knew nothing of use in gainful employment elsewhere. The art of digging a bed of gold-bearing sand into a river and washing it through a sluice box prepares one for little more than being a ditch-digger.

It is our guess that among the 600 or so full-time miners in the Park, perhaps as many as half are apprentices and are "trying their hand at it to see how it goes".

The part-time miners. Corcovado National Park contains an amazing collection of those who have jobs or small farms (fincas) elsewhere, but partly for the adventure, partly for the hope of striking it rich, and partly because it is a slack season elsewhere have come to try their hand at mining. We met an accountant from San Jose, the owner of a prosperous finca near Alajuela, a store owner from Golfito, a Swiss farmer, and a devout member of a religious group locally centered in Dos Brazos (the latter had been censused on his farm within the Park, and was to be compensated by the Costa Rican Park Service, but had not yet been; while he had stopped farming, he intended to mine until the Park Service paid off the farm and he was told to leave his gold mine). We were left with the impression that most farmers in the area mine gold during their slack season, and it was evident that the owners of the farms within the Park (see below) had also been gold miners.

The part-time miners that we met within the Park (as opposed to some of those we met in Puerto Jimenez) were as well-mannered and calmly friendly as were the full-time miners that we met. They were generally quite able to describe themselves, their activities, and their motivations. They were not, however, any more competent at understanding either the magnitude of the miner population or its impact on the Park than were the full-time miners.

The part-time miners would appear to be much less of a problem than are the full-time miners in an evacuation of the Park, because they have other livelihoods to turn to. However, they require inclusion in any planning because they and their social descendants will always be a potential threat to the Park. Furthermore, there are two kinds. There are the young to middle-aged farmers who occasionally mine, and there are older long-time residents of the Peninsula that long ago mined gold but now are relatively wealthy and well-established in many kinds of negotiations but for various reasons count themselves among the "gold miners". This kind was exceptionally well-represented at the meeting in Puerto Jimenez. Because of their

positions of power and respect in the community, such people can be either powerful friends or enemies, depending on where they see their fortunes falling - they are obvious challenges for the public relations component of the eviction and afterwords.

Are miners farmers? We were repeatedly told in San Jose, Puerto Jimenez and even in the Park that "gold miners are not farmers" and therefore it does no good to think of solutions such as evicting them from the Park and expecting them to turn to other livelihoods. However, it is our opinion that perhaps as many of the gold miners in the Park are now or recently have been farmers, and many others have worked at other professions. Yes, it is clear that there are some old time miners who have been miners most of their adult lives, but they are certainly less than 5% of the gold miners working in the southern third of the Park.

The farmers within the Park.

When Corcovado National Park was first established in 1975, there were better than 160 farmers living in the area. All of these (except the "old time gold miners") were paid for their farms and evacuated from the Park (and many were relocated in Cañaza, a small new town north of Puerto Jimenez and to the east of the central portion of the Park, Figure 1). These farmers are now restless over the grossly unoptimal farming and living conditions in Cañaza as compared with their rainforest farms in the Park (petition/letter to Ugalde, 14 March 1985) and are threatening to reinvade the Park; their problem and its solution must become part of the post-eviction program for the integration of the Park into the community, but we do not discuss it further here. When the eastern Park boundaries were widened to give the Park a more solid figure and insure that all of the Park's drainage basins originated in the Park, about 30 more small farms were found to be inside of the Park boundaries. For the most part, the owners of these farms have been paid off and many have left, and the remainder will leave as the legal tangles over their lands are straightened out (e.g., the owner drowns, the wife claims the compensation but two of the deceased owner's friends maintain that the farm was meant to go to them). While these farmers were all gold miners (and hunters), and thus were part of the damaging forces within the Park, they no longer pose a major threat simply because they have been removed (in a socially acceptable manner). To the degree that some may return (and one has already done so), they may be then pooled with the other miners for the sake of planning. Another has taken to renting his former farm as a house site to gold miners. At the moment, farms and farming in the Park are not a major environmental threat inside the Park, but farming looms on the horizon in the form of agrochemical contamination and squatters in the upcoming crunch for Costa Rican farmland.

The gold miners to date have shown virtually no inclination toward substantial farming and more permanent settlement within the Park. However, it is obvious that should the miners'

circumstances continue as they are, a certain and growing number of miners will find farming (including minor pasturing) within the Park to be evermore attractive as their particular gold mines give out and entire river systems are finally cleaned of the most easily accessible gold. Already the banks of the Río Claro and Río Madrigal are showing the first signs of very small amounts of cultivation in the form of vegetables (green beans, tomatoes, culandro) grown around the houses. Many hectares of primary forest on the banks of the Río Rincon across from (outside of) the Park have been cleared and planted to corn this year. In the case mentioned above of a former farmer renting his house site to gold miners, it was clear that one of the attractions of the house site was abundant fruit trees; fresh green beans were being cooked for lunch. At the headwaters of the Río Agujas, well inside the Park, a miner's house had tomatoes growing at the front door. A variety of garden vegetables, pineapples, bananas and beans were being grown at the five-house "village" at La Torre; we were given two liters of fresh beans as a going-away present by one miner. One cannot expect miners with families to live without vegetable and fruit vitamins just because they may decide to change house sites to follow mining conditions in the upcoming years. However, once a small farm, next a medium-sized farm.....

This threat must be viewed in the context that Costa Rica has a long traditional history of legal homesteading on "unused" forest lands, irrespective of who owns them on paper. Once again we are up against the fact that part of the ease of invasion and occupation of the Park by the gold miners is directly attributable to the lack of apparent ownership and use. When discussing alternative areas for mining outside of the Park, at least five interviewees made it clear that one of the major unattractive things about the land outside of the Park is that someone unambiguously owns it (except for the Forest Reserve), and that someone takes a dim view of gold miners working on his land. Added to this soup must be the fact that in Costa Rica, it has also long been traditional to forcibly or with the blessings of some government agency to homestead large blocks of state or large company lands (e.g., watersheds or Forest Reserves, abandoned banana plantations). In the miner's minds, the species "National Park" fits within the genus "unused State-owned land, legitimately colonized if there is sufficient "need".

Commercial mutualists with the miners.

It is self-evident that a population of workers bringing in a half a million dollars a year will be a major resource for the commercial interests of a nearby small town and rural community. Corcovado is no exception. The greatest importance of this community from the viewpoint of this report centers around its conception of the Park and of the Park's gold miners, and as a potential source of organization and/or action by the gold miners. Here I briefly mention the more conspicuous traits of this community, the traits that are unavoidable in any discussion of evacuation of the miners from Corcovado.

1. Puerto Jimenez (Figure 1) is the commercial center of the region (airport, medical facilities, Rural Guard post, hotels, bars, stores, soccerfield, government branch offices, central bank office, etc.). The Banco Central estimates that the Puerto Jimenez branch is annually paying about \$2,000,000 (US) for gold and that one quarter of this gold comes from within the Park (Lic. Oscar Salazar, Sección Metales Preciosos, during the meeting on 1 July). These figures can be determined because when the miner sells his gold, he gives his name and place of mining, and the Bank is convinced that the miners are not at all reluctant to state that they are mining in the Park. However, since about 30% of the total gold comes from large companies (and the revenue from it is probably not spent much in the Puerto Jimenez area), the Park is probably providing about one third of the gold-caused income of the Osa Peninsula. On the one hand, the removal of this will be a substantial loss to local commercial interests, and it is obvious that they know it. On the other hand, not all the gold-caused income of the miners is being spent near the Park, since it is obvious that many are using at least part of their income to support relatives well away from the Peninsula.

Since many of the gold miners to be evacuated from the Park would probably not continue to mine in the area immediately outside of the Park, increased mining in such nearby alternative areas should not be expected to provide enough new gold to compensate for the loss of the Park as a source.

2. When the miners have small amounts of gold (almost all of the time), they exchange their gold directly for food and other goods at the general store for a price about 2-10% lower than that paid by the Banco Central. When they find or accumulate a large amount (Yega estimates that perhaps 1-3% of the miners strike a rich deposit per year), they go to the Banco Central in Puerto Jimenez (500 colones per gram, just slightly greater than international rates, which effectively stops the flow of raw gold out of the country). The owners of general stores cash their gold in the Banco Central in Puerto Jimenez. It is obvious that the general store owners very near the Park at Rio Rincon, Dos Brazos, Carate, etc. are virtually totally dependent on the gold flowing out of the Park. It is not clear to what degree the Banco Central correctly identifies the gold brought in by the general stores as originating within the Park, since the stores are outside of the Park.

3. A large fraction of the population of the Osa Peninsula has mined gold at one time or another, has friends and neighbors who are or have been gold miners, and can see that a major disruption of the gold flow will have a depressant impact on the economy of the region. This needs to be seen in the context that the Osa Peninsula gold rush has clearly been an economic boon to the region, and it is relatively synchronous with the recent depression of the region's economy by the closing of banana farming in the Golfito-Palmar area (and its replacement by the much less labor-intensive African oil palm cultivation).

4. Puerto Jimenez is rich in two sorts of persons with strong vocal and political capabilities as well as a strongly vested interest in keeping the gold miners inside the Park: owners of stores, and owners of lands in the vicinity. Any public meeting, as was the one we held, is likely to be richly attended (as was ours) by such people. Given the current total absence of financial glue between the official Park and the commercial interests of Puerto Jimenez, the commercial interests are totally unlikely to be altruistic toward the Park, and have shown no signs of altruism to date. The local land owners outside of the Park are certainly not overjoyed by the idea of a displaced population of potential squatters on their lands (many of which were first obtained by squatting on lands owned by others or the State). Inextricably intertwined with this is the reality that some of the gold miners will actively seek to continue mining outside the Park, which simply will mean more competition for those who are currently mining outside of the Park, whether they own the land or are simply entering a Forest Reserve or private lands through the same kind of force as has placed the miners in Corcovado (though it is important to mention that several miners mentioned what is obvious - to mine in Corcovado, you do not have to fight an angry landowner, only the indifference of the State to enforcing its own laws).

5. While it is easy to see that in the long run the economic development of all aspects of the Osa Peninsula might well absorb some of the displaced miners and replace their monetary input into the community, it is very much of a "in the long run". Any land development schemes or sustained yield forestry that is to eventually occupy the Osa Peninsula outside of the Park will certainly not lack potential employees, and displaced gold miners will be competing with an unoccupied labor force from all over Costa Rica. It is imperative to recall that one cannot speak of the problems and solutions that occur in the Peninsula de Osa as independent from the rest of Costa Rica, any more than you can speak of solving Wheeling, West Virginia's problems independent from the remainder of the State of West Virginia (equal in size to Costa Rica).

6. We were repeatedly struck by the apparent willingness of members of the community both outside and inside the Park to at least listen to logical arguments about the function of the Park and its significance to the local economy. Equally, it is obvious that the community labors under a large number of totally false facts (or at least finds fabrications convenient to relieve guilt or bolster apparently logical arguments for the presence of the gold miners in the Park). Equally obvious, the community never been subjected to any attempt at public relations with the Park, biological education by the Park, or integration with the Park. Some examples of widespread falsehoods that we encountered are the following statements:

- a. All of the Peninsula is inside of Corcovado National Park.
- b. Corcovado National Park has been bought by gringos, and the point of evicting the gold miners is so that the gringos can mine the gold.
- c. The point of removing the gold miners is so that the companies can then be granted

concessions to mine the gold.

