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10 AGO 1987

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Turrialba, Costa Rica

# AGRICULTURE IN THE ATLANTIC ZONE OF COSTA RICA

SUMMARIZING REPORT OF AN EXPLORATORY SURVEY

Fred R. van Sluys  
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Turrialba, January 1987



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Costa Rica

  
Agricultural University  
Wageningen

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ATLANTIC ZONE PROGRAMME

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CENTRO AGRONOMOICO TROPICAL DE  
INVESTIGACION Y ENSEÑANZA - CATIE

AGRICULTURAL UNIVERSITY  
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El CATIE es una institución de carácter científico y educacional, cuyo propósito fundamental es la investigación y la enseñanza de posgrado en el campo de las ciencias agropecuarias y de los recursos naturales renovables aplicados al trópico americano, particularmente en los países de América Central y el Caribe.

El Programa Zona Atlántica (CATIE-UAW-MAG) es el resultado de un convenio de cooperación técnica entre el CATIE, la Universidad Agrícola Wageningen (UAW) Holanda y el Ministerio de Agricultura y Ganadería (MAG) de Costa Rica. El Programa, cuya ejecución se inició en abril de 1986, tiene, como objetivo a largo plazo la investigación multidisciplinaria dirigida a un uso racional de los recursos naturales, con énfasis en el productor pequeño de la Zona Atlántica de Costa Rica.

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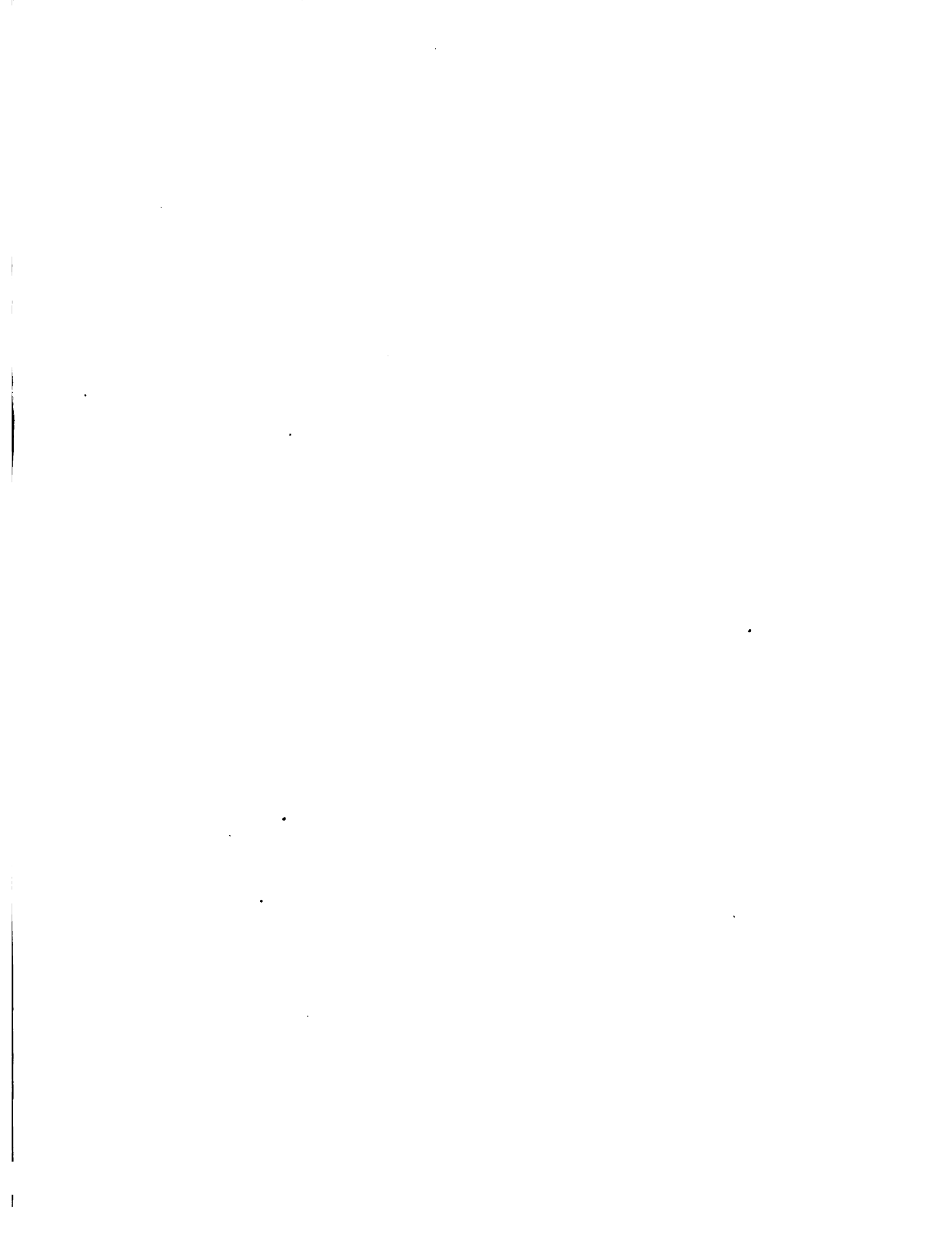
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## 1 INTRODUCTION

In March 1984 the Tropical Agricultural Research and Training Center (CATIE) in Turrialba, Costa Rica, and the Agricultural University Wageningen (AUW), the Netherlands, signed a letter of intent as a first step towards long-term cooperation in the field of joint multidisciplinary research aimed at sustained land use and at the rational development and use of the natural resources. Preference was given to areas of study that would involve the small land owner of the Atlantic Zone of Costa Rica.

In April 1985 the two parties signed a letter of understanding and proposed the development of a joint multidisciplinary research project. It was decided to first carry out a diagnostic study of the Atlantic Zone starting with an exploratory survey which would be followed by a baseline study in smaller subareas. The objective of the exploratory survey was a rapid identification of (1) the most important land use systems, (2) the physiographic land units, and (3) agricultural problems of the Atlantic Zone so as to enable selection of subareas for the baseline study.

The baseline study will consist of three interrelated parts:

- (1) An inventory of (the available information on) the ecological resources, the socio-economic conditions and the agriculture and its development.
- (2) Multidisciplinary investigations analysing:
  - The changes in land use and the history of agricultural development.
  - The socio-economic situation (demography, infrastructure, marketing, services) and of the social structures that influence the agricultural development.
  - The actual agricultural production systems, with emphasis on the use of ecological resources, reactions to socio-economic conditions, cost/benefit ratios, production costs, limiting factors, and ways of improving the existing systems or developing alternative ones.
- (3) Complementary studies. If necessary for a better understanding of the problems of the Atlantic Zone, complementary studies will be carried out outside the subareas.

The results of the baseline study will be used for the formulation of possible multidisciplinary research projects. Generally this research will be agricultural with emphasis on production systems, and will be supported by disciplines like agronomy, forestry, soil science, and socio-economics. These research projects will be carried out jointly with national institutions. Formal cooperation already exists with the Ministerio de Agricultura y Ganaderia (MAG) and with the Instituto Geografico Nacional (IGN).

For the purpose of the exploratory survey the Atlantic Zone was defined as the planning region Huetar Atlantica which consists of the province of Limon plus the district Horquetas of the province of Heredia (figure 1).

The exploratory survey was carried out in the period April-July 1986. The present report is a summary of the main findings as laid down in a number of working documents prepared by the participants of the survey (ANON., 1986b; KLOOSTERMAN *et al.*, 1986; SCHIPPER, 1986; VRIES, 1986; WAAIJENBERG, 1986; WEIDE, 1986).

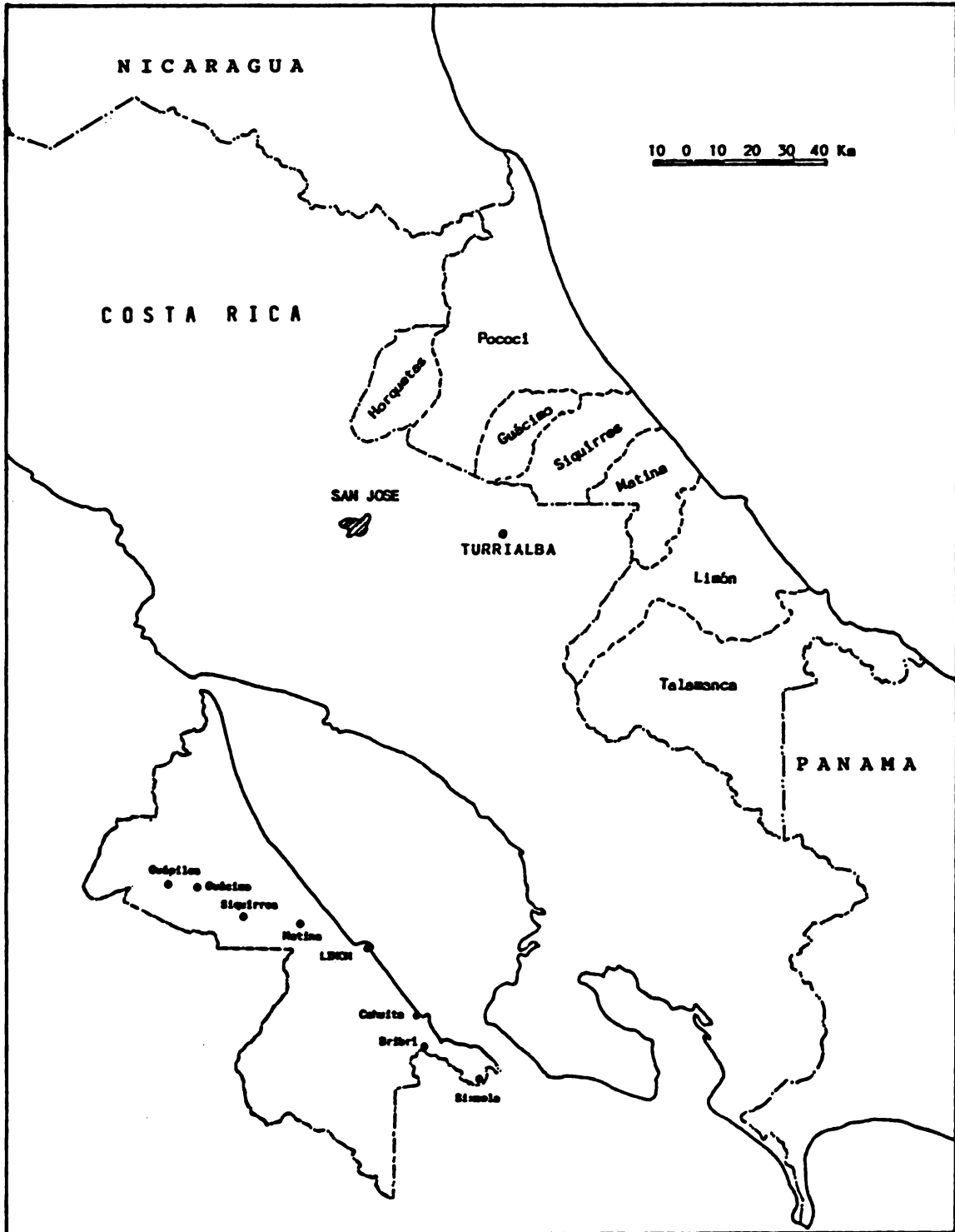


Figure 1. Administrative subdivision of Huetar Atlantica.



