Mesoamerican tree species: a s*ource book* for farm planting and ecological restoration

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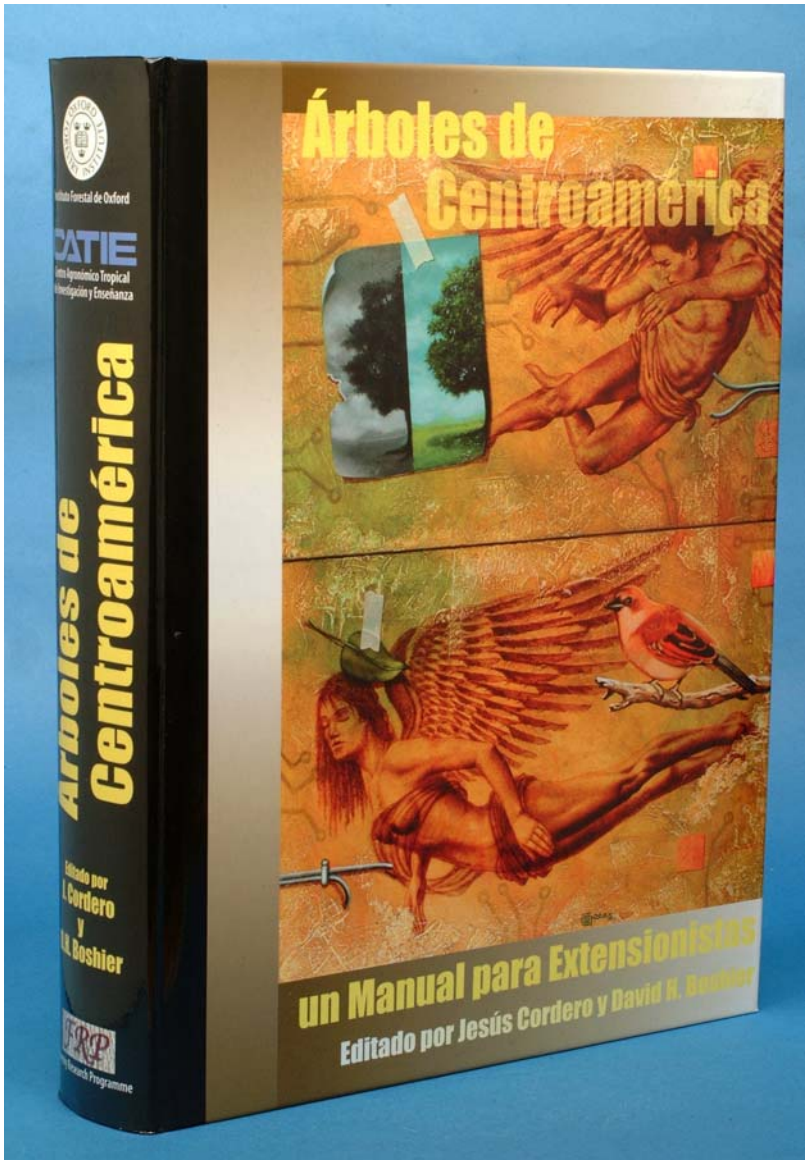

Final Technical Report

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Summary....3
2 Background....5
3 Project Purpose....6
4 Research Activities....7
4.1 Selecting the species....7
4.2 Mapping climatic zones....7
4.3 Evaluating Uptake....8
5 Outputs....9
5.1 Publication of *Source Book on Central American Tree Species for Farm Planting and Ecological Restoration*....9
5.1.1 The Sourcebook....9
5.1.2 Management options, not prescriptions....10
5.1.3 Sourcebook content....10
5.1.4 Botanical Issues....11
5.1.5 Website access....12
5.2 Uptake of the *Source Book* through integrated training....15
5.2.1 The multiplier effect....15
5.2.2 Diversifying the public for courses in Honduras....16
5.2.3 Promotion strategy....17
5.3 Dissemination of the benefits/successes/lessons learnt from the project's approach to a wider tropical audience....17
5.3.1 Diversifying courses....17
5.3.2 Distance learning course....17
5.3.3 Toolkits....18
5.3.4 Project synthesis paper....18
5.4 Full proposal for a Caribbean sourcebook project, through workshops in Cuba, Dominican Republic, Haiti and Jamaica....19
6 Contribution of Outputs....20
6.1 DFID and EU developmental goals....20
6.2 Contributions to the conservation of biodiversity....21
6.3 Dissemination Outputs....23
6.4 Wider usage....23
7 References....23

Summary

Project Purpose
Knowledge relating to land-use and forest decision making promoted for the benefit of small-scale poor farmers.

The highly diverse biological, cultural, environmental and socio-economic conditions encountered across Central America demand diverse approaches to sustainable farming. Trees are a vital component of most Central American farming systems, but often only a simple or limited range of management options and species are currently promoted by forestry projects. Many national, regional, and even global compendia have compiled information about useful trees. However, few have defined 'utility' from a farmer perspective based on farmer surveys. Species selection has usually been based on the authors' expertise and agenda, and often implies promotion of a restricted set of exotic species. Many have questioned the wisdom of this approach and highlighted its risks (*e.g*. invasiveness, lack of diversity). Furthermore, most such compendia emphasise technical aspects of tree planting and establishment, with little consideration of the context in terms of farming systems and farmer constraints and preferences, and do not provide specific indications of which species appear best suited to the many different reforestation options (*e.g.* small blocks, living fences, trees in fields/pasture, natural regeneration).

Research Activities
The project's objectives were to: a) provide a definitive account of current knowledge of indigenous tree species within Central America and their varied uses across the full spectrum of on-farm planting, ecological restoration and natural regeneration situations and socio-economic/farming systems conditions; b) ensure effective dissemination and uptake of that information through a network of collaborators. The approach to deciding the species to cover was radically different from previous species compendia, and based on the use of an existing extensive body of participatory survey data examining local people's needs and perceptions.

Outputs
The outputs of the project were;

1. A synthesis of existing information through publication (in Spanish) of "*Arboles de Centroamerica: un manual para extensionistas*".
2. Uptake of the *Source Book* through integrated training. Training demonstrated how to use the *Source Book* to prepare extension material on specific topics (*e.g.* for individual species, restoration in an ecological zone).
3. Dissemination of the benefits/successes/lessons learnt from the project's approach to a wider tropical audience through papers in English and Spanish.
4. Development of a full proposal for a Caribbean sourcebook project, through workshops in Cuba, Dominican Republic, Haiti and Jamaica.

Contribution to DFID's development goals
Achievement of the objectives contributed directly to the project purpose, making widely available existing knowledge on the maintenance, use, regeneration and planting of locally preferred indigenous tree species, particularly on resource-poor farms. Resource-poor farmers and rural communities more generally may benefit from the identification, promotion and use by target institutions of more appropriate tree species with improved performance and product qualities, and land use options that better meet their preferences. Promotion of the planting and use of multi-purpose and/or exotic tree species which does not take into account the range of forest products available to farmers from natural regeneration of native species may have deleterious effects on both farmer welfare and conservation.

