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Response Due Date: 12/10/98

Correspondence Description

Addressed to: *Mr. Kenneth King*	Correspondence Date: 12/03/98
Date Received: 12/04/98	Organization: WB
From: Lars Vidaeus	

Assigned To: M. Ramos ***Re-Assigned to: H. Mishra***

Status: Open

Type: Fax
Topic: PDF A: COSTA RICA: Biodiversity Conservation through Promotion of Organic Cacao Production in Forest Landscapes

Action Instructions

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☐ Please handle/respond on behalf of Mr. Kenneth King and provide a copy.
☐ Please handle/respond on behalf of Mr. Mohamed El-Ashry and provide a copy.
☐ Please prepare a draft response and return to Program Coordinator
☐ Please reply directly and provide a copy.
☒ Please review and/or technical comments

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M. Ramos, W. Lusigi, H. Acquay, M. Cruz, J. Taylor, Kanta

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THE WORLD BANK/IFC/M.I.G.A.

OFFICE MEMORANDUM

DATE: December 3, 1998

TO: See Distribution Below

FROM: Lars Vidaeus, GEF Executive Coordinator

EXTENSION: 34188

SUBJECT: **Costa Rica : PDF Block A Request for GEF Medium Size Project**
Biodiversity Conservation through promotion of Organic Cacao Production

Please find attached a PDF Block A Request for the Costa Rica Biodiversity Conservation through promotion of Organic Cacao Production Project. We would appreciate your comments by December 10, 1998. Thank you.

Distribution:
R. Asenjo, UNDP (New York) (Fax: 212-906-6998)
A. Djoghlaf, UNEP (Nairobi) (Fax: 9-011-254-2-520-825)
R. Khanna, UNEP (Washington) (Fax: 202-331-4225)

cc: Messrs./Mmes

de Mesa, GEF Secretariat (fax 23240)
Koch-Weser, Lovejoy, Kellenberg, Martinez, Abedin (LCSES)
Cackler (LCC2), van Puymbroeck (LEGLA)
Kimes, Castro, Mikitin, Bossard (ENVGC)

ENVGC ISC files
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PART II - PROJECT FRAMEWORK	
1. Project name: Biodiversity Conservation through Promotion of Organic Cacao Production in Forest Landscapes	**2. GEF Implementing Agency:** World Bank
3. Country in which the project is being implemented: Costa Rica	**4. Country eligibility:** Costa Rica ratified the Convention on Biological Diversity on August 26, 1994
5. GEF focal area(s), and/or cross-cutting issues: Biological Diversity	**6. Operational program/Short-term measure:** The project is in accordance with the GEF in two Operational Programs: Forest Ecosystems and Mountain Ecosystems.

7. Project linkage to national priorities, action plans, and programs:

This project is closely linked to the Action Plan related to the Costa Rican National Biodiversity Law of April 14, 1998 (N° 12635), which states that sustainable use of biodiversity should maintain development options for future generations, including food security, ecosystem conservation, and living standards. Moreover, it should help foster cultural diversity as well as encourage respect and enhance knowledge about the elements of biodiversity, particularly in the case of rural and indigenous communities and other cultural groups. Project activities are likewise linked to Forestry Law N°7575, approved in 1996, which supports the conservation of forested ecosystems and provides incentives for individuals and groups which implement conservation measures. Finally, the project coincides with the principles of the Indigenous Law (N°6172), which prioritizes development efforts within indigenous reserves and indigenous communities; supports technical capacity-building plans through technology transfer; and supports institutional strengthening of indigenous organizations.

Priority actions underway by the Ministry of Environment and Energy (MINAE) at the national level—and specifically in the project area (Limón Province, Municipality of Talamanca)—support biodiversity conservation both inside and outside of projected areas. These actions are based upon the findings of the 1996 GRUAS report (GEF/UNDP/MINAE), which delineates existing biological corridors in Costa Rica. Conservation of the Talamanca/Caribbean biological corridor has been identified as critical for protecting biodiversity along the Atlantic Coast of Costa Rica. Furthermore, the project forms a contiguous link with project areas within the Panama Atlantic Mesoamerican Biological Corridor project.

8. GEF national operational focal point and date of country endorsement:

GEF national operational focal point:	**Date of Country Endorsement:**
Carlos Herrera Amighetti FUNDECOOPERACION San Jose, Costa Rica	October 7, 1998

9. Project rationale and objectives:

This project aims to support indigenous agricultural production systems which exert low impact upon biodiversity and the surrounding environment in the Talamanca region and contribute to the general objective of consolidation of biodiversity within the Mesoamerican Biological Corridor (MBC) and buffer zones. The project will likewise contribute to improvement in the quality of life of indigenous and non-indigenous communities, given its geographic location.

