

*To Mary Jane and Stokes for starting the process, Paige and Cyrus for
putting up with it, and Eugenie for making it wonderful*

Private Capital Flows and the Environment

Lessons from Latin America

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4. Agriculture – Cases from Brazil and Costa Rica

Chapter Overview

Agriculture dominates the economies of many developing countries, including those in much of Latin America. International investors have been an important part of the Latin American agricultural sector as a result of its high productivity and access to export markets.

In order to shed some light on the relationship between foreign direct investment and environmental performance in the agricultural sector, three case studies were undertaken: pulp and paper (Brazil); soybeans (Brazil);¹ and bananas (Costa Rica).²

All three cases involve monocrops with a high proportion of exports and foreign investment.

The Brazilian cases considered two land-extensive, industrial monocrops – soybeans and pulp and paper. They are responsible for a growing share of Brazilian GDP, particularly from export revenues. Soybeans, meal and oil together, account for 9 percent of Brazil's exports, the largest of any sector and second only to the United States in production. Approximately 22 million tons of soybean products are produced each year on 11 million hectares of land – 26 percent of all cropland in Brazil. The pulp and paper sector makes up 1 percent of the country's GDP and is fifth on the export list, accounting for 8.5 percent of exports in 1994. Brazilian products constitute 50 percent of the eucalyptus-based cellulose market worldwide. While Brazil is a net exporter of pulp and paper (US\$1.8 billion in trade revenues), it still imports about US\$1 billion of newsprint and printing stock. Plantations of eucalyptus and pine are maintained on more than 4 million hectares.³

Both soybeans and pulp and paper have been the recipient of considerable foreign direct investment. For soybeans, 40 percent of the processing industry is owned by foreign firms and virtually all of the trading is done by transnational companies. Nearly 60 percent of the pulp and paper output is from firms with substantial foreign involvement – either direct control or as part of joint ventures. In both cases, however, raw material production is done principally by local farmers and silvicultural enterprises (some with links to the processing segment).

Banana production is one of the main sectors of the Costa Rican economy and has attracted much of the foreign investment made in the country. Of the US\$390 million invested in new plantations between 1987 and 1993, over half came from multinational companies (such as Chiquita, Dole, Del Monte and Geest Caribbean). These investments represent an increase of 160 percent in the total production area to over 50,000 hectares. They were driven largely by the anticipated opening of the European markets to increased banana imports – an expectation yet to be realized.⁴

Costa Rica enjoys considerable advantages as a location for banana production. Its Atlantic coast has optimum growing conditions. There is strong rivalry among local competitors, pushing improvements in performance. The government has promoted the expansion of the banana industry through investment incentives and research support. Highly specialized businesses are in place to support production and export activities.

By definition, large monocrop agricultural plantations impose heavy burdens on the environment, both directly and through associated development.

The production, processing and transportation activities necessary to support export monocrops impose considerable pressures on environmental resources. Production practices raise issues of soil erosion, water pollution, chemical use, loss of habitat and biodiversity, and waste. Processing operations use considerable amounts of energy and generate waste water and solid wastes. Not only do transportation corridors affect their immediate locations, they usually open up new areas for agricultural or other development – planned and unplanned.⁵

Many of these negative environmental impacts are evident in these cases. In Costa Rica, large amounts of pesticides are used, with serious implications for human and environmental health.⁶ In fact, litigation is now pending in Texas over the alleged sterilization of thousands of agricultural workers. New plantations have been accused of contributing to the deforestation of coastal lowlands. Efforts to shift watercourses and alter

flows are common. Substantial quantities of solid wastes are produced. Banana production can also deplete groundwater supplies and contribute to water pollution.

These impacts are lower in Costa Rica than in surrounding countries, however. Lower amounts of pesticides are used and no irrigation is needed. In addition, the gross production value per hectare is much higher for bananas than for other agricultural land uses in Costa Rica. For example, one hectare of bananas generates over five times as much money as one acre of coffee, over eight times as much as sugar and over 200 times as much as meat.

In Brazil, major efforts are under way to expand the output of both soybeans and pulp and paper. Included are plans for substantial new transportation corridors. Private investment will play a key role both in the expanded production and in the completion of the transportation links (through government concessions). For pulp and paper, concerns continue about the environmental consequences of extensive monocrop timber plantations which reduce biodiversity and strain water supplies.⁷

For soybeans, at least five new multimodal transport corridors – involving waterway, rail and highway links – are under consideration. With such links, soybean cultivation could expand to over 50 million hectares using currently marginal lands. Questions are being raised about the planning process for these different transport corridors, such as: (i) are their environmental impacts and economic prospects being considered on a regional basis or are they being assessed one by one (passing the same soybean through five different corridors); and (ii) what agencies are in a position to carry out such assessments (national government? development banks?).⁸

Led by multinational companies, improvements in environmental performance are being made as a result of pressure from export customers, efforts to reduce production costs and some government programs.

Not all of the changes in environmental performance are negative, however. In response to both commercial pressures – the demands of export customers and the need to reduce production costs – and a few government programs, some of the international investors considered in the three cases have reduced the environmental impacts of their operations. In fact, multinational investors are leading the way in improving environmental performance in all three sectors.

For example, in Brazil, many of the soybean and pulp and paper processing facilities, particularly those with foreign involvement, are operating with a high degree of environmental care. Their actions are in

response to assure both from export customers and parent companies to improve the environmental performance of production operations. State of the art processing technology tends to be used, either as a direct import or licensed from foreign owners. Industrialized world standards for product quality and environmental characteristics are often used, including sophisticated environmental management systems and process controls. For example, substantial reductions in the use of chlorine in paper processing have been achieved, with at least one firm using a chlorine free process.⁹ Much lower levels of environmental performance are found at small- and medium-sized enterprises, given the capital rationing they face and their lack of knowledge about environmental issues.

Even though soybean and pulp and paper production activities use large quantities of land, some reductions in the amounts of environmental damage accompany efforts to reduce production costs. For example, soybean output from the Cerrado region – with its arid conditions and high biodiversity – has grown from 12 percent to 40 percent of all production, increasing the overall impact on the area. The growing use of no-till cultivation and integrated pest management techniques have both reduced costs and environmental impacts. However, the recent introduction by Monsanto of transgenic soybeans resistant to that company's herbicides has raised serious concern in the environmental community. In the pulp and paper industry, eucalyptus monoculture plantations are detrimental to local habitats and soil conditions, as well as the subject of scientific doubt and intense criticism. At the same time, decreasing levels of inputs (such as pesticides and fertilizers) and high clonal productivity have again reduced both costs and impacts.¹⁰

Some governmental programs have affected these efforts in Brazil. For example, credits have been available from public agencies for production improvements – such as the Brazilian National Development Bank (BNDES) and the World Bank. In addition, government bodies are important actors in the provision of technical information and the review of new forest plantations.

