ALTERNATIVES TO SLASH-AND-BURN

EVOLUTION OF THE ALTERNATIVES TO SLASH-AND-BURN (ASB) PROGRAMME

A SYSTEM-WIDE PROGRAMME OF THE CGIAR 1994 – 2001, GLOBAL STRATEGY

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http://www.asb.cgiar.org

Purpose of document

As the longest-serving staff member in the ASB Global Coordination Office (GCO), I saw the need to write this paper to help others to understand the history of the ASB programme since inception and to preserve institutional memory. This paper is intended for staff and partners joining the ASB consortium, donors and stakeholders. ASB, a system-wide programme of the Consultative Group on International Agricultural Research (CGIAR), is a multi-level, global consortium of over 50 institutions governed by a Global Steering Group. The global consortium includes national government institutions, local and national NGOs, other national agencies, universities in developing countries, advanced research institutions and international organizations, and 6 international agricultural research centres. The International Centre for Research in Agroforestry (ICRAF) is ASB's convening center and hosts the global coordination office in Nairobi, Kenya. ASB is governed by a global steering group of 12 representatives from key institutions, and is chaired by ICRAF's Director of Research.

To compile this paper, I made good use of donor proposals, project briefs, working papers, questionnaires, donor evaluation reports and other publications, which I have been archiving through the years. *The paper, in chronological order, highlights the original problem, achievements, impacts, and evolution of the programme; it also lists the donors and staff involved***.**

Original Problem Statement

Shifting cultivation or "slash-and-burn" agriculture is a common practice in many tropical countries. Practised in its original form traditional shifting cultivation farming system has worked well over millennia, as long as population pressures stayed low and the fallow phase sufficiently long. Where population densities are low relative to carrying capacities, and forest areas are vast, slash-and-burn practices can be sustainable and harmonious with the environment. This is no longer the case in much of the humid tropics.

It is estimated that more than 200 million landless people have migrated into tropical forests in recent decades, and these numbers are increasing. Many migrants are new to farming and lack indigenous resource management knowledge. They tend to use non-traditional -- and non-sustainable -- practices. Considering then the millions of indigenous people already there, and the shortages of accessible fertile land, the result is that the ecological equation does not balance.

More than 15 million hectares of the world's primary rainforests are estimated to be degraded each year, an area about three times the size of Switzerland. Much of the land affected constitutes biodiversity "hot spots". As a result, substantial irreversible biodiversity losses occur. When forests are burned, carbon dioxide and other greenhouse gases are released, contributing to global climate change. Burning tropical forests give off approximately 1.6 billion tones of carbon each year.

Evolution of the programme

At International Centers Week **1990**, the United Nations Development Programme (UNDP) inquired about prospects of developing a CGIAR system-wide programme to develop alternatives to slash-and-burn agriculture. In February **1992**, the United Nations Development Programme addressed this issue through an inaugural workshop funded by UNDP held in Porto Velho, Rondônia, Brazil, with 26 environmental policymakers and research leaders from eight tropical countries, five non-governmental organizations (NGO's), six international centers, three regional research organizations and six donor agencies. Participants concluded that a global effort was indeed needed and decided to establish a consortium on Alternatives to Slash and Burn Agriculture, which became better known by its acronym, ASB. Participants set the broad basis for collaboration, selected eight benchmark sites, formed a governing body and assigned ICRAF the convening role (ASB, 1994—a global strategy).

The Consultative Group on International Agricultural Research (CGIAR) also supported the programme and developed it as one of its system-wide initiatives in 1994. Funding was provided by the Global Environment Facility (GEF). The International Centre for Research in Agroforestry (ICRAF) took the leadership to implement the programme due to the close link between agroforestry options and alternatives to unsustainable slash-and-burn practices. It is noteworthy that ASB is the first (and still one of very few) systemwide integrated natural resource management (INRM) programmes of the CGIAR. ASB is being looked upon as a model for their continued development. The first CGIAR *Review of Systemwide Programmes with an Ecoregional Approach* (the "Henzell Review" of 2000) suggests that these reviews could be a strong influence on the broader CGIAR audience regarding ASB as a successful prototype for INRM.

The initial goal of the ASB programme was to improve farmers' welfare and protect the environment by developing land-use practices that offer small-scale farmers sustainable and profitable alternatives to slash-and-burn. This goal has evolved, and the consortium is now focused on how to implement local, national and international strategies to slow forest conversion. This requires tools, options and strategies for matching agricultural development with climate change and biodiversity concerns.

