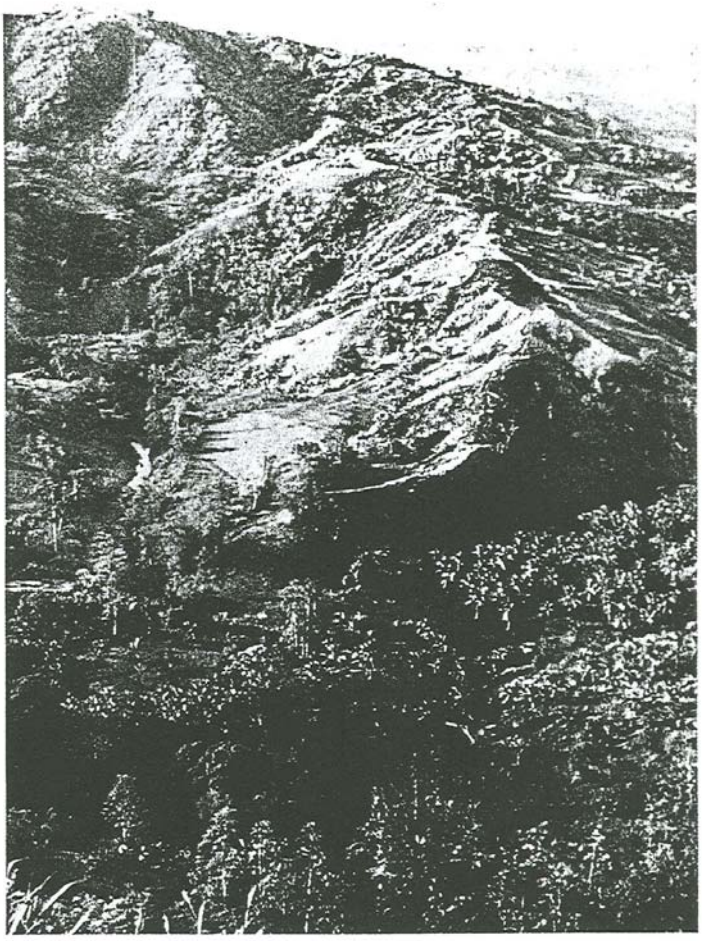
Agroforestry in transformation

by Per G. Rudebjer

During the one-hour drive from Jakarta to Bogor you can observe a remarkable diversity in land use: rice paddies, cassava cultivated under highway tree plantations, mixed home gardens and fruit and timber trees—all grown by small-scale farmers. But there are also golf courses and massive real estate development. Living for a while in West Java brings perspectives on forestry, agriculture, the environment and the people who manage natural resources. This island is one of the most densely populated places anywhere, some 120 million people on an area one-third of Sweden. Yet Java is full of trees. This has not always been the case: fifty years ago Java had large areas of unproductive *Imperata* grasslands after generations of shifting cultivation which became unsustainable due to human population growth. Today, small-scale farmers have converted most of the grasslands to rich agroforestry home gardens. Farmers are changing the landscape.

Climbing still higher beyond Bogor you enter large tea-estates. On the steep slopes you can see the remaining tropical rainforest that once covered the island. The Jakarta Post reported just the other day that illegal loggers in Mount Halimun—one of the national parks in West Java—threaten biodiversity and water supply to the city.

The 'outer islands', Sumatra and Kalimantan, add to the complexity of land use in Indonesia. Indigenous people, transmigrants and large companies compete in using the land, sometimes resulting in violent conflicts. Mining and oil companies are other actors. New roads are opening up the tropical forests. Land conversion is rapid. Ille-



Current agroforestry research studies the landscape-level impacts - biophysical as well as socioeconomic - of agroforestry practices in a watershed. Photo: Agustin Mercado, Jr.

gal logging outstrips the legal approach. FAO's forest resource assessment 2000 estimated that Indonesia has lost 1.3 million hectares of forest every year in the last decade (FAO 2001). Plantations, however, in particular oil palm and sugar cane, are increasing. The fire disaster of 1997 was partly a result of this on-going land conversion. But again, there is the flip side to the coin. Small-scale farmers on these islands long ago started to develop 'agroforests', a multi-storey agroforestry system where rubber resin and fruit trees are the main cash crops. The rubber and fruit trees are mixed with a lot of other woody and non-woody plants. Smallholder 'jungle rubber' agroforests cover an estimated area of 2.5 million hectares in Indonesia. They provide about 80% of the rubber latex consumed and exported by Indonesia, and are the world's second largest producer after Thailand (De Foresta, Michon 1997). The rubber agroforests are comparatively rich in biodiversity and store a lot of carbon. At the same time they provide an above-average living for a large number of farmers.