List of acronyms

CATIE	Centro Agronomico Tropical de Investigación y Enseñanza, Costa Rica
CECADI	Centro de Capacitación a Distancia, IICA, Costa Rica
CIFOR	Centre for International Forestry Research
CIMMYT	Centro Internacional de Mejoramiento de Maíz y Trigo, Mexico
CITES	Convention on International Trade in Endangered Species
COHDEFOR	Corporación Hondureña de Desarrollo Forestal
CONSEFORH	Proyecto de Conservación y Silvicultura de Especies Forestales de Honduras
CUPROFOR	Centro de Utilización y Promoción de Productos Forestales, Honduras
ESNACIFOR	Escuela Nacional de Ciencias Forestales, Honduras
FAO	Food and Agriculture Organization
FRP	Forest Research Programme of DFID
IICA	Instituto Interamericano de Cooperación para la Agricultura, Costa Rica
MINAE	Ministerio del Ambiente y Energia, Costa Rica
MIRA	Manejo de Información sobre Recursos Arbóreos
NGO	Non-governmental organisation
PRA	Participatory rural appraisal
RRA	Rapid rural appraisal
SENACYT	Secretaria Nacional de Ciencia Tecnología e Innovación, Panamá
UNAH	Universidad Nacional Autonoma de Honduras

Acknowledgements
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2 Background

Constraints

The highly diverse biological, cultural, environmental and socio-economic conditions encountered across Central America demand diverse approaches to sustainable farming. Trees are a vital component of most Central American farming systems, but often only a simple or limited range of management options and species are currently promoted by forestry projects. Many national, regional, and even global compendia (*e.g.* NAS, 1980, 1984; Niembro 1986; Singh, 1982; Timyan, 1996; Doran & Turnbull, 1997; CABI, 1998; ICRAF, 1998) have compiled information about useful trees. However, few have defined 'utility' from a farmer perspective based on farmer surveys. Species selection has usually been based on the authors' expertise and agenda, and often implies promotion of a restricted set of exotic species. Many have questioned the wisdom of this approach and highlighted its risks (*e.g*. invasiveness, lack of diversity). Furthermore, most such compendia emphasise technical aspects of tree planting and establishment, with little consideration of the context in terms of farming systems and farmer constraints and preferences, and do not provide specific indications of which species appear best suited to the many different reforestation options (*e.g.* small blocks, living fences, trees in fields/pasture, natural regeneration).

Demand

The research was identified by FRP as a priority in its call for proposals. From local PRA and other surveys there was evidence of demand for information on the characteristics and potentials of a wider range of tree species within Central America. Concern over loss of native forest species due to deforestation and changes in land-use systems had grown among political decision makers, extensionists and farmers. Such concerns were placed even higher on the political agenda following the devastation caused by Hurricane Mitch in 1998 (Hellin *et al.,* 1999). CATIE's and CONSEFORH's Outreach Programmes repeatedly received requests for the proposed outputs, while participants in CATIE's agroforestry courses and CONSEFORH's training/extension exercises, consistently expressed interest in materials to support farmers' field days with emphasis on native tree species for production or ecological restoration on degraded lands.

Previous Work

The project was based on the existence and synthesis of a large body of both published and unpublished information, a small sub-set of which is described below; indeed, its success depended on the existence of this work. The project drew from, and built upon, the considerable expertise and large body of technical and socio-economic information on Central American tree species and their use in local farming systems that has been assembled by projects funded by DFID (FRP & bi-lateral; DFID, 1998) and other donors over the last 20 years. Much information had already been published, focusing on particular species (*e.g*. Boshier & Lamb, 1997; CATIE numerous publications; CONSEFORH, publications; Greaves & McCarter, 1992; Hellin & Hughes, 1993; Hughes & Stewart, 1990; McCarter & Hughes, 1984; Stewart *et al*., 1996), groups of species (*e.g*. Hughes, 1998a, 1998b; Hughes & Styles, 1984; Hughes & Pottinger, 1997; Stewart *et al*., 1992; Stewart & Dunsdon, 1994), land uses (*e.g*. CATIE numerous publications; Hellin & Larrea, 1999), ecological zones (*e.g*. Barrance, 1997; Finegan, 1992; Parker Jervis *et al.*, 1998) and financial analysis (*e.g.* Domingo & Somaribba, 1998; Platen, 1996). Much of the information was, however, not published in Spanish and much was also unpublished, hidden away in data bases (*e.g.* MIRA), reports, field plot data, herbaria, notebooks and the experience of individuals. At the same time forestry activities within Central America had increased, with the promotion and adoption of more diverse approaches (*e.g.* agroforestry, Beer, 1995; ecological restoration, Janzen, 1986; small and large scale

plantations, Watson *et al*., 1998), and the implementation of numerous PRA farmer surveys within the region (*e.g.* Colindres *et al*, 1995; CUPROFOR, in DFID, 1998; Hellin & Larrea, 1997a,b; Proyecto Leña: Park *et al.*, 1982; R6913). This combination of circumstances meant that not only was there continued and expanded demand for up-to-date, reliable information on tree species characteristics and potentials within Central America, but also that there was a good opportunity to fill those needs with a more definitive account, in the form of a *Source Book*.

By taking a radically different approach to both identifying priority species and their description, the project aimed to avoid this omission, and was therefore not a duplication of previous or current initiatives (*e.g.* CABI Forestry Compendium). CATIE had already published a number of agroforestry teaching modules (*e.g.* Lok, 1998; Mendez *et al.,* 1998; Muschler 1999) promoting adoption of trees in a range of land-use systems, in a similar approach to this proposal. Again this proposal complemented that work. Similarly, the project did not duplicate existing dissemination efforts, as it worked with local organisations, building on their existing networks and extension activities (*e.g.* CATIE series "Generación y transferencia de technología", CONSEFORH series of species extension manuals: Kowal & Padilla, 1998).

3 Project Purpose

The project's purpose was "Knowledge relating to land-use and forest decision making promoted for the benefit of small-scale poor farmers"

The objectives were to: a) provide a definitive account of current knowledge of Central American tree species and their role in on-farm planting, ecological restoration and natural regeneration (output *sourcebook*); b) ensure effective dissemination and uptake of the information (output *training*).

There had been much research on native tree species of Central America, however, most information remained in libraries and filing cabinets of research institutions. For extensionists access to such information is limited both physically (due to location, time, cost) and because of the language and scientific style of writing. The format of the *Source Book* and accompanying CD-ROM support material ensure that the information and other resources (*e.g.* images) are readily available in a form that can be directly useful in preparation of extension materials. Active involvement, from the start, of collaborators from the region ensured the *Source Book*'s relevance to the problems and a sense of ownership that facilitated its dissemination and utilisation of the information. The focus on training and dissemination in the last 2 years of the project aimed to stimulate continued use of the information in choosing a more diverse range of species and land use options. The wide dissemination of the *Source Book* facilitates easy access to information relevant to resolving the limitations described above, for a wide range of users.

The immediate users of the *Source Book*, associated materials and dissemination network are NGOs and GOs engaged in extension activities. Ultimately a wider range of people are using the book; technical foresters, agroforesters, agronomists, ecologists, teachers, rural development and extension agencies.

4 Research Activities

The project was developed during the phase when DFID's Renewable Natural Resources Research Strategy (RNRRS) was refocused as the Renewable Natural Resources Knowledge Strategy (RNRKS). The project was developed principally as one that would add value to existing research through the compilation and dissemination of existing information. As such research activities consisted of data mining of existing research and data sets, rather than conducting new, original research. The following sections describe the main features of the selection of species and evaluation of initial uptake. Methodologies are described in detail in original documents given in the relevant appendices.

4.1 Selecting the species

An appropriate choice of tree species is crucial. Resource-poor farmers and rural communities more generally will benefit from the identification, promotion and use by target institutions of more appropriate tree species and land use options that better meet farmers' preferences. Research on farmer's preferences in tree species used a cost effective combination of existing information. Whilst carrying out new surveys of farmer preferences is both expensive and time consuming, the use of an extensive body of existing participatory survey data is a valid and efficient research approach that ensured extensive coverage of the region, relatively quickly and at low cost, adding value to previous work. The approach was therefore radically different to other species compendia in exploring local people's needs and perceptions to produce a list of tree species preferred by farmers across the region. More than 100 surveys were selected to give both a geographical balance, across the Central American region, and an ecological balance, covering the full range of ecosystems in the region.