The programme is implemented by a consortium of six international research centres and more than 30 NARSs, universities, NGOs and government agencies. Field research is conducted at benchmark sites in several countries in Latin America, Africa and Southeast Asia, which represent slash-and-burn agricultural conditions over larger zones. Results can be extrapolated over substantial areas of the humid tropical forest margins.

Originally ASB was based in three benchmark sites — in Brazil, Indonesia and Cameroon. The ASB programme has now expanded and is active in Peru, Thailand and The Philippines.

ASB Participating Institutions
National Institutions on Global Steering Group:
Agency for Agricultural Research and Development (AARD), Indonesia
Empresa Brasileira de Pesquisa Agropecuária (Embrapa), Brazil
Institut de Recherche Agricole pour le Dévéloppement (IRAD), Cameroon
Instituto Nacional de Investigación Agraria, (INIA), Perú
Philippine Council for Agriculture, Forestry and Natural Resources Research and Development (PCARRD), Philippines
Royal Forest Department (RFD), Thailand

International institutions on Global Steering Group:
Center for International Forestry Research (CIFOR)
International Centre for Research in Agroforestry (ICRAF)
International Centre for Tropical Agriculture (CIAT)
International Food Policy Research Institute (IFPRI)
International Institute for Tropical Agriculture (IITA)
Tropical Soil Biology and Fertility Programme (TSBF)

Separate from the governance committee, the main partners in the ASB Consortium include:

Other main partners/collaborators:
All are public institutions or NGOs, except where indicated by an asterisk.

'Southern' institutions
Asociación de Mujeres Campesinas de Ucayali (AMUCAU)
Asociación de Productores de Semillas Mejoradas, Plantones, y Madera de Alta Calidad (PROSEMA)
Association of Indonesian Rubber Processors (GAPKINDO)*
Bogor Agricultural University (IPB), Indonesia
CARE-Thailand
Center for Agro-Socioeconomic Research (CASER), Indonesia
Center for Soil and Agroclimate Research (CSAR), Indonesia
Chiang Mai University (CMU), Thailand
Consorcio de Desarrollo de Ucayali (CODESU), Perú
Family of Nature and Environment Lovers-Lampung (Watala), Indonesia
Forest Products and Socio-Economics Research Development Center (FPSERDC), Indonesia
Forestry and Estate Crops Research and Development Agency (FORDA), Indonesia
Gaja Mada University, Indonesia
Grupo Empresarial Amazónico del Perú S.A. (GEA) *
Instituto de Investigacion de la Amazonia Perúana (IIAP), Perú
Instituto Nacional de Recursos Naturales (INRENA), Perú
Lampung University, Indonesia
Lantapan and Claveria Landcare Associations, Philippines
Programme Regional de l'Afrique Centrale pour l'Environnement (CARPE), Cameroon
Replanting and Land Rehabilitation Division, Department of Forestry, Indonesia

Rubber Research Institute, Sembawa, Indonesia
Southeast Asian Regional Centre for Tropical Biology (SEAMEO-BIOTROP), Indonesia
The Indonesian Tropical Institute (LATIN)
Universidad de Ucayali (UNU), Perú
Universidad del Amazonia Perúana (UNAP), Perú
Universidad Nacional Agraria de la Molina (UNALM), Perú
Universidade de Brasilia, Brazil
Universidade Federal de Lavras, Brazil
Universite D'abobo-Adjame, Cameroon
University of Brawijaya, Indonesia
University of the Philippines, Los Banos, Philippines
University of Yaounde, Cameroon

'Northern' institutions
Centre de Cooperation Internationale en Recherche Agronomique pour le Développement (CIRAD), France
Centre for Biodiversity Management (CBM), Australia
Colorado State University, USA
Cornell University, USA
Department of Ecology, Faculty of Biology, Universidad Complutense de Madrid, Spain
Development Research Group of the World Bank, USA
Institut de Recherche pour le Développement (IRD), France
Resource Policy Support Initiative, World Resources Institute (WRI)
School of Agriculture and Forest Science, University of Wales, Bangor, UK
University of California, Davis, USA
University of New Hampshire (UNH)

Principal operational sites by country and ecology
Local. Eight existing ASB benchmark sites in Peru (1), Brazil (2), Cameroon (1), Thailand (1), Indonesia (2), and the Philippines (1), with the possibility of adding outreach to associated sites. These sites are intended to represent major agroecosystems of the forest margins of the humid tropics, including the Western Amazon, the Congo Basin, and lowland insular and montane Southeast Asia. Each site includes forests with globally-significant biodiversity and forest-derived agroecosystems that differ in their ability to supply the various environmental functions of natural forests and in their roles in providing sustainable livelihoods. The sites represent some of the richest centers of global biodiversity.

