

MASTERS THESIS

CENTRAL VOLCANIC CORDILLERA

BIOSPHERE RESERVE

LA SELVA BIOLOGICAL STATION

ENVIRONMENTAL EDUCATION CENTER

ALBERT GEORGE JOERGER

1991

Central Volcanic Cordillera Biosphere Reserve

La Selva Biological Station

Environmental Education Center



Albert G. Joerger
Master's Thesis

Landscape Architecture
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BIOGRAPHY

Albert Joerger is currently a candidate for a Master's Degree in the field of Landscape Architecture at Cornell University. Albert also completed his undergraduate degree at Cornell. While working on his undergraduate degree, Albert was a four-year Tradition Fellow. Having completed his undergraduate studies in economics at Cornell in December, 1988, Albert joined the Landscape Architecture field in the spring of 1989.

During his tenure in the graduate program Albert's academic interests took him to Japan to study Japanese gardens, to Washington as a Genschel Fellow at the American Forestry Association, as well as a tourism analyst for the National Park Service. His most exciting achievement,

however, was receiving the William Frederick Dreer Award. As a recipient of the Dreer Award, one of the largest travel fellowships in the University, Albert spent a year in Costa Rica researching conservation units and their management as well as observing landscape restoration. It was here that he developed his current interest in conservation planning.

Prior to his entrance into Cornell University, Albert attended Council Rock High School where he was a member of the National Honor Society. Another achievement during his high school career was the earning of the Eagle Scout Award. Additionally, Albert held a great interest in gardening, sharing this interest at home with his family, and in the community at a local geriatric center.

To my mother, for her unwavering patience, optimism and support

Table of Contents

| | | | |
|-----------------------------|----|--------------------------------|----|
| I. Abstract | | IV. Design Development | 21 |
| II. Introduction | 1 | Design Considerations | 21 |
| Investigation | 1 | Site Analysis | 27 |
| Goals and Objectives | 2 | V. Master Plan | 35 |
| Project Intent | 4 | Design Statement | 35 |
| Geographical Context | 7 | The plan | 36 |
| Central America | 7 | Environmental Education Center | 39 |
| OTS | 7 | Wetlands Observatory | 42 |
| Central Volcanic Cordillera | | Raparian Interpretive Center | 44 |
| Biosphere Reserve | 8 | Research Plots | 46 |
| Environmental Context | 9 | VI. Implementation | 49 |
| Site Context | 10 | VII. Subprojects | 50 |
| Cultural Context | 11 | VIII. Conclusions | 53 |
| Demographic Context | 14 | IX. Bibliography | 55 |
| Management Zones | 15 | | |
| III. Program Requirements | 16 | | |
| The Program | 16 | | |
| Day users | 17 | | |
| Long term users | 19 | | |

I. Abstract



Increase in population has caused pressure on international land resources utilized for conservation. With this pressure, it becomes clear that use of land adjacent to biological reserves must be considered. Buffer zones, the managed areas surrounding biological reserves, help to insure the sustainability of the primary resources within the biological reserves. Management plans for reserves must include these buffer zones.

A case in point is the world's foremost research center in the neo-tropics for wet tropical forest research, La Selva Biological Station. Potential land uses surrounding the reserve reveal an incongruity in promoting the sustainability of the facility. The existence of La Selva Biological Station could be challenged as a result of the current population expansion in the Atlantic Lowlands of Costa Rica. On La Flaminia Farm a regional center of urbanization was planned by IDA (a national rural development agency for the Costa Rican

government) less than one hundred meters from the core of the La Selva research facility.

La Selva Biological Station is a research facility which is owned and operated by the Organization for Tropical Studies (OTS). The primary mission of the Organization for Tropical Studies' is to facilitate research and graduate education in the neo-tropics. OTS, with its North American headquarters at Duke University, is an international consortium of forty-four research universities and institutions from North and Central America.

This document is a study of potential site development for the proposed La Flaminia Annex to La Selva Biological Station. The annex comprises fifty hectares between the current facility, La Selva, and a new highway. The purpose of this annex is to develop a teaching facility for local people that will also cater to visiting Costa Rican nationals and international visitors.

Traditional planning methods have been used in the preparation of this study. The site was identified by OTS, and existing site conditions were recorded. These included topography, existing vegetation and high water levels during periods of heavy rain. This information was developed both by personal on-site observation and utilization of existing aerial photography. After existing conditions were recorded, individuals associated with the station were consulted in both individual and group meetings. The resulting product of these meetings was the development of a preliminary program for the site. The program was articulated in several alternative site designs. After presentation of these alternatives to these groups, a final program was established. Presented here is the most promising alternative.

II. Introduction

Investigation

The process that led to the creation of this proposal for site development started in the summer of, 1990 with a tropical primer from the Organization for Tropical Studies. While interviewing residents at La Selva, the need of an interface between the international reserve at La Selva Biological Station and the daily lives of La Selva's neighbors became apparent. The transition between the reserve and the local community was undefined. Initially there was suspicion and speculation among local people about what and who were represented by OTS's facilities. Instead of local people viewing OTS as an economic and environmental advantage, they viewed it, at one time, as a possible front for other international organizations. These undercurrents produced mistrust because of the lack of understanding between the La Selva Organization and local

and regional governments. Subsequently, incongruent land uses were proposed around the station.

Field interviews of La Selva's neighbors were conducted during the early stages of background research for this proposal. In addition, a month's worth of field data was collected. This information was used to assemble a topographic map for site development. Members of the local community were utilized as field assistants to help collect the site information. More than eighteen transects were cut over the fifty hectares of the La Flaminia Farm that OTS is interested in acquiring.

Sensitivity was needed during the surveying process of the La Flaminia parcel because of the land tenure issues that surround the project. Most of La Selva's neighbors on the La Flaminia site were quite gracious in permitting

access to the La Flaminia property. Along with site surveying, air photos provided by Dr. David Clark at La Selva Biological Station and Dr. Phil Sullens, University of Oregon, were utilized in developing base material for the project. Furthermore, interviews of permanent and visiting research staff and support professionals at La Selva were undertaken, as well as interviews in San Jose at the OTS Costa Rican headquarters.

In order to form a composite view of current infrastructural expectations provided to visitors at conservation units across Costa Rica, it was necessary to visit conservation units in every life zone in Costa Rica. After returning to La Selva having formed a preliminary program for site development, alternative plans were developed and proposed. The preliminary site development plans were presented to the researchers and staff of La Selva as well as to regional officials at IDA (A Rural Development Agency) . A final program was identified and two design alternatives were developed. The first alternative was a separation of infrastructure on the site to allow for a

dispersion of users. The second alternative was a concentration of public-access infrastructure to centralize and contain site degradation.

Throughout the design process, the purpose of the development of La Flaminia was to build a stage for mutual understanding and for a beneficial interface between La Selva Biological Station and the local community. The potential synergism that could develop between the reserve and local people is currently unknown, but expectations run high.

Goals and Objectives

The goal of the development of the La Flaminia Annex to La Selva Biological Station is to promote the sustainability of Atlantic Wet Tropical Forests and related ecosystems. Raising local consciousness of the importance of soil and water protection is critical. The international significance of the forest as a necessary gene bank must also be realized. The forests are similar to cultural resources such as cathedrals and libraries. Creating an awareness of the rare, fragile and valuable resources found in these tropical forests will contribute to their sustainability.

Linking the importance of local forests to regional and global conservation efforts will illustrate the importance of local forest resources regionally, nationally and internationally. These resources are important globally because of their biodiversity and their potential for both pharmaceutical prospecting and tourism. Developing local pride in this

global resource will further integrate it into the everyday lives of the people living around the reserve and promote its sustainability. Through this appeal to local, national and international visitors, it is intended with this project to develop within individuals who visit this site an appreciation of nature as well as to offer specific actions for individuals to take in order to promote the sustainability of Atlantic Wet Tropical Forests.

The goal is to develop a center to facilitate the exchange of ideas between the biological station and the community. Included in the community would be local people, Costa Rican nationals and international people. The center will be a forum where OTS will offer research conducted at La Selva Biological Station in a technology transfer to a broad constituency.

Project Intent

This report outlines the facilities necessary for La Selva to effectively accommodate this constituency. With the population of local people, Costa Rican national and international visitors increasing, the time is appropriate to take the initiative by adopting the La Flaminia project. After many meetings with people including David Clark, La Selva Biological Station co-director, as well as visiting and resident researchers at La Selva, the following program was developed, establishing the goals set forth for the La Flaminia Project.

To facilitate the goals set in the program, an OTS public interface would need to be enhanced. The program outlines the physical site conditions needed to fulfill the goals.

Programmatically, the three most important aspects of the project are to develop a vehicle for public interface aimed at of translating the work of OTS to the general public, to create a center for regional environmental education and to create a buffer zone for the current

research facilities at La Selva in anticipation of increased visitation brought on by the new road. With this road, over half the Costa Rican population will live within ninety minutes of the reserve, and estimates are that thousands will pass the La Flaminia gates on a typical weekend.

What is being proposed here is a regional center for environmental education. This would be a mutually beneficial place for the exchange of ideas. It would be a common ground for the education of the local community and international research interest.

La Flaminia will showcase soil conservation, reforestation, watershed protection and the use of native species. It will also develop a sensitivity to local and cultural morays in its site development. Showcasing soil conservation will help to promote the sustainability of existing lands already in agriculture as well as new lands being developed. Soil conservation is important in

this region as population pressure pushes development onto steeper slopes with fragile tropical soils. Reforestation of the steepest slopes, riparian areas and areas unsuitable for agriculture will aid in soil conservation and watershed protection as well as provide a potential secondary income source to farmers from otherwise unproductive land. Watershed protection, which utilizes soil conservation and reforestation as components in watershed management plans, is necessary for the long term sustainability of human agricultural and natural ecosystems. Clearing of forest cover on stream banks and in the surrounding watershed area increases water temperature, silt load and potential for flooding. The use of native species in reforestation efforts minimizes the hazards of disturbing the fragile local ecology. Integrating these components using cultural heritage, such as architecture, will facilitate local understanding and cultural integration of these conservation practices.

The fifty hectare property will also serve as a core for a system of greenways extending along waterways in the region. Greenways would

create an important buffer for fresh water streams in the region helping to protect water resources from agricultural run-off and sedimentation.

Current national laws provide for a fifty meter setback along waterways. This setback is not always maintained. A first step in the process would be to secure this fifty meter area developing a system of rewards for observance of these national laws. Once this area is secured, expansion of the riparian zone will need to be considered.

In addition, the center will provide meeting space and classroom facilities and encourage the integration of La Selva with other local groups involved in natural resource management. These groups include the National Park Service, the National Forest Service, MAG, MUSA, the banana companies and NATUCOOP. Finally, the unique beauty of

the development will inspire regional pride in the ecological wealth of the Sarapiquí, a region in the Atlantic Lowlands of Costa Rica. The center will become a regional cultural resource.

Geographical Context

Central America

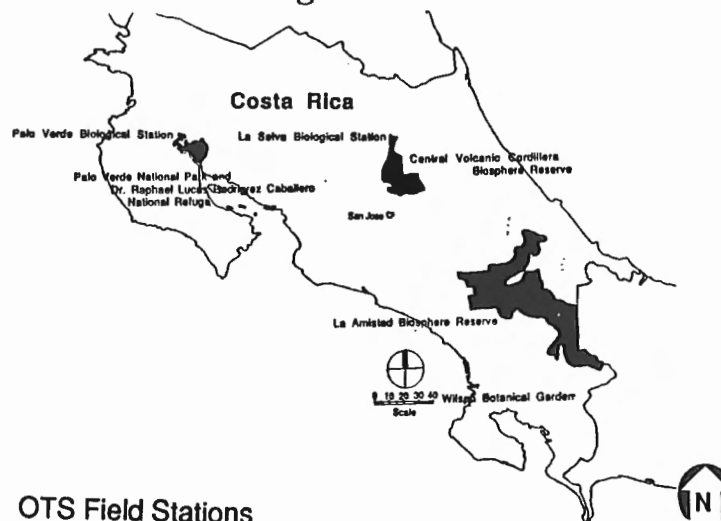


Map of Central America

The area for the proposed site development is located in Costa Rica, Central America. Costa Rica, part of the land bridge between North and South America, has flora and fauna from both these geographic areas.

Organization for Tropical Studies

OTS manages three field stations in Costa Rica: La Selva, The Wilson Botanical Garden and Palo Verde. These three stations are affiliated with larger conservation units. La Selva is part of the Central Volcanic Cordillera Biosphere Reserve. Wilson Botanical Garden is part of the La Amistad Biosphere Reserve. Palo Verde is located in Palo Verde National Park and Dr. Raphael Lucas Rodriguez Caballero National Refuge. Of these three stations, La Selva is the largest and most active.