Specific project objectives include: (i) carry out capacity-building activities that help maintain traditional land uses which are consistent with biodiversity conservation in priority areas of the Mesoamerican Biological Corridor and improve land management within forest and mountain ecosystems, including: to support production of organic cacao as well as the use of organic fertilizers and pesticides, combating disease and plagues with high quality, environment-friendly plague-resistant varieties; (ii) support beneficiary communities: by encouraging and helping to strengthen indigenous community organizations, creating increased opportunities relating to sustainable land use through capacity-building seminars with practical exercises for local organizations; (iii) promote environmental

education within the context of the Mesoamerican Biological Corridor, in support of traditional ethnic cultures; (iv) promote certification through local agencies and support the production and commercialization of organic cacao and related crops through markets in Europe and North America.

* * * * * * * *

The project will be carried out in buffer zones surrounding several protected forested areas, including Amistad International Park, 193,929 ha inside Costa Rica and 221,000 ha inside Panama; Chirripó National Park 50,900 ha, with the highest untouched mountain range in Central America; the Hito and Cerere Biological Reserve, 9,044 ha; Barbilla, 10,000 ha; the Las Tablas protected area, 19,602 ha; and the Tyni, Telire, Talamanca Ujarrás, Salitre and Cabagra indigenous reserves, 217,441 ha; the Talamanca-Caribbean Biological Corridor Cahuita and Gandoca-Manzanillo national park wildlife refuges.

The geographic location of these areas and reserves allows for an important genetic exchange between the flora and fauna of South and North America that, together with the differences in altitude and climate, support considerable biological diversity. The area's vegetation has more than 10,000 species of vascular plants or 90% of such species in Costa Rica, 4,000 species of nonvascular plants; nearly 1,000 of the 1,300 species of ferns known in Costa Rica; and 1,000 of the 1,500 species of orchids identified in the country. The various life zones of the area constitute real ecological niches for a variety of wildlife. With highly diverse forests and several threatened animals and plants, including 59 species of mammals, 43 amphibians, 51 reptiles, and over 350 birds, the area is extremely biologically rich. Furthermore, there are 15 species of birds, 10 species of amphibians and reptiles, and 13 species of mammals that are endemic to the area.

Agricultural expansion, driven by population increase and concentration, exerts pressure on areas previously covered by primary forest. Cultivation of cacao within existing natural habitats, however, provides income to local communities while placing minimal pressure upon existing biological resources. It is an agricultural system which can co-exist with flora and fauna while supporting the derivation of environmental benefits from biodiversity and providing economic benefits to indigenous communities from the cultivation of organic cacao alongside other edible plants or those used for medicinal purposes, construction, handicrafts, or to feed wild and domesticated animals (See Annex 2).

Production of organic cacao among indigenous farmers in the Talamanca region has frequently occurred without international certification, given the lack of access to international organic markets or international accrediting agencies. With such certification, cacao from the Talamanca region can be sold in international markets as organic, demanding a price of up to 40% higher than non-organic cacao. Not only will certified cacao extract higher profits internationally, but also it is a product that, while lower in gross weight, is of significantly higher quality than cacao produced in larger-scale production systems. In sum, certification will allow local indigenous communities: (i) to sustain forest and mountain ecosystems while contributing to their own well-being, utilizing demonstrative parcels of land to promote sustainable agriculture techniques and to introduce new uses for native plant species (e.g., organic fertilizers); (ii) to increase their knowledge of integrated pest management and other biodiversity-friendly means of combating diseases (e.g., *Moniliasis*) currently affecting organic cacao production, thus helping to increase yields; (iii) to promote methods of intensification of cacao production rather than extensification, thereby reducing pressure on biodiversity; (iv) to create the necessary conditions for the continued co-existence with beneficial flora and fauna; and (v) to stem further loss of soil and soil nutrients through sustainable agriculture techniques (e.g., use of cover crops, etc.) and to avoid serious problems caused by torrential rains and rivers carrying with them sediments that facilitate flooding.

In light of the information outlined above, the project's general objective is to contribute to the consolidation of biodiversity within the Mesoamerican Biological Corridor (MBC) and buffer zones, improving the quality of life in indigenous and non-indigenous communities. Furthermore, it well help to maintain a clean environment by eliminating the need for use of harmful agrochemicals and waste,

and burning of fields; encouraging consistence in uses of land that employ biodiversity conservation; promoting rehabilitation of forest ecosystems and related crops through organic agriculture which is environment-friendly, helps maintain tropical forest and provides diverse habitats for plants, animals and microorganisms.

10. Expected outcomes:

1. Increased use of biodiversity-friendly agricultural production methods in the project area, which serve to protect and promote ecosystem biodiversity;
2. Increased environmental conservation practices among indigenous and local communities in the project area, strengthened by their organization and management, are practicing environmental conservation in accordance with their cultures;
3. Increased commercialization of biodiversity-friendly, commercially-certified organic cacao;
4. Improved ecosystem health within primary and secondary forest ecosystems in the project area;
5. Improved soil health among indigenous and non-indigenous communities in the project area through the use of organic fertilizers that increase microbiological diversity of local soils.