National. Six countries with existing ASB national consortia (Peru, Brazil, Cameroon, Thailand, Indonesia, and the Philippines), with scope for outreach to new countries in the tropics.

Continental. ASB global synthesis activities span the tropics, including four continental units on three continents

- **Western Amazonia** in the Neotropics.
- **Central African forests** of the Afrotropics.
- **Insular Southeast Asia** (Sumatra and Mindanao) and **Montane Mainland Southeast Asia** (centered on Northern Thailand) in the Indomalay biogeographical realm.

Objectives.
Since its inception in 1994 as a CGIAR Systemwide Programme, ASB's aim has been to identify, develop, and implement innovative policies, institutions, and technologies that can reduce poverty and conserve tropical forests. The primary mechanism behind these innovations is participatory development of sustainable land use practices that can help conserve environmental functions of the remaining tropical forests while simultaneously increasing household income and food security for hundreds of millions of poor people.

ASB has focused on understanding and quantifying the contrasting global, national, and local perspectives on environmental problems and development opportunities. This has been accomplished by sustained collaborative research activity by ASB partners at benchmark sites (listed above). Through this network of sites that spans the humid tropics, ASB ensures that its analyses of local and national perspectives are grounded in local reality.

Achievements
Phase I (1994 – 1995): Characterization and diagnosis of the biophysical, socio-economic, and political factors associated with deforestation in slash-and-burn agriculture at the benchmark sites.

- Guidelines designed and implemented for multidisciplinary characterization of land-use systems.
- Rates and driving forces of deforestation identified at each benchmark site, using techniques which include remote-sensing, geographical information systems (GIS), field surveys and farmer interviews.
- Policy problems relevant to deforestation identified and documented.
- Key socio-economic constraints to agricultural production identified.
- Prototype Indices of above-ground biodiversity documented for complex agroforests in Indonesia.
- Methodologies for assessing carbon stocks and greenhouse gas emissions developed and tested.
- Capacity built through national and international training workshops.
- Strong partnerships developed with IARCs, NARS, NGOs and universities**.**

Phase II (1996 –1999): Assessing trade-offs between production and the environment.

- 'Best-bet' alternatives to slash-and-burn agriculture identified using multiple criteria across all benchmark sites. These options — complex agroforests, other tree-based systems, silvopastoral systems, improved fallows and community-based forest resource management — can offer resource-poor farmers sustainable and profitable alternatives to slash-and-burn.
- A cost-efficient method for rapid appraisal of above-ground vascular plant biodiversity at all benchmark sites developed and tested. The method was designed to assess the differences in the species composition, functional attributes and structure along a land-use gradient from primary forest to degraded cropland.
- Different land use systems analyzed and described in terms of their above-and below-ground biodiversity, carbon stocks and greenhouse gas emissions. Results from these appraisals highlighted the rich plant biodiversity of complex tree-based systems (agroforests).
- Strong correlation identified between above-ground biodiversity indicators, carbon sequestration, and below-ground biodiversity. This information will help greatly in the development of predictive models to assess the impact of land-use change.
- Data on below-ground biodiversity demonstrated that there are substantial differences among land uses with respect to the diversity and/or abundance of one of more of the groups of soil biota. For example, there is a drastic decrease in the number of termite species and the elimination of soil-feeding termites as land-use intensity increases and trees are removed from the system in Indonesia. Similar findings have been documented for earthworms in Brazil. Such changes in below-ground biodiversity may have significant implications for system productivity, sustainability, and resilience. The availability of these data on the soil biota, together with those on nutrient and carbon stocks, provides information that facilitates the development of management strategies for improved soil productivity.
- Various tree-based systems evaluated at the ASB benchmark sites and found to have comparable average carbon stocks during the course of their rotation. In order to compare the potential for carbon *sequestration* in a system, a method was developed and validated for computation of time-averaged carbon stocks, or the average carbon stored in a system over the rotation time of the system. ASB calculations indicate that tree-based land uses sequester about six times more carbon than annual crops or pastures.