In Costa Rica, banana producers have formed an Environmental Banana Commission to respond to pressure from export customers and NGOs. This is particularly true for Europe, a key target market with considerable environmental sensitivity (including lawsuits by environmental groups over conditions in the banana industry). Members of the commission are publicly committed to improving their environmental performance and have so far accomplished:

- 90 percent recycling of plastic waste (8,000 tons per year achieved);
- installation of waste water treatment systems for several of the packing

- plants owned by larger companies;
- reforestation of selected riverside areas;
- creation and maintenance of 1,300 hectares of private nature reserves;
- implementation of occupational health programs.

In addition, NGOs and industry together have started a third party 'eco-certification' program for the banana industry in Costa Rica.¹¹ Working with a US-based NGO – Rainforest Alliance and the AMBIO Foundation – over 5,000 hectares have already been certified.¹² Certification requires an inspection and evaluation of performance on the following topics: handling of hazardous substances; waste management programs; occupational health; drinking and waste water quality; and reforestation programs. Meeting these criteria can entail big expenditures – for example, Chiquita estimates that it has spent over US\$5 million in having its operations certified.

Government policies have an important impact on foreign investment – positively and negatively.

In all three cases, actions by governments had a significant impact on the level and nature of the international investment being made. This is true both in the countries receiving the foreign direct investment (recipient countries) and in those which are home to the capital, investor companies or target export markets (source countries). The multilateral development banks have played a role as well.

For example, both Costa Rica and Brazil have extensive investment promotion programs in place, involving tax credits, concessional finance (often involving the development banks), the provision of infrastructure and other incentives.¹³ In both countries such programs have specifically targeted the agricultural export sector, which has responded with increased international investment.¹⁴

Obviously, the success of those export-oriented investments depends on effective access to target export markets – also a key area for government action at both the recipient and source country level. While Costa Rica's efforts to promote the expansion of banana production worked for a while, it also demonstrates the impact that government policies in target export markets can have. Since the European Union restricted banana imports from Costa Rica and other countries in the mid-1990s, not surprisingly, investment in new production areas dropped off markedly.

In addition, recipient country policies can impede foreign investment – intentionally or not. For example, international investors have been confined to the processing sectors in Brazil, at least in part, because of legal restrictions on land ownership by foreign parties.

Governments can build on the positive environmental content already present by integrating environmental considerations into their investment attraction, trade and information programs.

When people think of the steps governments can take to improve the environmental performance of companies, they traditionally think in terms of enforcing environmental requirements.

What was remarkable in the three cases studied, however, was the evidence of improvements in environmental performance despite the almost total absence of traditional environmental enforcement. While both Brazil and Costa Rica have extensive environmental requirements on the books,¹⁵ many of which supposedly apply to agricultural operations,¹⁶ they were essentially never applied in practice in Costa Rica and not often in Brazil (with the exception of the review of new forest plantations, an area with little foreign involvement).

To the extent government programs were found to have made a difference in the behavior of foreign investors – either in deciding to make an investment or in its environmental content – they were in the areas of investment frameworks and trading regimes. Investment frameworks included both incentives (tax breaks) and disincentives (ownership restrictions), as did trading regimes (eco-certification programs versus import restrictions). Information programs on low-impact production techniques were also found to have influenced local producers in Brazil.

The implication for government action to increase the environmental content of foreign direct investment in the agricultural sector is that efforts should be focused on investment promotion, trade and information programs.¹⁷ While traditional environmental requirements and enforcement have an important role to play (particularly in reviewing proposed areas of new development), more immediate and widespread improvements in performance are likely to be achieved in the agricultural sector through these other routes.

While a broader policy action agenda reflecting these points is set out in Chapter 10, specific areas of work for governments in the agricultural sector include:

- integrating incentives for improved environmental performance into sector specific investment promotion programs, such as conditioning the receipt of financial support on compliance with environmental standards;
- supporting efforts by producers and consumers to develop global standards to be met for eco-certification programs, with greater involvement from developing countries;

- encouraging, not discouraging, customers in industrialized countries to purchase environmentally responsible products;
- working with multinational companies to increase the awareness of small- and medium-sized producers of lower-impact production techniques, and of customers on the relationship among appearance, fitness and environmental load;
- working with non-governmental and grassroots organizations to monitor sustainability of the native resource base.

The more detailed presentations of these findings and conclusions follow.

Section 4.1 Financing Expansion of Brazil's Pulp and Paper Industry

By Peter H. May and Valéria Gonçalves da Vinha from the Federal Rural University and the Federal University, respectively, in Rio de Janeiro, Brazil (1996).

Editor's abstract Pulp and paper production in Brazil constituted about 3 percent of global production in 1995 and Brazil now controls half the world market for eucalyptus-derived cellulose. Most enterprises are private joint ventures with significant foreign participation. Despite current overcapacity, over the coming decade further overall investment in the order of US\$11 billion will be needed to meet expected domestic demand growth for pulp and paper. Low raw material and labor costs give Brazil an edge in world markets, but the high domestic cost of capital and the absence of any recent official incentives make plantation expansion prohibitively expensive. Intense criticism of monocrop tree plantations also persists.

For the most part, the Brazilian pulp and paper industry views environmental investment as a cost, not a source of gain. Nevertheless, the industry has recently taken strides to satisfy market demands for 'green' products such as recycled content or sustainable forestry. Some firms are building links with NGOs to conduct research and monitor the industry's environmental impacts. Since 1989, the industry has invested \$512 million in environmental management and control. Smaller, under-capitalized firms have been ineligible for government loans and are thus more likely to have environmental problems.

In 1995, several laws impeding foreign investment in Brazil were dismantled, including restrictions on profit repatriation and eligibility of foreign corporations for official loans. Still dampening foreign private capital inflows are extensive public review requirements, and social and environmental disputes over the terms of expansion in the sector. Several changes are under discussion to ease credit and reduce environmental risks that will further attract foreign investment including facilitating investment credits for smaller firms, revising credit terms for plantation expansion, and streamlining environmental certification procedures.

Box 4.1

base. Furthermore, because developing countries generally produce similar goods for export to countries whose demand is relatively inelastic, there is a tendency for competition for the same markets to further erode returns, thus contributing to a vicious circle whose effect is to perpetuate degradation of natural resources and social impoverishment.

In the debate over these issues the WTO Committee on Trade and Environment, parties to the World Trade Organization (WTO) recognize that there will be some winners and some losers with regard to environmental and social costs that arise from trade-induced activity. However, there is broad agreement over the desirability to promote rapid and thorough trade liberalization within the limits of the agreement, in the expectation that growth in real income in the poorer nations will enhance prospects for adoption of improved domestic environmental standards. Such policy improvement is expected to arise as a function of observed correlation between higher per-capita income and environmental safeguards.

