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Title:

**A Socio-Economic Study of the Community Based Management of Mangrove Resources in
St. Lucia**

Forestry

Natural Resources Management

Introduction

Mangrove forests occur at the interface between land and sea in areas with flat and protected shorelines throughout the tropics. Although the exact extent of mangroves worldwide is not well known, in the Western hemisphere it is estimated that mangroves occupy over 5.8 million hectares (FAO 1994). Mangroves are unique ecosystems, which provide habitat for a wide diversity of plants and animals. They also provide many valuable products and services to human populations, many of which, such as shoreline protection and stabilization, are only recently being recognized. However, local communities the world over have long exploited mangroves for timber, fish, and various other goods which the forest provides.

Mangroves have come under increasing pressure of late as the need to provide economic opportunities has grown along with expanding populations. Again, no exact figures are available, but some estimate that as much as one million hectares of mangrove are destroyed annually worldwide (Hutchings and Saenger 1987). The growth of the aquaculture industry, conversion for coastal development, and timber harvesting have contributed to this phenomenon (Farnsworth and Ellison 1997). Such actions of course threaten to displace those who traditionally made their livelihoods from the mangrove (Kunstadter 1985). In many areas of the tropics, much of the value of mangroves stems from their sustainable utilization by local communities for the timber, fish and other resources available in the forest (Pons and Fiselier 1991). In many cases, a choice is made between pursuing a single economic use such as aquaculture, and preserving the forest for the multiple uses which it supports (Kunstadter 1985).

Increasing recognition of the value of the ecosystem services and timber and non timber goods that mangroves produce has led to conservation initiatives in many countries. However, as is the case with many environmental features, the preservation of these forests for their existence value alone is not a likely prospect (Thomas et al. 1991). Local people must be assured that they will benefit from the conservation of the forest more than they would from its destruction, either from the revenue stream resulting from exploiting mangrove resources on a sustained basis or through capturing a portion of whatever economic gains may spring from conservation, such as ecotourist revenue.

In order to make this determination, socio-economic data on the status of communities associated with mangroves, and how they use the mangrove must be gathered. This particular area has long been in need of attention from those concerned with mangrove conservation (Farnsworth and Ellison 1997). In a small step towards addressing this deficiency, this study documents the socio-economic aspects of the common property institutions for managing charcoal production from a small basin mangrove in St. Lucia.

Earlier studies have described the physical condition of the mangrove, called Mankote, both prior to and after the management intervention that resulted in the establishment of a resource users group (Smith and Berkes 1993). This study documents the socio-economic importance of charcoal production at the household level in order to observe the contribution that this occupation may make towards the creation of a sustainable livelihood for the resource users. Secondly, the present research offers a continued, although not continuous, time series of

charcoal production data, from 1989 through 1996. This information is presented to determine whether production is increasing or decreasing, both in terms of value and in volume. Finally, this information is placed in the context of the institutional management apparatus that has been developed to control access to and use of the mangrove.

STUDY AREA AND METHODS

St. Lucia is a small island country in the southern half of the Lesser Antilles in the eastern Caribbean (Fig. 1). The particular forest under study, Mankòtè Mangrove, is located on the southeast coast of the Island a short distance to the north of Vieux Fort (Fig. 2). It is a basin mangrove, cut off from the sea for much of the year by a sandbar. Much of the freshwater input to the mangrove comes from the St. Urbain Ravine, which flows down from the hills west of the mangrove, through agricultural lands, a land fill, and cattle pastures before emptying into the forest. To the south and southeast, the mangrove is bounded by the property of a tourist resort and by the Atlantic Ocean. To the north are some low cliffs that separate the mangrove from Savannes Bay.

St. Lucia is a former colony of both France and Britain, the latter gaining control of the island in 1814. Independence from Britain was won in 1979, but the nation continues to be a member of the Commonwealth. One legacy of the colonial age is the economic predominance of export oriented monoculture. In the colonial period, sugar was the main product, and the remains of old sugar plantations dot the island still. Now, however, it is bananas which are the mainstay of the island economy. Banana cultivation accounts for 60% of the agricultural sector, which remains the largest employer on the island, providing a livelihood for 21.6% of the economically active population. The vast majority of this production is exported to Europe, which provides St. Lucia and other Windward Island banana exporters with a protected market, although this is currently the subject of negotiations with the World Trade Organization. In 1993 export revenues from bananas totaled approximately \$ 136 million E.C. (\$71.6 million CAD)(Government of St. Lucia 1994).

However, the economy is currently undergoing a major transition. Banana export earnings in 1993, fell over 25% from 1992. The decline is due to falling prices, changes in exchange rates against the pound sterling, and the intrusion of other suppliers into the European market (Government of St. Lucia 1994). Tourism has replaced bananas as the most dynamic growth industry in St. Lucia. Visitors to the island spent an estimated \$ 569 million E.C. in 1993 (\$299.5 million CAD), far exceeding the agricultural sector in value, but not in terms of employment generated. The hotel and restaurant sector accounted for only 9.9% of total employment in the same year (Government of St. Lucia 1994).

Despite the expanding tourism industry and the presence of light industry and manufacturing, the national unemployment rate is 16.7% of the labour force. Unemployment is particularly high among young people. Persons between the age of fifteen and thirty accounted for 70% of the unemployed (Government of St. Lucia 1994). In Vieux Fort, with a total population estimated at 14000 persons, 8971, or 68% are under the age of thirty and the national population continues to expand at a rate of 2.1 per cent per year. (Government of St. Lucia 1996; 1994).

METHODS

This research encompasses a diversity of investigative topics, including descriptions of land uses and management systems, basic economic analysis, and social impact analysis. However, the focus of the study was on the members of the resource users themselves, and their relationship to the mangrove. The nature of the research inevitably placed a heavy reliance on information obtained from local people, particularly members of the Group, many of whom have little in the way of formal education. Furthermore, the study was conducted by a single researcher, unfamiliar with the area and language, over the period of a mere fourteen weeks. A methodological framework was sought which was suitable these constraints. The methods applied in the study are a few of the suite of techniques which have been developed to carry out Rapid Rural Appraisal studies by Robert Chambers and researchers at the International Institute for Development Studies in Brighton, England (Chambers 1985).

The primary tool of researchers applying this framework is the semi structured, informal interview. Other techniques used in RRA analyses are the review of existing secondary materials about the study area or project, transect walks, direct observation, group interviews, diagramming, seasonal calendars, focus groups, learning by doing, and residence in the field (Chambers 1994 ; 1985; Gow 1990). Because these methods are not often subject to the same statistical rigor that applies to quantitatively analyzed surveys, cross checking of information obtained in informal interviews or other means is essential in establishing the reliability of the data. In RRA this is done by the use of triangulation, which involves checking all information with more than one, and preferably three, independent sources of information. This may involve, for example, the use of different methods, seeking the opinions of individuals from different groups, or data collection at different times (Chambers 1994b).

Some of the methods associated with RRA were used to solicit information about the resource management system of the Aupicon Charcoal and Agricultural Producer's Group for the mangrove. As this is a common pool resource, the subjects of interest for this investigation were derived from the work of Oakerson (1992) and Ostrom (1990), who have developed frameworks for the analysis of common property systems. Oakerson recommends that four principal areas must be investigated when analyzing common property systems. These are: the physical and technical attributes of the resource in question, the decision making arrangements which govern resource appropriation, the patterns of interaction which these rules result in, and the overall consequences or outcomes of the management regime. Within this framework, the system of management devised by the producers was also examined for the presence or absence of the seven factors identified by Ostrom (1990) as being common to enduring and robust common property management regimes, which include clearly defined boundaries of the resource and the group, congruence between appropriation rules and the local conditions, collective choice arrangements, monitoring, graduated sanctions, conflict resolution mechanisms, and the minimal recognition of the right to organize (Ostrom 1990).