A provisional list of approximately 150 species based on the surveys and a sensitivity analysis (see annex 1.1 and chapter 9 of the manual for detailed methodology), was validated through workshops in the countries, where extensionists and technicians indicated species they considered important that weren't in the list. 30 additional species were added to the list through this process. Also included were a further 19 species with narrow distributions that are closely related to priority species and recognised to be of importance in particular localities (*e.g. Inga* spp. *Leucaeana* spp. See these species descriptions in the manual for more detail).

A couple of aspects in this process lend support to the manual's emphasis on native species and the methodology used in selecting the species. Of the 150 most highly rated species, only 12 were exotics, of which the majority were fruit trees (citrus, *Cocus nucifera*, mango, tamarind), along with *Delonix regia, Eucalyptus camaldulensis, Eucalyptus spp. Gmelina arborea, Leucaean leucocephala, Melia azedarach*, *Tecona grandis*. Of the 150 most highly rated species, 62% were not covered in the CABI Forestry Compendium, and only 17% covered in detail. This agrees with the original premise that; a) compared to 'experts' farmer's identify a different range of tree species as important, and b) the manual fills a gap not covered by previous species description initiatives.

4.2 Mapping climatic zones

Climate maps were essential to the project for a number of reasons. In the selection of priority species it was necessary to be able to locate surveys both physically and in a climatic zone. Similarly in the actual manual, the species descriptions and tables of options on what species might be suited to where, also required climate maps. Thus the user could answer the questions; where can I plant species x? which species a suited for planting in the area I work in?

A practical tool was needed that could represent broad climatic zones and the potential distribution of species, rather than vegetation maps. This was done through overlaying life zone maps with the number of dry months and then combining into a smaller number of zones. Thus, the final maps presented in the manual represent broad categories of wet/dry, lowland/upland that users in validation workshops found easy to use and agreed with the reality they knew on the ground. Details of how the zones were delineated are given on page 960 of the manual.

4.3 Evaluating Uptake

J. Hellin (CIMMYT's Impacts, Targeting and Assessment Program) conducted a review of the impact of the manual in Honduras. Impact is seen as the actual or potential changes leading to poverty reduction and improved livelihood security. It is, however, notoriously difficult to assess the impact of the training on poverty reduction and farmers' livelihoods. There are several reasons for this:

- Little time has elapsed since extension agents and farmer leaders were trained and, hence, it is somewhat unrealistic to expect to see concrete changes in farmers' management of forest resources.
- It is often problematic to establish sound cause-and-effect relationships and, therefore, it is difficult to attribute any changes to the manual *per se*.
- Extension can be stymied by the behaviour of extensionists and thus training does not guarantee messages will be conveyed adequately to farmers.

The training of extension agents and farmer leaders took place very recently, in some cases towards the end of 2005. It is therefore unrealistic to expect to see much concrete evidence of impact of the manual in terms of new extension material that trained extension agents have produced and/or changes on the farms belonging to the trained farmer leaders or other farmers who in turn have been 'trained' by these farmer leaders. While there was some evidence of impact, it is anticipated greater impact will become more apparent in the years ahead. It therefore is more realistic to assess the views of those who were trained: did they find the training useful and what are they now doing or planning to do that is different to before they were trained? How is the manual actually being used by the different types of people who've received training? Thus, despite the problems of assessing and measuring impact in terms of poverty reduction and livelihood security, the review looked at impact of the manual in Honduras in terms of:

- Extension agents and farmer leaders' perception of the training courses and extension material respectively.
- Evidence of trained extension agents having produced extension material based on the manual i.e. based on the training offered by CONSEFORH.
- Evidence that trained farmer leaders are sharing their newly-acquired knowledge with other farmers
- Evidence of farmers having planted trees etc. as a result of the training
- The potential impact of the manual in terms of poverty reduction.

The report (annex 2.1) is a qualitative study of impact based on findings during a field visit to Honduras from 8-14 January 2006. Trained extension agents and farmer leaders were visited in western Honduras (departments of La Esperanza and Intibucá). A questionnaire was sent to extension agents who attended CONSEFORH's training courses (see report for questionnaire, annex 2.1). Quantitative analysis is awaiting the return of sufficient completed questionnaires and will be covered in a supplementary report.

5 Outputs

All four project outputs were achieved, as follows.
1. A synthesis of existing information through publication (in Spanish) of "*Source Book on Central American Tree Species for Farm Planting and Ecological Restoration*".

2. Uptake of the *Source Book* through integrated training. Training will demonstrate how the *Source Book* can be used to prepare extension material on specific topics (*e.g.* for individual species, restoration in an ecological zone).

3. Dissemination of the benefits/successes/lessons learnt from the project's approach to a wider tropical audience. A project synthesis paper in English will be produced.

4. Development of a full proposal for a Caribbean sourcebook project, through workshops in Cuba, Dominican Republic, Haiti and Jamaica.

5.1 Publication of *Source Book on Central American Tree Species for Farm Planting and Ecological Restoration*

5.1.1 The Sourcebook

Successful planting and management of trees, along with the restoration and sustainable use of tropical ecosystems and their species, requires information on their regeneration, growth, and silviculture. Whilst there has been much research on Central American tree species, both within and outside of the region, only a small amount of the information has been synthesised, with a relatively small number of species often covered in such compilations. Most of the information remains in libraries and filing cabinets of universities and other institutions. Such research is effectively lost if the results are not made widely available to potential end-users in inexpensive formats that are easily understood. For extensionists and promoters who help farmers to adopt new skills and production strategies, access to such information is limited both physically (location, time, cost) and through the language and scientific style of writing.

The Central American Trees Sourcebook for Extensionists attempts to address these problems through compilation in a single book, providing easy access to this information in a style and language level suited to the intended users - extension services and rural development organisations involved in promotion of sustainable land use options in Central America. The manual, a joint effort of the Oxford Forestry Institute and CATIE (*Centro Agronómico Tropical de Investigación y Enseñanza*) is published in the local language (Spanish) and covers the use of 199 indigenous Central American species within the context of farming systems, farmer constraints and preferences. The materials were developed and tested in co-operation with extension networks in Central America, with species selection based on farmer preferences from more than 100 surveys.

A book is worthless if not read. Though the book contains masses of technical information, the style and language level aimed to make it instantly attractive to the intended users. Species descriptions use icons making common uses and farming systems obvious. Old sayings, jokes, cooking recipes, comic-like illustrations and practical examples pepper the book to make the learning process more attractive and effective. Writing proved difficult for many of the technical contributors who were used to academic writing. Their involvement was however vital to ensure technical

accuracy. Drafts of the manual and associated material were validated through workshops, prior to their printing and use in dissemination activities.