- ASB findings show that there is potential for increased C sequestration in soils through the rehabilitation of degraded pastures and grassland, but the largest sequestration potential in the humid tropics is above-ground through the adoption of tree-based land uses.
- Detailed data collected in Cameroon, Indonesia and Peru on greenhouse gas emissions indicates that all the upland systems are sinks of methane – highest in the forest and lowest in continuous cropping. The sink strength is reduced with increasing land-use intensity. The data suggest the possibility that atmospheric flows across mosaics of land-use practices may balance the sources and sinks of GHG at the landscape level.
- Tradeoffs (or complementarities) regarding likely environmental, agronomic, and socio-economic impacts (including household food security) of alternatives to slash-and-burn were analyzed using a quantitative matrix method developed by ASB partners spanning numerous disciplines and institutions.
- A bioeconomic model was developed for the Western Brazilian Amazon. This optimization model simulates the likely effects of policy changes on farm-level decision making and the resulting land-use patterns over a 25-year period. The model also measures some environmental effects of global concern, such as carbon stocks on private farms.
- Econometric models, developed to analyze the evolution of indigenous land and tree tenure institutions in Sumatra, Indonesia, demonstrated the efficiency and adaptability of these institutions.
- A spatially-explicit econometric model was developed to analyze the effect of public investments in infrastructure – especially the road network – on deforestation and land use patterns in Sumatra, Indonesia.
- Regionally disaggregated macroeconomic models were developed to assess the impacts of major macroeconomic shocks and policy changes on land use in Brazil and Indonesia, with special attention paid to the Amazon and Sumatra. Land uses, including deforestation, incomes and wage rates can be simulated for each region. Results suggest that recent major shocks will have large and potentially lasting impacts on human welfare and the natural resource base.

Principal achievements and impacts realised to-date.

ASB's comparative advantage rests in its proven record in the integrated assessment of natural resource management problems at multiple scales and in acting on the implications of ASB research for sustainable development and poverty reduction. ASB has been cited as among the most effective of the systemwide programmes of the CGIAR. The CGIAR's First Review of Systemwide Programmes with an Ecoregional Approach (the "Henzell Review" of June 2000, p.xxi) concluded that "the Alternatives to Slash-and-Burn Programme has gone further than the others in

relating its research sites to the whole area over which the problem occurs, and in scaling up to the global level in its findings on tradeoffs … This is very helpful for the global debate on sustainability issues."

The work of ASB to date has produced rich and unexpected results. In the seven years since 1994, ASB scientists have produced more than 375 publications and other scientific products, including over 100 journal articles, more than 120 book chapters, 37 reports and proceedings. (A searchable database ASB publications can be accessed through the ASB website www.asb.cgiar.org). These results can be grouped into three main sets of lessons regarding 1) forces driving deforestation, 2) the effects of deforestation on the environment and development, and 3) the effects of agricultural intensification on deforestation pressure.

Driving forces of deforestation. The driving forces of tropical deforestation are highly dynamic, varied and complex. However, despite the variability that exists among ASB sites, many small-scale farmers at all sites cut down trees because current national and international policies, market conditions, and institutional arrangements either provide them with positive incentives for doing so or do not provide them with viable alternatives. These farmers practice slash-and-burn-- on secondary forest fallow vegetation, logged-over forests and, in a few cases, primary forests-- largely because slashing and burning from their perspective is the cheapest and least risky means of clearing land for agricultural production. Deforestation is therefore driven in large part by the policy and institutional environments. Slash-and-burn and other deforestation practices are the result of a conjunction of factors, of which policy issues, market failures and lack of appropriate technology options are the most decisive. Therefore, attempts at slowing deforestation have little chance for success unless they also consider the role those national and international policies, institutions and markets play in farmers' decisions.

Effects of tropical forest conversion. Conversion of primary and secondary forest to other land uses, although profitable for farmers, usually brings negative consequences for plant and soil biodiversity, greenhouse gas emissions and carbon sequestration. ASB has quantified these effects. ASB results also have confirmed that clearing and conversion of forest can result in substantial changes in the diversity and composition of key functional groups of soil biota. A corollary finding is that some land uses do appear to minimise trade-offs between productivity and environmental effects. Land uses most likely to meet farmers' objectives and global environmental concerns are therefore those that are based on the incorporation of trees on farmlands, from multistrata systems and complex agroforests with high tree densities to silvopastoral systems with low tree densities. While no forest-derived system is a perfect substitute for the global environmental benefits of rainforest conservation, ASB results indicate that a remarkably wide range of smallholder land use options are agronomically sustainable, depending upon the larger environmental and economic context. A key policy insight from this work is that these (locally) sustainable options differ significantly in their environmental impacts and in their profitability and adoptability by poor households. ASB results show that a middle path of development exists – involving smallholder tree-based systems and community-based forest resource management -- that could attain an attractive balance between the environment and development. Whether or not this balance can be achieved depends on a range of

policy and institutional innovations, including means to effectively protect natural forests and to compensate households for foregone opportunities.