These brief examples show how quickly the land use has changed and still is changing in Indonesia, and that many stakeholders have competing interests in the use of natural resources. They also show that sectoral thinking is inappropriate: for instance, the many interactions in a watershed cannot be managed within one single sector. A broader and integrated view is needed. Agroforestry is one of these integrated approaches.

Agroforestry integrates technologies, policies and institutions

This article aims to outline how current agroforestry research and development address the need for land use options that at the same time address food security, poverty reduction and environmental protection.

Forestry as well as agriculture has been, and still often is, dealt with sector-wise, in research and in education, in Europe and in the tropics. This is where agroforestry, as an integrated approach, is caught in the middle. Trees on farms do not fit into the established agriculture/forestry dichotomy. For instance, agroforestry systems are often not classified as such in forest inventories. Integration is needed in agroforestry research, development and education.

Early agroforestry research focused on technology development. Alley cropping, a case in point, was widely researched and disseminated in the 1980s. It sounded promising: nitrogen-fixing hedges planted on the contours would improve soil fertility and reduce erosion. But farmers were slow to adopt the technology; in fact they often abandoned this method after a while. The high labour requirement to tend the hedges and above and below-ground competition with food crops were major obstacles.

There is increasing recognition that it is not enough to work on agroforestry technologies. For a technology to be improved, adopted and spread there is also need for enabling policies, functioning markets and supportive institutions at all levels. And there is need for a dialogue between all stakeholders in this process.

Indigenous agroforestry and land use practices are the starting points for current agroforestry research. Improved practices and new agroforestry options are developed jointly with farmers and in collaboration with many other partners, among them farmer-led organizations and local government units. The new agroforestry approach also embraces policy analysis and institutional capacity to scale-up the use of promising agroforestry practices.

Changing research and development paradigm

A couple of recent publications may illustrate this broadened focus on integrated natural resource management. In a workshop held in Penang, Malaysia, in 2000, the Consultative Group on Agriculture Research (CGIAR) concluded that: 'Integrated natural resource management (INRM) research offers a way of doing development-oriented research that aims simultaneously to reduce poverty, increase food security and achieve environmental protection. These three key factors that influence human well-being are inextricably linked with the health of the ecosystems in which people live and work. INRM reflects these broad interactions. It focuses on ecosystems rather than commodities; on underlying processes (both biophysical and socio-economic) rather than simple relationships; and on managing the effects of interactions between various elements of an ecosystem' (CGIAR 2000).

The report further comments that CGIAR has shifted toward systems thinking and integrated approaches in working to solve pressing world problems. It talks about an emerging INRM research paradigm, which includes not only physical capital (improved germplasm and technologies) and human capital (education and training), but also natural capital (land, water, forests) and social capital (through partnerships and participatory approaches).

Another recent analysis on global agroecosystems, by the International Food Policy Research Institute and World Resources Institute, discusses the great inter-dependence between agriculture and forestry. The report analyses two aspects of the world's agro-ecosystems:

- The condition of the delivery of key goods and services valued by society (food feed and fibre, water services, biodiversity and carbon storage)
- An assessment of the pressure on, and the current state of, the underlying resources base, in particular soil resource conditions.

According to the report, there are often significant trade-offs between the provision of agricultural and environmental outputs from agroecosystems. Thus, the development of new policies, technologies and institutional arrangements will be essential if we are to expand the 'production possibility frontier' and obtain both agricultural *and* environmental outputs from the world's ecosystems. One of the broad strategies to achieve this is by rehabilitating environmental goods and services within and beyond agroecosystems that would be beneficial for agricultural goals and services.