Indicators of Project Success include:

- Increase in numbers of households within the Talamanca/Caribbean biological corridor participating in organic cacao production and marketing programs (survey data).
- Increase in area of small holder organic cacao production within the Talamanca/Caribbean biological corridor participating in organic cacao production and marketing programs (survey data).
- Decrease in the rate of conversion of traditional cacao smallholder systems in the Talamanca/Caribbean biological corridor to other, non-biodiversity/corridor compatible land uses (survey data).

Indicators of Success in Biodiversity Conservation include:

- Species richness (e.g., avifauna, forest species, vascular plants, arthropods)
- Stability of faunal population
- Maintenance of continuity of Talamanca/Caribbean biological corridor in areas where smallholder cacao predominant land use.
- Continued presence of migrant and resident birds that are globally of conservation concern.

11. Planned activities to achieve outcomes:

Among planned activities to be financed by the Medium-Sized Project are:

1. Training through seminars, meetings, exchanges and practical exercises for community organization, management, and biodiversity-friendly cacao production methods, including product diversification. Demonstration and application of techniques for the conservation of wild species of domestic plants and animals. Production of didactic materials to support training programs;
2. Data collection and monitoring of biodiversity within the project area;
3. Technical assistance related to supporting production of organic fertilizers or biofertilizers that promote nutrient enrichment and microbiological diversity of local soils, and at the same time, help prevent soil contamination from homes, farm waste, and agro-industry. Reestablishment of native plant species, such as *el javillo, el ojoche, la chonta* (Astrocaryum), *el guácimo* (Guazuma ulmifolia) and *el balso* (Ochroma lagopus);
4. Establish and/or strengthen the process of organic certification. Identification and selection of international markets, such as Europe and North America, for cacao and related crops. Establishment of marketing channels for indigenous and non-indigenous farmers.

The estimated cost for the project is US$3,651,000 for three years. This includes US$1.3 million in economic activities by indigenous and non-indigenous communities for the production of organic cacao, US$160,000 by IICA, US$690,000 by producers, US$640,000 by the organizations that represent them, US$63,000 by government institutions and US$48,000 by non-government institutions

which support project activities. A grant of US$750,000 from the GEF is requested at this time to support the incremental costs of activities related to conservation and sustainable use of biodiversity within organic cacao production systems.

Incremental Cost Justification

In the absence of GEF support, indigenous communities in the project area would continue to produce organic cacao (as well as other organic products), continuing activities begun more than five years ago. These activities would continue to be supported by extension services provided by IICA, the National Association of Indigenous Agriculture (ANAI) and National Association of Organic Agriculture (ANAO, of which ANAI is a member) and the Talamancan Association of Small Producers (See Annex 1 for more information). Additionally, the following groups, are working in the region: Foundation for Biological Agriculture in Guilombé, Namasol Project, UCANEHU Association, SEJEKTO Cultural Association of Costa Rica, Bordon Association for Organic and Conservationist Agriculture, and Association of Organic Producers. The estimated cost of these extension services activities carried out by these organizations over the next three years totals approximately US$960,000.

Furthermore, baseline activities for the project include the activities of agriculturalists in the indigenous communities in the Talamanca region. Assuming that one-third of households in the region continue are cultivating organic cacao, and that one-third of household income is derived from such production, the economic value of organic cacao production over the next three years is approximately US$1.3 million. {Note: These calculations will be finalized during the PDF Block A activities.}

Despite these important activities, they are insufficient to support the establishment of standards for biodiversity-friendly organic cacao production nor identify potential international markets or marketing channels for organic cacao and related products. Likewise, it is unlikely that monitoring of the impacts of economic activities upon biodiversity in the project area will occur. Finally, support for product diversification and conservation of wild cultivars will be minimal.

The proposed Mid-Sized Project would make possible activities that would: increase use of biodiversity-friendly agricultural production methods in the project area; increase environmental conservation practices among indigenous and local communities in the project area; increase commercialization of biodiversity-friendly, commercially-certified organic cacao; improve ecosystem health within primary and secondary forest ecosystems in the project area; and improve soil health among indigenous and non-indigenous communities through the use of organic fertilizers that increase microbiological diversity of local soils. With GEF assistance for addressing global biodiversity objectives outlined above, the GEF Alternative would include investments totaling US$3,651,000, of which it is expected that US$750,000 will be requested from GEF.

12. Stakeholders involved in project:

In active participation would be indigenous and non-indigenous agricultural producers from the Municipalities of Talamanca, Siquirres and Matina, in the province of Limón. Among representative organizations would be: (i) the Talamancan Association of Small Producers; (ii) ANAI Association; (iii) the Foundation for Biological Agriculture and Guilombé Communication; (iv) The Bordon Association for Conservationist and Organic Agriculture; (v) the Caribbean Project; (vi) the Namasol Project; (vii) Ucanehu Association; (viii) the Rural Organic Producers Association; (ix) SEJEKTO Cultural Association of Costa Rica; (x) the National Indigenous Board; and (xi) the National Association for Organic Agriculture..