The educational level of extensionists and their access to IT varies enormously across the region. The project therefore offered a variety of options for accessing information: retrieval directly from the book, an interactive CDROM with a searchable data base and images to facilitate production of extension materials. The book is also freely available on the project's web site www.arbolesdecentroamerica.info

5.1.2 Management options, not prescriptions

The manual provides details of which species appear best suited to which systems (*e.g.* small blocks, living fences, trees with perennial crops, natural regeneration) and is aimed at extension services and rural development organisations in Central America. In managing their land to meet the needs of their families, resource poor farmers have to consider a wide range of influences, risks and opportunities. As such the decision of farmers as to whether, where and how to plant and manage trees is influenced by many factors. Although some suggest that farmers prioritise fruit trees, above other tree species, this tendency wasn't marked in the surveys. Of the 20 most favoured species in each ecological zone, 20-40% were fruit tree species, while the remaining favourites in each ecological zone showed a range of uses (timber species *e.g. Cordia alliodora*, *Cedrela odorata*, multipurpose species *e.g. Gliricidia sepium*, *Guazuma ulmifolia*).

Thus the book, rather than offering prescriptive solutions or tailor made packages, emphasises options for farmers to enable them to choose what responds to their needs. The book doesn't favour one group of species, use, or farming system above any other. The book's annexes list species by ecological zone, farming system or use; enabling the extensionist to identify and offer a range of species appropriate to the particular issue or need that a farmer has identified.

While trees can play an important role in improving production systems, it is rare that this is isolated from other components of resource poor farmers' production systems. The book and associated training recognise the importance of the tree within the farm and farmers' livelihoods as a whole and are therefore not aimed at forestry extensionists, but extensionists as a whole. A Honduran agricultural extensionist commented that they now had a tool that gave them the information they needed on trees, and that forestry extensionists needed something similar for agricultural crops.

5.1.3 Sourcebook content

The sourcebook's first 310 pages contain introductory chapters that provide background information on options for the use of trees on farms in sustainable land use systems. Species accounts comprise the bulk of the book, focusing on aspects of most interest to farmers/extensionists (*e.g.* uses, marketing, markets, suitability for use in different farming systems, silviculture). Accounts vary in detail according to available information (two-eight pages). The lack of information on some species considered of high importance illustrates the need for increased research on some native species.

Box 1 Content of Central American Trees Sourcebook for extensionists

- Introduction (context & aims)
- How to use the book to develop extension materials, with examples.
- Diversity - geography, climate, soils, vegetation, trees and land tenure in target countries.
- Products, markets and marketing–covering local markets, fair-trade, niche markets
- Factors related to success of tree planting and regeneration in target countries - includes case studies (successes & failures).
- Forest in farming systems - ecology & silviculture options.
- Trees in farming systems - opportunities for natural regeneration and tree planting (agroforestry, fencelines, fruit trees, land stabilisation).
- Trees in farming systems-opportunities for tree planting (small on-farm plantations).
- Tree planting and management of genetic diversity - approaches to managing species and within-species diversity in local (*in situ* & c*irca situm*) tree planting/ecological restoration programmes, with guidelines for seed collection and planting designs.
- Species selection - what species farmers protect or plant (farmer survey results).
- Species accounts - cover 199 Central American species, including both widely-used and lesser-known but locally valuable species. In detail they cover:
    - Farming/agroforestry systems in which used/suited to
    - Principal uses
    - Botanical and common names
    - Socio-economic factors
    - Uses, Products, markets and marketing
    - Distribution (with map)
    - Conservation status
    - Ecogeography - climate, soils, vegetation type
    - Habit - size and form
    - Propagation, management, silviculture
    - Seed collection and storage
    - Key botanical features and identification pointers - pictorial guide to species groups with particular identification problems (*e.g. Lysiloma* see figure 3).
    - Calendar of flowering/fruiting, genetic improvement and seed sources
    - Pests and diseases (where there are problems specific to this species)
    - Selected references - principal sources of additional information, list of extension material published & addresses to obtain them.

5.1.4 Botanical Issues

The compilation of a book covering 199 species, aimed at extensionists throughout Central America, raised a number of taxonomic and nomenclature issues. The species descriptions concentrate on products and silvicultural aspects with only brief botanical descriptions. However where there were known difficulties in distinguishing between species within a genus (*e.g. Leucaena, Lysiloma, Inga, Manilkara, Spondias, Tabebuia*) drawings of key features were given to aid identification. Taxonomic revision and advice was provided by experts in the particular genera.

The description of the same species in different countries under different scientific names, along with the transfer of species between genera causes problems for non-taxonomists. The book contains a list of the most frequent scientific synonyms for each species, to help readers coping with problems encountered when searching for information on particular species. Although the latest accepted scientific name is generally used, occasionally a former one is used, when this is “universally” known across the region, and the new one almost unknown, except to botanists.

Not being trained botanists, users said they preferred to see species descriptions sorted by common name, rather than by scientific name. This presented a problem as the common name of some species varies across Central America, not only by country, but also within countries, and with language. An example is *Gliricidia sepium*, one of the trees most valued by farmers. With many common names (*e.g. madero negro*, *madreado*, *madrecacao*, *matarratón*), choosing one name would bias the book towards one country and render species searching very difficult for people from other countries or with other native languages. Common names were therefore given in two ways: i) list of all common names available for each species, ii) alphabetical list of all common names, with details of use by country and region, to allow retrieval of their scientific name.

This listing also helps to distinguish species where common names are not exclusive to one species. This is typically associated with names derived from morphological characteristics or wood properties which are common to several allopatric species, or several similar species within a genus (*e.g. Lysiloma* - quebracho). Typical of this problem are studies where common names are recorded in the field with no further checking of species by a botanist. Studies cite a common name given by local people and often equate it with a scientific name from an available database. So information may be attributed to the wrong species. This is essentially an irresolvable problem. However, for species where this is known to be an issue, species descriptions give a warning as to duplication of common names and which species may be confused.

5.1.5 Website access

The whole of the book has been available at the project's website since February 2004. Access has always been free, however up until July 2005 it was necessary to register as a user before gaining access to the book chapters, species descriptions, search engines and image libraries. The use of a log-on enabled us to build a profile of the use of the website in this initial period (figure 5.1). It is evident that the website is accessed by different users from the project's main target group, emphasising the need for hard copy materials, even in a region where access to electronic media is relatively developed.

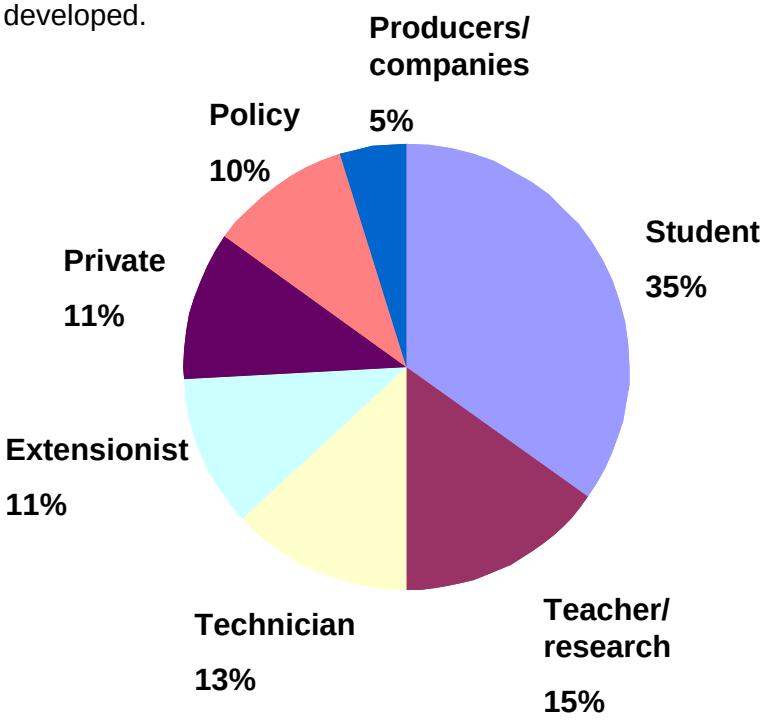


Figure 5.1: Profile of registered users of website during first 10 months operation

It was agreed that access and potential use was being reduced by the log-on requirement and this was removed in July 2005. Such a requirement means that species descriptions are not picked up by search engines and therefore the book's information is less easily identified. The increased use of the site since then, clearly justifies that move, with a jump from roughly 1,500 visitors per month to 2,500. Apart from the increase related to ease of access, other peaks match big publicity events/ announcements (*e.g.* launch at Costa Rica UK embassy + newspaper article) or when electronic Newsletters were sent to course students. The most popular pages were the search engines that people can use to search for species, common and scientific names, images.

