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Geophysics ..... 0373  
Hydrology ..... 0388  
Mineralogy ..... 0411  
Paleobotany ..... 0345  
Paleocology ..... 0426  
Paleontology ..... 0418  
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Speech Pathology ..... 0460  
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Mathematics ..... 0405  
**Physics**  
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Acoustics ..... 0986  
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*Certa bonum Certamen*

## **ABSTRACT**

**People and forests in development: perspectives from Cuba**  
© Gina LaHaye, April 1996

Since 1959, forest cover in Cuba has increased by approximately 30% to 1.1 million hectares in 1992. As forest cover was expanding in Cuba, human welfare conditions were also improving, rising to their highest levels in all of Latin American and the Caribbean in the early 1990s. This thesis argues that individual perceptions and uses of forest resources have influenced Cuban development. The bases for the argument rests on an analysis of attitudes and activities in Establo, a community located in the Sierra del Rosario region of western Cuba. The thesis claims that Cuba has implemented Alternative Development strategies in its socialization of forestry. Data from the community case study were used to examine if, and to what extent, forest resources have a function in the development of the community of Establo. As community interests are most affected by changes in local forest conditions, community-based research, it is argued, provides vital insight into the links between forest development and social development. The thesis contributes to the understanding of the process of forest development in Cuba.

Field data from interviews, questionnaires, and local forest surveys were gathered and analyzed on the basis of Q-methodology. Structured interviews with 60 respondents resulted in a total of 76 self-referent forest-related statements. Fifteen respondents were asked to rank the 76 statements along a continuum of most agree to most disagree (-5...0...+5) for the purpose of defining attitude (psychological) types. A factor analysis of the 15 Q-sorts revealed seven attitude types with respect to forests. Attitudes towards forests indicated a high degree of local human-forest interactions, forest conservationist perspectives, and multiple values for local and national forest resources. Forests and forest products were found to be essential in the everyday lives of the local people, but appeared to only have a moderate influence on the development of Establo. Forest development in and near Establo has played an important part in the community's overall stability since 1959, but has been an insignificant factor in the community's economic development. Past forest development efforts appeared to be facilitated via several social-political instruments : national and community-based leadership and participation in forest development activities, education and application of knowledge, integration of human and ecological objectives, and the determination to be self-reliant.

**Key Words:** Community, Cuba, Development, Forest, Q-methodology

## GLOSSARY OF TERMS AND ACRONYMS

**CDR** Committee for the defence of the Revolution

**CITMA** Ministry of Science, Technology, and the Environment

**IES** Institute of Ecology and Systematics

**IIF** Institute of Forest Investigations

**km** kilometer

**m** meter

**MAB** Man and the Biosphere Program (Smithsonian Institute)

**NPED** National Program of Environment and Development

**Neotropical forest:** forests in Central and South America (including Caribbean Region) characterized by several semi-deciduous forest tree genera including *Swietenia*, *Metopium*, *Hippomane*, *Dipholis*, and *Cameraria*. Other tree species include *Oxandra*, *Hypelate*, *Sacomphalus*, *Petitia*, and *Haenianthus*.

**Social forestry:** a participatory process that brings about the integration of social values into the practice of forestry and leads to the principal use of forest products for meeting basic human needs. Basic needs include sustainable and clean supplies of drinking water, air, arable soil, food, and energy.

## TABLE OF CONTENTS

TITLE PAGE .....	i
ACKNOWLEDGEMENTS AND DEDICATION .....	ii
ABSTRACT .....	iii
GLOSSARY OF TERMS AND ACRONYMS .....	iv
 <b>CHAPTER 1. INTRODUCTION</b>	
1.1 Background: Posing the Problem .....	1
1.2 Rationale for the Study .....	4
1.3 Research Question and Thesis Statement .....	7
1.4 Conceptual framework and Working Ideas for the Study .....	8
1.5 Thesis Format .....	16
 <b>CHAPTER 2. SOCIETY AND FORESTRY IN CUBA</b>	
2.1 Society and Forestry in Pre-Revolutionary Cuba .....	18
2.2 Forest Renewal and Social Development in Cuba .....	25
2.3 Facilitating Sustainable Development by way of Forest Policies and Institutions .....	37
2.3.1 Legislation and policies: highlights .....	38
2.3.2 Forestry institutions and operations .....	43
2.3.3 Policy support through education .....	45
2.4 Forestry During the Special Period .....	48

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### **CHAPTER 3. AREA DESCRIPTION AND RESEARCH METHODOLOGY**

3.1 Description of the Case Study Area .....	59
3.1.1 Lands and forests .....	60
3.1.2 Infrastructure and social characterization .....	64
3.2 Research Method and Q-methodology .....	71
3.2.1 Critical social research method .....	71
3.2.2 Q-methodology: Q-statement, Q-sort, and factor analysis .....	72
3.2.3 Critique of methods .....	79

### **CHAPTER 4. RESULTS AND DISCUSSION**

4.1 Questionnaire Responses .....	83
4.2 Q-sorts and Factor Analysis .....	86
4.2.1 Factor analysis and attitudes towards the forest .....	89
4.3 Statements Versus Actions .....	97
4.4 Theoretical Associations and Discussion of Results .....	102

### **CHAPTER 5. CONCLUSIONS**

5.1 Cuban Perspectives and Use of Forests .....	120
5.2 Implications for Forest Paradigms .....	121
5.3 Contributions to the Literature and Study of Forestry .....	122

<b>BIBLIOGRAPHY .....</b>	<b>124</b>
---------------------------	------------

- I. Questionnaire**
- II. Basic data portraying interviewed respondents**
- III. Respondents' statements made during interviews**
- IV. Fifteen Q-sorts used in analysis**
- V. SAS printout for Q factor analysis**
- VI. List of plant species found in the research area**
- VII. List of tree species used in commercial plantations**
- VIII. List of tree species used in agroforestry**
- IX. Map of Cuba locating Sierra del Rosario and case study area**

## CHAPTER 1. INTRODUCTION

" ... The forests are decreasing, the air is being poisoned, the rivers are being contaminated. Countless species of plants and animals are perishing. The soils are impoverished. Old and new epidemics are growing, and the legions of the dispossessed continue to multiply. Will the next generations reach the promised land pledged half a century ago by *UN members*?"

Fidel Castro Ruz,  
October 23, 1995  
In a speech to UN  
General Assembly, New  
York, USA.

### 1.1 Background

Forests are known to have an essential function in the quality of the earth's biosphere and the stability of climatic patterns (Geiger, 1980; Cannell and Jackson, 1985). Trees and other plants not only produce the oxygen we breathe, but serve as natural filters for a host of potentially harmful substances in the atmosphere, earth's crust, and water (Farb, 1973). Beyond the environmental influences, forests are also important in economies as sources of great economic wealth: timber, pharmaceuticals, energy, food, water, and recreation (Mendelsohn and Balick, 1995; Awang and Yuan, 1993; World Tourism Organization News, Aug. 8, 1995). Beyond the obvious economic influences, forests also provide a variety of social necessities: wood, medicine, food and water as well as mental and spiritual nourishment (Bahuguna *et al.* 1994; Brundtland *et al.* 1987; Marini-Bettolo, 1991; Wickramasinghe, 1994; World Bank, 1992).

How, and how much, we consume reveals our objectives and approach to development.

Forests have been studied for hundreds of years yet, despite vast academic and practical knowledge, the social dimension of forestry is only just beginning to make its way into the main stream literature (Beckley and Korber, 1995, p.712). While the development literature has barely addressed forestry issues, the mainstream forestry literature has yet to prioritize the integration of social elements into forest management and operations systems. This may be explained by the traditional practice of forestry as an art and science of growing trees to meet economic objectives, and development as a traditionally economically-motivated process (Smith, 1986; Levitt, 1992, p. 1-2).

Guided by the Cuban Revolution's objective to provide all Cubans with the basic necessities of drinking water, clean air, arable soil, food, and energy, forest development in Cuba became a participatory process that brought about the integration of social values into the practice of forestry. The use of forest products for meeting basic human needs first has resulted in both social and forest development benefits. Hundreds of thousands of Cubans have participated in planting and protecting forested areas to the extent that Cuba's forest cover has increased from an estimated 12% to 19% over the past 30 years (Reed, 1992, p.36-48; CITMA, 1993, p.52; FAO, 1993). Mather (1992) has indicated that Cuba is a clear exception to the dominant deforestation trend amongst 'developing' countries (Mather, 1992,

p.370-371). According to Mather (1992) the major factors in forest transitions have likely been associated with trends in population, demand for forest products-services, valuation of resources and perceptions of forests (Mather, 1992, p.372-374). Mather (1992) also notes that such associations are not well understood. Transitions in forest area require further study as they are scattered and vague and generally not well understood (Mather, 1992, p.375).

Over eight thousand plant species and 550 tree species flourish throughout Cuba (Bisse, 1988. p.xv; Black, 1976, p.19). Nearly one thousand of Cuba's plant species are considered endangered, of which 87% are endemic to the country (Government of Cuba, [April 16] 1993). Cuba is also home to 37% of terrestrial vertebrate species living in the Caribbean region. Of the 532 land vertebrate species in Cuba, 32% are endemic to Cuba (Bohemia, April 9, 1993). In all, approximately 51% of all species in Cuba are endemic to the country (Biodiversity News, No. 4, Spring/Summer 1995, p.7). Such findings are gaining the attention of scientists, environmentalists, and tourists from around the world.

Cuba has also gained international attention from researchers in the field of development. Recent global development reports clearly indicate that Cuba has achieved remarkable social progress since 1959 and now ranks number one in Latin America and the Caribbean in the health care and education sectors (Fürntrapp-Kloep, 1995; Human Development Report, 1995; World Bank, 1995; World Resources Institute, 1992). Cuba's social developments have reached

most of its 10.8 million people without destroying the forest in the process. In fact, Cuba's forests have expanded, wildlife habitat has improved, strict environmental laws have been legislated and enforced, sustainable agriculture techniques are practised at commercial levels, and environmental education is taught in most schools (Levins, 1991, p.6-18). While Cuba's social and political developments have been studied extensively, few have considered the role forests have played in Cuba's development. Fidel Castro's views on environmental stewardship have been well-documented in his speeches to the U.N. and the Cuban people, but what do the ordinary people of Cuba think about the environment and forests in particular? How have the interactions of people with forests affected the process of development in Cuba? In its own unique way it appears that Cuba has shown that deplorable social and ecological conditions may be overcome (simultaneously) when political and public will co-exist. The process of Cuba's remarkable social and forestry developments certainly merits international attention (Westoby, 1989, p.132).

## **1.2 Rationale for the Study**

Society has changed. Human population growth, technological innovations, education and improved communications have altered the way in which most societies perceive and consume forest products. A new forest management paradigm has recently emerged with its roots in ecosystem health, sustainability, and multiple-use of

forests (Beckley and Korber, 1995, p.712). These qualities, which are central to the Alternative Development Paradigm, have precipitated from a growing awareness of human connection and function in ecology. Key Alternative Development concepts include people-centred development, self-reliance, the use of natural resources for satisfying basic human needs, harmonization with local ecological dynamics, participatory activities originating from within a free society, and actions aimed at structural transformation towards self management and participation in decision making (Hettne, 1990, p.153-154; Korten, 1990; Gardner and Roseland, 1989, p.26-34). Cuba has been evolving within this 'new' paradigm for the past 37 years and has achieved considerable success (Fürntrapp-Kloep, 1995; Human Development Report, 1995). Understanding individual attitudes and actions within the Cuban community may provide insight into the basic mechanisms of how Alternative Development can be successful (Chapter 4).

Worldwide, rural community interests are most affected by non-crop functions of forests and are usually the first to be affected by changes in local forest structure (FAO, 1958, p.193). The study of a community's dependence on forest resources provides vital insight into the links between forest development and community development. Investigating individual and community forest values may reveal certain psychological dispositions that enable forest development to flourish or flounder. Examining the Cuban perspective may also facilitate a better understanding of people-forest interactions and clarify the role of social organization in

facilitating development.

While most countries are only beginning to admit that a world-wide forest crises is looming, early Cuban Revolutionaries acknowledged this reality for Cuba and, in 1959, set out to address its forest crises (Reed, 1992). Unfortunately, Cuba's achievements and setbacks in the process of forest development and its socialization have remained largely unreported outside of Cuba. While Cuba's success has been attributed to community-based, people-centred development, the role of Cuban society in achieving current forestry conditions has yet to be studied objectively at the community level. Cuban attitudes towards forest development remain undocumented, obscure and void of analysis. Numerous studies in the field of social forestry recommend that alternative systems of social organization in forest development need to be better understood (Wickramasinghe, 1994; Bahuguna, 1994, p.272; Korten, 1990, p.91, 214-216). Understanding why and how different forest management regimes succeed or fail in winning public support and participation could expedite future forest development efforts. This thesis involved an in-depth examination of the interactions of people with forests for a single case study of a rural community in western Cuba.

### **1.3 Research Question and Thesis Statement**

This study investigates people's perspectives and uses of forests and forest products within a single case study framework. It also examines if, and to what extent, forest resources have a function in the development of the community of Establo in western Cuba. Thus, in terms of these objectives, the study addresses the following research question:

What function do local perceptions and uses of forests have in the development of the community of Establo, Cuba?

#### **Thesis Statement**

This thesis argues that individual perceptions and uses of forest resources have influenced community and forest development in Establo, Cuba. The study also hypothesizes that forests and forest products are essential to the everyday lives of ordinary people. As such, community development may be affected to varying degrees by the development and/or decline of local forest resources. The thesis, argued with evidence, is that Cuba has implemented Alternative Development strategies in its socialization of forestry, inasmuch as Alternative Development is people-centred, need-oriented, ecologically postured, self-reliant, and aimed at structural transformation towards democratic participation in decision making and self-government (Hettne, 1990, p.153-154; Gardner and Roseland, 1989, p.26-34). The case study argument follows a logic

based upon the assumption that both physical and non-physical factors cause and/or influence human behaviour. Both empirical and theoretical evidence have been provided through literature reviews, field research and observations, and statistical analysis. The thesis proposes that more attention should be given to the social and non-timber dimensions of forest management and their role in sustainable development.

#### **1.4 Conceptual Framework and Working Ideas in the Study**

The conceptual framework of the thesis is rooted in the concepts and principles of *critical social research* methodology (Cameron, 1995). Critical social research is based on the assumption that conditions in both physical (terrestrial) and non-physical environments (mental, social, political, etc.) cause or influence human behaviour. Differences in behaviour are often studied with reference to non-physical factors such as education, social structure, and beliefs. Critical social research is based on both analytical and observatory designs. Data are purposely related to one another and/or cross referenced to facilitate interpretations and conclusions (Cameron, 1995). Critical social research method will guide the use of various tools of analysis which will examine whether or not principles and concepts articulated by the Alternative Development Paradigm are present and practised with respect to forest development at the community level in Cuba.

Several working ideas will be explored and tested by the findings of

the data. First, it is important to discuss the concept of a *paradigm*. A paradigm is a set of dominating principles governing a whole area of thought and scientific study (Kuhn, 1962; Wilber and Jameson, 1988, p.4). According to Kuhn (1962), a change from one paradigm to another may be foretold by a period of crises which threatens the fundamental assumptions of the core principle(s); and identified by a change of auxiliary assumptions or by a change in organization and structure of institutional agents beyond structural reforms (Eatwell, 1987; Kuhn, 1962). In the literature it is argued that three paradigms have guided thinking and practise in the field of development studies in the post World War II period: 1) the traditional Orthodox Paradigm; 2) the Political-Economy Paradigm; and 3) the Alternative Development Paradigm (Wilber and Jameson, 1988, p.3-27; Hettne, 1990, p.152-194; Korten, 1990). There has been a reported shift from thinking in the Orthodox Paradigm to the Political-Economy Paradigm, as well as efforts to advance a third Paradigm based on an alternative conception of development (Wilber and Jameson, 1988, p.3-27). Forest development theorists, however, have viewed this shift somewhat differently.

The literature pertaining to forest development appears to only recognize two distinct operational paradigms: 1) one paradigm which appears to be a synthesis of Orthodox and Political-Economy principles which share the same view of forestry, inasmuch as forestry objectives are founded on macro-economic perceptions of production and growth; and 2) a "new" Alternative Development Paradigm which considers forest development based on ecosystem

health, multiple-use management, grassroots participation, principles of sustainability, and a micro-economic perspective on development (Beckley and Korber, 1995, p.712; Clement, 1995, p.62; Wickramasinghe, 1994). Table 1 summarizes the author's analytical ordering of popular thought and perspective of forest development around nine conceptual issues. It represents a composite of the approaches and perceptions of the two schools of forest development identified in the literature and asserted in this thesis. The illustration clearly shows that the two school of forest development differ along at least nine dimensions of thought. Marxist models of forest development have not been addressed in the forest development literature reviewed for this study. Marxist analysis, however, constitutes a part of the Political-Economy Paradigm with its socio-economic and collective/class framework of analysis which lacks the critical third element of ecology present in the Alternative Development Paradigm.

**Table 1. Schools of Thought in Forest Development (adapted from Bengston, 1993).**

Concept	Orthodox / Political-Economy School	The Alternative School
Time	annual, to maximum of human life span	theoretical eternity
Model	Economic-social	Biological-social
Core / Goal	growth of economic system	sustainability of biological system
Human Role	human as dominant species ruling over biological system	human species as part of complex biological system
Use of Resource	limited to tangible forest products such as timber and paper	social, aesthetic, spiritual, energy, food, water
Value System	based on present investment opportunity and supply/demand; discounts to present market price and/or willingness to pay or accept compensation	considers future society, discounting rate reduced; multiple values, broad notion of value
Measures of Uncertainty	market vulnerability; supply and demand	ecological degradation and renewal time
Framework	few analytical tools or modes of operation	multiple, dependent on ecology & culture
Land Ethic	utilitarianism	conservation

Alternative Development has been the only school of thought to seriously question and change the underlying assumptions and structure of Orthodox and Political-Economy thinking (Korten, 1990; MacNeill *et al.*, 1991; Nerfin, 1977). Although the proponents of Alternative Development agree with the Political-Economy's conception of the need for change through people who share a common identity, the Alternative Development Paradigm does not

require that the State, market, or social movement to be the instrument of change. Alternative Development proponents believe change, and the implementation of core principles, must be directed by local citizens via community-based structures. The role of the government would ideally be to facilitate such structures and encourage locally-based organizations in a way that does not dominate or force local groups to carry out activities they do not agree with. Alternative Development political structures must allocate resources through community level government who share in the responsibility of development. Such structures would vary according to cultural, geographical, and ecological factors (Hettne, 1990, p.153).

This thesis bases its evaluation of community development on the measures and concepts of the Alternative Development Paradigm. These key Alternative Development concepts will be examined in the analysis of forest development in Establo, Cuba. That is, if true progress is to be made for humankind, forest development must be people-centred, need-oriented, participatory at all levels of planning and action, ecologically sound, and founded on principles of liberty, equality, fraternity, and biological sustainability (Korten, 1990; Nozick, 1992). Due to the scope and length of this thesis, development theories will not be argued or expanded, but will be asserted and referenced throughout the study.

While the anti-government movement was gaining support amongst the Cuban people during the 1950s, several fundamental conditions

of development were emerging throughout the world which necessitated and facilitated an alternative approach to development. Alternative strategies shared the quality of being global and national in vision, but activated and implemented at the local level (Gardner and Roseland, 1989, p.36-48). In particular, the path of Alternative Development has been paved by core concepts concerning community-based grassroots structures, ecological stability, self-reliance, and micro-economic in perspective. Economic dimensions of development are important, but secondary factors in the process of Alternative Development. After the needs of the community are met, and only then, are resource and/or commodity surpluses directed to an external market system for economic considerations.

Although self-reliance and self-sufficiency are distinct concepts, one should lead to the other, and both imply a sustainability factor. In terms of forestry, self-reliance may be defined by a community's ability to rely on local forest resources to meet their basic needs. The use of imported materials and technology may be permitted so long as they do not foster dependence on foreign products or become critical to sustaining the system. Any technology introduced to the system must be used to complement social and cultural practices. A modest consumptive pattern focused on meeting basic necessities is assumed so that all community members may share in the benefits of employment and the environment (Hettne, 1990, p.172-179).

Since the publication of 'Our Common Future' (1987), ecologically-centred development, or "ecodevelopment", has become a popular

subject within the field of development (Korten, 1990, p.26; Hettne, 1990, p.179). Contrary to Orthodox thinking, Alternative Development proponents view the earth's natural resources as finite. As such, the earth cannot tolerate current global exploitation rates without suffering irreversible degradation. The ecodevelopment concept is concerned with the rational use of renewable resources<sup>1</sup> and very limited use of non-renewable resources<sup>2</sup>. Ecodevelopment proponents argue that diminished natural resources have caused past human conflicts and the current state of affairs now threatens any chance for international peace. The concept also contends that communities should only rely on local resources (and to a lesser extent national resources), to meet their basic needs and sustain their livelihoods. Ecodevelopment promotes a proactive participation of all people and their communities in the conservation and protection of local resources, with forests being an integral part and source of many natural resources (Hettne, 1990, p.179-189; Nozick, 1992, p.67-95). Throughout the world, ecological and economic interests have often conflicted, but Cuba's Revolutionary philosophy reflects a belief that ecologically wise use of forest resources makes long-term economic sense (pers. comm. Karen Wald, 1995).

The concept of equity-led development, or "egalitarianism", calls for an immediate redistribution of power in the world, from 'superpowers' and male domination, to the equal empowerment of all

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<sup>1</sup> plants, animals, air, water

<sup>2</sup> minerals, fossil fuels

nations and their citizens. Activities are organized in an attempt to transform countries into more open and less hierarchical places. Egalitarianism recognizes the political right to national sovereignty and the human rights of every child, woman, and man. The concept focuses on eliminating all discrimination rooted in gender, race, class, and cultural differences. Feminist movements in Cuba and around the world have been instrumental in advancing the cause of egalitarian development in its entirety, but especially for women and children (Hettne, 1990, p.167-172). Cuba's Revolutionary movement has been particularly successful in advancing equity-led development in the plight of agrarian reform and public ownership and management of land, natural resources, transportation, and principal industries. Cuba has become a leader amongst developing nations when it comes to implementing egalitarian concepts, and hence, makes for an interesting setting in which to study people-forest interactions .

Functional and normative values implied by the above theoretical views have been largely based on subjective interpretations of the behaviour of the 'average' person. This thesis aims to examine such theories through an analysis of people's perceptions of forests and forest development following the principles of Q-methodology, and comparing the findings with the findings from the literature and local field conditions. Although the Q-method of analysis is objective, the findings are open to subjective interpretation by the researcher. As McKeown (1990, p.2-3) notes, "...Studying subjectivity presents both a methodological dilemma inasmuch as there are always at least two subjective "texts" involved- the respondent's and the

investigator's. ... The purpose of Q method is to discover and display [the structures and forms of people's opinions] in preparing them for understanding and interpreting their meanings." McKeown (1990) goes on to note, that data collection should capture the texts of the people being studied. "As Stephenson (1967, p.10) put it, "The focus has to be on the person looking, viewing, reading, listening - not as we observe him, but as he observes it all himself."

### **1.5 Thesis Format**

The thesis progresses through five chapters:

- 1) introduction;
- 2) society and forestry in Cuba;
- 3) description of study area and research method;
- 4) results and discussion; and
- 5) conclusions.

Chapter one outlines the importance of forests, the thesis argument, objectives, and the rationale for choosing to study forest development in Cuba. Chapter two presents a brief past-to-present overview of society and forestry in Cuba. This overview of forest and people in Cuban development is intended to document previous and existing forest development structures and activities. Chapter three highlights the social, geographic, and forestry conditions in the research area and describes the guiding research methods. Chapter three also provides a critique of the research method, techniques, and assumptions. Chapter four presents the results of the factor analysis and other data gathered during the field research. It

discusses the findings and their relevance to community-based forest development in Establo, Cuba. The study concludes with Chapter five, a summary of findings, contributions to the study of forestry and recommendations for further research. The bibliography and appendices follow accordingly.

## CHAPTER 2. SOCIETY AND FORESTRY IN CUBA

"... full of trees, lining the river, lush green, so different from ours, each with their own flower and fruit. Birds singing sweetly everywhere: abundant palms..."

Excerpt from the journal of Christopher Columbus for the 28 day of October, 1492 (see Reed, 1992).

Since Christopher Columbus' first voyage to the island, Cuba's forested area declined from an estimated 90% to an all time low of 10-14% in 1959 (see note in Table 2). After 1959, Cuba entered into a transitional phase of development which has since become one of Latin America's greatest social and forest development phenomena. A unique blend of Marxist-Leninist principles and environmentally conscience strategies guided Cuba's extraordinary social and environmental achievements which included the mass participation of Cubans in reforestation and planning activities. Cuba's forest history over the years of deforestation and its transition to a Socialist "forest" State are highlighted in the following pages. The chapter also exposes some of the forestry-related issues that have emerged during the recent Special Period in Cuba.

## **2.1 Society and Forestry in Pre-Revolutionary Cuba**

As Columbus' journal reveals, the small indigenous population of Arawak, Siboney, and Taino Indians had scarcely made an impact on Cuba's natural forest (Westoby, 1989, p.130). A century after the arrival of Christopher Columbus and the Spanish Armada, the indigenous had been pushed to the verge of extinction and majestic trees no longer lined many of the rivers. Early records indicated Spain's first logging operations took place during the 16th century along the banks of the Almendares River and the Ariguanabo area near Havana (Reed, 1992, p.36). Lumberjacks (Northern Mexican slaves) were soon imported to Cuba to replace local indigenous slaves who lacked tree felling skills (Black, 1976, p.97). The use of slaves in the forest industry made Havana shipyards the most productive and largest operations in the Spanish colonies during 17th and 18th centuries (Westoby, 1989, p.73, 131; Reed, 1992, p.36). Harvests of giant cedar, oak, mahogany, pine, and other precious timbers were used to strengthen Spain's navy and merchant marine. Cuban timbers and other products were also traded in Europe and other parts of the Caribbean.

The Spanish Crown's continual need for timber harvesters and agriculture labourers generated a massive influx of African slaves in the 17th and 18th centuries (Government of Cuba, 1995, p.4). When slavery was finally abolished in Cuba in 1865, efforts were made to attract Chinese labourers who worked for very low wages (Black, 1976, p.98). By the turn of the 20th century, Cuba was characterized

by a blend of African and Spanish cultures, with small Asian and French (Haitian) populations (Black, 1976, p.98-104). Most of the estimated 11 million people living in Cuba today are descendants of mixed marriages among these cultures.

During the 18th century, Cuba's agriculture sector expanded to meet the demands of foreign markets and its growing population. Sugar and coffee plantations increased while timber harvesting decreased as the supply of veneer and sawlog mahogany and other precious woods was depleted (Demeritt, 1991, p.108-120). By the end of the 18th century forests had managed to regenerate naturally over approximately 90% of the land, although the forest structure had been seriously degraded (Westoby, 1989, p.131). With the introduction of the railroad and steam powered engines in the 1800's, and petrol-powered locomotives in the 1900's, the sugar industry flourished and extended its roots across Cuba's forest land. The industrialization of agriculture had accelerated deforestation beyond previous rates.