Among cooperating government institutions are: (i) the Ministry of Agriculture and Livestock; (ii) the Ministry of Environment and Energy; (iii) the National Council on Production; (iv) the National Learning Institute; (v) Port Administration Assembly of the Atlantic Coast; (vi) the Agricultural Development Institute; and (vii) the Rural Development Program. Also collaborating are (i) the Center for Tropical Agricultural Research and Education (CATIE); (ii) the State Distance Learning University; (iii) National University; (iv) the University of Costa Rica; (v) Regional Agricultural School for the Humid Tropics; and (vi) Talamanca Technical Agricultural School.

III. IMPLEMENTATION OF BLOCK A PDF ACTIVITIES

13. Activities to be financed by the PDF:

Activities to be financed include: (i) Technical studies with specialists in biodiversity conservation and organic cacao production in order to conceptualize, define and set forth criteria for biodiversity-friendly organic cacao production; (ii) Elaboration of farm models that permits comparison of costs and benefits of modern cacao production systems, incorporating impacts upon biodiversity and the environment, with biodiversity-friendly organic cacao production; (iii) Preparation of an annual operating plan for the first year of the project, which will include scheduled activities, institutional arrangements, budgets, and distribution of administrative responsibilities; (iv) Preparation cal principles, there is a positive relationship between the diversity of shade trees and bird diversity. We suspect that many groups will show enhanced diversity as well.

2. We suspect that this is partly due to ir project initiation; (vi) Preparation of the project document for submission to the Global Environment Facility.

14. Expected outputs and completion dates:

The main product is a project proposal designed in accordance with GEF regulations, ready to submit on March 31, 1999.

The following are tasks to be completed and the time period for their completion:

1. Development of criteria by experts on organic cacao systems in association with biodiversity conservation (November 1998).
2. Assessment of costs and benefits of various cacao production systems and the effects upon biodiversity and environmental production by indigenous agriculturalists (January 1999).
3. Development of annual work program, including activities, budgets, and institutional arrangements (February 1999).
4. Preparation of socio-economic, anthropological and environmental assessments (February 1999).
5. Preparation of incremental cost analysis (February 1999).
6. Preparation of terms of reference and contracting of project personnel (February 1999)
7. Final project document sent to the World Bank (March 1999).

The final project document will have basic project components designed in accordance with the requirements of GEF medium-size grants, which include the proposed activities, institutional arrangements, market analyses, socioeconomic analyses, implementation plan, cofinancing contributions, and supervision and evaluation plans including measurement indicators.

15. Other contributors to PDF Block A activities and amounts:

Indigenous Farmers	US$2,000
Producer Organizations	US$2,000
Public Institution	US$1,000
Private Institutions	US$1,000
IICA	US$8,000
RUTA	US$5,000
Total:	US$19,000

16. Total budget and information on how costs will be met (including the Block A grant):

Activities:

Development of criteria by experts on organic cacao systems in association with biodiversity conservation.

GEF:	US$14,000	Co-financing:	US$10,000	Total:	$24,000

Assessment of costs and benefits of various cacao production systems and the effects upon biodiversity and environmental production by indigenous agriculturalists.

GEF:	US$3,000	Co-financing:	US$2,000	Total:	$5,000

Development of annual work program, including institutional arrangements.

GEF:	US$2,000	Co-financing:	US$2,000	Total:	$4,000

Preparation of socio-economic, anthropological and environmental assessments.

GEF:	US$2,000	Co-financing:	US$2,000	Total:	$4,000

Preparation of incremental cost analysis.

GEF:	US$2,000	Co-financing:	US$1,000	Total:	$3,000

Preparation of terms of reference and contracting of project personnel.

GEF:	US$2,000	Co-financing:	US$2,000	Total:	$4,000

Total PDF Block A Activities

GEF:	US$25,000	Cofinancing:	US$19,000	Total:	US$44,000

PART III: INFORMATION ON THE AGENCY / INSTITUTION

17. Name: Inter-American Institute of Agricultural Cooperation (IICA). Discussions will likewise be held during the PDF Block A activities to investigate a potential twinning arrangement with an environmental non-governmental organization with direct experience in biodiversity conservation.	**18. Date of establishment, membership, and leadership:** IICA was formed on October 7, 1942. Staff: IICA has 40 Officials (Managers, Directors, and Unit and Heads of Department); 28 Individual or Group Country Representatives; 52 Executive Project Specialists. The Technical Cooperation Agency of Costa Rica (ACT) employs two Executives at the Ph.D. level and six Executives at the M.S. level.
19. Mandate/terms of reference: IICA is an organization that specializes in supporting agricultural activities in the Americas. Its general objective is to support the 34 Member States to achieve agricultural sustainability, in a framework of hemispheric integration, and as a contribution to rural human development.	**20. Sources of revenue:** Budget for 1997 of US $ 135,100,000 including 20% from country quotas and 80% from external financing.