- d. All the gold in the Osa Peninsula is inside the Park.
- e. The miners do no damage to the Park, since they respect the "fauna y flora".
- f. The Park belongs to Costa Rica, I am a Costa Rican, and therefore I have the right to mine it as I please (the Banco Central, incidentally, may be subject to the same logic).
- g. The gold being extracted is saving the national economy.
- h. The gold must be extracted rather than leave it there to go to waste.
- i. The entire Park is occupied by gold miners.
- j. All gold miners in the Park will be out of work and starve if the eviction occurs.
- k. It is the responsibility of the State to find jobs for the gold miners if they are evicted from the Park.
- l. The Park is of no value to either the Osa Peninsula or the country.
- m. The gold miners are innocent of having broken any law.
- n. The damage to the Park was all done by other people.
- o. The majority of the gold miners are alcoholics, illegal immigrants, fugitives from the law, drug addicts, military mercenaries - this opinion is widespread in the rest of Costa Rica but only vaguely referred to by locals and the gold miners themselves. The closest we were able to get to the "fugitives from the law" aspect was the firmly held opinion that most fugitives were fleeing child support and felt justified in that the former wife was living with another man. "What we saw, and what I have seen in the past in the region, is that the Osa Peninsula is populated by virtually the same species of country folk as are encountered in any other rural area of Costa Rica (which is not terribly surprising since a large number listed their origins as other rural areas of Costa Rica).
- p. The damage done by the gold miners is really just the same as "environmental damage by nature" in that it mimics landslides.
- q. Corcovado is the only area in this region of the country where there is extractable gold. In contrast, Vega notes that there are large gold deposits in Isla Violines (Boca Río Sierpe), Esquinas (head of the Golfo Dulce), and in other river systems in southeastern Costa Rica. His commentary is backed up by a "regionalization" report of the Ministry of Energy and Mines (1984). In reply to this comment, at least five miners in the Park noted that it would be "too difficult" to go to these other places.

7. There are several buses operating in and out of Puerto Jimenez and there is the usual motley collection of vehicles to be expected in and around a small farming town. However, there is certainly no well-developed system of transport, public or private, that could be used by the miners at the time of the eviction in order to move their material possessions to wherever they decide to go. Liquidation of mining gear is likewise certainly not a solution, since at the time of

the evacuation, the market will be glutted with used irrigation pipe - an item not in hot demand in Puerto Jimenez at the best of times. There is, however, the possibility of someone arranging with a major user of irrigation pipe from elsewhere in the country to be on hand to purchase it, at a reduced rate, thereby increasing the cash on hand that a gold miner has to get started elsewhere and reducing the likelihood that he will simply return to mining in the Park. Such an arrangement could, for example, be facilitated by the Ministry of Public Works and Transport offering free transport of the purchased pipe to someone in the Meseta Central.

Miner's opinions on the Park as a park

If we heard it once from a miner, we heard it 30 times "We believe in the idea of a National Park, and we respect the fauna and flora; our mining does not hurt them". The statements were so ritualized and so similar from person to person, that it is clear that some aspect of the conservationist's credo has been successful in reaching these miners (probably at home, rather than in the Park itself). However, there is also a powerful incentive in hearing and repeating these words, since in the habitual intellectual rationalization so common among Costa Ricans, those words can go a long way towards relieving the guilt and worry generated by knowing that they are explicitly breaking Costa Rica laws - and explicitly breaking laws (as contrasted to bending them here and there) is morally unpopular among an amazingly high proportion of Costa Ricans. The miner's views in detail on their impact on the Park strongly suggest that they have no idea what is meant by "respect the fauna and flora".

While our goal was not to make our inspection tour a pilgrimage to educate miners, it was appropriate to occasionally reply to a miner's recitation of faith in the goodness of a park and his trivial impact on it. Janzen said, yes, we can see that you are not personally doing anything to either the forest or the animals, but perhaps you have forgotten about the aquatic plants and animals. You must remember that the purpose of a national park is to protect the aquatic organisms as well as the terrestrial ones. Janzen's comment was generally met with some version of "yes, I see what you mean" and the conversation stopped there. However, in two cases there was a revealing reply. Shrimp (= crayfish) had been specifically mentioned to one person and after thinking for some time, he said "yes, but after all, there are lots of shrimp in the ocean". A second interviewee several days later said "yes, I can see that our mining has destroyed the rivers in the Park, but in fact the gold is worth more to the country (to its economy) than are the fish".

After all the interviews we were left with the distinct impression that we were dealing with a highly rational population that is quite accustomed to using supposed facts to support daily and more long-term decisions about themselves and their neighbors. That the facts were generally wrong and that most of the discussion was in the form of rationalizations is irrelevant. It is our prediction that the population is highly educatable about both their true impact on the Park, the true value of the Park to the country and to them, and the necessity of evicting them. Furthermore, we feel that the miner's feeling that it is reasonable to be mining gold in the Park can be strongly undercut by providing him with detailed refutation of many of the "facts" he spouts. The purpose of such an exercise is NOT to defeat him in debate, but rather to make him less prone to view his occupation of the Park as holy (in the name of the country's economy) and his eviction as highly irrational or even mercenary.

Miner opinions on the eviction (desalojo)

Of 30 to 50 persons interviewed (range dependent on what you count as an interview), we met only one who expressed an opinion other than the following. I respect the law, and if the Rural Guard (Guardia Rural) comes and tells me that I have to leave, I will do so. There are a number of significant observations related to this:

1. No person ever substituted the words Guardaparques (Park Rangers) for the words Civil Guards. We were left with the distinct impression that most of the miners had no idea what the Park Rangers were (other than they were people who worked for the Park and could confiscate a mining pump or a game animal) or how their powers relate to those of the Rural Guard.

2. The above sentence was generally followed somewhere in the interview by a guarded or boldly stated comment that within 1-2 weeks, the gold miner would be back in the Park, mining again (in several cases of bravado, under cover of night if need be).

3. No person volunteered any indication that he understood that along with the eviction would come obliteration of the house sites, mine workings, tunnels and other complements to survival in the forest.

4. Until we met several participants of the Rio Claro shootout on the last morning of the last day, we never met someone who would admit to having been told to leave the Park by either a Park Ranger or any other person of authority. On the other hand, beginning with Director Mañia Elena, on various occasions select groups of miners were emphatically told that what they were doing was illegal as part of attempted negotiations with them. However, all miners we met had come to an understanding that by the letter of the law they were illegal and that it would be legal for the Rural Guard to evict them.

5. No one mentioned the problem of how they would get their large amount of heavy (and sometimes expensive) mining gear out of the site when told to leave, or even if they would plan to take it along or hide it in the forest.

6. All interviewees were asked point blank if they knew that they were mining in the Park and where the Park boundaries were. All said yes and all pointed correctly to the locations of the Park boundaries, except for two who thought they were in the Park but were outside.

7. Perhaps the saddest commentary expressed during the entire inspection tour, and it was expressed by two different interviewees was that of the person who said, yes, I will leave if told to do so, but if I come back to find that my gold mine is being worked by other miners, I will no longer remain pacific in my attitude. This opinion was likewise expressed as a much applauded plea by a gold miner at the public meeting in Puerto Jimenez, and is reflected in the widespread belief that the eviction is so that the companies can then mine the Park.

The distinct impression that we were left with was that of a motorist illegally parked by a

yellow curb while waiting for his wife in a nearby bank, and waiting for the traffic cop to come along and tell him to move on. The Corcovado miner knows he is breaking the law, does not see any obvious harm he is doing, has not been firmly told to move on, hopes that the law will change (or simply remain dormant), and in the meantime knows that he is doing something that is doing someone (including himself) some good. It is quite simply the tragedy of the commons all over again, with the commons occupied by a number of kinds of sheep, the commons margins varying in location and value depending on who you ask, and only certain members of the village knowing of the other uses of the commons.

Everything that I have seen about Costa Rican rural peoples, as well as what we saw within the Park, suggests that the vast majority of the gold miners within the Park are accurately characterized by the above comments. However, it is equally evident that there will be a few that will be substantially less cooperative. We met one and most every person who has traveled in Corcovado has met at least one person who states firmly that "they" will not take him out of here without cutting him into little pieces. Again, there are a number of facets of such people and statements that are relevant to the eviction.

1. It is virtually impossible to tell how much of such a statement is simply bravado consciously or subconsciously designed to delay yet further the eviction, a delay that has been conspicuously already promoted by the obvious fear that the outside Costa Rican world has of the miners in the Park (to say nothing of their fear of the supposedly "lawless types" that populate the peninsula).

2. The person making such a statement has nothing to lose by making such a statement, but much to gain both in creating fear and gaining applause (even if silent) from undecided neighbors.

3. Where such a person is genuinely feeling what he expresses, the resolution to stand by such opinions seems to be relatively proportional to the size of the crowd of supporters. If the eviction occurs, such individuals are likely to find themselves having to stand for their opinions largely without the support of neighbors (unless the eviction program has not taken the appropriate steps for rapid removal of the evicted miners from sites of concentration).

4. Costa Ricans feeling particularly belligerent are nevertheless highly susceptible to being argued with, and both their general feeling of respect for laws and logic tends to undermine their belligerent feelings.

5. The miners in general, and especially the regular miners who have survived several years of this life, are quite durable people. A direct confrontation is not only likely to meet a somewhat prideful person, but a person who is accustomed to contest with the elements. Psychological warfare, especially of the gentle and reasoning sort, has a much higher chance of success than does standard "police-style" direct confrontation laced with contempt for "drunken

and immoral types" (witness the April 1984 Río Claro shootout between the Rural Guards/Park Guards and gold miners).

In discussions of the situation in San Jose, the commission has fairly frequently been confronted with the spectre of labor organizers or similar manipulators of working people becoming involved in forming resistance among the miners to the eviction. While not meaning to deny the possibility, we were struck by the total absence of even the slightest flavor of such organizers in the speech, behavior and attitudes of the miners that we talked with. The public meeting in Puerto Jimenez was the perfect place for a local organizer to have made either a surreptitious effort or even to have appeared on behalf of the miners. Again, there was no trace of such activities either in the form of the meeting or the people speaking at it.

The public meeting in Puerto Jimenez

On 24 June and earlier, via several intermediaries, we announced to the Puerto Jimenez area that on the night of 27 June we would hold a meeting for any interested persons. We then spent 25-27 June exploring a portion of the Park that is heavily occupied by gold miners and talking to them. We initially hoped that the public meeting would be an opportunity to answer questions as well as to obtain opinions, but it was immediately obvious that it would be much more profitable to us and to the local participants if we restricted the activity to hearing opinions. Furthermore, as an outside commission, we were certainly not in a position to provide authoritative answers to the questions of most importance to the miners. The meeting was held in a dance hall in the center of town, and we used the dance band microphones and loudspeakers.

We opened the meeting at 8:30 pm (and closed it at 10:30 pm) with the firm statement that we were there to hear their opinions and would not attempt to answer their questions, argue with them or offer solutions. Initially, this disclaimer was not believed by the audience. The reader of this report should recall that the purpose of the meeting was to gain an understanding of the what the miners think or want the outside world to think, rather than to obtain facts about the miners or other aspects of the situation. Janzen opened with the statement that we wished to specifically hear their commentary on the following questions:

- a. What is the impact of the miners on the biology of the Park?
- b. Who are the miners, and what is your opinion of how many are there of you?
- c. What is your attitude about the eviction?
- d. What can you tell us about how to avoid your return to the Park after the eviction?