The first revolutionary war between the Spanish Crown and naturalized Cubans took place from 1868 to 1878. Carlos Manuel de Céspedes, an affluent Cuban landowner and farmer, was amongst the first to lead the 19th century revolutionaries and one of the many who lost their lives fighting for Cuba's independence. Although the 10 year conflict failed to liberate Cuba from Spanish rule, it strengthened solidarity among many Cubans. José Martí, a famous 19th century Cuban writer, captured the aspirations and spirit of the

struggle in his extensive works of poetry and other writings. Martí's self-imposed exile ended when he returned to Cuba in 1895 to join the revolutionary fighters. Martí was killed in battle just months after the Cuba's War of Independence had begun (McManus, 1989, p.28). His writings are reported to have had a great influence on the anti-imperialist and socialist precepts of the Revolution. Martí's influential writings include several descriptions of Cuba's natural ecology, such as his "Diary of Dos Rios", which he wrote in during the final days of his life, and his poem, "Tree of my soul", which reflect the beauty of trees. Martí's writings are descriptive and appear to encourage a respect for the beauty of the forest, but have not contributed to the process of forest development *per se*.

The war against the Spanish Crown continued until 1898 when the intervention of the United States ended Spanish rule. In 1901, with the assistance of U.S. envoys, a new Constitution was adopted in the Cuban Assembly with the addition of a short addendum. The infamous addendum, known as the Platt Agreement, granted the United States special privileges to intercede in Cuban affairs when the U.S. saw fit to do so (McManus, 1989, p.29-30). According to Huguet (1958), Cuba's large scale 20th century logging operations were a direct consequence of the 1901 Platt Amendment and its related 1903 treaty with the U.S.. The Platt Amendment gave Cuba a "most favoured nation" trading status with the United States and expedited Cuba-U.S. trade in lumber, sugar, and many other products (Huguet, 1958).

Cuba's agricultural expansion and industrialization had reduced forest cover to 50% of Cuba's land area by the year 1900 (Westoby, 1989, p.131). Agriculture crops, especially sugar, became the primary foreign exchange earner during the early 1900s (Bergad, 1990). Sugar came to occupy 33% of Cuba's productive ferrolitic and humic-calsimorphic soils by the 1920s, while cattle, coffee, rice, corn, and beans were cultivated on less fertile soils (Reed, 1992, p.36). During this time 8% of the large agriculture land holdings constituted 71% of the land ownership (Black, 1976, p.389). Indeed, Fidel Castro's father was himself one of the smaller landowners having owned 800 ha of land and leased another 10,000 ha (Betto, 1988, p.93-94). Although Castro's father did not obtain his land via political channels, politics had played a major role in the granting of concessions for many foreign and Cuban land owners. The agricultural and forestry affairs of the first half of the 20th century were administered by several political factions, but two governments dominated events: 1) Machado's elected 'liberal' government dominated politics from 1924 until 1933; and, 2) Fulgencio Batista's "elected" presidency from 1940-1944, and his non-elected military dictatorship from 1952-1958 (Aguilar, 1972; Bonachea, 1974). Batista's murderous regime controlled political power until January 1, 1959, when the popular Revolutionary faction led by Fidel Castro Ruz became Cuba's governing body.

Government and industrial forest management activities prior to 1959 have remained largely unreported. Black (1976) made reference to a total of 10 million seedlings planted by all

administrations before 1959 (Black, 1976, p.20). During interviews in 1995, several Cubans noted that before the Cuban Revolution, forest management was limited to harvesting and natural regeneration. Harvested forest lands with more fertile soils were turned into private or State agricultural fields. If a site was intensely logged and somewhat remote, local farmers would use the area to cultivate their own crops. Shifting cultivation had been common practice in many areas (pers. comm., various Cubans in Cuba, 1995).

Huguet (1958) estimated that forest cover stood at 50% the beginning of the 20th century with only modest imports of foreign forest products. By 1958, imports had risen substantially and forest cover was reduced to an estimated 10-14%, "most of which was impoverished woodlands" (Huguet, 1958). "In 1957, Cuba consumed 2.35 million cubic meters of forest products, importing most of its pine and all its plywood, newsprint, and paper. Imports represented 73% of the total forest products consumed in Cuba, amounting to an expenditure of US\$34 million" (Reed, 1992, p.38). Considering Cuba's logging history, forest statistics, and personal commentaries from older Cubans, it would be accurate to say that prior to 1959 the governments of Cuba did not undertake any significant forest development activities.

Huguet's report (1958) did not include forest data from the mountainous Oriente region of eastern Cuba. The Batista government denied Huguet permission to visit the area because of dangerous rebel activities throughout the area. One year after the FAO

published Huguet's report, these same rebels came down from the mountains and out of the forests in a victorious defeat of the Batista government. The most favoured nations status was withdrawn the following year with the introduction of agricultural reforms by Cuba's new government. The new government led by Fidel Castro Ruz read Huguet's report and began implementing most of its recommendations. Table 2 reflects the changes the Revolutionary reforms had after 1959.

Table 2. Official statistics from the Government of the Republic of Cuba on forest development in Cuba (CITMA, 1993, 52).

Year	Total Area (Mil. ha)	Forest Cover (Mil.ha)	Forest Area (%)	Population (Mil. inhab)	Forest/ inhab. (ha)
1812	11.1	9.9 <sup>+</sup>	89.2	0.5	19.8
1900	11.1	6.0	54.0 <sup>*</sup>	1.8	3.3
1959	11.1	1.5	14.0 <sup>*</sup>	6.9	0.22
1991	11.1	2.16	19.5 <sup>*</sup>	10.8	0.20

+ Although forest cover may not have decreased significantly from 1500-1800, timber quality and forest dynamics had seriously deteriorated.

\* Estimates average from 50-54% cover in 1900, 10-14% in 1959, and 18.2-26.0% in 1990-1991. See Huguet, 1958 (FAO Report); Westoby, 1989, p.131-132; Reed, 1992, p.36-48; FAO, 1993; Rosset & Benjamin, 1994; Cuba Business, Jan/Feb, & Sept., 1995.

## **2.2 Forest Renewal and Social Development in Cuba**

"Always, we stuck to the woods. On some rare occasions we would sleep at some hut close to the woods. Daytime was spent under the protection of the tall trees, under a canopy of leaves, and always on guard."

Ernesto Che Guevara, 1967.  
Episodes of the Revolutionary  
War, p.60.

During interviews conducted for this study, several older Cubans noted the importance of forested areas in defeating the Batista government both locally and nationally (pers. comm., Alejandro Chile and Parmenuo Peña, 1995). The radical changes introduced by the men and women referred to in Che Guevara's quote enabled Cuba's forest cover to vastly increase in the past 37 years. Prior to 1959, Cuba's forest policies and practices resembled those of any other developing capitalist countries. The beginning of the Revolution marked the end of imperialism in Cuba and beginning of a sovereign workers' socialist State. Forest resources, and all other natural resources in Cuba, became State property. New conservationist policies were introduced and all timber exports were halted. The search for detailed publications on Cuba's forest industry operations and administration from 1960 to the 1980s was unsuccessful, but information was obtained from atlases, business reports, and personal interviews with Cuban foresters.

The task of rehabilitating Cuba's forests and forest industry was not

easy given the impoverished state of the forests and a lack of trained staff and research to guide forest development (Westoby, 1989, p.132). Natural resources and most of the remaining forest land were nationalized in 1959 and 1963 under the Agrarian Reform Law. Private land ownership has always been permitted in Cuba, but has been restricted since 1963 to an area of less than 67 ha for individual and corporate ownership. In the case study area, only a few of the respondents owned or rented small parcels of land. Private commercial forest management activities were not evident. It appears that the State has been the only official manager of forest lands since 1959. Westoby (1989) noted that the State had a great task on their hands in 1959, as there had been no information on forest production capacity or its economic potential. With little scientific preparation, Cubans began cultivating trees in record numbers, planting an estimated 68 million seedlings from 1960 to 1965 (Reed, 1992, p.38). Unfortunately, a significant proportion of these early plantations were lost to poor quality seed, species-site mismatches, and failure to tend the tree crops during the first five years. Despite overcutting in the early 1960s, the new government failed to meet even half the required wood production estimates of 150,000 cubic metres ( $m^3$ ). The failure to meet wood demands brought about an emphasis on production activities that used wood more efficiently (Westoby, 1989, p.132). The annual allowable cut (AAC) was reduced to 45,000  $m^3$  accordingly and greater emphasis was placed on improved reforestation and conservation activities.

As Cuban forestry students graduated from university and training

centres and joined the workforce, reforestation programs became more successful. The IIF has estimated there are now over 1000 professional foresters and more than 3000 forest technicians in Cuba (IIF, Sub-project proposal No. 11.7, unpublished). Together, foresters, technicians, and thousands of volunteers and paid labourers effectively reversed the rate of deforestation and achieved planting rates in excess of 46 million seedlings per year over the past 30 years (Reed, 1992, p.38). Planting programs have included a mix of mahogany, cedar, caoba, majagua, caribbean pine, eucalyptus, and royal palm (Black, 1976, p.20; Appendix VII).

The 1961 U.S. embargo on Cuba fostered a strong relationship between Cuba and the (former) Soviet Union, especially during the years 1962-1989 (Zimbalist and Eckstein, 1994, p.7; Ritter, 1992, p.116). Trade and technological exchanges with the Soviet Union and other Marxist-Leninist countries in Eastern Europe improved all sectors of Cuba's industrial infrastructure, some more sustainably than others (Eckstein, 1994). Mechanization of difficult and dangerous jobs was a main objective in the 1960s and 1970s. Several sawmills and pulp and paper mills were built during this period with imported machinery such as Beloit-Fampa machines. Tractors, chainsaws, silvicultural tools, and milling equipment were traded for Cuban sugar and small quantities of other products (pers. comm. Hernández-Figueroa and various forestry workers, 1995). During the 1970s, the federal government became increasingly aware of the rising national debt, environmental hazards, and Cuba's dependence on imports. During the same period, research findings, education, and

ideological visions were evolving towards more sustainable systems of industrial development which were less harmful to human and ecological development. As the U.S. blockade tightened and Cuba's sugar harvest decreased, machine parts, fuels, and technological upgrades became increasingly difficult to obtain. By the time Soviet-Cuban relations had disintegrated in 1989, many mills were in need of serious repair and upgrading.

According to "FAO Yearbook: forest products 1981-1992" (FAO, 1994), Cuba's roundwood production in 1981 was 3,316,000 m<sup>3</sup> and remained steady until 1992. Cuba began importing roundwood again in 1987, and exported a small amount in 1991 (FAO, 1994, p.11). Cuba exported other processed forest products from 1984-1992, and probably continues to do so on a small scale today (FAO, 1994, p.278). Fuelwood, and a small amount of charcoal, production was estimated to be 2,802,000 m<sup>3</sup> in 1981, and has experienced a steady decline since then to 2,529,000 m<sup>3</sup> in 1992 (FAO, 1994, p.18). Cuba imported small quantities of wood in all FAO wood commodity categories over the period from 1981-1992, except for veneer sheets and household/sanitary paper (FAO, 1994). National production of manufactured lumber ("*tableros de madera artificial*") was estimated at 338,000 m<sup>3</sup> in 1981 and peaked at 866,000 m<sup>3</sup> in 1987 before falling below 620,000 m<sup>3</sup> in 1988 (Atlas socio-economico de Cuba, 1990, p.35). Production of industrial chemicals, paper, and cellulose from forests amounted to 671.9 million pesos in 1980, but decreased to 603.3 million pesos in 1989. Timber production was estimated at 152.6 million pesos in 1980, but fell after 1985 to 123.4 million

pesos in 1989 (Atlas socio-económico de Cuba, 1990, p.39). Approximately 91 thousand hectares of production forest were estimated to have an extractable merchantable wood volume of 1,177,500 m<sup>3</sup> in 1991 (IIF, Sub-project proposal No. 11.4, unpublished). Forest products have contributed many of the basic substances used in Cuba's other industrial manufacturing processes (pers. comm. Fidel Hernández-Figueroa, 1995).

By far, Cuba's greatest forest production strategy has been the high level of involvement of the Cuban population in building and benefitting from forest growth. Cuba's people-centred and ecologically-conscious approach to forest and human development has led to Cuba's first place standing amongst Latin American and Caribbean countries in national living standards. Forest resources have played an important role in the development of several of Cuba's renowned health and educational programs: the Family Doctor Plan, the Medical Plan for Agriculture, and the Forestry Production Cooperatives Network. They are all involved in the production and use of natural medicines (Rodríguez-Rodríguez, *et al.* 1990). Forest buffer zones, forest reserves, urban parks, and community gardens have contributed to improved air and water quality and the well-being of people. Table 3 displays a few of the Revolution's achievements in the social and ecological sectors.

Table 3. A selection of social and ecological figures on Cuba

	1960	1975	1989	1995
Under-five mortality rate*	87	na	18 (lowest in L.A.)	na
Life expectancy*	63	72	74 (2nd highest in L.A.)	75
Adult literacy rate*	na	90	96	na
% Pop. with access to safe water~	na	56	97.7	na
Doctors/person ~, -, <sup>1</sup>	1:1081	1:1122	1:204 (Highest in L.A.)	1:194
Scientists/person+	na	na	(Highest in L.A.)	same
Housing/family+	na	na	(Highest in L.A.)	same
Average of health and education indicators+	na	na	(Highest in L.A.)	same
Estimated Population per sq.km.~	na	83.8	91.1	97.2
Agricultural Land (% of land area)~	na	52.4	54.0	57.4
Forests & woodlands (% of land area, averaged) <sup>2</sup>	12.0	15.0	18.8	22.0
Deforestation rate (%)~	(-9.6)	(-2.8)	(-0.9)	0.9

## Sources:

\* UNDP Human Development Report, 1990, p.135,143

~ World Bank, World Development Report, 1995, p.86,87; and Eckstein, 1994, p.220-232

+ Rosset &amp; Benjamin, 1994

- Cuba Business Jan/Feb. 1995<sup>1</sup> Cuba Business Sept. 7, 1995, p.6<sup>2</sup> Average of estimates from Reed, 1992; CITMA, 1993, p.52 FAO, 1993; Rosset & Benjamin, 1994; Cuba Business Jan-Feb, Sept. 1995.

na = not available. Note that forest area figures denote significant negative deforestation rates although the World Bank report failed to calculate them although they had the data. Those figures should read -9.6, -2.8, and -0.9 respectively.

L.A. = Latin America

Note: note the discrepancy between deforestation rates and forest/woodlands area. The various literature reports obviously do not correlate.

Since 1959, forestry operations in Cuba have been deliberately labour intensive in keeping with the ideals of the Cuban Revolution, which place great importance on maintaining high employment levels and encouraging participation in environmental stewardship.

Technology has also been welcomed in Cuba. Both artificial and natural regeneration methods have been integrated into Cuba's reforestation program since the 1960s. Artificial regeneration activities have been supported by a network of local nurseries located in 13 of the 14 provinces in Cuba (excluding the City of Havana). These nurseries have been supported by a small but intensive tree improvement program in operation since 1969 (Esquivel, M. *et al.* 1990; Hammer and Esquivel, 1990; IIF brochure, no date). Tree improvement activities have focused on the identification of quality seed production areas and seed collection techniques and procedures. A network of field trials and seed production sites now covers over 200 ha in Cuba. Seed zones were established in the 1970s once Cuba's seed collection monitoring system was in place. A network of over 2000 seed banks now support reforestation efforts throughout the country (Bulletin of the National Information Agency, April 24, 1993). Since the late 1960s, species have been matched to site conditions whenever possible.

Cubans planted approximately 1.4 billion seedlings on 306,704 ha between 1959-1987 (IIF, Sub-project proposal No.11.2, unpublished). Two types of planting stock have been used in plantations throughout Cuba: container stock (pine, eucalyptus, casuarina, etc), and bareroot stock (teak, cedar, majagua, etc). Approximately 90 species have been grown in Cuban forest nurseries, but only 20 species have been used for commercial development (IIF, Sub-project proposal No.11.2, unpublished). The four species of pine, along with mexican cedar, mahogany, majagua,

eucalyptus, and casuarina account for approximately 80% of seedlings produced in nurseries. Nursery operations usually extend from November until the end of the planting season in September, depending on the species and stock requirements (IIF, Sub-project proposal No. 11.2, unpublished). Caribbean pine (Pinus caribaea) seedlings planted near the case study site were grown at the local nursery and planted on well drained sandy soils. Planting was carried out manually using shovels and large trowels to dig 10-20 cm holes at a typical spacing of 1.5 x 1.5 m. The seedlings were planted by the local people who received training and supervision from State foresters (pers. comm., Ing. Fidel Hernández-Figueroa, 1995).

Silvicultural treatments (excluding planting) have been applied to 115,200 ha of production forest since 1959, of which 90,900 ha of forests were estimated to have an extractable merchantable wood volume of 1,177,500 m<sup>3</sup> in 1991 (IIF, Sub-project proposal No. 11.4, unpublished). Silvicultural practices have been advanced, labour intensive and varied according to species and site conditions (Betancourt-Barroso, 1987; Chong, P.W. 1989). Manual weeding and 'cleaning' around planted trees has been practised regularly, and usually continues until trees reach a 'free-to-grow' state. Spacing and commercial thinnings were practised whenever economic and site conditions permitted. Although the use of imported chemical pesticides and herbicides was common during the 1960s and 1970s, they have had little use since 1990 (Rosset and Benjamin, 1994). Fortunately, organic agricultural practices were introduced into the agriculture sector as more ecologically-sustainable production

practices. Cuban researchers have been successful with several biological controls including extracts from the *paraíso* plant and *tabaquina*, a waste product from the tobacco industry (Granma, March 3, 1993; Prisma, November, 1992). Such practices were actively promoted and implemented in the 1980s as the Cuban government became aware of their rising national debt and economic vulnerability to internal market forces (Rosset and Benjamin, 1994). Today, biopesticides are produced in Cuba by Cubans and widely used in the agriculture sector (Levins, 1991). A small quantity of biopesticides have been used on commercial forest plantations. Although there have been no major forest pest outbreaks, forest pests have affected some forest areas and sawn lumber (IIF, Sub-project proposal No. 11.6, unpublished).

Harvesting operations have usually involved manual tree felling techniques using axes, although chainsaws have been used when gas, oil, and chainsaws were available. Trees have usually been limbed in the forest and extracted with the use of oxen or a skidder-tractor. In the past two decades, most harvesting operations have been confined to small areas ( $x < 25\text{ha}$ ) with appropriate protection reserves left between harvest sites. Logging operations in the Sierra del Rosario area were usually carried out to meet local demands for State projects. Illegal cutting has been a reoccurring nuisance, but generally confined to small areas ( $x < 2\text{ha}$ ). Violators have usually been caught as the shortage of wood products and strict timber regulations make it very difficult to conceal any amount of lumber (pers. comm. with forest guards, Sierra del Rosario, Cuba, 1995).

Gross forest area in Cuba has been estimated at 2,819,800 ha, or approximately 25% of Cuba's territory. Of the total amount, 2,018,500 ha or 18% of Cuba, had some degree of forest tree cover in 1990 (IIF, Sub-project proposal No.11.4, unpublished, data gathered during 1991). Since the 1960s, two-thirds of all forests have been protected by law from commercial logging. The remaining forest areas, 33% or less than 500,000 ha of forests, have been classified as production (commercial) forests (Reed, 1992, p. 38). A United Nations Food and Agriculture Organization report (FAO, 1993) divided production forests into two categories: natural forests (464,200 ha or 15.6%) and plantations (194,600 ha or 3.2%), for a total production forest area 18.8% in 1990 (FAO, 1993, Tables 3a-8c). The IIF estimated Cubans planted 306,704 ha during 1959-1987. Given the FAO statistics, this would mean that seedlings may have been planted within existing forest areas, and or some areas were replanted because of plantation failure, and/or the plantation figures are underestimated.

Natural forests in Cuba are rich in a diversity of tropical and semi-tropical trees. Cuba has approximately 550 tree species, 300 of which are indigenous forest tree species, but only 20 species are grown for commercial purposes (Bisse, 1988, p.XV; pers. comm., Hernández-Figueroa, 1995; see Appendix VII for list of commercial species). Plantation species compositions has been estimated at 49% conifers, 24% casuarina, 22% eucalyptus, and 5% other hardwoods (IIF, Sub-project proposal No.11.4, unpublished). Commercial forest areas are usually located at mid-elevations, away from the coastal and low

lying areas with high evapotranspiration rates. Of special note are the pine and hardwood species planted in terrace formations at Sierra del Rosario. The forest terraces provide an interesting example of innovative reforestation techniques.

Broadleaf evergreen, coniferous, and semi-deciduous tropical forests common to the Caribbean and Central America countries still cover parts of Cuba today. Generally, Cuba's forested areas are limited to the mountainous areas: 1) Sierra Maestra and Sierra Sagua Baracoa in eastern Cuba, 2) Grupo Guamuhaya in the central region, and 3) the Guaniguanico mountain chain in Pinar del Rio Province where field research was conducted for this study (Black, 1976, p.19-20). Eastern Cuba has the most extensive area of forest, but Pinar del Rio, and in particular Sierra del Rosario, experience the wettest forest conditions (UNESCO, 1986). Some forest areas within SRBR are now classified as humid tropical forest, a type of forest a layperson may think of as a jungle (pers. comm. García-García, 1995). Areas of humid tropical forest also exist near Moa in eastern Cuba, but have been affected by joint Canadian-Cuban nickel mining activities. Reforestation efforts restored 3 thousand of the 11 thousand hectares damaged by mining activities up until 1993. Government sources indicate that an annual fund of 1 million dollars is needed in order to support a plan to continue restoring 1 thousand hectares per year or forest development would suffer (Government of Cuba, [April 16] 1993).

Very few patches of primary forests still exist in Cuba, nevertheless, some of the first forests to be protected are now exhibiting mature

secondary forest characteristics. 'Turismo Por La Paz', a newsletters available via the Internet, has noted that Cubans have developed interpretative trails in many of the protected forest areas (Castillo-Barroso, 1994). Such trails are being used by foreigners and Cubans in the growing ecotourism sector (Government of Cuba, [April 16] 1993). Unfortunately, there are very few extensive forests outside Cuba's mountainous zones. The more fertile lowlands are still occupied by monoculture style food crop plantations.

Agroforestry as an instrument for development has not been extensively practised on Cuban soils. The indigenous peoples of Cuba were the first to employ agroforestry techniques on small parcels of land (Renda-Sayous *et al.*, 1994, p.15). The first commercial application of agroforestry came during the 18th century as Haitian immigrants introduced coffee plantations under the shade of forest trees. Over 20 tree species were used to shade coffee plants and satisfy other needs: edible fruit, fuelwood, sawlog and pulpwood timber, and fodder for animals to name a few (Appendix VIII). In more recent times, agroforestry has been practised on a small scale by private farmers (*campesinos*). Although agroforestry has not received much attention during the past years of the Cuban Revolution, recent efforts by the IIF have increased public awareness of agroforestry systems as a sustainable means of agriculture and forest production<sup>3</sup>.

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<sup>3</sup> An excellent review of agroforestry in Cuba entitled, "Los sistemas agroforestales en la Republica de Cuba", was published in 1994 and co-authored by Arsenio Renda-Sayous, Efraín Calzadilla-Zaldívar, Marta Jiménez-Aguila, and Joaquín Sánchez-Rondón.

### **2.3 Facilitating Sustainable Development by way of Forest Policies and Institutions**

Sustainable Development in the context of this paper is defined in The Brundtland Report published as, 'Our Common Future' (1987), where development is viewed as meeting the present [basic] needs of people without compromising the ability of future generations to meet their own [basic] needs. The word basic has been added to clarify needs as those which are necessary for human survival - clean water, fresh air, food, shelter, and free access to natural resources that provide these basic necessities. Success within a sustainable society would be measured in terms of its ability to meet the basic needs of its poorest citizens (Gardner and Roseland, 1989, p.31). This is by no means the only definition of sustainable development, but one that is used in this thesis.

The Revolutionary government's natural resources policies have been designed to strengthen Cuba's forests in a sustainable and socially conscious manner. Cuba's awareness of human and ecological connectedness has fostered an integrative approach to addressing development problems. Despite all of its successes and failures, Cuba's centrally-planned economy has allowed forest development activities to be decentralized, community-based, and aimed at meeting the domestic market demands. Cuba's approach to national and community development contains with the core values of the Alternative Development Paradigm: 1) people-centred; 2) participatory; 3) ecologically-friendly; and, 4) micro-economic in

perspective. The agrarian reform policies and the push for reforestation in the 1960s were socially and scientifically integrated into a progressive environmental and human development strategy for Cuba (Reed, 1992; Levins, 1991). The following paragraphs will highlight some of the policies and structures that have facilitated a more holistic approach to development.

### 2.3.1 Legislation and Policies: highlights

The following list highlights some of the forest and environmental policies and actions taken by the Cuban government from 1959-1994 (adapted from Cuba National Report, 1995; Reed, 1992):

#### 1959

One of the first laws enacted in 1959 involved a new forest policy protecting the forests;

The Reforestation and Woodlands Inventory Program called for a national survey of potential reforestation sites to meet target of 25% forest cover;

The Turquino Plan targeted 40% of mountainous areas for reforestation (75% of Cuba's 8000 plant species are found in mountainous regions), and the Manati Plan focused on the rehabilitation of mangrove sites which later accounted for 26% of Cuba's woodlands and were the 10th most extensive mangrove forests in the world in 1990;

Under the Agrarian Reform Law the new government assumed authority to expropriate land from private owners and designated some of the degraded public land as new forest development areas;

Education program launched to increase environmental

awareness and encourage people to seek forestry training and skills in other environmental disciplines;

Long term forest management planning was introduced as a new concept in forest development;

1976

Constitutional revisions legislated Article #27 stating that it was the responsibility of every citizen and the State to protect the environment (amended again in 1992 to include a more comprehensive definition of the social and economic aspects of the environment);

1977

Creation of the National Commission for the Protection of the Environment (COMARNA) responsible for the coordination of all environment related activities in Cuba. Their mandate was to ensure minimal overlap and maximum cooperation amongst all institutions working in the environment sector;

1981

Law #33, the Environmental Protection and the Rational Use of Natural Resources, outlined institutional means through which forest protection activities would proceed;

1992

National Plan of Action (NAP) rewritten based on the resolutions of the 1992 United Nations Conference on Environment and Development (UNCED);

National Program on the Environment and Development (PNMAD) established to oversee NAP's implementation;

State Program for the Comprehensive Development of Mountain Areas introduced to promote conservation and local participation in management of natural resources in mountainous areas;

Article 27 (1976) amended to include a more comprehensive definition of the social and economic aspects of the environment;

1994

Creation of the Ministry of Science, Technology, and the Environment (CITMA) to be the lead agency for implementing environmental policies (replacing COMARNA);

Dismantling of Academy of Sciences, structural changes included decentralization of authority to give several research institutes more autonomy to seek foreign funding for their own projects. Projects still approved through national office to avoid project duplications;

State continues to fund most programs, but at a reduced level.