In counter argument, environmental groups manifest concern that, while the world waits for trade to improve the plight of the poorest, the natural environment will be pillaged, leaving little to protect once they become able to afford such protection. These concerns assume greater relevance when one considers the gains that have accompanied the tenfold growth in world trade ensuing from eight rounds of GATT (Global Agreement on Tariffs and Trade) negotiations. The purported improvement in environmental protection to be purchased with economic growth has not materialized; on the contrary, energy consumption, pollution emissions, soil degradation and loss of cultural values have only been exacerbated in much of the world.

It is important to consider the degree to which domestic environmental policies can anticipate possible negative environmental repercussions, or whether safeguards must be adopted within trade accords themselves which will reflect the desirability of internalizing environmental costs. Alternatively, consumer pressures for improved environmental content in imported goods may serve as the motor for adoption of production practices that protect the environment, through such mechanisms as eco-labeling.

Economic competitiveness might be affected by regulatory disharmony for those nations that unilaterally assume the onus of environmental protection. If an importing nation establishes stringent quality restrictions on its own production processes, it may then feel justified in applying protective rules to impede entrance by goods not produced with equal stringency. International trade regulations make such discrimination difficult, however. For example, they disallowed nations from establishing restrictions against imports based on the processes used in their production, although product quality restrictions may be applied if the importing nation adopts equally stringent standards. The GATT allows that nations may restrain entry of products harmful to life or health, as well as those that may affect the nation's ability to conserve exhaustible natural resources, but leaves them with the burden of proof that such restrictions do not represent 'arbitrary or unjustifiable discrimination between countries where the same conditions prevail'.

Box 4.1 cont.

Concern that the GATT was inadequate as a safeguard for sustainable trade was confirmed by the widely cited Mexican tuna case. In 1990, the US, seeking to protect dolphins affected by predatory industrial fishing practices in accordance with the Marine Mammal Protection Act of 1988, banned imports of tuna from Mexico, Venezuela, Panama, Ecuador and Vanuatu that were documented to result in incidental dolphin mortality higher than the levels observed for US industry. Mexico subsequently brought the case to a GATT panel, which ruled that the unilateral trade ban be removed, on the grounds that restrictions of this sort could not be applied to resource depletion problems beyond the regulating nation's territory. This case was considered a serious blow toward unilateral application of trade barriers as an incentive toward environmental improvement in production techniques.

Despite these initial blows to harmonization, anticipatory adoption of environmental measures by export industries has grown as a strategy to ensure continued competitiveness in increasingly demanding overseas markets. With the promulgation of environmental management standards embodied in the ISO 14000 series we may expect harmonization of production technology and environmental reporting by exporting firms, although the presence of a management plan in conformance with the standard does not imply change in environmental performance. Furthermore, ISO criteria will not immediately affect those firms that are primarily oriented toward domestic markets. However, standards adoption can act as a benchmark for sectoral corporate responsibility.

Another tactic that has been adopted in lieu of harmonization in trade rules is that of market segmentation through eco- or green-labeling. The discrimination between goods produced using different production processes and internalization of differential costs can be accomplished at a level further along the marketing chain, using eco-labeling. Such practices, involving provision of information to intermediate or final consumers regarding the conditions under which goods are produced, do not represent trade restrictions because such information is generally provided by sources dissociated from government.

Source: Peter H. May, Federal Rural University, Rio de Janeiro, Brazil.

Section 4.3 Bananas - The Costa Rican Experience

By Jorge Rivera, in collaboration with Esteban R. Brenes of INCAE in Costa Rica.

Editor's abstract For more than a quarter century, bananas have been Costa Rica's most important agricultural commodity, making up a quarter of the country's total exports. Through a series of incentives to reverse a decline in foreign exchange earnings from the fruit, the government recently stimulated a dramatic expansion in banana cultivation. The stimulus heightened competition for the dominant players Dole, Del Monte and Chiquita, who still market 68

mention that about 43,000 people depend directly on the banana industry to obtain income.

Competitors

Chiquita Brands After several mergers of different banana producing and marketing companies in Central America and the Caribbean, including Minor Keith operations, the United Fruit Co. was incorporated, in 1889, under the laws of the state of New Jersey. Gradually, United Fruit built a virtual monopoly in all activities dealing with bananas in Central America. During its 1930's heyday, the company controlled over 2,500 km of railroad and more than 1.4 million hectares in Honduras, Guatemala, Costa Rica, and Panama.²⁹

Over time, United Fruit's power eroded and the company changed hands several times; its current trade name is Chiquita Brands. Headquartered in Cincinnati, Chiquita is a minority partner in a financial business conglomerate; it is considered the world's leading company in marketing bananas. Its Costa Rican subsidiary is called Compañía Bananera Atlántica Ltda. (COBAL). It owns 12 percent of the country's production area and, in 1985, it marketed 18 percent of total banana exports, with foreign exchange earnings of US\$119.3 million.

Dole In the 1930s, there was only one other major company in the region, the Standard Fruit Co. in Honduras. In 1956, this company became interested in growing bananas on the Atlantic coast of Costa Rica, and it successfully managed so to do. (The area had been abandoned by the United Fruit Co., because of crop health problems and, after a major labor union crisis in the 1930s, the company was forced to transfer operations to the Pacific coast of Costa Rica.³⁰) Subsequently, in 1964, Standard Fruit was taken over by Castle & Cook, a multinational company specializing in fresh fruit and vegetables, which introduced the Dole brand in the international banana trade. Headquartered in California, its strength lies in a broad diversification of product lines. It is now the largest banana company in Costa Rica, covering 15 percent of total banana plantations and marketing 29 percent of national production in 1995, with foreign exchange earnings of US\$189.3 million.

Del Monte The other major competitor is Del Monte Tropical Fruit Co., which began in Guatemala in 1972. It was created when the US corporation Del Monte Foods bought United Fruit's banana operations there. This deal came about as a result of a ruling by the US Court of Justice to enforce the Sherman Antitrust Act. It then started operating in the Costa Rican Atlantic coast through its local subsidiary, the Banana

percent of Costa Rica's production from only 38 percent of the area devoted to the crop. Between 1988 and 1994, the land planted in bananas expanded by 160 percent at a cost of nearly US\$400 million.

Banana producers argue that the environmental impact of banana cultivation is relatively low in Costa Rica compared to surrounding countries owing to an endowment of natural resources and a climate virtually perfectly suited to the crop. Monocrop production techniques and a heavy reliance on agrochemicals take a toll, however. Plantation workers exposed to pesticides are especially at risk, and water courses suffer from run-off resulting from unmanaged wastes.