In contrast to the conversations that we held with miners in the Park both before and after this meeting, the members of the audience that were willing to speak did not attempt to reply to the above questions but rather each delivered a small oration that was often both dogmatic and ritualized. While most of the orations were commentaries on some aspect of the situation, several were rather explicit attacks on the Park, the Park's personnel in general, or the National Park Service. This resulted in the conspicuously painful situation that the Park Director, as a member of the commission, was forced to have this thrown at him without being allowed to reply. Equally, our three accompanying Park Rangers had to suffer the same indignity. However, all four of them weathered the event with excellent composure, and displayed the kind of measured response that is going to be both difficult and mandatory in the days to come when working in the community around the Park.

Who were the speakers? Three speakers were clearly men who are active and probably full-time modern gold miners (the actual location of their mines was not given). The remaining 11 speakers ranged from 2 unabashed opportunists who would clearly enjoy a central political

role representing the miners, to 2 long-term (30-years plus) residents of the southern Osa Peninsula. The latter had undoubtedly been serious gold miners at one time in their careers and identified themselves as "old time gold miners". However, both are major property owners outside of the Park and neither of them had the calluses and hardinesses we witnessed among the gold miners in the field. Who was the audience? Of the approximately 200 men, women and children, there were at least 40 men that had the physical appearance of hardened field workers. However, it is impossible to know how many were miners, and if miners, how many were miners in the Park. Strong applause followed each oration, and neither the speakers or the audience displayed the calm thoughtfulness that we encountered among miners in the Park.

Below we paraphrase the key statements made by the speakers and in the approximate order in which they appeared. The appropriate replies to most of them are obvious, and the members of the Park Service dealing with both the miners and the community around the Park at the time of the eviction and immediately after must be well armed with these replies. Again, as mentioned earlier, the goal is not to win in open debate, but rather to place the antagonist in a position where his/her own beliefs lead to (perhaps begrudging) acknowledgment of the legitimacy of the Park and its potential value to the community.

1. The destruction by gold mining is done by the mining companies, not by the individual miners (coligalleros); the gold miners do not hunt.
2. What exactly is Corcovado National Park, and what are its objectives?
3. The miners would be happy to cooperate with the Park if they are not thrown out of it.
4. Destruction (landslides, erosion) is a natural process, and what they are doing is no different.
5. Mining has little effect on erosion.
6. Miners produced more gold last year than did the companies.
7. The miners would welcome information on environmental education and on how to behave in the Park.
8. Can we have written information on what would be our responsibilities in the Park?
9. Gold miners do not destroy; if they cut trees, they also plant trees - cacao, avocados, citrus.
10. What do we (those in favor of the Park) want to see preserved in the Park?
11. By a person who identified himself as not a miner: I am very upset with the gold mining companies because they are the ones who do the damage, not the miners.
12. If they are asked to leave, they won't do it; what would the government do with them?
13. Asking the miners to leave will kill commerce and many other businesses; "If gold dies, towns such as this one will die".
14. What alternatives to mining in the Park does the government offer?

15. We have no other jobs than to be gold miners.
16. Mining laws are unfair because the gold miners have to pay taxes.
17. If the gold miners have to leave, please do not let the gold mining companies take over.
18. If mining is stopped, the area will have to be designated an "area of national emergency".
19. The gold miners were here before the Park and the Park was imposed on them; the farmers were compensated but the miners were not. When is the government going to look after the gold miners, to pay the gold miners?
20. The people who have been thrown out of the Park have been treated unfairly - they were thrown in jail, for example.
21. Can the Park Service provide information on how to behave in the Park and evidence that we are actually doing damage (and we say we are not doing damage).
22. The Park Service must organize meetings with the miners as a whole; the miners produce a lot of benefit for the country, and the miners maintain that they are responsible for the integrity of the community.
23. The Park Service should explain exactly what is going on.

Almost all persons who spoke mentioned that nobody disagrees with the idea of a Park; they clearly wanted to convey the impression that everybody likes the Park as long as they are not asked to leave; numerous speakers stated that they want to be part of the Park.

In considering the difference between these statements and what the gold miners in the Park say, it is important to bear in mind that it is hard for a gold miner to say he is doing nothing when he is standing next to his man-made landslide into a small stream. Likewise, when a gold miner has just told you that he left his job as an accountant in San Jose to become a hard rock tunnel miner and was reading a 4 cm thick philosophical treatise when you arrived, it is hard for him to argue that a) he is saving the national economy and b) that he has no other possibilities of employment.

If the opinions expressed in the public meeting in Puerto Jimenez can be taken as representative of those of the commercial establishment and the community surrounding the Park, then the community clearly favors continuing gold mining in the Park, is of the opinion that the miners do little or no damage in the Park, and believes that the gold that they produce far outweighs any value that the Park may have either for the local community or the country at large. There is also a clear sentiment that the Osa Peninsula has been quite forgotten about in the overall development plans of the country (and therefore the gold is their only salvation); however, we note that from the various plans and programs we heard about in the 1 July meeting in San Jose, the Osa Peninsula is no longer forgotten and is the explicit subject of concern of MINEPLAN, IDA, the Ministry of Mines and Energy, etc. This is also evidenced by the newly constructed highway from the Interamericana to the Rincón-Puerto Jimenez area.

Alternatives to eviction

It is the collective (and unanimous) opinion of this commission that there is no alternative to total eviction of the gold miners from Corcovado National Park. How its effects can be ameliorated and over what time scale the miners should be evicted constitutes a large part of the subject of this report. The reasons for our belief in eviction as the only option are simply that

1. knowingly or otherwise, the gold mining operations are destroying and maintaining in a destroyed condition a major portion of the Park's ecosystems over about one third of the area of the Park,
2. they are present through a history of governmental inaction in the face of the commonplace human desire to harvest a resource rather than through any particular humanitarian need that transcends the value to Costa Rica of its National Park System,
3. their presence legally and philosophically is clearly against various laws, laws that intend to protect the long term rights of a very large number of people against the individual resource harvest desires of a small number of people, and
4. while the eviction will undoubtedly cause substantial grief to some people, a basic human principle is that when a robbery is being committed, you stop it first, and then you may or may not worry about rehabilitation of the robber.

All intermediate plans that we can think of do not solve the damage to the Park, do not eliminate the precedent set by allowing destructive harvest of a National Park, and do not answer the legal/moral point of avoiding destruction of a system set aside for perpetuity. In the letters from concerned Park Rangers and other thinkers on the problems, resistance to miner eviction repeatedly takes two points as its moral base: that some of the miners are needy and that the miners do little or no harm to the Park. It is our opinion that the question of need is no more relevant than it is when someone steals your wallet, rustles your cattle or robs your bank. It is also very striking that those who plead need for the miners tend to place it next to a page on which a long list of discriminating traits makes it clear that only the morally upstanding middle-aged family men with large families qualify for the category of "needy" (e.g., report to Ugalde by a Park Ranger, Sr. Manuel Solis, May 1985). As for the question of damage to the Park, one has to be both unaware of the integrative aspects of tropical ecosystems and disinterested in aquatic systems to claim no damage by the miners.

The intermediate plan to which we gave the greatest amount of attention was in abruptly closing the Park and then allowing all officially registered miners to continue working until they wished to abandon their mine site, but not to permit them to change locations. This was abandoned on the basis that the patrolling effort would be enormous and probably ineffective, it

would not stop the sediment input into the streams for years to come, and amounts to setting up a National Park as a device for absorbing the unemployed at a very substantial cost to the Park. It also sets a very dangerous precedent for the imminent poaching of timber and whatever other harvestable resources a Costa Rican park is found to contain. For those who are thinking of such a plan of registered and controlled mining, and especially given some success in controlling placer miners in US National Parks or National Forests, it must be remembered that in Corcovado no mine is registered, there are no topographic surveys or maps on which they could be registered, and the life blood of this kind of mining is being able to move as one pleases, working a few days here and a few weeks there, until some local pocket of placer gold gives out or a storm buries your works under stream-born silt. We may also add that checking the permits and mining sites of 10-20 miners would be a full days work that would have to be repeated on a daily basis.

We also discussed the possibility of compensating the miners in the Park for their holdings, under the same spirit that a farmer is compensated (for having cut down the trees and planted pasture, etc.). However, if only those in the Park at a surprise instant are compensated, those who happen to be out on leave are very unfairly treated. There is also no way to compensate only those who were mining in the new part of the Park at the time of the amplification (1980), since they are not known (it is tempting to suggest that the true "old time" miners in the original Park area could be compensated if still there, but in fact there were more modern type miners working in the Los Chiles area as early as 1978 - Janzen slept in their houses). If there is advance warning, there will be a major rush into the Park in order to claim ownership to this or that hole in the riverbed. Since a mine base price might be 10,000 to 15,000 colones (\$200 as a round figure), a single sum compensation of this amount for perhaps 1000 miners (\$200,000) might not be considered as outrageous if it bought total peace, but it would not. Furthermore, the potential donors in the international community are likely to be much less interested in seeing such a sum go to bail out a four-year piece of inactivity/incompetence than to a major land purchase of pristine rainforest elsewhere in the country, or to serious preventative maintenance to avoid this kind of situation for any national park in Costa Rica. Any statement that the gold miners will be compensated for their holdings is simply false. Within the country there has never been any intention or interest in such compensation for miners (in contrast to the generally approved concept of compensation for the farmers). Compensation was never mentioned to us by the miners in the Park, while it is one of the first things mentioned with respect to farmers within the Park.

Several reports have suggested that the eviction be done in stages, rather than as one operation. However, the attempt to clear one sector while leaving others open to mining (to be later cleared), simply allows miners to move from one side of the Park to another as they

attempt to stay one step ahead of the eviction. Second, such a plan will greatly lengthen the amount of time that the Civil Guards will have to stay in the Park and that the entire Park Service will have to remain in a state of emergency. Third, the only thing that recommends it is that it makes the unpleasant task of eviction seem a little further away. It certainly will not mollify the miners or make them any more inclined to be cooperative with either the Park or the concept of a truly preserved national park.

Eviction

While several abortive attempts have been made to evict (desalojar, el desalojo) the miners from the Park in the past several years, and while the subject has been the object of much debate within the National Park Service for at least 5 years, only in the past year has an organized plan developed for an eviction of the miners (the first draft was by the previous Park Director, German Haug; the current plan was developed by Director Juan Carlos Romero in conjunction with an in-house committee; prior to this, Director Maria Elena Mora concentrated on negotiations and discussions with the miners at the time of and immediately following the amplification of the Park). As presently conceived, the plan consists of about 30-40 Park Rangers working together with 200 members of the Rural Guard (Guardia Rural) and sweeping through the Park from roughly the area of a Sirena-Los Patos axis up the various drainages and removing everyone encountered, by force if necessary (hopefully not). This eviction is to be preceded by about a two week warning, in order to allow the miners to leave voluntarily. Once the Park is free of miners, combined forces of Park Rangers and the Rural Guard would again sweep through the Park, destroying houses and mine workings. An ever-diminishing number of Civil Guards would remain in the Park for the following 1-3 months, during which fairly intensive patrolling will occur so as to locate returning and newly invading miners and remove them. Finally, the eviction is to be followed by greatly increased "presence" of the Park Guards along the eastern and southern Park boundaries (the interface with much of the rest of heavily occupied Osa Peninsula) and some sort of environmental education program aimed at the community outside of the Park. Had this plan been followed, the warning to leave would have been given about 1 June 1985 (preliminary warnings of the pending event were given in April-May 1985), but this date was postponed in order to obtain the present report.