"Of all the countries in the Caribbean area, Cuba has made the greatest effort to check and reverse the march of deforestation" (Westoby, 1989, p.131). The environmental policies and programs introduced since 1959 have effectively encouraged thousands of Cubans to participate in nation-wide reforestation and conservation activities (Government of Cuba, 1995; Reed, 1992). Although most of the 'Agenda 21' recommendations (1992 UN Earth Summit) were already present in Cuba's government policies, the Cuban government amended its constitution again in 1992 to fully integrate Agenda 21' into Cuba's statutes (Lane, 1994, p.69-77; Granma International, April 4, 1993; Juventud Rebelde, March 28, 1993). Today, Cuba maintains the strongest environmental law enforcement program in all of the Caribbean and Latin America (Brodine, 1992, p.23).

In preparing Cuba's most recent National Plan of Action (NAP, 1992), planners incorporated follow-up activities and a monitoring schedule

to ensure that the new economic initiatives introduced during the Special Period would not jeopardize social and environmental progress. The National Program on the Environment and Development (PNMAD) was established to oversee NPA's implementation. PNMAD activities have included the following efforts: 1) promotion of alternative and sustainable energy systems; 2) protection of ground water; 3) preservation of biodiversity; 4) protection of ecotourism resources; and 5) the protection of marine resources. The State Program for the Comprehensive Development of Mountain Areas was also introduced to reinforce conservation and local participation in management of natural resources in mountainous areas.

Forest development plans also form an integral part of the National Program of Environment and Development (NPED) (CITMA, 1993). Forest development objectives are presented in the NPED and include conservation of current forest areas, increase of forest cover (especially in open areas), and diversification of ecological and socio-economic activities (CITMA, 1993, p.54). The document cites activities to fight deforestation, mitigate drought and desertification, and maintain and improve the Protected Areas System. NPED advocates ecosystem management and conservation of biological diversity, with special attention to watershed protection and fresh water resource development. The NPED is updated every 5 years, with the most recent NPED written in 1993. The 1993 plan lists several objectives for forest development (CITMA, 1993, p.54):

- \* the maintenance and expansion of forested areas through conservation, law, and reforestation activities, especially in areas with sparse vegetation;
- \* an increase in ecological and socio-economic derivatives from forest resources, while focusing on conservation and planting activities;
- \* promote economic contribution of forests, incorporating ecotourism and other sectors into plans;
- \* improve respect, values, and efficient use of a diversity of vegetation types and forest land;
- \* State institutions and communities are to reinforce sustainable forest development and support improved systems of monitoring and evaluating forest programs and their effectiveness;
- \* reinforce and magnify respect and support for forces that participate in reforestation, especially the mass of volunteers who work at the community level; and,
- \* improve efficiency, strength, and capacity of technical and professional staff who work in the forestry sector<sup>4</sup>.

Such forest development objectives are ambitious. Unfortunately, the NPED fails to mention the institutional mechanisms through which the objectives would be achieved. Only on a few occasions do national plans specifically target programs or mention State departments that should carry out specific actions. The actions proposed to meet policy objectives are numerous, but lack detail. The working document

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<sup>4</sup> In 1993, there were approximately 33,000 people directly employed in State forestry, of which approximately 1200 were forestry professionals with a university degree, and 3700 were forest technicians with a technical diploma (IIF, Sub-project proposal No. 11.7, unpublished; CITMA, 1993).

reviewed for this thesis appears to only serve as a general guide.

### 2.3.2 Forestry Institutions and Operations

In Cuba, the Ministry of Science, Technology, and the Environment (CITMA) oversees the administration of the National Program of Environment and Development (NPED). The Ministry of Agriculture co-ordinates forest management and timber operations via district forestry offices located throughout the country. The district offices perform the day to day forestry operations as would local provincial forestry offices in Canada. Forest operations and planning directives are handed down from the federal Ministry of Agriculture to the provincial agricultural offices who then coordinate district activities. The district forestry offices carry out the day to day forestry activities as per provincially-approved annual operation plans. Annual reports are written by all district offices and compiled at the provincial level which in-turn submits provincial reports to the Ministry of Agriculture. Forest research studies are undertaken by both CITMA and the Ministry of Agriculture. Within the two ministries, several institutions conduct forest-related research, but the majority of core forestry studies are carried out by the Institute of Forest Investigations (IIF) and the Institute of Ecology and Systematics (IES).

The IES, which is connected with the CITMA, employs ecologists, biologists, and other scientists whose research focus on ecology and

biodiversity issues of both terrestrial and marine ecosystems (see Baez *et al*, 1991). The IIF, which falls under the jurisdiction of the Ministry of Agriculture, employs a majority of foresters, forest engineers, and technicians whose efforts focus on the development of forest resources. The IIF research mandate covers 19 areas of forest investigation including genetics, ecotyping, seed, regeneration, fire, silviculture, hydrology and watershed management, forest economics, entomology, timber supply analysis, and agroforestry research. The Ministry of Light Industries, Basic Industry, and the Sugar Industry have collaborated with the IIF on several projects (IIF brochure, no date). These collaborations have lead to national efforts concerning the use of forest products in social and economic development: essential oils in medicine and industry, forest biomass energy, tannins, resins, and pharmaceutical production to name a few (IIF, Sub-project proposals No. 11.2 to 11.7, unpublished).

Cuba's sophisticated Protected Areas Network (PAN) has played an important role in organizing and preserving forest areas since the enactment of Law33/81 (Government of Cuba, [April 2] 1993). The PAN was developed after an extensive international survey of forest protection networks and compares with the World Conservation Union (IUCN) current system of classifying protected areas. Administered by the Ministry of Science, Technology, and the Environment, the PAN consisted of 72 different areas in 1993. A strong social and economic development strategy aimed at improving the multiple-use of land and marine ecosystems guides the development of most PAN units. International cooperation in the

development of Cuba's PAN system has led to the development of several forest areas: 4 World Biosphere Reserves, 10 national reserves, 5 national parks, and 35 "Development of Resources" areas (Government of Cuba, [April 2] 1993).

Other government organizations include the Enterprise for the Protection of the Flora and Fauna which designs programs for the purpose of rehabilitating forest ecosystems (Bohemia, April 9, 1993). The World Day of the Environment and the Forest Workers Day are also celebrated on July 5th (Granma, May 21, 1993). Activities for International Day of the Environment have also been well attended in Cuba (Granma, May 18, 1993). Cuba is also home to several non-government forestry-related organizations such as the Cuban Society for Nature and the Cuban Movement for Peace and Sovereignty of the Peoples who also sponsor ecological projects and meetings (Juventude Rebelde, May 16, 1993; Government of Cuba, [April 16], 1993).

### 2.3.3 Policy Support through Education

Forest policies in Cuba have been supported by an extensive government campaign to educate all citizens in the benefits of environmental stewardship. Today, the quality and structure of Cuba's environmental education programs are comparable to those in Canada. A child's first year in school, usually at the age of 4 or 5 years, includes components of environmental education. Primary

school includes grades one through six, while secondary school covers the remaining grades of seven through to twelve. Forest awareness activities at these levels involve tree planting, environmental science projects, arts and crafts, and essay writing contests (pers. comm., various school teachers in Sierra del Rosario, 1995). Adults who have not completed secondary school are offered adult education classes through work and/or community services. In such cases, environmental education varies according to the person's type of work and living conditions. There are also special education programs for the mentally disabled and other disadvantaged groups.

Cuba has various levels of technical and university forestry education (Herrera *et al.*, 1984). Emphasis is placed on practical forestry training in silviculture and soils, with field to lecture ratios estimated at 50/50 over the course of training. The Bachelor of Science in Forest Engineering degree offered at *Centro Universidad* in Pinar del Rio Province is a five year program that includes courses in math, engineering, physics, chemistry, biology, and silviculture. The school also encourages self sufficiency and sustainability through example. As with many other work centres, the university has day care facilities, a medical team and clinic, a dentist, pharmacy, shops, and fitness facilities. The school also produces its own wooden furniture and some of its food stuffs (pers. comm., Hernández-Figueroa, 1995). The IIF estimates there will be 1338 forest professionals and 3807 forest technicians by the year 2000 (IIF, Sub-project proposal No. 11.7, unpublished).

In summary, environmental policies have facilitated successful forest development through several important mechanisms: 1) massive public participation in reforestation and conservation programs; 2) general and advanced environmental education at all levels of schooling; 3) investment in forestry research and development including social forestry studies; and, 4) an integrative approach to ecosystem management (National Information Agency, bulletin dated April 29, 1993). Forest-related research in Cuba has been far-reaching and decentralized, but the organization of forest research studies lacks coordination and cooperation among the different research institutes. Interviews with Cuban researchers from various institutes revealed that many are unaware of projects at other institutes working in the field of natural resources. It would be advantageous if the Ministry of Agriculture and the Ministry of Science, Technology and Environment were to improve communications, cooperation, and information exchanges with one another and other institutes involved in forest-related research. The IIF has proposed a system of information exchange, diskette document distribution, and/or workshops among various natural resources agencies to facilitate better communications and improve interdisciplinary efforts (IIF, Sub-project No.11.7, unpublished). Unfortunately, the project is still awaiting international funding. Recent efforts by the IIF to substitute hundreds of thousands of dollars in imports with Cuban-made biodegradable forest products is to be commended (IIF, Sub-project No. 11.2, unpublished). Tree improvement programs continue to improve. Nursery development has been hampered by a low level of mechanization and it continues

to lack basic nursery equipment (IIF, Sub-project No.11.2, unpublished). Management-related sectors in forestry are perhaps the weakest areas in forest development in Cuba.

## **2.4 Forestry during the Special Period**

Forestry statistics for the years prior to 1992 have estimated that Cuba's forest cover grew from an estimated 14% in 1959 to 19.5% in 1991 (see notes in Table 2). There have been no 'official' forestry statistics for Cuba since 1992 (pers. comm., Renda-Sayous, 1995). Recent unofficial forestry statistics for Cuba have been conflicting. Reports by Acosta (1995) and the World Bank (1995), suggest that forest area in Cuba has been decreasing since 1992. Global surveys of forest cover indicate that deforestation has been, on average, exceeding afforestation efforts around the world (Mather, 1992, p.367; Grainger, 1993, Chapter 7-8; Myers, 1993; World Bank, 1992). These same studies have shown that when countries are evaluated individually on the basis of development status (developed, developing, underdeveloped), the majority of 'developed' countries now have higher afforestation rates than deforestation rates, whereas most 'developing' and 'underdeveloped' countries continue to experience net deforestation. Mather (1992) has noted that Cuba appears to be an exception to this general trend (Mather, 1992, p. 370-371). Cuba's forest transition, however, as well as most other national forest cover transitions require further study as they are scattered and vague, and generally not well understood. Four years

have passed since Mather (and Westoby, 1989) cited Cuba's potential as a model for other countries struggling to overcome deforestation. Recent reports now indicate that Cuba may also be losing the battle against deforestation. The following paragraphs explore forest development trends during the recent Special Period in Cuba.

The U.S. blockade of Cuba entered its 34th year in 1995. Reports indicate that most sectors of the Cuban economy have been affected by the deterioration of Soviet-Cuban relations and a 'tightening' of the U.S. blockade of Cuba (Eckstein, 1994; Economist Intelligence Unit Cuba Country Reports, 1995; Cuba Business, various issues, 1995). After thirty years of afforestation in Cuba, unofficial forest cover estimates for the past three years of the Special Period (1992-1995), suggest that deforestation has surpassed afforestation efforts in Cuba (World Bank, 1995, p.86,87; Acosta, 1995, p.1). Such reports are supported by the fact that Cuba has had little choice but to increasingly rely on their own forest resources for a multitude of products in energy, medicine, food, building materials, recreation, and small scale industrial materials. National production and support networks have suffered the consequences of a general lack of raw materials. Powerful hurricanes over the past few years have destroyed crops, trees, homes and infrastructure works, with 1994 being one of the worse years on record for a lack of basic materials and food (Contigo Cuba, April 1995).

In 1993, it was estimated that the Union of Paper Workers were able to produce coated and uncoated paperboards from 200 to 600 G/M<sup>2</sup>

using paper clippings, bagasse and or wood chemical pulps (Business Tips on Cuba, September 1993, p.9). The October issue of the same newsletter reported that Cuba had at least one pulp and paper mill designed to produce high-brightness printing and writing papers from bagasse pulp and long-fibre wood pulp. The mill has averaged an annual capacity of 60,000 tons of paper and 18,000 tons of pulp. The mill was once operated on a joint basis by the French firm Creusot Loise, but is now run by the Cuban government. In 1995, Cuba had 105 sawmills operating at an average capacity of 51%. Production levels were depressed because of the lack of oil, parts and improved technology. Cuban sawn lumber currently meets about 10% of demand (IIF, Sub-project No. 11.4, unpublished). Many of Cuba's mills have been in operation for over 20 years and would benefit tremendously from new technologies.

Journalists with Cuba's oldest magazine, Revista Bohemia, indicated that they too had been affected by the Special Period<sup>5</sup>. Due to a lack of paper, the magazine and its English counterpart Bohemia, averaged less than 65 pages per issue every two weeks. Prior to 1989, the magazine produced an average of 80 pages per issue.

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<sup>5</sup> In a related story, minutes before interviewing journalists at Revista Bohemia's main office, a large piece of paperboard was retrieved by the researcher as it blew across the street in front of Bohemia's office. The paperboard turned out to be the wrapper off of an industrial paper roll from J.D. Irving's paper mill in New Brunswick. The import data and shipping information was legible and indicated it had just recently been shipped to Havana. Although it is beyond the scope of this thesis to explore potential forest product markets in Cuba, the findings do hint at vast opportunities for joint Canadian-Cuba forestry ventures.

Granma has also been cutback from a daily newspaper to a weekly newspaper in order to save on paper. As Table 4 suggests, the NPED was accurate in estimating that forest products manufactured in Cuba met approximately 45% of Cuba's industrial and domestic demand in 1993 (CITMA, 1993, p.53). This information suggests a serious incapacity for Cuba in meeting its internal demand for forest products (Table 4).

Table 4. Level of national satisfaction for several forest products (1991 data; adapted from IIF, Sub-project proposal No. 11.4, unpublished).

Forest Product	Demand	Production	Level of Satisfaction (%)
Sawn Lumber (Mm3)	918.0	92.2	10
Plywood (Mm3)	60.0	-	-
Panelwood (Mm3)	121.0	65.0	70
Crossties (MU)	1000.0	227.3	23
Fence Posts (MU)	30.2	20.2	67
Firewood (Mm3)	500.0	482.0	96
Charcoal (Veg; Mt)	62.3	59.3	95
Charcoal (Act; Mt)	2.8	-	-
Pulpwood (Mt)	50.0	-	-
Acidic Acid (ton)	170.0	-	-
Tar (ton)	290.0	-	-
Methanol (ton)	600.0	-	-
Coloform (Mt)	11.2	-	-
Turpentine oils (Mt)	0.4	-	-
Tannins (Mt)	2.3	-	-
Essential oils (Mt)	2.1	-	-

The repercussions of the Special Period on Cuba's forest resources

have eluded most foreign researchers and statisticians. Within Cuba, a shortage of financial and material resources has meant fewer studies, smaller surveys, and even fewer written reports concerning the state of the forest since 1992 (pers. comm. Renda-Sayous, August, 1995). Forest engineer Arsenio Renda-Sayous with Cuba's *Instituto de Investigacion Forestales* (IIF), noted that official figures on forestry activities have not been available since 1992 because of a lack of paper, transportation, and other materials necessary to compile forestry statistics (pers. comm., Renda-Sayous, August 1995). Other government agencies have also struggled to compile basic data relating to natural resources. Years of continuous environmental monitoring activities have experienced interruptions and may be stopped all together. Such observations and their related studies have been important in understanding and charting climatic patterns and factors that affect Cuban ecology and the use of natural resources. Scientists are hopeful that recent 'Special Period' initiatives which permit agencies like the IIF to seek external funding on their own will save valuable research studies (pers. comm. Renda-Sayous, 1995). Many organizations hope that their fund raising efforts will initiate needed projects in the fields of biodiversity, forest (environment) economics, marketing, and growth and yield studies.

Journalists have been attempting to compensate for the lack of official forest surveys and reports, but their sources are difficult to trace and appear to be 'guestimates' from politicians, natural resources staff, and farmers. The Interpress Service (via APC on the

Internet) has carried several of these reports. On August 25, 1995, Dalia Acosta's article, "Environment-Cuba: Energy Crisis Destroying Forests", warned that Cuba may soon rejoin the 66% of developing countries that rely on wood to meet their basic energy needs. Interviews conducted for this thesis tend to support Acosta's suspicions that demands for wood energy and other wood products have risen because of shortages in gas, kerosene, electric fuel, and metal products. In Establo and surrounding areas, forest fruits such as mango, mamé, lemon, and pomarosa were being harvested with greater care to meet both food and medicinal needs (P. Peña, 1995). Newspaper and leaves have replaced toilet tissue in many instances since 1992. Products such as toilet tissue were considered luxury items by many living in and around the Establo research site (farmers' comments in Establo, 1995).

Acosta (1995) noted that a June 1995 report by the National Energy Source Development Programme acknowledged that recent increases in the use of fuelwood were weakening "an already poor forest resource". Environmentalist feared that Cuba's fuel shortage could result in "long-term damage to Cuba's forests and urban green areas as desperation is leading to the indiscriminate felling of trees" (Acosta, 1995). Acosta (1995) also noted that 1989 estimates indicated Cuba has lost 142,000 km<sup>2</sup> of forest as a result of population growth, agricultural expansion, and charcoal and fuelwood production. (The loss did not decrease forest area estimates because new plantations offset decreases.) Charcoal producers have been cited as the greatest threat to forests because they often leave

charcoal ovens burning unattended in the forest to avoid being caught by forest guards (Acosta, 1995). Research conducted in the Sierra del Rosario area refutes Acosta's findings in the case of charcoal producers. In the forested areas surrounding Establo almost all charcoal producers camped at or near the site of their charcoal ovens until they were finished burning. Several men were gone for one to two weeks at a time tending their charcoal ovens. It is possible that these men had permission to burn in designated areas, but the researcher was unable to confirm such permission.

On February 2, 1993, the newspaper Granma reported that special attention must be given to planting more area. Elias Linares, the Director of Forestry for the Ministry of Agriculture, noted that reforestation efforts had fallen short of planting area targets, but had met planting targets for the number of seedlings planted (Granma, February 2, 1993). Acosta (1995) also referred to parliamentary sources who believed recent reforestation efforts would only meet 42% of the planned targets because of low seedling survival rates. Quoting deputy Francisco Morales, Acosta (1995) reported that only 25% of fuelwood harvest areas have been replanted in recent times. Nevertheless, a recent report by Radio Havana Cuba noted that forestry workers in Santiago de Cuba had recently completed reforestation activities as scheduled for the Manati-Turquino Reforestation Plan (Radio Havana Cuba, December 8, 1995). While there have been no significant shortages of planters in Cuba, nursery and planting tools have been in short supply: shovels, work gloves, planting sacks, tubing for nursery irrigation systems, and vehicles to

transport workers and seedlings to planting sites (Acosta, 1995). Acosta's accounts were echoed by other authors published in 1995 issues of Juventude Rebelde, a weekly Cuban newspaper.

During interviews with people living in Establo, Cuba, many commented that the government and community groups had always planted more trees than were cut in the 1970s and 1980s. Most respondents had themselves planted hundreds of trees (Chapter 4). Many of those same respondents indicated that they now thought more trees were being cut than planted in and around Establo. Similar sentiments were repeated during the 1995 interviews with Cuban scientists and foresters. Cubans gave a number of reasons for the apparent decline in reforestation and forest development efforts: 1) bad weather including drought and hurricanes; 2) increased exploitation of natural resources to meet household energy and food needs; and, 3) the lack of a strong commitment by Cubans to participate in rural field and forest work. Fidel Castro spoke on several occasions in 1995 about the seriousness of increased urbanization and corresponding disinterest in agricultural and forestry field work amongst the now highly educated work force (various issues Granma International, 1995; Latin American Weekly Report, Dec. 1986, p.3). Such trends threaten the labour-intensive, socialist production system.

Since the 1960s, the Cuban government has linked forest development and social welfare, especially in the field of health care and medicine. Cuba has made significant investments in the research

and development of Cuban 'green' medicines (pers. comm. Institute for Fundamental Research in Tropical Agriculture, Havana, 1995; Eckstein, 1994). While research and development activities progressed, Cuba continued importing medicines and related commodities to meet national demands. By 1990, Cuba's biotechnology and health care system produced 80% of medicines consumed by Cubans (Eckstein, 1994, p.132). Supply, however, has not yet met demand for many drugs such as those used to treat headaches and stomachaches (Eckstein, 1994, p.133). Today, many Cuban residents keep gardens to supplement their food and medicinal needs. Many individual and government efforts participate in regenerating certain plant resource *in-situ* and *ex-situ* (Government of Cuba, [April 16] 1993). Within the case study area, local doctors and community members used local plant materials for medicinal purposes.<sup>6</sup> The increase use of natural medicines appears to have a negligible affect on local resources within the case study area.

Since 1959, almost all forest products produced in Cuba have been consumed by Cuba's domestic and industrial markets. Reports now indicate that the Cuban government is seeking foreign partners in the production and marketing of paperboard for international and domestic markets (Business Tips on Cuba, September, 1993). The fact

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<sup>6</sup> During research in Sierra del Rosario's rainy season, the researcher received successful treatment for her "bad cold". The doctor's prescription amounted to 75% natural medicine (orange peel, lemon, honey, and *cana santa y cordovan*) and 25% aspirin. The aspirin was manufactured in Cuba).

that Cuba has been considering exporting forest products reflects a Special Period economic initiative that compromises domestic needs for forest products. Cuba has not been able to satisfy its own demand for forest products since the early 19th century. Such economic initiatives come in the face of increasing pressure from the U.S. embargo on Cuba. As recently as the summer of 1995, a Canadian forest company stopped selling forest products to Cuba because of U.S. threats to blacklist and boycott the Canadian company (Cuba Business, Oct. 1995, p.3). Despite a 1994 resolution by the UN General Assembly which affirms the illegality of the U.S. blockade of Cuba, the U.S. has continued to threaten and intimidate all countries that trade with Cuba. The culminative effects of the blockade have undoubtedly placed increasing pressure on Cuba's environment as a supplier of basic necessities.

Despite setbacks during the Special Period, Cubans have managed to maintain many State and community-based forestry projects. The socialist structure and caring nature of the Cuban culture has kept Cuba's forests in the green. Education has created a conscience awareness of conservative and wise use of resources. Many individuals continue to plant trees and other plant species around their homes for personal use. Despite some of the environmental-economic conflicts that have arisen during the Special Period, Cuba remains a leader in implementing and enforcing environmental policies and sustainable practices. Continued popular support for Cuba's Revolution has kept the forest development agenda alive in Cuba, but the increased pressure on Cuba's forests cannot be

dismissed.

### **CHAPTER 3. AREA DESCRIPTION AND RESEARCH METHOD**

Cuba's host agency for this study, the *Instituto de Ecología y Sistemática* (IES), selected the general location in which the research was to take place - the Sierra del Rosario World Biosphere Reserve (SRBR) in western Cuba. Several criteria then guided the specific choice of the research site within the proposed area:

- \* distance from main forest area;
- \* diversity of people and occupations in the community;
- \* size of community;
- \* site location relative to researcher's residence (transportation was limited to walking or biking); and
- \* available information on the community.

Given the conditions of the host agency and the site selection criteria, the researcher selected the village of Establo to be the case study community.

#### **3.1 Description of the Case Study Area**

Establo is located approximately 55 km southwest of Havana in the foothill region of Sierra del Rosario. The area is situated along the provincial border separating the Provinces of Havana and Pinar del Rio (Appendix IX). The community of approximately 700 people was one of 6 villages within the boundaries of the 25,000 ha Sierra del Rosario World Biosphere Reserve (SRBR). As the name suggests, the area is part of Smithsonian's Man and the Biosphere Program (MAB)

and their international network of world biosphere reserves. The SRBR is registered with the World Conservation Union (formerly IUCN), under the IV and IX management categories. The SRBR has been protected by Cuban Law No. 33 since 1981, and became a world biosphere reserve in 1984 (UNESCO, 1986). Forests occupy over 60% of the reserve land, with smaller areas of agricultural fields, natural savanna sites, State tourism and military facilities. Establo is situated along the eastern boundary of SRBR whereas Soroa, the world famous orchard site, is located in the far western region of SRBR. Establo's location on the edge of the reserve area was 10 km from the researcher's residence. Its immediate surroundings included agricultural fields and degraded forest land (Figures 1 and 2).

### Lands and Forests

Early human settlement in the SRBR region dates back thousands of years when indigenous families were believed to have sparsely populated the lush tropical forest (Black, 1976, p.10). Significant human disturbances were unknown in the area until the influx of Spanish and French colonials in the 16th century. The Spanish Crown claimed the land for European settlers and established 18 "*corrales*" in the Sierra del Rosario region. The indigenous peoples were forced to work as slave labour or migrate to harsher remote areas. The wealthy *corrales* landlords employed indigenous and African slaves to slash and burn the forest and cultivate agricultural crops, particularly coffee and tobacco. Two centuries of agricultural

activities devastated forests in the Sierra del Rosario region. As soil productivity decreased on the *corrales* plantations, many colonials left the area in search of more fertile ventures. By the end of the 19th century Sierra del Rosario was characterized by a population of peasants left to eke out a living on the severely degraded soils. The present day museum operated by the community of Las Terrazas in SRBR provides an excellent review of the history of the *corrales* and their demise.

In 1964, a rehabilitation project for Sierra del Rosario zone was announced by the Castro government. Under Osmany Cienfuegos' direction, thousands of local workers participated in shaping today's SRBR, a vital part of Cuba's three major forest watersheds. The present day forest vegetation in Sierra del Rosario is representative of neotropical forests in Central America. The submontane evergreen forest predominates in SRBR with a high degree of endemism in areas with humid evergreen tropical forest (UNESCO, 1986, p.1-2). Thorny matorral xeromorphic and various herbaceous communities are also present in SRBR. The reserve preserves several endangered plant species such as *Pachyanthus tetramerus*, *Ouratea laurifolia*, *Derypetes triplinervia*, and *Cynometra cubensis*. The fauna of the area are characterized by an abundance of birds, many of which are endemic to Cuba. There are also numerous reptiles and amphibians, but mammals are scarce in the area and the rest of Cuba. SRBR is home to the smallest frog in the world as well as numerous other invertebrates (UNESCO, 1986). A detailed report by Herrera *et al.* (1988) provides a comprehensive analysis of geomorphological and

ecological factors in the SRBR.