The exploratory survey team consisted of specialists in soil science, vegetation science, landscape architecture, forest husbandry, forest technology, social forestry, sociology, farm economics, animal husbandry, and agronomy. For the first three the emphasis was on the soils and vegetation, i.e. the 'land' group. The others concentrated on 'land use, farming systems and institutions'.

The exploratory survey consisted of the following steps:

- March to May 1986: preparation in the Netherlands. This involved compilation of a bibliography, design of tentative checklists, drawing of soil and vegetation maps based on aerial photograph interpretation, preliminary discussions.
- 19 May to 14 June 1986: visits to institutions, discussions with officials, and literature study in San Jose, Turrialba and in the Atlantic Zone (Guapiles, Siquirres, Limon).
- 2 to 14 June 1986: fieldwork throughout the Atlantic Zone. For the 'land' group this consisted of extensive field checking of the maps that had been prepared. The 'farming systems and institutions' group followed the 'sondeo' approach: observations of land use and informal interviews with farmers, labourers, etc. by teams of 2 or 3 persons. The composition of the teams was changed daily to enhance interdisciplinary discussion and exchange of viewpoints. The checklists served as guidelines, but were not followed strictly. Field checks, observations and interviews were discussed and reported daily.
- 16 to 20 June 1986: compilation of a preliminary report (ANON., 1986a) and its presentation to representatives of CATIE, MAG, IGN, MIDEPLAN, JAPDEVA and ASBANA.
- 20th June to August 1986: additional fieldwork, literature study and reporting. The present report, compiled by the permanent field staff, is based on the reports submitted by the various disciplines or groups of related disciplines.

### 3 RESULTS: CHARACTERISTICS OF THE ATLANTIC ZONE

#### 3.1 Actual situation and historical review

##### 3.1.1 The present situation

The present situation is the result of a number of marked changes that took place during the last decades and that manifest themselves in various interrelated phenomena. Most imminent are the accelerated deforestation and the exploitation of the natural resources in connexion with colonization, immigration, pressure on the land, land speculation and 'precarismo'. Consequently the agrarian structure is being redefined and social conflicts emerge.

The northern part of the Limon province, with Guapiles as a growth pole, is an economic area which especially shows rapid infrastructural changes both physically and institutionally. Changes will be even more dramatic once the San Jose - Guapiles road is opened. This northern part shows on the one hand a modern plantation economy with its land use, technical management, social structure and even its own culture, and on the other hand the exploitation of natural resources applying and demanding different types of technology, together with the opening up of new areas on the agricultural frontier. The latter phenomenon can be largely explained by the colonization and immigration both from within and outside the Atlantic Zone. As a result a complex economy has evolved which is linked up with national and especially international markets, partially induced or accompanied by institutional development and state directed projects. This structuring has consequences for actual and future land use and for agrarian development in both old and newly opened areas.

The changes that have shaped the area of Talamanca, i.e., the southern part of the Atlantic Zone, are different from those in the north. Apart from a long-time economic isolation, social differentiation in relation to ethnically and culturally different groups inhabiting the area have had their effect on agrarian structure, land use and exploitation of the natural resources.

In the older area of Limon-Centro land use is more established and there is a tendency towards differentiation of agrarian production. In this area the traditional cocoa producing farms find themselves in a critical situation due to the reduced yields from the very old and moniliasis (Monilia roxeri) affected plantations.

##### 3.1.2 Main determinants for development

In spite of subregional differentiation, the Atlantic Zone has been shaped largely by the demand for particular agricultural products by world markets. Within this context, reviewing the history and studying the present situation, three main determinants can be distinguished:

- (1) Population aspects such as migration and (re)settlement, social, cultural and ethnical differentiation, organizational aspects and responses to state and private interventions.

- (2) State policy and intervention, regional and agrarian sector policy, plans and projects.
- (3) Intervention of (multi)national enterprises, with or without state support, including the introduction of technology.

A short review of the history of the zone, mainly agrarian, should clarify these statements.

### 3.1.3 Historical review

#### Cocoa-railroad period

After the cultivation of cocoa, which was concentrated near the town of Matina, the railroad construction starting in 1871 drastically altered the development and future of the zone. Though the principal motive for the railroad was the transportation of coffee from the Central Valley, its presence offered possibilities for the cultivation and transportation of other crops or products. As it was difficult and certainly not a priority to develop the region by national government initiative, large areas along the railway were given in concession to the railway company (Soto-Keith contract, 1884), thus giving birth to the United Fruit Company (UFC) and its monopolization of the banana industry. In the twenties the zone experienced a boom period in banana production. Significant numbers of immigrants from other parts of Costa Rica and from abroad were attracted and these enlarged the existing labour force of Jamaicans, Chinese and Italians already present since the railroad construction.

#### Withdrawal of the banana companies - the Panama disease, 1920-1960

When in the twenties the banana plantations were struck by the Panama disease (*Fusarium oxysporum*) followed by labour unrest in the thirties the UFC shifted its operations to the Pacific side of the country. The virtual elimination of banana production and export dropped the region into a profound crisis.

The labour force, much of which consisted of black people who were forbidden free movement in the country, was forced into small scale cocoa and subsistence production. After some experiences with other crops like Manilla hemp and rubber, cocoa became again the major crop for the debilitated regional economy in the decade of 1950-1960. Because of special arrangements between the UFC and the State, squatting and production activities could be adjusted to the UFC's needs, in this way controlling most of the commercial land along the railroad. After the withdrawal of the UFC national entrepreneurs bought up large tracts of land converting them into pasture.

#### Renewed banana production and increased state participation

Finally, in the 1960's, with the merging state policy of regional development and state participation, national entrepreneurs took the initiative to re-establish banana cultivation in the Atlantic

Zone and in 1979 national owned plantations accounted for 60 % of the regional production.

In this period a lot of events occurred, setting the conditions for the present situation and future development of the region. Standard Fruit extended its field of operations into the Valle de la Estrella and the Valle de Sixaola under contract with the Costa Rican state in 1956. New areas were cleared (Rio Frio, Guapiles, La Rita, etc.) by Standard Fruit, United Brands and Bandeco while older areas were reopened in the Matina and Siquirres areas.

As to the physical infrastructure new railway ramifications were constructed (Rio Frio, Estrella) and new roads were opened to incorporate periferical locations such as Cariari.

In 1963 the Junta Administrativa Portuaria y de Desarrollo de la Vertiente Atlantica (JAPDEVA) was created as a regional development body. From 1962 the Instituto de Desarrollo Agrario (IDA, formerly ITCO) started settlement programmes, first to attract people, later to intermediate between precaristas and land invasion groups and the banana plantations.

Perhaps most important was the 'Banana Credit Project' which enabled national producers to open plantations.

All these state promoted or induced activities characterize the changing situation and conditions within the zone. Nowadays with banana again the second export product after coffee and major single source of state income and foreign currency, the economic and social structure of the Atlantic Zone cannot be referred to as an 'enclave economy'. As opposed to the beginning of the century the regional economy is characterized by a tripartite presence of three major agents: the state, national investors and the multinational corporations. The state participates directly or indirectly by creating conditions for productive development, as well as creating reproductive conditions through social projects, altogether setting the conditions for actual - and future - agricultural development and land use.

### The area of Talamanca and Sixaola

Though the southern area shares the general features of the history of the Atlantic Zone some specific remarks upon population aspects can be made for a better understanding of the actual situation. By 1930 the area already accounted for one third of national banana production. The fruits were exported through Panamanian harbours due to the absence of road and railway connections to the rest of the zone. After the withdrawal and later return of the UFC the mainly Amerindian population dedicated itself in the lower lying parts to smallholder agriculture, though not completely re-establishing traditional agricultural practices as still maintained in the higher areas, and in the reserves in the Talamanca valley.

Population increase through natural growth and immigration has caused conflicts over the land between Jamaican blacks, Amerindians, settlers and national and foreign entrepreneurs, mostly ranchers.

These factors stress the complexity of ethnical-cultural aspects related to socio-economic and environmental aspects in the area; and the need for a special approach for analysis and development of the Amerindian territories or reserves in the Talamanca valley.

Nowadays the area is linked up with the rest of the Atlantic Zone by road, but the state did not enter here in the same way as in the Pococi-Guacimo area, except for recent IDA involvement in the river plains and the RECOPE activity of prospecting and initiating oil and coal exploitation. This energy project will strongly affect future development regarding infrastructure and environment. The dominant influence of foreign companies, the strong influx of 'outsiders' and the relative neglect of the area by the state until recently, left little room for the development of self-generated initiatives.

### 3.2 Physiography and soils

The most important land systems were defined on the basis of geology, geomorphology, topography and soils. The systems are:

- (1) Land system of the Cordillera Central (C), which is mainly quarternary.
- (2) Land system of the Cordillera de Talamanca (T), which is tertiary.
- (3) Land system of the alluvial plain (R), including remnants of tertiary volcanoes.

For a subdivision of these land systems see table 1 and figure 2. The major soil related problems of the Atlantic Zone are listed in table 2.

Table 1. Key to the land system and soil unit map.

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CLi/CLt	Mud streams (lahars) and lava streams from the Irazu (i) and Turrialba (t) volcanoes with very dark and porous soils (Andepts).
CFy	Recent alluvial fans with very dark, stony and porous soils (Andepts).
CFo	Old alluvial fans and mud streams with clayey reddish brown soils (Humults and Dystropepts).
CFr	Flood plain of braided rivers with stony and sandy soils (Vitrandepts and Entisols).
CM	Mountain slopes with soils as in CL, but very thixotropic (Hydric Dystrandeps).

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Table 1. Continued.

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TM	Very steep slopes with shallow to moderately deep soils (Inceptisols).
TV	Deep clayey soils developed on tertiary volcanoes on generally steep slopes (Tropudalfs).
TA	Recent alluvial soils (Fluvents and Tropepts).
TH	Deep reddish clays in a hilly landscape (Paleudults).
RH	Reddish clays developed on tertiary volcanoes in a hilly landscape (Paleudults).
RAP	Relatively recent alluvial soils with somewhat impeded drainage (Inceptisols).
RAu	Reddish brown clays on old alluvial terraces (Paleudults) associated with alluvial soils in flat bottomed valleys, which are often poorly drained (Aquepts and Tropepts).
RS/RB	Swamps (S) and beachridges (B) (Aquepts, Histosols and Entisols).