At the time of the inspection tour, numerous miners had already heard of some form of the plan and seemed psychologically ready to be told to leave. Our brief overflight of the Park was interpreted by some as the first steps and they had already removed their pumps from inside the Park, and asked us if it was then alright to re-enter the Park and continue work. Likewise at the time of our inspection tour, about the only details seemingly in the way of carrying out the plan was uncertainty as to the amount and duration of the help to be given by the Rural Guard.

After having seen the situation, listened to all parties discuss the eviction, and thought about the capabilities of the Costa Rican Park Service and Rural Guard, and taking into account that we are some 8 months before the Presidential election, it is the considered opinion of this commission that the National Park Service in general and Corcovado National Park specifically is not at this instant prepared for the eviction. However, it also appears to us that much of what yet needs to be done could be done in 1-2 months, or if not, would require several years to carry out. In other words, a short delay is highly desirable in our opinion. Corcovado National Park,

the Costa Rican National Park Service and conservation biology in Costa Rica hang in the balance.

Below we discuss the eviction in detail, and make numerous suggestions with respect to it. Many of these suggestions are already floating in the sea of opinions within the Park Service, and some have been specifically recommended by internal working committees assigned to the problem. However, there has been no detailed analysis of the problem or realistic detailed operations plan ever drawn up. It is our hope that our commentary here and this report in general will serve as a catalyst for such analysis and such an operations plan, now.

Legality. There is abundant legal basis for eviction of the gold miners from Corcovado National Park. These have been summarized by the Park Service legal counsel (Ana Maria Tato, letter, 24 June 1985) and we paraphrase them below:

1. Article 100 of Law 4465 establishes the norm that any person who invades a national park or biological reserve will be sentenced to 6-24 months in prison or fined for 15-100 days (in Costa Rica, certain prison sentences can be exchanged for a set fine for each day).

2. Article 3 of paragraph 2 of Law 3763 (ratification of an international treaty for the protection of New World fauna, flora and natural beauty) prohibits the destruction of a national park.

3. Law 6794 (August 1982) ratifies Executive Decree No. 5357-A so as to include in article 10 the prohibition of the removal of rocks and sand from Corcovado National Park.

4. Section 7 of Article 8 of Law 6084 (24 August 1977) prohibits the collection or extraction of rocks, minerals, fossils or any other geological product from any Costa Rican national park; when the amplification of the Park occurred on 15 February, 1980 (Executive Order 11148-A), the decree explicitly states that the area under the amplification is covered by the same regulations as was the original Park area. The decree also states clearly that anyone mining on the Park boundaries must live outside of the Park, and stop their activities if they infringe on the normal maintenance of the Park.

5. Paragraph 2 of Article 8 of the Mining Code (Law 6797 of 4 October 1982) prohibits mining exploitation in areas declared national parks or biological reserves. This law also details prison sentences and fines for violations.

Discussions with relevant government officials. Corcovado National Park and the general surrounding community are under the jurisdiction of the officialdom of Golfito (there is a 6-7 person Rural Guard post in Puerto Jimenez, but it answers to Golfito). At the least, the senator, judges, alcaldes and municipal president of the districts of Golfito and the Peninsula de Osa must be not only notified of all the details well in advance, but their opinions and advice sought at the same time that the Park Service intensively educates them on the problem and why

the eviction is necessary. Not only will these persons be directly involved in rulings and opinions on events occurring during the eviction, but their support is essential during the subsequent attempts to maintain the Park free of gold miners through active presence and patrolling. To date, none of these people have been approached, queried or otherwise informed and advised directly of the situation, though some informal thought has been given to the idea of bringing some of them to the Park to see the situation.

The officer(s) in charge of the Rural Guard is a special case, since his assistance is an obvious requirement for a successful eviction and period immediately following. Recognizing the powerful importance of the chain of command in police and military affairs, it is obviously important that his superiors in San José are well informed and in full agreement with all major aspects of the operation. While such arrangements have apparently been made with some of the parties concerned, other vital arrangements have yet to be made. A start has occurred with a visit to the problem area by several officers of the Rural Guard from San José in late June, but given the potential for fragmentation of chains of command, much more must be done.

As will become evident below in the discussion of long-term maintenance of the Park free from human influence, many other government agencies are involved and must be kept informed from these early days onward (e.g., the Banco Central, the Instituto de Desarrollo Agrario, the Dirección Forestal, CATIE, the Ministry of Energy and Mines, the Ministry of Public Security, the National Parks Foundation, all other branches of the Ministry of Agriculture and Livestock, the Universidad de Costa Rica, the Universidad Nacional de Costa Rica, the Universidad Estatal a Distancia, key members of both of the large political parties, pertinent commercial enterprises, etc.). Many of these agencies have personnel and policies of enormous value to the Park Service in general and to this operation specifically; it is clear that conservation in Costa Rica has come about through many helping hands, and this is certainly a time to maximize the possibilities for help from outside the Park Service. Lack of information flow among relevant and interested parties will clearly impede the operation. Furthermore, secrecy in this operation is not needed or desired; the more accurate information is publically available, the harder it will be to start annoying rumors.

Advance warning to the miners and surrounding community. While it is clear that the miners must be advised well in advance of the eviction date, so as to minimize the number of conflicts between them and the Park and Civil Guards, this advance warning also introduces a number of complications that must be nullified but it is also part of the preparation time for the eviction.

1. A rumor is circulating that merchants in the Puerto Jimenez area are planning a truck blockade of the single road from the Interamerican Highway (the outside world) to Puerto

Jimenez. While such a blockade would be highly visible and subject the persons involved to direct governmental action, is the government willing to take such action? On the actual dates of the eviction, even a few days of road blockage could easily disrupt the entire operation and create an incident that might make an only mildly enthusiastic officer of the Rural Guard back out entirely.

2. With advance warning, local merchants could do much to cause there to be virtually no vehicular or horse transport for the miners leaving the area. The subsequent bottling up of both miners and opportunistic onlookers from the community in Puerto Jimenez could easily lead to crowd sizes and attitudes very conducive to rioting or semi-organized confrontations with the Park Guards and Civil Guards. This situation not only emphasizes the importance of insuring transport out of the area, but in setting up temporary sleeping shelters a goodly distance from Puerto Jimenez (can the Red Cross be useful in this context)? In addition to making a very difficult situation at the time, this is hardly the way to begin a long term *integration* of Corcovado National Park with the minds and economics of the community of the Osa Peninsula.

3. The Rural Guard is talking seriously of placing police checkpoints at the traditional areas of exit from the Park, and checking the identifications of all those leaving the Park. While we can understand their interest in this side-benefit to them, we feel that it would be inadvisable. With the advance warning, anyone with a truly questionable record will have long since left the Park, and such checkpoints will be ineffective yet be a severe nuisance that will simply increase even further the resentment by the miners. This plan must be abandoned in favor of gentle, friendly and cooperative eviction of the miners. The last thing the Park needs is to have the eviction of the miners be viewed by the populace as a whole as simply an elaborate excuse to check the papers of a large body of relatively independent people.

4. During the period of advance warning, the same offers of transport to distant parts of Costa Rica for the miners (see below) must be made and be available without fail. Truck or bus transport must be available every several days to move persons to central points such as Golfito, Palmar, Sierpe, Buenos Aires, San Isidro and San Jose. Such transport must leave at least from Dos Brazos, Agujas, and the junction of the Río Rincón and Río Pavón (the latter site will require about 1 day of bulldozer work to clean up the road so that a large truck can reach this point); it is not reasonable to expect a miner to transport several hundred kilos of mining gear and personal belongings from the Park boundary to Puerto Jimenez, in order to use the regular transport. Likewise, where the terrain permits, packhorses should be made available to aid in removal of mining equipment and personal belongings. Additionally, storage facilities must be arranged whereby a person can leave his personal gear while making return trips without fear of it being stolen. It would likewise be very functional to convince some merchant who could use large amounts of used irrigation tubing to purchase what the miners have at a lowered price (see

below); the same applies to shovels and other tools. While such help in transport, might appear to be purely humanitarian, in fact it is necessary to minimize excuses for failing to leave the Park during the pre-eviction period and in maximizing the difficulty of returning. Every voluntary exit to a distant point is one less potential conflict and one less person who can be recruited by someone who wishes to be difficult.

5. The concept of advance warning is irreconcilably tied up with the question of compensation for mines. The miners are paying a price for being relatively mobile. If each miner had a long-term location, as did the farm owners, then compensation could be fairly reliably assigned, but it would be virtually impossible to do anything but make an instantaneous sweep through the Park and compensate those at a site at the moment. The impossibility and unfairness of this is obvious. If there is to be any compensation, it cannot be done through some kind of on the spot payment or credit system to individuals, or there will be a mass migration into the Park to take advantage of the offer. Instead, it is our opinion that any compensation should be in the form of generalized services that benefit all those that wish to take advantage of them (e.g., transport out of and away from the Park, specific efforts to relocate specific individuals such as "old time miners," efforts to aid rapid economic development of the general area, community education, and other services to be discussed below).

We cannot even see a practical way to identify miners as "refugees from Corcovado", thereby giving them, for example, priority in hiring in forestry development schemes planned for the area. If identification tags (carnets) are given to those that leave voluntarily, then there will be a mass migration to get into the Park in order to flee from the Park and obtain a refugee tag. If identification tags are given just to those that have to be forcibly evicted, then one is offering inducement to stay in the Park until forcibly removed, and rewarding the most recalcitrant of the miners as well.

6. It is evident that the period of advance warning is going to be a period of intense noise and argument from the miners and even more so from the community in general. This is a time when, irrespective of how unpleasant for the Park service, its best and gentlest interactors with members of the community must be continuously available in the community and the Park to answer questions and talk to individuals and groups. The questions will be highly repetitive, aggressive, and designed to generate fear and confusion. The questioners will never appear to give in. Needless to say, the real audience is the listeners to the side; almost invariably the intensive and aggressive questioners will be those that are going to lose something other than a gold mine in the Park; they will be merchants, landowners, politicians-to-be, etc. If there is ever a time for saturation presence of the Park Service in the southern and central portion of the Osa Peninsula, this is it. Winning the hearts and minds, or at least winning the moderate respect of relatively poor peoples from whom one is taking jobs and among whom one is

increasing competitive pressures, is no easy task and not something to be left to a few volunteers on vacation leave from the Park Service office in San Jose. While it is very pleasant to see that certain individuals within the Park Service have so volunteered, a much greater effort is needed.

7. The advance warning period, as well as all available time at present before it, must be a period of intense physical activity so as to dramatically increase the presence of the Park on the land it holds. Yes, there are rivers as boundaries and where not, there are 5 m wide somewhat overgrown lanes cut through the forest along the boundaries. Yes, every miner knows where the Park boundary is in the area where he works (although we encountered two miners outside of the Park who thought they were inside). But no, the Park does not present itself as a distinctive entity, as well owned and distinctive as any large private farm. For example, there is not a single identification sign on the boundaries of the Park (except for a few artsy rustic signs on the beach). There are no road signs or other kinds of large graphic signs on the roads approaching the Park, roads traversed by virtually every gold miner in the Park. There are no elaborating signs at its boundaries about what cannot be done in a Park and what is the function of a Park. There are no trail markers or trail map signs. No maps are for sale of the Park or its trail systems. There are no propagandizing signs about the Park on any commercial establishment in the entire community surrounding the Park. There has never been a public lecture, slide show or series of any other kind of presentation ever given about the Park to the community around the Park. The Park guards still do not have conspicuous uniforms with official seals embroidered on them; yes, they are in the making, but since the guards have to pay for them (at the cost of the cloth) one can imagine that they will be poorly represented among individual wardrobes and rarely replaced when damaged.