The information presented here was gathered during the field study period which took place between May and August of 1996. During this time, the researcher resided in the village of

Pierrot, the same community as the majority of the charcoal producers active in the mangrove. The timing of the research was such that part of both the rainy season and the dry season were included, thus allowing any changes in occupations and harvest patterns which were the result of seasonal fluctuations to be observed, at least to some extent.

The initial week to ten days of the study period were devoted to conducting a review of secondary materials concerning the history of the project. The primary instruments of data collection in describing the management regime employed by the resource users were informal, unstructured interviews with Group members, and direct observation. The small number of producers working on any given day, and the relatively small size of the mangrove made it possible to speak with more than one producer in a day, and to return to the same informant for further discussions and clarifications many times over the research period.

Triangulation of information collected in these interviews was obtained by asking every member of the ACAPG similar questions about the same issues. Where relevant the information provided by informants was also checked with knowledgeable government officials and CANARI staff. Small group informal interviews were also used whenever the opportunity presented itself. Government personnel were vital sources of information regarding the legal and policy context in which the Charcoal Producers' Group operates. Also, many Government staff had been personally involved in the development of the integrated farm - woodlot project and were able to clarify and expand on information provided by the Group members themselves.

For charcoal production, data concerning the volume of charcoal production is collected on an ongoing basis by one of the ACAPG members. Although three different sizes of bags are used to transport and store the charcoal after it is produced, the various sizes are standardized to the equivalent of a small bag at the time of data collection. A small bag is known to hold four tins of charcoal. Each tin is sold at the market for \$7.00 E. C¹, giving a value of \$28.00/small bag. Production data from October of 1994 to September of 1996 were used to estimate the value of the harvest over those years. The quantity of charcoal was estimated by weighing a sample of small bags to establish a mean weight, which was then simply multiplied by the quantity of production. For the purposes of comparing that years' production levels with previous years, production data from 1989-1991 were used.

Of the menu of techniques described in the preceding discussion of RRA, not all were used in this research. Indeed, in some respects there were significant deviations from the methodological strictures of RRA. Principal among these is that RRA places great importance on the use of a multidisciplinary team in the field. The learning between the team members is considered only slightly less important than that which occurs between the team and the participants in the study (Chambers 1985). This element of the methodology was absent from this study, which was conducted by only one person. It will be for others to decide if this is a significant omission or not.

BACKGROUND

¹ \$1.00 Canadian = \$1.90 EC (Eastern Caribbean Dollars) in 1996

Mankòtè has a long history of exploitation by the population of the adjacent communities for a variety of uses, including timber harvesting, waste disposal, bathing, fishing and charcoal production. These activities were interrupted during World War Two and for some years thereafter by the presence of a U.S. Air Force base which used the mangrove to conceal aircraft. After the base was closed in 1960, local people began using the mangrove again (Smith and Berkes 1993). Charcoal is an important fuel resource due to its low cost, ease of transport and slow burning properties. Charcoal is also valued as part of the local culture and for the flavour it gives food prepared with it. The alternative to charcoal is bottled gas, but many residents continue to prefer charcoal, especially for longer cooking tasks (Smith and Berkes 1993). This applies particularly to lower income families, who in many cases cannot afford the initial capital investment of gas stoves (World Wildlife Fund 1988).

In 1981, the Caribbean Natural Resources Institute (CANARI) identified the Mankòtè area as a priority for conservation as part of a larger assessment of the development and conservation requirements of the country's southeast coast conducted for the St. Lucia National Trust and the Government (Walters and Burt 1991). Descriptive surveys conducted subsequently revealed that the mangrove resource was under pressure from over harvesting by charcoal producers, and from the use of the area as a waste disposal site for the local population. CANARI subsequently began a dialogue with the charcoal producers and others to identify possible solutions. In 1986, the mangrove was declared a marine reserve area, and waste dumping has been curtailed, although not eliminated altogether (Smith and Berkes 1993).

As part of its ongoing conservation and development program in Mankòtè, CANARI has aided in the establishment of a communal resource users group, consisting of some of the previously existing loose coalition of charcoal producers who acted to regulate charcoal production in the mangrove to some degree. Working in collaboration with various Government agencies, CANARI has sought to implement an integrated rural development project which incorporates both improved management of the mangrove itself and the use of government owned land for a combined fuelwood plantation and farm managed by the group. The group, known as the Aupicon Charcoal and Agricultural Producers' Group (ACAPG) is now the sole agent authorized by the Department of Fisheries to extract resources from the mangrove, and they are able to prevent open access to the resource to some extent (Smith and Berkes 1993).

Surveys conducted in 1992 revealed an increase in the amount of timber available in the mangrove. This is most remarkable given that, as discussed later, this increase was coincident with intensified harvesting activities (CANARI Report on Activities 1993). Researchers have attributed this improvement largely to the adoption of less destructive harvest methods by the Aupicon Charcoal and Agricultural Producers' Group (Smith and Berkes 1993).

The Aupicon Charcoal and Agricultural Producers' Group has collectively acted as both stewards and exploiters of the timber resources found in Mankòtè Mangrove for over a decade. They have done so through the institution of a community based common property resource management system. Previous research in Mankòtè has identified the granting of exclusive rights and responsibilities to the ACAPG as a critical factor in the conservation of the resource. By controlling access and assuring that the group will benefit in the future from the continued

existence of the forest, a clear motivation for preserving the resource has been established (Smith and Berkes 1993). The Aupicon Charcoal and Agricultural Producers' Group is currently engaged in the development of a co-management agreement with CANARI and the Government of St. Lucia which will formalize the producers rights of access to resources exploited in Mankòtè Mangrove. To date, their rights and responsibilities in this regard have been largely a matter of custom and tacit agreement on the part of the Government. In return, the producers will be partially responsible for management of the resource (CANARI 1995).

This is being done as part of a nationwide management initiative for the management of beaches and mangals which seeks to establish local management authorities (LMAs) under the authority of the Fisheries Act. These LMAs are intended to provide local control over coastal resource use and to involve communities in the integrated management of those resources (K. Nichols, Deputy Director, Department of Fisheries, pers. comm. 1996).

SOCIO - ECONOMIC ANALYSIS OF CHARCOAL PRODUCTION

For many people in the developing world, especially in rural areas, livelihoods are wrested not from a single occupation to which all their energy is devoted, but from a number of economic activities. The diversity of income sources spreads the risks associated with unanticipated misfortunes including bad harvests, low prices or sudden unemployment. Such is the case with most of the members of the ACAPG. It is therefore useful to describe the role which charcoal production plays in the socio economic strategies of the Group members, and how it contributes to their livelihood security. For the majority of group members, charcoal production is only one of two or three other occupations which together make up their livelihood strategies. While it was not possible to quantify the relative contributions of each, it was possible to determine a ranking of the importance of each to the household for most producers. This ranking will be complimented by an estimation of individual incomes based on field observations.

Figure 3 shows the considerable variation in the time required for production. The variable production times point out the flexible nature of charcoal production. Total production time varied between seven and twenty days, and averaged 12.6 days. The burn time varied between four and fourteen days, with an average of 6.8, and most often represented a large portion of the time required to make a pit of coal. For most producers, a working day is usually three or four hours, between the hours of five A.M. and noon.

The flexibility of the system allows producers to adjust the process to meet their particular needs at that point in time. Producers decide on the quantity of coals they want to make based on the amount of money they need, the time frame they need it in, and the amount of work they are prepared to do. The highly flexible process is also ideally suited to a subsistence strategy that relies on more than one source of income. The majority of the producers have more than one occupation demanding their time and should a job opportunity come along, charcoal making can be abandoned at any stage of the process and resumed at a later date. Thus there are few, if any, costs associated with leaving the mangrove to work elsewhere when possible.