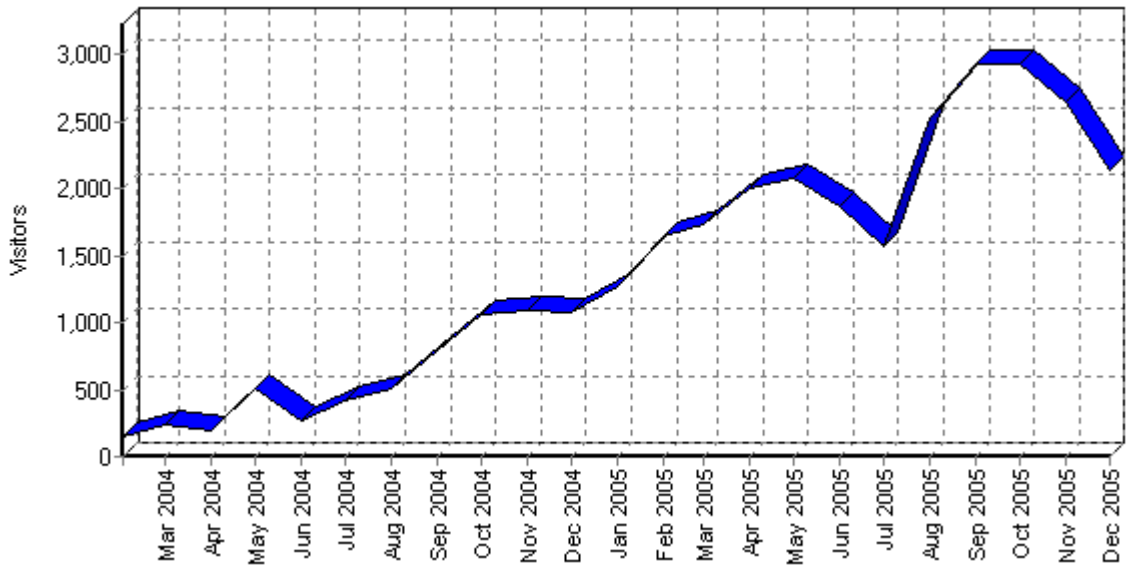
Website access general statistics summary

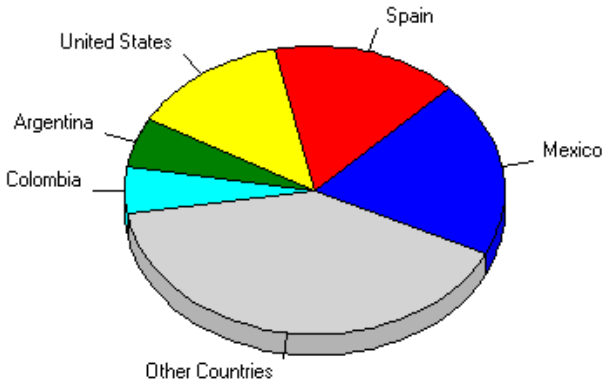
Hits 133,244 *since Feb 2004*. The number of hits can be misleading, since any entry in the log file is a hit. Therefore, to evaluate the number of people visiting the web site, it is better to consider the number of "Visitors" and "Unique IPs"

Visitors *31,623 since Feb 2004*. The number of times someone has accessed the web site to browse it and get information. However, this person could be doing it for the first time or be a returning visitor.

Unique IPs *21,039 since Feb 2004*. The number of individuals who have used the web site. It is not exact as two different people using the same computer qualify as the same unique IP. Organisations with a computer network (CATIE, OFI, etc.) show unique IPs for individuals, since their network connections have in most cases a unique IP assigned to them.

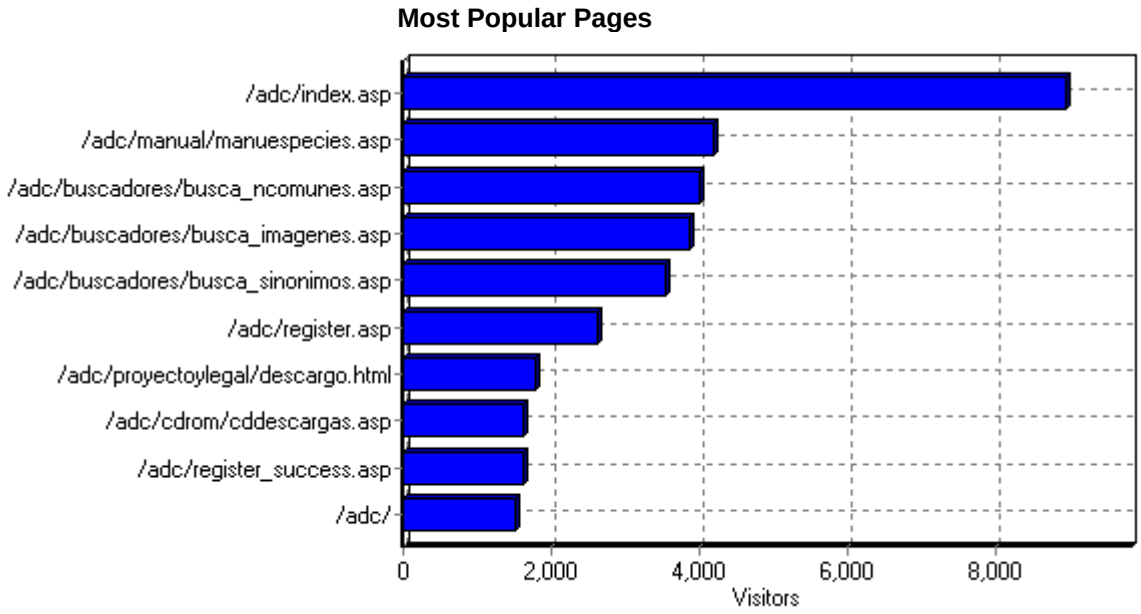
Activity by Month





Most Active Countries (target countries shaded)

	Country	Hits	Visitors	% of Total Visitors
1	Mexico	26.971	6.224	19.68%
2	Spain	13.508	5.050	15.97%
3	United States	11.383	4.243	13.42%
4	Argentina	4.357	1.743	5.51%
5	Colombia	8.340	1.672	5.29%
6	Peru	6.987	1.643	5.20%
7	Chile	3.597	1.529	4.84%
8	Costa Rica	12.169	1.520	4.81%
9	Venezuela	3.077	985	3.11%
10	Guatemala	6.045	972	3.07%
11	Panama	4.821	814	2.57%
12	El Salvador	4.933	749	2.37%
13	Ecuador	1.496	410	1.30%
14	Bolivia	2.887	407	1.29%
15	United Kingdom	4.084	405	1.28%
16	Honduras	3.709	388	1.23%
17	Nicaragua	3.390	344	1.09%
18	Brazil	980	323	1.02%
19	Puerto Rico	706	246	0.78%
21	Dominican Republic	968	225	0.71%
26	Uruguay	373	108	0.34%
30	Cuba	208	61	0.19%
33	Paraguay	101	40	0.13%
38	Belize	53	19	0.06%
	Subtotal	125.143	30.120	95.26%
	Total	133.244	31.623	100.00%



5.2 Uptake of the *Source Book* through integrated training.

5.2.1 The multiplier effect

Writing and distributing a book is no guarantee of its use, and transfer of the information to farmers. Effective transfer and uptake of information require that dissemination is an integral part of a project from its inception. National collaborator networks, involving a wide range of government and NGO agriculture/natural resource and development agencies within each country, were central to both validation of the source book and the dissemination process. Dissemination used a 'multiplier effect' whereby a group of facilitators from each country were trained and then gave courses for extensionists and other target groups throughout the country (see figure 5.2).