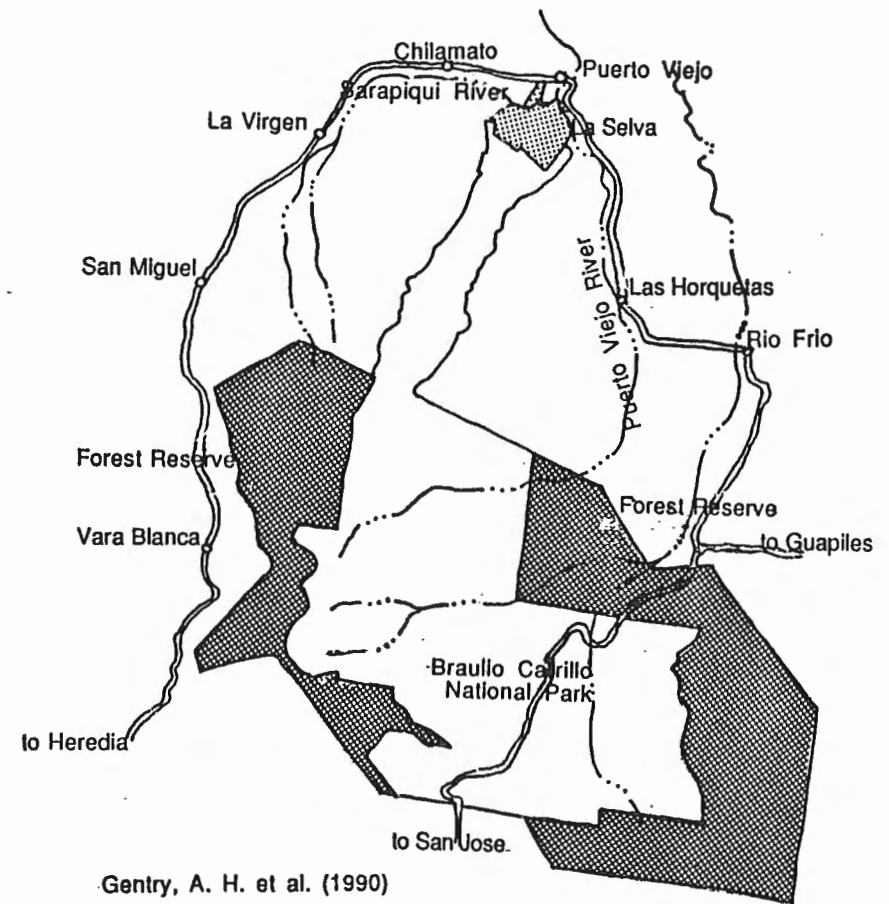
OTS Field Stations

Central Volcanic Cordillera Biosphere Reserve

The Central Volcanic Cordillera Biosphere Reserve, with its component forest reserves, protection zones and national parks stretches from the highlands in the central valley to the Atlantic lowlands. La Selva adjoins the forty-five thousand hectare conservation area at its northern terminus.

La Selva Biological Station, Costa Rica, operated since 1968 by OTS, includes a land area of more than fifteen hundred hectares. La Selva serves as an educational center for a broad variety of courses in various aspects of tropical biology. The station is one of the most active ecological research sites in the neo-tropics.

La Selva is located between the flat Atlantic lowlands and the foothills of the steep slopes of the Barva Volcano in a region called "Sarapiquí" after a principal river in the area.



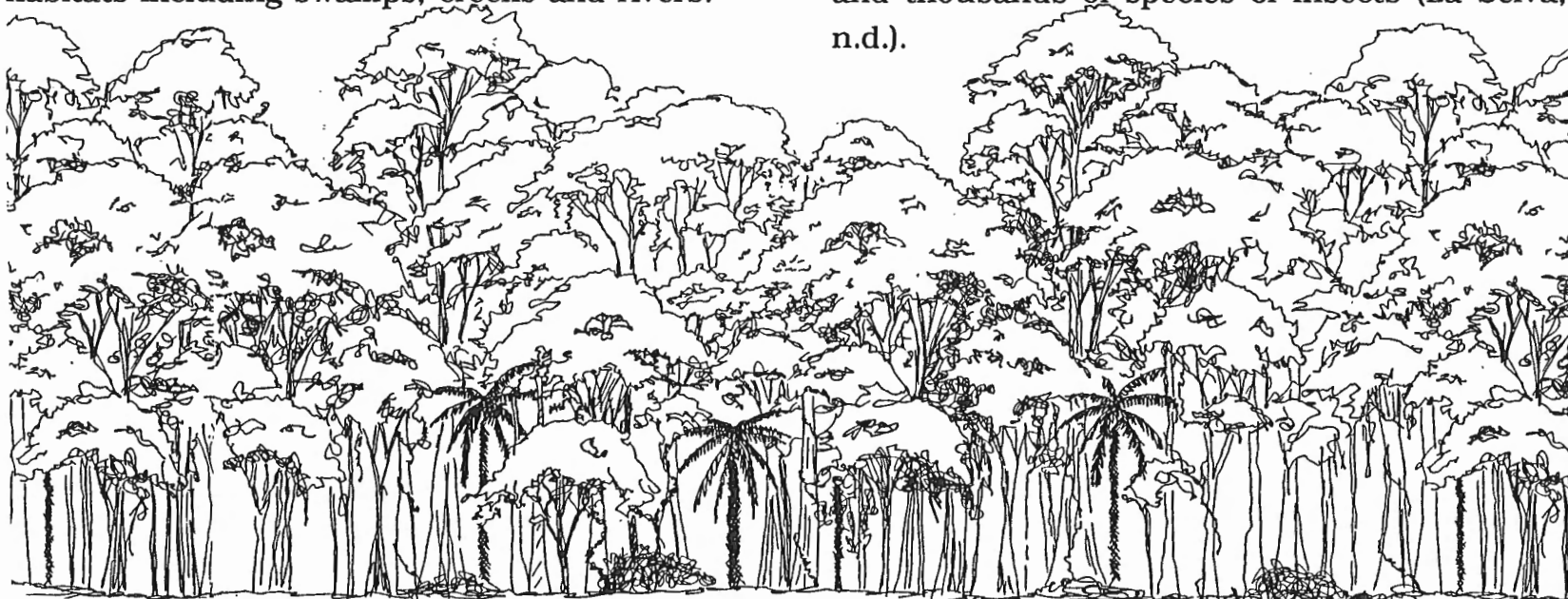
Central Volcanic Cordillera Biosphere Reserve

Environmental Context

The natural vegetation of the area contained in the reserve is tropical rain forest, also called 'Tropical Wet Forests' in the Holdridge Life Zone Classification (1967) La Selva contains a diversity of terrestrial and aquatic habitat (Alameda & Pringle, 1988) characteristic of wet lowland tropics, virgin tropical wet forests, logged-over forests, secondary forests of varying ages, agricultural areas such as plantations and pastures, as well as aquatic habitats including swamps, creeks and rivers.

The average annual precipitation is 4,000 mm with an average of more than 100 mm every month. There is a drier season between January and May. This is called "el verano" by local people. The average temperature is 26 degrees C.

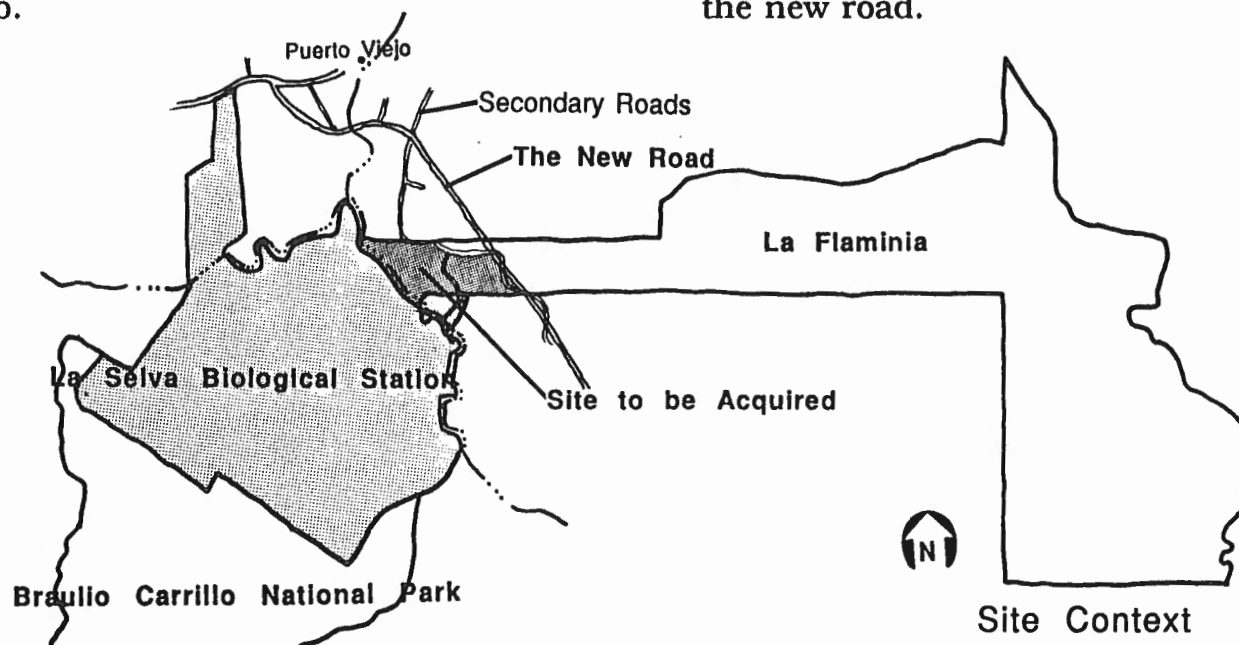
Biological diversity within La Selva's holdings is quite high, including more than 2,000 species of higher plants, 400 species of birds and thousands of species of insects (La Selva, n.d.).



Site Context

The proposed education center for this project is situated on a segment of the La Flaminia Farm. The La Flaminia Farm is land adjacent to La Selva Biological Station. It consists of approximately 1500 hectares. Of this 1500 hectares, OTS plans to acquire 50 hectares that are immediately adjacent to OTS holdings at La Selva Biological Station. This new site is land between the station and the new road connecting San Jose-Guapiles Highway and Porto Veljo.

The population in the Sarapiquí region is increasing. With this increase comes greater pressure on the environment. OTS recognized both a need and an opportunity. The need is to buffer the research and teaching core of La Selva, and the opportunity is to become more a part of the local community. Both of these will be achieved through the development of an environmental education center on the 50 hectare site between the current station and the new road.



Cultural Context

In the community surrounding La Selva, the Sarapiquí region, the main factor contributing to deforestation is agricultural development. Loggers in the area cut only those tree species of economic value and those trees in the way of extraction of the species of value. After an area is 'high graded', forest cover remains.

Much of the agricultural development is done by agricultural colonists and is supported by Costa Rica's agrarian reform laws. A colonist gains certain legal rights to land as soon as he removes the forest. He can eventually acquire title to his homestead. A typical colonist stakes out 10 to 40 hectares of forest by cutting boundary lanes. He proceeds to clear some section of this land and plant pasture by broadcasting grass seed among the fallen trunks. In many cases the timber is not even removed due to the difficulty of access. On steep slopes these pastures are unproductive, highly susceptible to erosion and quickly invaded by woody scrub. The farmer eventually either sells the land or abandons the pasture.

Abandoned pastures quickly fill with luxuriant second-growth vegetation (locally called 'charrales'). These areas represent an increasingly common vegetation type in the Sarapiquí region (Gentry, 1990).

The demand for land is great because of a high population growth of 2.6% annually (Gentry, 1990) in Costa Rica as well as in-migration from other parts of the country. The suitable alluvial lands are already taken; what remains are marginal abandoned pastures with second-growth vegetation and areas of steep slopes with poor soil. Colonizing land in a speculative manner is also commonplace.

The La Flaminia Farm is currently held by agricultural colonists. The colonists first came in the late 1970's to the upland section of the site. The 50 hectares that OTS seeks was settled in the mid 1980's by agricultural colonists. The site now slated for a community environmental education center 100 meters from the dining facility at La Selva was once set

aside to become a housing development, a nucleus of regional urbanization. It was planned that there would be one hundred thirty residences and two farms on this site. The adjacent conflicting land uses of a biological station and a new residential community would greatly alter the effectiveness of La Selva to reach its primary goals of facilitating research and graduate education.

Since a great number of the residents came from outside the Sarapiquí region, the area is not steeped in centuries of agricultural tradition. In a survey conducted at farms surrounding La Selva, the colonists seemed open to new ideas. Many had informal agricultural experiments on their farms and were hungry for new information to make their new life a success. This conclusion can also be reached based on the past success of the naturalist guide program and the trials out-planting project run by Rebecca Butterfield.

Twenty six individuals enrolled in the naturalist guide program, all of whom

graduated, and half of these people obtained full-time positions as naturalists in the community. This speaks well for OTS's educational insight and the community's openness to new ideas. In the outplanting project, trees were given to local people to plant on their private farms. Local landholders participated in planting these trees on their land. Local people seem willing to enter into mutually beneficial relationships with OTS.

Why not just acquire the 50 hectares in the La Flaminia site and fence them off, not allowing public access to the site? This solution however would not allow an effective interface between La Selva and its neighbors. Fostering this interface will allow La Selva's neighbors to see the relevance and importance of the biological station to the area and to mankind in general.

Historically, transportation into the region was difficult. In colonial times rivers were the principal route of commerce. Boats traveled from the Caribbean up the San Jose and Sarapiquí Rivers to Puerto Viejo. Boats were

unloaded and mule trains loaded and taken on an arduous trek to the highland central valley. Since 1970 roads have penetrated the region and a high level of deforestation has followed.

The new paved all-weather road connecting Porto Viejo, Sarapiquí and the San Jose-Guapiles Highway has also caused a drastic change in the accessibility of La Selva Biological Station to visitors further afield than the local population. Before this road was improved, traveling from San Jose to La Selva might have taken six hours. At one time it took 10 hours including a boat ride to go from San Jose to La Selva (there were no all-weather roads to La Selva). Upon completion of the new road, travel time to get from La Selva to San Jose will be approximately 70 minutes.

The significance of this new road cannot be overstated. It will bring to La Selva's doorstep many Costa Rican nationals and international visitors. These people could be a ready audience to hear the word of tropical conservation if OTS develops the facilities to

receive them. From the La Flaminia site people will be able to see the contrast between protected areas being actively conserved and adjacent land uses. The tremendous contrast between the lush forested conservation areas of the Cordillera Volcanica Central Biosphere Reserve (which is visible from the La Flaminia site) and adjacent high graded forests and pastures with low productivity will be a dramatic experience. Reaching this audience will help OTS gain exposure to both Costa Ricans and the international public.