The topography of the SRBR is hilly to mountainous, with elevations above sea level ranging from 50 m near Establo to 550 m near Las Terrazas. There are five main rivers running through SRBR, two of which provide natural therapeutic sulfur baths. There are also many intermittent streams which become vigorous waterways during the rainy season from May to October. The average annual rainfall for Sierra del Rosario has been estimated at 2000 mm/yr. SRBR geology is complex, but surface soils are generally sandy, permitting good drainage during the wetter months, but much drier conditions during the winter months. Isolated pockets of naturally occurring acidic soils support xerophytic shrubs and grasses. These areas are often hidden from distant view by thousands of majestic royal palm (Roystonea regia) trees and the hardy pines. Gently sloped hillsides and plains are comprised of deeper fertile soils with a significant limestone base (oxisols) (Herrera *et al*, 1988). These areas are often used for production of agriculture crops, but the Establo area is dominated by cattle pastures and royal palm trees (Figure 1).

Figure 1. Panoramic view of topography and vegetation in the vicinity of Establo (looking south towards Sierra del Rosario).



The eastern part of the SRBR falls under the jurisdiction of Ministry of Agriculture's Forestry Directorate for the Province of Havana. Forestry activities in Establo are administered by the local forestry office. Most of the forest economic activities in Sierra del Rosario, however, have been carried out in the central zone of the reserve by the *Unidad Presupuestada Sierra del Rosario* located near Las Terrazas. Forestry activities have included plantation establishment and maintenance, silvicultural treatments, fire and pest control, charcoal production, conservation of flora and fauna, and crafts made from forest products.

In the Establo area, mango and royal palm trees are the most dominant tree species. (A list of over 100 tree and plant species growing in the community of Establo is presented in Appendix VI.) A stretch of degraded forest extends along the north side of the road leading into Establo from Cayajabos. There are also small forest 'islands' within 2 km of the village. A small forest of thorny marabu shrubs encroaches on State agriculture fields in the San Francisco area. Grassy cattle pastures dotted with royal palm trees extend up to Establo's roadside and stretch over the gently rolling fields to the edge of the SRBR forest. Distance to the forest edge averages about 5 km from Establo's centre (Figure 1 and 2).

### Infrastructure and Social Characterization

The 1964 rehabilitation plan for the SRBR also included a plan for the diversification of socio-economic activities. Social and ecological principles guided agriculture, forestry, tourism, and human resources development strategies. Initial development activities such as bulldozing and road construction caused serious ecological disturbances, but the authorities deemed the actions necessary in order to accelerate social development and improve natural regeneration conditions in the SRBR area. Terraces were built to stabilize erosion, indigenous tree species were used to reforest the terraces, small plantations and agroforestry plots were established, and areas that had not been disturbed in recent times were left to

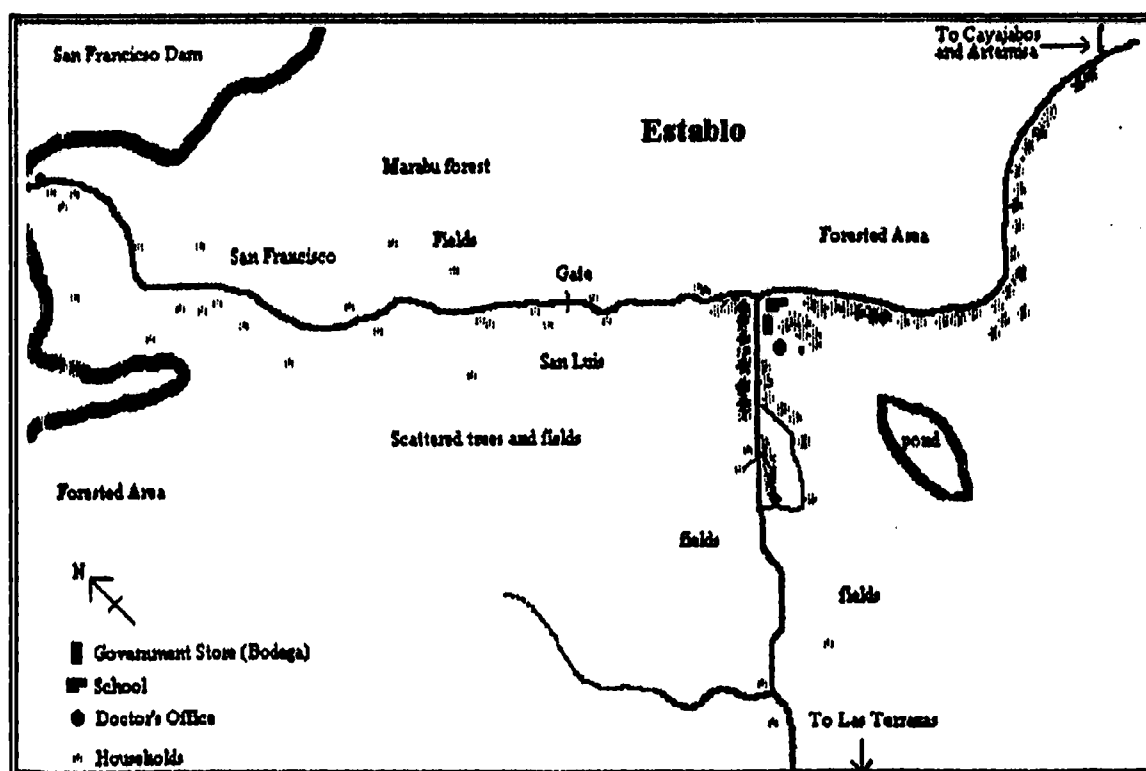
naturally regenerate. Las Terrazas' Ecotourism Complex was developed as the SRBR principal revenue generator. Facilities included the 4-star, 26 room Hotel Moka located near the geographic centre of the SRBR, several well groomed hiking trails, sports and recreational facilities, fine dining, excellent health care services, a movie theatre and a dance hall to mention a few. The social and ecological environment of today's SRBR give credit to the authorities' earlier decisions. The new facilities were made available to all people, but few Cubans could, and still cannot, afford the luxuries of the Moka Hotel. On rare occasions Cubans may be awarded a special rate to stay at the hotel as a token of appreciation for contributions to the defense and strengthening of the Revolution (pers. comm. with hotel management, 1995).

Although the community of Las Terrazas, and not Establo, was at the centre of development activities, it would be erroneous to say that Establo did not benefit from the zone's improvements. People from Establo and beyond were employed to implement the SRBR plan. Establo received new roads and infrastructure works. Establo's gently rolling fields became the grazing grounds for hundreds of State dairy cattle. The community also received the benefits that the Cuban Revolution brought to rural communities: a school, doctor's office, government store, clean drinking water, electricity, jobs and so on. Establo does not, however, receive the benefit of Las Terrazas' generator power during blackouts, improved indoor plumbing, the well-stocked pharmacy, day care facilities or elementary school facilities available in Las Terrazas. Unlike Las Terrazas, Establo's

infrastructure is more typical of a small rural community without the direct attention of specialized development. Establo has received all of the nationally-delivered services of the government except for the San Francisco district north of town which does not receive electricity. (This is due in part to discourage settlement near the large San Francisco hydroelectric dam.)

The centre of Establo is located at the juncture of the community's two paved roads. The busy T-shaped intersection marks the location of the local government store, primary school, and doctor's office (Figure 2). Houses extend along the south side of the main road from Cayajabos and along both sides of the road as it turns west through town on its way to Las Terrazas. Large robust mango trees line both sides of the main road from Cayajabos and continue along the road as it extends into the San Francisco area. There are so many mango trees that the State employs people to harvest the fruit in late May and early June and transports the fruit to Havana markets. There has always been plenty of fruit and an adequate harvest of vegetables for the local people and livestock.

Figure 2. Sketch map of Establo and surrounding areas (not to scale).



Many homes in Establo have indoor plumbing, but the village water and sewer system was in need of major repairs during 1995. The doctor's office lacked primary medications, bandages, and equipment. Drinking water was trucked into the community, but many had to supplement their other needs with water drawn from wells or nearby dams and ponds. Most families have been able to meet their basic food and fuelwood needs (wood or kerosene fuel). Although there is a primary school in Establo, elementary and high schools students must travel 5 km and 17 km respectively to get to school. Students commute back and forth from school by either walking,

biking, or getting a ride on the small bus or passing vehicles. The distance and transportation difficulties experienced by Establo high school students may attribute to the communities above average school drop out rate (pers. comm., Establo doctor, 1995).

The Ministry of Agriculture has been the main employer in Establo for the past 35 years. State dairy and cattle farms now occupy most of the land base. Chicken, pig, and bee farming are also important enterprises in the area and are often integrated with dairy and cattle farm operations. Most Establo households have kept chickens or a pig for their personal food consumption. There were a few self employed farmers (*campesinos*) in Establo during 1995, some of whom owned small parcels of land or rented land from the State. The soils in the areas were of moderate depth and fertility. Farmers have been successful at growing a diversity of crops such as field rice, yuca, squash, bananas, boniato, and beans.

The community of Establo was comprised of a racially integrated population of whites, blacks, and mulatto persons, although their appeared to be more white-skinned persons. Establo population figures for 1994 were obtained from the local doctor's office in the community. In 1994, there were 27 new infants, 161 children aged 1-14 years, 424 people between the ages of 15-64, and 47 seniors over the age of 65 living in Establo. The doctor also noted some local health issues: pre-mature and underweight child births, 68 patients with asthma, 43 people with serious hypertension (high blood pressure), and a few cases of alcoholism. Social problems have

included above average drop-out rates amongst high school students and unemployment amongst young adults, especially females.

The medical services in Establo during 1995 appeared to be typical of small rural villages in Cuba. Establo had one doctor's office (*consultario*) that was staffed by a female doctor and nurse. As mentioned earlier, the doctor's office seriously lacked primary medicines, bandages, and equipment. Cayajabos, 5 km down the road, has a population of approximately 3000 people, with 5 medical posts providing a variety of medical services including physiotherapy and post surgery care. Their supply of medicines, bandages, and equipment was also less than adequate in recent years (pers. comm., local medical staff, 1995). The regional hospital in the nearby city of Artemisa was somewhat better equipped. The local *Comités por la defensa de la Revolution* (CDR) were reported to play an important role in the delivery of health care programs, especially health education and preventative medicine. Many local residents noted that the Establo CDR has played an important role in most sectors of the community's development.

The majority of Establo residents, and other Cubans, have participated in CDR activities. There is only 1 CDR operating in Establo, but about 73,000 others in Cuba (Black, 1976, p.308). A CDR is a community or work-based organization whose primary function is to protect and advance the Cuban Revolution from the grassroots level (Black, 1976, p.308). Adversaries may take many forms so the activities of the CDR are diverse. Although directives are conveyed in

a top-down approach from the national government, the CDR movement is basically a volunteer organization. A local CDR often adapts national directives to local situations and circumstances. Depending on the local conditions, the CDR may be involved in several civic activities: promotion of public meetings, recruiting volunteer labourers for forest and agricultural activities, organizing blood donation and vaccinations campaigns, helping people get to their doctor's appointments, collecting recyclable materials, cleaning public areas, and community security activities such as sophisticated neighbourhood watch programs (pers. comm., Sra. Hermosa Perez Meneira, Havana, April 1995). In essence, the CDR epitomizes the grassroots organization of the Cuban Revolution.

During the field research (May-August, 1995), Establo CDR activities included assisting with elections, delivering educational information, collecting recyclables, monitoring security in the neighbourhood, and fostering family values and social relations amongst the people of Establo. The CDR did not appear to play a visible role in Establo local forest development activities. Several local residents, however, noted that Establo's CDR has assisted in reforestation programs in the past.

### **3.2 Research Method and Q-methodology**

#### **3.2.1 Critical Social Research**

This study employed the critical social research method to further the understanding of the relationships between people and forest in development. The method assumes that the physical elements of the earth and mental, cultural, economic, and political conditions cause or influence human behaviour. The critical social research approach was based on both analytical and observatory designs, and data were purposely related to one another and/or cross referenced to facilitate interpretations and conclusions. In this study, respondents' attitudes towards forests were believed to be formed out of personal experiences of living and interacting with forest resources. The research objective was to gather as much relevant information as possible from literature reviews and field research, and then cross reference the findings. Data collection involved literature and policy reviews, interpretation of media, on-site observations, structured and unstructured interviews, and a analysis of forest conditions. The research design was participatory, analytical, and observational, and applied both objective and subjective tools of analysis.

A literature review was conducted to examine other studies that have employed critical social research. Few studies were found, perhaps because of the more involved approach to analysis. Nevertheless, Parker (1992) successfully used critical social research in his reappraisal of "forest islands" and Kayapo resource

management practices in Amazonia. Parker's research included a survey of plant species and their uses, an analysis of plant distribution patterns, and structured and informal interviews with villagers and long term foreign residents in the study area.

### 3.2.2 Q-methodology: Q-statement, Q-sort, and factor analysis

In order to document the community's true experience, the researcher employed Q-methodology, an objective method of sampling individual views of forests in development and self-referent expressions of individual realities. Stephenson (1935), who introduced Q-methodology, or "Q" as it is referred to, described Q as a process that enables empirical analysis of self-referent communications (Stephenson, 1953). Self-referent communications are expressed through a process of people ranking (sorting) their own statements about something along a continuum of most to least agree (Figure 3). A person, or group of persons in this case study, are subjected to experiments in relation to self and a specific topic of study, such as forests. According to Stephenson (1953), the sample of self-referent statements is recorded and becomes representative of the population if it samples behaviour without favouring some parts, and is found to be statistically significant (Stephenson, 1953, p.222). Through the objective study of human subjectivity, the Q process brings together a universe of statements about sections of behaviour. In Q, inner experience and behaviour are analogous. Attitudes, or psychological types, are defined as mental categories that are

expressed in behaviour. Thus, subjective and observed behaviour examined by Q analysis are treated as indistinguishable in scientific principle (Stephenson, 1953, p.4).

Figure 3. Q-sort with 45 statements about a topic (from Brown, 1986, p.63).

(most disagree)						(most agree)				
-5	-4	-3	-2	-1	0	+1	+2	+3	+4	+5
8	2	28	6	7	3	5	9	1	4	21
12	16	36	8	23	18	10	14	13	11	25
42	17	39	31	26	24	20	30	19	32	40
	43	41	37	33	29	27	38	44	45	
					35	34				

When respondents rank their own statements along a continuum from most agree to most disagree, they are in effect presenting their own model of views on the topic of forests. The explanations of the Q-sorts, and their corresponding factor analysis, constitute the theory of the research (Stephenson, 1953, p.142). This theory may then be examined in relation to pre-existing theories on the subject matter. From such explorations, one may then formulate an argument on the subject matter (Stephenson, 1953, p.3, 22, 32).

Since 1935, over 1000 studies have used Q technique for both hermeneutic and applied scientific study (Brown, 1986). At least five researchers are known to have used Q-methodology in forest-related research: Hooker (1972), Kurtz and Lewis (1981), Ariso-Campa (1991), and John Fairweather at Lincoln University in New Zealand. The first four of the aforementioned researchers participated in the following studies: 1) "Human beliefs and values regarding nature and forests: a framework for listening", Doctoral dissertation, Yale University (Hooker, 1972); 2) "Decision-making framework for non-industrial private forest owners: an application in the Missouri Ozarks" (Kurtz and Lewis, 1981), whose research was published in the Journal of Forestry, May 1981, p.285-288; and 3) "Forest (text)ures: assessing semiotic dimensions of visual landscapes". Doctoral dissertation, State University of New York, Syracuse (Ariso-Campa, 1991). John Fairweather, who was with the Agribusiness and Economic Research Unit at Lincoln University (New Zealand) in 1994, has also done forest research using Q-methodology, but details of Fairweather's work were unavailable for review (pers. comm. Steven R. Brown, 1995).

Unfortunately, only one of the aforementioned studies was obtained for review in this study. Kurtz and Lewis (1981) used Q-methodology techniques to classify non-industrial private forest owners in the Missouri Ozarks (USA) on the basis of their motivations and objectives for owning land. Interactions among factors that influenced the use and management of private non-industrial forest land were investigated. Groups of owners with similar attitudes

towards management defined several typologies. Timber production was by far the prime motivation for owning and managing land in the study area. The report refuted common theory that timber production was not the prime objective in owning non-industrial private land.

This case study has sampled a group of persons from the same community in order to define attitude 'types' that may have been present in the community. By sampling a group of persons the results of the study could indicate whether or not certain truths occurred as *factors* relevant to the population sample. The results could then show that individuals who shared these facts belonged to the same FACTOR. A proportion of persons in the group may form such and such an attitude which defines each FACTOR (Stephenson, 1953, p.5-6). Thus, a FACTOR is defined by a set of statements that represents an attitude type, an attitude that is statistically different from other FACTORS (Stephenson, 1953, p.6-7). When a rotation of the initial correlation matrix is performed a more in-depth analysis of associations and other possible combinations of the FACTORS becomes possible. Rotating the initial data matrix may be used to test the assumptions or propositions held in relevant theory or popular belief (Stephenson, 1953, p.32).

## Field Research Activities

After an initial survey of the research site, a basemap was prepared and a systematic random design was performed to select the homes of those to be interviewed. Sixty respondents were interviewed to obtain an accurate sense of the diversity within the community. To ensure that ethical and cultural matters were handled with care and sensitivity in the research process, the host agency and local workers participated in formulation of the interview questions and data collection. Appendix I contains the Spanish and English versions of the questionnaire.

Each interview session began with informal introductions and an explanation of the research objectives. Respondents filled out a structured questionnaire which included basic questions concerning their involvement in forest-related activities (Appendix I). The formal part of the interviews ended after tape recording the oral responses to the last two questions: "Tell me everything you think about the forest", and "Has the forest affected the development of the community? If so, how?" (Appendix I). The interviews lasted an average of 30 minutes. The discussions were tape recorded so that a team of researchers (3 Cubans, 1 Canadian) could later transcribe each statement (in no order) onto its own index Q-card. The team of researchers recognized 76 different statements pertaining to the discourse on forests. A number was written on the back of each card which then became the statement number. Thus, there were 76 Q-cards to be sorted by the respondents. Typically, statements in other

Q-samples have ranged from 40 to 60 (Brown, 1986, p.62).

A period of approximately three weeks had elapsed between the first interview session and the initial Q-sort exercise. After transcribing the 76 statements onto index cards, the respondents were visited a second time and asked to rank the statements (Q-cards) along a grid ranging from +5 (most agree) to -5 (most disagree), with 0 as the neutral point (Figure 3). This marked the key moment in the subjective self-referent Q process. By ranking his/her own statements the respondents were able to present their own model of views on the topic of forests. In the initial Q-sort exercise, several respondents commented that they felt strongly about most statements and thus found it difficult to assign statements to the +/- 1, 2, or 3 orders along the continuum. As a result, the initial Q-sort exercise exhibited a skewed-to-the-extremes distribution- flat in the middle and clustered at the edges - thus rendering the data unsuitable for a paired comparison factor analysis. A second Q-sort was performed with 15 respondents who were given a suggestion of distribution as shown in Figure 3, and a condition of instruction to rank the statements against one another so as to prevent the occurrence of the first Q-sort problems. The fewer number of sorters was still more than enough to survey differences in attitude types. The final Q-sort distributions were suitable for the paired comparison and factor analysis.

The outcome of each Q-sort varied, but was structurally similar to that shown in Figure 3. The position of each numbered

card/statement on the grid was then recorded and the rank order data entered into the field station's computer in a spreadsheet format. The information was stored on diskette (and hardcopy) and filed for transportation back to Canada. Further observations and informal surveys were conducted, making note of forest conditions and resource use.

Upon return to Canada, the data matrix was submitted to a Statistical Analysis Software (SAS) program for analysis. The SAS program and data computations were performed at the University of Georgia (USA) under the supervision of Dr. Rick Watson. Dr. Patrick Doran at Oklahoma State University (USA) coordinated the data transfer and advised on the research methodology process. Correlations were analyzed using the principal components factoring as described by Brown (1980, Part II). The Q factor analysis procedure was no different than other standard factor analyses. The initial Q factor analysis determined the number of attitudinal groupings (FACTORS) implicit in the Q-sort data matrix. The initial data matrix was then rotated for theoretical explorations. The resulting "scores" were tallied for each statement in each of the factor 'types'. Each FACTOR (set of statements) produced one array representing the sum of the statements from the individual Q-sorts. If two people shared a common outlook, then those individuals would have been highly intercorrelated, they would have defined a factor together, and the sum of their separate responses would have resulted in a single Q-sort that represented the view they shared. With ten factors there would have been ten such Q-sorts, and so on (Brown, 1986, p.60). In

this case study, 7 FACTORS were found to be significant (AppendixV).

### 3.2.3 Critique of Methods

#### Theory

Any critique of Q-methodology as a process of understanding human behaviour and relations must consider Q's principal assumptions- inner experience and behaviour are analogous. Attitudes are believed to be a consequence of personal experiences that stem from a person's interactions with his/her physical, emotional, and mental surroundings. Both subjective and observed behaviour in Q analysis are considered indistinguishable in scientific principle (Stephenson, 1953, p.4). A rejection of one or more of these principles would weaken any theoretical arguments based on Q-analysis data. Consequently, one must acknowledge these assumptions in testing other theories with arguments based on Q-sort factor analysis results. One must also recognize that cause-effect logic is irrelevant to Q analysis and its findings.

A suggestion of distribution was offered to the Q-sorters when they performed the Q-sorts. Suggestion of distribution may be construed as violating the principles of operant subjectivity (McKeown and Thomas, 1988, p.34). Given that the respondents have a wide selection of categories in this case study, it was unlikely that operant subjectivity was violated. "Furthermore, both Brown (1971, 1985)

and Cottle and McKeown (1980) demonstrate that the shape of a Q-sort distribution is methodologically and statistically inconsequential." (McKeown and Thomas, 1988, p.34). Following the Law of Error theory, the suggested distribution was used simply to assist the respondent in sorting the statements along the lines of "more or less" agreement. In no way did the suggestion 'force' the sorter into an either-or situation. The neutral rank (0), also served to ease the sorters' feeling of indecision or lack of relation in the event that he/she did not hold a specific belief. Statements with a neutral rank were considered to have no meaning, nor did they contribute in any way to the psychological typing of respondents (McKeown and Thomas, 1988, p.35).

### Applications

Q-sort technique must also be considered as a potential source of error. A person's cognitive ability to rank-order statements against other statements on the same topic has been debated in relation to Q-technique applications (McKeown and Thomas, 1988, p.34). The rank-order session requires a person to make many sudden decisions regarding the meaning and importance of each statement, statements which may not have been expressed by the Q-sorter before. The number of rank categories may also be an element of contention in a Q-sorters decision making process. In this study, there were eleven such categories (-5 to +5, including a zero category) which several respondents found served no purpose other than to complicate their

decisions with too many categories (Figure 3). This was quite obvious in the first Q-sort exercise, and somewhat less obvious in the second Q-sort session. The initial Q-sort exercise proved difficult for many and resulted in a skewed-to-the-extremes distribution, flat in the middle and clustered at the edges. Only after giving the Q-sorters a suggestion of distribution (Figure 3), were many able to avoid the occurrence of the first Q-sort problems.

The second Q-sort exercise was necessary because the initial skewed distributions rendered the data unsuitable for a paired comparison of statements in factor analysis. It should be noted that the second Q-sort was conducted by Cuban forest researchers and not the Canadian researcher. Although this divergence was unavoidable, it was performed following the same procedures as the first Q-sort exercise, but four months later. During that time, the respondents may have had a chance to discuss the various ideas in the statement amongst themselves and possibly influenced each others beliefs and perceptions of forests. Such events were unlikely to influence most respondents' opinions as similar incidences during the initial Q-sort proved unfounded. During the initial Q-sorts exercises respondents often performed their Q-sorts with a crowd of on-lookers, usually family and friends who happened to be nearby at the time. On several occasions, on-lookers offered their ideas of where a statement might be 'ranked', but the respondents usually responded with "That's your opinion, not mine", or "Maybe, but I'm not sure so I'll rank it as neutral". The possibility of respondents being influenced by the local Cuban researchers was considered negligible

given the strict operating instructions and the Cuban researchers' overt professionalism.

There was, however, the potential of subjective translation on behalf of Cuban foresters who transcribed statements. The manner in which transcribers distinguished if a statement was the same or different may have resulted in fewer or more statements being transcribed. The Cuban foresters appeared, however, to write down every sentence that had the slightest relation to forests and forestry. In transcribing the statements from the recorded interviews, statements referring to specific species and uses were left out of the sample, except for statements #7 and #66 which were more general and mentioned during the interviews by more than 50% of respondents. This action was deemed appropriate given the already large sample size of 76 statements and the desire to focus on general attitudes towards forests. Statements omitted from the sample have been considered in the chapter on results and discussion. Finally, many respondents did not understand the word *desarrollo* (development) used in the final question concerning community development. In order to communicate the idea of development, a description of livelihood, progress in health and prosperity, economic welfare, and "forest presence-absence" scenarios was used to facilitate comprehension. Nevertheless, it was possible that some some respondents still did not understand the question.

## **CHAPTER FOUR. RESULTS AND DISCUSSION**

Cuban counterparts confirmed that the random sample of respondents was representative of the community (Table 5 and Appendix II). During the taped interviews the respondents made a total of 76 statements relating to forests (Appendix III). These 76 statements formed the Q-sample. Statements were considered to have no priori meaning or relation to respondent traits, they were simply treated as statements about the topic of forestry.

### **4.1 Questionnaire Responses**

The random sampling of respondents generated interviews with 23 females and 37 males from the community of Establo (Table 5). Forty-eight percent of the respondents were younger than the group average of 43 years, with the youngest respondent being 14 years and the oldest 78 years of age. Eighteen percent of the respondents were retired. Although the study area had many State agriculture farms, just 15% of those surveyed were employed as State farm workers. Only 8% of the group worked for the State forestry service, although 18% currently worked in or near the forest (5 forestry workers, 4 campesinos, plus two others).

Table 5. Demographic Summary of Surveyed Population

Occupations:	% of Sample	# Female	# Male
Self employed (other than farmer)	-	-	-
State agriculture worker	15%	2	7
Farmer (Campesino)	7%	-	4
Forest worker	8%	1	4
Housekeeper	23%	14	-
Construction worker	2%	-	1
Professional or Technician	15%	3	6
Other	12%	2	5
Retired	18%	1	10
Females (ave. age = 39)	38%	23	
Males (ave. age = 46)	62%		37

Housekeeper was the most common occupation. Sixty-five percent of the women, representing 23% of the sample group, worked as full time housewives. None of the male respondents claimed to be housekeepers. Within the community, an overwhelming majority of men and women said that the work of housewives was demanding and important to the welfare of the family. Most women commented that their male partners did very little household work despite a Cuban law which obliges men to participate equally in the household chores (Family Code Law). Many men retorted that women did less than 50% of the "field" work.