Table 1 indicates the other employment engaged in by the charcoal producers. Only two producers responded that coal making was their sole means of support. However, of the producers who do have other occupations, coal making was regarded as their main occupation by all but four of them, two of whom are not group members, and therefore are not regularly working in the mangrove. Thus, coal making is the only or is the most important occupation for six out of the ten producers listed. In fact, the other occupations are in many cases used primarily to supplement the income from charcoal making. This is particularly true of the construction and agricultural laborer jobs listed in the table. The jobs used to supplement income from charcoal production are usually short term wage employment, which may last for a day or a week, rarely more. But these jobs have the advantage that the wages are paid at the end of every day. Because there may be as much as two weeks in between charcoal harvests, many of the producers rely on these short-term jobs, known as “hand to mouths” to provide cash to meet immediate needs. Because the charcoal making cycle is so flexible, they are able to work as long as the job lasts, and then resume coal production.

Of those for whom charcoal making is their most important or sole source of income, it is important to note that this is not merely what they do when other employment is scarce. The life of a charcoal maker is valued for the freedom it offers, and for the chance to work in relatively pleasant physical surroundings. Charcoal producers set their own hours, and are their own bosses, attributes which are highly valued by many of the group members. These benefits are in addition to that fact that charcoal production does in fact pay as well or better than most of the occupations open to the producers. The minimum wage in St. Lucia is \$5.40/hr E.C. (Department of Communications and Works 1996). A labourer in a factory or in agriculture was recorded as earning between \$25.00 and \$35.00 E.C. a day in 1992 (Espeut 1992). Charcoal producers engaged in these occupations confirm these numbers, saying that they earn between \$25.00 and \$30.00 E.C. a day in agriculture, and can make a maximum of \$45.00/day in construction. Usually, farm labour is a five-hour day, from seven to noon, and builders work a full eight-hour day. Thus daily wage rates roughly match that of the minimum wage.

Charcoal production can pay considerably more than this, for less time spent working. The average daily earnings of a charcoal producer are \$68.30 E.C. if the burn time is not included. Including the monitoring time as a day’s labour gives an average daily income of \$28.58 E.C. This compares favorably with the wages available in agricultural labor and construction, although it is less than the maximum amounts in those categories. But when one considers that the average work day in the mangrove is three to four hours, while that in agricultural labor is five, the hourly earnings for charcoal production using an average workday of 3.5 hours is \$8.16, which exceeds those available in the other occupations.

The figures in Table 2 below were derived from field observations, and provide empirical corroboration for the charcoal producers' own estimates of their monthly earnings from the mangrove. Informants believed that they could earn between \$800.00 and \$1000.00 month if they worked hard every day, but more realistically, they earn between \$500 and \$600. The figures shown below indicate that two weeks of work, including burning time, is capable of yielding \$600.00, and 20 days of work can yield over \$900.00. They also show that an estimate of \$500.00 to \$600.00 a month is reasonably accurate. The inputs required in this process are few

and inexpensive. As shown in Table 2, the mean input cost per production cycle is just over \$32.00 E.C. The inputs which comprise this total include the purchase of a new cutlass every three to four months, transportation of the coals to market, and the \$7.00 E.C. per load cost of a market stall in Vieux Fort. Most of the other required inputs such as storage bags, cardboard rolls, and paper used to build the pits, and the tools needed to cover them, are obtained at little or no cost from the town land fill.

CHARCOAL PRODUCTION

Charcoal production is the most important use of the mangrove in terms of both its economic value and its impact on the health and integrity of the forest. Therefore, monitoring the level of activity in the charcoal sector, including the number of participants and the volume of their production is a vital component of monitoring the status of the mangrove. Documenting the quantity and value of charcoal production also provides authorities with a better idea of the importance of the mangrove in providing a means of subsistence for the charcoal producers. The Aupicon Charcoal and Agricultural Producers' Group has been active in monitoring their own production and reporting these figures to CANARI since the mid 1980s. The data available permit a comparison between several years, although there is no continuous data covering the entire life of the project. These figures have been examined to detect changes in the quantity of charcoal harvested. Production from October of 1994 to September of 1996 has been used to document the total value of the charcoal harvest on an annual basis.

Total production for 1994-95 was 2007 bags of charcoal. Production fell by just over 27% in the next year, when only 1452 bags were produced. When multiplied by the average weight of a small bag, these totals give production volumes of 39.17 tonnes and 28.34 tonnes in 1994-95 and 1995-96 respectively. A small bag is sold in the market in Vieux Fort for \$28.00 E.C. Thus when these figures are totaled, the cash value of the charcoal harvest over the two years can be determined. In 1994-95, that figure was \$56,196 E.C. (\$29,576.84 CAD), and in 1995-96 \$40,656.00 E.C. (\$21,397.89 CAD) was earned by the Group. The decline in production between the two periods is attributable to two factors. Probably the most important is that, although the two figures continue to show the expected seasonal variation, the rainy season of 1995 was quite late, and much drier than usual. As a result, the producers were able to maintain production throughout the season largely unaffected by the presence of water in the mangrove. Secondly, there was, on average, one less producer working in the 1995-96 season. In 1994-95, the number of active producers ranged from five to nine over the twelve months, and the average was seven. In 1995-96, the number of active producers ranged from four to eight, and the average was 6.

Total production volumes for 1989-1991 have been estimated from the work of Smith and Berkes (1993). They show that production is slightly greater in the later time periods. In 1989-90, the total production was approximately 25.64 tonnes, and the next year showed an increase to 34.89 tonnes. This gives a total over the two years of 60.53 tonnes. In the two year period of 1994-1996, that total is 67.51 tonnes. This is a relatively slight difference, but is noteworthy because Smith and Berkes report between ten and fourteen active producers working in the mangrove in

the period between 1989 and 1991. In the more recent period, although the ACAPG numbered twelve members, no more than nine were actively making charcoal. This indicates that although the number of producers making charcoal on a regular basis has declined, production from the mangrove has not. This is consistent with the observations of community members who are familiar with the Group. They feel that although there are fewer people working, the mangrove is not harvested less. This is attributed to the fact that people used to be engaged in charcoal making on a very casual and part time basis, but now those who remain in the mangrove are devoting a greater effort to charcoal production. Subsequent to 1987, when the number of producers recorded reached a peak of 21, many producers gave up charcoal making in Mankòtè, either because they were unwilling to work in a collective context, or because other employment opportunities became available. In the period between 1989 and 1996, for which production data are available, between fourteen and six people working in the mangrove have maintained remarkably constant production volumes. The fact that the mangrove has been able to sustain this level of production over seven years indicates that the current harvest pressure is not causing further degradation of the forest. The charcoal production volumes for the years 1989-91 and 1994-1996 are summarized in Figure 4.

The fact that similar quantities of charcoal are being distributed among fewer people suggests that the remaining producers are realizing greater revenues from their work in the mangrove. The total income from charcoal production was \$57,111.00 E.C. in 1987, divided among 21 producers (Romulus 1987). This is the equivalent of \$62,690.45 E.C. in constant 1990 dollars. In 1994-95, total revenue is estimated at approximately \$46,213.82 E.C. and in 1995-96, \$32,287.17 in 1990 dollars. These revenues were distributed between a maximum of nine people, confirming the conclusions suggested by the production figures.

Table 3 shows the changes in income per person between 1987 and 1996.

The generally increasing per capita income confirms the conclusion that the producers who continue to be active in the mangrove are, on average, realizing a greater income from their work there than was previously the case. The constant production figures, and the fact that the remaining charcoal producers are earning more from their labour in the mangrove indicates that some measure of success has been achieved in the management of the forest, both in terms of preserving the resource and in enhancing the livelihoods of the charcoal producers.