21. Recent activities/programs, in particular those relevant to the GEF:

In Latin America and the Caribbean:

- "Windows of Sustainability", Project of Cooperation between IICA and GTZ; practical examples to demonstrate and employ concepts and methods of sustainable rural development; under

implementation since 1996 in: (i) Reventado River Basin, Cartago, Costa Rica; (ii) region of Puriscal, Costa Rica; and (iii) Cobre River Basin, Jamaica. Recently "Windows of Sustainability" has been implemented in Honduras, Brazil and in the border area between Colombia y Venezuela.

- "Development in Biodiversity Resources in the Amazonian River Basin"; for the sustainable development of the basin, protection, conservation, rational use; regional coordination among eight countries with harmonious participation from the social actors involved and inclusion of the issue of gender, seven years in association with PROCITROPICOS/CECTA/CEEMA. Proposal before the GEF-World Bank.

In Central America:

- "Sustainable Slope Agricultural Program for Central America-PASOLAC"; includes among its components: Agroforestry and Environment. Presently in El Salvador, in the northern area of the Lempa River Basin; program was initiated in March 1995, and ended in December 1999.
- "Mesoamerican Network of Phytogenetic Resources-REMERFI"; objective is to improve conservation and sustainable use of phytogenetic resources through the strengthening of national resource systems and the coordinated instrumentation of respective actions nationwide and in the Mesoamerican area.

In Costa Rica:

"Communication, Gender and Sustainable Development Project", support to the Bribi and Cabecar and Cabecar Indigenous groups in Talamanca regarding medicinal plants and organizational processes. 1997 - 98.

- "Institutional Strengthening for the Development of Indigenous Communities in Costa Rica";
- IICA/National Indigenous Board Cooperation Project/PDR-MAG (sent to the World Bank IDF).

PART IV - INFORMATION TO BE COMPLETED BY IMPLEMENTING AGENCY

22. Project identification number:

23. Implementing Agency contact persons:

Christine Kimes, Global Environment Coordinator
(tel:) 202-473-3689 (fax:) 202-614-0087 (email) ckimes@worldbank.org
John Kellenberg, Task Manager
(tel:) 202-458-1397 (fax:) 202-522-3132 (email) jkellenberg@worldbank.org

24. Project linkage to Implementing Agency program(s):

The project is complementary with on-going World Bank-implemented projects targeted towards poverty alleviation, natural resources management, and biodiversity conservation within the Mesoamerican Biological Corridor, including the Rural Poverty and Natural Resources project and Atlantic Mesoamerican Biological Corridor project in Panama, the Rural Municipalities project and Atlantic Biological Corridor project in Nicaragua, and the Rural Land Management project and Biodiversity in Priority Areas project in Honduras. The project complements the ongoing World Bank/GEF Biodiversity Resources Development Project in Costa Rica. Furthermore, together with the World Bank/GEF Medium-Sized Project Promotion of Biodiversity Conservation within Coffee Landscapes in El Salvador, this project supports the continued evolution of projects supporting the sustainable use of biodiversity conservation in the region.

Annex I

Cacao Agroecosystems and Biodiversity in Costa Rica
Some Relevant Evidence

The area of cacao and associated crop production in Costa Rica is estimated to be 4,000 hectares, of which 3,000 hectares is within forest areas and 1,000 in plantations. Approximately 70% of the current cacao production comes from 500 hectares of intensively managed, high input plantations. Average yields from these plantations are about 1 metric ton per ha. At the other end of the spectrum are approximately 1,500 hectares of Talamancan forest with cacao underplantings being managed 'naturally' (i.e., rustic shade management) by Kekoldi and BriBri indigenous communities. Average yields from these low density, understory plantings are about 0.2 metric tons per hectare.

As described by Parrish et. al. (1998, see Annex II) the proposed project (Talamanca/Caribbean biological corridor) areas is;

> ...predominantly composed of small cacao farms. These small landholders typically face substantially different challenges in growing a productive crop than large corporate-owned plantations. The rustic rainforest tree shade of small landholders in the region tends to have a tenuous existence, as these farmers are more susceptible in poor-market times to the need to sell their valuable tropical lumber or convert the entire cacao crop to open-grown *platanos*, banana, beans, or pasture than are large established plantation owners...These environmentally sensitive organic markets and the predominance of potentially environmentally enhancing shade management practices of cacao in the increasingly deforested Talamancan landscape have resulted in a focus on the use of cacao as conservation tool to enhance the biological corridor....

The importance of maintaining landscape elements, such as those provided by the small cacao farms, which contribute to the conservation of the Talamanca/Caribbean biological corridor, cannot be understated. The corridor is under direct threat from the commercial production of bananas (now covering thousands of hectares), continued logging of lowland tropical forest and of forested areas under traditional agroecosystems, and from for small-scale clearing for annual agriculture. Organic cacao provides a significant alternative, at the landscape-scale, as an environmentally sustainable, corridor compatible, land use with the potential to meet economic needs while preserving forest remnants. In the absence of such support, the maintenance of these traditional systems is in doubt as economic pressures at the household level will drive the conversion of these smallholder shade crop systems toward land uses that are more lucrative in the short term.