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Table 2. Major soil related problems.

- 
- Structure degradation in the top soil, particularly under pasture (virtually all soils).
  - Soil compaction and risk of land slides (unit TH and also CFo).
  - Leaching of nutrients especially under annual crops.
  - Deficiencies of micro-nutrients (CFo, RAu, RH, TH, CLt).
  - Phosphate retention (CFo, CFy, CLi, CLt, CM, TH, RH).
  - Drainage problems (RAP, RAu, RB).
  - Risk of flooding (CFr, TA, RAu).
  - Run-off and erosion in the steep parts of the Cordilleras (especially Talamanca) due to deforestation resulting in an increased risk of flooding and sedimentation in the lower parts (TM, TH, TV).
-

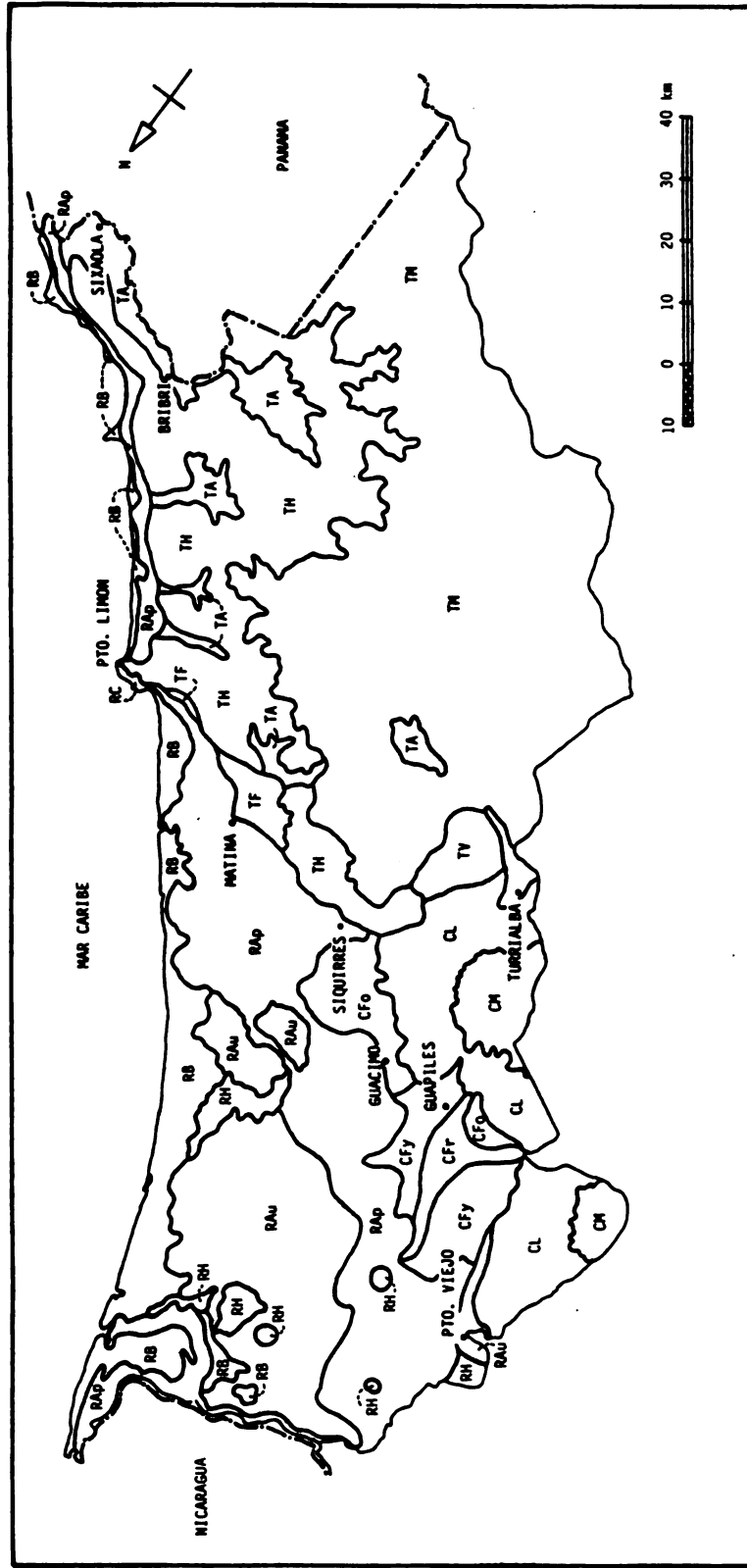


Figure 2. Provisional map of the land systems and soil units of Huetar Atlántica, the district of Puerto Viejo and the cantón Turrialba.

### 3.3 Climate

The time available for the exploratory survey was too short for a thorough analysis of the climate. However, figures 3 and 4 adequately illustrate the main properties of the climate of most of Huetar Atlantica. With an average annual temperature of 24 °C or more, an average annual rainfall ranging between 2000 and 5000 mm, and an average potential evapotranspiration of 1200-1500 mm, the weather is almost continuously hot and wet. This means that in much of the zone crop growth is possible throughout the year. Less positive is that weeds, pests and diseases also thrive throughout the year, crops have problems during flowering and ripening, livestock suffer, amongst other things, from foot rot, many areas are insufficiently drained, and field operations and their planning are hindered by the excessive rainfall.

Perhaps the most complete climate analysis for agricultural purposes of Costa Rica is that of ROJAS (1985). He lists 10 meteorological stations in the Atlantic Zone. Several of them appear to be on banana plantations.

### 3.4 Vegetation

The natural vegetation of the Atlantic Zone is tropical rain forest. Regional and local differences in physiognomy and species composition are mainly the result of (1) altitude, and in connexion with this, mean temperature and temperature extremes, air humidity, precipitation and soils, (2) the total annual rainfall as an ecological gradient from northwest to southeast, and (3) local relief and hydrology which are reflected in drainage pattern and possible (periodic) flooding. The dominant vegetation types of the physiographic land units as distinguished in section 3.2 are as follows.

Unit Clt / Lahar landscape of the volcano Turrialba

Extensive areas of virgin forest are still left on the northern and northwestern foothills. On the southern foothills of the volcano almost all virgin forest is gone. Areas with heavily exploited forest and secondary growth are still present, especially above 1000 m.

Unit CA / Intramontane valleys

No undisturbed virgin forest is left. On some hills with steep slopes and on the slopes of the valley in the south logged-out forest or secondary forest is encountered.

Unit CFo / Alluvial fans, relatively old

Only remnants of the original virgin forest are left in the form of selectively logged forest or heavily logged forest with a very strong secondary character.

Unit CFy / Alluvial fans, relatively young

The actual state of the vegetation differs little from that of the previous unit. Original vegetation can be found in several stages of disturbance and only occurs in some small dispersed areas.



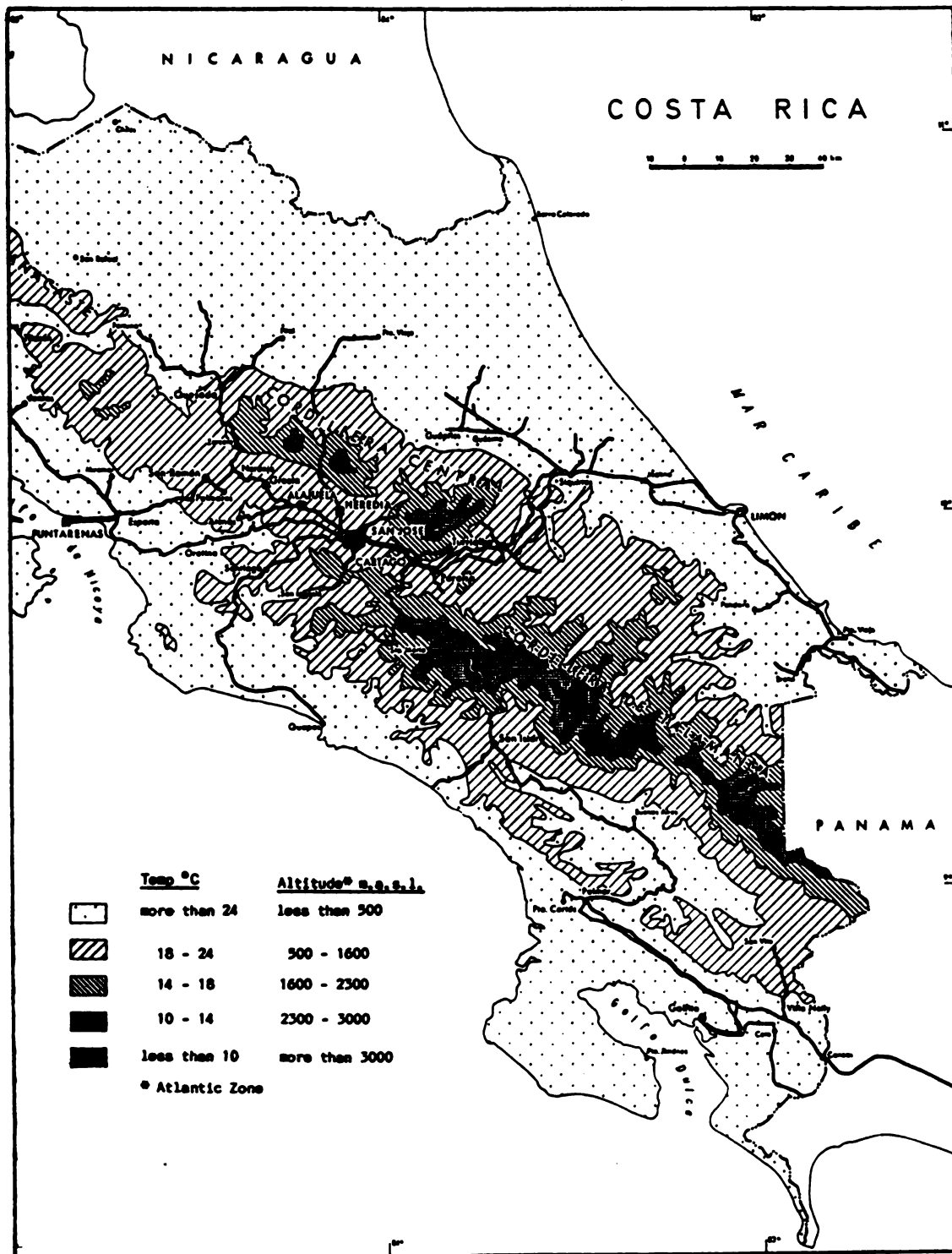


Figure 3. Altitude and average annual temperature (NUHN, 1978).