However, while individual producers' incomes are increasing, the real value of the charcoal harvest from Mankòtè is doing the opposite. While the nominal value of the harvest has remained fairly constant between 1987 and 1996, the value of the charcoal harvest has not increased as fast as the price of other goods. Figure 5 shows the difference between the nominal and real value of the charcoal harvest in 1990 constant dollars. The graph shows that since the base year, 1990, the value of the charcoal harvest has not kept pace with inflation. This means that the real earnings of the charcoal producers are being eroded, and they are not able to buy as much with the charcoal they produce as they used to be able to. The presence of a powerful incentive to increase production raises the possibility that the sustainability of the harvest in the mangrove is by no means assured.

The entire volume of charcoal produced in the mangrove is sold in the town of Vieux Fort. Charcoal from Mankòtè remains an important source of cooking fuel for many residents of the town and surrounding communities. However, the Aupicon Charcoal and Agricultural Producers' Group are not the sole suppliers of charcoal to the Vieux Fort market. Charcoal is also produced on many farms located on the drier hillsides in the region when land is cleared prior to planting a new crop.

Part of documenting the importance of charcoal production in Mankòtè to the local community was to estimate the proportion of total charcoal demand in Vieux Fort which is met by the ACAPG. This is useful both as part of an assessment of the importance of the mangrove to the regional economy as an energy source, and because the ability of individuals within the ACAPG to dispense of their entire production at favorable prices is limited by competition. Accordingly, information was collected at various times in the Vieux Fort market about the origin of coal vendors who were not part of the ACAPG, and the quantities of charcoal these others brought to the community. This exercise returned results, summarized in figure 6, showing that Mankòtè charcoal accounted for between 18.5% of total consumption in June, 29.5% in July, and 22% in August.

The data do not warrant making any definite conclusions about the importance of Mankòtè to the coal market in Vieux Fort, but suggest that other areas contribute the majority of the charcoal consumed in the town, perhaps as much as four fifths to two thirds. This figure may in fact attribute too much to Mankòtè, since group production is over represented in the available data set. Due to the considerable limitations of these data, a second set of calculations were performed to provide an alternative assessment of the contribution of Mankòtè to the total charcoal consumption in Vieux Fort. A 1984 study of energy consumption in St. Lucia found the average charcoal consumption per household per year to be 330 kg (UNDP/World Bank 1984). In 1996, the number of households in Vieux Fort using charcoal for cooking on a regular basis was 482 (Department of Statistics 1996). This gives a total charcoal consumption in Vieux Fort of approximately 159,060 kg/yr. In 1995, Mankòtè supplied 39,177.64 kg to the town, or 24% of the total. In 1996, total production from Mankòtè was 28,343 kg, or 17% of the total. These figures suggest that an estimate of approximately twenty per cent of the total charcoal consumption of Vieux Fort being supplied by Mankòtè Mangrove is not unreasonable.

THE MANAGEMENT REGIME FOR CHARCOAL PRODUCTION IN MANKÒTÈ

In the area surrounding Vieux Fort, there is a strong local tradition of exploiting public lands for private uses. Virtually every open area is used by someone for grazing cattle, pigs and horses. Prior to the establishment of a resource users group in the early 1980s, the mangrove, like much of the surrounding public lands, was also an open access resource. Any person who so desired was able to fish, hunt, dump garbage and extract timber largely as they pleased. The open access nature of the resource, and the fact that there were large quantities of wood available in a small area led to an excess of harvest effort in the forest which threatened its survival.

In the 1980s, a survey indicated that there were 21 charcoal producers working in Mankòtè (Romulus 1987). Anecdotal evidence indicates that there were more in previous years, but the

rise of the banana industry and other employment opportunities in the region induced people to abandon coal making in favor of other occupations. During these years, this harvest pressure had seriously depleted the mangrove. By 1985, average stem diameter in Mankòtè was approximately 1.5 - 2 inches dbh, a decline of 3.5-4 inches from measurements taken five years previously. Work at the time with the charcoal producers indicated that they were well aware of the fact that the rate of harvest was not sustainable (Bossi and Cintròn 1985; Annias Verneuil, Dept. of Forest and Lands, pers. comm. 1997).

Discussions and formal workshops were then initiated with the active charcoal producers to identify possible options for the preservation of the mangrove. At this time, the Department of Forest and Lands was planning to begin experimenting with plantations of the fast growing species, *Leucaena*, and it was decided by CANARI, the Department of Forest and Lands, and the charcoal producers to initiate the planting of a woodlot on vacant Government land near the mangrove to provide an alternative source of wood for charcoal making to the natural forest. As well as initiating the fuelwood plantation, CANARI and the Department of Forests and Lands worked with the charcoal producers to develop harvest techniques for use in the mangrove, some of which were novel, and others which built upon traditional practices of the harvesters (CANARI 1994).

The people who coalesced around the fuelwood plantation project became the core members of the Aupicon Charcoal and Agricultural Producers' Group. Since the formation of the Group, the mean stand diameter of the trees in the mangrove has stabilized. As of 1992, the mean stand diameter had not changed significantly from 1986 measurements (Smith and Berkes 1993), indicating that the downward trend in the availability of timber which was observed in the early 1980s did not continue following the establishment of a users group.

Researchers have attributed this change to the adoption of improved cutting practices (Smith and Berkes 1993) which built upon many of the traditional harvest techniques used by the charcoal producers, but also introduced new and better ways of doing things. Perhaps the most significant change has been the virtual elimination of clearcutting in favor of a more selective harvest system which leaves the smaller stems for future growth. Similarly, some of the more experienced harvesters observed that piling slash on top of tree stumps impeded coppicing by preventing sunlight from reaching the stump. This knowledge has since been transmitted to all the Group members, and most are very careful to pile the slash in such a way that it is kept clear of the newly cut stumps.

In addition to introducing some widely accepted cutting standards, the formation of a resource users group has meant a decline in the number of active charcoal producers. Romulus (1987) found 21 people or teams of people to be active in the mangrove. In 1996, the official Group membership was 12 people, of whom a maximum of 9 were engaged in charcoal production in any given month. These people are the core of active charcoal makers around whom the Group was formed. The reasons for this decline are several. When the Group was initially formed, a decision was made by CANARI and the Department of Forest and Lands to encourage those who depended most on the mangrove to exert persuasive pressure on the more casual users to cease harvesting (Annias Verneuil, Dept. of Forest and Lands, pers. comm. 1997). Due to this pressure

some harvesters decided to stop making coals in Mankòtè. In addition, some of those who decided to stay became frustrated with the early efforts of the Group, particularly with the poor returns realized from the group farm and woodlot, and subsequently decided to leave the Group and charcoal making. Finally, as St. Lucia experienced greater economic growth in the banana and light industrial sectors, increasing employment opportunities elsewhere enticed some away from the arduous life of a charcoal producer.

At present, the Group is composed primarily of three families, who together make up the great majority of the twelve member group. The Group is formally headed by a President, but in fact his responsibilities are undefined. Of the three families, one family dominates the Group, both numerically and in influence. The other members of the Group have been recruited from the surrounding community, and are friends or distant relations of the central family.

Those who remain have adopted an informal and highly flexible management regime which reflects the seasonal and part time nature of charcoal making. Unlike many forestry management schemes, there are no formal rotations or cut blocks established in the mangrove. When CANARI first began to study the area, the individual families engaged in charcoal making had divided the mangrove into individually held areas called "champs" (fields) (Y. Renard, CANARI, pers. Comm. 1996). However, by the 1990s, this system had given way to a less clearly defined regime. Smith and Berkes (1993) describe a system in which producers selected an area at the beginning of the season with sufficient timber of appropriate diameter, and worked that area following a zig-zag pattern for the remainder of the work season. Areas which were harvested in one season were left to recover for at least two years before being harvested again. This allowed time for the small stems which had been left from the earlier harvest to grow large enough to be used for charcoal production. The authors note that the net effect of these cutting practices is that a cover of large trees cannot be restored.