The education of the respondents varied from 10% without schooling to 6% with a university education (Appendix II). The majority of respondents had received primary and 'junior high' (secondary

school) education equivalent to a grade 9 education in Canada. Of the 6 respondents who had not attended traditional schools, only 3 could not read or write. The other 3 respondents were either self taught or taught by family members or CDR community services.

Six of the sixty respondents remarked that they had never planted a tree. Of the 90% who had planted trees, 62% had planted more than 100 trees either around their homes or in reforestation areas as part of a government program. This suggests that 90% of the respondents had a high degree of participation in forest development activities. Over half the respondents said they had visited the local forests more than 100 times in the past. Most visited the forest throughout the year regardless of season or day of the week, although weekend visits were slightly more common than weekday visits. Reasons given for visiting the forest varied without association to any personal or social characteristics:

- \* to cool down in the cool shade and breeze
- \* to clear the mind, to think, to feel better mentally
- \* for recreational purposes (camping, hiking, swimming, birding, visit friends in the hills, admire beauty)
- \* to get to know the plants and land (informal education)
- \* to get water
- \* to get medicinal vegetation
- \* to get food (fruits, leaves for flavouring, roots, coffee beans, animal meat or fish)
- \* to get wood for cooking and home building
- \* to work (job, military service, school trip)
- \* to graze animals (chickens, pigs, horses, some cows)

Several respondents did note they felt an emotional and mental

attachment to the forest. There was no mention of a spiritual attachment to the forest. It was only after the interview and Q-sort process was completed that two female respondents referred to a spiritual value of the forest.

All but one of the respondents said the forest was important or very important to the community and had had a positive effect on development of their community. The sole 'not important' perspective belonged to a mature 16 year old campesino man who had grown up in the area. The respondent worked a few kilometers from Establo on a cooperative farm growing food. He noted that although the forest was important to him and his country, he felt it was not important to the development of the Establo as the community was primarily a dairy cattle farming area.

#### **4.2 Q-sorts and Factor Analysis**

Generally, the 76 forest-related statements expressed during the interviews exhibited a favourable disposition towards forests and forest use (Appendix III). More statements than not emphasized pleasant experiences in relation to forests, with a mean Q-sort rank of +2, suggesting a positivist view of forests. Most statements were made in reference to "our" this or that, and how the forest affected this or that. Few statements were made in the first person "I", even though the respondents were asked to give their personal testimony. A visual examination of the Q-sort rankings revealed that only 4 of the 76 statements (#s 4, 28, 32, 35) appeared exclusively on the

positive (agree) side of the continuum. Three other statements (# 7, 55, 62) were either neutral or positively ranked. All other statements were ranked on both sides of the neutral point (0) along the agree-disagree continuum.

Before factor analysis and significance testing, the respondents were in total positive agreement with 4 statements:

#4, The forest gives us wood for furniture, houses, and many other things;

#28, The forest serves as a refuge for birds and other animals;

#32, In a country without forests it would not be easy to live;

#35, The forest gets work for men.

No statement received complete negative rankings from the group of respondents, that is, there was no absolute disagreement on any of the statements. However, statements #37, "I do not have much relation with the forest" received the greatest number of negative ranks (disagreement), but its mild negativity was found to be insignificant after analysis (Appendix IV, V). Statement #67, "I have not been taught anything about the flora & fauna", was the only statement that repeatedly ranked to the extreme negative (disagree) end of the continuum without also occurring on the extreme positive of the continuum. As the statement suggests, the majority of respondents have received education concerning forest plants and animals. The Cuban government's commitment to environmental protection, reforestation, and education in various aspects of forestry

appears to have influenced respondents' self-referent statements. As noted earlier, the education of the respondents varied from 10% without schooling to 6% with a university education (Appendix II). The range of simple and complex ideas conceptualized in the self-referent statements is likely a reflection of education levels as well as interactions with forest areas. Respondents also noted that the Revolution's educational campaigns advanced a perception of forest which associated reforestation and conservation with social and biological developments that would lead to better living conditions (pers. comm., Jose Antonio Acosta-Salgado, 1995). Field observations noted that many respondents maintained home gardens and kept chickens and or a pig or two in their yards. Many respondents also told stories of their ventures into forested areas to look for wandering livestock. During these times they would learn more about the flora and fauna of the forest.<sup>7</sup>

Respondents expressed an overwhelming positive view of forestry developments nationally and locally during 1960-1990, but the lack of recent State forestry activities in the Establo area was noted by some respondents with disappointment. Interestingly, only one statement specifically made reference to the economic role of forests in the community and Cuba. The reference to the economic value of forest made by 17 year old woman who had recently trained as a veterinary technician but was working as the housekeeper in her

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7 The researcher participated in one such 'hunt' for a few pigs that went missing in a degraded forest area near the community. A close encounter with the thorns of the marabu tree can teach a valuable and lasting impression.

home. None of the respondents made reference to the role of CDR in forest development.

#### 4.2.1 Factor Analysis and Attitudes Towards Forests

Factor analysis facilitated the determination of how many basically different Q-sorts were present. The analysis was performed according to Brown (1986), with the first 7 factors accounting for 74% of the variance in the data (Appendix V). The 7 factors were retained for further analysis as per the NFACTOR criterion (Brown, 1986). After data rotation, factor scores were generated by averaging the score given to each statement by all Q-sorts associated with the factor. A significance level of  $Z=2.58$ , with a confidence level of 99%, defined the limit of significance for the factor scores at  $\pm 0.2959$  (Appendix V). Thus, factor loadings greater than 0.2959 indicated significant agreement within a factor while loadings of less than -0.2959 indicated significant disagreement within a factor. The statistical analysis resulted in 7 FACTORS or attitude types. Each FACTOR (labeled 1 to 7) expressed a different conception about the forest, with those persons sharing a common conception defining the same factor.

The initial factor method (principal components, PC) generated a total of 41 significant associations/connections for the 7 FACTORS given a 99% confidence level. FACTOR-1 was significantly associated with all but one of the 15 Q-sorts (Q-sort #12 was the exception), and accounted for 38% of the communality variance. However, factor

connections were not clearly focused (+ or -, unipolar), so a rotation of the data was performed using the varimax factor method. Data rotation resulted in 27 significant connections from the 7 FACTORS (Table 6). After rotation, the variance within FACTC 2-1 was reduced by approximately half to 20%. The variance was greater after rotation in the other 6 factors. (Since many connections were 'almost' significant at 99%, a comparison confidence was performed and resulted in another 9 significant connections at 97% in PC, and 4 more significant connections after varimax rotation. As noted in McKeown and Thomas (1988, p.51), these 'insignificant' associations may be important in theoretical discussions of factor/attitude formulations as they include a greater spectrum of data which may or may not support theoretical arguments.)

Table 6. Connections, order of significance regardless of sign, amongst FACTORS.

FACTOR PATTERNS: Significant Attitude Associations at 99% confidence (FACTOR #)										
Q-sort #	Strongest connections		Moderately strong connections		Moderate connections		Weaker connections		Weakest connections	
	PC	VR	PC	VR	PC	VR	PC	VR	PC	VR
1	1	1	-4	-5	3	6	-2		5	
2	1	3	-5	2						
3	5	4	1	-7		1				
4	4	5	2	6	1					
5	-7	7	1							
6	-3	2	1		6					
7	1	1	3		-4					
8	1	1	-6	3						
9	1	2	-4	1						
10	1	3	7	2		6		1		
11	-2	4	4		1		5		-7	
12	2	5								
13	3	6	6		4		1			
14	1	3	-6		-5		4			
15	1	3		2						
# of Connections	15	15	15	10	12	4	5	2	3	0

PC = Principal Components, Initial Factor Method

VR = Varimax Rotation, Rotation Method

- : Minus sign indicates negative connection

As shown in Table 6 and Appendix V, the strength of each Q-sort connection also varied. The following Q-sorts were found to be the most representative of each FACTOR:

Q-sorts # 7 and 8 most accurately personified FACTOR-1;

Q-sorts # 6 and 9 most accurately personified FACTOR-2;

Q-sorts # 2 and 14 most accurately personified FACTOR-3;

Q-sorts # 3 and 11 most accurately personified FACTOR-4;  
 Q-sorts # -1, 4 and 12 most accurately personified FACTOR-5;  
 Q-sorts # 4 and 13 most accurately personified FACTOR-6;  
 Q-sorts # -3 and 5 most accurately personified FACTOR-7;

We can see that Q-sort #3 and #4 were significant in defining two different FACTORS. Given that all Q-sorts were rotated around the same factor, this merely indicates that Q-sorts #3 and #4 were closely associated with two particular FACTORS, #3 in a positive-negative sense and #4 in a positive-positive sense respectively (McKeown and Thomas, 1988, p.52). Interestingly, there were only two negatively significant Q-sorts involved in the distinction of the attitude types. Q-sort #1 in F-5, and Q-sort #3 in F-7, carried negative signs indicating that the two Q-sorts characterized attitudes that significantly disagreed with their respective factor grouping. The fact that there were only 2 of a possible 15 negative descriptors may suggest that the majority of the sample population were in general agreement with a positive view of forests, albeit they held different views with respect to forests.

Q-sort #3 also contributed significantly to the definition of F-4, but in a positive way. This may suggest that attitude types F-4 and F-7 have the greatest factor difference, even though they account for a lesser amount of variance overall (see Table 9). The fact that Q-sort #4 was positively significant in two different attitude types merely indicates that the two FACTORS shared a belief of statement #4, but obviously differed on many other beliefs. From Table 7 we may

observe some of the strongest held beliefs and disbeliefs which distinguish the different attitudinal types. The five highest and five lowest average scores within each factor are presented in Table 7. Results of the analysis indicate that certain truths expressed in the statements occurred as *factors* relevant to the population sample.

Table 7. Statements that received the five highest (agreed) and lowest (disagreed) average scores within each FACTOR Family (F-n) after rotation.

Rank-Score	F-1	F-2	F-3	F-4	F-5	F-6	F-7
1 (most agree)	24*	1	26	30	74	7	29
2	72	58	74	61	70	60	16
3	75	2	63	8	3	56	59
4	40	73	14	6	69	68	18
5	52	65	66	20	55	17	19
72	25	39	37	34	52	73	11
73	38	40	46	52	38	52	26
74	70	29	45	1	64	70	14
75	45	34	7	76	67	74	67
76 (most disagree)	56	19	6	57	65	30	75

Rank Scale: Linear scale from Most Agree, Score = 1, to Most Disagree Score = 76.  
Total of 76 statements.

\* : Statement number as per Q-sort card. In this case, FACTOR-1 people most agreed with Statement #24, which stated, "It is necessary to plant the forest in order to receive its benefits."

In the final factor analysis, each of the FACTORS composed a set of statements that represented an attitude type, an attitude that is

statistically different from other attitudes in the population sample (Stephenson, 1953, p.5-6). Table 8 displays the ten statements that were expressed as the strongest beliefs defining each attitudinal types with respect to forests:

Table 8. The ten most significant statements that defined some of the beliefs for each FACTOR or attitudinal type with respect to forests.

FACTOR #	Most Agreed with the statement....	Most Disagreed with the Statement..
1	24) "It is necessary to plant the forest in order to receive its benefits" 72) "There is a difference in the health of those that live here and those that live in the city" 75) "One should not cut the forest" 40) "The forest is studied often" 52) "The forest evades (prevents the expansion) of fires"	56) "The Forest Reserve permits/ invites visitors, tourists" 45) "The forest is beneficial because we can bring legumes to the market" 70) "We depend on the forest completely" 38) "Those who live in the city are filled with smog" 25) "The forest is good for bathing in the river"
2	1) "The forest is the prettiest, nicest, and best that exists" 58) "The forest serves to feed us" 2) "The forest gives us everything" 73) "Before the Revolution the forests were being destroyed" 65) "I do not visit the forest to kill animals"	19) "I go to the forest to entertain myself, for recreation (camping)" 34) "The forest gives beautiful orchids" 29) "The forest is where birds are conserved" 40) "The forest is studied often" 39) "All the uses of the forest are direct not indirect"
3	26) "We need the forest that was destroyed" 74) "The government is preoccupied with reforestation throughout the country" 63) "This study will help care for trees" 14) "Forests are the lungs of the country" 66) "In the forest were planted ocuje, majagua, eucalyptus, which are used in forestry for wood"	6) "The forest gives us fresh water" 7) "Royal palm is a symbol and has many uses" 45) "The forest is beneficial because we can bring legumes to the market" 46) "The forest is a principal centre of the economy" 37) "I do not have much relation with the forest"

Table 8. The ten most significant statements that defined some of the beliefs for each FACTOR or attitudinal type with respect to forests. Continued from previous page.

4	<p>30) "Birds bring seeds and they are born (germinate)"</p> <p>61) "The State needs the forest"</p> <p>8) "The forest beautifies our countryside"</p> <p>6) "The forest gives us fresh water"</p> <p>20) "The forest is healthy"</p>	<p>57) "In the rivers there are many fauna"</p> <p>76) "The forest gives us shade"</p> <p>1) "The forest is the prettiest, nicest, and best that exists"</p> <p>52) "The forest evades (prevents the spread) of fires"</p> <p>34) "The forest gives beautiful orchids"</p>
5	<p>74) "The government is preoccupied with reforestation throughout the country"</p> <p>70) "We depend on the forest completely"</p> <p>3) "The forest gives us fruit"</p> <p>69) "The forest is all beneficial"</p> <p>55) "In the forest there are many animals"</p>	<p>65) "I do not visit the forest to kill animals"</p> <p>67) "I have not been taught anything about the flora and the fauna"</p> <p>64) "I do not know about trees because I do not go to the forest"</p> <p>38) "Those who live in the city are filled with smog"</p> <p>52) "The forest evades (prevents the spread) of fires"</p>
6	<p>7) "Royal palm is a symbol and has many uses"</p> <p>60) "The forest helps the development of all"</p> <p>56) "The Forest Reserve permits/invites visitors, tourists"</p> <p>68) "The people in this community are very grateful for the forest"</p> <p>17) "Forests are very important to other countries"</p>	<p>30) "Birds bring seeds and they are born (germinate)"</p> <p>74) "The government is preoccupied with reforestation throughout the country"</p> <p>70) "We depend on the forest completely"</p> <p>52) "The forest evades (prevents the spread) of fires"</p> <p>73) "Before the Revolution the forests were being destroyed"</p>
7	<p>29) "The forest is where birds are conserved"</p> <p>16) "The lack of forest has an influence on the lack of rain"</p> <p>59) "The forest is a tranquil place"</p> <p>18) "Forests are very important to Cuba"</p> <p>19) "I go to the forest for entertainment, for recreation (camping, etc.)"</p>	<p>75) "One should not cut the forest"</p> <p>67) "I have not been taught anything about the flora and the fauna"</p> <p>14) "Forests are the lungs of the country"</p> <p>26) "We need the forest that was destroyed"</p> <p>11) "The forest helps to decontaminate"</p>

Statement #37 was the only comment to received all positive scores after rotation of the correlation matrix. This indicates that all attitude types considered it a fact that 'they' have a strong relationship with the forest. Statement #4 was the only unipolar negative statement, thus suggesting that respondents all shared a value for the forest as a supplier of wood.

Statements # 75, 74, 70, 56, 29, 7, and 1, had the greatest range of significant factor scores. This extreme bipolar trait suggests that respondents' perceptions strongly differed on the following forestry concerns: cutting of trees, forest dependency, bird conservation, beauty and greatness of forests, the SRBR function as a tourist area, the symbolism and uses of the royal palm tree, and the government's preoccupation with reforestation. Of these, statement #74 repeatedly scored to the extreme positive (most agree) side of the continuum, and only once to the extreme negative side of the continuum (in FACTOR-6). Statement #74, with its positive disposition, concerned the government's preoccupation with reforestation throughout Cubā. Most believed the Cuban government has been very active in reforestation activities throughout the country. Indeed, the statistics and landscape confirm such facts.

#### **4.3 Statements versus Actions**

A more subjective analysis is introduced in comparing respondents' discourse on forests with their use of forest products and forested areas. This section cross examined the connections between mental and physical behaviour, that is, between attitudes and observable actions. The following paragraphs attempt to address the question, "Do community-based activities support the findings of the factor analysis?". Field observations were made over a period of approximately 100 days in and around Establo during and after the respondent interviews and Q-sorts.

As noted in the discourse, timber and edible goods were observed to be the most common uses of local forest resources in Establo. The use of firewood and charcoal, wood and palm leaves for construction use, and the consumption of various fruits and legumes were observed on a daily basis. Fruit and legumes grew naturally in the forest areas and were also cultivated in some of the local agricultural fields and residents' yards. Mango, pomarosa, chirimoya, avocado, banana, and mamé fruit trees grew within the immediate area and nearby forests. The majority of local residents participated in the harvest and consumption of such fruits on a regular basis when possible. Generally, the respondents and other community members harvested no more than their families could consume. The fact that many were observed harvesting forests products does not necessarily conflict with the expressed belief that forests should not be cut. No all respondents believed forest should not be cut. Many of those who

noted that forests should not be cut restricted the comment to "large forest areas" and forest areas in "fragile forest areas". Nevertheless, the fact that an increasing number of Establo respondents have had to rely on forests for basic supplies cannot be ignored. Based on field observations, it appeared that forest degradation had surpassed forest development in recent years in the local area. Unfortunately, official surveys were not available to confirm or disprove this apparent trend.

Men appeared to be the primary harvesters of timber in and around Establo. Although hardwood species such as ocuje, majagua, and cedro, and the (softwood) pines, were preferred construction timber, the distance from harvest site to home (or work) seemed to correlate negatively with harvest selection. It appeared that cutting trees for (reasonable) personal consumption was tolerated and unregulated by authorities. An informal regulatory process involving neighbours' approval and word of mouth seemed to guide domestic harvest activities outside the main SRBR forest area. The few incidences of illegal tree cutting in the forested areas immediately surrounding Establo were small, and usually carried out by individuals in need of fuelwood/charcoal for personal use (pers. comm. with area residents, 1995). Field observations were unable to confirm if those who expressed forest preservation statements were actually involved in tree cutting. Nevertheless, observations of tree cutting created a sense of conflict in the community with the dominant belief that forests should not be cut. It should be noted that harvesting within the SRBR forest was strictly regulated by the State, and all harvest

violations were thoroughly investigated by forest guards. Within the SRBR core area, forests were noticeably advanced in growth and stand dynamics. Fringe zones and areas outside the boundaries of the reserve forest were regenerating, but signs of degradation persisted. For the most part, it appeared that Establo residents respected the success of the forest rehabilitation project (SRBR Project) and tried to minimize their negative disturbances.

Royal palm was observed to be the most widely used tree species. Mango and royal palm were the most visible species in the vicinity of Establo, but royal palm trees were possibly the most abundant species. Palm fruits were fed to pigs, its palm leaves used for roofing, and its wood used in house and furniture construction. Approximately 25% of the homes in Establo and surroundings were built from royal palm wood, another 25% from pine and majagua, and perhaps 50% from cement. Many of the wooden houses had palm thatched roofs and or clay or metal roof panels. Unlike many other tropical countries, the houses did not have water catchment troughs along the edges of the roof as a means of trapping rainwater for drinking and or bathing. One house did have a home-made solar panel on its roof, but the storage battery had broken down two years ago and the builder was unable to obtain the materials to repair it.

Several Establo residents were encountered on forest trails during research forest surveys. The residents gave numerous reasons for their visits to the forest area:

- \* seeking food to supplement their State food rations
- \* getting water for the horses and home cleaning
- \* swimming-bathing
- \* fishing
- \* "to get away and relax" in the refreshing atmosphere
- \* to listen to, and maybe catch, a few birds
- \* looking for medicinal plants
- \* rounding-up livestock that had been grazing for the day in the forest

Back in the village, respondents were observed planting forest tree seeds and plant cuttings around their homes. Some residents kept a small home garden or shared a garden with nearby friends and relatives. Field and forest plants were used for medicinal, food, and or ornamental purposes. Others without home gardens spoke of locations in forested areas where they would go whenever they needed certain medicinal or food goods. Many of the children commented that they enjoyed going to explore in the forest, especially on school trips and vacations. On weekends and school holidays, children were observed fishing and harvesting fruits and vegetables with their families.

It appeared that forests in the area of Establo were most directly affected by local peoples' conservative use of forest resources. Subsequent to that, participation in both community and provincial reforestation activities appeared to have an immediate and lasting affect on forest conservation and expansion. Unfortunately, there did not appear to be local monitoring or evaluating mechanisms for ensuring the sustainability of forests and reforestation efforts. It

appeared the responsibility for sustainability rested with the SRBR forestry personnel, provincial authorities, and federal policy makers. If this is in fact the case, the responsibility and programs to carry out such checks should also be in place at the local level. According to Nozick (1992, p.14), responsibility, as well as planning and implementation, at the local level is the most effective way of achieving sustainable (forest) development.

In summary, the field observations concurred with the statements and attitudes expressed by the respondents. A degree of inconsistency was observed in the expressed popular belief that forests should not be cut, as most residents participated in, and benefitted from, subsistence-level timber harvesting. Further inference may be added concerning forest-related activities and the implications of each statement within each attitudinal type, but such fine detail is not warranted here. The focus of the thesis argument rests on general attitudes towards forests and their statistical and theoretical implications in community and forest development.

#### **4.4 Theoretical Associations and Discussion of Results**

Up to this point, discussion has focused on the significance of factor loadings and corresponding statements. Determining the significance of the FACTOR group (attitude type) is a more complex procedure involving both statistical and theoretical criteria. Eigenvalues generated by the Statistical Analysis Software program (SAS) were used to determine statistical significance of the FACTORS. "By convention, FACTORS with eigenvalues greater than 1.00 are considered significant" (McKeown and Thomas, 1988, p.51). Such convention is dictated by the calculation of Z values and population size (Appendix V). Five FACTORS were found to be significant as the sums of their squared factor loadings were greater than 1.00. However, the NFACTOR criterion used to define significant FACTORS in this study also included a variance measure ( $x > 5\%$ ) to allow for more than statistically-correct explorations. This technique has been shown to produce meaningful results in various studies (McKeown and Thomas, 1988, p.52). As a results, FACTORS 6 and 7 were subjected to further analysis having accounted for more than 5% of the total variance in the principal components analysis (Table 9, Appendix V).

Table 9. Variance explained by each FACTOR before and after rotation.

	Before Rotation (PC)	After Rotation (VR)
FACTOR-1	38	20
FACTOR-2	12	18
FACTOR-3	12	16
FACTOR-4	11	13
FACTOR-5	10	12
FACTOR-6	9	12
FACTOR-7	7	9

As McKeown and Thomas (1988) have also noted, common sense goes a long way in determining and interpreting the importance of FACTORS within the context of the research setting. From the 7 FACTOR groups, the strongest connections have been considered in determining the essence of each attitude type (Table 8 and below).

**FACTOR-1** was characterized by beliefs that forests should be planted not cut, forest are studied often, forests prevent the spread of fires, and forests affect personal health. F-1 type attitudes *did not* believe forests in the area attracted or served tourists, that forest vegetables could not be brought to local markets for commercial exploitation. They did not depend on the forest for everything, did not believe people who lived in cities were full of smog, and did not think highly of bathing in forest rivers. **FACTOR-2** type forest attitudes believed forests were a source of many goods. They agreed forests were the "best", provided food and all other necessities, that forest were being destroyed before the Revolution, and F-2 type people did not kill forest animals. F-2 attitudes *did not* value the

forest as a recreational area, did not believe local forests contained many orchids, that birds were not conserved in the forest, forests were not studied very often, and they did not believe that all forest uses were direct, as some uses of the forest were intangible and indirect.

**FACTOR-3** forest attitude valued the forest as an essential part of life with little economic significance. Respondents identified with the beliefs that the forests were being destroyed before the Revolution, that the Castro government was dedicated to reforestation, forests were studied often, forests were the lungs of Cuba, and several timber species were planted and used by the State for wood products. F-3 respondents *did not* notably value the forest as a source of fresh water, did not think of royal palm as a symbol, did not agree with the idea of forest vegetables being sold in the local markets, did not see the forest as a principle centre of the economy, or that they had no personal relation with the forest. **FACTOR-4** types believed the State needed forests, that birds transported seeds, that the forest beautifies the countryside, provided fresh water, and affected personal health. However, F-4 types *did not* believe rivers had abundant fauna, forest provided shade, forests were the best, prevented the spread of fires, or that the forest had many orchids.

**FACTOR-5** attitude types felt that the government was dedicated to reforestation, that they personally depended on the forest completely, provided food, that forest were always beneficial and had many animals. F-5 types did not kill animals, were taught about

forests, knew about forests and visited forests, did not believe city people were full of smog, and did not believe forests prevented the spread of fires. **FACTOR-6** types agreed that royal palm was a symbol and had many uses and that all people in the community were very grateful for forests. They felt that forests helped all development, attracted tourists, and that other countries needed forests. The F-6 attitude did not believe birds transported seeds that eventually germinated nor did they believe the government was dedicated to reforestation. F-6 types did not depend on the forest completely, did not believe that forests prevented the spread of fires, or that the forests were being destroyed before the Revolution.

**FACTOR-7** was the final attitude type to be considered for analysis. Respondents with an F-7 attitude had a conservationist, as opposed to a preservationist, view of forests. They felt forests were areas where birds could be conserved, forests affected the climate, forests were a tranquil place, Cuba needed forests, and that forests had recreational value. F-7 attitudes *did not* believe forests should not be cut, that they had not been taught about forests, forest were the lungs of country, forest were being destroyed before the Revolution, and did not believe forests help decontaminate the environment.

The **FACTORS** (attitude types) were diverse within themselves, yet different enough to form seven significantly different typologies. As such, it was very difficult to label each **FACTOR** as encompassing one concept of forests. Several theoretical issues may be debated and or supported by the results of the factor analysis. The intent of this

study was to investigate attitudes towards, and uses of, forest areas and to determine if such attitudes influenced the development of the study community. Theories which have specifically dealt with such inquiries have been absent from the literature. There are several broader philosophical viewpoints which indirectly allude to ecological beliefs and how they might influence development locally and globally.

The topic of forests in development has been debated in disciplines ranging from the pure and applied sciences to the arts and environmental movement. Forests are believed to have an essential function in the stability of the earth's biosphere and climatic patterns (Geiger, 1980; Cannell and Jackson, 1985). Forests have been used to generate economic wealth in countries such as Canada, the U.S., Malaysia, and Cuba (Biodiversity News, various issues, Smithsonian MAB Program, 1995; The State of Canada's Forests, Government of Canada, 1994). Researchers have also documented the use of forest resources for a variety of socially connected essentials: fuelwood, water, shelter and building materials, medicine, food and mental and spiritual nourishment as well (Bahuguna *et al.* 1994; Brundtland *et al.* 1987; Marini-Bettolo, 1991; Wickramasinghe, 1994; World Bank, 1992). Despite the broad academic and practical knowledge of forests, the social dimension of forestry has only just begun to make its way into main stream literature (Beckley and Korber, 1995, p.712).