In response to consumer, not government demand, the banana industry has taken strides to protect the environment without sacrificing its outstanding yield. An Environmental Banana Commission formed and publicized a series of commitments to reduce impacts. A new certification is available for an 'Eco-OK Banana'. It is principally the large multinational producers who have been successful in implementing protective measures, including plastics recycling and reforestation programs. Disappointing demand in Europe, on top of already burdensome debt payments and the high cost of capital have hindered smaller producers from participating in these voluntary environmental protection measures.

General description of the banana sector in Costa Rica

The banana growing activity in Costa Rica grew out of the country's need in the late nineteenth century to complete the construction of a railroad connecting the interior to the Caribbean Sea, in order to transport coffee, the main export product, to European markets. Previously, coffee was marketed via the Pacific and, in some cases, through Chilean middlemen.

Finding itself unable to come up with the financing alone, the government entered into a contract with Minor C. Keith, granting him the rights to exploit the railroad for 99 years, together with 300,000 hectares of newly accessed land. In return, Keith committed himself to completing the railroad and repaying the government's outstanding debt with British bankers, who had initially financed the works.²⁷

This agreement gave origin to a prosperous banana production business.²⁸ Nevertheless, despite the activity's continuous growth, interrupted only by the international repercussions of the crisis in the 1930s and the Second World War, it was not until 1970 that bananas displaced coffee as the country's main agricultural export crop.

Currently, Costa Rica is one of the most competitive producers of banana. In fact, it is the second largest banana exporting country in the world and has the second highest productivity. This high level of competitiveness is mainly the result of the following factors: optimum environmental conditions for production; the tradition of supplying the most demanding banana consumer market (Europe); and intense rivalry among producers given the presence of all the major world competitors. It is also important to

Develop. S.A. Corporation (BANDECO). Recently, Del Monte's control over banana operations in Latin America has also changed hands many times, with assets and brand name being transferred in the transactions. Its current owner is a Chilean fruit producing and marketing group. In 1995 it marketed 21 percent of exports and owns 11 percent of production area. Foreign exchange earned in this period reached US\$137.8 million.

Table 4.2 summarizes the basic statistics for industry competitors in the country, as well as reflecting global industry composition, given that Costa Rica is the second largest banana exporting country and most global players have operations here.

Table 4.2 Basic Banana Statistics, 1995

Company	Marketed		
	Boxes ¹	Percent	Hectares ²
Dole	32,690,808	29	8,033
Del Monte	23,790,237	21	5,891
Chiquita	20,593,905	18	6,511
Geest Caribbean	6,372,711	6	2,843
Others ³	28,641,598	26	28,888
Total	112,089,259	100	52,166

Notes:

- 1: Total exported boxes, both own and purchased from independent producers.
- 2: Only plantations on own land are included.
- 3: Mostly national marketing firms and independent producers; also foreigners, with Colombians being the main group.

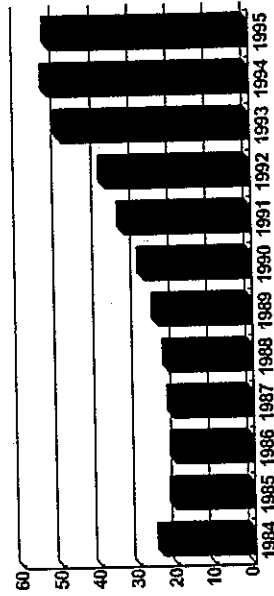
Source: Corporación Bananera Nacional.

The 'Others' category in the above table is both large and diverse. The largest marketing firm in this category is the Colombian organization BANACOL, accounting for 4.9 percent of total export boxes and owning 2.1 percent of the country's plantations. Included in this group are also other Colombian businesses, small European companies, and various Costa Rican firms. It is worth mentioning that, for several years now, the three major companies' relative market share of total exports from Costa Rica, with the exception of Chiquita, has been declining. This is due to increased competition from Geest Caribbean and other small producers that are engaged in expanding and/or adding new plantations.

Recent banana expansion As shown in Figure 4.3, banana plantations in the country grew from 20,000 hectares in 1988 to 52,737 in 1994, when the

largest new plantation area was reached. While this constitutes only 1 percent of national territory, 99 percent of the industry is located in the Atlantic region of Costa Rica, where its greatest impacts are concentrated.

Figure 4.2 Export Volume, 1984-95 (Millions of Boxes)



Note: Each box weighs 18.14 kg.

Source: Corporación Bananera Nacional.

This 31,000 hectares expansion meant a direct investment estimated at US\$393.2 million (see Table 4.3).

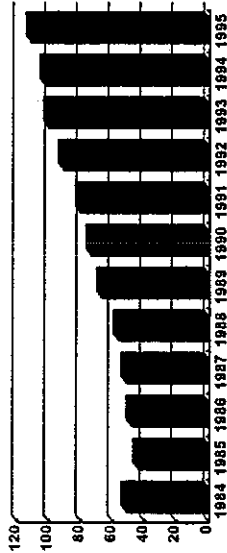
Table 4.3 Estimated Direct Investment During Banana Expansion

Year	Investment (US\$ millions)
1987	12.83
1988	33.48
1989	44.32
1990	63.29
1991	58.52
1992	139.31
1993	41.45
Total	393.20

The investment made to establish the crop in the recent expansion has been estimated at US\$12,000 per hectare, as a weighted average. While direct costs of planting reach US\$10,000 per hectare in Costa Rica, this can only be said about the 60 percent of the expansion made by independent producers. In the case of big companies, their costs go up to US\$16,000 per hectare, since the scale of their projects forces them to incur additional indirect planting costs, such as access roads, high-voltage electric lines, and workers' housing quarters.

As a consequence of the expansion described above, the exports grew annually about 10.7 percent during 1990-93. In 1994, however, the growth decreased to 2.2 percent as a result of EU's trade restraints that came into force in July 1993 (see Figure 4.2).

Figure 4.3 Production Area, 1985-95 (Thousand Hectares)



Source: Corporación Bananera Nacional.

The considerable growth of this sector came about according to banana development plans fostered by the Costa Rican Government. For instance, one of the main production incentives introduced was subsidized credit to finance new projects that restored plantations and rehabilitated farms to increase their productivity. In addition, the government lowered taxes on new production.³¹

The environmental content of investment in Costa Rica's banana industry

The impact of the government on the environmental content of investment in the banana industry has been of little importance. The biggest factor promoting changes in environmental performance has been direct consumer pressure.

Banana production in Costa Rica is based on the monoculture model and large-scale production for export. As a consequence, both high yields and high environmental impacts are produced. However, improved natural resource management practices have been introduced by leading companies.