Impacts of agricultural intensification on deforestation. A third important lesson derived from ASB research is that most types of agricultural intensification at tropical forest margins increase, rather than decrease, pressure for deforestation. This occurs because such intensification provides additional economic incentives for farmers to cut trees in forested areas, attracting new migrants to forest margins.

Specific milestones, outputs, and impacts, 1994-2000.

Milestones

- Guidelines designed and implemented for multidisciplinary characterisation of land-use systems.
- Rates and driving forces of deforestation identified at each benchmark site using techniques which include remote-sensing, geographical information systems (GIS), field surveys and farmer interviews.
- Policy guidelines relevant to deforestation identified and documented.
- Key socio-economic constraints to agricultural production identified.
- Indices of above-ground biodiversity documented for complex agroforests in Indonesia.
- Methodologies for assessing carbon stocks and greenhouse gas emissions developed and tested.
- Capacity built through national and international training workshops.
- Strong partnerships developed with IARCs, NARS, NGOs and universities**.**

Outputs and impacts

- 'Best-bet' alternatives to slash-and-burn agriculture identified using multiple criteria across all benchmark sites. These options — complex agroforests, tree-crop agroforests, silvopastoral systems, improved fallows and natural forest management — can offer resource-poor farmers sustainable and profitable alternatives to slash-and-burn.
- A cost-efficient method for rapid appraisal of above-ground vascular plant biodiversity at all benchmarks developed and tested. The method was designed to assess the differences in the species composition, functional attributes and structure along a land-use gradient from primary forest to degraded cropland .
- Different land-use systems analysed and described in terms of their above-and below-ground biodiversity, carbon stocks and greenhouse gas emissions. Results from these appraisals indicate that the complex tree-based systems have the richest plant biodiversity. The high plant biodiversity measures for fallows and secondary forests needs further analysis and interpretation but are consistent with the results from other studies of forest gap dynamics.
- Strong correlation identified between above-ground biodiversity indicators, carbon sequestration, and below-ground biodiversity. This information will help greatly in the development of predictive models to assess the impact of land-use change.

- Data on below-ground biodiversity demonstrated that there are substantial differences among land uses with respect to the diversity and/or abundance of one of more of the groups of soil biota. For example, there is a drastic decrease in the number of termite species and the elimination of soil-feeding termites as land-use intensity increases and trees are removed from the system in Indonesia. Similar findings have been documented for earthworms in Brazil. Such changes in below-ground biodiversity may have significant implications for system productivity. The availability of these data on the soil biota, together with those on nutrient and carbon stocks, provides information that facilitates the development of natural resource management strategies for improved productivity.
- Various tree-based systems evaluated at the ASB benchmark sites and found to have comparable average carbon stocks during the course of their rotation. In order to compare the potential for carbon *sequestration* in a system, it is necessary to compute the time-averaged carbon stocks, or the average carbon stored in a system over the rotation time of the system. ASB calculations indicate that tree-based land uses sequester about six times more carbon than annual crops or pastures.
- ASB findings show that there is potential for C sequestration in the soils through the rehabilitation of degraded pastures and grassland, but the largest sequestration potential is above-ground through the adoption of tree-based land uses.
- The general trend from the data collected in Cameroon, Indonesia and Peru on greenhouse gas emissions indicates that all the upland systems are sinks of methane – highest in the forest and lowest in continuous cropping. The sink strength is reduced with increasing land-use intensity. The data suggest the possibility of designing mosaics of land-use practices to balance the sources and sinks of GHG at the landscape level.
- Tradeoffs (or complementarities) regarding likely environmental, agronomic, and socio-economic impacts (including household food security) of alternatives to slash-and-burn were analysed using a quantitative matrix method for tradeoffs analysis developed by ASB scientists.
- Bioeconomic model developed for the Western Brazilian Amazon. This model maximizes net income to farmers and simulates the likely effects of policy changes on farm-level decision making and the resulting land-use patterns over a 25-year period. The model also measures some environmental effects of global concern, such as carbon stocks on private farms.
- A regionalised macroeconomic model developed to assess the impacts of major macroeconomic shocks and policy changes on development objectives in Brazil and Indonesia, with special attention paid to the Amazon and Sumatra. Land uses, including deforestation, incomes and wage rates can be estimated for each region. Preliminary results suggest that recent major shocks will have large and potentially lasting impacts on human welfare and the natural resource base across the tropics.
- ASB partners provided research support for tenure reform that established a prototype for community-based management of forest lands in Krui on the island of Sumatra in Indonesia. In January 1998, Indonesia's Minister of Forestry signed an historic decree that established—for the first time in Indonesia—an official precedent for community-based natural resource management, recognizing the legitimacy of community-managed agroforests on a significant area of state forest land. This decree recognizes the environmental and social benefits of an