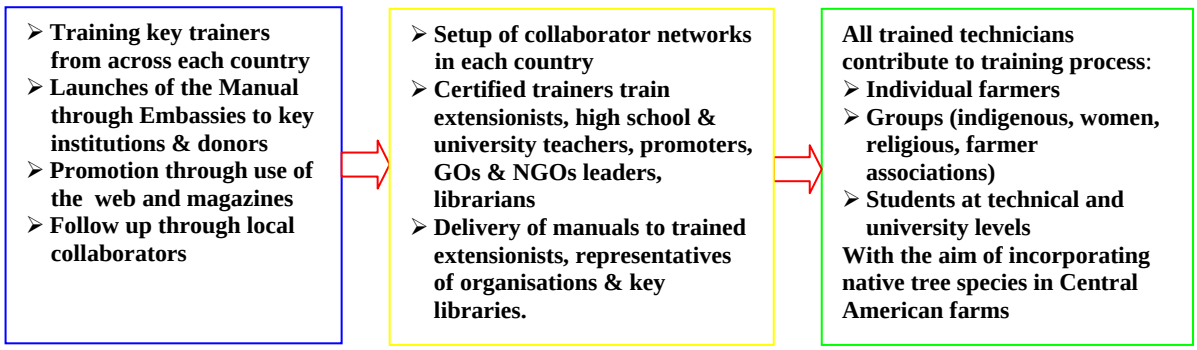


Figure 5.2. Multiplier effect used for dissemination of the Central American tree manual and promotion of the uptake and use of information.

The project's main deliverable (the Sourcebook) is targeted at any extensionist who works with rural communities, i.e. not only forest extensionists. The involvement of extensionists from a full range of disciplines and organisations ensures the maximum opportunity for dissemination. Additionally the stakeholder workshops identified the potential to increase the project's overall impact on natural resource management through diversifying the public for workshops in the dissemination process.

Distribution of the sourcebook was free, conditional on participation in a course on use of the Sourcebook and associated materials. This has ensured the Sourcebook reaches those who will use it in their daily work with farmers, rather than remaining on the shelves of bosses. Organisations wishing to receive training for its extensionists are required to pay the costs of the trainers and provide the facilities to run the course. Such has been the demand for the book that the organisations are happy to contribute enabling the project's resources to be concentrated on the printing and free availability of the maximum number of books. An estimate of the additional resources attracted to the project through this approach, up to the end of 2004, is given in annex 2.2.

More than 1100 extensionists have been trained covering a mix of foresters, agroforesters, agronomists and extensionists from rural development agencies (see table 5.1). The course demonstrated how the Source Book can be used to prepare extension material on specific topics (*e.g.* for individual species, restoration in an ecological zone).

Training	Belize	Guatemala	El Salvador	Honduras	Nicaragua	Costa Rica	Panama	Total
Courses for trainers	1	1	2	1	1	1	1	8
Courses for extensionists	1	13	8	14	16	15	8	75
Certified trainers	5	14	17	16	17	16	15	100
Trained extensionists	15	186	89	255	292	224	124	1,185
Organisations	7	23	15	40	49	36	25	195

Table 5.1 Training in use of the Central American tree manual as part of the multiplier effect over two years (November 2003-2005).

The effectiveness of the dissemination strategy in reaching the target audience across the whole Central American region, as well as a diversity of organisations, covering a mix of foresters, agroforesters, agronomists and extensionists from rural development agencies, is illustrated in table 5.1. Although not the original target group, interest from teachers (university and high school) in using the material has shown the book offers a useful resource for a wider audience and some have been included in training courses. As a teacher from Honduras said; "*I'm using the book to develop activities for my pupils. It helps to build their knowledge and they have something to show their parents to diversify production.*" This offers the potential to mainstream sustainable on-farm tree management options deeper into the conscience of each country. Also included were librarians of some agricultural/forestry departments so they can direct users to the manual as a resource within their library.

5.2.2 Diversifying the public for courses in Honduras.

CONSEFORH, the principal collaborator in Honduras, saw the need and demand for short courses for farmer groups using material prepared from the manual. CONSEFORH produced extension material based on the manual (see annex 2.1), which it then used in training courses for farmer leaders. Nine courses have been offered to date with 123 farmer leaders trained. Extension agents and farmer leaders indicated that they found the extension material produced by CONSEFORH very useful (see annex 2.1).

As part of the training, farmers produced a diagram of their farms as they are now and another diagram of the changes they want to bring about as a result of the training. The farmers' diagrams of future changes include live fences and the use of fruit trees as shade trees in coffee plantations. It is too soon after the training to expect farmers to have implemented many changes but as a result of the training courses, some of the farmer leaders asked CONSEFORH to provide seedlings, particularly of *Swietenia* spp. (caoba) and *Cedrela odorata* (cedro).

5.2.3 Promotion strategy

In addition to the activities already described in this report, other activities were realised to ensure promotion and uptake of the project's outputs. These are detailed in the promotion strategy (see annex 2.3).

Embassy launches

The UK embassies in Costa Rica, Honduras, Nicaragua and Panama were willing collaborators offering assistance at a variety of stages through the opening of workshops, and hosting official launches of the Sourcebook. The effusive help from FCO was in stark contrast to the lack of response from DFID regional offices. The launches targeted managers/leaders/decision makers of government agencies and NGOs. They raised awareness of the project's outputs, promoted support for the participation of lower level employees in project activities, and promote support for continuation of activities post FRP. They also raised the profile of the project through associated press coverage.

Poster competition

To promote the use of the manual in producing extension materials a competition was run. This was not a success in that few entries were received although the quality of those received was good (see examples in annex 2.4).

5.3 Dissemination of the benefits/successes/lessons learnt from the project's approach to a wider tropical audience.

Although the original target group for the project's outputs was clear and remained the focus of the project, once the Sourcebook was available it became clear that there was interest from other groups, both type and geographically. Some of this is described in sections 5.2.1, 5.2.2 and 5.4. In addition the following actions were pursued, although without detriment to the main focus on extensionists.

5.3.1 Diversifying courses

The course described in section 5.2 was also run for MSc students at CATIE, as a weekend option. This was heavily subscribed and well received. These students are from all over Latin America and the Caribbean and thus increase the geographic coverage as they return to their countries. An additional course was also given at CIPAV (their request) in Colombia for extension workers, teachers and students.

5.3.2 Distance learning course

The wide usefulness of the Sourcebook was further illustrated through the interest shown by IICA's Distance Learning Center (CECADI) in using it as a basis to develop distance learning courses. With support from FRP a trial CDROM based agroforestry course (already supplied to FRP) was developed by CECADI/CATIE/OFI based on the Sourcebook's chapter 6. The course was trialled with a group of 32 students of

the Masters in Sustainable Tropical Agriculture at the University of Guayaquil in CATIE (see report in annex 3.1). Marketing of the course will start in 2006.