Positive environmental aspects: using the natural resource base efficiently to gain competitive advantage and reduce environmental impacts

It is difficult to identify the positive environmental effects generated by the banana industry. In fact, this is a common characteristic of most of the

intensive agricultural activities in the tropics. Hence, Costa Rica's banana production environmental impacts can be better assessed by comparing its performance with banana plantations in other countries and with other intense agricultural activities. Thus, what is called 'positive aspects' in this section, should be understood as either improvements achieved by Costa Rica in relation to other countries or to other agricultural activities.

Use of fertilizer and irrigation systems Currently, the banana plantations in the country are located on the Atlantic coast. This region has optimum agricultural soils, and therefore, Costa Rican plantations require smaller amounts of fertilizers than the other banana producing countries. Comparatively, this difference provides the country's banana industry with annual savings of approximately 1,530 tons of fertilizers. The Atlantic coast climate conditions also fall within the optimum range for banana crops. Thus, unlike plantations in other countries in the region, Costa Rica's plantations do not require irrigation systems, producing a savings of about US\$800 per hectare per year and reducing water consumption by about 507,250 liters per week per hectare during periods ranging from two to five months a year.

Industry productivity Given the benefits cited above in climate and natural resource endowment, it is no surprise that banana production is particularly advantageous among agricultural activities in Costa Rica. A comparative analysis of banana production and other agricultural activities shows that banana gross production value per hectare is considerably higher (see Table 4.4).

Table 4.4 Comparison of Area Used and Percentage Composition of Gross Production Value of Major Export Products, 1990

Agricultural Activity	Banana	Coffee	Meat	Sugar Cane
Gross Production Value	24.5%	14.6%	8.2%	4.3%
Hectares (000s)	28.3	90.0	2,420.1	42.2

Sources: Banco Central de Costa Rica and Atlas Agropecuario³².

Productivity is also very high in relation to other countries. Costa Rica had the highest yield in the world, in 1989, at 2,731 boxes per hectare.

Current EU restraints have disturbed markets and the 1995 figure of 2,149 boxes/hectares does not reflect the industry's full potential. Costa Rica is second only to Panama, which is now the country with the highest productivity in the region (see Table 4.5). Nonetheless, it continues to have one of the highest productivities in the world and is specialized in meeting the requirements of demanding customers accustomed to consuming fruit with a perfect appearance.

Table 4.5 Relative Productivity of Some Countries in the Region, 1996

Country	Relative Productivity
Panama	100.0
Costa Rica	89.1
Guatemala	86.9
Colombia	79.6
Honduras	78.8

Note: Representative data of a company operating in the region.

The above-mentioned comparisons in terms of productivity and efficient use of resources have led the Costa Rican banana industry to argue that it is less environmentally harmful than its counterparts in other countries of the area and other domestic agricultural activities.

Industrial environmental management As to improving environmental management, the industry showed the first signs of change in 1991, with the creation of the Environmental Protection Unit within Corporación Bananera Nacional, the sector's official regulating institution. One year later, both producers and representatives of marketing companies created the Environmental Banana Commission and presented the government at the time with their environmental commitment in a public document. The document was guided by the goal of striking a balance between agricultural production and environmental protection. Table 4.6 shows a summary of this proposal.

Recycling of plastic wastes One of the outstanding achievements is an improved management of waste plastics, an input required by plantations in the amount of 178 kg per hectare per year. For example, Dole and Del Monte created an alliance to build a plastics recycling plant, together with a local supplier of plastics. In turn, Chiquita established its own plastics recycling program. Thus, plastic materials used by the industry have acquired a salvage value that has motivated independent producers to

participate in the recycling efforts. Now, it is estimated that 90 per cent of the plastic used by the industry is recycled.¹³

Table 4.6 Summary of Banana Sector's Environmental Commitment

Commitment	Objectives
Creation of the Environmental Banana Commission (EBC)	Establishing policies and practices to make the activity sustainable.
Waste Management	Encouraging waste management under the principles of reduction, reuse, recycling, and landfills.
Use of Agrochemicals	Encouraging lower impacts and risks in using pesticides through various actions, such as creating buffer zones, improving infrastructure, and reviewing regulations, among other things.
Soil Use and Reforestation	Establishing the crop only on suitable soils and preserving vegetation along river banks. Additionally, promoting private reserves in areas of influence.
Evaluation	Every six months, the EBC will assess farm compliance with the commitment.

Reforestation and conservation of pristine forest Small riverside reforestation programs have taken root since 1992 and some commercial forestry projects are found in areas that have been abandoned because of market crisis. Chiquita has planted approximately 70,000 trees through these programs. Some forested areas still standing within big-company estates have been declared forestry reserves; in the case of Chiquita these areas cover approximately 630 hectares. Del Monte also keeps 1,200 hectares of pristine forest.

Occupational health programs The occupational health area has been reinforced within companies. Currently, the agrochemical industry is itself

actively involved in worker training programs and collection of empty containers to be reused, in some cases, or properly disposed of, in others. Unfortunately, the innovations already discussed together with others, such as electronically guided crop-dusting instead of using workers as flagmen, are being implemented more intensively at the farms of major marketing companies, such as Chiquita and Dole. Small owners argued that Europe's restricted demand, the high cost of capital, and borrowing for recent planting projects during expansion have not allowed them to establish similar methods.

Box 4.2 Environmental Certification

In this case the company commits itself to comply with certification standards that generally exceed the legislation. Through environmental audits the certifying organization determines whether compliance exists. If so, the company receives an environmental seal that consumers can recognize on the product. The main advantage of these programs is third-party credibility, which has an impact on company image.

In Costa Rica the Eco-OK banana certification program was established in 1993 with the support of two NGOs, the US Rainforest Alliance and the local AMBIO Foundation. The purpose is to provide consumers with an 'environmentally friendly' banana, since large-scale production under tropical agricultural conditions is not possible without the use of agrochemicals with the current level of technology. Subsequently, the program was expanded to Hawaii, Ecuador, and more recently to Panama.

The certification program aims to minimize negative environmental impacts. It requires establishing integral programs on hazardous substance handling, waste, occupational health, environmental research and education, water quality monitoring in water systems and, finally, restoring and conserving the ecosystems where banana operations take place.³⁴ Several producers are involved in the program, including the commercial plantation at EARTH University, although the largest participant is Chiquita, the industry's world leader.³⁵ Out of the 29 farms owned by this company in the country, 25 have been certified, with a total of 5,265 hectares, and the rest have already started the process. Table 4.7 shows a summary of evaluation criteria required to certify a farm.

Negative environmental impacts of monoculture production dependent on agrochemicals Both in Costa Rica and in the major producing countries the activity is based on large-scale monoculture production and reliance on agrochemicals. The high yields obtained are the result of intensively using resources and environmental services.