Most recent observations indicate some slight changes from the system observed earlier. The rotation of harvest areas continues to be between two and three years, with the continued effect that larger trees are absent for the most part from the mangrove. At present, each producer selects an area to work in at the end of the rainy season when work in the mangrove resumes. Each of the six regularly active producers, with one exception, has an area that he prefers to work in. Within that area, the producers move from one stand to the next through the season. They select stands that contain enough harvestable wood to produce the quantity of charcoal that they desire for that production cycle. Occasionally, when one area of the forest contains an abundance of "ripe" trees, three or four producers will work in close proximity in that area. However, this is not a communal harvest. What each person cuts is his or her own, and is converted to charcoal in a separate pit from the others. Although they work close by each other, there is no apparent conflict over who gets to harvest which trees. However, this pattern of activity usually endures for one production cycle only. After the trees have been cut and set to burn in a pit, the person whose area the stand is in usually asks the others to move on. Occasionally, this engenders disputes, but these are most often resolved between the individual producers, many of whom are related, and all of whom know each other well.

When the rains come, accompanied by powerful waves from storms over the Atlantic ocean, the mangrove fills to varying depths with water brought by runoff from the hills behind it and by waves from the sea. The rainy season causes an involuntary moratorium on harvesting over much of the mangrove. During this time, the area available for harvesting is reduced and the level of harvest activity is accordingly curtailed. Some of the charcoal makers quit the mangrove during this season to pursue other employment opportunities in agriculture or construction, a decision made much easier by the clouds of mosquitoes which infest the mangrove during these months. Those who remain are forced to work on the edges of the mangrove where the terrain is slightly elevated and the charcoal pits are less prone to flooding. Even in these areas though, a heavy rain can cause flooding, and if a burning pit is inundated, its entire content will be spoiled. Producers adjust to this uncertainty by shortening the production cycle, cutting smaller lots and burning them for shorter periods.

This resource management system is highly flexible and is well suited to the seasonal fluctuations created by the rains and the constraints imposed by the amount of timber available in various areas of the mangrove. Each producer is able to select a part of the mangrove that suits his needs, and scarcity in one producer's preferred area is hedged by the ability to move temporarily into another's area. This entirely informal system is made possible by the small number of appropriators, most of whom are related to each other, and all of whom interact with each other on a daily basis. Each producer is constantly aware of where the others are working and what they are doing. This facilitates the communication and compromise necessary for the operation of such a system without the need for codified allocation rules. However, the absence of codified rules and means for their enforcement does impose certain costs.

One of these is that conflict between group members is occasioned by disagreements about exactly what the rules are and in what circumstances they apply. The draft co-management agreement for the management of the mangrove was an attempt to establish a formal set of rules for harvesters which were written in collaboration with Group members. However, field observations revealed that certain of the practices stipulated in the agreement are not universally respected by all Group members, although they are respected by most people most of the time. Examples include repeated instances of slash being piled over stumps, cutting stems smaller than the minimum allowable diameter, and cutting timber for sale rather than using it for charcoal. In cases where these violations were discovered and discussed, the violator felt that his accusers were incorrect in their application of the rules in that particular set of circumstances. In no case was a punishment collectively decided upon and meted out. This is largely due to the fact that there exists no established set of graduated sanctions for punishing offenders. Once a violation is discovered, the only recourse available to those who wish to enforce the Group's standards is informal peer pressure to convince violators that their actions are inappropriate. In cases where there is little agreement about what the rules are, or whether they are appropriate, such sanctions have proven ineffective.

The Group encounters yet greater difficulties of enforcement when it attempts to apply the rules it has devised to the wider community. Although the ACAPG enjoys de facto Government recognition of their exclusive right to harvest wood in the mangrove, many residents of the surrounding communities do not recognize these rights. The letter of the law states that it is a

crime to remove or destroy any of the flora or fauna within a marine reserve area such as the mangrove without the minister's written permission. Only in the fall of 1996 has the Department of Fisheries formally recognized the ACAPG's exclusive right to harvest in Mankòtè. In light of their own historically uncertain legal rights to operate in the mangrove, the charcoal producers have heretofore had no authority recognized by others to prevent outsiders from harvesting wood in the mangrove. As a result, exclusion of unauthorized harvesters is difficult at best, and hazardous at worst, exposing group members to the possibility of violent confrontations with illicit harvesters.

Despite the official recognition of the Department of Fisheries in 1996 that the ACAPG is the sole entity authorized to harvest wood in the mangrove, there is no established recourse to enforcement agencies such as the police in Vieux Fort or Fisheries officers. Therefore, the Group has been left to its own devices in attempting to enforce their claims. While there is widespread agreement amongst the members of the ACAPG regarding the seriousness of the problem, they are less united as to what to do about it. There is a keen awareness among some of the Group of the fact that many of the people who cut wood in the mangrove do so out of acute necessity, and that it is unfair of the Group to deprive these people of the means of making a living. Many Group members are equally aware that there is already some resentment among the wider community that one particular group is apparently trying to monopolize the resources in the mangrove for their own use. More active exclusion of community members is likely to incur yet more enmity among those who would be excluded. Some of this persuasion believe that rather than keeping people out of the mangrove, it would be more productive to help them by showing them an appropriate area to cut in, and demonstrating proper cutting techniques. While this could potentially avoid the problem of people cutting improperly and in areas which had been earmarked for conservation, and has the advantage of avoiding conflict with the larger community, it would not address the issue of reducing harvest pressure.

Discussion

Previous research has concluded that the transformation of Mankòtè mangrove from an open access resource, in which the timber resources of the forest were open to all, to a common property resource, in which a group of eligible resource users are defined and others excluded, has resulted in the reversal of the previously observed trend toward the destruction of the mangrove (Smith and Berkes 1993). The study presented here suggests that the harvest pressure currently exerted by the ACAPG appears to be sustainable, at least over the short term. Production volumes appear to be holding constant since at least 1989. If harvest pressure exceeded the regenerative capacity of the resource, one would expect to see a decline in production volumes as merchantable timber became scarce or unavailable. However, one might argue that the time series is too limited to safely make such a conclusion, and that in fact it is equally plausible that the charcoal producers are merely continually moving their cutting operations into areas which have been rested for some time. They may eventually run out of these

areas, and be forced to return to cutover sections before they have had a chance to reach harvestable age.

In the absence of biophysical data measuring trends in the quantity of timber available throughout the mangrove, it is impossible to categorically refute such an argument. However, this line of reasoning seems less plausible than the first. This is because the area available for charcoal harvesting is quite limited. Mankòtè occupies only 63 ha. Of this, a large part of the forest, approximately half, sees very little harvest activity because the road leading through the forest is impassable to most vehicles, making it difficult to transport the charcoal, and because the area is dominated by red mangrove (*Rhizophora mangle*) and stunted stands of buttonwood (*Conocarpus erecta*). Red mangrove is not much used because it is extremely hard to cut and because it occurs along the major waterway in the forest, and producers are anxious to preserve these trees for their stabilization and shade provision functions. The buttonwood here is very often of such small diameter that it is not worth the charcoal producers' while to harvest them. Of the area that remains, yet more is unproductive for timber, being occupied by open, grassy clearings or by a number of small seasonal ponds. Therefore, the area of the mangrove being used for charcoal production is probably somewhat less than half the total area of 63 ha.

Although the number of producers has fluctuated over the years, from fourteen to five, it is very unlikely that even this small number would be able to continue harvesting over a period of almost a decade in such a meager area if their cutting rates exceeded the regenerative capabilities of the forest. Indeed this is even more plausible when one considers that in addition to the harvests of the authorized producers, illegal harvests continue to deplete the available timber supply. The production volumes represented by this illegal harvest are, of course, unknown, but are believed to be significant. It seems likely that if the combined harvest of the illegal and legal charcoal producers were greatly exceeding the ability of the forest to renew itself, that production volumes should decrease and conflict over the remaining cutting areas should increase. While there exist several sources of conflict within the Group, access to timber is not often one of them. Nevertheless, current harvest pressure continues to be sufficiently burdensome that the mangrove cannot regenerate for long enough to reestablish mature specimens of all the four mangrove species represented.