5.3.3 Toolkits

The usefulness of the Sourcebook and potential for wider applicability is evident from two requests to incorporate elements within CDROM toolkits under development. In addition the Sourcebook's CDROM has been installed in the network of subsidised internet cafes run by the National Secretariat for Science and Technology, throughout Panama.

IDB CDROM

CATIE has developed an Information System to support coffee farmers in the selection of options for diversification of their farms. The project is in collaboration with CIRAD and funded by IDB. The Information System will be a CD and web based product that primarily hopes to guide technical staff working with farmers in deciding on new productive options. Mainly it directs the user to different web based information services, one of which is R7588's Sourcebook. The species selection tool and chapter 5 are included as part of the decision making support structure. The species selection tool is included on the CD. Access to other parts of the Manual would be through a web connection.

ICRAF CDROM

As part of their scaling-up activities for agroforestry technologies, ICRAF (World Agroforestry Centre) developed a toolkit to provide information on sustainable production and distribution of agroforestry seeds/seedlings to farmers, including issues of seed quality, the need for developing joint strategies for seed production and ways of introducing sustainability in seed production and distribution systems. A CD-ROM is included in the toolkit, providing a compilation of reference materials on tropical trees. These materials primarily focus on tree seeds, but also include electronic versions of Longman's tropical tree manuals, and PDF versions of R7588's Sourcebook. The materials are on the CD-ROM as a static website (copy of http://herbaria.plants.ox.ac.uk/adc/manual/manucapitulos.asp), including a link to the various chapters. Such a static website is especially relevant for many of ICRAF's partner organizations as internet access is very weak.

5.3.4 Project synthesis paper

Two summary papers were presented in symposia and will be published in the respective proceedings.

i) *Indigenous trees for farmers: information transfer for sustainable management in Central America and the Caribbean.* Presented by D. Boshier at the International Multidisciplinary Symposium, Martinique, December 5-10, 2005 Forest Ecosystems in the Caribbean: Ecology to Development.

ii) *Manual Árboles de Centroamérica: una herramienta para el fomento de la biodiversidad dentro de los ecosistemas agropecuarios de la región y su aplicación en Guatemala.* Invited presentation by G. Detlefsen at the VII Guatemalan Forestry Congress, Antigua, Guatemala, October 26-28, 2005.

5.4 Full proposal for a Caribbean sourcebook project, through workshops in Cuba, Dominican Republic, Haiti and Jamaica.

The interest in and uptake of the sourcebook has shown the potential for the project's overall philosophy and approach to be useful in other regions. Initial requests from Cuban authorities, people in Dominican Republic, and IICA staff in the region led to the development of a similar initiative in the Greater Antilles (CARIBTREES). Although initial interest centred on using the Sourcebook (reprinted and translated as appropriate) in these countries, it is clear that any new initiative could build on the Sourcebook, but would need to be adjusted to the species, ecosystems and people of these countries.

The following points summarise the main successful aspects that could be used in other regions:

- Choice of species based on farmer preferences
- Gauging the opinions of farmers through use of existing surveys, PRAs, RRAs etc from within region, adding value to previous projects/research within the region.
- Use, at all stages, of easily updated data bases. These will be linked to production of final outputs (sourcebook, CD-ROM, etc.), saving time and cost.
- Production of a Sourcebook of high technical quality, but in a style and language easily accessible to extensionists/promoters. Such material is readily accessed by technicians/researchers/students, whereas more technical material is not accessible to extensionists.
- Focus in species descriptions on aspects of most interest to farmers/extensionists: *e.g.* uses, marketing, markets, suitability for use in different farming systems, silvicultural aspects
- Workshops to validate draft materials and provide feedback to improve final products
- Use of low cost printing and distribution techniques to maximise quantity of material available.
- Free distribution conditional on taking courses on use of Sourcebook & CD-ROM, such that outputs reach those who will use them in their daily work with farmers.
- Training through a 'multiplier effect' whereby facilitators, trained in each country, agree (by signed agreements) to repeat the training course for extensionists and others throughout the country.
- Use of methodologies (both simple to adopt and adapt) for creation of low cost, high technical quality extension materials, adapted to local needs of farmers.

Attention to the following aspects would improve any similar initiative:

- Emphasis on native species, but including highly valued non-invasive exotics, ensures maximum benefits for both development and biodiversity conservation, while avoiding negative impacts of potentially invasive species.
- Ensure national collaborators are actively involved at all stages in producing the project outputs and not just sporadically in workshops.
- Separate the gathering of information on markets and uses from other aspects related to species' descriptions. Assign adequate time and resources, as the topic requires field research to produce valid, complete and up to date information.
- Organise efficient communication networks involving all collaborators, with use of rapid, low cost, communication technologies - email, chat, internet telephone, videoconference.

- Decentralise some of the gathering and input of information, allowing better distribution of the work load amongst a greater number of people, with a quicker end product “owned” by a larger group. This will involve training people in protocols for gathering and processing of information to ensure the final compilation is simple, objective and valid. This will help avoid bottlenecks that delay other activities

Workshops were held in Cuba (24-26/5/2005), Dominican Republic (8-10/6/2005) and Jamaica (29/6-1/7/2005), using the original Sourcebook, with sample chapters and species descriptions translated into English and French for use in activities (see annex 4.1). A breakdown of the participating people and institutions is given in annex 4.2. Arrangements were also made for holding a workshop in Haiti, however the worsening security situation in Haiti forced its postponement. The feasibility of rescheduling the workshop has been under constant review, but it has eventually been decided to cancel it. Instead Ing Rachelle Chery of IICA-Haiti a specialist in agricultural rural development and who has been central to organising the cancelled workshop will travel to CATIE in Costa Rica for 3 days of briefing by CATIE and OFI staff in March.

The full proposal submitted to the EU is given in annex 4.3. As part of this initial work a bibliography of literature relating to natural resources in the Caribbean was compiled. This is given on the report CDROM as it is too large to print out (>800 pages). A MS access data base was compiled based on a revised version of Bwa Yo chapter 22 (Timyan 1996), with lists corresponding to Scientific, Synonyms & Common Names.

6 Contribution of Outputs

The use of the Sourcebook’s information in changing practices will depend on its relevance to the problems and interests of small farmers. Prioritising native species, the manner in which the species were selected and the focus on the management of trees within farming systems increases the possibilities that the information is relevant to the needs and reality of farmers. However, it will be necessary to wait some time before changes in the field may be apparent. Current monitoring focuses on how trained extensionists use the material in their day to day work (section 4.3).

6.1 DFID and EU developmental goals

The project’s outputs and approach contribute to Goal 7 of the Millenium Development Goals, which seeks to ensure environmental sustainability and includes indicators related to the maintenance of biological diversity and the planting and management of trees. The Sourcebook promotes the implementation of sustainable land management options to improve rural livelihoods and conserve biodiversity, in line with UK government and EU policies, United Nations Conventions: to Combat Desertification (UNCCD) on Biological Diversity (CBD) and fulfilment of a range of certification standards.

EU Development Policy

The sustainable development of the type promoted by the project is a central goal of the EU Development policy, with the communication ‘The Conservation of Tropical Forests: the Role of the Community (1989)1’. The Communication was followed by the 1990 Council Resolution: Tropical Forests: development aspects. The protocol on Sustainable Management of Forest Resources was added in 1995 to the Lomé Convention. In this the EU and ACP States acknowledged the importance and the need for the rational management of forest resources with a view to ensuring long-term sustainable development of forests in ACP countries in conformity with the Rio

Declaration of Principle on the Environment and Development including the nonlegally binding Forest Principles, the UN framework agreement on climatic changes and the Conventions on Biodiversity and Desertification to which the UK and the EU are signatories.