As a result of this land-intensive use, soils are affected by degradation and erosion. Water systems suffer shifts in their courses and flow, and are filled with contaminants. Surrounding ecosystems are also affected by

monoculture effects, such as the loss of biodiversity, pesticide dispersio. and waste disposal.

Table 4.7 Evaluation Categories in the Eco-OK Banana Program and Summary of Inspection Factors

Evaluation Categories	Inspection Factors
Handling of Hazardous Substances	Pollution prevention systems and enforcement of procedures to safely use agrochemicals and fuels.
Integral Waste Management	Waste management strategy and final disposal procedures for both operating and residential waste.
Occupational Health	Permanent training programs to prevent health risks to workers, their families, and the environment. Periodic health controls.
Water Monitoring	Physical, chemical, and pesticide-residue tests on underground and run-off water. Bacteriological tests on drinking water.
Ecosystems	Reforestation programs in rivers, creeks, public roads, and reserves in marginal areas of plantations. Reforestation in buffer zones between plantations and residential and industrial areas.

Deforestation in coastal lowlands Destruction of more than 20,000 hectares of tropical forest in the coastal lowlands was a clear effect of the installation of banana plantations during the first seven decades of this century. No concluding information,³⁶ however, is available to show that expansion stemmed primarily from forest clearcutting (see Table 4.8), since most of it was located in areas previously devoted to cattle raising.

Use of pesticides Costa Rica has one of the highest levels of pesticide consumption in the world. In 1989, for example, 16 kg/hectares of pesticides were used, while the worldwide average was only 2.7 kg/hectares.³⁷ The banana industry contributes about 50-60 percent of pesticide consumption in the country, expending more than US\$1500 per hectare of plantation.³⁸ Moreover, 63 percent of the pesticides used by this

industry 995 (855 tons) had medium to high toxic potential. It is also important to note that airplane dispersion of these chemicals is still the main method of application. Consequently, they are carried by wind beyond plantations to rivers, creeks, and residential areas. Table 4.9 shows generic information about the industry's estimated pesticide consumption found in typical plantation management.

Table 4.8 Forested Areas Granted Under Permits in Atlantic and Northern Areas and Increase in Crop Production Area, 1985-91 (Hectares)

Banana Expansion	Cleared Primary Forest	Cleared Secondary Forest	Pastures, Thickets, and Abandoned Crops
11,465	306	2,480	8,679
100%	3%	22%	75%

Note: A 64 percent of the expansion had been reached.
Source: CNB³⁹

It is important to note, however, that there are big toxicological differences between the different products used. Table 4.10 shows generic information on the toxic potential of pesticides used in the industry, in typical plantation management. Only 15 percent of pesticides applied are highly toxic, on a percentage basis, although they account for 195 metric tons of active ingredients in mostly organophosphorus compounds. This chemical group of pesticides has been proven to have cancer-producing, fetotoxic, teratogenic, and mutagenic effects.⁴⁰

Table 4.9 Estimated Annual Pesticide Consumption in the Industry

Pesticide	Active Ingredient (metric tons)	Percentage
Fungicide	850	62
Nematicide	410	30
Herbicide	100	7
Insecticide	5	0.4
Total	1,365	100

Table 4.10 Estimated Annual Toxic Potential of Pesticides in the In.

Toxic Potential	Active Ingredient (metric tons)	Percentage
Medium	660	48
Slight	510	37
High	195	15
Total	1,365	100

The environmental impact of the use of these amounts of chemicals has not yet been assessed. However, a clear indication of their negative effects is the high frequency of public health problems among banana workers and their families. In fact, about 6 percent of the banana plantation workers suffer problems of intoxication every year⁴¹ (twice the worldwide average for workers in agriculture). It is also known that an average of 72 percent of the reported cases of poisoning in the country occurs in the banana plantations.⁴² The industry's current standard is to periodically test cholinesterase blood levels in workers performing pesticide applications and to require them to take decontaminating showers at the farms. Unfortunately, these preventive measures and the required use of personal protection equipment are often not practiced.

Management of solid wastes and waste water In 1993, the banana industry generated approximately 8,372 tons per day of solid wastes (see Table 4.11), an amount equivalent to 2.40 tons of wastes per ton of bananas exported.⁴³ These wastes represented about 72 percent of the total amount of solid wastes generated in Costa Rica by urban sources in 1990.⁴⁴ The general practice for the disposal of most of these materials has been the use of open-air dumps located along river banks where they are finally carried away by flood waters. A considerable amount of the solid waste is made up of non-exportable bananas, those not meeting international market quality standards. However, 80 percent of non-compliance is due to appearance flaws that do not alter fruit pulp quality whatsoever. Approximately 5 to 16 percent of these bananas are exported at a reduced price and another small percentage is consumed in Costa Rica.⁴⁵ The remainder are disposed in the open-air dumps.

Waste water discharged in large amounts by packing plants should also be mentioned. Typically, there is one plant in every farm using 720 liters of underground water per minute for processing about 4000 boxes (18.14 kg/box). As a result, annual water consumption in these packing plants is approximately 5.7 million liters per year per plantation hectare.⁴⁶ This water is used to wash bananas and is discharged through farm drainage

system... in rivers and creeks. Its pollution potential can be significant, since the water contains pesticide residues, suspended solids, latex and aluminum sulfate.⁴⁷ Currently no data is available about the level of pesticide contamination in this waste water. Nevertheless, the high incidence of poisonings among packing plant workers is a strong indication of significant problems. For instance, in 1991, packing plant workers suffered 22 percent of the reported cases of poisonings in the banana industry. It is also important to note that on water consumption the industry pays only an initial fee for the right of drilling wells and there is no further charge for this resource, in spite of the fact that underground water is owned by the state.

Table 4.11 Waste Generated in 1993 (Tons/Year)

Wastes	Amount	Tons of Waste per 100 Tons Exported
1. Twine	2,100	0.22
2. Plastic bags	2,801	0.29
3. Packing material	3,211	0.34
4. Total non-degradable	8,112	0.85
5. Crown and flowers	24,505	2.57
6. Raceme's stems	143,528	15.06
7. Fruit rejected	317,592	33.33
8. Pesticides (estimated 25% loss)	2,369	0.25
9. Nitrogen	771	0.08
10. Agrochemical containers	n/a	
11. Sub total	502,620	
12. Total waste requiring treatment	502,620	52.75
13. Stems and leaves	2,553,310	267.99
14. Total waste	3,055,830	320.74

Source: Hernandez C. and Witter S. (1996), 'Evaluating and managing the environmental impact of banana production in Costa Rica: a systems approach', *Ambio*, 25 (3), May (171-8).

Finally, two serious developments with worldwide repercussions elicited multiple outcries against the banana industry in the last few years. Local environmentalist groups, backed up by European organizations, filed a complaint of an ethical nature against the transnational company Dole with the International Water Court in The Hague, The Netherlands. The reason

for the filed complaint was the pollution of La Estrella River on the Atlantic coast of Costa Rica.