The above litany is not meant to damn the Park Service, but rather to identify those areas that conspicuously need attention if the Park is to ever be integrated into the emotional and intellectual community that surrounds it (and has been marching inexorably up to it during the past 10 years). Many of these things can be rectified in just 1-2 months of intensive activity before the eviction. Most of these things simply did not seem very relevant to Park development when the Park was focused on Sirena and the biological tourists and researchers using that site.

8) It is evident that the Park Rangers come from a wide variety of backgrounds, but they have all been explicitly and implicitly indoctrinated with the concept of protecting the Park. In this society, as in others, this makes them de-facto policemen. As such, some tend to take on the stereotyped behaviors of policemen as viewed in newspapers, television, movies and the Costa Rican street. In great part, this is not the kind of Park Ranger needed now or in the future. At the very least, all the Park Rangers to be involved directly or indirectly in the eviction should receive an intense short course and practice session in gentle and manipulative psychological

responses to crowds, isolated drunks or other out-of-control individuals, harassed individuals with their backs to the wall and nothing to lose, fathers with families watching their performance, older individuals attempting to hold together a coterie of apprentices, etc. Demand a cedula and you have a potential fight on your hands if it is not in his pocket; ask if the person owns one, and if he does not produce it, ask him to go get it, and you have a potential evictee. The goal is peaceful eviction, not "saving face" or punishing trespassers. It is our experience that within a group of "country-folk" Costa Ricans there are generally a number of psychologically wise people on the subject of inter-personal relationships. We are certain that there are some within the National Park Service. Put them to work.

While it is going to take far longer than 1-2 months to develop the Park-community interaction to where it will permit and sustain the Park's upcoming efforts at keeping out the gold miners (and other kinds of interlopers) through patrolling, enormous strides forward can be taken in the initial steps, even with a seemingly unreceptive audience. Its called pressing the flesh, and this is the time for it, if there ever was. In this game, sincerity is measured in great part by the amount of effort put into the show, even where the propaganda is obvious.

Location of the ranger stations and the central Park Administration.

At present there are three ranger stations in what might be termed the most critical regions - Los Patos (near the confluence of the Río Rincón and the Río Pavón), Dos Brazos de Río Tigre, and Madrigal. I will discuss each in turn.

Los Patos. It is located in a fantastic site for a deep rainforest biological research station, and is a very fine building for living in, but the Los Patos station is essentially functionless for the purposes of both the eviction and subsequent effective presence on the Park boundaries and nearby regions that are rich in gold-bearing streams (Río Niño, Río Termo, Río Rincón, etc.). This opinion has also been stated firmly by internal reports of the Park Service. Current park plans are to move this building to the site of Roxana's old house (Cerro de Oro, or Cerro Degro on the official topographic map), which is in the Park but across the Río Rincón from Roxana's new pulperia. We suggest that instead, the Los Patos station be left intact, patrolling functions be immediately moved to Roxana's old house (fix it up after occupation as need be), and rent a small amount of building space (or build it) at the junction of the Río Rincón and Río Pavón. Yes, sometime in the future a fine new building would be highly appropriate for the site of Roxana's old house, but for the time being the combination of that and a bit of rented space will serve quite well.

Dos Brazos del Río Tigre. While located in a good pasture site and next to a (usually) passable road to Puerto Jimenez, this new prefab building is lethally far from the action. It is a solid hour's walk from the building to the Park boundary, and up a wicked 200 m climb as well (El

Pegón). It is imperative that this building be continually supplemented with a Toyota pickup truck for transport to Puerto Jimenez and to the end of the road before beginning the long hike to the Park boundary, and that it be additionally supplemented by a major Park Guard encampment at La Bonanza or La Torre, two major gold mining centers just inside the Park boundaries. These encampments can obviously be built now, and should be side by side with the miners who are to be removed from the site. At some later time, the Dos Brazos building obviously has to be moved to a site right on the Park boundary or just inside (e.g., La Torre), but that is not imperative at the moment. Additional funds must be spent on the manual labor of turning El Pegón from a slippery chute to a reasonable facsimile of several hundred stairsteps (the same applies to the vertical climb into the Park from the junction of Quebrada Piedras Blancas and the left branch of the Rio Tigre, a site where the Park service correctly wishes to make a small Ranger post).

Madrigal. Plans have been made and the site selected to build a new ranger station at the mouth of Quebrada La Leona, the point of intersection of the Park boundary with the seashore. However, it will be months before this can occur. In the meantime, we strongly recommend that temporary quarters be erected at the site, since the 1 hour walk from the Madrigal station to the Park boundary renders the Madrigal station totally ineffective for any patrolling or surveillance activities at the Park boundary.

Other sites.

In addition to the above well known sites, it is our opinion that at least three other smaller stations need to be operative during and immediately after the eviction. The degree to which they need to be maintained in later years can be determined at that time.

Where the Río Agujas leaves the Park, either near the company gold mining compound or perhaps better, near or on Finca Alegre owned by Gerardo Vega and adjoining the Park about midway between Roxana's general store and Dos Brazos. Vega has volunteered the use of his house there in emergency, but a temporary station for Park guards could be quickly built without difficulty.

Where the Quebrada Piedras Blancas joins the left branch of the Río Tigre, just as both of them leave the Park. This point is midway between Dos Brazos and Finca Villalobos which already exists in the form of one of the recently purchased farms (with farmhouse) high over the upper reaches of the Quebrada Piedras Blancas.

Finca Villalobos, which is the natural take-off point to walk down to Carate from the south central portion of the Park boundary. This farmhouse is already in place and an excellent house site, with fruit trees, running water and sunny pastures. It is also accessible by horse trail to a well-established large farm (Guillermo Jimenez Calderon) outside of the Park on the Quebrada

Piedras Blancas.

Improvements to existing and immediately future ranger stations.

Certain changes must occur in the stations along the Park boundaries before the eviction:

1. There must be reliable radio communication among them and with the outside world.

While in theory the portable radio carried on our inspection tour can reach all over Costa Rica, in fact it was not even able to call the Park administration building at Sirena. The problem is that the highly dissected terrain places one often at the bottom of steep-sided valleys where this kind of communication just does not work unless there is a repeater station somewhere in the vicinity. During this time of potential crises it is imperative that radio systems known to function are operative along the Park boundaries, even if the system has to be on loan from some other government agency for several months after the eviction.

2. There are certain trails that are essential to the success of the eviction, but some of these are extremely difficult to traverse because of damage done by passage of pack and ridden horses. It is apparently impossible to prohibit the entrance of these horses at present (a. right of way problems (servidumbre) across the Park in the case of the trail from the upper Quebrada Piedras Blancas to Dos Brazos; b. entrance by horseback traders from Roxana's pulperia at Cerro de Oro, under the threat that if they are not allowed to sell meat in the Park, the miners will turn to hunting). Several months is not enough time for trails to naturally recuperate even if horses are prohibited. An obvious solution is to put local people (gold miners?) to work making foot trails that are parallel to those that are currently best described as ankle to mid-calf deep grooves of liquid mud. On several of the steeper trails, a crew of 2-3 or three working with shovels could also vastly improve the steps.

3. Food and firewood stores must be established at the various ranger stations so that no time and energy is spent on provisioning logistics during the first couple of weeks after the eviction.

4. All members of the Park service to be involved in the operation should be spending several weeks hiking the relevant trail systems so as to not only know how to get where fast and how at night, but also so as to understand how long and how much effort it will take for them personally. During this time, needless to say, the presence of the Park personnel can be made maximally conspicuous and it is an excellent time to be communicating patiently with the miners to answer the same kinds of questions that other Park personnel will be answering in the community around the Park.

5. The temporary ranger stations should be made physically secure so that the guards can rest comfortably at night and in heavy rain. While we feel that military security offered to the Park guards by any kind of building is illusory, we also recognize that a sense of freedom from the elements and "the enemy" can be very important in maintaining morale. On the other hand,

it is obvious that senior Park personnel have a major task on their hands to bring younger members of the Park Service to realize that this is neither a Hollywood war movie nor a situation that is best resolved through physical conflict. In the same vein, there is a strong tendency among Park Rangers in all Costa Rican parks to strongly avoid working as solitary individuals; substantial improvements in efficiency of manpower use could come about through some psychological effort in the direction of removing the substantial fear of the dark and of "dangerous animals" that occupies the minds of many of the younger Park Rangers.

Support from Puerto Jimenez

The medical system at Puerto Jimenez must be prepared for the increased medical load that will result from the eviction, if in nothing more than snakebite cases and a pulse of sick individuals that have here-to-fore decided to just wait it out in the forest. Of like manner, it is imperative that the eviction occur at the beginning of a long string of working days, with no holidays and a minimum of weekends. As our inspection tour discovered in a several hour wait on the airstrip, the planes customarily used for charter service to Puerto Jimenez and Sirena (current Park Headquarters) tend to be repaired on the spot rather than the subject of intense preventative maintenance; tests of actual flight performance by the planes to be in use would probably be a wise investment.

Aid from the Rural Guard.

The actual eviction and intense patrolling of the Park for several months afterwards are beyond the manpower capabilities of the Park Service in general and Corcovado specifically. The eviction cannot occur without the aid of several hundred members of the Rural Guard (or other government agency). Without their aid, removal of the gold miners from the Park will be a several year project that while probably feasible, will be very expensive in manpower and material resources - and these will have to be expended at a level of sophisticated coordination not possible at present or in the immediate future within the National Park Service. While guaranteed aid from the Rural Guard may sound simple and straightforward, in fact it will require considerably more negotiation and firm commitments than at present have occurred. The primary variables are the following:

1. We are approximately 8 months before the next Presidential election in Costa Rica, and the government has the power to withdraw the Rural Guard from any activity during this time and put it to work on matters pertaining to keeping the election orderly and honest.
2. Given the problems on Costa Rica's northern border, a national emergency could drop on the eviction at any moment; plans must be made for this event.

3. The upper level commanding officers of the Rural Guard (Ministerio de Gobernación y Policía) are political appointees, rather than civil servants, and therefore automatically subject to political interests. Some of them may find it very convenient to withdraw Rural Guard support of the eviction in order to calm an outcry that may be used by political opponents.

4. Although San Jose officials may decide that the Rural Guard will help in the eviction, regional officers may choose to disregard this decision (depending on its firmness) if the eviction turns out to be embarrassing to them. For example, one intermediate-level officer has threatened to immediately withdraw the Rural Guard if there is any violence (violence being undefined in this case).

5. The Rural Guard has a unit of some 30 men that are specially trained for rural evictions. Their officers have visited Corcovado in June and feel that the eviction can be carried out with little difficulty. However, they have also pointed out that their men are trained to move things right along and to destroy house sites, etc. as they remove the evictees. This difference in approach, which can make a critical difference in the miner's responses, is obviously something that has to be straightened out if the Park Service is to maintain a reputation of being maximally humanitarian in protecting the Park.