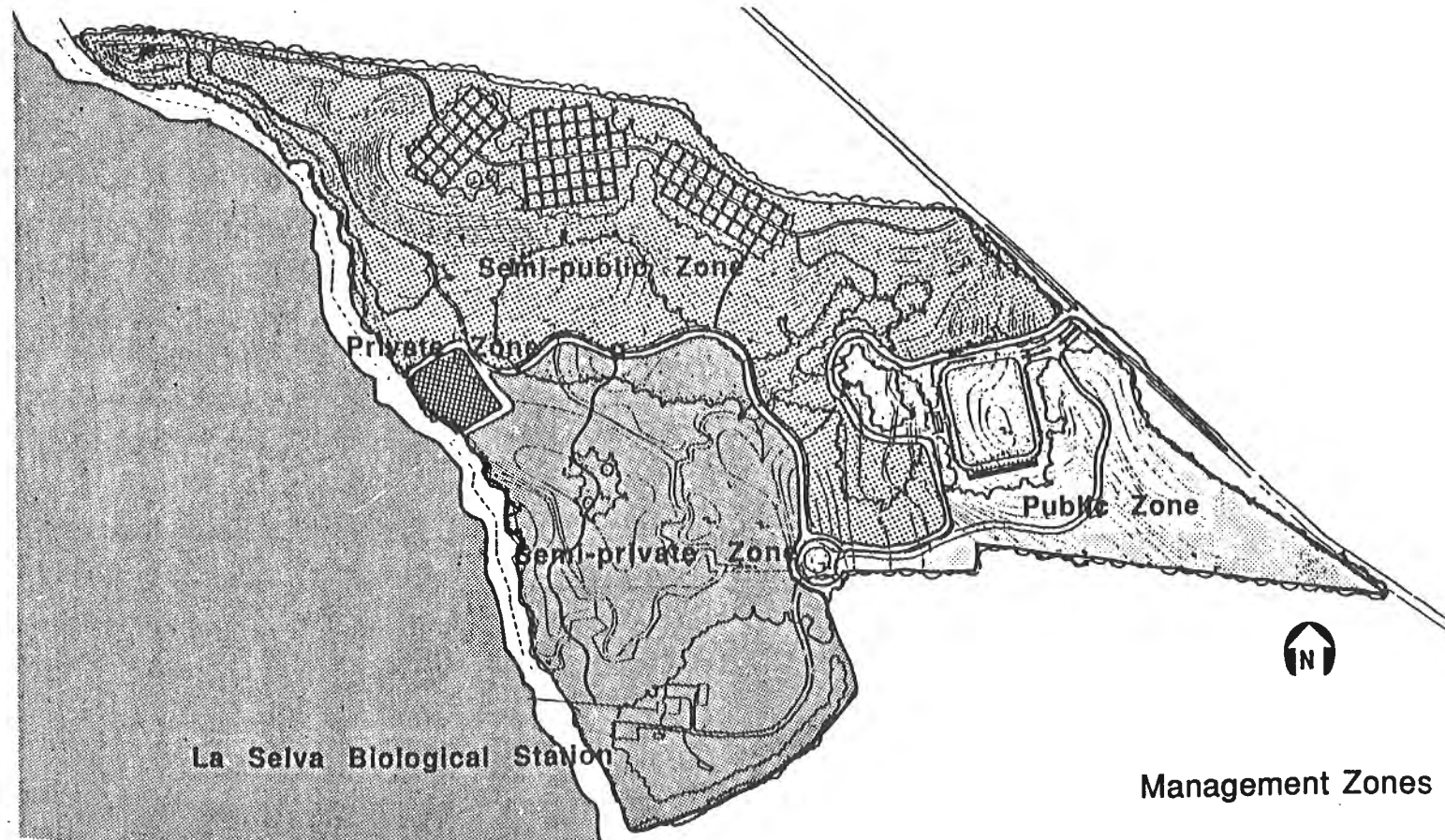
Demographic Context

Three distinct groups will use the facilities at La Flaminia: local people as well as other Costa Ricans and international visitors. Individuals within these three groups will vary from the casual passerby to the sophisticated ornithological visitor. Interpretive displays should be readable at different levels. The first level be for the visitor just to be impressed with the presentation, gaining a straight-forward view of ecology. The other end of the spectrum will be the person interested in individual research reports.

Management Zones

La Flaminia, in conjunction with La Selva Biological Station, will be delineated into four levels of access: public, semi-public, semi-private and private. Public areas will be totally accessible during business hours.

Semi-public areas will consist of restricted guided tours. Semi-private areas, i.e. research facilities, dining facilities etc., will be open to overnight guests. Private designation will be limited to residential areas.



III. Program Requirements

The Program

The following program was developed through a series of on-farm interviews with local people, IDA (Rural Development Agency), group and individual meetings with staff and friends of La Selva, as well as extensive visitation to other conservation areas in Costa Rica.

The environmental education center on the La Flaminia Annex to La Selva Biological Station will have to meet the needs of a diverse user group. The center, along with its education component, will also act as the front door to the station as well as the northern terminus of the Central Volcanic Cordillera Biosphere Reserve. La Selva's environmental education center will act as a gateway to the biosphere reserve, orienting visitors not only to the local ecology but also to the larger regional context of the conservation unit. Users for the facility

will include, but are not limited to, La Selva's neighbors: local people, visiting Costa Rican nationals, international researchers and ecotourists.

Visitors will be exposed to information facilitating appreciation and stewardship of the complex ecosystems and natural beauty present in the region. People who visit the environmental education center will leave with an appreciation of nature, an understanding of the fragile balance of local ecology and a realization of how local, regional and global ecologies interact. They will also have an increased awareness of environmentally sound land management practices.

In developing the program two distinct user groups became apparent: day users and long-term users. Day users would not make use of La Selva's dining or dormitory facilities. They will stay for only the day. Long-term users are

researchers, students and guests of La Selva use the dormitory, lab and food-service facilities of the station.

Program for Day Users

Visitors' Center

This center will showcase regional resource management, OTS activities and a shop promoting locally produced, environmentally-sensitive products. The center will be a structure sensitive to local architecture, and will include conference rooms, a classroom, a reading room, rest rooms, and observation deck. These facilities will support environmental education as well as provide meeting space for appropriate community and governmental groups.

Environmental Center Services

The environmental center will offer a wide range of services. These will include training courses for ecoguides who will lead tours on the property and in the Sarapiquí region. It

will also facilitate the organization of a river guide cooperative, offering classes in soil conservation and sustainable agro-ecological practices. The center will organize a 'Friends of La Selva', a group for local residents, Costa Rican nationals and international visitors interested in the reserve and facilitate the organization of a greenway association for watershed protection.

Observation Tower

The observation tower will be of a height adequate to orient the visitor both to the site and the larger regional environmental context of the Central Volcanic Cordillera Biosphere Reserve. Views from the tower will allow visitors to see the powerful juxtaposition of conserved areas in the Central Volcanic Cordillera Biosphere Reserve with the adjacent agricultural lands.

Parking

Parking should be developed on site, not for the maximum demand of use for the facility, but with the environmental carrying capacity of the site in mind. Parking facilities should not

overpower the site. Parking will be established for cars and buses. Integral to the entry sequence is a drop-off and access for visitors coming to the site on public transportation.

Trail System

The trail system will include multiple levels of access. One component of the system associated with the visitor center will be a closed loop, unlimited access, highly-interpreted wetlands observation walk. Interpretive moments along the walk will showcase the sensitivity and importance of wetlands ecosystems to biodiversity. The walk's physical design will limit individual access to two points, an entrance and an exit. Water could be utilized as a natural barrier to prevent individuals from leaving the path. Included in this trail system will be a guided nature walk which consists of river access, archaeological interpretations, agro-ecological trials projects, successional plots and, forestry trials with the potential for self-guided components within the trail system.

Included in the development of the proposed trail system will be shelters for sun and rain protection, potable water sources and seating. A hierarchy in the trail system, delineating primary and secondary circulation would be established. Included in the trail system would be a link to primary forests in the current La Selva Station. Access to this trail would be guided and limited by visitation levels currently in place at La Selva. This pedestrian link to the core of the station would facilitate access for researchers working on the La Flaminia site.

Wetlands Observatory

This would be a covered structure open to unobstructed views of the wetlands ecology, integrated into the visitors' center by a closed-loop, unlimited-public-access, highly-interpreted wetlands trail. It would offer protection from sun and rain.

Picnic areas

These picnic areas will include tables, grills, a potable water source, toilet facilities and protection from sun and rain. It is important to designate an area for picnicking because without a designated area, individuals may choose their own picnicking site. Many Costa Ricans use conservation areas for family outings that include a picnic component.

Riparian Interpretive Center

The riparian center will be designed to facilitate river access, reestablishing the water as an important economic, cultural and environmental resource. This will create new jobs and renewed interest in the river. Infrastructure would include education, picnic and toilet facilities.

Demonstration Plots

Integrated into the area will be demonstration sites that can be utilized as part of the education component of the facility. Possibilities for these plots include permanent secondary restoration plots; extension projects for new agricultural crops (sustainable or

otherwise), hillside farming plots, agro-ecological demonstration area and a regional archaeological display.

Arboretum

The arboretum will be integrated into the landscape scheme of the entire site featuring species of regional economic and cultural interest. The resources necessary to create the arboretum will be minimal since complete tree installation on the site is already necessary.

Program for Long-term Users

Individual Research Plots

Proposed research projects at La Flaminia will dovetail with the educational focus of the center and will be of general interest to visitors. Projects of this type will be encouraged in the La Flaminia Annex.

Permanent Vegetative Restoration

Given the current degraded nature of the site, development plans will include restoration of potential vegetation. Every aspect of site preparation and management practices would be documented. Where feasible, replicates would be established to aid in the development of a meaningful resource for research.

Vegetative types included in the restoration program will include wetlands vegetation, riparian forests, upland forest and alluvial vegetation.

Successional Plots

Established within La Flaminia will be areas of vegetation at distinct and significant stages of natural regeneration.

Experimental Plots

Experimental plots will showcase agriculture, agro-ecology and forestry research conducted at La Selva. Integrated in the area will be permanent educational research plots for OTS courses.

IV. Design Development

Design Considerations

A preeminent tenet of the site development is that of access. The juxtaposition of embracing La Selva's neighbors yet maintaining an uncrowded, smooth-running research core is a necessary consideration. Determining usership levels for the facility based on environmental visitor carrying capacity will need to be established by the reserve. Demand for access will vary seasonally. The utmost caution will be exercised in preventing site degradation.

The following section is a discussion of a number of alternatives which are components of the master plan. Alternatives are explored, conclusions and recommendations are developed.

1. Entrances

Access to the La Flaminia Annex and to La Selva could be integrated or separated. The advantage of one entrance is a clarity to the experience of entering La Selva. With one entrance, whether people are heading toward the research core or the interpretive center they will go through the same gate. This will help mitigate the feeling of entering "Real La Selva" or the visitor center and facilitate seamless integration of the La Flaminia annex to La Selva.

Two entrances will ensure segregation of the researchers from the visitors, although this same separation could be achieved through one entrance and proper signage or one entrance and an information admission center at the gate. Another drawback of two entrances would be ecotourists who felt "in the know" coming down into the research core. Under a

system of one entrance and an information person/guard at the gate, these people will be directed away from the research core.

It was determined that one entrance will best meet the need to integrate the station into the community. One entrance will allow for unmistakable association between the research core and the La Flaminia Annex.

2. Water access

The site has frontage on the Puerto Viejo River. Also within the site are naturally wet areas and a stream with several tributaries.

Water is a natural public draw but also a great liability. Given the importance of water resources regionally, an aquatic component must be integrated into the center. Access needs to be controlled to the water resources on the site.

Areas where an aquatic component can be integrated into the design is a riparian trail

and center, a wetland center and through the overall interpretive thrust of the facility.

3. Vehicular access

Considered here is the level at which vehicular access will be allowed within the site. The two extremes are total vehicular access to all of the site's resources or limited access by vehicles creating an area where people park and leave their vehicles experiencing the site as a pedestrian. There is a definite need for vehicular access into the site for maintenance as well as the three rights-of-way currently held through the site.

Keeping vehicular access to a minimum prevents their importance from being overemphasized as well as environmental degradation of the facility associated with vehicles. Although this potentially limits the people who will gain access to the site, it allows those people who come to the site to be closer to nature and have a more meaningful experience while at the facility. Therefore, a

plan allowing a limited and concentrated yet flexible vehicular access will be developed for the site.

4. Structures

Careful placement of structures on the site will determine if OTS achieves its goals of a public interface and a filter for the research core. Centralized public structures will naturally centralize visitors on the site. Decentralized structures of public access will disperse visitors throughout the site.

Facility management is easier if users are centralized. With this in mind, it was decided to centralize public access structures creating a public access zone within the site. Visitors who come to the site will want to engage the site at different levels of intensity. To meet this need there will be, within the facility, interpretive events readable at many levels. Centralizing visitors aids in management and helps to prevent degradation of sensitive restored ecosystems and research plots.

While centralizing the majority of the visitors on the site would be efficient, it is culturally insensitive to achieve this efficiency with one large structure. As a result of this, a number of small structures will be organized in an outdoor space allowing for a more regionally sensitive and culturally appropriate site development. This will be the public zone.

There will be a series of thematic areas developed outside the public zone to engage those visitors with more focused interests. These thematic areas will be considered the semi-public zone. These areas will be accessed with the aid of an interpretive guide. Additional structures will be integrated into these areas as the need arises for more infrastructure to meet the educational mission of the facility.

5. Trails

The trail system is integral to the site. The success of the zones established for the reserve depends on an effective trail system. These trails will allow access appropriate to the visitor interest levels. It will also maintain the integrity of the environmental resources on the site. There will be guided trails and self-guided trails.

Guided trails afford the greatest amount of control for public access. Self-guided trails provide the least personnel cost. Savings in personnel could be offset by the added cost of maintaining unstaffed and unsupervised trails.

Within the La Flaminia Site a mix of guided and self-guided trails will serve to maximize La Selva's resources to gain maximum visitor exposure with minimum site degradation. There will be a short, highly interpreted trail associated with the environmental education and wetlands center which will be self-guided. There will also be longer, guided trail systems

catering more to an individual's personal interest.

6. Admission

Admission will be charged to gain access into the site. User fees will be established with the aid of the La Selva Advisory Committee. User fees at other reserves in Costa Rica will be considered in establishing fees for the La Selva facility. Local people will be encouraged to join the 'Friends of La Selva' Organization. This will be offered at no charge to local people. Membership in the Friends organization would allow free access to the site and its programs.

7. Security

Security is not a problem at La Selva at the present time. Population in the region, however, is increasing. This could cause pressure on the reserve and security will become more of an issue than it is at present. The La Flaminia Annex need not develop

extensive security measures at this time, although an awareness of the potential need to increase security at the site must be kept in mind during the planning stages. This site cannot be developed in a fashion which is difficult to secure.