Thus, while it is not possible to conclude categorically that the current rate of harvest in Mankòtè is sustainable, the available evidence suggests that it is. This study provides yet more corroboration for the notion that resources managed in common may in fact be capable of achieving social, economic, and ecological sustainability. The charcoal producers themselves have, in cooperation with CANARI and Government agencies, designed a set of harvesting standards and practices which have enabled them to maintain harvest levels in the mangrove for almost a decade. Furthermore, the group itself has persisted over time, providing its membership with access not only to the mangrove, but to other resources including land on a vegetable farm, and the right to harvest trees from the adjacent fuelwood plantation. The conservation and development project consisting of these three components has made a significant contribution to the livelihood security of the members of the ACAPG.

Nevertheless, common property resource management of the kind described here is not a panacea. While it has apparently been successful in controlling the rate of harvest, this has been achieved at some cost. The most obvious of these is that the formation of the users group required that some people working in the mangrove at the time the group was formed were hence forth to be excluded. The basis for choosing who will stay and who will be forced out is always problematic for organizations implementing this kind of transformation, and any such attempt is certain to cause conflict within the affected community, just as attempting to deny anyone access to resources is contested by those on the losing end.

At present, the Group is structured in such a way that other than personal or kinship ties, there exists no mechanism through which people can apply for membership, and there are no criteria for establishing membership rights. The dominance of a single family, and the claims made by the Group in the community that they alone have the right to harvest timber in the mangrove, combined with the absence of any mechanism for changing Group membership, has led to the perception among some in the community that the Group is trying to gain complete control of the resources in Mankòtè.

This has resulted in conflict between some Group members and those who historically have used the mangrove as economic necessity dictated, but who now are not members of the Group, and are therefore being excluded from the mangrove. These people feel that they too enjoy historical use rights to the mangrove which they are now being prevented from exercising by an informal conglomeration of self interested family members with an uncertain legal foundation for their claims. In the past conflict between the Group and the community has taken the form of vandalization of the fuelwood plantation (Walters and Burt 1991), and more recently, suspected thefts from the farm, and general open hostility manifested in threats and machete rattling.

These conflicts have also contributed to, although they are not solely responsible for, a high level of dissention within the Group that has impaired its ability to operate as a unit, especially in organizing collective efforts towards needed improvements on the farm. Some Group members are sympathetic towards those who have been excluded from the mangrove as a result of the formation of the Group. These conflicts have made enemies of Group members, who then refuse to work together to accomplish tasks which are to their mutual benefit.

In such a situation, conflict is to be expected. In order to ensure that the mangrove continues to be appropriately conserved, while at the same time seeking to provide a check on the potential for concentration of use rights, some mechanism for establishing criteria for group membership and/or for considering applications by non Group members for harvest rights is required. A co-management agreement, such as the Local Management Authority that is in the process of being devised could serve this function. Being composed of personnel from Government agencies, community groups, and CANARI, as well as of Group members, a Local Management Authority could establish criteria for membership in the Group and consider applications to become a member. A legal entity which serves to support, but is separate from, the ACAPG would be capable of authoritatively controlling membership in the Group, and therefore access to the mangrove, on the basis of these criteria and the carrying capacity of the forest. Applications for membership in the Group, for one time permission to cut timber for construction, or for

permission to exploit the fish, crabs, and other subtractable resources of the mangrove, could be reviewed by the Authority, and rejected or accepted as deemed appropriate.

Such an organization would go a long way towards eliminating the concentration, perceived and real, of access rights in Mankòtè. Should the trend of declining numbers of harvesters continue, there may be opportunity to allow presently excluded persons to become Group members. This would have the additional benefit of bringing people with new energy, skills, and commitment to further strengthen the Group's capacity for management. Such an institution would also serve to deflect much of the hostility that is now directed at the Group as a result of their attempts to control access to the mangrove. Decisions to exclude certain persons or disallow certain uses would then become the outcome of a process by a duly constituted authority composed of a variety of interests, rather than being perceived as the arbitrary and self interested decision of a small, illegal cartel.

Conclusion

Over the past decade and a half, Mankòtè mangrove has been transformed from an open access resource which was clearly suffering the tragedy of the commons predicted by theorists such as Hardin (1968) to a common property resource managed by a collective of resource users, the Aupicon Charcoal and Agricultural Producers' Group. This case is in some respects exceptional to many common property resource management institutions, in that the institution did not evolve organically over a period of many years in an effort by local resource users to govern the use of those elements of the natural world upon which they depended. Rather, the integrated conservation and development project known as the Aupicon Project, consisting of a fuel wood plantation, a farm, and the mangrove, was initiated by a regional NGO in cooperation with National Government authorities who recruited the participation of the charcoal producers.

Over the last several years, the Group has, to all appearances, succeeded in managing the mangrove for charcoal production in such a manner that the condition of the resource base has stabilized, and the production of charcoal appears to be sustainable. Although a complete time series of charcoal production data was not available, there are several years for which figures exist, permitting an examination of changes in harvest levels over time. The annual value of charcoal production was found to be fairly constant over the seven year period between 1989 and 1996, with some fluctuations due to changes in the number of active producers and local weather conditions. In 1994-95, the total value of charcoal production was found to be \$56,196 E.C., for 39.17 tonnes of coal. In 1995-96, those values were \$40,656 E.C. for 28.34 tonnes. This gives a total production over the two years of 67.51 tonnes, a 6.98 tonne increase from the previous period for which records were available. However, overall, charcoal production has remained fairly constant between 1989-1996, indicating that the existing level of harvest may be sustainable.

This production is now being distributed between fewer producers. In 1989-1991, between ten and fourteen producers were reportedly active, while in the more recent period, no more than nine people were working. This indicates that each individual producer is producing more charcoal, and realizing a greater income. However, despite the constant production volumes and rising individual incomes, the value of the charcoal harvest is declining in real terms. This raises the

possibility that the charcoal producers may increase production in the future to compensate for the falling value of the harvest.

The resources of the mangrove, particularly charcoal production, were found to make an important contribution to the livelihood security of the community of resource users. While coal production was previously an essentially a part time or casually pursued activity, those producers who remain active all list charcoal making as their primary occupation. Furthermore, in the majority of cases, working in the mangrove was given as the principal source of household income. Charcoal production was also found to be a competitively remunerative occupation when compared with others available to group members. A daily income of approximately \$28.00 was calculated, which compares well with wages paid agricultural and construction laborers. Overall, Group members estimated that they usually earned approximately \$500.00 to \$600.00 E.C. per month during the dry season, a figure that was confirmed by field observations of monthly production. It must also be emphasized that charcoal making is not an occupation of last resort, done only because no others are available. Most of the regular producers attach a high value to the freedom and flexibility of the business, in which each man is responsible to no one but himself.

The sustainability of the harvest and the importance of charcoal production to the livelihoods of the Group members indicate that significant success has been achieved in the management of Mankòtè by the Group members, with the assistance of CANARI and various Government agencies. However, continued improvement is possible. Along with the deliberate creation of an institution which is provided with some level of management control over a resource comes the responsibility of ensuring that that institution is designed to both protect that resource and to meet the needs of the membership. This may require that the institutional structure evolve over time, just as the institutions of indigenous common property resource management are continually changing to adapt to changing circumstances. Initially, the charcoal producers' input was sought largely in a consultative capacity. Later, it was hoped that the ACAPG would be able to assume full management responsibility for the mangrove, woodlot and farm. However, long experience has demonstrated that this is not feasible at present for a variety of reasons discussed in the preceding sections. The ACAPG is now being conceived of as a partner in a co-management agreement with the Government and other stakeholders, rather than as a purely community based resource management institution (Brown 1995). The implementation of such an agreement, in the form of a local management authority would be most useful in resolving the outstanding issues of concentration of access to the mangrove, and of considering the protection and use of the many non timber resources, such as crabs and fish, which are present in Mankòtè.