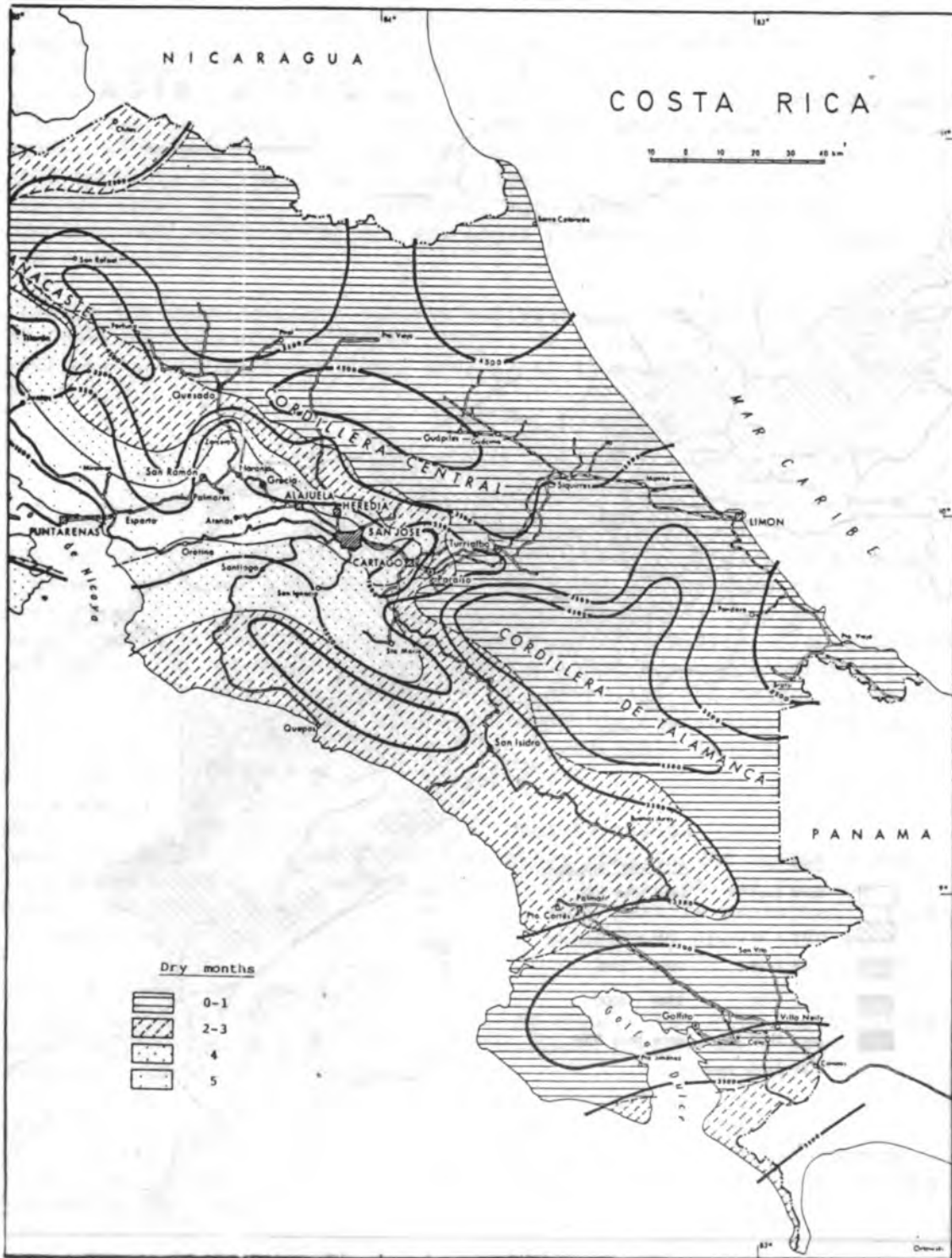


Figure 4. Quantity and distribution of rainfall (NUHN, 1978).

**Unit CFr / Flood plain and braided river systems**

Natural and semi-natural vegetation is mainly found in the river beds and their immediate surroundings like old river beds and periodically flooded areas.

**Unit CM / Mountainous landscape**

The occasional frosts at these altitudes have a marked effect on the natural vegetation and the land use. In the submontane and montane zone some forest is still left on the very steep slopes, particularly the ones bordering the small river streams. But most of the area is covered with pasture and an occasional tree. Locally bamboo (Chusquea sp.) bushes occur. In the upper montane zone the trees gradually make way for shrubs and herbaceous plants, resulting in a kind of paramo vegetation.

**Unit RAp / Relatively young alluvial plains**

Large areas have already been deforested. Primary forest is only left in the extreme north near the Rio San Juan. North of the line Limon-Siquirres-Rio Frio only small plots with a maximum of 100 ha are left.

**Unit RAu / Undulating terrace landscape, relatively old**

Large areas with natural, virgin vegetation or with little disturbed vegetation are found mainly between Rio Colorado and Rio Chirripo in the north and the Rio Suerte in the south. South of the Lomas de Sierpe only relics of natural vegetation are left in the form of logged forest.

**Unit RH / Landscapes of hills formed in Tertiary volcanic rocks**

Only most of the hills of the national park 'Tortuguero' and some adjacent areas are still covered with original, virgin forest. Clearing outside the park is in full progress and large parts have been logged out, resulting in a forest with much secondary growth.

**Unit RS / Landscape of backswamps**

Depending on relief and hydrology three types of swamp forest are distinguished. (1) Forest on (almost) permanently flooded soils, consisting of virtually one species, the raphia palm (Raphia taedigera). (2) Forest on periodically flooded soils, with Prioria copaifera (cativo) as the predominant species. (3) Forest on occasionally flooded soils, with Carapa guianensis (cedro macho) and Pentaclethra maculosa (gavilan) as the dominant species.

**Unit RB / Landscape of beach ridges**

The beach ridges form a narrow strip along the coast where mainly coconuts are grown. The vegetation is dominated, apart from coconut palms, by Terminalia catappa (tropical almond) and Coccoloba uvifera (sea grape).

**Unit RC / Coral terraces**

Natural vegetation is left only in the national park 'Cahuita'. The primary forest has been selectively logged and some coconut palms have been planted in between.

**Unit TF / Alluvial fan**

Very little is left of the original vegetation. Virtually all of these

soils are being used for crops or pastures. The most conspicuous tree is Cordia alliodora (laurel), partly as remnant of the original vegetation, partly from natural regeneration. They occur in pastures or are being used as shade in cocoa.

#### Unit TA / Intra-montane valleys

The majority of these valleys have long since been used for crops and pastures. The valley slopes are still covered with some logged-out natural vegetation.

#### Unit TH / Hilly landscape

Primary forest still covers large areas and secondary forest is present in many stages of succession. On the slopes and hills around the intra-montane valleys especially, crops like bananas and cocoa have been grown. Many of the fields have been abandoned resulting in secondary growth. Going up hill the amount of primary forest increases.

#### Unit TM / Mountainous landscape

Here the most extensive areas of undisturbed forest are found. Large areas form part of national parks, e.g. 'La Amistad'. The physiognomy and species composition of the forest depends on the altitude, i.e., on temperature. Above 3000 m trees become sparse and make way for shrubs and herbaceous plants, resulting in paramo.

#### Unit TV / Volcanic landscape

Only the extreme steep slopes are still covered with remnants of the original vegetation. Most of it has been selectively logged, often to such an extent that it is more appropriate to speak of secondary forest.

### 3.5 Land use

Table 3 demonstrates the importance of the major types of land use. At present much of the original forest cover has been destroyed by wood extraction (ANON., 1986b) and by conversion into pasture and crop land. The figures in table 3 characterize the actual land use and recent developments, i.e., (1) a rapid deforestation, (2) much emphasis on perennial crops as compared with annual crops, and (3) an enormous expansion of the area under pasture. More details on land use follow in paragraphs 3.6 to 3.8.

### 3.6 (Agro-)forestry systems

#### 3.6.1 Forest production

Huetar Atlantica has some of the last large primary forest resources of Costa Rica on the Cordillera de Talamanca, the Llanura de Tortuguero and the slopes of the Turrialba and Irazu volcanoes. However, the area under forest rapidly decreases. Main causes are

(partial) clearing for agricultural purposes, land speculation, and timber logging. For a fuller description of forests, their exploitation and destruction see ANON. (1986b). This paragraph restricts itself to some remarks on the major forms of forest/tree exploitation.

Table 3. Land use (ha) in Limon Province/Huetar Atlantica, 1963-1982.

Land use category	1963	1973	1982
	Limon Province	Huetar Atlantica	Huetar Atlantica
Annual crops	?	ca. 7600	19000
Arable land	36000	21300	?
Permanent crops	39100	44400	78300
Grazing land	35000	71800	232900
Forest, shrub, etc.	91600	140800	?
-----			
Total farm area	205200	278200	652200
Non-farm area (mostly forest)	767500	728200	352500
-----			
Total area	972700	1004700	1004700

Notes: Main references are DGEC (1974 & 1975), IDA/RUTA (1984). The results of the 1984 DGEC census have not been published yet; the figures presented in the last column are provisional.

#### Forest reserves and national parks

These function as protection for watersheds, as biological reserves, objects for study, and as tourist attractions. In forest reserves timber extraction is regulated by the Direccion General Forestal (DGF). In spite of law and good intentions parts of these areas have already been deforested, by loggers and illegal squatters.

#### Reserves for the indigenous population

Generally these are on land with limited agricultural potential and poor accessibility. The indigenous population practices shifting or a more permanent cultivation growing among others maize, beans and plantain, the last two partly as cash crop. These reserves are threatened by increasing squatter pressure (ORNES, 1983) and by oil and pit-coal explorations (RECOPE). In the reserve of the Talamanca valley for instance there are large cattle ranches owned by outsiders.

### Timber extraction

Most timber extraction takes place in recently opened up areas along the borders of new settlement areas. Due to the high cost of transportation usually only the very best timber is removed. There are several sawmills in the area, but most of the raw timber is transported by road to the Meseta Central. Some processed timber is exported via Limon. Although formally permits and management plans are required, in practice more timber is cut than allowed and the only management tool appears to be the power saw.

### Conversion into pasture and crop land

This is the greatest and most irrevocable threat to the remaining forest. Conversion into 'pasture' especially requires little inputs: no more than cutting a few trees, fencing with barbed wire, and allowing the cattle to do the rest. Afterwards the pasture may be gradually improved which usually involves cutting more of the remaining trees. The conversion may be accompanied by timber extraction, but often is not, as prices for standing timber are low and there may be a hurry to enforce the claim to the land by rapid deforestation.