indigenous land use system (damar—*Shorea javanica*--agroforests), the role of indigenous institutions in ensuring the sustainability of this natural resource management system, and the rights of smallholders to harvest and market timber and other products from trees they planted. The Forestry Minister's decree of January 1998 provided a lasting precedent that survived the collapse of the Suharto regime in May 1998. ICRAF's most recent External Programme and Management Review (CGIAR 1998, p. 41) cited this ASB policy research on management of forest margins in Indonesia as "ground-breaking in that it showed how analysis incorporating biophysical and socio-economic information could lead to fundamental changes in the ways governments viewed forest lands and the role of people in preserving biodiversity in existing agroforests."

External Evaluation of Phase I & II

In December 1994, a proposal for a Phase II (GLO/93/G32) was submitted for GEF consideration. The GEF Secretariat requested an external evaluation of Phase I as a basis for granting approval and further funding.

February, 1995- Ph. I

Dr. Hari Eswaran, World Soil Resources, USDA was appointed by the GEF/UNDP to carry out the evaluation of the project. The evaluator endorsed the outcome of Phase I, whose objectives had been adequately met. The evaluator recommended funding for a second phase of five years.

March 1997- Ph. I

Scientific and Technical Advisory Panel (STAP) conducted a review of Phase I which was highly successful, with the reviewers recognizing the importance of both the aims and outputs of the programme. The evaluator noted that ASB-activities have constituted a real boost to their partner national research systems. The ASB project had enabled existing foundations of scientific understanding of agricultural productivity and land degradation to be used in the benchmark sites.

May-July 1998 – Ph. II

Dr. Otto T. Solbrig, Bussey Professor of Biology, Harvard University carried out the Phase II evaluation and brought up a lot of questions. However, the consortium members noted that Dr. Solbrig had a very short time-frame for the review considering the large number of documents needing evaluation, and that he lacked adequate resources to undertake a thorough field review of the programme. The consortium replied to all questions raised and recommended that a next review should be done more thoroughly.

Problem Identification for ASB Phase II

Traditional shifting cultivation tends to disappear as rural population densities and market integration increase. The resulting land uses may not be economically or environmentally sustainable because of soil degradation, nutrient depletion, and loss of other ecosystem functions. Alternatively, access to markets may make forest-derived land uses so profitable that they attract an inflow of low-income migrants, which, in turn, accelerates forest conversion. Where global environmental problems and poverty coincide at the margins of the remaining tropical forests, this is the domain of ASB. **The fundamental challenge of ASB is to identify innovative**

policies, institutions, and technologies that can reconcile two of the great issues of our time: forest conservation and poverty reduction.

The global ASB Consortium is poised to begin a multi-year programme to develop and implement local, national and international options to balance tradeoffs between forest conservation and poverty reduction. The present ASB programme comprises four main parts:

- Accelerating the spread of technologies and land use practices that conserve biodiversity, store carbon, and maintain local environmental services while providing attractive opportunities for poor rural households to increase their income and food security.
- Supporting formulation and implementation of policy options and institutional innovations that encourage the adoption and sustainable management of land use alternatives that enhance biodiversity conservation and carbon storage, without sacrificing the goals of poverty reduction and national development
- Building capacity to incorporate a wider range of environmental and social issues—spanning local, national, and global concerns--in analysis and debate on agricultural development, land use, and natural resource management.
- 'Internationalizing' ASB's national partners by equalizing access to information (through application of information technology and also through 'north-south' and especially 'south-south' exchange), and by investing funds and effort to build national partners' capacities in integrated natural resource management. .

Principal outputs, milestones, and impacts expected by 2004.

Planned outputs

The ASB Systemwide Programme is poised to develop and implement local, national and international options to balance tradeoffs between rainforest conservation and poverty reduction. This programme has seven principle types of output:

- Natural resource management options. Improved conservation and development options identified through ongoing participatory testing, adaptation, and evaluation of landuse practices, production technologies, institutional innovations, and policy reforms that conserve biodiversity and maintain local environmental services, including mechanisms to compensate local people for foregone opportunities, while providing attractive opportunities for poor rural households to increase their income and food security. As noted above, ASB research has identified a middle path of development – involving smallholder tree-based systems and community-based forest resource management -- that could attain an attractive balance between the environment and development.
- Strategies to accelerate the spread of these management options and land use practices that conserve biodiversity, store carbon, and maintain local environmental services while providing attractive opportunities for poor rural households to increase their income and food security.
- Participatory methods and negotiation support tools: action research at specific sites will identify and test workable mechanisms for efficient and effective participation of multiple groups of stakeholders that have differing (often conflicting) interests in environmental and development outcomes. Innovative negotiation support tools will be developed for use by a range of stakeholders to tackle the challenges of adaptive environmental management, with particular

emphasis on social interaction and political processes at the landscape/watershed scale. These will include validation of measurement techniques adapted to needs of specific stakeholders, building on local knowledge to empower communities, and use of indicators to assess and monitor environmental impacts and development tradeoffs.