More serious, however, was the case of more than 1,500 banana plantation workers who were allegedly sterilized as a result of their exposure to a nematocide called DBCP (dibromochloropropane). This product was heavily used during the 1970s in Costa Rica, yet more cases of sterilization were still appearing during the 1980s. As of early 1997, a trial is taking place in the US State of Texas. Parties to the suit include people harmed by the DBCP, banana transnationals (Dole) and the producer of the pesticide (Dow Chemical and Shell).

Factors underlying environmental content: consumers as generators of change

Strong pressure from European NGOs and consumers has been the most important factor for promoting improvements in the environmental performance of the major banana companies established in Costa Rica. Their importance has been widely recognized by the private sector and the government. For example, the creation of the Environmental Banana Commission in 1992 was the response of the main companies to increasing criticism against their environmental management practices. In contrast, small scale producers have been reluctant to implement any kind of environmental improvements. These producers think that the new environmental concerns expressed by consumers are contradictory. As one of these small-scale producers put it:

The banana production system is designed to produce bananas with perfect skin and size. Those are the bananas bought by people in Europe and the US! If you use more 'environmentally friendly' production practices, the banana produced would not have ideal appearance... Consequently, they [the bananas] would not be exported. (R. Rodriguez, Limon, March 1996)

The activism against the environmental practices of the banana industry in Costa Rica has been coordinated by an England-based network called EuroBan. This network coordinates the different concerns of about 28 organizations in different countries of Europe, mostly NGOs, that share similar concerns about the banana industry (Corrales, Lenin, San José, Costa Rica, April 1996). Environmental denouncement in markets has been the strategy wielded by these organizations against large-scale banana production. Accordingly, in 1992, there was even word of a boycott in Europe against bananas from Costa Rica.⁴⁸ Also, the most active NGOs have connections with local groups traditionally opposed to banana activities. For instance, the Costa Rican NGO *Foro Emaus* has played the

role in providing information and data to its European supporters.

On the other hand, some NGOs have chosen to work together with producers in order to develop independent 'eco-certification' programs. This is the case of the already mentioned US-based NGO Rainforest Alliance and the local NGO AMBIO. More recently, Conservation International together with the Costa Rican Tropical Scientific Center have also begun cooperative programs with big banana companies.

Need for greater progress

The environmental improvements achieved by the leading banana companies operating in Costa Rica can only be seen as an initial step. The transnational banana companies view such improvements as necessary for retaining access to the European and the American market. However, the real challenge involves small- and medium-size producers that represent 62 percent of the total number of plantations.

These small- and medium-size producers cannot afford to invest in environmental improvements unless they can obtain an immediate direct income increase. More environmental protection for these parties must make financial sense in order to be implemented or even to be considered. Consequently, consumers should pay higher prices to obtain 'environmentally friendly' bananas.

Are consumers in Europe and the US willing to pay more for an 'eco-friendly' banana? Unfortunately, the answer is that the average person in these countries is not willing to pay more. So far, only high income consumers are willing to pay more for 'environmentally friendly' bananas.

On the other hand, new cost efficient environmental management practices will not be created if the government of Costa Rica does not introduce incentive based environmental regulations. However, the government has not even been able to enforce the existing command and control regulations, as is the case in most of the developing world. The main government argument has usually been that the enforcement of environmental regulations would considerably increase the cost for producers.

Nevertheless, a detailed analysis of the industry described above demonstrated that there are some areas where environmental improvement would lead to savings. The management of plastic wastes and the use of pesticides are examples of these areas. At least in these cases the government should be actively providing information and assistance to small- and medium-size farmers and at the same time enforcing environmental regulations.

Finally, it is important to note that some of the negative environmental impacts caused by banana production directly affect public health. This has

been particularly true in terms of the impacts of pesticide use. Here, again, the government has the most important role to play in improving the situation, independently of consumer demand and the economic interest of the banana producers.

Notes

- 1 The case on pulp and paper in Brazil is by Peter H. May and Valéria Gonçalves de Vinha from the Federal Rural University and the Federal University in Rio de Janeiro, Brazil. The case on soybeans is by Ana Célia Casaro and Peter H. May both from the Federal Rural University in Rio de Janeiro, Brazil. Their more detailed papers are included below as Sections 4.1. and 4.2.
- 2 This case is by Jorge Rivera in collaboration with Gabriel Quijandria of INCAE in Costa Rica. Their more detailed paper is included as Section 4.3.
- 3 Carrere, Ricardo (1997), 'The Environmental and Social Effects of Corporate Environmentalism in the Brazilian Market Pulp Industry'. Paper presented at the UNRISD/UNC International Workshop on Business Responsibility for Environmental Protection in Developing Countries, 22-25, September, Heredia, Costa Rica; Lowe, Justin (1993), 'A Paradise Pulped for Profit', *Earth Island Journal*, 8 (4), p.17.
- 4 The European Union has had awkward trade relationships with former Caribbean colonies. See: *The Economist* (1997), 'Expelled from Eden', 345 (8048), 35-9.
- 5 See generally, Thrupp, Lori Ann, Gilles Bergeron and William F. Waters (1995), *Bittersweet Harvests for Global Supermarkets*, Washington, DC: World Resources Institute.
- 6 See generally, Cabado, Pablo, David Wier and Constance Matthiessen (1989), 'Will the Circle Be Unbroken?', *Mother Jones*, 14 (5) June, 20-28; Murray, Douglas (1994), *Cultivating Crisis: The Human Costs of Pesticides in Central America*, Austin, TX: University of Texas Press; Thrupp, Lori Ann (1988), 'Pesticides and Policies: Approaches to Pest Control Dilemmas in Nicaragua and Costa Rica', *Latin American Perspectives*, (59) 15 (4), Fall.
- 7 For general discussion of the impact of agriculture on biodiversity see: Srivastava, Jitendra P., Nigel J.H. Smith and Douglas A. Fomo (1996), *Biodiversity and Agricultural Intensification: Partners for Development and Conservation* (Environmentally Sustainable Development Series and Monographs Series No. 11), Washington, DC: World Bank
- 8 Echeverria, Rubén G., Eduardo J. Trigo and Derek Byerlee (1996), *Institutional Change and Effective Financing of Agricultural Research in Latin America*, Washington, DC: World Bank (Technical Paper No. 330).
- 9 IIED (1996), *Towards a Sustainable Paper Cycle*, London: International Institute for Environment and Development for World Business Council for Sustainable Development.
- 10 For further discussion on harmonizing biodiversity and agricultural goals, see: Srivastava, Jitendra P., Nigel J.H. Smith and Douglas A. Fomo (1996), *Biodiversity and Agricultural Intensification: Partners for Development and Conservation* (Environmentally Sustainable Development Series and Monographs Series No. 11), Washington, DC: World Bank.
- 11 Spencer-Cooke, Andrea (1997), 'Eco-labeling Goes Bananas', *Tomorrow*, September-October.
- 12 Mackey, Chris (1997), 'Going Bananas for Eco Safety: Banana Industry in Costa Rica Supports Environmental Protection', *Americas* (English Edition), 49 (8) p. 3.
- 13 More extensive discussions of governmental investment support programs in Costa Rica

and Brazil are provided in the following papers: Investment Promotion in Costa Rica, by Ligia Castro in collaboration with Jorge Rivera, Gabriel Quijandria and Esteban Brenes; Investment Promotion in Brazil, by Peter May, and Ana Célia Castro from the Federal Rural University, Rio de Janeiro, Brazil. Both papers are available on the Edward Elgar homepage at <http://www.e-elgar.co.uk>.