### On-farm forest production

On most farms there are patches of forest or individual trees left. These may be sold to loggers or may be cut gradually for use on the farm. In grassland there often is regeneration of notably 'laurel' (Cordia alliodora), an appreciated timber species. However, (on poorly drained soils?) older trees often show dieback symptoms. Permanent pastures are usually fenced with 'poro' (Erythrina spp.) or 'madero negro' (Glyricidia sepium).

### Forest plantations

At present there are only limited areas with planted forest, mostly Pinus sp., 'laurel' and Eucalyptus sp. Forest plantations are hardly attractive as long as there is a seemingly perpetual flow of first class timber from natural forests. Moreover knowledge of plantation management appears limited. Forest plantations are subsidized, which may make it attractive to cut natural forest in order to replace it with a forest plantation.

### 3.6.2 Technical problems

The technical problems listed below may not seem to be serious as long as there remains enough natural forest.

- Expensive and often impossible transport due to long distances, poor road conditions and excessive rainfall. When it rains the extraction of logs is nearly impossible.
- Lack of management knowledge of (semi)natural forests. The only known, but never executed, plan is that of VEIMAN (1982) for the management of JAPDEVA forests.
- High losses of timber. In the field only the best trees are cut and of these the best parts are extracted. In sawmills there are high losses due to poor sawing management and bad storage conditions.

### 3.6.3 Institutional problems

Major institutional problems related to forest protection, production and exploitation are:

- Uncertainty about land tenure. Land left under forest may be invaded by squatters, who can claim that the land was not being used; in Costa Rica forest is hardly considered to be a form of land use.
- Poor control and enforcement of forest laws may favour individuals, but damage forestry as a whole.
- Lack of incentive to economize on timber resources. The present price structure, with the price of standing timber 2.6 % and the cost of extraction and transport 25 % of the consumer price, causes an unacceptable waste of valuable timber.

## 3.7 Cropping systems

### 3.7.1 Crop production

The information on annual crops in table 3 is confusing as many sources do not distinguish clearly between annual crops and arable land. However, the increase in the number of small farms in the past decade (paragraph 3.9) makes it likely that the area with annual crops also increased.

The reported increase in permanent crop area between 1973 and 1982 is questionable. The area under banana did not change much. The area under cocoa may have increased during the first part of the period, but since the arrival of the disastrous Monilia disease in 1978 many plantations were abandoned, and reverted to secondary forest. It would not make much sense to include these forests under permanent crops. The areas with plantain, coconut, coffee, pejobaye, macadamia and other tree crops increased, but it remains doubtful whether these increases were large enough to account for the reported increase in the total permanent crop area.

Table 4 gives an overview of statistical data per crop. They represent the situation in 1973; the results of the 1984 census have not yet been published. Below some information on the main cropping systems is presented. For convenience the data are given per crop, although several crops, for instance cocoa and plantain, are intercropped. For information on recommended cropping methods one is referred to MAG (1983).

#### Banana

Banana is the second most important export crop of Costa Rica, after coffee. Annually about 50 million boxes of 18.14 kg are exported. More than 90 % of Costa Rica's 21000 ha under banana is situated in Huetar Atlantica.

Large acreages exist in the cantons Pococi (Cariari, Río Frio and Santa Clara), Siquirres (among others Carmen), Limon (Estrella valley) and Talamanca. Comparison of figures 2 and 5 shows that most banana plantations are situated on the land units TA and RAp, i.e., on fertile (well drained) alluvial soils.

A large part of the production and all of the marketing is dominated by a few (multinational) companies, who each grow hundreds or thousands of hectares: Bandeco, Standard Fruit and United Brands. The rest is being produced by Costa Rican enterprises, most of them also with several hundreds of hectares, who sell via the large companies. ASBANA supports national producers with research and extension. Banana is not a crop for small farmers. They cannot afford the capital intensive production methods which include packing plants and chemical control of pests (nematodes) and diseases ('sigatoka negra' and 'sigatoka amarilla', *Mycosphaerella* spp.). Other bottlenecks for them are the strict organization and quality control required for production and marketing.

The high production costs, notably for crop protection, are a major problem for banana growing. It is not unlikely that there will be a gradual shift to the drier south. There are plans for a large increase in the banana area. The climate factor may have a strong influence on the choice of the locations. For more information on banana one is referred to KOCH (1977), PARDO (1983), MAILLARD (1984) and SOTO (1985).

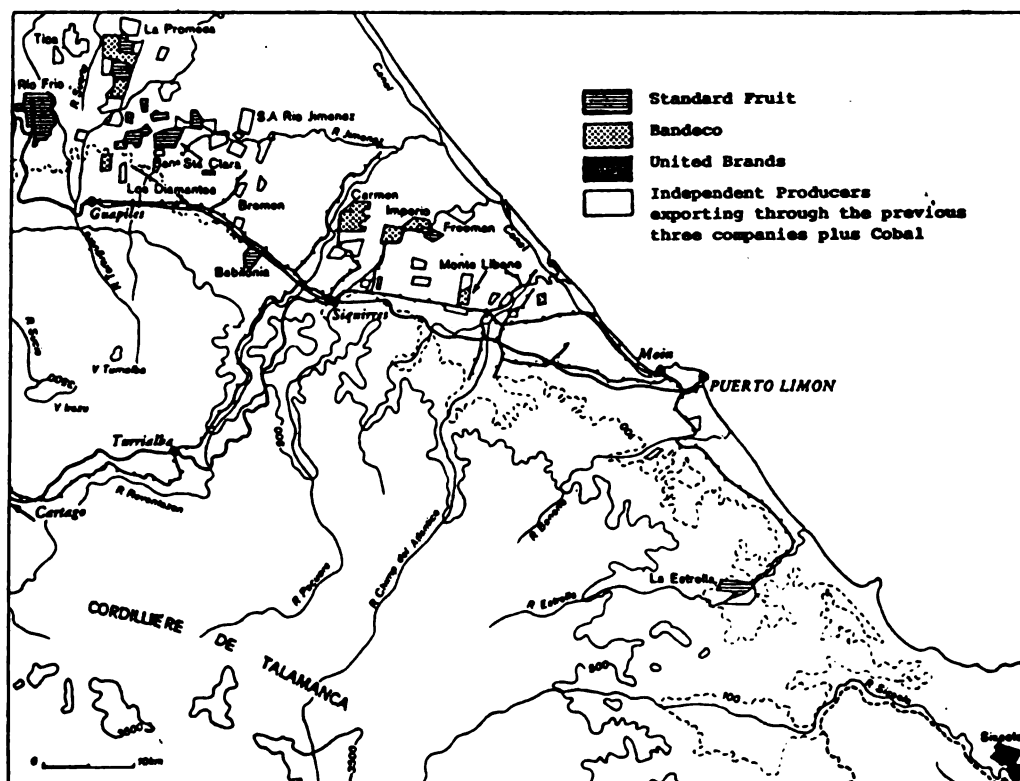


Figure 5. Banana plantations in the Atlantic Zone (MAILLARD, 1984).



Table 4. Main crops in Limon Province, 1973 (DGEC, 1974).

Crop	Maize	Rice	Cassava	Bean	Sugarcane
Total area	5245	753	566	171	146
Number of farms	1532	474	553	189	122
Av. crop area/farm	3.4	1.6	1.0	0.9	1.2
Modal crop area/farm	2-10	1-2	1-2	0.5-1.0	1-2
Modal farm size	5-100	10-50	5-50	10-100	5-100
Av. yield, kg/ha	1100	900	6400	350	16100
Main cantons	Pococi	Matina	-	Pococi	Pococi

Crop	Banana	Cocoa	Plantain	Coconut	Coffee
Total area	20698	17224	1551	940	485
Number of farms	802	1935	664	781	343
Av. crop area/farm	25.8	8.9	2.3	1.2	1.4
Modal crop area/farm	+20	5-100	2-5	1-3	1-3
Modal farm size	100-1000	5-500	5-50	5-50	5-100
Av. yield, kg/ha	32600	220	10900	2700	1600
Main cantons	Pococi	Talamanca Matina	Matina Talamanca	Limon Talamanca	Siquirres

- Notes:**
- All areas are in ha.
  - Yields were calculated as total production/total area; coconut yield expressed as nuts/ha.
  - Figures refer to compact plantations. Dispersed plants of e.g. coconut and plantain are not included.
  - 'Modal' refers to 'most common' and 'most important' area. Generally the smaller areas/farm are most common (number of farms) and the larger more important (large part of total area). For most crops the difference is small. However, for banana nearly all farms have only a few hectares and most of the total area is made up of a few large farms with hundreds of hectares.
  - Under plantain 78 farms and 148 ha with 'guineo cuadrado' are not included.

#### Plantain

Plantain is grown both for home consumption and for the market, the latter mainly by small to medium scale farmers. San Jose forms the major market, but some plantain is exported. Usually both input levels (no spraying) and yields are lower than those of banana. A few years ago plantain was severely affected by 'sigatoka' and the area under cultivation was substantially reduced (VEIMAN, pers. comm.). There seems scope for improvement of the marketing system (paragraph 3.7.3). For more information see LEMELLE *et al.* (1982).

### Cocoa

Until 1978 when the fungus Monilia roxeri became a real threat cocoa was the major cash crop for small and medium scale farmers, especially in the south of the Atlantic Zone. Monilia attacks only the fruits and control is possible by a combination of resistant hybrids, removal of diseased fruits and shade control. These, however, involve high (labour) costs and therefore many plantations have been abandoned. There are nevertheless indications of an increasing interest in the crop, probably related to the Programa de Fomento Cacaotera (MIDEPLAN, 1984). For more information see ENRIQUEZ (1983), ENRIQUEZ & PAREDES (1985), SEPSA (1982), WOOD (1982).

### Coconut

Most (tall) coconuts are grown by smallholders in the coastal strip both north and south of Limon, within a few hundred meters off the seashore. The crop receives little attention. It is grown for its fresh nuts and for oil production. Problems are yellowing of the leaves and lack of security caused by '0-50 m and 50-200 m laws'. Throughout the zone some large coconut plantations are found, mostly with young, often not yet producing dwarf palms. For more information see ROJAS (1978).

### Coffee

The major coffee growing areas in Huetar Atlantica are around Alegria, on the slopes of the Turrialba volcano, and in the Guayacan area, along the Siquirres - Turrialba road. Part of the area is certainly below the optimal altitude, and much of the land might be better suited (ecologically) to macadamia.

### Macadamia & pejibaye

Both crops share the advantage of being new and promising. In fact they are only attractive for (large) farmers with access to the (export) market. For pejibaye fruits and palmito there is a limited national market. For more information on pejibaye fruits see TRACEY (1985?).