8. Facilities and Amenities

There will be a flexibility in site development which will allow for multiple levels of development within the site. The modular nature of the master plan will allow for various levels of infrastructural development based on the academic needs and financial ability OTS. The possibility for growth within the site is present. The ability to add increased classroom, research and living space is also possible.

Amenities for the site will include 24 hour electricity with back-up generators provided by the existing facilities at the biological station. Sanitation facilities, potable water available throughout the site, all-weather

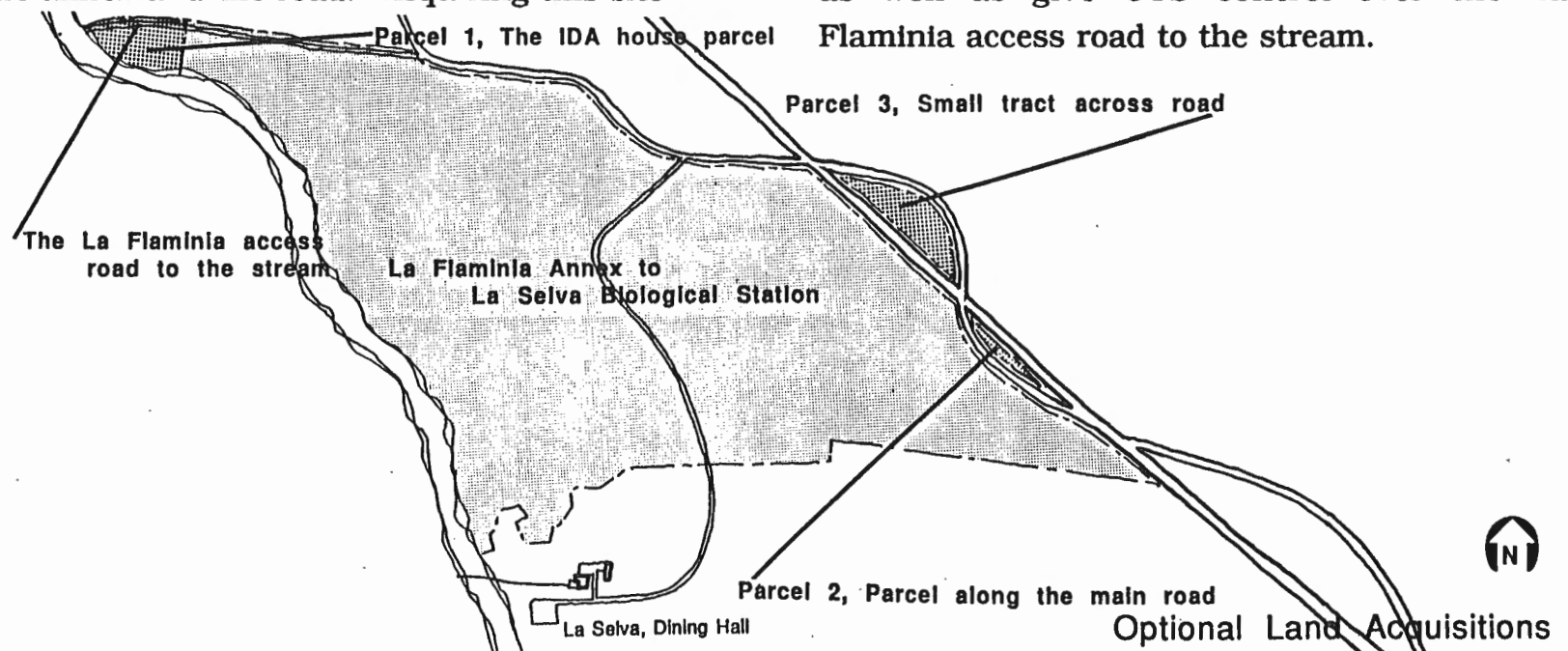
material utilized in the circulation system, areas which provide sun and rain protection will all be integrated into the site plan.

Development of facilities like picnic areas and amenities like flush toilets, encourage visitors to utilize planned areas for predetermined uses. These facilities and amenities promote a functional, smooth running facility.

9. Optional Land Acquisitions

With the road nearing completion it has become apparent that there are some small critical pieces of land that should be acquired. Getting maximum frontage on the new road while eliminating the secondary roads cutting through the La Flaminia Annex to La Selva Biological Station will make the boundaries clearer and easier to manage. An important parcel is along the main road and lies between the annex and the road. Acquiring this site

will increase road frontage on the main road and do away with a secondary road which separates the parcel from the annex. There is a small tract across the road which might also be helpful in assuring control over our watershed as well as visual protection for the entrance. The most important tract which is of interest is known as the IDA house parcel. It would secure another 400 meters of river bank as well as give OTS control over the La Flaminia access road to the stream.

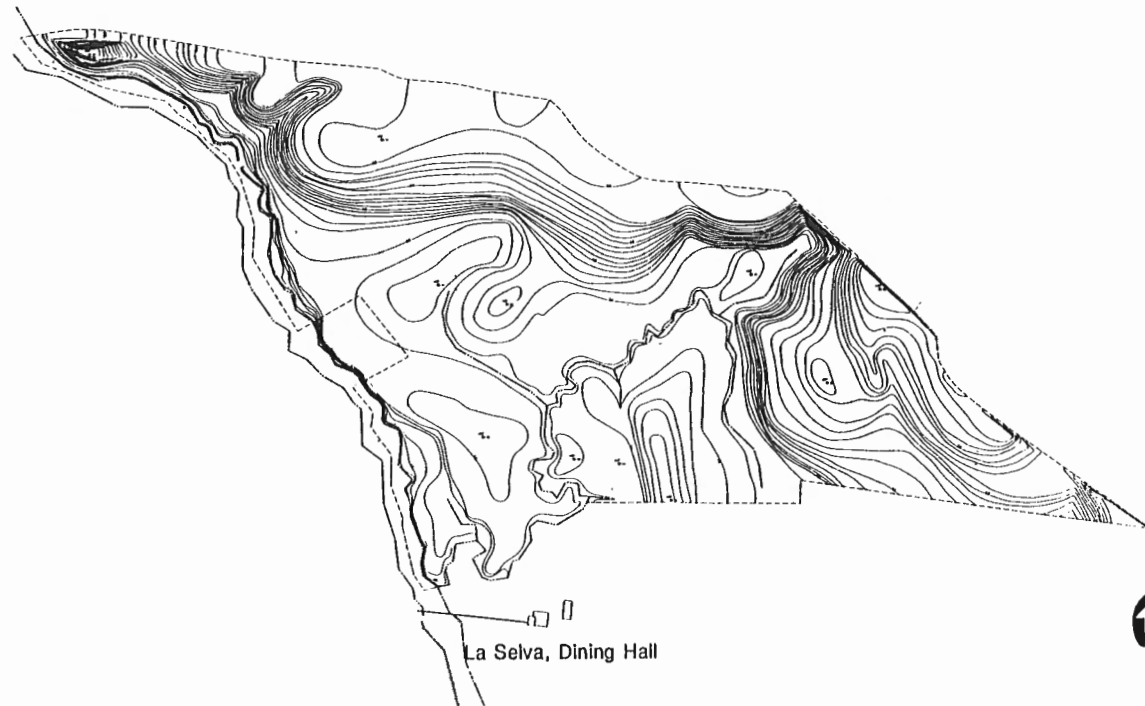


Site Analysis

1. Slope

Due to the variability of slope within the site, it is necessary when siting infrastructure to be conscious of the slope. Slope on the site varies from 2% to 58%. This offers the opportunity to gain excellent views into the site. Circulation will need to be established in areas in which the slope of the trail can kept within 8 to 12%. Vegetative cover will need to be

maintained in areas of steep slope to prevent soil erosion. Permanent vegetative restoration will occur on the steepest slopes. Level areas will be utilized for research plots. Within the plots topography will be utilized to allow the demonstration of traditional level land and hillside farming.

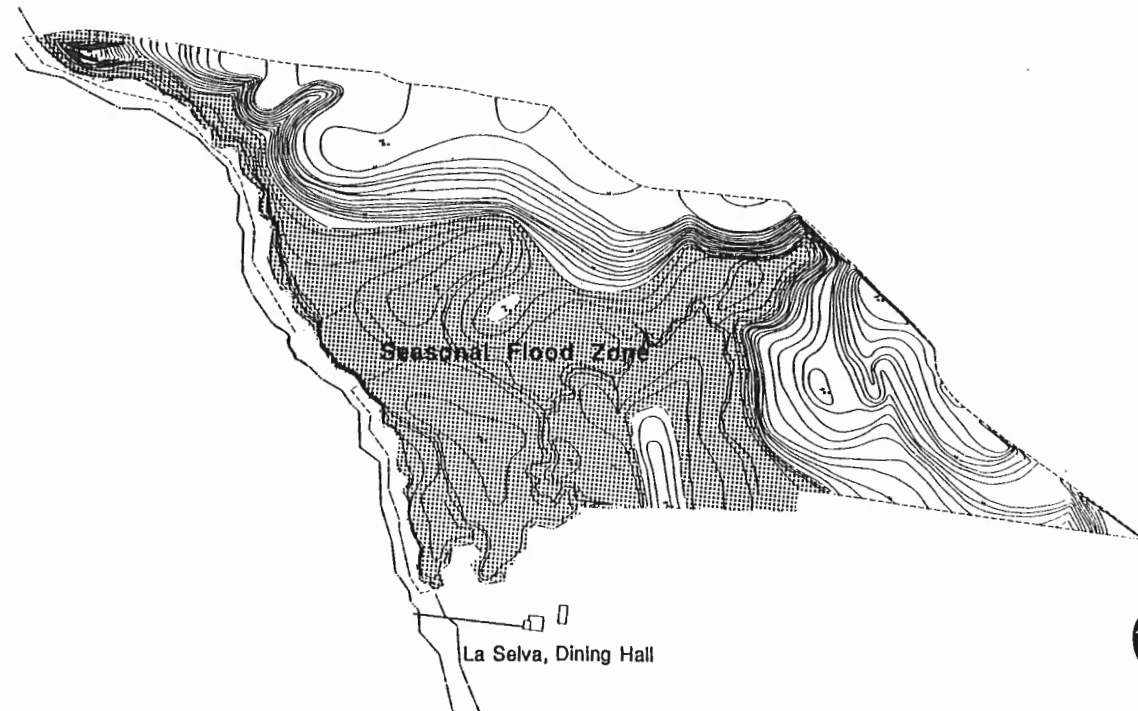


Site Analysis

2. Flood Area

Over half the site is subject to annual flooding during the rainy season. At times access to La Selva is made difficult by this flooding (access by boat only). The access road needs to be realigned to allow for year-round vehicular

access to La Selva Biological Station. Buildings should not be constructed within the seasonal flood zone. Major vehicular circulation will be elevated out of the flood zone. All major areas will be accessible regardless of the weather.

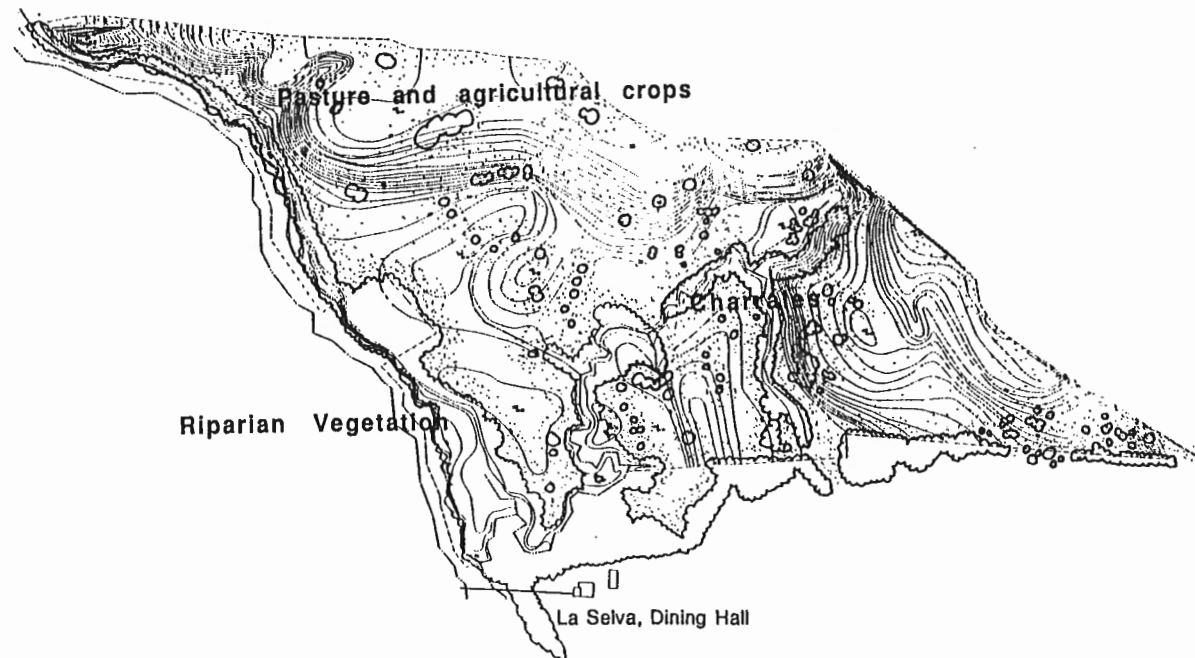


Site Analysis

3. Existing Vegetative Cover

Existing vegetation on the site consists of charrales (second growth forests), pasture, agricultural crops and riparian vegetation. The entire site has been cut, cleared and high graded at different times in its history. The