6. As mentioned earlier, it is imperative that the eviction not become synonymous with a gigantic police identity check. As such, agreements will have to be worked out to the effect that the police or Rural Guard units understand that their function is to aid the Park Service in this eviction, even if it means passing up certain other opportunities. When discussing these plans with members of the Rural Guard, it was repeatedly stressed that junior officers felt that they had to have multiple reasons for the Rural Guard to stay for several months ("because they are not accustomed to such a long stay on one project"), such as labeling a portion of the operation a training course in jungle survival and imagining that they are sweeping the area for foreign mercenaries. It is imperative that such officers be assured that they do not have to fabricate such rationalizations, but rather that the operation is in itself a legitimate expenditure of time and effort, and that the goal of thoroughly and peacefully removing humans from a national park is a worthy one. There is even discussion of the guards having to kill animals for food during their "course in jungle survival"; it is obvious that a national park cannot be used for this portion of such a course, and even more so not at a time when the purpose of the eviction is to eliminate human impact. Incidentally, should the rural guard really wish to have training in the food aspects of "jungle survival", we suspect that there are members of the community of field biologists studying in Costa Rican parks and reserves that could be very valuable members of the training cadre.

7. The eviction is dependent on government officials to close the various sources of alcoholic beverages for several days before the eviction, during it, and several days after. This will of

course make an immediate negative impact on the relevant merchants, an impact that deserves considerable thought by the the Rural Guards and Park Rangers as to how to ameliorate it.

8. Let us say that a contingent of Rural Guards and several Park Rangers move up (or down) a particular river system within the Park and in the process accumulate a small crowd of some 10 miners with a few family members and a lot of personal belongings (probably more than the miners can carry). Just how is this group going to move over extremely muddy and steep footpaths at any rate other than a snail's pace, effectively tying up all of that set of Guards for 1-2 days while they move along? This is not a set of POW's (prisoners of war) being goaded down a wide dirt road by cloutish soldiers with submachine guns. These details require considerable discussion with a receptive Rural Guard, and perhaps even a bit of practice. It is one thing for an officer to proudly state that his men can clear this or that drainage in x days, and quite another to know that they actually can do it without physical conflict. It has to be made abundantly clear to the Rural Guard that much more hangs in the balance than whether they have a few nasty things said about them in a San Jose newspaper. The evacuation cannot be viewed as a training ground, a large experiment with only a certain moderate chance of success.

9. The combined Park Rangers and Rural Guards must have a clearer concept of their legal rights with respect to the dwellings of the gold miners. The Park Director (Juan Carlos Romero) is of the opinion that they cannot obtain a generalized judiciary document that legalizes the entry of any unspecified house when the miners are there, so as to evict the miners. He believes that a separate order, specifically identifying the person and dwelling, is required for each miner. If this is the case, much of the eviction could easily be thwarted by clever gold miners. The spectre of Guards impatiently waiting for days outside of a miners house for him to step outside comes to mind as part of the comedy. On the other hand, the Rural Guard is of the opinion that this is not a problem and that they can evict as they please. Binding legal advice is obviously necessary. Once the miners are out of the Park, the Park Director is of the opinion that he can legally confiscate and destroy the dwellings and mine workings.

Preparation and response of the National Park Service.

As stressed in the Introduction to this report, the eviction of the gold miners from Corcovado followed by the return of the Park to a miner-free regenerating/pristine condition is the single largest crisis that has yet faced the Costa Rican National Park Service. Put simply, if the Park service cannot mobilize the laws and attitudes of Costa Rica to protect Corcovado from gold miners, they have simultaneously demonstrated the futility of further conservation efforts in Costa Rica; international support, as well as internal support, will go elsewhere and the largest successful program in tropical conservation biology will die. It follows from this, as well as from the obvious fact that much of the problem stems from inactivity on the part of the National Park Service during the past four years, that it is imperative for the National Park Service to

apply virtually all of its resources to the problem for the several months until it is clearly past the crisis level and into what might be termed an active management phase. If the National Park Service is not willing to apply all of itself to the problem, how can one expect more peripheral agencies to make a special effort to help, to say nothing of the hundreds of people who are going to have their lives, hopes and futures seriously strained by the eviction?

In view of this, the commission has a number of seemingly drastic but extremely important suggestions with respect to the Costa Rican National Park Service as a whole with respect to the evacuation. Again, some of these have been discussed and favorably received within the Park Service, but we have not been left with a feeling that the Park Service as a whole shares our sense of extreme emergency.

1. Immediately declare a widely publicized state of emergency, with the stated intent of freeing virtually all personnel and funds for this operation. If there are other immediate truly unavoidable crises operating at the moment assign a specific small team of people to hold that situation static, and emphasize to all protagonists that when the Corcovado situation has calmed down, a substantial force of (now) more experienced Park Service staff will be unleashed on the other crises.

2. The state of emergency should involve cancelation of all in-house courses and attendance at courses outside of the country. All usual vacation or other kinds of leave should be made optional, with the personnel that remain at work being compensated as usual for the time involved. Persons with particular experience in the zone (e.g., Park personnel with previous experience in Corcovado) should be encouraged to cancel their official vacations or leave-taking, and allowed to accumulate the free time for later longer vacations.

3. The state of emergency should involve closing of the other Costa Rican National Parks to all except quite self-sufficient researchers who can argue on a case by case basis that 1) they will not require Park services and 2) interruption of their research would destroy significant continuity of studies in progress. A skeleton crew should be left at the various Parks only for essential maintenance and patrolling where deemed especially necessary. There may well be numerous cases where Park personnel can be temporarily traded among other Parks so as to free up a maximum number of a certain kind of Park Rangers for temporary use in Corcovado, Park rangers that are especially competent in harsh field circumstances, mature in their ability to deal with potentially explosive human interactions, and experienced with hot lowland habitats like those of Corcovado National Park. In virtually all cases, the park directors from other parks should be on hand in Corcovado as second-in-command to the operation director (and be equally knowledgeable about the operation); it is imperative that all this does not fall apart when the Park Director is struck by a fer-d'lance on the second day of the eviction.

It should be stressed that closing the parks is more than a simple attention-getting activity.

It is highly symbolic of what is going to happen over the upcoming several decades if the National Park Service cannot use the laws and attitudes of the country to protect the parks that it already has. Corcovado was closed to tour groups and courses on 15 May 1985 at the request of the Park Director so that all his personnel are free for the eviction and its planning. We need also to stress that the Park Service, in the best of times, operates with numbers of field personnel well below the minimum that are required just to hold conditions static. It is evident to us that part of the "inactivity" on the part of the Park Service that has led to the current condition in the southern third of the Park is simply an overall extreme shortage of personnel. Even under the current emergency (with numerous positions already borrowed from other parks for Corcovado), the total Park staff is 40 persons, about 2/3 of which are on active duty on any given day. Considering that virtually all patrolling is on foot and therefore very time consuming, and considering that we are talking of protecting 43,000 hectares from quite literally hundreds of persons who would like to harvest something from the Park at any given moment, the staff of 40 is absurdly low. There are two obvious solutions. Raise the overall number of field positions available to problematical parks like Corcovado (and train those rangers to work independently), and concentrate on those community relations that will someday result in almost no patrolling being necessary to counter explicit encroachment.

4. The state of emergency requires members of the main administrative office to sit down and fight among each other until all are agreed on what is to occur before a single major step is taken. If a person simply cannot force himself or herself to abide by the general view for the purposes of this crises, then he or she should temporarily step down from a position of authority and either take a vacation, or handle some other productive post. This is not a time for petty in-house powerplays, jealousies, court intrigue, or simple stubbornness. If you cannot convince your associates of your position, then agree to disagree and stop trying to sabotage the Park Service. It has already been clear during a number of the in-house committee meetings on the subject of Corcovado that certain members of the San Jose main office "do not believe in having an eviction"; when pressed however, they have no alternative plan. Such forces obviously have the potential to destroy or greatly impede whatever final plan the Park Service decides on, and have to be nullified before any steps are taken.

5. The state of emergency will not be properly developed by simply moving all able-bodied persons to Corcovado for the eviction. However, it will free up people from their routine duties in San Jose and other parks to work at developing links between the Park Service and the other relevant institutions (private as well as public) within the greater San Jose community, and to work in the community surrounding the Park. While it has already been suggested by an in-house report that the various Ranger/Guides in various Costa Rican parks are obvious candidates for this type of public relation activities, it is also clear that the older and more

experienced members of the National Park Service staff, irrespective of their official titles, would be appropriate. Incidentally, this is also the time for all those members of the conservation-education community in Costa Rica, whether associated with the National Park Service, UNED, CATIE, UN, free-lance or whatever, to demonstrate that they really can produce a focused product to meet a specific and highly pertinent demand rather than just those pretty (and useful) folders or audio-visual shows on fascinating rainforest beasts.

6. The Director of the Park Service has a very special role to play in all of this. It is clear that he has the ability and inclination to use personal persuasion as a major weapon in conflicts over the Costa Rican parks. It is a chronic disease of Costa Rican park establishment that the actual cash to purchase expropriated farms often appears much later than does the decree or request to cease farming, hunting and logging. The Director has proven very effective in personally persuading farmers to be patient with the system and thereby keep the situation in some kind of relatively static equilibrium until funds are found or released. In the case of the eviction, it appears to us that his personal presence as mediator and persuader will be of very great value in the community surrounding Corcovado, with special reference to two situations. First, there are guaranteed to be disgruntled miners. Personal conversations with a person in confident yet gentle control will be an essential tool for both calming their anger and convincing them that the "other side" is not just a bunch of sleezy right-wing politicians trying to steal Corcovado from the Costa Ricans. Second, there are the powerful central members of the gold miner community outside of the Park (e.g., Felix Avellán). As mentioned elsewhere, powerful members of the conservation community need to meet seriously with such people, with the aim of making it quite clear that in the long run, they, as well as the entire community, will benefit far more from a thriving living Corcovado National Park than from a batch of washed out muddy ditches down steep hillsides and silt — rich lowland rivers.

7. It is imperative that the central office designate (or locate outside of the Park Service) a team of 3 persons whose full-time task it is to document virtually everything that happens, be a source of report and factual information for the press and TV as well as those explicitly carrying out the eviction, and write up a documentary book on the aftermath. They must have access to a high grade xerox machine (not the one in the office), round the clock access to a word-processor, and 24-hour national and international telephone access. There must be a well-publicized hot-line telephone number where concerned citizens can get information on what is happening.

After the eviction

An enormous amount of confidence, resources, effort and grief will go into the eviction. If the aftermath is a simple or complex re-invasion of the Park for gold now, or in later years for the timber and land that the Park contains, the disaster will be even greater than a failure of the eviction at present. Here the commission concerns itself with parts of the social ecosystem that might appear above and beyond the scope of the gold miner problem in the southern third of the Park, yet are in fact central and critical to the survival of Corcovado (and by analogy, the remainder of the Costa Rican national park system).

Interactions among government agencies.