- Policy options and institutional innovations that encourage the adoption and sustainable management of land use alternatives that enhance biodiversity conservation and carbon storage, without sacrificing the goals of poverty reduction and national development.
- Crosscutting ecosystem assessment: a nested, multi-level assessment of the interface between the tropical forest ecosystem and forest-derived agroecosystems, focusing on the landscape mosaics that characterize the forest margins. This crosscutting assessment will contribute to the Millennium Ecosystem Assessment (MA) regarding the tropical rainforest biome. In turn, association with the MA will provide the analytical framework for the pantropic problem domain and an analytical tool to prioritise outreach sites and identify the range for extrapolation of results.
- Local and national capacity to incorporate environmental and social issues—spanning local, national, and global concerns--in the analysis of and debate on agricultural development, land use, and natural resource management. Strengthening national partners' capacities will be pursued through: (a) further development of appropriate training materials derived from ASB results; (b) acceleration of ASB training of national partners in adaptation and use of ASB methodologies in order to expand the pool of collaborating national scientists; (c) initiating training of national partners in fundraising; (d) investing to enhance national partners' information and communication technologies to better link them with substantive and funding opportunities.
- Dissemination for pantropic impact: strategic understanding of mechanisms that can accelerate the adoption (and further adaptation) of improved development options in concert with effective, locally-responsive conservation strategies. An expanding action research network will translate results into broad-based conservation and development impacts through a range of media and dissemination pathways tailored to local, national, regional, and global target groups, including the private sector, international institutions, and global fora.

Future milestones

- An expanding network of new partners, who become increasingly engaged in INRM and confident of their abilities to undertake and sustain these activities.
- National partners' access to information and command of information and communication technology enhanced.
- Enhanced capacity of national partners for fundraising. Successful funding proposals prepared by ASB national consortia.
- A range of stakeholders, including local communities, farmers' groups, NGOs, and other civil institutions, have sustainable capacity to use ASB methods and results of simulations and participatory assessments.
- A wider range of environmental and social issues–spanning local, national, and global concerns—incorporated in analysis of and debate on agricultural development, land use, and natural resource management at various levels.

- ASB outputs influence international debate regarding appropriate balance between environmental concerns and development options in the humid tropics through an expanding external audience among development agencies and environmental groups.
- ASB viewed as a model for integrated natural resource management research and action. Organizational successes and difficulties will receive specific attention from new international partners with expertise in study of social learning processes. Ongoing process documentation and evaluation will improve organizational efficiency within the programme and capture strategic insights relevant to other programmes.

Expected impacts

- Impact on poor people at the margins of tropical rainforests (ultimate beneficiaries). Expansion of ASB national consortia will broaden and deepen active participation by local people and civil society in INRM problem definition, negotiation regarding conflicting interests, identification and assessment of options, and design and implementation of interventions. ASB also will develop tools for empowerment of local people through community-based monitoring of environmental impacts.

- *Impact on ASB's national partners.* ASB will create the basis for sustainable INRM capacity among ASB's NARS partners and other national and local collaborators, which, in turn will enhance the efforts of NGOs, rural communities, and farmer organizations, and extension agents to disseminate the sustainable options identified and developed by the programme.

- *Impact on policymakers and decision-makers dealing with landuse in tropical countries*. These policy-makers range from those with responsibilities at the local level to those dealing with regions and whole nations. ASB will build their capacity to make improved decisions by providing them new data and validated approaches to balance development and equity objectives with environmental degradation mitigation and rehabilitation objectives. These datasets and approaches also will help national-level policy-makers to increase their bargaining power in international negotiations concerning environment and development. Such increased capacity can, in turn, result in very significant positive effects on the adoption of sustainable land-use practices at forest margins by small-scale farmers.

- *Impact on ASB's international partners, including the CGIAR system*. ASB's objectives and outputs, as well as its modus operandi as a consortium, make the programme directly relevant to the integrated natural resources management focus which the CGIAR is working to implement (CGIAR System Review Secretariat, 1998). Consortium scientists share a strong conviction that the future of the CGIAR lies in building synergistic working relationships with partners and regions, as well as applying innovative and tested approaches to the development of options in integrated natural resources management.