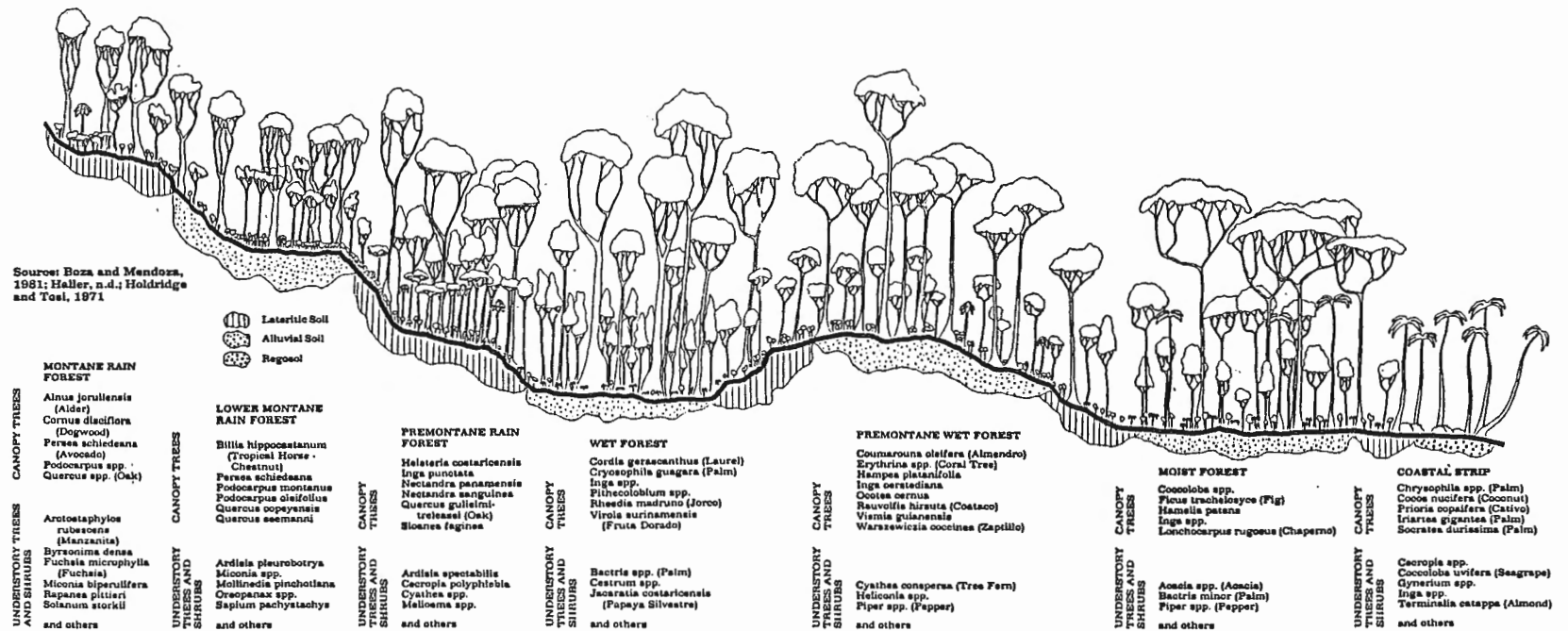
existing vegetation is not significant and will not be considered in the development of the master plan. Current vegetation should not hamper the development of this site as it is of marginal value



Vegetation Transect: Natural Vegetation

Here is the potential natural vegetation. The La Flaminia Annex to the La Selva Biological Station lies in the wet forest zone. One

component of the restored vegetation for the site will be that of the potential vegetation.



Source: Lyle, 1985; Boza and Mendoza, 1981;

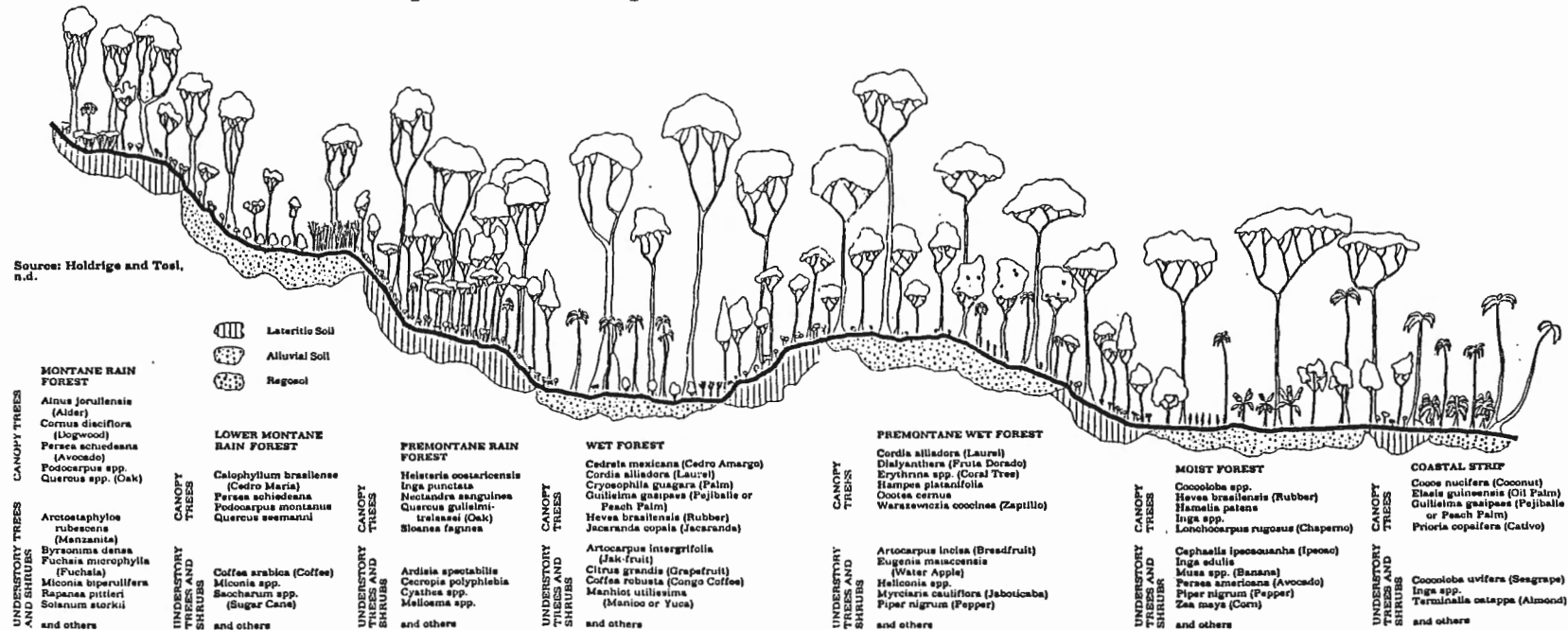
Haller, n.d.; Holdridge and Tosi, 1971

Vegetation Transect:

Ideal Crops

Outlined here are the ideal crops for the Atlantic Slope of Costa Rica. The area in which the La Flaminia Annex falls is the wet forest zone. Listed are ideal crops. These crops will

be integrated into the research component of the facility. New ideal crops will be introduced as identified.



Source: Lyle, 1985; Holdridge and Tosi, n.d.

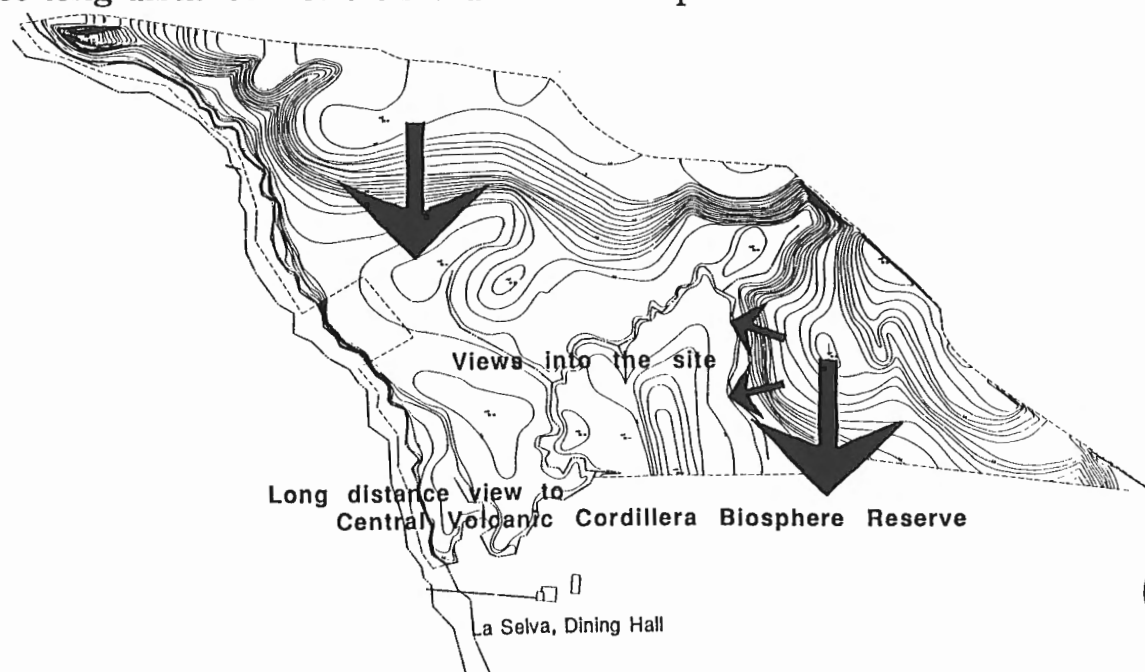
Site Analysis

4. Views

Views from the site illustrate the contrast between managed conservation land and land in agricultural development. In view from the site to the south is the zone of protection as part of the Central Volcanic Cordillera Biosphere Reserve. This view, although difficult to see at all times of year because of cloud cover, is one of importance and beauty. It is important because it helps place the site in context. These long-distance views should

be integrated as an important component of the site development.

The site's location is a telling example of the ravages of deforestation. Views from the site are potentially negative because of the current lack of regional planning in the area. Short distance views immediately off the site should be screened on all borders (north, east, south) except on the border shared with La Selva.



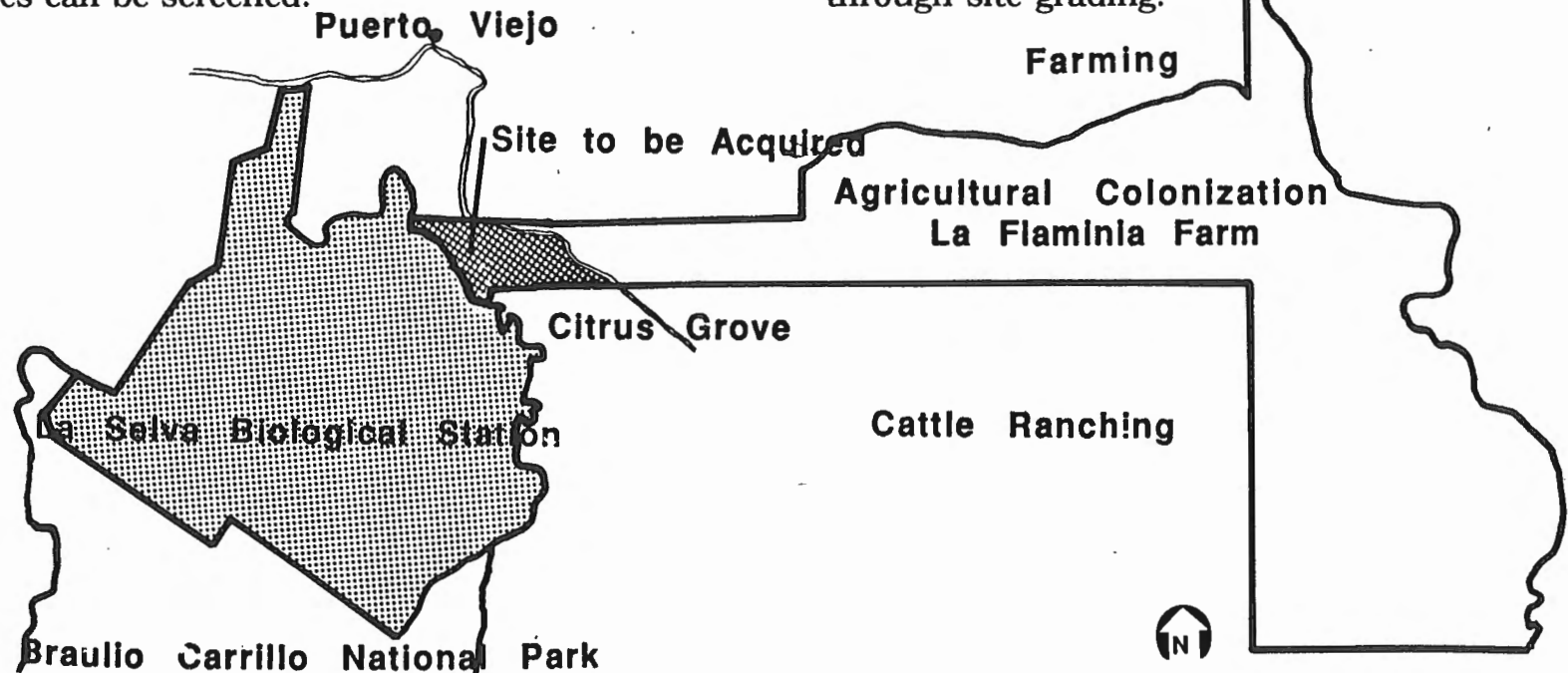
Site Analysis

5. Adjacent Land Uses

Adjacent land uses to La Flaminia include biological reserve, citrus groves, cattle ranching, agricultural colonization, road development and nearby corporate farming.

A realization of the uncertainty of adjacent land use needs to be considered when placing infrastructure within the site. Infrastructure should be located in areas where adjacent land uses can be screened.

Infrastructure within the site should also be placed with regard to noise pollution from existing and potential residential areas. A potential hazard and management problem is adjacent agriculture to the site and the potential for agricultural run-off into the site. An effort should be made to isolate the La Flaminia Annex from agricultural run-off through site grading.