Proceedings of the First International Workshop on Sustainable Cocoa Growing held in March 1998 in Panama have been published by the Smithsonian Migratory Bird center. A synthesis of several relevant documents is provided below[1]

Parrish, J., Reitsma, R., and Greenberg, R. 1998. Cacao as Crop and Conservation Tool: Lessons from the Talamanca Region of Costa Rica.

The Nature Conservancy has recently initiated efforts with its partner organizations in the Talamanca Region of Costa Rica to use cacao to enhance environmental conservation of a biological corridor stretching across the region. In the presentation of this case study, we explore cacao as a crop in southeastern Costa Rica, examining its management and the issues facing farmers of the Talamanca district. We also present data that demonstrate

[1] The primary documents may be found on the Internet (at `http://www.si.edu/smbc/`)

the importance of cacao in harboring biodiversity and that suggest the value of cacao in assisting local and landscape-level conservation.

The Cacao Landscape of Talamanca, Costa Rica

Rustic Shade Management of Talamancan Cacao. As in much of the world, cacao in Talamanca is grown along a spectrum of management from rustic, or traditional farms, to intensively managed planted polycultural shade canopies. Rustic cacao farms in Costa Rica are characterized by the planting of cacao under thinned primary or older secondary forest. In this traditional system, the understory is cleared and replaced by young cacao trees that grow to fill the lower stratum of the forest ecosystem. *Since the majority of the mid- and overstories of the forest are left untouched except for some thinning, the rustic cacao farm is structurally diverse and therefore expected to harbor a vast array of secondary plant and animal diversity such lianas, epiphytes, mosses, lichens, insects, herpetofauna, and birds (Perfecto et al. 1997) (itals. added).* In Talamanca, this rustic cacao is most commonly found on the small farms held by members from the Kekoldi and BriBri indigenous communities.

Polycultural Shade in Talamanca Many farmers may elect a polycultural form of management, where shade trees are planted amidst cacao trees either exclusively for cacao shade, or for the combined purposes of shade and alternative crop generation. The polycultural system can range from having multiple species of planted shade trees with occasional remnant forest species, to monocultural shade in which only one tree species is planted to supplement the cacao, as in plantations of cacao and Erythrina spp. Plantations with laurel (Cordia alliodora) as the predominant shade tree over cacao are becoming increasingly more common in Talamanca. Lumber from this species provides important additional income and farm resources.

Abandoned Cacao Plantations Abandoned cacao plantations compose a common cacao agroecosystem in the Talamanca district of Costa Rica where some cacao pods may be harvested occasionally. Because of the susceptibility of cacao to fungal infestation, many farmers have left cacao plots to go fallow. Abandoned cacao plantation can constitute a significant proportion of the land cover of the lower Talamanca region, with the years since abandonment ranging from 1-30 years. In older abandoned plantations, significant secondary forest has overtaken the previously managed cacao, with up to near 100 % canopy cover with an understory of moribund cacao trees. Some farmers slowly reclaim these abandoned plots as the markets shift and incidence of disease in a region declines, or they may harvest uninfected pods as time permits. In Costa Rica, the abandoned cacao still makes up a considerable proportion of the landscape and likely harbors significant biodiversity. Because of the transition of the cacao farm to secondary forest, the faunal and floral communities may begin to more closely resemble that of secondary forest rather than the communities of more intensively managed systems.

Case Study: The Role of Cacao in Conservation Planning in Costa Rica

Surveys of the avifauna. Results to date have illustrated clearly that cacao habitats can harbor high species richnesses equivalent to that of forest. Although more migrant species can be found in the more open habitats of managed cacao and tacotal, resident species richness in managed cacao can actually surpass that of nearby forest. Similarly, the abundance of both resident and migrant birds at sample points in managed and abandoned cacao was near equal to or greater than that found in forest points. *Simple measures of species richness and the abundance of individuals suggest that, categorically, cacao has great potential for providing habitat for birds of Talamanca (itals. added).*

Yet from a conservation standpoint, the composition of these bird communities is far more important than sheer numbers of species or individuals, given the lack of forest habitat that currently exists, the rate of deforestation, and the current population status of many bird species at risk. Therefore, a comparison of the bird communities of forest with managed and abandoned cacao plantations was made in order to

characterize species as being typical of Talamancan forest communities. The number of forest species found in managed and abandoned cacao sampling points in Talamanca was not different from the number of forest obligate species per point found in sampled forest habitats themselves. Although forest typically had more trees per census circle and usually more diverse shade tree species composition, canopy cover and canopy height in the three habitats tended to be similar. However, a final test of the value of cacao would lie in the presence in the cacao and forest habitats of migrant and resident birds that are globally of conservation concern by a variety of ranking methods.