- 14 See note 5.
- 15 Quesada-Mateo, Carlos A. and Vivienne Solis-Rivera (1990), 'Costa Rica's National Strategy for Sustainable Development: A Summary', *Futures*, 22 (4), May, 396-417.
- 16 More extensive discussions of governmental environmental requirements and programs in Costa Rica and Brazil are provided in the following papers: Environmental Protection in Costa Rica, by Ligia Castro in collaboration with Jorge Rivera, Gabriel Quijandria, and Esteban Brenes; Environmental Protection in Brazil, by Peter May of the Federal University of Rio de Janeiro. Both papers are available on the internet at the Edward Elgar homepage at <http://www.e-elgar.co.uk>.
- 17 For additional case studies of sustainable agriculture, see: Thrupp, Lori Ann (1996), *New Partnerships in Sustainable Agriculture*, Washington, DC: The World Resources Institute.

Section 4.1 Brazil Pulp and Paper

- 18 Champion is a solely owned subsidiary of Champion, a US firm. Jari is run by several Brazilian firms and banks under the principal control of the Antunes Group. Aracruz ownership is estimated at Brazilian private, 1/3 foreign capital and 1/3 government financing. 3.5 percent of stock is traded on the NYSE and the Brazilian stock market. Klabin is family-owned and has received financing through BNDES. Cenibra is 49 percent controlled by Japan/Brazil and 51 percent controlled by Companhia Vale do Rio Doce, a giant state-holding corporation. Privatized in 1997.
- 19 Fonseca, Maria da Graça Derengowski and José Sidnei Gonçalves (1995), 'Financiamento do Investimento da Agroindústria e Agropecuária: Análise de Dois Planos Governamentais Recentes', *Informações Econômicas*, 25(6), 31-47.
- 20 BNDES (1993), *Segmento de Celulose do Mercado*, Rio de Janeiro: Banco Nacional de Desenvolvimento Econômico e Social, Área de Planejamento, Depto. de Estudos Setoriais-DEEST.
- 21 MMA (1996), 'Agenda de Trabalho Conjunto para a Formulação de um Novo Programa de Reflorestamento do País', Brasília: Ministério do Meio Ambiente, dos Recursos Hídricos e da Amazônia Legal/IBAMA/Funatura, with support of ITTO.
- 22 Luis, Nassif (1996), 'Entrevista com Osmar Zogbi, Presidente do ANFFC', *Folha de São Paulo*, 3 September.
- Section 4.2 Brazil Soybeans
- 23 *Folha de São Paulo* (1996) 'Sojicultores Brasileiros Levam Produção Para Bolívia', 18 August.
- 24 Landers, John N. (1996), 'O Plantio directo na agricultura: o caso do cerrado do Brasil', in Lopes, Ingenes et al. (eds), *Gestão Ambiental no Brasil: Experiência e Sucessos*, Rio de Janeiro: Fundação Getúlio Vargas/World Bank, pp. 3-34.
- 25 Lustig, Theodore (1991) 'Soybean Oil Inks: A New Perspective', *Graphic Arts Monthly* 63(12): 94.
- 26 FOE/GTA (1996), *Coherent Public Policies for a Sustainable Amazon: The Challenge of Innovation and the Pilot Program*, São Paulo: Friends of the Earth Amazon Program/Grupo de Trabalho Amazônico, p. 79.
- Section 4.3 Costa Rica Bananas
- 27 Monge, Carlos (1965), *Historia de Costa Rica*, San José: Librería Las Américas.
- 28 *ibid.*
- 29 Soto, Moisés (1985), *Bananas: Cultivo y Comercialización*, San José: Impr. L.I.
- 30 *ibid.*

- 31 La Nación (1996b), 'El Crédito Bananero en Banco Nacional', (San José: April 8).
- 32 Cortés, G. (1992), *Atlas Agropecuario de Costa Rica*, San José: UNED.
- 33 Plastic bags and plastic twine are important materials in the banana production process. The bags are used to protect the banana fingers from insects and contaminants. They also serve to create a micro-environment that stimulates fruit development. On the other hand, the plastic twine is used to hold the banana trees against the effect of the wind. The traditional discarding method for the plastic bags has been to dump them in open-air disposal areas together with other solid wastes. The twine has been usually disposed of on to the plantation floor.
- 34 ECO-OK (1996), *Manual de operación*, San José: Fundación AMBIO.
- 35 Vega, Carlos (1995), 'Sostenibilidad Ambiental: Una Visión modesta de Un Gran Objetivo', *Rutas Bananera*, San José: November 1995.
- 36 UICN/ORMA (1992), *Diagnóstico del Impacto Socio-ambiental de la Expansión Bananera*. San José: UICN.
- 37 Ministerio de Ambiente y Energía (1996), 'Plan Nacional de Acción Ambiental' (version preliminar), San José: Ministerio de Ambiente y Energía, p. 56.
- 38 Rivera J. (1996), *Environmental Impact of the Foreign Direct Investment in the Banana Industry of Costa Rica*, INCAE: San Jose, Costa Rica, p. 7.
- 39 Cámara Nacional de Bananeros (1991), *Sobre Bananeras y Ambiente*, San José, Costa Rica.
- 40 Hilge, L. et al. (1992), *El Uso de los Plaguicidas en Costa Rica*, San José: UNED.
- 41 See note 31.
- 42 See note 33.
- 43 Hernandez C. and S. Wtuer (1996), 'Evaluating and Managing the Environmental Impact of Banana Production in Costa Rica: A Systems Approach', *Ambio*, 25 (3), 171-8.
- 44 See note 43.
- 45 See note 43.
- 46 *Ibid.*
- 47 See note 43.
- 48 Bonilla, C. (1992), 'La Actividad Bananera y El medio Ambiente', *Memoria II. Congreso Bananero Internacional*, San José: CORBANA-UPEB.