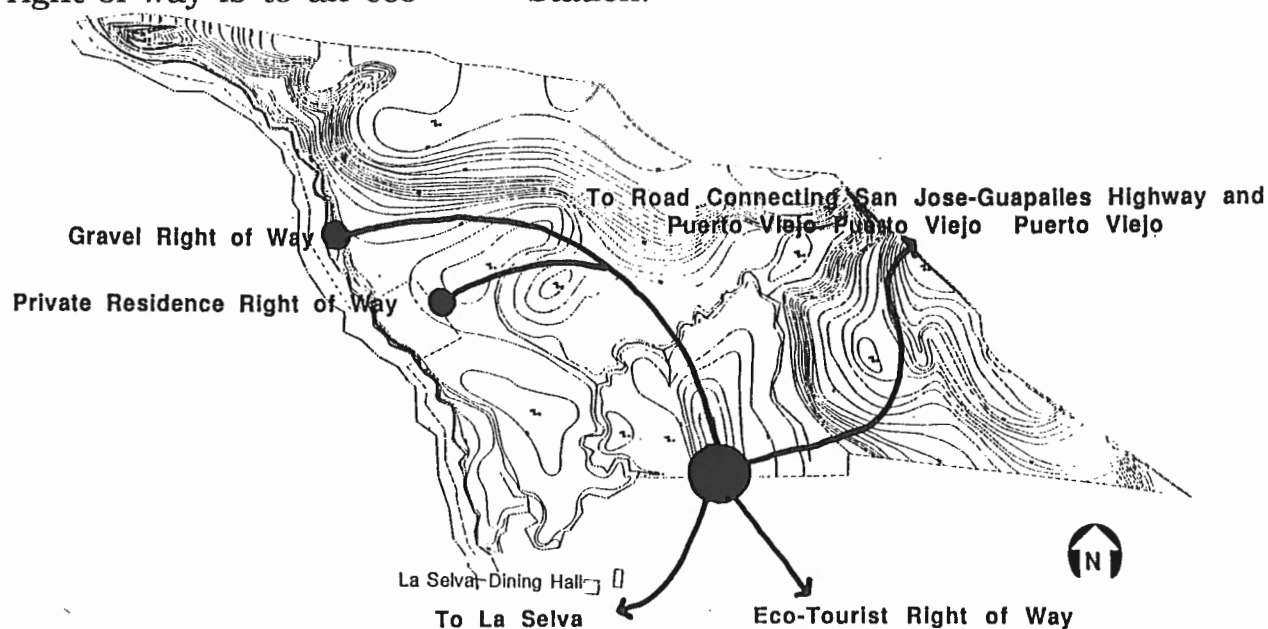


Site Analysis

6. Existing Rights of Way

There are three existing rights-of-way through the proposed La Flaminia annex to La Selva Biological Station. The first is an excavation point for road gravel held by the local government. It is thought by the La Selva organization that this right-of-way can be renegotiated with the local government and relocated. The second right-of-way is to a private residence. It is thought that this residence could be purchased in time by OTS, La Selva. The third right-of-way is to an eco-

tourist operation. This third right-of-way could be integrated into the overall site plan or more ideally, purchased by OTS. The owners of the third property have frontage on the main road. Ideally, a separate access way could be developed for this property because of the potential high need for access to this property. It is recommended that wherever possible, rights-of-way be eliminated through the La Flaminia Annex to the La Selva Biological Station.



V. Master Plan

Design Statement

The purpose of the La Flaminia Annex is to develop educational and technical support to promote the sustainability of Atlantic Tropical Wet Forests in Costa Rica as well as an interface between the biological station and the community. This is accomplished through the development of a complete public access visitor center, observation tower, picnic and active play area and a highly-interpretive wetlands loop. Water around the loop will act as a natural element to prevent unrestricted access to the rest of the site. Second, visitors can choose to engage the site more fully and take a guided walk to the river, the research plots, archaeological displays and successional plots. Third, a restricted number of guests with reservations could participate in carefully guided tours of the primary forest. Fourth, researchers and ecotourists with reservations could spend the night and participate in the extensive resources of the entire property,

utilizing the proposed La Flaminia entrance as a gateway to the research core. These different levels of access develop a filter which facilitates the smooth running of the research core of the facility.

In developing the master plan for the La Flaminia Annex of the La Selva Biological Station several design challenges were present. The first challenge was inviting people in to the station while buffering daily research operations. The second challenge was to work with a language that was understandable at all levels as well as sensitive to regional culture. Another challenge was integrating the diverse usership allowing for a wide range of user backgrounds. Lastly, developing a design which fulfilled the program needs while visually and intellectually engaging the user.

This plan is not meant as a final development document but was developed to promote

exchange between affected and interested parties on the development of the La Flaminia Annex to La Selva Biological Station.

The Plan

(See foldout 1)

The proposed master plan will act as an interface between the built communities surrounding the reserve and the natural environment of the reserve. Rectilinear shapes integrated into the curvilinear circulation system help to develop a transition between the agricultural landscape surrounding the reserve and the apparent naturalistic environment within the reserve. The plan is zoned to allow for multiple levels of access. The environmental education center, wetland observatory, the picnic grove, observation tower and the La Selva Green are of unlimited public access during daylight hours.

The close proximity of major infrastructural development to the new highway was decided

for several reasons. The first reason was ease of access. The second reason was to minimize paving within the site. The third reason was to minimize disturbance within the riparian zone.

Proposed Buildings

The buildings are situated on the site in areas of visual prominence. This will help to orient the visitor to the layout of the site and draw them into the site visually. These facilities enable the site to operate as a filter supporting usership from the most basic drive-by guests to seasoned ornithological researchers.

Proposed planting

The proposed planting development of the site is a mix of restored riparian vegetation and flowing greenways. Integrated into this framework are structures, all-weather vehicular access, and an extensive trail system -self-guided and enhanced with interpretive displays and guided trails.

Proposed Grading

The proposed grading plan is developed to facilitate three factors: first, to isolate the site

from adjacent agricultural run-off; second, to place the visitors' center at a high elevation relative to the rest of the site to allow visual access to the site; third, to minimize grades over eight percent on the circulation system. This is an important element to allow access for the physically challenged.

All proposed site development in the master plan will be sensitive to local building styles and cultural mores. This will circumvent barriers established by inappropriate architecture. This will facilitate the integration of the center into the community.

The master plan is broken into an environmental education center, a wetlands observatory, a riparian interpretive center, and research plots. These areas are discussed in depth in the following sections.

Riparian Interpretive Center

To Puerto Viejo

New Road connecting San Jose-
Guapales Highway and Puerto Viejo

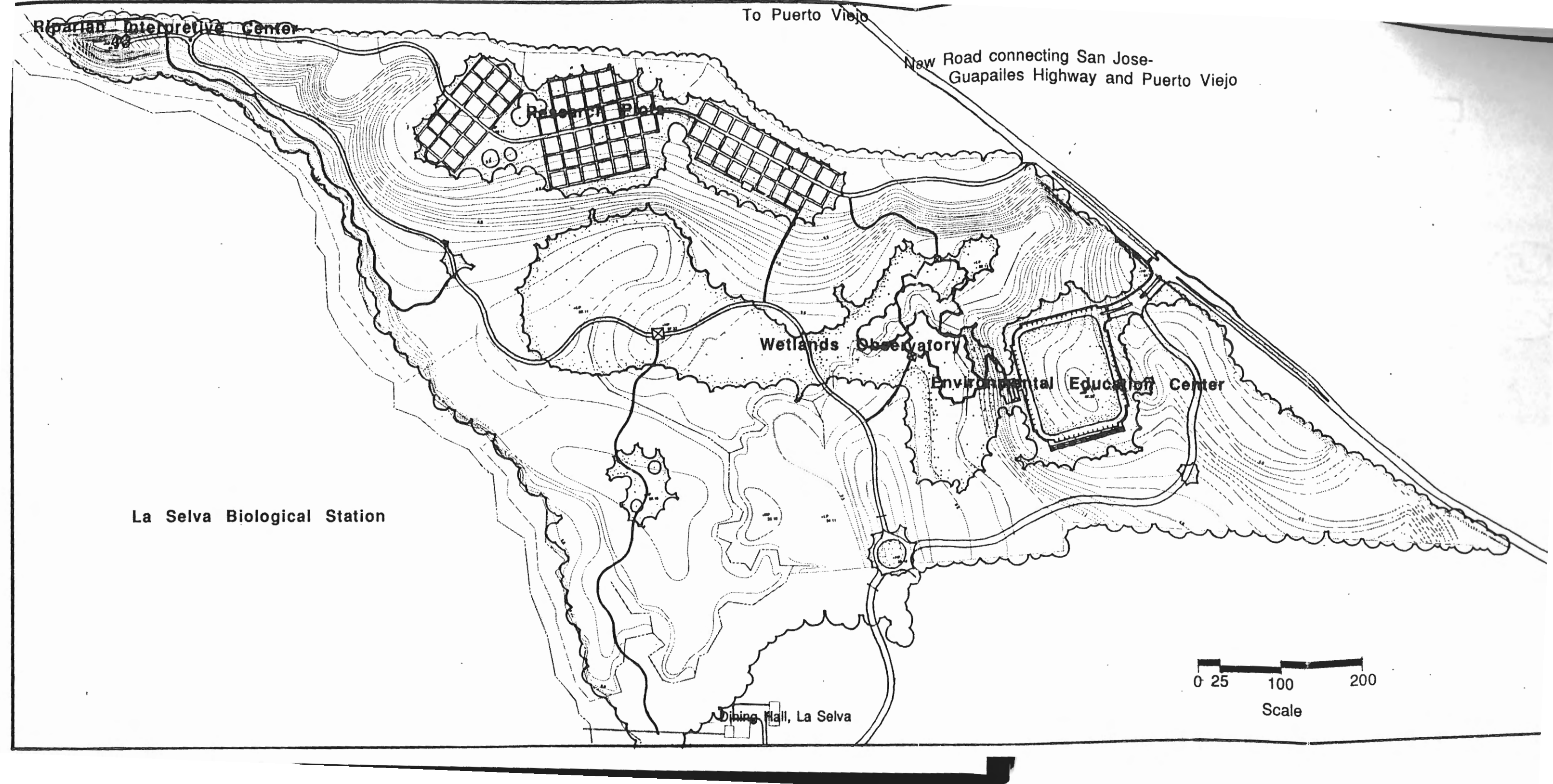
Research Plots

Wetlands Observatory

Environmental Education Center

La Selva Biological Station

Dining Hall, La Selva

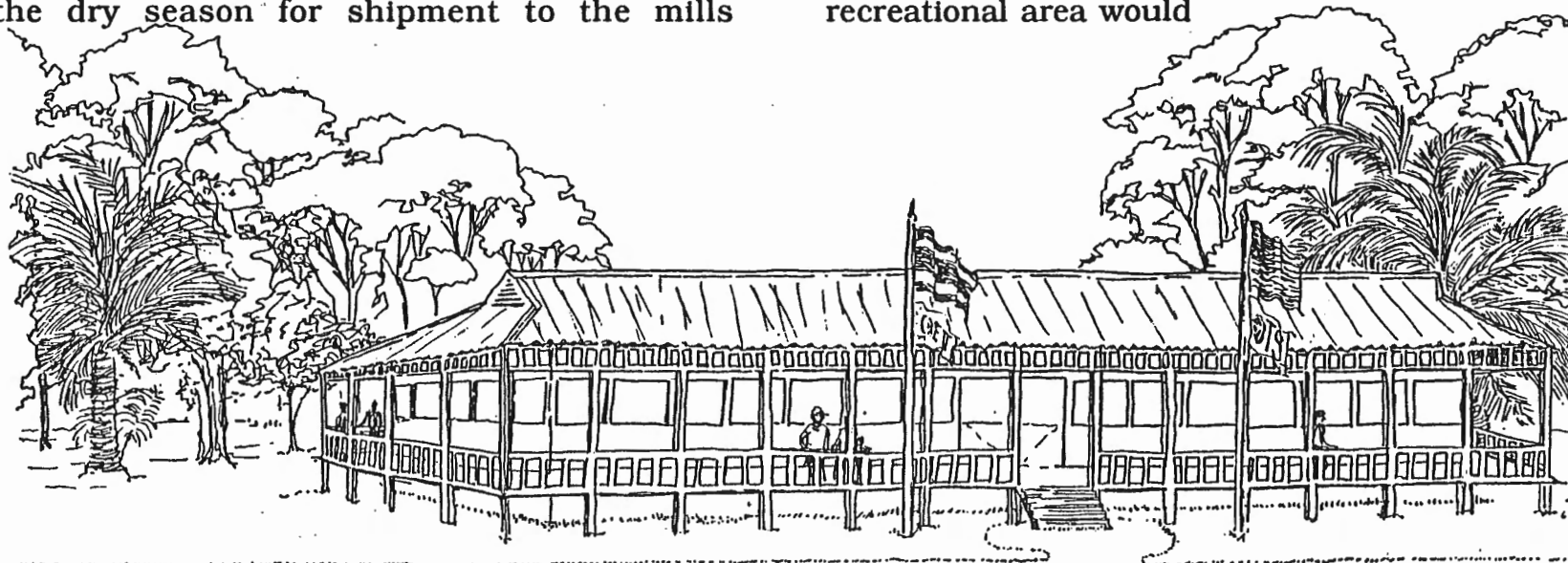


Environmental Education Center

(See foldout 2)

The environmental education center is situated prominently on the La Selva Green with commanding views of the surrounding areas. The concept for the La Selva Green was developed as a representation of development patterns observed in Costa Rica. Areas of new settlement would often develop around abandoned log patios. Log patios are areas cleared and leveled to stockpile lumber during the dry season for shipment to the mills

during the wet season. Important to the location of the patio was proximity to an all-weather road. As towns developed, log patios are often converted into recreational areas, primarily soccer fields. Around these recreational area people develop residences. Eventually retail facilities as well as important religious and state buildings are placed in prominent areas around the square. Often the recreational area would



Environmental Education Center

develop into an urban park necessitating a need for a new soccer field. The La Selva Green reflects this tradition. It provides two major functions: overflow parking and a soccer field. Surrounding the Green is a one-way circulation loop with on-street parking. This was chosen to minimize the visual impact of the visitor parking facilities.

Also afforded in this scheme, is the ability to increase density and allow for the development of further research, education and residential facilities. This can be accomplished through the use of building sites provided but currently unutilized around the proposed La Selva Green.

On the south side of the La Selva Green is a series of picnic pavilions reflecting the regional tradition of Costa Rican urban development. As can be seen in many camping and picnicking facilities throughout Costa Rica, the people generally enjoy being in close proximity to other people. On the east side of the La Selva Green is an observation tower providing distant visual access in all

directions. The Environmental Educational Center is located on the west side of the site situated with commanding views of the surrounding area. The center serves to orient people to the site and familiarize them with the resources available within the site. The center is intended to promote an awareness of natural resources; their local, regional and international importance.