### Maize

Throughout the Atlantic Zone maize is a subsistence crop grown by small farmers. It is an important cash crop for small and medium scale farmers, notably in the areas around Guacimo and Cariari, where the harvest is bought at subsidized prices by the Consejo Nacional de Produccion (CNP). Nevertheless farmers complain about low returns due, amongst other things, to high costs of chemical weed control, harrowing, insect control, 'doblar', harvesting and transport. For more information see CATIE (1984a,b), BONILLA (1983).

### Rice

The largest areas are found in the Bataan-Matina area where it is grown as a cash crop, mostly by medium scale farmers. Cultivation is highly mechanized. Production costs are high: tractor cultivation, application of fertilizers and pesticides by plane, combine harvesting, often carried out by contractors.

## Cassava

Grown by small farmers for subsistence and by small and medium scale farmers for the market, notably export to the USA, dominated by small agrobusinesses. For the same market cocoyam and yams are also produced. For more information see ARMIJO et al. (1983), SANARRUSIA (1983), ESCULIES & NAVARRO (1984).

### 3.7.2 Agronomic problems

Crop production in the Atlantic Zone of Costa Rica is characterized by low yield/cost ratios due to problems related to weeds, pests and diseases, drainage, workability and fertility. The problems are determined by the soils (physiography, texture, structure, drainage) and by the more or less continuously hot and humid climate. They are aggravated - according to interviewed farmers - by high input prices, poor availability of credit and high interest rates.

Although the climate appears rather uniformly wet there are several references to periods of drought and excessive rainfall, hampering the growth or ripening of crops. In some years, like in 1985, hurricanes cause extensive damage in banana among others.

Weeds are notably problematic in annual crops. Control is labour intensive, often involves toxic and expensive herbicides, and may interfere with soil conservation.

Pests and diseases cause crop losses (e.g. ear rot in maize, pod rot in cocoa) and may increase the costs of labour (e.g. crop sanitation in cocoa), chemicals and spraying equipment (notably in rice and banana). Problems may be large enough to prohibit (Panama disease in banana) or discourage (Monilia in cocoa) the cultivation of a crop. There is some scope for selection of sites (e.g. plantain in drier areas), microclimate manipulation (reducing shade in cocoa) and timing of production (ripening of maize in relatively dry period).

Drainage problems, as a result of the high rainfall and land properties, occur in large areas. They limit the choice of crops, increase costs, and interfere with cultivation.

Workability problems are diverse and related to soil (e.g. drainage, stoniness, slope) and climate (e.g. rainfall). Soil properties may restrict mechanization and increase required energy/power. Rainfall limits the effective availability of labour and hinders planning.

Fertility (physical, chemical) problems are likely to increase in the future, see KLOOSTERMAN et al. (1986).

Incorrect use of machinery, pesticides and fertilizers causes high production costs, crop damage and yield losses, and may reduce the potential for future production.

### 3.7.3 Infrastructural and institutional problems

The infrastructural and institutional problems listed below differ from area to area and from farming system to farming system. They can be divided into three groups: the financing and supply of inputs, the availability and transfer of knowledge, and the physical and institutional access to markets.

Many farmers, notably the small ones, experience problems with financing crop production. They complain of lack of security - title deeds are needed for obtaining credit - and high interest rates. Establishment of permanent crops especially requires large capital inputs and several years of paying interest without earning income. Farmers frequently complain about the high cost of labour, caused by the presence of the large banana companies, where labour unions have negotiated relatively good wages. On the other hand many small farmers earn additional income by doing off-farm work.

Both government officials and farmers complain about lack of knowledge on crop production technology. The only information available for extension often comes from outside the area and has not been tested locally. The only organization in the area with a substantial research budget and programme is ASBANA. The foreign banana companies have a considerable amount of agronomic knowledge, but understandably are not interested in sharing it.

Even when there is locally tested technology available, its transfer is often insufficient. An example is the technology to control Monilia in cocoa by planting a mixture of resistant hybrids, pruning the trees, reducing shade and removing diseased fruits. Many farmers have heard rumours about it, few know more or less how to do it, but an even lower number apply the techniques. Both research and extension seem to be far from the farmer.

Farmers in remote areas, especially those without their own transport, are limited in their possibilities by long distances to non-farm inputs and markets, like towns and buying centers of the Consejo Nacional de Produccion (CNP). This applies most strongly to farmers in newly opened areas and in the Talamanca canton. Small and medium scale farmers in these areas are susceptible to exploitation by middlemen with capital and transport. An example is the marketing of plantains in the Valle de Talamanca, which is dominated by merchants from outside the area, as far away as San Jose.

This leads to the next point: the institutional aspects of access to markets. For some products, like maize and rice, the CNP offers guaranteed prices. However, it remains doubtful whether this expensive practice can and will be continued in the future. For other products like plantain the market is 'free', as described above. The market for export products like banana, roots and tubers, ornamentals, and macadamia is dominated by large companies, usually foreign based or financed. This means that small producers either have no access to these markets or are fully dependent on these companies.

There is a need for improvement on the above points. However, it should be realized, that not all farmers are equal and that certainly not all have equal access to capital, inputs, knowledge and markets. For example, the optimism displayed by newspapers about alternative crops like cardamon, ornamentals, macadamia and pejibaye is not justified as long as many farmers cannot successfully grow them for one reason or another.

### 3.8 Livestock systems

#### 3.8.1 Livestock production

Table 3 shows tremendous increases in the area under pasture. Observations in the field leave no doubt that these increases are real. However, the figures exaggerate the importance of pastures and livestock. Only a small part of the pastures is for intensive milk production. Most is for extensive beef production, with much lower production values per ha than most crops, excluding cocoa. Another part of 'pastures' consists of forest which, after logging a few trees, is provisionally fenced with barbed wire and stocked with cattle receiving no more than minimal care. The fence and the cattle in such cases frequently function to prove that the land is occupied and so serve speculation rather than production purposes. The main livestock (production) systems and their characteristics are listed below.

##### Dual purpose cattle farming with on farm consumption of milk

Most of these farms are small, also grow annual (maize, beans) and some perennial crops (cocoa, plantain), may have some pigs or chickens. Often part of the income is derived from off-farm work. Productivity generally is low; lack of cash (no sale) and credit preclude improvement.

##### Dual purpose cattle farming with sale of dairy products

These farms sell milk or cheese on the local market and so generate a regular income which may enable investment (specialization) in pasture, minerals, better breeds. Common breeds are Brahman, Indo-Brasil, Holstein-Friesian, Jersey.

##### Specialized dairy farming

Usually larger farms, up to more than 100 ha, with milking parlours with concrete floors, investments in pastures, medicines, etc. The marketing is usually via 'Borden'.

##### Beef production (A cow-calf operations, B fattening)

Group A rears calves up to 150 kg (8 months) and sells them to B to be fattened to about 500 kg (an additional 2-2.5 years). Often A and B are found on the same farm. Such farms require improved pastures on fertile well drained soils and are often found in recently opened areas where land is still cheap.

##### Cow-calf operations

Usually medium to very large-scale holdings with extensive production in remote areas, where sometimes the major product of the cattle is that they 'prove' land ownership.

### Pig holdings

There are few specialized farms. The pigs are fed with rejected bananas and whey, a by-product of cheese production.

### 3.8.2 Husbandry problems

The major technological problems are:

- High production costs compared with farm gate prices.
- Dependency on grass (grazing) land - often of low productivity and poor quality - for forage production.
- Little integration with cropping systems; crop residues are underutilised, better use might be made of manure, animal power (cattle) is hardly used.
- Animal diseases, many related to the hot and humid climate and the muddy pastures.
- Poor storage and transportation facilities.

### 3.8.3 Institutional problems

Several of the main institutional problems of livestock production are similar to those of crop production.

- Shortage of extension and veterinary services and lack of specific recommendations.
- Cattle farmers have little influence on government and marketing institutions.
- A poorly organized (local) market. Beef cattle are often sold to Montecillos (Alajuela). Small farmers have to sell via intermediaries. Recently rural slaughterhouses, supervised by the CNP, are being established for the internal market.
- Dependency on the international (USA) beef market with fluctuating prices, which at present are low due to slaughter of milk cattle in USA and Europe.
- Milk is sold either via intermediaries or directly to 'Borden'. The farmers themselves have to organize transport. There is little scope for expansion of the national milk market; milk products are too expensive for a large part of the population.

## 3.9 Farming systems

### Farm characteristics

In this paragraph some farm characteristics that affect the choice of activities (subsystems) are discussed. These characteristics are often correlated: background of farmer, farm size, access to finance, knowledge and markets, and security of tenancy.

As to their background, farmers in the Atlantic Zone of Costa Rica are extremely varied. The original population of Amerindians is now largely confined to Bratsi district of Talamanca canton, where they live in a number of reserves. Most of them are small scale farmers who grow maize, beans and plantain, the last two often for cash. The origins of the negro population are diverse: some were imported in colonial times as slaves, others settled in the first half of the 19th century as fishermen from Panama and Nicaragua, many came as contract labourers for the construction of the railway in the last quarter of the 19th century (PALMER, 1977). At present they are (cocoa) farmers, fishermen, labourers and businessmen. In the 20th century the large scale immigration of Spanish speaking whites began. Some came to invest in forest exploitation or farming. Most - forced out of their home areas by poverty or lured by the attractions of the new area - cleared small patches of forest or squatted on already cleared land, often after working several years for banana companies or cattle estates. They form the majority of small farmers who usually grow both subsistence and some cash crops. Recently there has also been an influx of farmers from the USA, usually with far larger than average farms and with (export) market orientated production: livestock, ornamentals, macadamia. It seems that the background of the farmers has an influence on their farming system, but it might be useful to know how far this influence stretches, and where it stops.

There is a strong correlation between farm size and the activities that can be chosen. Some activities, like meat or cocoa production, have a rather low gross margin per ha. To make a living out of these requires much land and in the case of cocoa also much labour. Other activities like banana and to a lesser extent paddy rice need large acreages for successful production (land preparation, spraying by plane), harvesting (combine, packing plant) and/or marketing (timely production of large quantities of homogeneous quality). Part of these requirements might be fulfilled by cooperatives of small farmers as well as by private companies.

The access to finance, knowledge and markets or the lack of it are major determinants in the choice of activities. Usually the larger the farm, the better their perspectives regarding these aspects. The export markets are dominated by foreign capital to such an extent that many farms producing for export and most export businesses are owned by non Costa Rican individuals and companies.

The security of tenancy determines the possibilities for obtaining credit, for which a title deed is needed, and influences the choice of activities. Under conditions of insecurity it is not attractive to invest in land. For example, one is tempted to use the land for extensive grazing and not for permanent crops. On the other hand the presence of immovable investments like fences or cocoa increases the security of tenancy.