The proposed co-management agreement is intended to consolidate the legal status of the ACAPG and to address some of the institutional and management issues which are in need of attention. For such an agreement to be effective, the members of the ACAPG must be prepared to continue to devote their energy and labor to establishing management objectives and to implementing them. Furthermore, other decision makers must be committed to maintaining a functioning mangrove ecosystem which provides important goods and services, both to those who gain their living from the forest and to the public at large.

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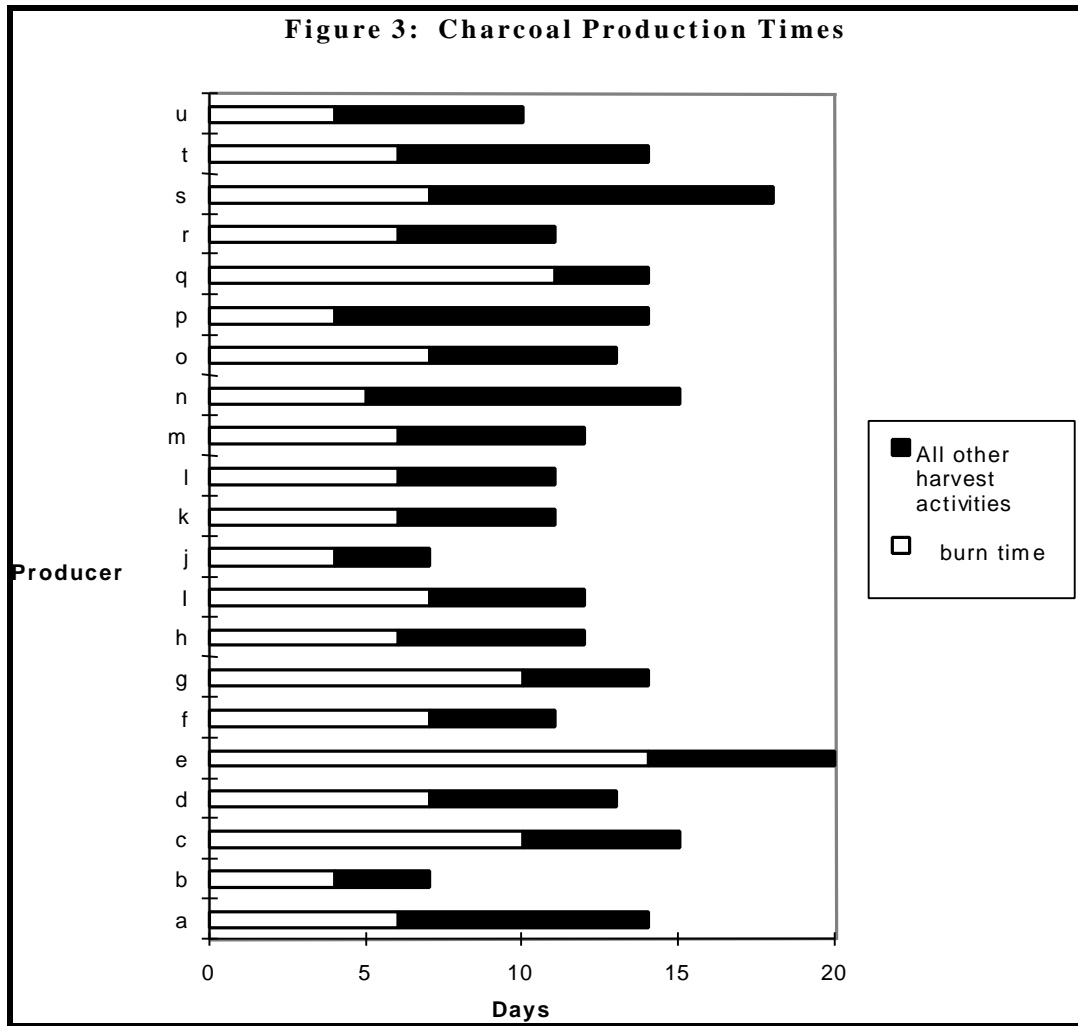
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Figures

Figure 1: St. Lucia

Figure 2: Study Area

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**Fig. 4: Charcoal Production, Mankote Mangrove
1989-1991; 1994-1996**