Over time, population growth, technological innovations, education,

and telecommunications have altered the way in which most societies perceive and consume forest products (Beckley and Korber, 1995). As noted in Chapter one, popular theory suggests that three paradigms have guided human thinking and behaviour since the 1940s (Wilber and Jameson, 1988, p.3-27; Hettne, 1990, p.152-194). Forest development researchers have debated forestry issues along two lines of thinking: 1) a combination of Orthodox Political-Economy productionist (economic) principles; and 2) an Alternative Development rationale centred on participatory people-centred development, human-ecological connectedness, and the concept of sustainable development (Beckley and Korber, 1995, p.712; Clement, 1995, p.62). Forest development researchers have not acknowledged a shift in forest thinking which might correspond with the apparent shift from Orthodox to Political-Economy structured development. As Kuhn (1962) noted, there are three signs of a change or shift from one paradigm to another (Eatwell, 1987; Kuhn, 1962):

- \* usually preceded by a period of 'crises' which threatens the fundamental assumptions of the dominant principle;
- \* a questioning and change of auxiliary assumptions; and,
- \* a change in organization and structure of institutional agents beyond structural reforms.

Based on Kuhn's analysis, there has only been one shift in forest development thought since the industrial revolution- from the traditional economic view of forests to the social-ecological view of forests in development. This thesis concurs with the two distinctions in forest development thought as suggested in the forestry literature

(Beckley and Korber, 1995, p.712; Clement, 1995, p.62).

Although the Alternative Development Paradigm is usually presented as a recent paradigm in development thought, it should be noted that anthropology evidence suggest that early human development was based on the core principles of the Alternative Development Paradigm (Rajasekaran *et al.* 1991, p.387-401). The Orthodox approach dominated 'development' beyond the 17th century as colonialism and industrialization eclipsed human development. Orthodox proponents addressed forestry development through improved efficiency of existing structures and stability among organizations and people. The more liberal Political-Economy Paradigm, which surfaced during the 1980's, centred on an ideological belief of inherent stability and social order through privatization (Wilber and Jameson, 1988, p.12). Forest research within such a framework typically proposed increases in, and deregulation of, private activities accompanied by the liberalization of domestic economies and opening them to international business. The elimination of government subsidies and deregulation in all sectors of the economy was a central strategy within the Political-Economy Paradigm.

The Alternative Development movement resurfaced during the latter half of the 20th century with the tides of social protests of the 1960s, the energy crisis in the 1970s, and an environmental awakening in the 1980s. Alternative Development advocates sought a transformation of government structures in order to bring about

sustainable development in a more equitable and integrative approach to human and ecological development (Hettne, 1990, p.153). At its core, the Alternative Development Paradigm required that any type of development (forest, human, economic, local...national) must be people-centred, participatory, ecologically sound, and micro-economic in perspective. The Alternative framework of analysis has argued that activities must be need-oriented, ecologically sound, endogenous (originating from within a free society), self-reliant and not universally dependent, and aimed at structural transformation towards local management and participation in decision making (Hettne, 1990, p.153-154). Forest management activities associated with the Alternative Development Paradigm are rooted in forest ecosystem health and diversity, sustainable harvests, and multiple-use management of forest resources (Beckley and Korber, 1995, p.712). Unfortunately, 'alternative' forestry publications have offered only vague means of achieving the dismantling of existing institutions and organizations in order to integrate social values and ecologically sound practices within the forestry sector. As a result, the 1990s have been plagued by a series of crises in the theory and practice of development and natural resource management (Mandel, 1964; Freeman, 1984; Amin *et al*, 1982; Habermas, 1976; Hettne, 1990). Crises in today's world may be traced to the systems that have dominated human and environmental development over the past century (Hettne, 1990, p.180-182; Korten, 1990, p.1-8; Korten, 1984, p.299). Social-political publications suggest that Cuba addressed their human and environmental crisis through the efforts of the Revolution, and have

been evolving within this 'new' paradigm for the past 37 years and achieved considerable success within it (Eckstein, 1994; Petras and Morley, 1992, p.42-43).

Beliefs and principles expressed by the respondents in Establo were analogous to those of the Alternative Development Paradigm with regards to human and forest development. Respondents' attitudes communicated an ecological and human connectedness. Economic and political factors were considered, but did not dominate viewpoints. Generally, all behavioral typologies shared a common concept of forests as a biological-social system, as oppose to an economic-social system of development. Respondents expressed multiple values for forests. Reference to future generations were absent from respondents statements, but they expressed a memory of destructive conditions in the past. Utilization of forest resources was oriented towards modest consumption of energy, food, water, and wood for basic social necessities. Respondents communicated a land ethic along the lines of conservation, but not preservation, allowing for moderate consumption patterns. Bengston (1993) notes that such values reflect a stronger ecological connection which identifies with the theory of Alternative Development.

Normative values implied by the above theoretical views have been largely based on subjective interpretations of the behaviour of 'average' persons. Recent social forestry studies have investigated forest-related beliefs with respect to technology, land ownership, urban settings, forest protection, and general public opinion. Even

fewer studies have actually surveyed and analyzed people's attitudes towards forest in detail. One of the few forest-related studies to employ Q-methodology was published by Kurtz and Lewis (1981). They investigated interactions among factors that influenced the use and management of private non-industrial forest land in the U.S.. Five types of private land owners were distinguished among the study population on the basis of attitudes towards forest management: timber agriculturalist, timber conservationist, forest environmentalist, range pragmatist, and those who did not 'fit' into the first four types were considered as a fifth type that was labelled as "common disposition". Timber production was found to be the prime motivation for owning and managing land in the study area. The findings refuted common theory that timber production was not the prime objective in owning non-industrial private land.

Although there were no private forest owners in Establo, if one were to apply Kurtz and Lewis (1981) typologies to depict Establo respondents, the timber conservationist or common disposition type would best describe the Cuban respondents. In Establo, motivation for participating in forestry activities appeared to be a tightly woven fabric of factors: food, human health, timber, and water resources. These factors, along with a condition of environmental stability, figured promptly in all of attitude typologies. Respondents were generally forest advocates, but disagreed on aspects of forest harvesting. While F-1 type attitude believed one should not cut the forest in the Establo region, those who expressed an F-7 attitude approved of timber harvest for local and State consumption. All

groups were equally concerned about environmental impacts of forest harvesting. Respondents appeared to possess rudimentary knowledge of forest operations and ecological dynamics. Most trusted the efforts of the government and the State's commitment to environmental protection and reforestation. FACTOR-6 was the only attitude type that did not believe the government was pre-occupied with national reforestation or that the forests had been destroyed before the revolution.

Ninety-nine percent of Establo respondents remarked that they had interacted with, and thus altered, the forest for various reasons: fuel and cooking supplies, fruits, wood for small construction jobs, plant medicines, recreation, and work-related activities. Field observations confirmed these interactions and noted their occurrence on a daily basis. Harvesting of timber and non-timber products were always observed to be at a subsistence level, usually for personal consumption. As noted earlier, the cumulative effects of individual harvests were visible in the areas immediately surrounding Establo. According to Mather (1992), major factors affecting forest transition are likely associated with trends demand for forest products-services, population, valuation of resources, and perceptions of forests (Mather, 1992, p.372). Population has steadily increased in Cuba as has the number of inhabitants per forest area since 1959, levelling off at 5 inhabitant for every 1 hectare of forests in 1991 (Table 2). Urbanization has increased in Cuba (Eckstein, 1994, Chapter 6), but it was not known if the Establo area had undergone significant increases or decreases in population over the past

century. The demand for forest products, however, had increased in the local area as well as in the rest of Cuba, especially for firewood and charcoal because of a lack of cooking gas and kerosene (Acosta, 1995; pers. comm. various Establo residents, 1995). This increase in demand for timber, and the lack of proactive State and community forestry initiatives in Establo, appeared to have the greatest influence on the recent degradation of forest resources in the immediate area. This apparent condition of persistent degradation was limited to the old agricultural fields and forest fringe areas, and did not carry over into the main forest reserve of Sierra del Rosario.

Although Establo respondents communicated the fundamental principles of Alternative Development, it appears as though the State centralization of forestry management and authority has hindered community initiatives in organized forest development efforts. As noted earlier however, the strong federal environmental policies and education programs have advanced a perception of forest which associated reforestation and conservation with social and biological developments that facilitate better living conditions (pers. comm., Jose Antonio Acosta-Salgado, 1995). Burwell *et al.* (1994) reported what they believed was an improved community-based forest development structure that effectively promotes reforestation within a socio-economic framework. Their study presented a model of forest development based on the Ghanaian experience of the Collaborative Community Forestry Initiative (CCFI). The resulting forest development model identified three stages of development that facilitated the success of the project: training, infrastructure

development, and development of self-reliance. The study found that the success of each stage was dependent on the local villagers and their interest in forest development, as measured by the level of participation and the production of seedlings at the local nurseries. Several key ingredients relating to the CCFI's ongoing effectiveness were offered as a framework for other community-based forestry initiatives:

- \* development of a common vision;
- \* joint activities by the collaborative partners;
- \* regular meetings at various levels of project management;
- \* designated functions for the organizational entities and their relationship to each other;
- \* clear roles and responsibilities by all partners at all stages; and,
- \* a good monitoring system.

Forest development in Cuba has taken a similar path with respect to national design and implementation, but these have not been fully realized at the community level in Establo. There are however, hundreds of Establo residents involved, to varying degrees, in the planning and implementation of national, provincial, and municipal forestry activities. Cuba's approach to forest development mirrors that of the CCFI's, but is centralized at the national level and operationalized at the community level. Nevertheless, Cuba's success in development is without a doubt attributable to the interest and participation of the Cuban people at the local level.

The results of the factor analysis indicate that a social-biological framework with a secondary economic component best represent

Establo perspectives. Factor analysis found that expectations of economic gains, and associated risks, were insignificant in the attitude types. In rural Pakistan, Amacher *et al* (1993) found that attitudes towards risk and the expectation of uncertain economic gains were critical to the adoption of new forest technologies, technologies that are assumed to facilitate development. Access to greater resources of money, labour, and land, were also found to be critical factors in people's acceptance and use of new technologies in forestry (Amacher *et al*, 1993). These issues did not figure in any of the self-referent statements made by Establo respondents.

The findings of this case study support the conclusions of Bahuguna *et al* (1994), who found that sharing a conviction of "common resource- common responsibility- common benefits" facilitates an equitable distribution of forest benefits to local community members. Establo respondents expressed their statements of belief using the term "ours" rather than "mine", and "we" rather than "I", denoting a community connection in belief and values. Bahuguna *et al* (1994) also concluded that participatory forest management through grassroots organizations had played a significant role in regenerating local forests, regulating removal of forest products, and controlling animal grazing in the study area. These community-based activities were found to be directly responsible for the success of local development. In Establo, questionnaire responses indicated that 90% of respondents had planted 1 or more trees, and 62% had planted more than 100 trees in their lifetime. This suggested an overwhelming majority of respondents had, in the past, actively

participated in reforestation activities.

Field observations in Cuba during 1995 noted more people participating in, and mutually benefitting from, harvests of various forest products, but fewer people were observed planting forest tree species. The harvesting activities were usually carried out on an individual basis or with neighbours. There was no evidence of government reforestation efforts in Establo at the time field observations or in recent years. It is unlikely that the Cuban system would become "collective" as suggested and defined by Bahuguna *et al* (1994) as the Cuban government owns and directs the management and operations of forest activities on behalf of the people of Cuba, many of whom do not wish to participate in the strenuous field activities. Though the benefits are shared collectively amongst community members, the findings indicate that Establo's forest management activities are participatory, but not collective.

In summary, respondents' communicated an ecological and human connectedness in their attitudes towards forests. Economic and political factors were considered, but did not dominate viewpoints. Generally, all behavioral typologies shared a common concept of forests as a biological-social system, with a micro-economic outlook on forest development. It appears that respondents self-referent responses support the notion that forests have played an important role in meeting human necessities, especially at the household level. The economic aspects of forestry were secondary concerns, significant in only one of the seven attitude categories. The 'hidden'

presence of the economic contributions of forests to everyday life should not be ignored. Though insignificant by way of factor analysis, an economic valuation of social and biological factors would surely reveal a wealth of resources in the Establo area.

Given the findings of the literature review, interviews, field observations, and Q-analysis, Establo may be regarded as a functioning, albeit imperfect, example of an 'alternative' community. Establo has met the criteria described by the Alternative Development Paradigm: people-centred and socially-oriented activities, high degree of local participation, ecological principles, and a micro-economic perspective of development (Hettne, 1990, p.153-154; Gardner and Roseland, 1989, p.36-48; Korten and Klauss, 1984, p.299-309). Activities in Establo have been need-oriented, endogenous (originating from within a free society), and geared towards self-reliance not foreign dependence. Forests and forest products appeared to play an essential role in the everyday lives of people living in Establo. The findings of this case study clearly reveal that the use of forest products has affected both individual livelihoods and the development of forest resources in the local area. Cuba's exceptional education programs were cited by respondents as important sources of development influence. It appeared, however, that principal development activities were initiated by the State through agricultural projects which were implemented through community-based structures and carried out by the local people. The State, therefore, appeared to be the primary development channel.

Unfortunately, the community has also had some difficulties operationalizing the ecological aspects along the Alternative Development path. It would seem that Cuba's ambitious environmental policies have not been supported in recent times by equally ambitious forest management practices in Establo. Field visits and literature reviews of forest soils, plant species, and social dynamics in the Sierra del Rosario region, revealed an underutilized resource with considerable potential for further industrial and or socially-oriented development. Although case study respondents in Establo valued and perceived forests as an important part of the community's development, their local land base and forest plant species were also underutilized. Many of the agriculture fields in Establo were void of all but a few trees and were not being used to cultivate secondary crops that livestock do not eat. Some of the State farmland was overrun by marabu, a thorny shrub species of little use to livestock. According to local campesinos, the marabu had occupied large tracks of land for over five years. Given the nitrogen fixing abilities of marabu, the soil in these areas should now be sufficiently fertile to support agroforestry or silvopastoral systems. Residents hinted that there may be a lack of communication between local agriculture and forestry officials whose jurisdictions both include Establo. It was not clear which of the organizations had greater authority over natural resources in the various sectors of development.

The limitations of local observations and research data prevent any scientifically supported findings relating to whether Establo is, or is

not, representative of rural communities in Cuba. Nevertheless, brief visits to other rural communities support the notion that Establo is likely representative of other rural communities located near forest reserves. It is the opinion of the researcher that rural and urban communities located 'far' or 'out of sight' from forest areas would likely produce different results which may lead to different conclusions.

## CHAPTER FIVE. CONCLUSIONS

"Trees are useful to people in two distinct ways: as producers of a wide variety of goods, commonly called 'forest products', and as custodians of favourable environmental conditions. It would not make sense to try to qualify one of these functions as more important than the other. Both are indisputably essential to the well-being and survival of humans".

Gunnar Poulsen, 1977,  
commenting on Canada's  
"Trees for People" Program  
(IDRC).

### 5.1 Cuban perspectives and use of forests

This thesis has argued that individual perceptions and uses of forests have had an influence on forest development locally in the vicinity of Establo, Cuba. The findings lead to the conclusion that the collective experiences of individual perceptions and uses of forest resources have had a moderate influence on the development of Establo and its surrounding forests. Respondents' self-referent statements, supported by field observations, communicated that forest benefits were usually derived directly on a subsistence level and indirectly in the form of environmental stability and public health and welfare. During interviews, respondents noted that they believed forests and forest products have only had a moderate or indirect function in the community's development. The findings also support the conclusion that State agricultural industries have had a greater and more visible impact on community development in

Establo than have the collective efforts of local and State forestry initiatives.

## **5.2 Implications for forest paradigms**

Establo residents' perceptions of forests were oriented towards a use of forests for meeting basic social needs. Given such a strong orientation towards social forestry, the findings support the idea that Establo may be viewed as a functioning, albeit imperfect, example of an "Alternative Development" community. Establo residents have experienced people-centred and socially-oriented development with high degrees of local participation, but have not pursued ecological development with as much vigor and united efforts. Nor have community organizations and most individuals fully integrated natural ecological systems into their local development activities. The findings of the literature review and field observations relating to forest soils, plant species, and social dynamics in the Establo region conclude that, in recent years, State environmental policies have not been supported by ardent forest development practices. Although most respondents from the community valued and perceived forests as an important part of local development, the local land base and forest species were clearly underutilized. The underutilization of resources and discrepancies between self-referent statements and actions lead to the conclusion that the operationalization of Alternative Development precepts, and the advancement of the Cuban Revolution, have been hindered by such circumstances.

### **5.3 Contributions to the literature and potential for future research**

The thesis provides an argument for the influence of individual perceptions and uses of forest resources at the community level in Cuba. It has reviewed forest development in Cuba and investigated factors believed to affect transitions in forest area and cover. As such, the thesis has contributed to both the forest development literature and the general literature pertaining to Cuba.

While the thesis has not argued the causes of forest transition, it has investigated factors believed to be associated with reported transition in forest areas (Mather, 1992, p.368-371). The findings revealed several social-political instruments that have allowed Cuba's national forest cover to substantially increase in the past 37 years: harmonized national and local leadership, high level of participation, education and application of knowledge, partnership and communication between people and government in development, integration of human and ecological ambitions, an ideology approaching deep ecology, and a tenacity for self-sufficiency. The study has noted a positive trend in forest development in Cuba between the years 1959-1991, but recent media reports and field observations indicate that net deforestation may be the new trend in Cuban forest activities. This apparent change in the transitional direction beckons further analysis and understanding as it questions the current strength of the Cuban Revolution and the Cuban people's desire to follow the Alternative

path.

The experiences and use of forest resources by the people of Establo have shaped a vision and value of the forest that is uniquely their own. It would be inappropriate to comment on the likely hood of differing values if the data had been collected in the city of Havana or in the forest village of Las Terrazas. As Dwyer and Schroeder (1994) suggest, further analyses of attitudes towards forest in urban settings are needed. It is recommended that comparative analyses of other rural and urban communities be undertaken by future studies.

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## APPENDICES

## **APPENDIX I**

### **The interview questionnaire**

The interview questionnaire:

**Relación entre Personas y Bosques/Montes- Cuestionario Individual**

Esta estudiante canadiense (Gina LaHaye) trabaja con el Instituto de Ecología y Sistemática (de la ACC) realizando una investigación para conocer las relaciones de las personas y los árboles, bosques. Por favor, puede usted responder algunas preguntas. Gracias.

**Por favor, marque con un circulo el número que usted desee en cada pregunta.**

(a) Sexo: 1. Varón 2. Hembra

Sex: 1. Male 2. Female

(b) ¿Cuanto año tiene usted?

*How many years old are you?*

1. 10-15 2. 16-20 3. 21-25 4. 26-30 5. 31-35 6. 36-40  
7. 41-45 8. 46-50 9. 51-55 10. 56-60 11. 61-65 12. 66+

(c) ¿Cuál es su ocupación principal? Trabaja como ....

*What is your main occupation?*

1. Cuenta Propia 2. Agropecuario 3. Campesino 4. Obrero forestal

5. Ama de casa 6. Obrero construcción 7. Retirado  
8. Prof o Tech. (detallar) \_\_\_\_\_ 9. Otro tipo de Ob. \_\_\_\_\_

1. Self employed 2. State Farm worker 3. Farmer-self 4. Forest worker  
5. Housekeeper 6. Construction worker 7. Retired 8. Professional or Technical worker  
9. Other \_\_\_\_\_

¿Son los bosques/montes importantes para .....

*Are forests/mountains important to ....?*

(note: people in the study area refer to trees, forests and mountains as synonymous)

(d) usted? you? \_\_\_\_\_ 1. no importante 2. importante 3. muy importante

(e) su comunidad? your community?

1. no importante 2. importante 3. muy importante

(f) su país? your country?

1. no importante 2. importante 3. muy importante

(g) ¿Cómo usted aprendió sobre los bosque/montes?

*How did you learn about the forest/mountain?*

1. su familia    2. escuela    3. los amigos    4. usted solo  
 1. *your family*    2. *school*    3. *your friends*    4. *yourself*

(h) ¿Usted alguna vez ha plantado un árbol?    1. No    2. Si

*Have you ever planted a tree?    1. no    2. yes*

(i) ¿Más o menos, cuantos árboles usted ha plantado?

*Approximately how many trees did you plant?*

1. 1-4    2. 5-10    3. 11-50    4. 51-100    5. 101-1000    6. 1000+

(j) ¿Donde usted ha plantado estos árboles?

*Where did you plant the tree(s)? (list of areas)*

1. En la Sierra del Rosario
2. En otras partes de la Provincia de Pinar del Rio
3. Provincia de La Habana
4. Provincia de La Ciudad de La Habana
5. Otras Provincia (señale) \_\_\_\_\_

k. ¿Haz ido usted al bosque/monte?

*Have you been to the forest/mountain?*

1. Si    2. No [si No, por que? \_\_\_\_\_]

(l). ¿Mas o menos, cuantas veces ha ido usted al bosque/ monte?

*Approximately how many times have you gone to the forest?*

1. 1-4    2. 5-10    3. 11-30    4. 31-50    4. 51-100    5. 100+

(m). ¿En que época usted va al bosque/monte?

*In what season do you usually visit the forest?*

1. invierno    2. verano    3. Todas época  
 1. *winter*    2. *summer*    3. *All seasons*

(n). ¿Usted visita el bosque/monte en ....

*Do you visit the forest/mountain in ....*

1. fin de semana    2. durante la semana    3. solo en vacaciones  
 1. *Weekend*    2. *During the week*    3. *Only during vacations*

(o). ¿Para que usted visita el bosque/monte?

*What are reasons for visiting the forest?*

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-----  
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p. Por favor, dígame todo lo que usted piensa del monte. RESPONSE TAPE RECORDED

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-----  
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q. ¿ Piensa usted que el bosque/monte ha tenido algún efecto en el desarrollo de su comunidad? ¿Por qué? ¿Cómo? RESPONSE TAPE RECORDED

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## APPENDIX II

**Summary of basic data from 1995 interviews and description of occupations**

Appendix II. Summary of basic data from 1995 interviews and description of occupations. (\*) denotes persons who performed Q-sorts used in analysis.

Person #	Gender	Age	Education	Occupation
1	M	50	S	2 (?)
2	F	24	S	5
3	F	44	P	5
4	F	28	S	5
5*	F	46	P	5
6	F	51	P	2 (?)
7	F	62	P	5
8*	F	38	S	5
9	M	52	P	7 (2)
10	M	22	T	3
11	M	35	Pre	4
12	F	27	T	5
13	M	27	S	6
14	M	78	P	7 (2)
15*	F	31	S	5
16	M	33	Pre,T	8T (Detective)
17*	M	41	Pre	9 (store keeper)
18*	F	17	T	9 (vet. student)
19	M	52	P	2 (apicola)
20*	M	71	P	7 (2,cows+)
21*	M	72	P	7 (2,agricola)
22*	M	26	Pre	4
23	F	74	-	7 (2)
24	M	27	S	8P (comercio)
25	F	31	U	8P (teacher)
26	F	32	P	2 (avicola)
27*	M	52	S	8T (custodio)
28	F	34	U	8P (teacher)
29	M	26	T	3
30	M	23	S	8T(carpenter)
31	M	19	S	4
32*	M	38	P	9 (Custodio)
33	F	37	S	4
34	M	41	Pre	9 (bus driver)
35	M	16	S	3 (co-op)
36	M	68	-	7 (9, gen labour)

Continued next page ...

Continued from previous page .....

Person #	Gender	Age	Education	Occupation
37	M	67	S	7 (9, gen labour)
38	F	74	-	5
39	M	53	T/U	8T (mechanic)
40	M	65	-	7 (2,cows)
41	F	26	S	5
42	M	76	P	7 (4)
43	M	74	-	7 (4)
44	M	27	S	2 (?)
45	M	64	-	9 (Custodio)
46	F	31	T	8T (nursing)
47	F	18	S	5
48	M	56	P	7
49	M	30	S	2 (?)
50	M	45	P	2 (pigs)
51	M	49	P	2 (cows)
52	M	47	P	3 (?)
53	M	70	P	2 (?)
54	M	14	S	9 (Student)
55*	M	37	S	8T (carpenter)
56	F	55	T	5 (8, photograp)
57	F	23	U	9 (Student)
58*	F	46	P	5
59	F	51	S	5
60	M	58	S	4
TOTAL= 60	F=23, M=37	Ave= 43	/	/

**Note:** Four Q-sorters were not among the original group of 60. The four were 3 women (nurse, vet, housekeeper) and one man (49 year old construction worker).

**Legend:**

F= female; M= male; gen = general; age measured in years.

**Formal Education:** P= primary (p-6); S= secondary (7-11); Pre= Grade 12; T= technical training (and P,S); U= university; many also received schooling from workplace or CDR.

**Occupation categories:** 1. Self employed; 2. State agriculture worker; 3. Farmer (Campesino)  
4. Forest worker; 5. Housekeeper; 6. Construction worker; 7. Retired;  
8. Professional or Technical worker; 9. Other.

## Occupation Categories for Study Area (Appendix II con't)

1. *Cuenta Propria* = Self Employed (other than farmer)  
a person who works for themselves, without hired labourers, and does not receive a salary from the State. Pays an additional tax/duty to the Government of Cuba independent of other general fees.
2. *Agropecuario* = State Farm (agriculture) Worker  
a person who works at a State farm and receives a salary from the State. State farms produce animal and plant food for the nation. In Cuba this occupation covers a variety of sectors:  
Agronomy (plant production),  
Pecuario (animal production),  
Avicola (birds, turkeys, ducks,...),  
Apicolo (bees and honey production)  
Forestry (work in forested areas)
3. *Campesino* = Farmer (self employed)  
a person who works (makes their living) on their own private land. They do not receive a salary from the State but the person may decide to join the non-government ANAP organization and contribute to a social security fund which they then draw upon after retirement.
4. *Obrero Forestal* = Forestry Worker  
a person who works for the State forestry department
5. *Ama de Casa* = Housekeeper  
a person (*ama*- feminine, *amo*- masculine) who works in the home caring for the home and doing household chores.
6. *Obrero de la Construcción* = Construction Worker  
a person who does construction work for the State
7. *Retirado* = Retired  
a person who is recognized by the State as officially retired from their work and receives some sort of pension or social security. In Cuba, as in Canada, the official age of retirement is 65 years, although some may retire earlier if physical or mental disabilities warrant. In exceptional cases, some people may choose to keep working for the State or for themselves. In the survey area, the majority of "retired" people were performing traditional food and household maintenance jobs on a daily basis without pay in order to supplement household or community necessities (farming a piece of land, cutting wood, repairing dwellings, etc.).
8. *Profesional o Tecnico* = Professional or Technician  
a professional is one who holds a university degree in their work specialty, a technician is classified as one who has completed studies at a vocational or polytechnical level in their area of work.
9. *Otras* = Other  
this category was reserved for a diversity of other workers including students, bus drivers, storekeepers, caretakers and custodians.