### Farm types and farm sizes

A common classification of farm types in Costa Rica is one based on farm size (HALL, 1984). It distinguishes four classes: 'minifundio'

(< 4 ha), 'finca campesina' (4 - 20 ha), 'finca mediana' (20 - 200 ha) and 'latifundio' (> 200 ha). In table 5 the distribution of farm types and farm sizes in 1984 is given.

The increase in the number of farms in the Atlantic Zone between 1963 and 1984 did not strictly follow the strong population growth in that period (paragraph 3.10). Actually, between 1963 and 1973 the number of farms decreased and the average farm size and inequality of land distribution increased. This may be partly explained by a strong expansion of the area under bananas, whose present distribution is shown in figure 5.

Between 1973 and 1984 the number of farms grew at the rate of 5.3 % per year from 5134 to 9028 due, amongst other things, to the activities of the Instituto de Desarrollo Agrario (IDA) (figure 6). In order to canalize the 'precarismo' threat IDA initiated settlement schemes (1298 families), assisted spontaneous squatters in buying land (1908 families), and arranged title deeds (2771 families) (IDA/RUTA, 1984). In spite of these impressive numbers many small farmers still do not have title deeds (IDA, 1982), and land distribution is still rather unequal (table 5).

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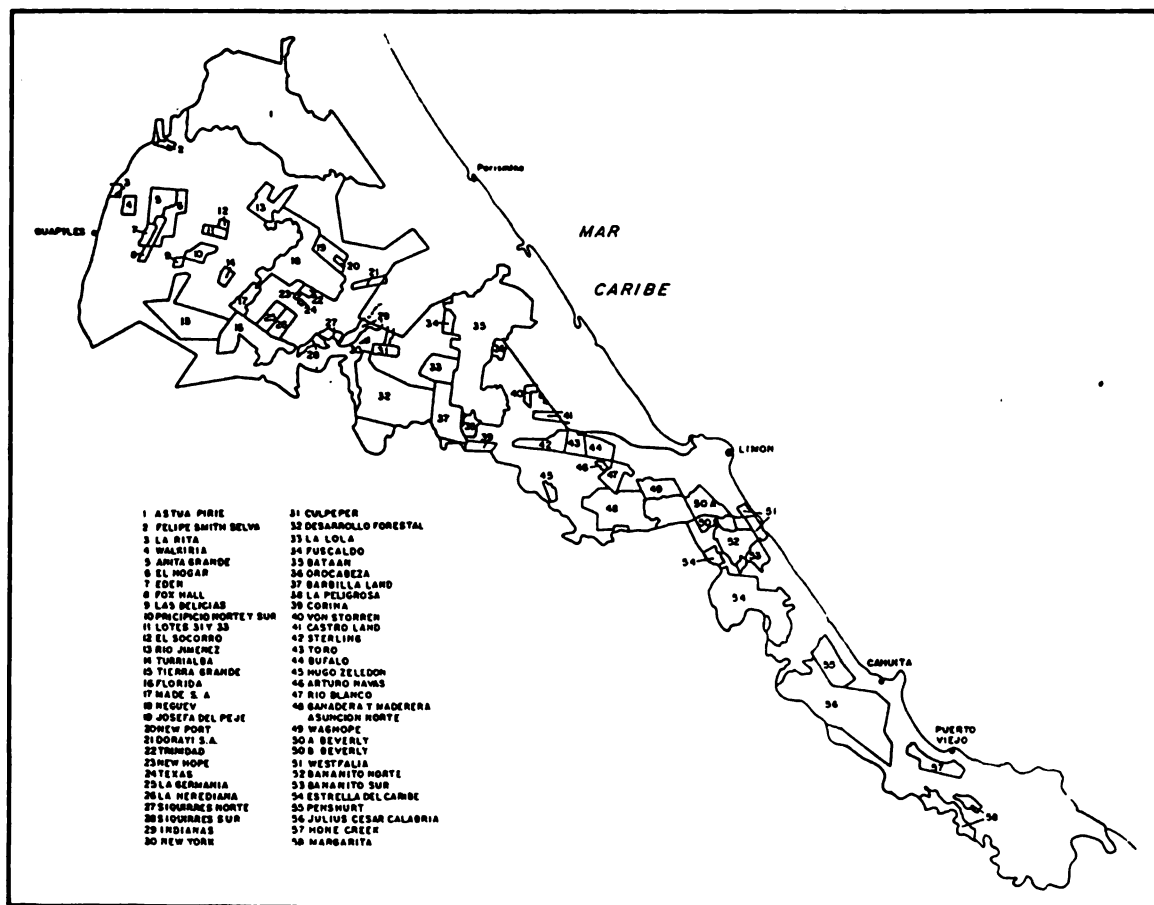


Figure 6. Areas with major IDA involvement in settlement schemes and farms 'spontaneously' occupied by squatters (IDA/RUTA, 1984).



Table 5. Farm types and farm size distribution, Limon province, 1984.

Farm type	Farm				Area			Average
	size (ha)	number	%	cum %	ha	%	cum %	ha
Minifundio	0<-< 4	1754	19	19	3400	1	1	2
Finca campesina	4s-< 20	4445	49	70	43000	15	16	10
Finca mediana	20s-<200	2577	29	97	125100	44	60	49
Latifundio	>200	252	3	100	114700	40	100	455
<b>Total</b>		<b>9028</b>	<b>100</b>	<b>---</b>	<b>286200</b>	<b>100</b>	<b>---</b>	<b>32</b>

Source: preliminary unofficial 1984 census of agriculture data.

### 3.10 Socio-economic aspects

#### Population

From 1963 to 1973 population growth in the Atlantic Zone was 5.6 % per year, as opposed to 3.5 % in the period 1973 to 1984. These figures are well above the national growth rates in both periods, i.e., 3.3 and 2.3 % per year respectively. This indicates a strong migration towards the Atlantic Zone.

Table 6. Population, population density and population growth between 1963, 1973 and 1984 per canton of the Atlantic Zone.

Canton	Area km²	Population			Growth rate		Density
		1963	1973	1984	63-73 %/year	73-84 %/year	1984 pers/km²
Horquetas	566	2713	7236	10351	10.3	2.7	17
Pococi	2404	11196	28688	44187	9.9	4.0	18
Guacimo	577	5731	11572	16372	7.3	3.2	28
Siquirres	860	11317	18133	29079	4.8	4.4	34
Matina	773	7561	10489	14733	3.3	3.1	19
Limon	1766	29039	40830	52602	3.5	2.3	30
Talamanca	2810	3541	5431	11013	4.4	6.6	4
<b>Atlantic Zone</b>	<b>9756</b>	<b>71098</b>	<b>122379</b>	<b>178427</b>	<b>5.6</b>	<b>3.5</b>	<b>18</b>

Source: population data from census of population 1963, 1973 and 1984.

Population is not spread evenly over the zone (table 6). Main population centres are Limon, Siquirres and Guapiles. On a district basis, population density varies from 52 persons per km<sup>2</sup> in Cariari district in Pococi to 1 and 2 persons per km<sup>2</sup> in Colorado district in the north and Bratsi in the south respectively.

The growth rates have been rather different for the different cantons in the zone too. From 1963 to 1973 population growth in Horquetas (10.3 %), Pococi (9.9 %) and Guacimo (7.3 %), all in the north, has been much more than the average of 5.6 % for the zone, while from 1973 to 1984 growth has been more than average (3.5 %) in Pococi (4.0 %), Siquirres (4.4 %) and Talamanca (6.6 %). Pococi still is an important growth point, but in general growth shifted more to the center (Siquirres: settlements) and to the south (Talamanca: new banana plantations).

### Regional economy

So far it has not been possible to obtain data on the value of production for the different sectors of the economy of the zone. However, data are available on the number of people employed in the different sectors (table 7).

Table 7. Employment in different sectors of the Atlantic Zone, 1983.

Sector	Employment in 1983	
	persons	%
Agriculture	24700	44
Industry	3800	7
Construction	2700	5
Basic services	4400	8
Commerce	6900	12
Services	11500	21
Other	1500	3
<b>Total</b>	<b>55500</b>	<b>100</b>

Source: MIDEPLAN (1984).

Between 1973 and 1983 the primary sector, i.e., agriculture, became relatively less important in terms of employment (table 8). Most new employment has been created in the tertiary sectors (all non-agriculture, -industry and -construction sectors), but in relative terms the secondary sector (industry plus construction) has been growing faster (6.3 % per year) than the tertiary sector (5.4 % per

year). Employment in the primary sector hardly grew (0.5 % per year). Unemployment in 1983 was estimated to be 8.5 % of the labour force.

**Table 8. Economically active population distributed over the three main economic sectors in the Atlantic Zone, 1973 and 1983.**

Sector	Economically active population			
	1973		1983	
	persons	%	persons	%
Primary	23283	57	24672	45
Secondary	3507	9	6465	12
Tertiary	13656	34	23052	43
<b>Total</b>	<b>40446</b>	<b>100</b>	<b>54189</b>	<b>100</b>

Source: MIDEPLAN (1984).

The data on the type of work (table 9) are interesting. About 80 % of the economically active population work as employees. This is very high in a society where agriculture is the main economic activity. It means that a large proportion of the labour force in agriculture are labourers and not farmers.

**Table 9. Economically active population according to type of work in the Atlantic Zone, 1973 and 1983.**

Type of work	Economically active population			
	1973		1983	
	persons	%	persons	%
Employee	30088	77	43570	80
Self-employed	6268	16	8424	16
Employer	264	1	1077	2
Family work without salary	2194	6	1118	2
<b>Total</b>	<b>38814</b>	<b>100</b>	<b>54189</b>	<b>100</b>

Source: MIDEPLAN (1984).

Farmers are classified as self-employed. In 1973 there were 5134 farms of which 4894 were classified by the census of agriculture as individual farms, which means 78 % of the 6268 'self employed' workers. The remaining part of the self-employed workers have shops or other business.

### 3.11 Agro-economic areas

A number of major interrelated processes have shaped and are still shaping the Atlantic Zone. These processes are deforestation, the influx and colonization of people from outside the area, (re)distribution of land, construction of new roads, the movement of foreign banana companies, changes in crop patterns, and the tendency towards intensification. Based on these processes two geographic areas were distinguished within Huetar Atlantica.

The 'central railway area between Limon and Guapiles', which is characterized by:

- Relatively early settlement, since the second half of the 19th century.
- Strong influence of banana companies on among others land, market, employment and infrastructure.
- The relatively well developed railway and road connections with San Jose and Limon.
- A pronounced presence of governmental and semi-official organizations like MAG, IDA and CNP.
- The redistribution of land by settlement schemes, land invasions, and by buying and selling.
- The diversification and intensification in cropping and livestock systems, influenced by changes in pricing and marketing opportunities factors.