- *Impact on other international institutions and global fora* -- e.g., the Global Environment Facility, the World Bank, the Intergovernmental Panel on Climate Change (IPCC), the Secretariat of the United Nations Framework Convention on Climate Change (UNFCC), the Convention on Biological Diversity (CBD) -- engaged in international policy debate and negotiations on deforestation and global change mitigation. The provision of a unique set of empirical data collected at the watershed/landscape level concerning biodiversity levels and their relation to agricultural productivity, farmers' profitability, greenhouse gas emissions, and carbon sequestration - per land use, and expressed as trade-offs with agricultural development - will contribute to enhancing the quality of this debate and of its negotiated outcomes.

Funding Profile

1994 only	Global Environment Facility (GEF) of the United Nations Development Programme (GEF/UNDP)
1995	No funding- GEF withdrew funds and only renewed in 1996.
1996 - 1999	Following appeals from the ASB Donor Support Group, headed by DANIDA, the programme began to receive support from the following groups. DANIDA was the largest donor, contributing 1.2 M in 1997 and 1998. The other national governments have made small (100 to 300K contributions).

ACIAR (Australia):	01 January - 31 December, 1996 01 January - 31 December, 1997 01 January - 31 December, 1998
DANIDA(Denmark)	01 January - 31 December 1996 01 January 1997 - 31 December 1998
NETHERLANDS:	01 January - 31 December 1997 01 January - 31 December 1998
NEWZEALAND:	01 January - 31 December, 1998
NORWAY:	01 January - 31 December, 1997 01 January - 31 December, 1998
UNDP (2.7 M)	01 July, 1996- 31 December 1997

Other Donors 1992 - 1999

Swedish International Development Authority SIDA
The Asian Development Bank ADB
The European Union EU
The Ford Foundation FF
The Government of France
The Government of Germany
The Government of Great Britain DFID
The Government of Japan JICA

The Government of New Zealand
The Government of Spain
The International Development Research Centre IDRC
The Inter-American Development Bank IADB
The United States Agency for International Development USAID
The United States Forest Service USDA FS

New Sources of Funding 2000
The CGIAR Finance Committee TAC/WorldBank
The European Union EU
The World Bank – Netherlands Partnership Programme (BNPP)

Service to ASB Programme

Nov' 99 – to present	Chair	Anne-Marie Izac, Director of Research, ICRAF
1994-Nov 1999	Chair	Pedro A. Sanchez, DG, ICRAF

Main partners

Indonesia -	AARD, CIFOR, ICRAF
Brazil -	EMBRAPA
USA	IFDC, IFPRI
Kenya	TSBF, ICRAF
Cameroon	IITA, IRAD, ICRAF
France	CIRAD, ORSTOM
Thailand	MAC, ICRAF, RFD
Vietnam	MARD
Philippines	PCARRD
Peru	INIA
Colombia	CIAT

June 2000–Present	Principal Economist & ASB Global Coordinator	Tom Tomich
Sept. 2000–Present	ASB Programme Associate	Jessa Lewis
1992–Present	ASB Programme Administrator	Joyce Kasyoki
1998–May 1999	ASB Global Coordinator	Erick C.M. Fernandes
1998–May 1999	Assisting Coordinator	Polly Ericksen
May 1999–June 2000	ASB Interim Coordinator	Polly Ericksen
1995-1997	ASB Global Coordinator	R.D.H. (Chip) Rowe
1996-1997	Assisting Coordinator	Catherine Kenyatta
1994-1995	Assisting Coordinator (Consultant)	Christine Kalume & Asenath Omwega
1991-1995	ASB Global Coordinator	Dale E. Bandy

Publications:
ASB has produced many exciting publications documenting ASB's activities over the years. A searchable database of ASB publications can now be accessed via ASB's website (www.asb.cgiar.org), that displays virtually everything produced by ASB to date on various topics. Hard copies are available from the global coordination office – email: asb@cgiar.org.

Information dissemination/public awareness includes:-
ASB global website (www.asb.cgiar.org), re-launched in 2001 as tool for external audiences. The contents and links are complete. By October 2001 the site had almost 17,000 hits from over 4,500 visitors. Our challenge for 2002 and beyond is to keep it fresh.

Revived listserver in 2001 as tool for internal audience. The listserver has received over 80 messages so far in 2001 and is expected to continue in 2002 and beyond. The listserver is used to disseminate information of interest, as well as programme logistics to the ASB Consortium .