Table 2 presents the occurrence of bird species of conservation concern in the forest, managed cacao, and abandoned cacao habitats sampled in Talamanca according to criteria of The Nature Conservancy, Stotz et al. (1997), Partners in Flight and U.S. Breeding Bird Survey (for migratory species), and the CITES treaty on trade in endangered species. Based on data from the sampled points, ten threatened resident bird species were found, with 5, 6, and 7, species found in forest, abandoned cacao, and managed cacao, respectively. Overall, more species (17) of conservation concern were found in managed cacao, than in sampled forest points (13) or abandoned cacao (11), evidence that some aspects of managed cacao management are providing habitat for threatened forest species. Although cacao should not replace forest, as many species can only survive within intact forest habitat, cacao can clearly serve to supplement forest habitat and enhance the survival of forest species in an increasingly fragmented landscape. *These data suggest strongly that cacao has its greatest value when located near forest patches and suggests that cacao may help to enhance the size and health of protected areas when used as a buffer zone crop, or the functional size of the thin, narrow biological corridor of Talamanca (itals added).*

Table 2.
Occurrence of bird species at risk in Talamancan forest, managed cacao, and abandoned cacao.

Scientific Name	Status	Concern Criteria	PIF Scr	Forest	Managed Cacao	Abandoned Cacao
Buteogallus anthracinus	R	C			X	X
Buteo albonotatus	R	C			X	
Dacnis venusta	R	HS				X
Manacus candei	R	HS		X	X	X
Phylloscartes superciliaris	R	HS			X	
Tangara inornata	R	HS		X	X	X
Thryothorus atrogularis	R	HS		X	X	X
Geotrygon veraguensis	R	HS		X		
Microbates cinereiventris	R	H		X		
Micrastur semitorquatus	R	H				X
Vermivora chrysoptera	M	PB	25		X	
Hylocichla mustelina	M	PB	20	X		
Dendroica castanea	M	P	19	X	X	X
Oporornis formosus	M	P	19	X	X	
Wilsonia canadensis	M	B	18	X	X	X
Catharus fuscescens	M	B	17	X		X
Coccyzus americanus	M	B	17		X	
Contopus borealis	M	B	17		X	
Contopus virens	M	B	17	X	X	X
Buteo swainsoni	M	C	16		X	
Archilochus colubris	M	C	14	X	X	
Buteo platypterus	M	C	12	X	X	X
Total Number of Bird Species at Risk				13	17	11

H: The Nature Conservancy/Natural Heritage Global Ranks between G1 and G3/4.
S: Ranked as a species of conservation concern according to criteria of Stotz et al. (1997).
P: Partners in Flight score of greater than 18.

B: Nearctic-Neotropical migratory bird species showing significant population declines according to the U.S. Breeding Bird Survey.
C: Species protected according to the CITES treaty.

Somarriba, E. and Beer, J. 1998. Cocoa-Based Agroforestry Production Systems in Costa Rica and Panama

Known Factors. Litter production and net primary productivity of shaded cocoa plantations is similar to that of natural tropical forest and is much greater than most tropical agricultural systems. Carbon sequestering in shaded cocoa systems was 5 Mg/ha/yr over 10 years when sugar cane fields were converted to cocoa plantations. These systems can be sustainable with little and even no external inputs (indicators: net primary productivity, soil organic material, commercial production).

Preliminary Findings. Indications are that cocoa plantations are suitable for small farmers in remote areas and buffer zones. Dried cocoa beans can be stored without rotting, value per unit weight is high thus facilitating transport to remote markets, forest-like structure enhances biodiversity and smooths the gradient between protected areas and surrounding agricultural areas.

Unknown factors. The effect of increased soil organic material on biodiversity (e.g. soil flora and fauna). How important are cocoa plantations in buffer zones as a means of extending protected areas and whether biodiversity conserved increases as a result.

Greenberg, Russell. 1997. Biodiversity in the Cacao Agroecosystem: Shade Management and Landscape Considerations. Smithsonian Migratory Bird Center.

The ability of cacao farms to harbor biological diversity – particularly forest dependent species -- is known for only a few taxa (primarily ants and birds) and from a few sites. Much of what we suspect to be true of cacao farms with respect to biodiversity is based on research in similar systems (primarily coffee) or is inferred from established ecological principles. On this basis, we suggest that (1) overall biological diversity and the diversity of forest dwelling organisms is higher in cacao plantations than non-shade crops or pastoral systems; (2) diversity will increase with an increase in both floristic and structural diversity of the shade level; (3) diversity within cacao plantations will be highest when they are located adjacent to extant patches, corridors, or large tracts of forest. Shaded plantations may play a particularly critical conservation role for migratory organisms (birds and perhaps insects) that arrive seasonally from the Temperate Zone, or from drier or higher altitude zones. Also, within the high levels of 'unplanned' biodiversity of traditional cacao farms, it is likely we will find many species that perform as unyet studied or quantified "ecological services" such as biological control of pests and disease.