### APPENDIX III

Statements about the forest recorded during interviews with people living in Cuba.  
May-June, 1995.

Statements about the forest recorded during interviews with people living in Establo, including San Luis, El Destino, and San Francicso, in Pinar del Rio Province, Cuba. May-June, 1995.

1. The forest is the prettiest, nicest, and best that exists
2. The forest gives us everything
3. The forest gives us fruit
4. The forest gives us wood for furniture, houses, and many other things
5. Forests are very important for everyone
6. The forest gives us fresh water
7. Royal Palm is a symbol and has many uses
8. The forest beautifies our countryside
9. In the forest one breathes good air
10. The forest purifies the air
11. The forest helps to decontaminate
12. The forest gives us fresh air and a fresh breeze
13. The forest has a relationship with the atmosphere
14. Forests are the lungs of the country
15. The forest helps the environment
16. The lack of forest has an influence on the lack of rain
17. Forests are very important to other countries
18. Forests are very important to Cuba
19. I go to the forest for entertainment, for recreation (camping, etc.)
20. The forest is healthy
21. The forest gives us medicine
22. In the forest one senses contentment
23. The forest helps clear the mind
24. It is necessary to plant the forest in order to receive its benefits
25. The forest is good for bathing in the river
26. We need the forest that was destroyed
27. The forest serves as a refuge for people
28. The forest serves as a refuge for birds and other animals
29. The forest is where birds are conserved
30. Birds bring seeds and they germinate (are born)
31. One should not abuse the forest, one should conserve it
32. In a country without forests it would not be easy to live
33. Without forests one could not live
34. The forest gives beautiful orchids
35. The forest gets work for men
36. The forest gets work for women
37. I do not have much relation with the forest
38. Those who live in the city are filled with smog
39. All the uses of the forest are direct not indirect
40. The forest is studied often
41. There are fewer forests because they were cut for cooking, and destroyed
42. Now fewer birds come
43. Before we planted, now we cut much for firewood
44. In the forest there are bees which give us honey for medicine
45. The forest is beneficial because we can bring legumes to the market
46. The forest is a principal centre of the economy
47. The forest is very good for children
48. The forest helps us to resolve many problems
49. The forest protects communities (towns)

50. The forest protects agriculture in that we plant rows of trees to protect the crops
51. The forest prevents soil erosion
52. The forest evades (prevents the expansion) of fires
53. The forest gives seeds
54. The forest is interesting
55. In the forest there are many animals
56. The Forest Reserve permits / invites visitors, tourists
57. In the rivers there are many/much fauna
58. The forest serves to feed us
59. The forest is a tranquil place
60. The forest helps the development of all
61. The State needs the forest
62. This study will help the development of our country, Cuba
63. This study will help care for trees
64. I do not know trees because I do not go to the forest
65. I do not visit the forest to kill animals
66. In the forest were planted ocuje, majagua, eucalyptus, which are used in forestry for wood
67. I have not been taught anything about the flora & fauna
68. The people in this community are very grateful for the forest
69. The forest is all beneficial (Everything in the forest is beneficial)
70. We depend on the forest completely
71. It is different to live in the forest than in the city
72. There is a difference in the health of those that live here and those that live in the city
73. Before the Revolution the forests were being destroyed
74. The government is preoccupied with reforestation throughout the country
75. One should not cut the forest
76. The forest gives us shade

### Appendix III con't

List of Statements as recorded in Spanish during Interviews (Q-Statements, ordered 1 to 76)

1. El bosque es lo más lindo, bonito, bueno que existe
2. El bosque nos da todo
3. El bosque nos da las frutas
4. El bosque nos da madera para muebles, casa y muchas cosas más
5. Los bosques son muy importante para todos
6. El bosque da agua fresca
7. La palma es un símbolo y tiene mucha utilidad
8. El bosque embellece nuestros paisajes
9. En el bosque se respira un aire bueno
10. El bosque purifica el aire
11. El bosque ayuda con la descontaminación
12. El bosque nos da el aire y la brisa fresca
13. El bosque tiene que ver con la atmósfera
14. Los bosques son los pulmones del país
15. El bosque ayuda al medio ambiente
16. La falta de bosque ha influido en la falta de lluvia
17. Los bosques son muy importantes para otros países
18. Los bosques son muy importante para Cuba
19. Voy al bosque a entretenerme, a recrearme (Campismo)
20. El bosque es saludable
21. El bosque nos dan medicina
22. En el bosque se siente uno contento
23. El bosque ayuda a despejar la mente
24. El bosque es necesario que se plante para recibir sus beneficios
25. El bosque es bueno para bañarse en el río
26. Necesitamos de los bosques que se han destruido
27. El bosque sirve para refugiarnos (para los personas)
28. El bosque es refugio de los pájaros (y otras animales)
29. En el bosque es donde se conservan las aves
30. Los pájaros traen las semillas y ellas nacen
31. No se debe abusar del bosque y si conservarlo
32. En un país sin bosque no será fácil vivir en él
33. Sin el bosque uno no podría vivir
34. El bosque da orquídeas lindísimas
35. El bosque le resuelve trabajo al hombre
36. El bosque le resuelve trabajo a la mujer
37. Yo no tengo tanta relacion con el bosque
38. Los que viven en la ciudad están llenos de hollín
39. Todos los usos del bosque son directo no indirecto
40. El bosque se está estudiando mucho
41. Hay menos bosque por que se ha cogido para cocinar, destruyéndolo
42. Ahora se ven pocos pájaros
43. Antes se sembraban, ahora se corta mucho para leña
44. En el bosque hay abejas que nos dan la miel para medicina
45. El bosque beneficia que traigan viandas a la placita
46. El bosque es un centro principal de economía
47. El bosque es muy bueno para los niños

48. El bosque nos ayuda a resolver muchos problemas
49. El bosque protege a los pueblos
50. El bosque protege a la agricultura pues hay que sembrar cortinas de arboles para proteger los cultivos
51. El bosque no permite la erosión de los suelos
52. El bosque evita los incendios
53. El bosque se da de semillas
54. El bosque es interesante
55. En el bosque hay mucho animales
56. El bosque de la Reserva permite a los visitantes (turistas)
57. El estado necesita del bosque
58. En los rios hay mucha fauna
59. El bosque sirve para alimentarse
60. El bosque es un lugar tranquilo
61. El bosque ha ayudado al desarrollo de todas
62. Este estudio ayuda al desarrollo de nuestro pais, Cuba
63. Este estudio ayuda a cuidar los arboles
64. No conosco lo as arboles porque no voy al bosque
65. No visito el bosque para matar animales
66. En el bosque se ha sembrado el ocuje, la majagua, eucalyptus, que en la forestal se utilizan maderas
67. No tengo a nadie que enseñe sobre la flora y la fauna
68. Las personas en esta comunidad tienen que agradecerle mucho al bosque
69. El bosque es todo beneficio
70. De el bosque dependemos por entero
71. Es diferente vivir en el bosque que en las ciudades
72. Hay diferencia en la salud del que vive aqui y el que vive en la ciudad
73. Antes de la revolucion se demolian los bosque
74. El gobierno se preocupa por repoblar bosque en todo el pais
75. No se deben talar los bosques
76. El bosque nos da sombra

## APPENDIX IV

### Q-sorts results for 15 community members

Q-sorts results for 15 community members: 76 statements sorted by 15 people. Statement numbers in descending order from 1-76, beginning with statement #1 on this page.

Statement Rank Order given by each Q-sort # (Person #)

	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>	<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>	<u>11</u>	<u>12</u>	<u>13</u>	<u>14</u>	<u>15</u>
1.	4	2	-4	5	3	5	-3	-4	5	2	5	3	2	3	5
2.	3	4	-5	4	1	5	2	-2	5	4	0	5	5	3	4
3.	1	1	4	5	3	3	3	5	3	5	-2	5	4	4	2
4.	5	5	5	4	5	4	5	5	5	5	3	5	5	5	5
5.	2	1	-5	3	5	5	4	2	2	5	2	3	0	3	3
6.	4	-5	4	2	2	2	-2	-3	5	1	2	5	4	5	1
7.	3	3	5	5	5	1	3	4	2	3	5	1	5	5	0
8.	1	1	5	5	1	0	-4	1	0	4	5	1	4	5	4
9.	2	2	-4	4	-1	3	0	-1	3	1	3	2	4	4	2
10.	5	2	5	1	5	3	2	3	5	2	5	3	5	2	-1
11.	3	2	4	3	-3	-1	4	4	3	5	5	3	5	4	-2
12.	3	1	-5	5	-4	-1	-3	-3	4	4	3	1	4	4	-4
13.	0	1	5	4	0	-3	-4	2	4	2	4	2	4	3	-1
14.	4	5	4	5	-5	1	5	5	5	5	3	1	5	5	4
15.	3	2	5	1	-2	3	3	1	5	5	3	2	5	4	5
16.	4	3	-5	-1	3	-4	-1	5	4	-1	4	-4	2	5	3
17.	5	2	-4	5	-5	2	-5	0	1	3	4	3	5	4	4
18.	5	1	-5	3	4	3	5	5	3	5	3	3	5	4	5
19.	0	0	-5	2	5	-5	-2	-5	-2	2	-1	4	5	3	2
20.	2	-1	5	-2	5	3	0	-1	4	4	2	1	4	4	4
21.	4	2	-5	5	3	2	-5	4	5	4	3	2	4	5	0
22.	-1	2	-5	-3	-2	0	-5	-3	2	0	-3	5	5	3	3
23.	-2	4	-5	1	0	1	-3	0	4	-1	-1	4	4	3	-2
24.	4	4	5	3	4	-5	4	5	5	5	-3	4	5	4	-3
25.	1	0	-5	4	-5	-3	-5	-5	4	3	-2	2	2	2	1
26.	0	4	5	5	-3	-1	-5	2	5	5	2	-5	4	4	5
27.	2	1	-5	4	4	0	2	5	3	1	-4	2	5	2	0
28.	1	2	5	3	2	1	5	3	5	4	3	1	5	5	3
29.	-1	0	-5	2	5	1	3	5	0	0	2	1	5	4	1
30.	0	-1	4	4	-5	-1	0	4	2	-2	5	2	3	3	2
31.	5	5	5	4	3	5	4	3	4	5	2	1	3	5	-1
32.	5	4	5	3	3	4	5	5	5	5	5	3	3	5	5
33.	5	3	4	-1	-1	3	5	5	5	5	4	3	5	3	5
34.	0	0	-5	5	-4	-5	-3	-5	0	1	-5	1	4	2	-2
35.	2	3	4	5	1	5	3	4	4	3	3	1	3	3	2
36.	2	3	-4	2	1	5	3	3	4	3	3	1	3	2	1
37.	0	0	-5	-1	-5	-5	-4	-2	1	1	-2	0	0	-3	-5
38.	1	1	-5	-5	-2	1	-5	-5	1	-2	2	-5	4	1	-1

continued from previous page... statement numbers in descending order from 1-76, beginning with statement #47 on this page.

Statement Rank Order given by each Q-sort # (Person #)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
39.	-1	-2	4	-4	-4	-4	-3	-5	-1	2	1	5	2	1	-4
40.	3	-3	4	5	3	-5	4	5	5	4	1	1	5	3	2
41.	5	1	-4	-5	2	2	2	3	4	3	1	3	3	2	0
42.	4	0	4	-5	-4	3	1	5	2	0	-3	-5	2	2	-2
43.	3	2	-5	-2	0	3	5	4	3	5	2	4	4	2	1
44.	5	4	5	5	5	-1	0	5	5	5	3	1	5	3	3
45.	-5	0	-4	4	-5	4	-5	-5	4	1	-2	-3	3	-3	-3
46.	4	1	-5	3	2	4	3	2	4	3	-3	3	1	-2	0
47.	5	4	-5	2	4	3	1	-3	5	5	1	1	4	2	1
48.	5	5	4	4	-2	4	0	0	5	1	2	5	4	2	4
49.	2	1	5	3	-4	3	5	3	3	-1	3	2	4	2	3
50.	4	3	5	4	-1	-2	4	4	2	3	3	1	5	3	3
51.	5	4	5	-3	-2	3	2	5	5	5	2	-2	5	3	2
52.	4	3	-5	-5	-4	-4	3	3	5	1	-4	-3	0	2	1
53.	1	0	4	1	-5	2	-5	-2	0	-2	2	1	3	2	-2
54.	3	3	-5	5	-3	2	-3	0	5	4	-4	3	3	3	3
55.	0	3	4	3	1	3	1	4	5	5	0	3	5	2	3
56.	-1	1	5	5	-5	3	-5	-5	1	2	1	-5	5	2	2
57.	5	3	-5	1	2	2	0	5	5	4	-4	-1	4	2	-1
58.	5	3	4	2	3	5	3	3	5	5	-2	5	4	1	3
59.	4	3	-5	5	4	3	1	2	5	0	3	1	5	3	1
60.	5	4	5	4	-1	0	5	4	5	5	3	-1	5	1	2
61.	5	-2	5	5	-4	3	2	5	5	3	5	1	5	3	4
62.	4	4	5	5	2	0	5	5	5	5	5	1	5	5	5
63.	1	4	5	5	1	-1	3	5	4	4	3	2	3	5	5
64.	5	2	-5	-3	-5	-4	5	-3	0	1	1	-4	5	1	-3
65.	5	4	-5	-5	-1	3	-5	-2	5	5	5	-4	0	4	5
66.	5	5	-5	5	5	2	5	5	5	5	3	1	5	5	5
67.	4	4	5	-5	-5	0	-5	-3	3	4	2	-5	0	2	-1
68.	5	5	4	5	3	5	1	2	5	5	3	-1	5	3	5
69.	1	5	-5	5	1	5	5	4	5	5	1	5	3	3	1
70.	-5	4	-3	4	-4	5	-5	-2	5	2	4	5	0	2	-1
71.	4	5	-5	3	4	-1	5	5	3	2	-2	4	5	2	4
72.	5	4	5	2	2	-1	5	5	5	0	0	3	4	3	3
73.	4	4	5	-5	-3	4	4	-1	4	4	0	4	0	2	2
74.	5	5	5	5	3	5	5	5	5	5	-2	5	0	5	5
75.	5	3	5	3	-5	4	5	5	5	5	-1	5	4	5	2
76.	5	2	-5	5	0	-3	-3	0	3	5	-3	5	3	3	-1

**APPENDIX V****Factor Analysis/SAS Output**

## Factor Analysis Output

The SAS System

08:29 Wednesday, October 25, 1995

Initial Factor Method: Principal Components

Prior Communalities Estimates: ONE

Eigenvalues of the Correlation Matrix: Total = 15 Average = 1

	1	2	3	4	5	6	7	8
Eigenvalue	4.2310	1.3863	1.3145	1.2773	1.1422	0.9941	0.7801	0.7469
Difference	2.8448	0.0717	0.0372	0.1351	0.1481	0.2140	0.0332	0.1321
Proportion	0.2821	0.0924	0.0876	0.0852	0.0761	0.0663	0.0520	0.0498
Cumulative	0.2821	0.3745	0.4621	0.5473	0.6234	0.6897	0.7417	0.7915

	9	10	11	12	13	14	15
Eigenvalue	0.6148	0.6046	0.5212	0.5092	0.4273	0.2855	0.1651
Difference	0.0102	0.0835	0.0120	0.0819	0.1418	0.1205	
Proportion	0.0410	0.0403	0.0347	0.0339	0.0285	0.0190	0.0110
Cumulative	0.8325	0.8728	0.9075	0.9415	0.9700	0.9890	1.0000

7 factors will be retained by the NFACTOR criterion.

## Factor Pattern

FACTOR1 FACTOR2 FACTOR3 FACTOR4 FACTOR5 FACTOR6 FACTOR7

COL1	0.49967	-0.32349	0.36482	-0.37287	-0.03223	0.30276	0.09929
COL2	0.59306	-0.00340	-0.27542	-0.20872	-0.43481	-0.03847	0.17596
COL3	0.42100	-0.27535	-0.17275	0.22854	0.62358	-0.11920	0.21735
COL4	0.32718	0.53027	0.07505	0.57054	-0.00721	0.01323	0.11596
COL5	0.53029	0.22011	0.28484	0.00100	-0.12432	0.19900	-0.60684
COL6	0.43469	0.15350	-0.61212	-0.11370	0.11757	0.38628	-0.06262
COL7	0.65380	0.07301	0.36435	-0.32190	0.25724	-0.16306	-0.02576
COL8	0.72311	-0.05416	0.25449	-0.16263	0.14052	-0.40039	-0.04902
COL9	0.69880	0.05220	-0.28587	-0.29610	0.09321	0.11507	0.05688
COL10	0.66557	0.01632	-0.02200	0.05164	-0.11218	0.05827	0.30223
COL11	0.32327	-0.50331	-0.08654	0.43469	0.31238	0.08113	-0.30381
COL12	0.29242	0.72214	-0.07036	-0.02471	0.26654	-0.18955	-0.03698
COL13	0.32651	0.05897	0.50333	0.36926	-0.05145	0.46958	0.28826
COL14	0.52623	-0.20709	-0.01868	0.31393	-0.43834	-0.47533	0.01424
COL15	0.64806	-0.14200	-0.26159	0.24326	-0.25166	0.07237	-0.17835

Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7
4.231028	1.386261	1.314520	1.277336	1.142214	0.994069	0.780092

Final Communalities Estimates: Total = 11.125521

COL1	COL2	COL3	COL4	COL5	COL6	COL7	COL8
0.729005	0.692655	0.785428	0.733064	0.834099	0.767094	0.762574	0.799495

COL9	COL10	COL11	COL12	COL13	COL14	COL15
0.685612	0.553719	0.750729	0.720894	0.806029	0.836991	0.668132

The SAS System

08:29 Wednesday, October 25, 1995

Rotation Method: Varimax

Orthogonal Transformation Matrix

	1	2	3	4	5	6	7
1	0.58421	0.49923	0.46276	0.24044	0.14388	0.26360	0.21756
2	-0.02081	0.11929	-0.20332	-0.49353	0.82032	0.04866	0.15857
3	0.45286	-0.66389	-0.13685	-0.15899	-0.09782	0.49102	0.24391
4	-0.49348	-0.29428	0.31500	0.52357	0.39381	0.37417	0.03794
5	0.32387	0.00973	-0.64077	0.59582	0.25688	-0.10672	-0.22813
6	-0.31761	0.44851	-0.45830	0.00067	-0.27442	0.57946	0.27721
7	0.06241	0.08912	0.07701	-0.21027	0.02071	0.44709	-0.85890

Rotated Factor Pattern

	FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7
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COL1	0.54746	0.22271	0.01916	-0.01331	-0.46531	0.37885	0.13825
COL2	0.20719	0.53413	0.55688	-0.21731	-0.07020	0.04561	-0.00921
COL3	0.31405	0.19674	0.01823	0.71000	0.13900	0.05982	-0.34751
COL4	-0.06675	0.02507	0.22053	0.07508	0.69633	0.42266	0.10094
COL5	0.29238	0.13556	0.10371	0.02777	0.13028	0.14800	0.82452
COL6	-0.05886	0.84397	-0.03929	0.15002	0.12646	-0.03776	0.09934
COL7	0.83778	0.11502	0.04436	0.05327	0.10184	0.10090	0.14871
COL8	0.78870	0.05086	0.34926	0.16875	0.11564	-0.01684	0.10369
COL9	0.42101	0.68959	0.15053	0.07633	0.04826	0.01775	0.04113
COL10	0.31707	0.38560	0.39241	0.05215	0.09309	0.36562	-0.07385
COL11	0.00207	0.04323	0.13996	0.81753	-0.13502	0.05872	0.19808

COL12	0.28036	0.20040	-0.09643	-0.12138	0.75132	-0.08639	0.07844
COL13	0.08742	-0.03699	0.02650	0.07176	0.05543	0.88072	0.11149
COL14	0.15825	-0.05816	0.88689	0.13157	0.04943	0.01464	0.04500
COL15	0.02743	0.42278	0.55555	0.28246	0.00995	0.11555	0.29456

#### Variance explained by each factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7
2.248419	1.970468	1.797127	1.405606	1.381674	1.295752	1.026475

Final Communalities Estimates: Total = 11.125521

COL1	COL2	COL3	COL4	COL5	COL6	COL7	COL8
0.729005	0.692655	0.785428	0.733064	0.834099	0.767094	0.762574	0.799495

COL9	COL10	COL11	COL12	COL13	COL14	COL15
0.685612	0.553719	0.750729	0.720894	0.806029	0.836991	0.668132

#### Scoring Coefficients Estimated by Regression

#### Squared Multiple Correlations of the Variables with each Factor

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7
1.000000	1.000000	1.000000	1.000000	1.000000	1.000000	1.000000

The SAS System

08:29 Wednesday, October 25, 1995

Rotation Method: Varimax

#### Standardized Scoring Coefficients

FACTOR1	FACTOR2	FACTOR3	FACTOR4	FACTOR5	FACTOR6	FACTOR7
COL1	0.24566	0.08044	-0.13954	-0.09677	-0.40473	0.28321
COL2	-0.02923	0.25591	0.32160	-0.29160	-0.10819	-0.00815
COL3	0.14675	0.03694	-0.11264	0.50314	0.11361	0.01580
COL4	-0.15434	-0.06596	0.10029	0.01959	0.49304	0.30901
COL5	0.02028	-0.04318	-0.08560	0.01659	0.02839	-0.07272
COL6	-0.20433	0.56797	-0.18951	0.07595	0.03425	-0.05119
COL7	0.46204	-0.10075	-0.12819	-0.02383	0.04126	-0.04875

COL8	0.41501	-0.19545	0.12136	0.04918	0.06430	-0.18405	-0.01237
COL9	0.10583	0.35875	-0.07421	-0.03230	-0.02466	-0.05718	-0.06909
COL10	0.03788	0.13901	0.15133	-0.08411	0.01656	0.26661	-0.26056
COL11	-0.10721	-0.05705	-0.01725	0.63109	-0.10659	-0.05854	0.25064
COL12	0.14802	0.05040	-0.13849	-0.09321	0.54617	-0.14654	0.01847
COL13	-0.06662	-0.05132	-0.09345	-0.01618	-0.01116	0.76233	-0.04826
COL14	-0.02323	-0.23518	0.63375	0.00175	0.02654	-0.11746	-0.05146
COL15	-0.20123	0.15045	0.26914	0.13558	-0.04884	-0.02758	0.24258

The SAS System 08:29 Wednesday, October 25, 1995

OBS FACTOR1 FACTOR2 FACTOR3 FACTOR4 FACTOR5 FACTOR6 FACTOR7 ID SCORE1 SCORE2  
SCORE3 SCORE4 SCORE5 SCORE6 SCORE7

1	1.31813	-1.81460	-0.36710	1.88712	-0.40667	0.22749	-0.95075	1	66	1	26	74	30	49	15
2	0.64749	-1.49644	-0.12241	1.08009	-0.66677	-0.79396	-0.61648	2	57	3	38	63	16	19	20
3	-0.68524	0.14919	-0.18678	0.11620	-1.80337	-0.07547	0.00114	3	25	47	34	44	3	42	39
4	-0.93466	-0.89109	-0.79654	-0.51511	-0.61851	-0.51676	-0.79697	4	13	13	12	25	21	28	18
5	-0.69473	1.52247	-0.70294	0.29764	-0.49864	1.43224	-1.74813	5	24	69	15	50	28	71	6
6	0.24064	-0.66112	4.25945	-1.44517	-0.66276	-0.54857	-1.09128	6	46	25	76	4	17	26	12
7	0.37648	-0.63222	2.84368	-1.13452	-0.13809	-1.55016	-1.15734	7	53	26	75	10	38	1	10
8	1.47575	0.97386	-1.12332	-1.74493	-0.59116	-0.51281	-0.28325	8	70	61	9	3	23	29	29
9	0.94572	-0.01024	-0.26355	-0.13905	-0.29918	-0.03838	-0.60611	9	62	40	31	38	35	43	21
10	-0.93809	-0.41162	1.15230	-1.23882	0.13521	0.97986	-1.13158	10	12	29	69	7	52	64	11
11	-1.08957	0.98543	-0.09686	-0.92257	-0.46325	-0.76758	1.37671	11	6	62	41	16	29	21	72
12	0.76826	0.58848	-0.09190	0.38548	-0.11136	-0.97932	1.02969	12	59	57	42	51	39	9	63
13	0.31885	1.11034	-0.01603	-1.24810	-0.83698	0.01258	0.42563	13	49	64	46	6	8	44	48
14	-0.77423	-0.27720	-1.42537	-0.40838	-0.06461	-0.96301	1.76710	14	22	32	4	28	42	10	74
15	-0.08995	-0.75822	-0.35146	-0.98773	0.08563	-0.62796	0.73989	15	41	21	27	14	49	24	54
16	-0.17583	1.43239	-1.36044	-0.26878	1.96159	1.41579	-1.83057	16	37	68	6	30	70	70	2
17	1.40574	0.12290	-0.80643	-0.26742	-0.03365	-1.23449	0.34848	17	68	46	11	32	43	5	47
18	-0.29095	0.21886	-0.61604	-0.26753	1.05318	-0.95641	-1.76401	18	35	49	17	31	67	11	4
19	1.62885	2.32622	-0.51209	0.50371	0.64567	-1.01751	-1.75040	19	71	76	20	54	63	8	5
20	0.36377	-0.25071	0.31335	-1.27778	0.34853	0.20486	-1.17071	20	51	33	58	5	57	47	9
21	0.47246	-0.00769	-0.76300	0.19327	-0.20904	-0.37586	-0.96424	21	56	41	14	48	36	36	14
22	1.39750	0.18488	-0.15418	1.30494	-0.32800	0.35845	-0.07384	22	67	48	36	67	33	55	35
23	0.79085	0.11840	-0.00777	1.21625	-0.88752	0.90350	-0.23262	23	61	45	48	65	7	63	32
24	-2.14883	1.09383	-0.26339	1.24043	-0.73364	-0.81115	0.84501	24	1	63	32	66	11	17	58
25	1.73934	1.78939	-0.36769	0.95267	-0.60834	-0.20723	0.76166	25	72	71	25	60	22	40	56
26	1.30740	-0.19284	-1.91710	-0.81516	0.49104	-0.73477	1.44874	26	65	36	1	20	58	22	73
27	-0.57185	0.79591	0.29296	1.51606	-0.66867	-0.52359	0.82369	27	29	59	56	69	15	27	57
28	0.44945	-0.15294	-0.79257	-1.06172	0.54862	0.13322	-0.02595	28	55	38	13	13	61	46	38
29	0.05563	1.85080	-0.10372	-0.29888	-0.62384	0.45080	-2.25592	29	44	74	40	29	20	57	1
30	-0.07242	1.43014	-0.11169	-2.08066	-0.92561	3.62167	0.23033	30	42	67	39	1	6	76	45
31	-0.65272	-0.84428	-0.69050	-0.24716	0.04156	-0.08378	0.05177	31	26	16	16	33	46	41	40
32	-0.88302	-0.79643	-0.84864	-1.16762	-0.07127	0.33796	-0.60002	32	17	19	10	8	41	53	22
33	-1.08091	-0.79958	-0.04342	-0.89150	0.54166	-0.38825	0.32104	33	7	17	45	18	60	35	46
34	1.10692	1.86224	0.15006	1.75735	-0.82856	-0.81291	1.05191	34	63	75	50	72	9	16	64
35	-0.16816	-0.60204	-0.05515	-0.90462	-0.56164	0.32225	-0.11563	35	38	27	43	17	25	52	34
36	-0.02908	-0.71337	0.28645	0.02474	0.09010	0.51014	-0.79478	36	43	23	55	42	50	59	19
37	0.28376	1.24623	1.79679	1.18271	0.32684	1.32761	1.10046	37	48	65	72	64	56	68	66
38	1.82245	0.46061	0.92517	-0.07925	2.25821	0.33803	-0.58709	38	73	54	66	40	73	54	23
39	0.37086	1.81345	1.46637	-0.59064	-0.54899	1.07484	1.30975	39	52	72	71	23	26	65	69
40	-1.33961	1.82928	0.42029	-0.95704	-0.70602	-0.87694	-0.40078	40	4	73	59	15	13	14	27
41	-1.00724	-0.18173	0.96012	0.52287	1.08215	0.82662	-0.90423	41	9	37	68	55	68	62	16
42	-0.95503	0.43637	0.94534	0.04396	1.98136	1.14403	1.33993	42	11	52	67	43	71	67	70
43	-0.92231	-0.21993	0.48707	0.49610	0.19240	0.20933	-0.39216	43	14	35	61	53	53	48	28
44	-0.58390	-0.00739	-0.52929	-0.59468	0.02331	-1.09598	-0.54182	44	28	42	19	22	45	6	24
45	2.29892	-0.87763	1.94891	0.55066	-0.62827	0.05742	1.06815	45	75	14	74	57	19	45	65
46	-0.65120	-0.97416	1.92596	1.39102	-0.37441	0.74344	-0.81172	46	27	12	73	68	32	61	17
47	0.40043	-1.22944	0.29629	1.04315	0.70330	-0.82688	-1.05053	47	54	9	57	62	64	15	13
48	0.23395	-1.45304	0.25491	-0.23174	-0.38303	-0.24773	0.43335	48	45	7	54	35	31	39	50