It is obvious that to date the National Park Service has not immersed itself in the planning activities of the other agencies involved in the planning and carrying out of the economic development of the Osa Peninsula. Recently, the first step was taken in the formation of an inter-agency committee, but this committee's activities are in their infancy and bear the marks of being close to going the way of all such inter-agency committees that are formed with good intentions but having no focal driving force or cause of common interest to many agencies. It is the responsibility of the National Park service to make the other government agencies abundantly aware of what Corcovado National Park offers the Osa Peninsula specifically as well as the country as a whole. For example, the Park Service wants the Banco Central to stand up and state firmly to the Puerto Jimenez community at large that a) only one quarter of the gold (equal to half a million dollars per year) bought by the Bank in Puerto Jimenez comes from the Park, and b) the Banco Central does not see the gold from Corcovado as being of sufficient importance to Costa Rica's economy to be worth the sacrifice of Corcovado (and hence the Park Service). In return, the National Park service has to provide the Banco Central with factual propogands such as a) research and scientific tourism associated with Corcovado alone bring a million dollars per year to Costa Rica (calculation by Mr. Michael Kayne, Costa Rica Expeditions) and b) in the long run the tourist opportunities for Puerto Jimenez with the Park as a major attraction will mean much more for the long-term development of Puerto Jimenez and its environs than will a bunch of miners buying groceries and booze in local pulperias.

The Park Service must be aggressive in selling its value on such matters, rather than wait for the more direct and obvious human service agencies to come knocking on the door. We heard in the 1 July meeting that IDA and MIDEPLAN are eagerly looking forward to hearing whether a European group will begin to develop a huge tract of Forest Reserve off the northeastern corner of Corcovado into a sustained yield forest management system. There is the obvious opportunity for the Park system to ask its biologists and its biologist friends both what sorts of resources

does the Park itself offer such a program, and what sorts of expertise can the National Park Service coerce into being cooperatively involved in the program. Seeds of native trees for planting come to mind immediately for the first part of the opportunity, and the flood of plant ecologists working as esoteric biologists in the country's Parks and Reserves come to mind for the second half of the program.

Along similar lines, the eviction is going to be putting numerous people out of work (or at least they predict it will), people who are very much at home in living in the forest on meager resources, forest of the very type that the plan mentioned above plans to manage. Parks could play an obvious humanitarian role by attempting to maintain register contact with such people, and thus be in contact with a highly acclimatized labor pool ~~that~~ should be of much greater value to such a management plan than people selected from the unemployed of San Jose and other highland areas. No, the Park Service cannot promise the evacuated full-time miner a job, but the Park Service can play an aggressive role in maximizing the chance that such a miner finds a different kind of forest employment, thereby minimizing the chance that he will be tempted to try to slip by the Park Rangers 6 months or a year from now. As will be emphasized below, while the National Park service obviously cannot feel that its job is to find employment for Costa Rica's rural unemployed, it is very much to the Park Service's advantage to lend maximum ideas and moral support to plans that will stabilize local rural economies in such a manner that a national park is not viewed as wild land to be colonized for the harvest of gold, timber, land or whatever. That is to say, if State-owned Forest Reserves are up for grabs to the more ambitious and daring colonist (as they are in much of Costa Rica today), it is and will become increasingly difficult to maintain the opposite for equally unoccupied and valuable national park terrain. Instead of sitting around and bitching about how weak and ineffectual the Forest Service and the Wildlife Service appear to be, offer all possible help and support to them.

Many government agencies do have partial to on-going plans with respect to the overall economic development of the Osa Peninsula. However, there is no central office or point where all of these plans can be viewed and discussed. Furthermore, few if any government agencies have a clear idea of the value (cash and moral input) that a properly functioning large and internationally known National Park can bring to the local community. It is up the Park service to lay out its plans for the tourist and other development of Corcovado in such a manner that is obvious to relevant government agencies as well as to the community at large just what a resource it is, and how it can make gold mining appear really quite trivial. Yes, all this will take time, but then again, I suspect that most everybody concerned will realize that regional development does not happen overnight - but mapping out the routes can happen virtually overnight.

Upon hearing a) how relevant is regional development to solving the gold mining problem in

Corcovado, and b) that many agencies are just now gearing up to have at it, it is tempting to respond with the comment that we have to leave the eviction until the overall situation on the Osa Peninsula is much bettered. In such a wait we are talking of several to many years, and these are years that cannot tolerate the ever greater accumulation of irreversible destruction of the Park and feeling of tenancy by the people in the Park. This is a country where increased duration of illegal occupancy leads steadily to increased legitimacy of that occupancy.

Specific interactions with the legal system.

The laws dealing specifically with persons who are found gold mining, hunting or pursuing other destructive or harvest activities within the Park require some specific modifications before they will permit high quality patrolling of a place as large and inaccessible as is Corcovado National Park. At present, a person mining or hunting in the Park is committing a simple misdemeanor and subject only to a modest fine (and confiscation of tools). For the crime to be a felony and therefore have real penalties, not only does gold or game have to be found on the person and confiscated, but even a highly illegal mining pump has to be taken in to the judge as proof. What has to be developed by the legal system is that mining is mining and hunting is hunting, irrespective of how successful was the quest, or how clever was the person at acquiring the booty. A bank robbery is a bank robbery, whether the vault was empty or full when blown open. If a miner has worked hard for several days to get a heavy mining pump or several hundred meters of pipe deep into the Park, it should not be up to the Park Ranger to have to drag them out to Golfito to get a conviction. If the legal system decides that a Park Ranger's word cannot be taken as to whether a person was a gold miner or a tourist passing through the Park, then indeed all the patrolling will be largely ineffective. A person does the same amount of damage to the Park in washing two tons of soil into a creek irrespective of whether he finds any gold. Likewise, the damage to the Park is the same whether the person is a ranch owner out for a weekend adventure or whether the person is an out-of-work banana company prior employee; it is the judge's job to decide on the size of the fine, but the Park ranger must have the authority to label the act as criminal without having to additionally play games with the lawbreaker or serve as his packhorse.

Does gold make it different?

There is a widespread opinion among Park Service members, and among conservationists in Costa Rica as well, that Corcovado is a very special case because of the traditionally high value of gold, the adventure in obtaining it, its inanimate nature, the inaccessibility of Corcovado, the rapid rise in the international value of gold during the past 5 years, etc. It is the opinion of the commission that this opinion is shortsighted and basically incorrect. While gold is obviously

valuable and there is much of it in Corcovado, in a very short time it will be the trees in Corcovado that will be the bulk item of enormous value. Later it will come to be threats of severe pesticide contamination, weather changes from deforestation, acid rain, etc. For example, a very rough estimate of the current value of the timber standing in Corcovado National Park is \$100,000,000.00 (Dr. Gary Hartshorn, Tropical Science Center). At current rates of gold extraction, it will take 200 years to extract that much gold out of Corcovado, and the accessible gold will have been exhausted long before that time. It is likely that Costa Rica's standing wild timber reserves will be virtually non-existent within 20-30 years time, and there is no substantial plantation or other kind of re-timbering program that will fill the need. It is easy to predict major importation of timber, heavy changes toward stone-based material for construction, and skyrocketing values of wild rainforest hardwoods, such as are currently prominent in Corcovado, are being harvested daily from the forest reserves around Corcovado (e.g., Esquinas), and being used as marvelous sources of fuelwood when not sold as timber. A nszareno (Peltogyne purpurea) log worth \$200 at the roadside at the head of the Golfo Dulce is worth \$1000-1500 in San Jose, and may be worth ten times that if delivered to Scandinavia or New York. Put most simply, timber is the next gold in Corcovado and land follows that. If a methodology and mind-set for selling and protecting the Park as an intact living natural jewel in Costa Rica's treasure chest is not developed NOW under the current crisis, not only will there be only a very flawed jewel to sell the public, but the audience of skeptics will be much larger than is the Puerto Jimenez-Corcovado community. And of course it is not just Corcovado. Santa Rosa National Park is under severe threat from agricultural chemicals carried by rainwater runoff. Chirripo is under severe annual threat from fire, and Amistad will be under threat from farmers if those there cannot be compensated soon. NO large flat interior lowland piece of Costa Rican rainforest has ever been put into a National Park, and the interaction with Nicaragua makes such an occurrence seem less likely every day.

It is imperative that the Costa Rican National Park Service place at the top of its list of development priorities those interactions with the remainder of the society that will generate a feeling that the Parks are as inviolate as are the schools and churches. I may note that there is a substantial amount of gold in Costa Rica's churches and anthropological collections, and yet there appears to be no major drive to use it to pay off the national debt. There are two ways to save a tapir. Assign it a 24 hour Park Guard with a submachine gun, or expend the same amount of energy rendering it immoral to serve tapir meat to your family and neighbors.

Corcovado and its surrounding community.

A few days spent in Puerto Jimenez, the Park and the rural countryside between the two will cause numerous ideas to come to mind as to what should be first steps in making the surrounding community think of the Park as a resource and community possession rather than as a fortress.

containing some pirate's treasure and a country-club for wealthy gringos. Many have been thought of by members of the Park Service or obliquely suggested by local residents. However, there is no specific program within the National Park Service designed to foment such things for the Parks in general or Corcovado in particular. Such a program is obviously needed, and not in the form of someone sitting behind a desk in San Jose writing pretty folders or soliciting TV specials on the Park for gringo home viewing. Below we mention a few ideas but assume that any observant person examining the community with this goal in mind would both render our list both incomplete and superficial. There are quite enough correct directions and policy suggestions in the in-house committee reports on Corcovado in the Park Service to suggest that if the authors had been turned loose on the problem in the field rather than in distant San Jose, some very workable and sound operation plans would have appeared, lacking little more than funding and a cohesive blessing from the Park Service as a whole.

1. Turn to the community for purchase of food and other general store supplies. Yes, they are more expensive in Puerto Jimenez and other pulperias, but a person that does not integrate into his community by virtue of purchases must have exceptional other things to offer. I am fully aware that at present the Park Guards pay for the food they eat; but the food fund is very substantially enriched by input from researchers paying for meals, and the Park food is indirectly subsidized by the flights to Sirena from San Jose. These costs may, for example, instead be directed at the purchase of local food. However it is done, maintaining Corcovado on food airmailed from San Jose costs dearly in more than just charter costs.

2. Turn to the community for recreational activities by Park guards. Flights to Sirena should be closed except to those who wish to pay for them personally or with non-Park funds, and general Park access should be by bus to Puerto Jimenez. If there are ways to encourage Park Guards to relocate their families to the community outside of the Park, then encourage them by all means. This suggestion assumes that the Park Administration is moved to the Dos Brazos area and Sirena becomes just another Ranger Station (albeit a large one, perhaps under subsidy from tour groups). When flights are necessary for the Park, use them also for inspection overflights (the large cost is the two hour round trip in getting the plane to the Park, not the five minutes examining a potential problem).

3. Include in the job description of the Park guide or naturalist a substantial effort at explicit public education outside of the Park, such as lectures in the schools, guide service explicitly offered to the schools for classes, public lectures in the evening in Puerto Jimenez dance halls, etc.

4. Liberally decorate the Park boundaries with explanatory signs and some nature trails with identified trees and some explanatory rotulos. High quality maps, on rainproof paper, of trails, guard posts, and sites of particular interest are an obvious must

5. Work with mining companies or other owners of heavy machinery to improve the roads right to the Park boundaries, to maximize public and tour group access. For example repair the bridge between Playa Blanca and the Park at Río Rincón and blade out and gravel the last 2 km of the road. The mining companies are obviously professionals at moving enormous quantities of riverine sediments and changing the watercourses of entire rivers. Instead of saddling them with whitewash environmental statements and silly anti-damage regulations in habitats long since trashed by agriculture, make them pay their taxes by doing real work to increase access and value of the areas to be kept pristine. The same applies to logging concessions in the Forest Reserves near the Park.