United Nations Conventions
Issues of land degradation and improved management options are central to the project and there are a number of relevant international standards. The Conference of the United Nations for Environment and Development (CNUMAD), held in 1992 in Rio de Janeiro, drew a new integrated view on the concept of desertification. This new view emphasises the adoption of measures to enforce sustainable development at a community level, with the following definition: "Desertification means land degradation in arid, semi-arid and arid sub-humid areas resulting from the negative effects of human activities." The United Nations Convention to Combat Desertification (UNCCD), to which all target countries are signatories, characterised land degradation in the Caribbean basin as showing accelerated urbanization and poor planning, resulting in the loss of cropland, losses of protected watersheds and the diminished conservation of the biodiversity. Poverty, rupture of social structures, and economic instability are results of drought and desertification in the region. Thousands of people a year move to the cities to look for new opportunities, with women and children more vulnerable when the family head moves to the city.

The project's activities are relevant to Article 10 of the Convention on Biological Diversity (CBD) and the implementation of provisions related to research and sustainable use in the CBD work programmes where it states; 'The ecosystem approach is a strategy for the management of land, water and living resources that promotes conservation and sustainable use in an equitable way and that puts people and their natural resource use practices at the center of decision making'.

Contribution to national and certification standards
There are a number of standards to which the project's activities contribute, whether through the promotion of underlying principles or through the actual dissemination and implementation of improved sustainable land management options. Working through national networks, involving government organisations and the use of promotional activities directed at policy makers, increases the likelihood that the project's results are adopted into mainstream national standards. CATIE's experiences with influencing management policy of national coffee and cacao boards are relevant to this issue.

A number of certification initiatives have over the last 15 years developed standards, criteria and indicators for sustainable forest management (International Tropical Timber Organisation, Forest Stewardship Council, Centre for International Forestry Research), all of which promote the use of native species and the conservation of biodiversity. The Sourcebook offers new options for management of native tree species within farms where information is limited. Similarly certification standards for niche marketing of fruits and other products such as coffee and cacao, require the application of agroforestry systems promoted by the Sourcebook.

6.2 Contributions to the conservation of biodiversity
The conservation benefits of trees maintained in agro-ecosystems is polemic. A negative viewpoint describes them as 'living dead' (Janzen, 1986) while a more positive view maintains that such trees can bring various benefits (*e.g.* Gascon *et al*. 2004). In some tropical ecosystems there is little left of the original forest and what remains is highly fragmented, existing within a complex mosaic of varied land use. Such uses vary from practically no tree cover (pasture or monocrops) to highly complex agroforestry systems where there is maintenance of both a high degree of

forest cover and a high diversity of tree species (Boshier, 2004). In Central America for example, almost all traditional production systems (including cattle grazing) have trees mixed in some way, *i.e.* they are agroforestry systems (Beer *et al*, 2004). Trees found in such fragmented conditions and managed in agroforestry systems may be important in the conservation of forest tree species. They may provide habitat for pollinators and seed dispersers that facilitate gene flow between trees of other species, or create habitat conditions that favour regeneration (Boshier, 2004). They may facilitate gene flow between fragmented forest patches and reserves, conserve genotypes not found in reserves and increase population sizes. These functions may be of greater importance in situations where large tracts of forest are practically non existent (*e.g.* agricultural land) and where the trees maintained represent a significant part of a species' population or genetic diversity. In such cases options for conservation through traditional approaches (*e.g.* large protected areas) are reduced and it is necessary to explore other options in which the species can be conserved by managing networks of small forest patches within mosaics of varying land use types. The fact that many tree species that exist in such disturbed vegetation can be conserved through existing agroforestry practices can free resources for the conservation of more critically threatened species requiring more conventional, resource-intensive approaches (Boshier, 2004). Ignoring such systems as an option for conservation could lead to the erroneous identification of which species are truly threatened (Boshier *et al,* 2004).

Recent studies support the positive viewpoint (Boshier, 2004; Boshier *et al,* 2004). However, there remains the doubt as to whether species favoured in such agro-ecosystems are only those of pioneer ecological characteristics, which survive in any disturbed condition and add little to the conservation of biodiversity (Gordon *et al,* 2003; Gordon *et al,* 2004). Although it is true that in farmer's fields, common species such as *Gliricidia sepium* and *Cordia alliodora* predominate, there are other endemic or threatened species that are abundant or are even now only found in such fields. A good example is pacific mahogany (*Swietenia humilis*), a species with legal protection (CITES appendix II) that is favoured in farmers' fields and by their management (Boshier *et al,* 2004).

Whether the project will contribute to the conservation of biodiversity in Central America will depend principally on two aspects:

- The extent to which the transfer of knowledge about native tree species produces changes in the management of native trees on farms in the region (particularly in the most deforested and densely populated zones, such as in the altiplano of Guatemala).
- The extent to which an increase in the management of native trees by resource poor farmers helps towards the conservation of threatened tree species.

The manual fosters the management of native species in general and can help to increase their presence in the region, helping to conserve biodiversity. Additionally, of the 199 species described 14 are classified as threatened in the lists of IUCN (*e.g. Abies guatemalensis* and *Guaiacum sanctum*; Oldfield *et al*., 1998) or CITES (Convention on International Trade in Endangered Species of Fauna and Flora; *e.g. Swietenia humilis* and *S. macrophylla*), while others are threatened locally. Apart from stressing the importance of these species, the manual offers options for their sustainable management, both in natural forest and in agroforestry systems, which makes their conservation more feasible.

A typical case is that of *Leucaena magnifica* an endemic species restricted to an area in the department of Chiquimula, in the south east of Guatemala. The species only became known to science in 1984, although it was well known locally by farmers who

appreciate it for a wide range of uses, such as firewood, posts and beams *L. magnifica* is considered one of the most threatened species within the genus *Leucaena*, partly due to its very restricted natural distribution (<400 km^2). With the loss of native forest in this zone, active protection by the same farmers in traditional agroforestry systems has conserved the species up to this moment and offers the possibility of its future conservation through sustainable use. However, lack of knowledge of the species' existence among development agencies (not distinguishing it from the better known exotic *L. leucocephala*) and their promotion of the planting of *L. leucocephala*, puts in danger its use and conservation in agroforestry systems. This could also have negative impacts on the livelihoods of farmers, through a reduction in the range of products normally available to them from the natural regeneration of *L. magnifica* and the increase in costs involved in planting a species. In raising the profile of native species, such as *L. magnifica*, the Central American Trees manual can help in their conservation.

Although it will be some time before we can evaluate the true impact of the project and its approach in terms of support to biodiversity conservation, it certainly offers many opportunities and means to contribute, and its impact in this respect will not be negative.

6.3 Dissemination Outputs

A total of: 1 book, 2 CD-ROMs, 2 conference papers, 2 posters, have been published (or in press) to date, as project outputs. A full list of the project's dissemination outputs is given in the FRP excel spreadsheet, including the courses and workshops described in sections 5.2-5.4.

6.4 Wider usage

The interest in and uptake of the sourcebook described in sections 5.2-5.4 have shown the potential for the existing outputs to be useful to a wider range of endusers and for the project's overall philosophy and approach to be useful in other regions of the tropics and possibly elsewhere where the management of trees on farms is integral to rural livelihoods. These will be followed up through new proposals to a range of donors.

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