49	-0.82400	0.52492	1.34867	-1.06364	-0.56970	0.32179	0.99534	49	20	56	70	12	24	51	62
50	-0.89715	1.38000	-0.04683	0.55499	0.10346	-0.89761	0.12779	50	15	66	44	58	51	13	43
51	-0.86016	-0.85206	-0.19111	-0.42197	1.70797	-0.58167	1.22055	51	18	15	33	27	69	25	67
52	-1.28362	0.48211	-0.30066	1.83804	2.10713	1.92583	0.86185	52	5	55	29	73	72	73	60
53	1.43977	0.85943	0.79066	-0.19952	0.08279	0.62933	0.19530	53	69	60	63	37	48	60	44
54	0.67407	-0.79913	-0.49282	1.68732	-0.64525	-0.31721	0.75419	54	58	18	21	71	18	38	55
55	-0.11748	-0.78289	-0.01413	-0.13478	-0.98280	-0.42493	0.43981	55	40	20	47	39	5	32	51
56	2.56145	-0.12432	-0.14648	-1.11746	0.20609	-1.29808	1.35036	56	76	39	37	11	54	3	71
57	-0.75174	-0.43952	0.20675	1.93688	0.84775	-0.48797	-0.06241	57	23	28	51	76	66	30	37
58	-0.88438	-1.52535	0.90311	0.53129	-0.51592	-0.40835	-0.06546	58	16	2	65	56	27	33	36
59	0.25009	-0.22407	0.25115	0.13959	0.06077	-0.43911	-1.82328	59	47	34	53	45	47	31	3
60	-1.02790	-0.34434	0.23981	-0.55059	0.55187	-1.32120	0.90629	60	8	31	52	24	62	2	61
61	-0.41205	0.05149	0.54974	-2.05529	-0.17317	-0.90960	0.61601	61	34	43	62	2	37	12	52
62	-0.77636	0.09445	-1.22373	-1.15912	-0.09311	-0.78922	-0.16931	62	21	44	8	9	40	20	33
63	-0.42744	0.44067	-1.58126	-0.85429	-0.80998	0.45427	0.10653	63	33	53	3	19	10	58	42
64	-0.44854	1.60495	0.86301	0.84355	2.29592	-1.03664	0.85539	64	32	70	64	59	74	7	59
65	1.30055	-1.48279	-1.28814	-0.23277	2.93601	1.41511	-0.54135	65	64	5	7	34	76	69	25
66	-0.51102	-0.35539	-1.37535	0.46016	0.23591	-0.80947	-1.62726	66	30	30	5	52	55	18	7
67	0.77318	-0.69782	-0.41391	-0.45603	2.63023	1.11073	1.81598	67	60	24	23	26	75	66	75
68	0.34952	-1.47207	-0.54196	-0.60248	0.49949	-1.25326	-0.40690	68	50	6	18	21	59	4	26
69	-0.45409	-1.05994	-0.39496	1.02209	-1.26351	0.42135	-0.27665	69	31	10	24	61	4	56	30
70	1.87640	-1.27784	-0.17418	-0.22562	-1.81908	2.29059	0.61885	70	74	8	35	36	2	74	53
71	-0.98764	0.30309	-0.30964	1.62251	-0.31021	-0.39385	-1.30864	71	10	51	28	70	34	34	8
72	-1.48879	0.23735	0.04254	-0.00733	-0.01125	0.29101	-0.25514	72	2	50	49	41	44	50	31
73	-0.83227	-1.48990	0.47245	0.16275	0.71827	1.88720	1.22373	73	19	4	60	47	65	72	68
74	-0.21692	-1.00902	-1.66175	0.15029	-2.58287	2.54389	0.08490	74	36	11	2	46	1	75	41
75	-1.36332	-0.73208	-0.48214	0.29086	-0.70295	-0.32060	2.10600	75	3	22	22	49	14	37	76
76	-0.14025	0.60440	-0.26689	1.92070	-0.73237	-0.66703	0.43202	76	39	58	30	75	12	23	49

Note: The scores are numbered such that numbers 1 to 34 represent positive associations (agreement with statement) and 36 to 76 are negative associations (disagreement with statement), 35 is the neutral position.

### Standard Error Calculations for N=76

significance level = 0.01 (99% confidence),  $Z=2.58$ :

$$\text{standard error (s.e.)} = \frac{1}{[s (\text{sq.root of } N)]} \quad \text{s.e.} = \frac{1}{[(\text{sq.root of } 76)]} = \frac{1}{8.7178} \quad \text{s.e.} = 0.1147$$

As a rule of thumb, correlations are significant if they are approximately 2 to 2.5 times greater than the standard error, but this study targets a significance level = 0.01, ( $Z=2.58$ )

Hence, correlations are significant if they are an average of:

$$2.58 \times 0.1147 = 0.2959$$

Hence, loadings in excess of +/- [0.2959] are statistically significant with 99% confidence.

## APPENDIX VI

List of plant species found in Establo (including the areas of San Luis, El Destino, and San Franciso), in Pinar del Rio Province, Cuba.

\*The following list of plant species were recorded by Ms. Ramona Oviedo Prieto of the Institute of Ecology and Systematics (Cuba), during May-June of 1995. Plant uses were dictated by the people living in the area, special thanks to Sr. Peña Infante for contributing and reviewing the list. The work was conducted in cooperation with the thesis work of Gina LaHaye on-site in the communities of Establo (and including the areas of San Luis, El Destino, and San Franciscó), in Pinar del Río Province, Cuba. Scientific names are followed by their local common name.

Gina LaHaye, Saint Mary's University, Canada

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LISTADO FLORISTICO PRELIMINAR DEL ASENTAMIENTO "EL  
ESTABLO"  
RESERVA DE LA BIOSFERA SIERRA DEL ROSARIO.

Scientific Name	Common Name	Local use of plant
<u>Acanthaceae</u>		
<i>B. leperone guttata</i> , Bradegoe	"Cola de Camarón"	Tilo leaves in hot water to sleep well, calms the nerves
<i>Justicia pectoralis</i> , Jacq	"Tila", "Tilo"	
<i>Thumbergia alata</i> , Bojer	"Anteojito de Poeta"	
<i>Thumbergia erecta</i> , T Anders	"Tumbergia"	
<i>Thumbergia fragrans</i> , Roxb	"Jazmin del Vedado"	
<u>Araceae</u>		
<i>Anthurium cubense</i>	"	feed to animals to increase milk production
<i>Caladium bicolor</i> vent	"corazón de cabrito"	
<i>Dieffenbachia</i> sp,	"Malanga de la dicha"	
<i>Philodendron lacerum</i> , (Jacq)Schott	"Bejuco lombricero"	
<i>Philodendron</i> sp.	"	ornamental
<i>Syngonium auritum</i> (L.) Schott	"Malanga trepadora"	
<i>Scindapsus aureus</i> Engl.	"Malanga trepadora"	
<i>Xanthosoma</i> sp.	"Malanga"	
<u>Agavaceae</u>		
<i>Agave</i> sp.	"Maguey"	
<u>Alliaceae</u>		
<i>Allium porrum</i> , L.	"Ajo porro"	cooking flavour
<i>Allium sativum</i> , L.	"Ajo"	cooking flavour

**Amaranthaceae**

<i>Amaranthus cruentus</i> , L.	"Moco de Pavo"	ornamental
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**Amaryllidaceae**

<i>Crinum</i> spp.	"Lirios"	ornamental
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**Anacardiaceae**

<i>Anacardium occidentale</i> , L.	"Marañón"	edible fruit
<i>Mangifera indica</i> , L.	"Mango"	edible fruit
<i>Spondias purpurea</i> , L.	"Ciruela"	edible fruit

**Apliaceae**

<i>Foeniculum vulgare</i> , mill	"Hinojo"	
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**Arecaceae**

<i>Caryota urens</i> , L.	"cola de pescado"	
<i>Cocos nucifera</i> , L.	"Cocotero"	
<i>Chamaedorea</i> sp.	"Chamaerodia"	
<i>Chrysalidocarpus lutescens</i> , W. Wendel.	"Areca"	ornamental
<i>Roystonea regia</i> , O.F Cook	"Palma real"	many uses!, wood for building, ruit for animals (pigs), leaves for roofing

**Apocynaceae**

<i>Allamanda cathartica</i> , L.	"Alamanda"	
<i>Nerium oleander</i> , L.	"Rosa francesa", "Adelfa"	ornamental
<i>Catharanthus roseus</i> , L., G. Don	"Vicaria"	for eye problems, cleans eyes
<i>Plumeria rubra</i> , L.	"Lirio tricolor"	ornamental
<i>Thevetia peruviana</i> , (Revs) Schum	"Cabalonga"	

**Annonaceae**

<i>Annona muricata</i> , L.	"Guanabana"	big edible fruit
<i>Annona reticulata</i> , L.	"Chirimoya", "mamón"	edible fruit
<i>Annona squamosa</i> , L.	"Anón"	edible fruit

**Asteraceae**

<i>Ambrosia artemisifolia</i> L.	"Artemisa"	
<i>Artemisa</i> cf <i>absinthium</i> L.	"Inciense" "ajeno"	
<i>Bidens pilosa</i> L.	"Romerillo"	for relief of chest colds
<i>Chrysanthellum</i> sp.	-	
<i>Eupatorium odoratum</i> , L.	"Rompesaraguey"	for relief of muscle pain and
tension		
<i>Isocarpha</i> sp.	"Manzanilla Cubana"	for relief of diahhrrea
<i>Matricaria chamomilla</i> , L.	"Manzanilla Alemana"	
<i>Montanoa hibiscifolia</i> , C. Koch.	"Montanoa"	
<i>Pluchea carolinensis</i> , Jacq G Don,	"Salvia cimarrona"(sweet)	leaves for relief of pneumonia
<i>Pseudelephantopus spicatus</i> (Juss) Rohl	"Lengua de vaca"	cooking
<i>Tagetes erecta</i> , L.	"Flor de muerto" "Chambergo"	for relief of tooth gum pain
<i>Verbesina alata</i> , L.	"Botoncillo"	

**Araliaceae**

<i>Aralia</i> sp.	"aralias"	
<i>Digigotica</i> sp.	-	
<i>Polyscias</i> sp.	"Aralia grande"	

Asclepiadaceae

Calotropis procera (Ait) R. Br.	"Algodon de Seda"	many uses, relief of earache
Cryptostegia grandiflora (Roxb) R. Br	"Estrella de Norte"	

Boraginaceae

Tournefortia hirsutissima L.	"Nigua peluda"
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Balsaminaceae

Impatiens balsamina L.	"Madama"
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Bignoniaceae

Crescentia cujete L.	"Guira"
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Bixaceae

Bixa orellana, L.	"Bija"	cooking colorific
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Bombacaceae

Ceiba pentandra, (L.) Gaertn.	"Ceiba"
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Bromelaceae

Ananas comosus (L.) Merrill	"Piña"	edible fruit
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Burseraceae

Bursera graveolens Triana & Planch	"Sasafrás"	relief of coughing, stomach
Bursera simaruba (L.) sargent aches	"Almácigo"	

Caesalpinaceae

Bauhinia cumianensis HBK.	"Bejuco tortuga"	cooking, urinary pain relief
Bauhinia vaiegata L	"Arbol orquidea" "Casco de vaca"	
Caesalpinia pulcherrima (L.) Sw.	"Guacamaya"	relieves some skin problems
Caesalpinia violacea (mill) standley	"Yarua"	
Cassia alata L.	"Guacamaya Francesa"	
Cassia ligustrina L.	"Guanina" Sen"	
Delonix regia (Bojer) Raf.	"Framboyan rojo"	

Clusiaceae

Clusia rosea Jacq.	"Cocy"
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Combretaceae

Terminalia catappa L.	"Almendo de la India"
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Commelinaceae

Rhoeo spathacea (sw) stearn	"Cordol an"	relief of colts
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**Capparaceae**

*Cleome spinosa* Jacq. "Volantin"

**Crassulaceae**

*Kalanchoe* sp.  
*Kalanchoe pinnata* Pers. "Siempre viva" ornamental

**Caricaceae**

*Carica papaya* L. "Fruta bomba" edible fruit, sweetener

**Cactaceae**

*Cereus hexagonu* (L) Mill "Cactus columnaris"  
*Hylocercus undatus* Britt Rose "Pitahaya", "Flor de Cadiz"  
*Nopalea cochinellifera* (L) salm dyck "Tuna"

**Convolvulaceae**

*Ipomoea batatas* (L.) Lam "Boniato" edible legume

**Cucurbitaceae**

*Benincasa hispida*, Cong "Calabaza China" edible sweet legume  
*Cucurbita moschata* Duch "Calabaza" edible legume  
*Luffa cylindrica* Roem "Estropajo" cleaner for dish, etc.  
*Sechium edule*, Sw. "Chayote" cooking, salads  
*Trichosanthes* sp. "Tomate Angolano" cooking, salads, puree

**Cruciferaeae**

*Brassica Oleracea* L. "Col" cooking, salads

**Casuarinaceae**

*Casuarina equisetifolia* L. "Casuarina", "Pino de Australia" wood has many uses, furniture etc.

**Ebenaceae**

*Diospyros* sp. -

**Euphorbaceae**

*Acalypha* sp. "Rabo de gato"  
*Breynia disticha* forst "Nevada", "Nieve"  
*Codiaeum variegatum* Blum var "Croton"  
*Euphorbia* mill ch des moulins "Corona de Cristo"  
*Euphorbia pulcherrima* wild "Flor de Pascua"  
*Euphorbia tirucalli* L. "Palito chino" "Disciplinilla"  
*Euphorbia trigona* Haw. "Cardon"  
*Jatropha aethiopica* muell. arg "Matadiabetis"  
*Jatropha curca* L. "Piñon de Botija" fence posts  
*Jatropha integerrima* Jacq "Peregrina"  
*Jatropha multifida* L. "Nuez Vomica Cubana" "Ceibilla"  
*Manihot esculenta* Crantz "Yuca" edible legume  
*Pedianthus pithymaloides* (L). Pot "Itamo Real" ornamental

**Fabaceae**

*Arachis hypogaea* L.  
*Cajanus indicus* Spreng  
*Erythrina* sp.  
*Erythrina variegata*  
*Girardinia septium*, Kth  
*Vigna sinensis*, savi.

"Mani"  
"Gandul"  
"Piñon"  
"Piñon"  
"Piñon amoroso" "Bienvestido"  
"Frijol de Caritas"

edible fruit, sweets  
cooking  
fence posts  
edible legume (beans)

**Gesneriaceae**

*Episcia cupreata*, hauss

"Episcia"

**Geraniaceae**

*Pelargonium graveolens* L.

"Geranio de olor"

ornamental

**Helecho**

*Nephrolepis exaltata*, Schott

"helecho macho"

ornamental patio flower

**Lauraceae**

*Persea americana* Mill

"Aguacate"

edible fruit (avocado)

**Lamiaceae**

*Coleus blumei*, Benth  
*Hyptis verticillata*, Jacq  
*Ocimum basilicum* L.  
*Ocimum basilicum* L. var *purpureum*  
*Ocimum gratissimum* L.

"Manto de la virgen"  
"Malva apesada" "Coge mundo"  
"Albahaca"  
"Albahaca morada"  
"Oregano cimarron"

ornamental  
deodorizer for bathroom  
relief of coughs, chest congestion  
food spice, roots relieve chest congestion

**Lithraceae**

*Lagerstroemia indica* L.

"Jupiter"

fence posts, house construction, charcoal

**Liliaceae**

*Asparagus plumosus* Baker  
*Asparagus sprengeri* Regel  
*Dracaena drago* L.  
*Dracaena fragrans* Ker Gawl  
*Sansevieria* sp.

"Esparrago plumoso"  
"Esparrago Espriñ"  
"Drago de canarias"  
"Dracaena" "Falso Inlag Ilang"  
"Lengua de vaca"

**Meliaceae**

*Azadirachta indica*  
*Swietenia macrophylla* King

"Arbol del Nim"  
"Caobas de Honduras"

mahogany wood has many uses

**Moraceae**

*Cecropia peltata* L.  
*Ficus* sp.

"Yagruma"  
"Piñon de México"

**Myrtaceae**

*Eucalyptus* sp.

"Eucalipto"

extract oil for medicine, wood used in construction

*Psidium guajava* L.  
*Punica granatum* L.

"Guayaba"  
"Granada"

fruit used as sweetener in foods  
fruit used in liquid as throat gargle

**Musaceae**

Musa sp. weeds	"Platano"	edible fruit (banana), leaves control
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**Mimosaceae**

Pithecellobium dulce Benth.	"Inga dulce"	
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**Malvaceae**

Gossypium cf arboreum L. as Hibiscus elatus L. Hibiscus rosasinensis L.	"Algodón" "Majagua" "Marpacífico"	edible fruit with many uses, fruit used a gauze and to clean a wound; wood has many uses
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**Malpighiaceae**

Thyallis glauca(cav) Kuntze	"Granito de oro"	ornamental
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**Nyctaginaceae**

Bougainvillea spectabilis, wild Mirabilis jalapa L.	"Buganvil" "Flor de papel" "Maravilla"	ornamental flower ornamental flower
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**Oleaceae**

Jasmin simplicifolium Forst	"Jazmin café"	perfume, ornamental
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**Orchidaceae (orchids)**

Catleya trianaei, Linden & Reichb	"Catleya"	
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**Passifloraceae**

Passiflora edulis, Sims	"Maracuyá"	
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**Pinaceae (pine trees)**

Thuja orientalis L. Pinus caribaea Morel.	"Tuya" "Pino macho"	wood has many uses
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**Piperaceae (vines)**

Peperomia obtusifolia Piper articulatum L. Piper auritum HBK. Piper ossanum,	"Charol" "Pimiento de sabana" "Calsimon de anís" "Trel Platanillo de Cuba"	
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**Poaceae**

Cymbopogon citratus (Dc) strapf Saccharum officinarum L. Zea mays L.	"Caña santa" "Hierba de limon" "Caña de azúcar" "Maiz"	leaf used in tea to relieve colds sugar cane many uses, dried cane burned for energy corn, eaten by humans and animals
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**Portulacaceae**

Portulaca oleracea L.	"Verdolaga"	herb
Portulaca pilosa L.	"Diez del dia"	ornamental

**Rutaceae**

Citrus aurantium L.	"Naranja agria"	
Citrus Grandis osbeck	"Toronja"	
Citrus Limon (L.) Burm.	"Limon"	
Citrus reticulata Blanco	"Mandarina"	
Citrus sinens L Osbeck	"Naranja dulce"	
Muraya paniculata L Jack	"Murallera"	
Ruta graveolens L.	"Ruda"	medicinal plant

**Rosaceae**

Eriobotrya japonica L	"Nispero del Japon"	edible fruit
Rosa sp.	"Rosas"	rose flower, ornamental

**Rubiaceae**

Coffea arabica L.	"Cafe"	coffee drink and flavour
Gardenia jasminoides Ellis	"Gardenia"	ornamental flower
Ixora coccinea L.	"Santa Rita", "Isora"	
Pentas coccinea stapf	"Pentas"	

**Sapindaceae**

Melicocca bijugatus Jacq.	"Mamoncillo"	edible fruit used in juices
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**Solanaceae**

Brulfelsia jamaicensis Griseb.	"Dama de noche"	ornamental flower
Capsicum frutescens L var cachucha	"aji cachucha"	cooking, seasoning
Capsicum frutescens L var guaguao	"aji guaguao"	cooking, spicy seasoning
Cestrum diurnum L.	"Galan de dia"	ornamental flower
Cestrum noctunum L.	"Galan de noche"	ornamental flower
Nicotiana tabaun, L.	"Tabaco"	leaves smoked, famous Cuban cigars

**Sapotaceae**

Chrysophyllum caimito L.	"Caimito"	edible fruit
Manilkara zapotilla (jacq) Gilly.	"Nispero", "Zapote"	edible fruit
Pouteria campechiana (H.B.K.) Bachai.	"Canistel"	edible fruit
Pouteria dominguesis (Gaertn) Baehni.	"Sapote culebra"	edible fruit
Pouteria mammosa (L.) Cronquist.	"Mamey Colorado"	edible fruit, delicious

**Sterculiaceae**

Guazuma ulmifolia Lam	"Guasima"	wood used as low grade
charcoal		

**Scrophulariaceae**

Capraria biflora L.	"Escabiosa"	
Thecroma cacao L.	"Cacao"	

**Turneraceae**

Turnera ulmifolia L.	"Marilope"	
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Verbenaceae

Clerodendrom speciosum (Dombrain) Moldenke	-	
Duranta repens L.	"No me olvides"	
Lantana camara L.	-	
Lantana trifolia L.	"Filigrana"	herbal use
Lippia alba(mill) N.E Brown	"Quita dolor" "menta americana"	mint
Vitex agnus castua L.	"Vencedor" "Incienso japonés"	incense
Vitex trifolia	"Vencedora"	ornamental

Urticaceae

Pilea microphylla Liebm	"Frescura"	
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Vitaceae

Cissus sicyoides L.	"Bejuco ubi"	for relief of coughs
Vitis tiliacfolia H et B	"Parra cimarrona"	ornamental

Zingiberaceae

Alpinia pupurata	"Alpinia"	
Hedychium coronariun Koem	"Mariposa"	ornamental

## APPENDIX VII

**List of commercially planted forest tree species  
(from poster at field research station, Sierra del Rosario)**

List of commercially planted forest tree species (from poster at field research station, Sierra del Rosario)

1. Pinus caribaea
2. P. tropicalis (mainly on sandy or eroded soils)
3. P. cubensis
4. P. maestrensis
5. Eucalyptus saligna
6. E. grandis (above 300m)
7. E. pelida
8. Cedrela cubensis (Cedro macho)
9. C. odorata (Cedro hembra)
10. Swietenia mahagoni
11. Tectona grandis
12. Casuarina equisetifolia
13. Hibiscus elatus
14. H. tiliaceus
15. Cordia gerascanthus
16. Roystonea regia
17. Terminalia eriostachya
18. Grevillea robusta
19. Khaya spp. (Africana)
20. Albizia falcataria

## APPENDIX VIII

### List of forest tree species used in agroforestry

Appendix VIII. List of forest tree species used in agroforestry (from Renda-Sayous, Arsenio R. *et al*, 1994, p.16).

<u>Common Cuban Name</u>	<u>Scientific Name</u>
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Species traditionally used as shade trees in coffee production:

Algarrobo	<u>Samanea saman</u> (Jacq.) Merril
Búcare	<u>Erythrina poeppigiana</u> (Walp.) O.F. Cook
Guamá	<u>Lonchocarpus dominguensis</u> (Pers.) DC
Piñón florido	<u>Gliricidia sepium</u> (Jack.) Kunth ex Walp
Jobo	<u>Spondia mombin</u> Lin

Species used for shade and harvested for precious wood, fruit, etc.:

Cedro	<u>Cedrela odorata</u> L.
Baría	<u>Cordia gerascanthus</u> Lin.
Jocuma	<u>Mastichodendron foetidissimum</u> (Jacq.)
Majagua azul	<u>Hibiscus tiliaceus</u> L.
Majagua	<u>Hibiscus elatus</u> Sw.
Yamagua	<u>Guarea guidonia</u> (L.) Sleumer
Palma real	<u>Roystonea regia</u> (H.B.K.) O.F.Cook
Eucalypto	<u>Eucalyptus</u> spp.
Caoba de Honduras	<u>Swietenia macrophylla</u> , King.
Roble australiano	<u>Grevillea robusta</u> A. Cunn
Teca	<u>Tectona grandis</u> L.F.
Caoba Africana	<u>Khaya</u> sp.
Albizia	<u>Albizia falcataria</u> (L.) Fosberg
Mango	<u>Mangifera indica</u> L.
Aguacate	<u>Persea americana</u> Mill.
Guayaba	<u>Psidium guajaba</u> L.
Cítricos	<u>Citrus</u> sp.
Caimitillo	<u>Chrisophyllum oliviforme</u> L.
Mamey colorado	<u>Pouteria mammosa</u> (L.) Cronquist
Guáráno	<u>Cupania macrophylla</u> A.Rich

And more recently,

Pino macho, Pino amarillo	<u>Pinus caribaea</u> Morelet
Pino	<u>Pinus cubensis</u> Griseb.
?	<u>Leucaena leucocephalla</u> (Lam.) De Wit.
Aroma blanca/mans	<u>Leucaena glauca</u>

APPENDIX IX  
Map of Cuba

Appendix IX: Map of Cuba locating Sierra del Rosario and Establo. Geographic coordinates for the SRBR are 22°47' to 22°54'N longitude, and 82° 52 to 83°00'W latitude.