Link to La Selva Biological Station

New Road

Bus Stop

Observation Tower

Gate House

Turning Lane



La Selva Green

Environmental Education Center

Observation Deck

Link to Wetlands Loop

Wetlands Loop

Picnic Pavilions

Restored vegetation

Fold-out

Central Volcanic Cordillera Biosphere Reserve
La Selva Biological Station
La Selva Annex Proposed Site Development Plan



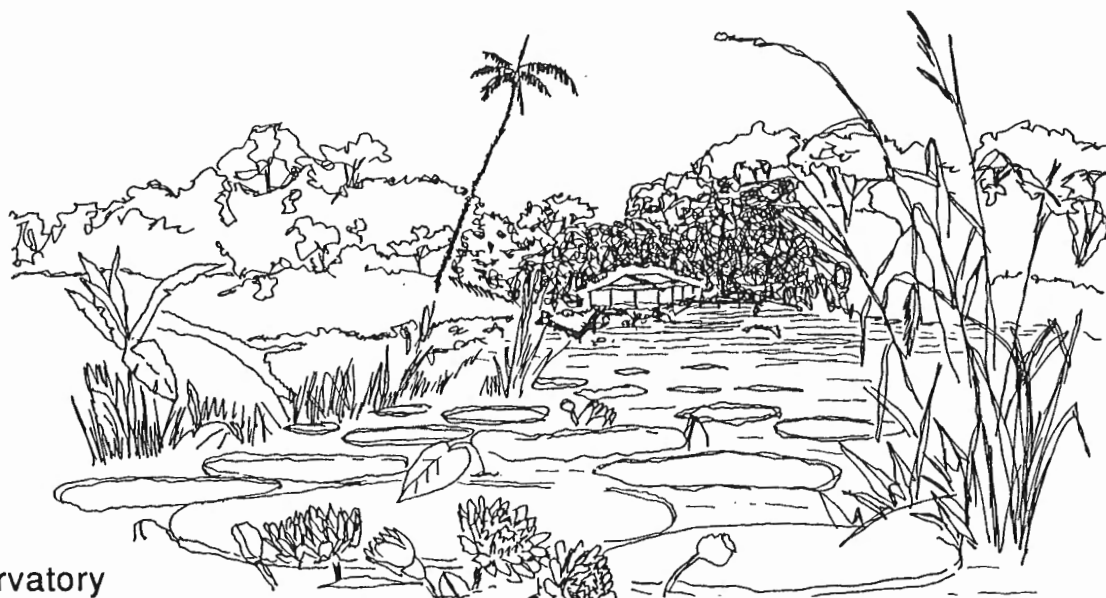
Wetlands Observatory

(See foldout 3)

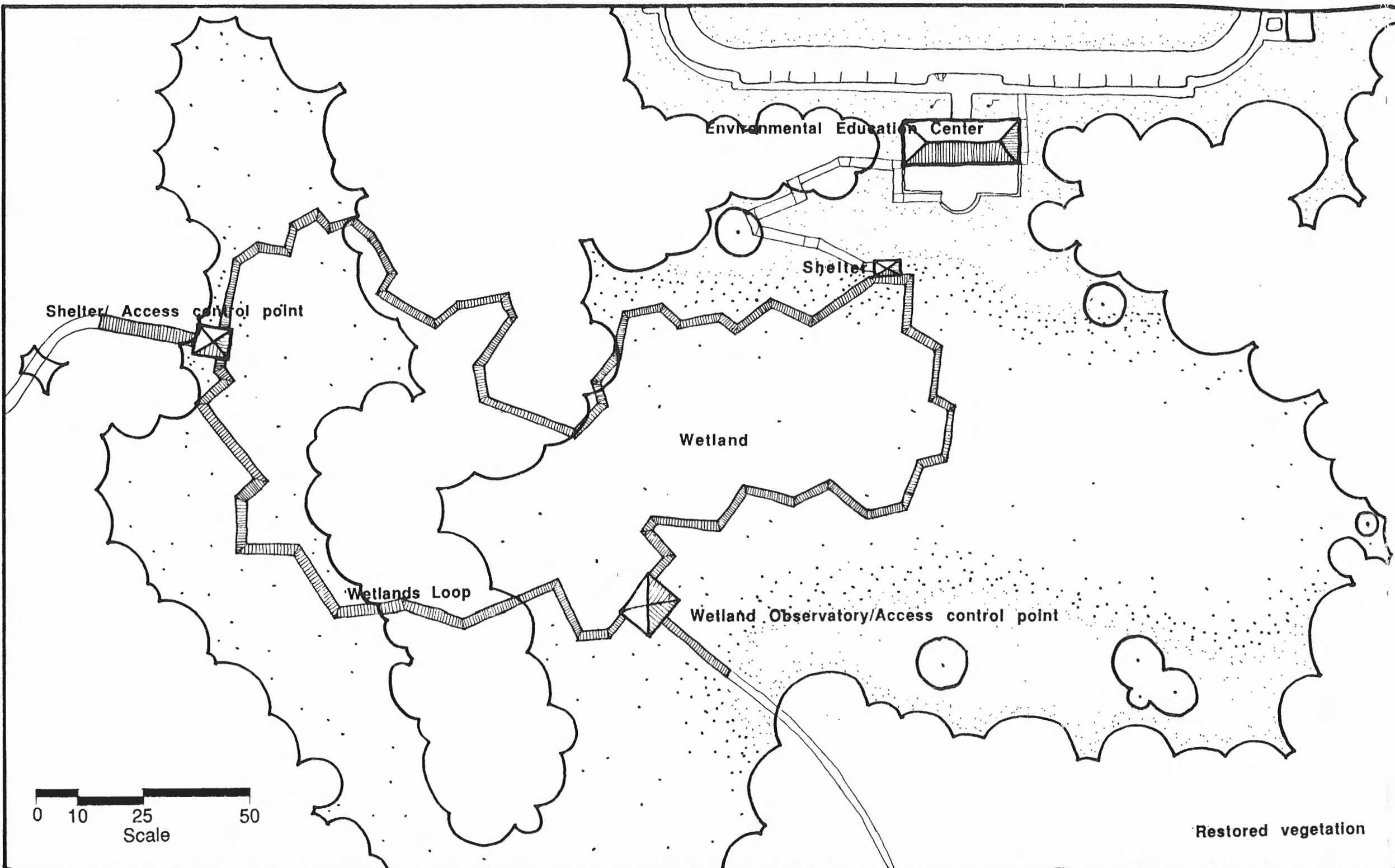
The Wetlands Observatory is linked to the Environmental Education Center through a trail system accessible to the physically challenged. This system has integrated into it interpretive opportunities highlighting soil conservation, ecosystem restoration and the importance of responsible land stewardship. The observatory which offers shelter from the elements emphasizes the importance and fragility of fresh water wetlands in the regional ecosystems. The observatory is linked to a

system of catwalks. The catwalks allow visitor access throughout the wetland area. Integrated into the system are two access control points to allow access for proposed guided tours of the remainder of the La Flaminia site.

Within the restored wetland, water level will be able to be manipulated. This would allow for research projects to utilize the facility as well as educational programs.



Wetlands Observatory



0 10 25 50
 Scale

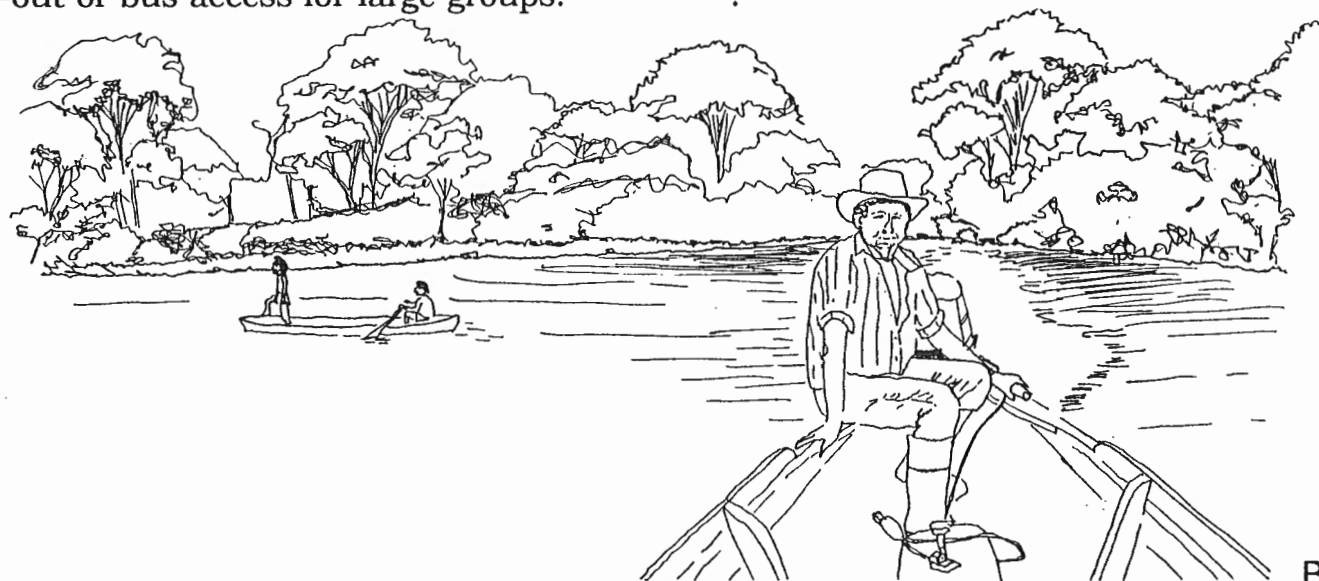
Restored vegetation

Riparian Interpretive Center

(See foldout 4)

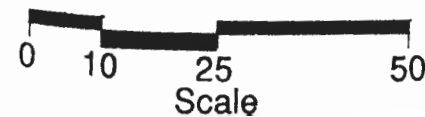
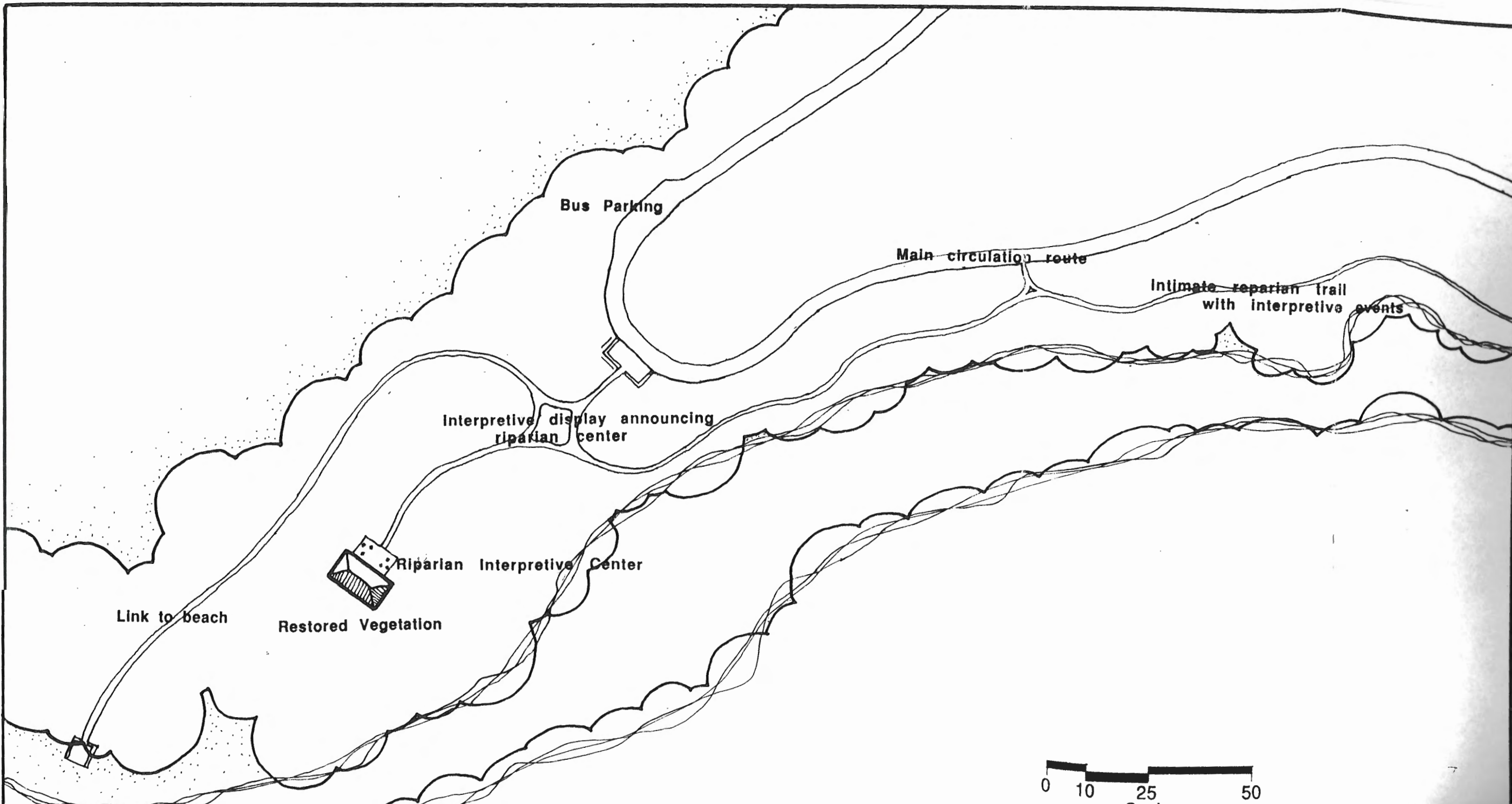
The Riparian Interpretive Center will be developed as part of the guided tour of the facility and will make use of an existing building on the site. The site was chosen due to its proximity to the river and the high elevation of the existing structure which will prevent flooding during periods of heavy rain. Care was taken in the site development to allow for access to the facility from the water as well as the potential for large vehicles to access the facility. This might be utilized as a boat pull-out or bus access for large groups.