Table 1
Recommendation Matrix for Cacao Shade Management and Shade Management Research

Presence of Shade Trees	**1. We know** – based mostly on studies of coffee –that for a number of taxonomic groups, diversity increases with the presence of shade trees. The proportion of forest or woodland species also increases with the presence of a shade canopy. The reason for these increases is the presence of new habitat structures, as well as the amelioration of microclimate and the presence of more, different food sources to support greater diversity at low trophic levels . **2. We suspect** that the diversity and composition of the associated flora and fauna increases in predictable ways with increases in the structural and floristic diversity of the plantations and (up to a point) with total canopy cover. **3. It is possible** that increased complexity of trophic & other ecological relationships dampens the occurrence of pathogen or pest outbreaks. **4. We recommend** that in order to support higher levels of biological diversity, cocoa be grown under a shade canopy. We further recommend that this canopy be as floristically diverse as practical. Research is required in different regions to establish the relationship between shade levels and tree composition to the diversity of some selected taxa (i.e., epiphytic plants, Lepidoptera, birds) that represent different levels of vagility, forest dependence etc.
II. Forest (Rustic) Shade Canopy	**1. We know** from studies of both coffee and cocoa that a shade management system with thinned forest trees resembles a degraded form of natural forest, with a higher level of diversity of birds, trees, epiphytes etc. than any other shade management system. **2. We suspect**, based on some narrower studies, that (1) is also true for cacao. We further suspect that a canopy of thinned primary forest supports more of the local forest specialist species than managed secondary forest. **3. We do not know** the influence of different levels and strategies of tree thinning on diversity. Further, there have been no studies of the long-term equilibrium diversity under different landscapes and cacao plantation size (assuming there is an equilibrium). Because of poor reproduction (due in part to weeding in the case of trees) species populations may not be self-replacing. We do not know under what circumstances the management of forest for cacao is the ultimate cause of habitat degradation or is an alternative to destruction. **4. We recommend** that cocoa be grown under managed natural forest whenever feasible. However, we do not recommend that new large tracts of forest be managed for cocoa production until further study - on a region-by region basis - of how cocoa growing impacts forest protection. We recommend long-term and experimental studies on the stability of rustic cocoa farms as ecological systems.
III. Floristic Diversity of Planted Shade Canopy	**1. We know** that based on few empirical studies and ecological principles, there is a positive relationship between the diversity of shade trees and bird diversity. We suspect that many groups will show enhanced diversity as well. **2. We suspect** that this is partly due to increased structural diversity, diversity of chemical defenses, and reduction of phenological gaps in leaf, fruit and flower production. We suspect that dominant shade trees that are native, perennial, and with heavy foliage cover support greater bird diversity, as well as greater diversity in most other taxonomic groups. **3. We do not know** what mix of common shade trees, such as *Inga, Erithryna* and other trees optimizes cacao production and biological diversity. **4. We recommend** that cocoa be planted under as taxonomically diverse a canopy as possible. We advocate the establishment of a program of interdisciplinary research on the degree to which particular trees support biological diversity throughout the year along with the ease with which the trees are propagated and the degree to which the tree competes with or provides refuge for pathogens and pests of cocoa.
IV. Structural Diversity of Shade Tree Canopy	**1. We know**, based on studies in coffee and ecological principle, that the greater the foliage height diversity (presence of plant canopies at different strata) the higher the overall diversity for birds and most other taxonomic groups. Further, the higher absolute amount of foliage at all levels the greater the amount of refuge of prey from predators. We know that the greater abundance (and diversity?) of epiphytic and parasitic plants, as well as liana the greater the diversity of birds. **2. We suspect** that the greater the number of tall trees, even at lower overall levels of canopy cover, the greater the bird diversity as well as the representation of a number of forest taxa. We suspect that the greater the abundance of standing dead wood, the greater the diversity of arthropods, birds and many other taxonomic groups. **3. We know little about** the specific relationship between shade tree composition and the abundance and diversity of secondary structures (epiphytes etc.). **4. We recommend** that shade trees and secondary trees be selected, in part, to maximize structural diversity. We further suggest that trimming be done in such a way as to allow a portion of the shade trees to reach natural heights and that minimal pruning of epiphytes and parasitic plants on shade trees be carried out. We suggest that interdisciplinary research with agronomists and ecologists be conducted to determine what is an optimal level of shade tree pruning.
V. Cacao Farms in the Landscape	**1. We know** that forest patches that are larger and closer to tracts of forest support a greater diversity of forest forms than smaller and more isolated patches. We also know that forest patches located along altitudinal gradients with intact habitat supports higher diversity – particularly of mobile organisms than those in an area of uniform topography. **2. We suspect** that shade plantations connected to forest by corridors of shade plantation, forest, or riparian growth; will sustain higher levels of forest diversity and provide habitat for mobile forms as well. **3. We do not know** quantitative effects of surrounding landscape on the composition of any shaded cacao system for any taxa. **4. We recommend** that, wherever possible, cacao farms be clumped to form larger habitat tracts. Cacao farms should be connected to remnant forest tracts through corridors of habitat – ideally forest, but also other shaded plantation (coffee at higher elevations, for example), and gallery vegetation. We recommend that the development of cacao as a shade crop be institutionally linked to regional programs of forest protection.