The 'coastal area south of Limon', including the Estrella and Talamanca valleys, which is characterized by:

- A population of Amerindian, African and more recently of Spanish origin, each with their own culture or way of farming and living.
- Relative isolation from the rest of the country, resulting in little integration with the national economy and a strong orientation towards export markets.
- A vulnerable economy depending on a few cash crops (banana, cocoa, plantain), and lack of alternative activities and employment opportunities.
- The recent and ongoing improvement of the road network and other infrastructure, related to oil and pitcoal exploration and exploitation by RECOPE (Refinadora Costarricense de Petroleo S.A.).
- A somewhat drier climate than in the rest of Huetar Atlantica, of interest in view of the prevailing fungus diseases.

A third area of interest is formed by the 'agricultural frontiers' found dispersed over the area under review. Though not a distinct geographical area these frontiers, where new farm land is opened, deserve

special attention because of the role deforestation and colonization play there. Examples are the foothills of the Cordillera de Talamanca, the Lomas de Sierpe (Azules), and the Llanura de Tortuguero. For the sake of this treatise these frontiers are considered as one.

Characteristic of these frontiers is:

- The logging of valuable timber species.
- The strong immigration from other parts of Huetar Atlantica and Costa Rica.
- The interrelated phenomena of land occupation ('precarismo') and land speculation.
- Expansion of farm land, notably for extensive grazing.

Logging and high immigration are particularly marked in the northeastern part of the Atlantic Zone where there are no strong Amerindian claims on the land.

Furthermore a number of smaller areas can be distinguished each of which has specific characteristics.

- The coast south of Limon with cocoa, coconut and plantain and an incidental banana plantation, e.g. Peshurst and Sixaola.
- The Valle de Talamanca with some large cattle ranches and cocoa and plantain production by small farmers. Part of the land is Amerindian reserve.
- The Valle de Estrella, which is one large banana plantation.
- The foothills and mountains of the Cordillera de Talamanca, an area of Amerindian and forest reserves.
- The Limon-Siquirres area with cocoa farmers, banana plantations, and with mechanized rice production replacing plantain as a cash crop in Matina.
- The Siquirres-Guacimo-Guapiles area, one of the most diverse of Huetar Atlantica, with adjacent banana plantations, small farmer settlements, large milk and beef ranches, and many small to medium farms with annual crops like maize and roots and tubers.
- The Guapiles-Cariari-Rio Frio area which is comparable to the previous one but of a more recent date and with more emphasis on banana and livestock production.
- The slopes of the Turrialba and Irazu volcanoes, with coffee, macadamia, pastures and forest.
- The northeastern forest area, with large-scale logging, land speculation, extensive livestock production, and invasions of small farmers turned into settlement schemes with IDA assistance.

## 4 SUBAREAS FOR THE BASELINE STUDY

### 4.1 Selection criteria

The criteria for the selection of areas for the baseline study have been the following:

- Representative of the most important agricultural transformation processes in the Atlantic Zone of Costa Rica.
- Including more than one dominant farming system to enable multi-disciplinary study of the interactions between these systems and between them and their environments.
- Attractiveness for training purposes.

Some additional considerations should be taken into account. The choice of the subareas should be optimized for the programme as a whole and not for each discipline individually. It is not necessary that all subareas are of interest to all disciplines involved. Such a condition may be impossible to meet. But each discipline should have at least one such subarea.

Logistically the number of subareas should be kept small. However, a few subareas, each with large variation, may be selected at the expense of their representativity. Several areas of the Atlantic Zone show little variation. A balance will have to be struck between variability within and between subareas.

Since the programme aims at solving problems of small farmers the subareas must allow for selection of problems it can handle in such a way as to work out (a) feasible solution(s).

### 4.2 Selected areas

The exploratory survey team recommended two areas for the baseline study (ANON., 1986b):

- The cantons Pococi and Guacimo, with both the 'central railway area' and several 'agricultural frontiers': Lomas de Sierpe, Lomas de Cocori, slopes of Turrialba and Irazu volcanos.
- The district Sixaola in the canton Talamanca, representative for the 'coastal area south of Limon' and the 'agricultural frontiers' in the foothills of the Cordillera de Talamanca.

Within the Pococi/Guacimo study area subareas would have to be selected in such a way that both a deforestation area and settlement schemes are represented (ANON., 1986a).

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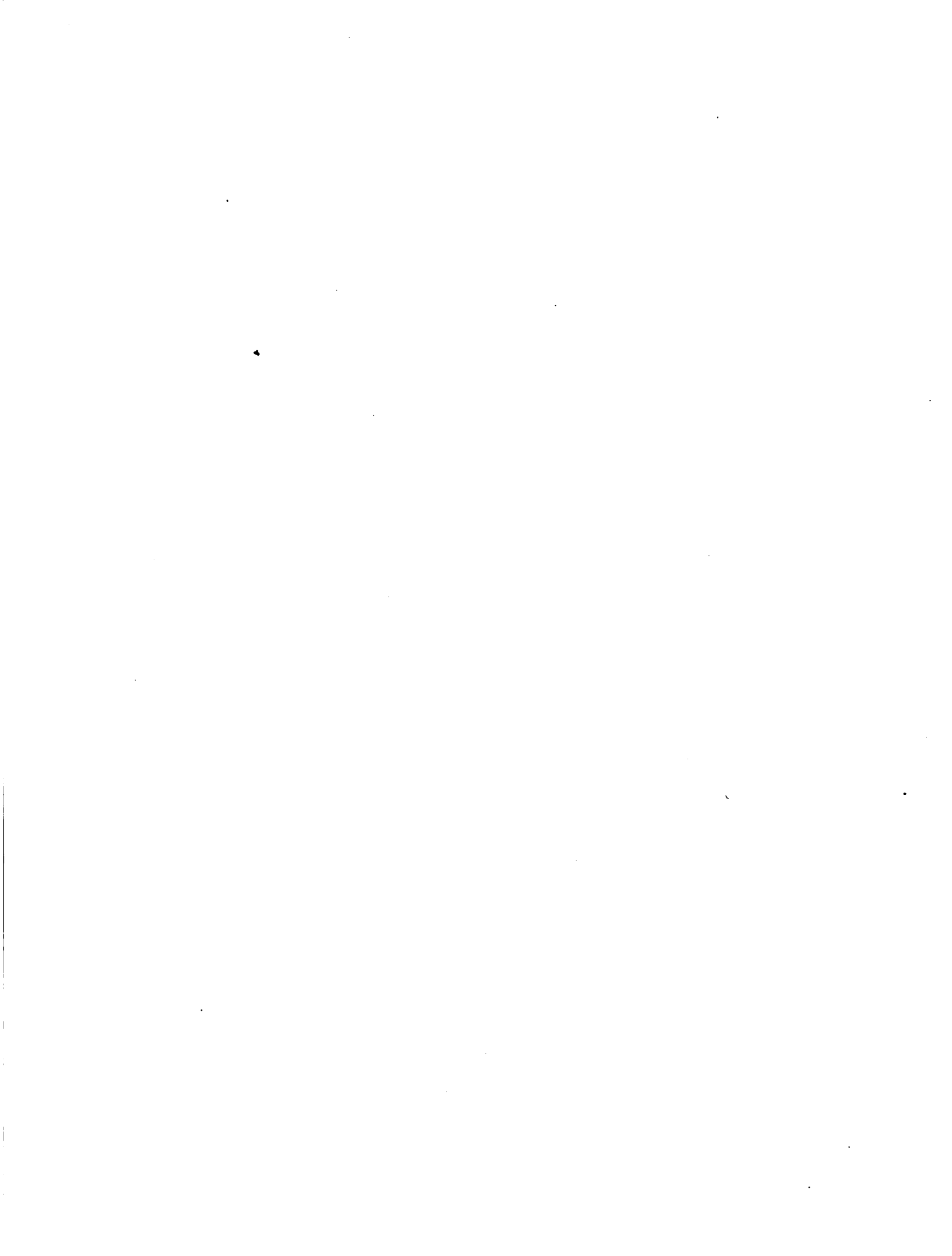
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## **ANNEX 1. ACRONYMS**

The abbreviations in parentheses are former names.

<b>ASBANA</b>	<b>Asociacion Bananera Nacional (Association of National Banana Growers)</b>
<b>AUW</b>	<b>Agricultural University Wageningen, The Netherlands (Universidad Agricola Wageningen, Holanda)</b>
<b>CATIE</b>	<b>Centro Agronomico Tropical de Investigacion y Ensenanza (Tropical Agricultural Research and Training Centre)</b>
<b>CNP</b>	<b>Consejo Nacional de Produccion (National Production Council)</b>
<b>DGEC</b>	<b>Direccion General de Estadistica y Censos (Statistics and Census Office)</b>
<b>IDA (ITCO)</b>	<b>Instituto de Desarrollo Agrario (Agrarian Development Institute)</b>
<b>IGN</b>	<b>Instituto Geografico Nacional (National Geographic Institute)</b>
<b>JAPDEVA</b>	<b>Junta Administrativa Portuaria y de Desarrollo de la Vertiente Atlantica (Atlantic Coast Economic Development and Port Authority)</b>
<b>MAG</b>	<b>Ministerio de Agricultura y Ganaderia (Ministry of Agriculture and Livestock)</b>
<b>MIDEPLAN (OFIPLAN)</b>	<b>Ministerio de Planificacion Nacional y Politica Economica (Ministry for National Planning and Economic Policy)</b>
<b>RECOPE</b>	<b>Refinadora Costarricense de Petroleo (Costa Rican Oil Refiners)</b>
<b>SEPSA</b>	<b>Secretaria Ejecutiva de Planificacion Sectorial de desarrollo Agropecuario y de recursos naturales renovables (Executive Secretariat for Agricultural Sector Planning)</b>
<b>UFC</b>	<b>United Fruit Company</b>



## **ANNEX 2. LIST OF PARTICIPANTS**

The following persons and disciplines have participated in the exploratory survey:

<b>Hanneke Kloosterman</b>	<b>Landscape architecture</b>
<b>Paul Romeijn</b>	<b>Social forestry</b>
<b>Jimmy S.A. Slijkhuis</b>	<b>Vegetation science</b>
<b>Fred R. van Sluys</b>	<b>Rural sociology</b>
<b>Frits J. Staudt</b>	<b>Forest technology</b>
<b>Charles S. Veiman</b>	<b>Silviculture</b>
<b>Pieter A. de Vries</b>	<b>Rural sociology</b>
<b>Henk Waaijenberg</b>	<b>Agronomy</b>
<b>Aernout P.A. van der Weide</b>	<b>Animal production</b>
<b>Wim G. Wielemaker</b>	<b>Soil science and land evaluation</b>
<b>Gert Zommelink</b>	<b>Animal production</b>





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