As part of the facility a more intimate trail system developed off of the major circulation loop is proposed. The interpretative program on the trail and within the river center will compliment one another by promoting watershed protection. The message presented to visitors will be that of watershed management including soil erosion, site stabilization, riparian ecology as well as the social and economic implications of watershed management and utilization



Boat Man

Central Volcanic Cordillera Biosphere Reserve
La Selva Biological Station
La flaminia Annex Proposed Site Development Plan
Riparian Interpretive Center



Research Plots

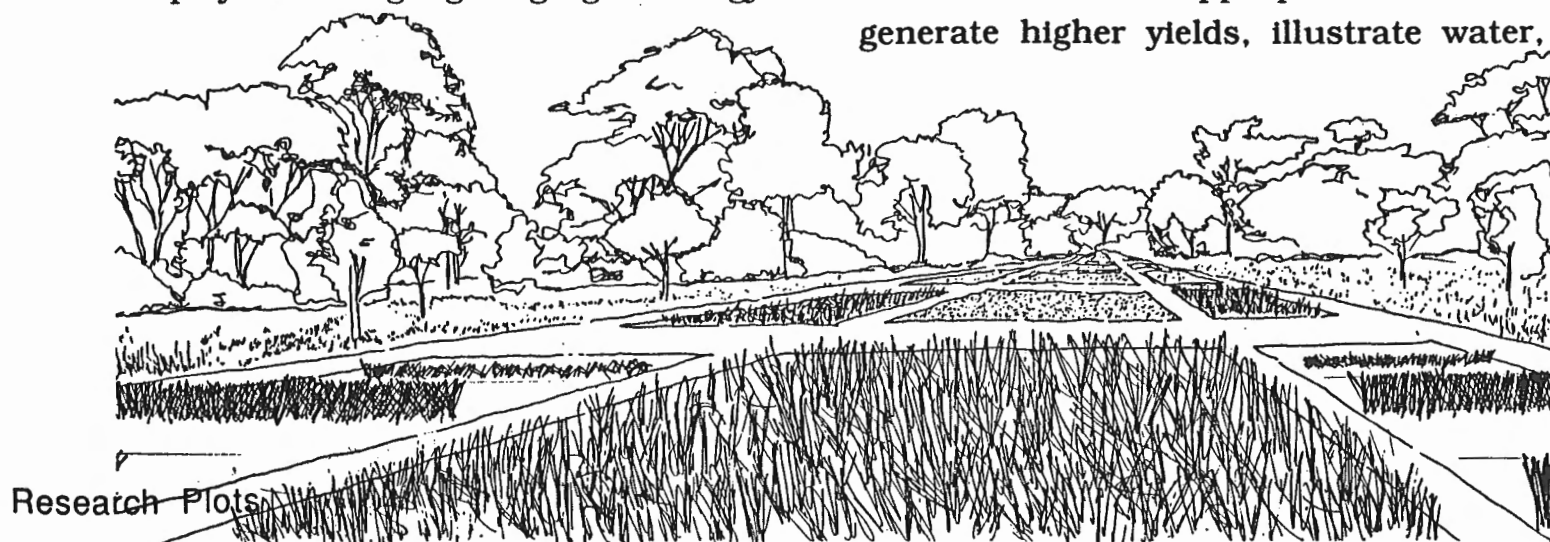
(See foldout 5)

These plots are intended to facilitate a transfer of technology from OTS to the community. The research plots are proposed to be established on an upland section of the site which is generally level to somewhat sloping. The plots are located along the major circulation loop.

Integrated into the design is all-weather vehicular access to allow research and equipment access to the site year round. Included within the research plot areas will also be display areas highlighting agro-ecology

and new plant varieties. Plots will also be established for the utilization of OTS courses. Research plots were placed with consideration to topography, creating within the site the potential to experiment with hillside farming techniques as well as agricultural practices on level ground. Seasonal high water levels were also considered in the placement of the proposed research plots. Sensitivity to this factor will prevent water damage to these research areas.

Plots will show appropriate land use to generate higher yields, illustrate water, soil,

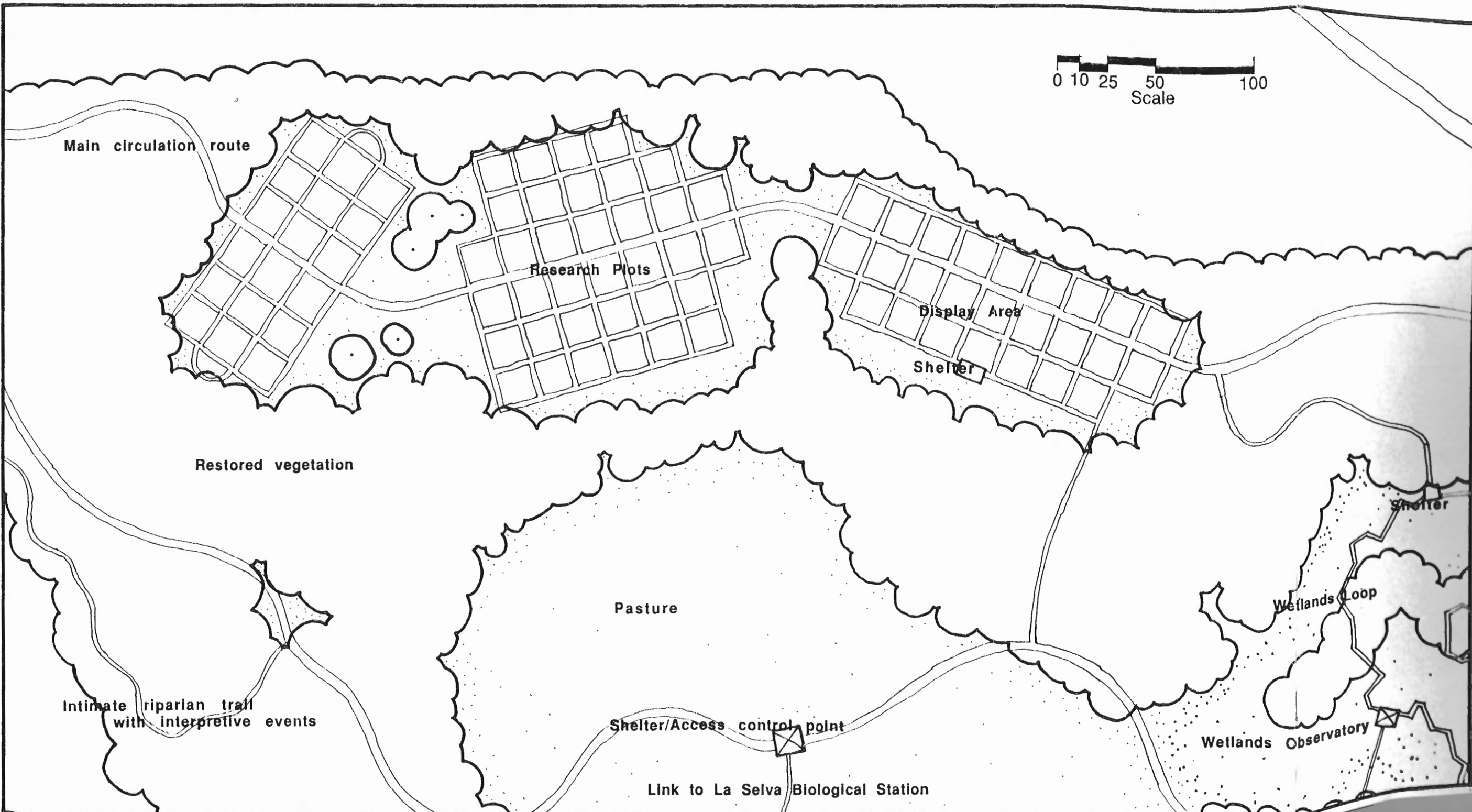
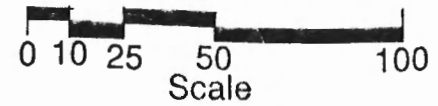


Research Plots

tillage and other management techniques to increase productivity. Areas unsuitable for agriculture on the site will be used to illustrate land uses environmentally appropriate to site conditions while still generating income. Throughout the demonstration plots sustainability of land use will be integrated as a tenet of site practices.

Care will be taken to develop a variety of forest edge around the site to allow for experimentation with edge effect. Edge effect is the product resulting from the interface of differing types of ecosystems - i.e. forest and pasture.

Research Plots



VI. Implementation

The first step necessary to bring the La Flaminia project to fruition is site acquisition. This includes any of the three identified out-parcels we wish to acquire. Once the site is acquired by OTS, the immediate initiation of development would limit the possibility of reinvasion by agricultural colonists.

After site acquisition is completed, fences on the site would need to be mended, or erected where nonexistent. The next logical step would be to perform all proposed earth work; road and trail beds as well as the necessary grading.

The site will be developed in stages. This process will allow for particular segments of the project to be developed individually. An example of this would be the vehicular circulation system or the successional plots. Upon completion of the parts, a cohesive whole will be formed. This permits for two aspects of the project to be realized.

First, the life spans of individual research projects within the site will vary. Second, the interests of the projects' potential patrons will differ.

Once tenure to the site is secured, the next most urgent task will be completion of the earthwork and vegetative stabilization of the site. These two tasks would require closely timed coordination. Completed earthwork would allow for isolation of the La Flaminia Annex from the adjacent agricultural run-off and a new all-weather access road to the station. Further circulation will be developed as funding allows.

Due to the degraded condition of the site, steps toward reforestation and restoration should begin as soon as possible. This restoration information could be potentially, useful for researchers. Complete documentation as to existing site conditions and finished site work is recommended.

VII. Subprojects

Upon completion of the master plan, subprojects that require future contemplation are the following:

1. Restoration of Riparian Forests

Restoration of the riparian forest with interpretive trails explaining the restoration process is an early project of importance. The vegetation along the stream corridor will need to be developed as a model for restoring stream vegetation regionally.

2. Successional Plots

These plots will offer individuals a view of what to expect from areas of abandoned pasture throughout the region. Study of these plots can lend insight as to what can be expected with regard to natural regeneration in deforested zones.

3. Wetlands Restoration Created as a Focal Point for the Visitor Center

The ecological importance of wetlands can be showcased in the restored wetlands area.

Potential research questions could be developed around newly developed, manipulatable wetland areas.

4. Research Plot Development

It is imperative to determine the necessary size, areas and numbers of replicates sufficient to fulfill the research component of this project. Plots should be modular in nature to allow for a diversity of research questions. Consideration should also be given to the ephemeral nature of research funding so as to allow the simultaneous accomodation of projects of multiple time-frames to be accommodated simultaneously.

5. Cohesive Interpretive System for the Entire Facility

Individual interpretive opportunities should support the environmentally based message put forth in the entire facility. Displays should have a uniformity and cohesiveness in their presentation.

6. Ecosystem Restoration

A plan for the actual restoration of the desired ecosystems and their maintenance needs to be developed. Documentation of this process is critical if the site is to facilitate restoration research.

7. Community Education

Development of a cohesive community education program for local people would help integrate La Selva into the surrounding community. Local school children could be brought on-site, and staff of the education center could visit local schools. Courses could be offered to local people on issues facing farming in the region.

8. 'FRIENDS OF LA SELVA'

'Friends of La Selva' would be an organization of local, national and international people interested in the preservation of biodiversity and the sustainability of life in the Atlantic Lowlands of Costa Rica. Membership would be offered with a special thrust to attract La Selva's neighbors. In the hopes of stimulating local interest in the reserve, La Selva could offer its neighbors free membership to the organization. Members of 'Friends of La Selva' would be offered free access to the property.

9. The Corridor Project

In conjunction with development of the La Flaminia Project, a system of greenways extending along the Sarapiquí and Puerto Viejo Rivers is proposed. This would facilitate the preservation of riparian flora and fauna as well as protect water quality. Through careful analysis of the usership of this water resource, destructive practices could potentially be mitigated.

Given interest in the idea, an association could be formed with the aim of restoring and

protecting the fifty meter river boundary. Participants would receive some form of recognition for demonstrating environmentally-sensitive, land-management techniques, such as allowing for a percentage of forest cover on their property. One motivation for participation in this program would be the center's recommendation for positions offered within the project (i.e. guides for the rivers and trails). Another motivation would be the natural benefit of soil conservation.

VIII. Conclusion

Given the dynamic nature of development in the Sarapiquí region as well as the challenges facing the sustainability of the new development, the need within the region for the development of the La Flaminia Annex to the La Selva Biological Station is urgent. The modular nature of the proposed master plan increases the feasibility of this project. Flexibility, both financial and physical, is a key tenet which is integrated into this development plan and should be integrated into the management of the site.

Examples of flexibility within the site are the ability of the La Flaminia Annex to be self-guided or guided. Currently, it is the feeling of the La Selva organization that the majority of site access into areas sensitive to degradation should be accessed only with the interpretive aide of a field guide. At this time the employment of guides is a financially feasible goal. In the future, however, this may not be

feasible and all site development should occur with this possibility in mind.

The circulation system, because of service needs, is designed to allow for vehicular access to the site. Currently, public vehicular access is only being considered for a small portion of the site. With the presented design, this option could be changed and one-way vehicular circulation throughout the site could be allowed with minimum redevelopment.

In order to capture the attention of participants and move their spirit, an exciting flow of events must be experienced as individuals move through the site. People must be attracted to the site before an educational dialogue can be developed. Through this dialogue the researchers and the people will exchange their respective knowledge. To insure the educational success of this project the site will need to be actively managed to enhance the experience of the

visitors. Management techniques would need to be developed to exploit the full potential of the site.

The next step is to raise the funds necessary to hire a professional office. The office can utilize this background information and the dialogue this report creates to develop a master plan including working drawings for site development. Simultaneously, tenure of the site must be secured. Individual subprojects can be adopted as individual researchers and resources are identified.

This proposal is not to be considered the final word on the site development for the La Flaminia Annex to the La Selva Biological Station but rather a document to generate dialogue between individuals and organizations interested in promoting the sustainability of the Atlantic Wet Tropical Forests in Costa Rica. Offered here is a feasibility study which should be considered a living document, a document which will be a part of the development process for the La Flaminia annex to La Selva Biological Station. The dynamic nature of the Sarapiquí region demands the flexibility and foresight encompassed in this plan.

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