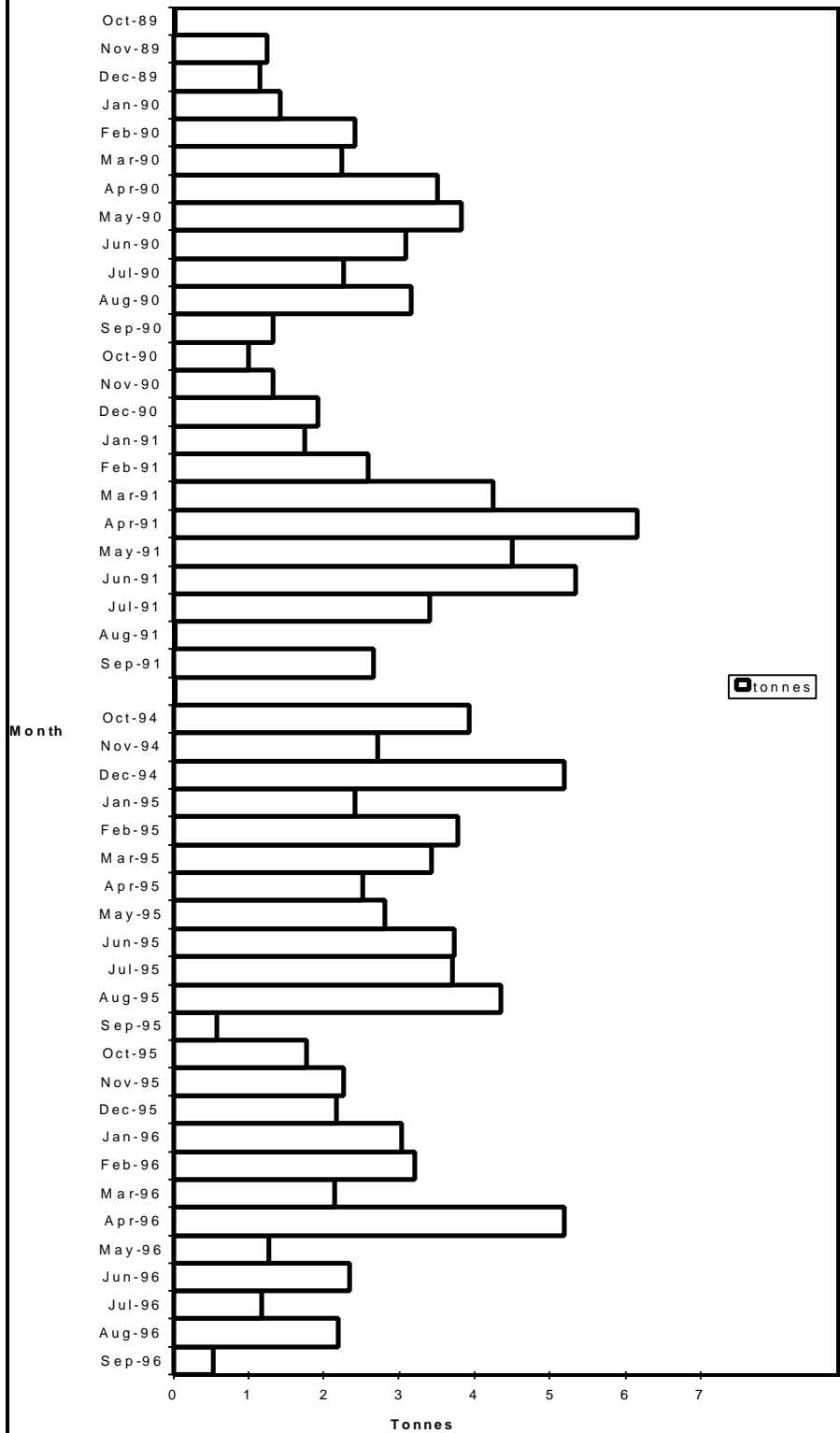


Figure 5: Nominal and Real Values of Charcoal Production from Mankôtè, 1987-1996

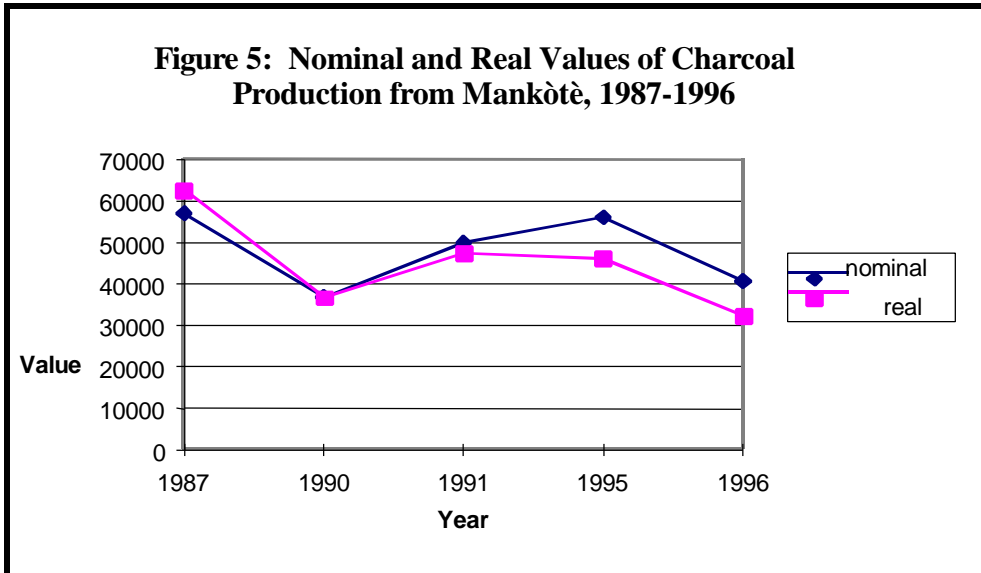
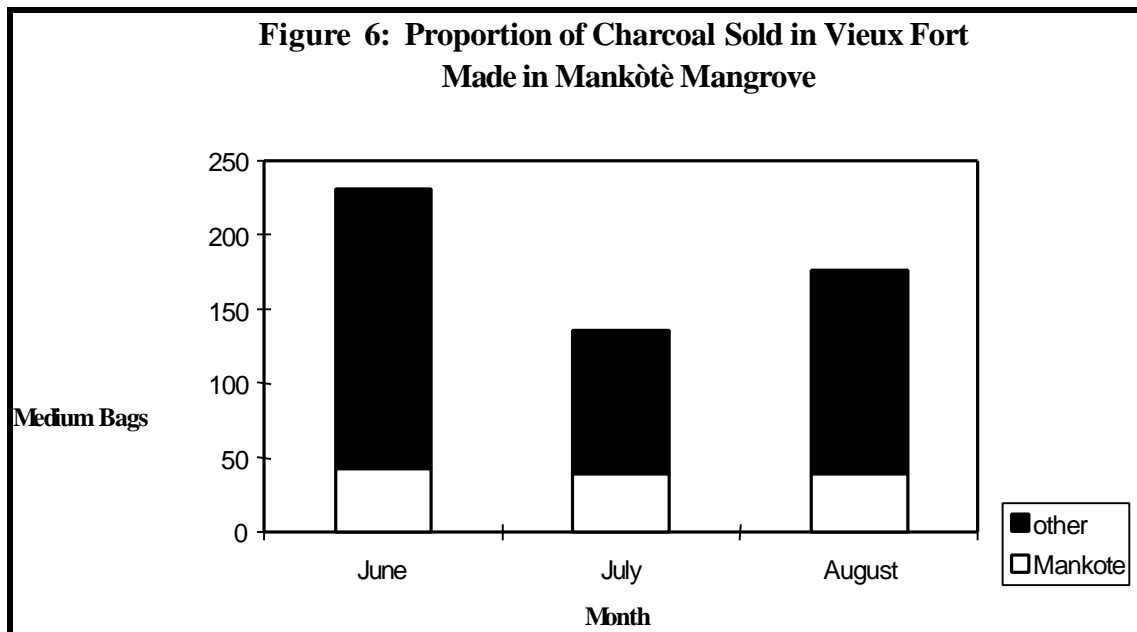


Figure 6: Proportion of Charcoal Sold in Vieux Fort Made in Mankôtè Mangrove



Tables

Table 1: Occupations of Charcoal Producers

<i>Producer*</i>	<i>Other Occupations</i>
1	security guard, family farm, group farm
2	group farm, family farm, construction, agricultural labor
3	group farm, construction, agricultural labor
4	family farm, construction, agricultural labor
5	none
6	security guard
7	none
8	group farm, family farm
9	cleaner
10	farming, construction

*producer refers to adults who were active in producing charcoal during the research period. Not all are group members

Table 2: Estimated Incomes and Earning Periods for Charcoal Producers

Producer	Month	Burn Time	Total Time	Gross Earnings	Net Earnings*
1	May	6 days	14 days	\$600.00	\$550.00
2	May	4 days	7 days	\$308.00	\$279.00
3	May	10 days	15 days	\$392.00	\$357.00
4	June	7 days	11 days	\$196.00	\$175.00
5	June	14 days	20 days	\$952.00	\$875.00
1	June	7 days	11 days	\$120.00	\$104.00
6	June	10 days	14 days	\$532.00	\$487.00
6	June	6 days	12 days	\$224.00	\$201.00
2	June	7 days	14 days	\$480.00	\$438.00
6	June	4 days	7 days	\$252.00	\$227.00
4	June	6 days	11 days	\$252.00	\$227.00
4	July	6 days	11 days	\$399.00	\$364.00
1	July	6 days	12 days	\$400.00	\$365.00
7	July	5 days	15 days	\$238.00	\$215.00
6	July	7 days	13 days	\$675.00	\$620.00
4	July	4 days	14 days	\$236.00	\$213.00
6	July	11 days	15 days	\$364.00	\$331.00
4	August	6 days	11 days	\$266.00	\$241.00
8	August	6 days	14 days	\$168.00	\$149.00
1	August	4 days	10 days	\$170.00	\$151.00
Mean		6.8 days	12.5 days	\$361.00	\$328.00
Min.		4 days	7 days	\$120.00	104.00
Max.		14 days	20 days	\$952.00	\$825.00
Mean input costs per production period					\$32.75

*Net earnings represent the minimum possible values, assuming the maximum transportation cost of \$2.00/bag, and that all loads were composed of small bags.

Table 3: Value of the Charcoal Harvest and Number of Participants for Selected Years.

Year	Quantity	Estimated Value in 1990 constant EC dollars	Number of Participants	Income per Participant in constant 1990 EC dollars
1987	N/A	\$62,690.45 EC*	21	\$2985.26
1989/1990	25.64 tonnes	\$36,778.68 EC*	10/11	\$3343.52
1990/1991	34.89 tonnes	\$47,348.28 EC*	11/14	\$3382.02
1994/1995	39.17 tonnes	\$46,213.82 EC*	9	\$5143.86
1995/1996	28.34 tonnes	\$32,287.17 EC*	8	\$4035.89