6. When conservation-education minded people appear from the States, Universidad Nacional, CATIE and other places with their pet projects to try out in Costa Rica or its Parks, be firm in asking that instead they take on the more directed and applied problem of fomenting public interest and understanding of parks in particular problem areas such as Corcovado.

7. Aggressively encourage tour group operators to make use of the side of Corcovado that is adjacent to the community, find out what they view as their basic needs, and work with them to allow and help them meet these needs. If they need a special kind of building or access, get imaginative and aggressive in permitting them to construct such a building or develop that access. While there is no direct harm in continuing to maintain Sirena as a site of major tour and researcher interest, a major effort should occur to make the sites such as the Los Patos area, the Río Agujas area, the Río Piedras Blancas area, etc. competitively attractive. In view of the virtual extirpation of game animals in these areas at the moment, it may be difficult in the first years, but if the southern part of the Park is kept free of miners, hunters and ranchers, the animals will come back from other parts of the Park. There is a strong and partly justified feeling of resentment among many of the Corcovado personnel against the insensitive way that various tour groups and courses have used the Sirena somewhat crowded facilities and treated the Park Rangers as if they were employees in a luxury hotel. There are obvious ways around this in the form of separate facilities, established protocol as to work responsibilities, and increasing the quality of tour guide input from Park personnel. These ways will cost money, and it is reasonable to expect the tour and course industry to pick up the bill, but they also have to have firm guidance and cooperative acknowledgment of their role in the development and survival of Corcovado.

Along the same lines, it is obvious that the current biology tour groups in Costa Rica could use some solid home-grown competition. There are obvious ways that the Park Service and the biologists working in the Parks could favor the development of this competition, as well as directly offer tours with the proceeds going to the Fundación de Parques Nacionales.

8. Corcovado is a very large place, and it will never be possible to patrol its borders in detail. However, as the next ten years roll in, it is obvious that the Park will be bordered almost entirely by farms and forest-management systems. These people will form a nearly continuous human barrier to poaching and timber stealing, or a nearly continuous poaching and timber stealing threat, depending on how they are treated. In addition to the obvious necessity of maintaining detailed friendly contact with them, these neighbors can be extremely important as "citizen game wardens" or some similar term. It is conspicuous in a number of Costa Rican parks that there are certain neighboring landowners who strongly discourage hunters and there is little problem with poaching along these portions of the park boundaries, as opposed to those portions of the boundaries adjacent to large ranches that permit hunting. It would not even be outrageous to issue some kind of informal badge or other identification papers to neighbors that wish to be thought of as aggressively conservationist, thereby giving that person a bit more clout in keeping hunters, for example, off of his land and thereby denying them access to the Park.

9. While it is against the letter and philosophy of the park laws to harvest any object from Corcovado as well as any other national park, research and collecting permits have been and are issued for work that clearly benefits our understanding of the biology of a park as well as tropical biology. In like manner, there are certain kinds of harvest that can be done from a park such as Corcovado that increase its chances of survival and have no biological impact that is discernable over and above the truly natural perturbations and mortalities that occur. In the case of Corcovado, there is one very major possibility that will loom ever larger. As deforestation progresses, there is going to be ever more interest in reforestation with mixed species stands of valuable slow-growing hardwoods (e.g., cocobolo, nazareno, nispero, guapinol, manu) as well as developing plantations of faster growing native species (e.g., cedro amargo, eura, pochote, caoba). As deforestation progresses, high quality seed is going to get scarcer both because of the elimination of seed tree populations and the disruption of pollinator systems with subsequent failure of seed set in isolated trees in pastures and on roadsides. A place like Corcovado is an obvious source of the needed seed. It should be either sold for the cost of collection labor or the collector provides the labor; the profit to the Park is in the act of Corcovado's contribution to social and economic development. It should be collected under the supervision of a knowledgeable park biologist who knows when and where relatively small amounts (though absolute numbers, perhaps tens of thousands of seeds = the crops of one or two adult trees) can be collected without harm to either the plant or animal population. Done properly, such seed collection will do far less damage than a single trail cut for tourist traffic.

It is certain that as the Costa Rican parks become ever more conspicuously unique vegetation types and living systems in a sea of cultivated plants and pastures, ever more uses such as the

one described above will come to mind. The National Park system must have a philosophy that remains open to such possibilities. There may even come a day when the gold can be extracted by an as yet unknown technology that has no effect on the system other than to produce air spaces where the gold was; on the other hand, by the time the world comes to that, it may well have travelled well beyond the barbarism of viewing gold as something on which to base value systems.

10. As the human population grows to occupy thoroughly the entire area around the Park, there will undoubtedly be numerous cases of poaching in which the individual is captured and hauled in front of a judge. Even assuming that the laws and fines are efficient and reasonable (see above) there is quite a different problem. Many park rangers view themselves, and quite correctly, as policemen to a certain degree. Yes, it is all fine to promote public education, keep trails open, and repair acts of God (fires, landslides), but just as the real world and TV teach us, a policeman is at the pinnacle of his success when he apprehends a lawbreaker. The problem is that many of the lawbreakers will live quite literally next door to the Park. An arrest can very easily create a feeling of extremely strong resentment on the part of the lawbreaker, and especially so if it results in the loss of hunting dogs, fine firearms, a weeks meat, etc. As near as we can determine, there is virtually no policy within the Park system directed at ameliorating this effect through some kind of post-arrest education. We would simply point out that one resentful person can cause an enormous amount of damage to a national park, with little effort, by leaving gates open, setting fires, dropping pesticides into a river, spreading lies about the Park, etc. Perhaps this is an area for judges to be delivering sentences in the form of x days of labor working on a project in the Park, with the Park guards, rather than paying a fine in colonies or spending time in prison.

11. Janzen has studied and lived in a variety of Costa Rican national parks for about half of each of the past 13 years. It is clear to him that there are several personnel policies associated with the Parks that are in drastic need of revision. While realizing that some of these are currently under discussion within the National Park Service, they are mentioned below to underline their importance in this matter.

a. Traditionally park directors change posts every two years or less. It has been normal for a director to leave and be replaced, with virtually no contact between the incoming and outgoing director. There is obviously a very large need for a month or more of overlap between successive directors. The possibility should also be strongly considered of allowing an appropriate person to remain as a director of a specific park for a very long time, with his position being reviewed at intervals; the value in continuity, familiarity and dedication to development is obvious, despite the possibility for maltreatment of the opportunity.

b. While some parks, Corcovado being one of them, have grandiose and highly descriptive

management plans, none of the Costa Rican large parks have detailed written management (= operation) plans for specific classes of problems, plans that are to be continuously followed by a succession of park directors. Corcovado desperately needs such a plan and at the present time does not have one (though in response to the gold miner crisis, a sort of operations flow sheet was drawn up).

c. The living conditions for most park rangers are severely impoverished as compared with their cheerful and item-rich homes in distant towns. While obviously a park ranger has the opportunity to fix up his or her living quarters as he or she wishes, we wonder if there are not explicit ways that life during their 20-odd day stint of duty in the park could not be made more comfortable? Park rangers are not soldiers living in a barracks and expected to act like ants. They must learn to work independently and make decisions on behalf of the Park rather than running about in nervous clusters, each looking to the other to make what may turn out to be a wrong decision.

Conclusions?

In conclusion we offer the summary at the beginning of this report. We feel strongly that it is for the National Park Service specifically, and various relevant other government agencies in general, to develop the actual detailed plan that is followed in the next several months and years. They know the costs and possibilities far better than we do. Will it work? If Costa Rica wants it to.

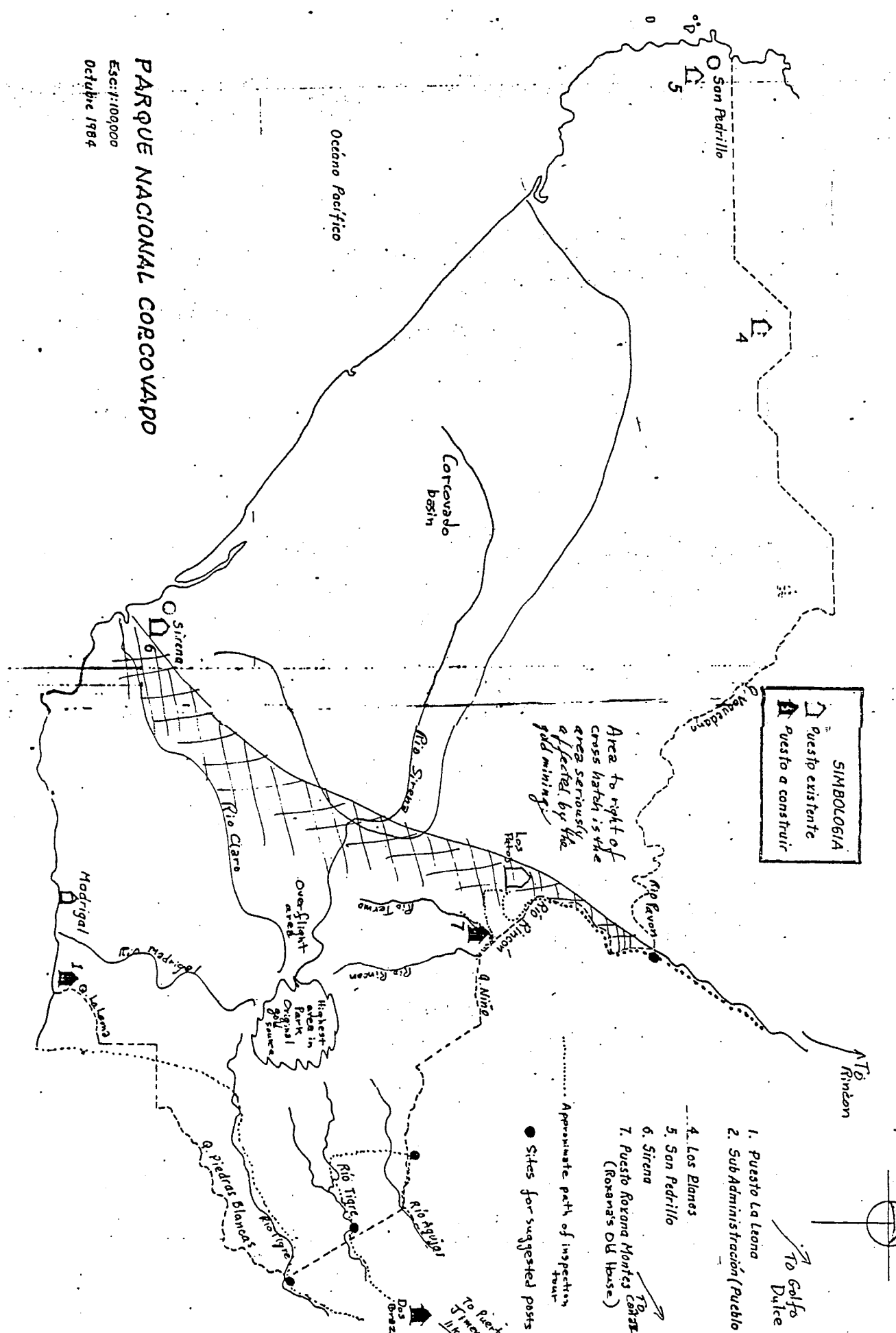


Figure 1