Some interesting observations in the report on agroecosystems are:

- Livestock and agroforestry-based agroecosystems are poorly represented in the data analysis largely because of the difficulties of adequately locating extensive pasture and tree crops with the available satellite data.

Natural vegetation strips enriched with agroforestry trees provide additional sources of income and increases food security. Photo: Agustin Mercado, Jr.

• Depletion of soil organic matter is widespread, reducing fertility, moisture retention and soil workability and increasing CO^2 emission. Good land use can rebuild the levels of soil organic matter.

• Inadequately managed intensification on sloping lands with lower quality soils tends to increase soil erosion as well as the effects of sediment on aquatic systems, hydraulic structures and water usage.

• A majority of rain-fed agricultural land in Latin America, Sub-Saharan Africa and South and Southeast Asia has a significant and increasing tree cover, which enhances habitat for wild biodiversity.

• The number of domesticated tree crops has increased.

• There is mounting evidence that farmers increasingly protect or establish trees on farms for economic reasons. This situation reflects the global revolution in forest products supply, in which domesticated tree production is replacing the shrinking natural forests (Wood, Sebastian, Scherr 2000).

Global concerns are also intrinsically linked to the land use of small-scale farmers. Trees on farms bind carbon in the ecosystem, thus counteracting global warming. Trees on farms also contribute to biodiversity conservation in two ways; by reducing pressure on tropical forests and by increasing biodiversity in the agricultural landscape.

At watershed level, agroforestry systems help maintain watershed functions related to soil productivity and water supply and quality. But most importantly, trees on farms provide farmers with cash income and products for their livelihood and contribute to nutritional security and a better environment.

New ICRAF strategy

About 1.2 billon people in developing countries depend on agroforestry products and services for their well-being. These, mostly small-scale, farmers are the ultimate beneficiaries of the agroforestry research carried out by the International Centre for Research in Agroforestry (ICRAF) and its partners. ICRAF is addressing the issues described above in an integrated research and development agenda. Agroforestry—trees on farms— is increasingly looked upon from a dynamic landscape perspective, rather than as plot-level technologies. Products, environmental services and human benefits are complementary objectives. There are also trade-offs that need to be taken into account. ICRAF's new corporate strategy for 2001-2010 outlines the objectives for our work in the next decade:

ICRAF's mission is to conduct innovative research and development on agroforestry, strengthen the capacity of our partners, enhance worldwide recognition of the human and environmental benefits of agroforestry, and provide scientific leadership in the field of integrated natural resource management.

Research: conduct interdisciplinary natural resource management research to improve agroforestry trees, enhance their ecosystem functions, and improve policies.

Development: rapidly scale up the adoption and impact of agroforestry research by engaging with development partners.

All ICRAF's activities are located along the research–development continuum.

Research programmes are:

• Natural resources strategies and policies
• Tree domestication
• Ecosystems rehabilitation

Development programmes:

• Advancing innovation and impact
• Training and education.

These programmes are conducted in five regional programmes: Southern Africa, East and Central Africa, the Sahel, Latin America and Southeast Asia.

Efforts at the research end produce the new technologies and policy innovations needed to make ICRAF's development efforts successful. Efforts at the development end generate results in farmer's fields that feed back into the Centre's research, helping to keep research relevant to the needs of the poor (ICRAF 2000).

'Landcare' in the Philippines

How is this integrated agroforestry research agenda achieved in practice? One illustrative example comes from ICRAF's research site in Claveria in northern Mindanao, Philippines, where a partici-

patory approach to technical and institutional development for agroforestry is used (Mercado AR, Patindol M, Garrity D 2000).

Contour hedgerows of pruned leguminous trees or 'Sloping Agriculture Land Technology' (SALT) have been promoted since the early 1980s by the extension system in the Philippines. Most farmers were clearly aware of the reasons for declining crop yields and possible strategies to combat soil degradation. Yet, farmers' adoption of the SALT concept was low. ICRAF's research showed that the reasons were:

- High labour requirement in establishing and maintaining the hedges
- Competition between hedgerows and crops for resources above and below ground
- The limited value that was added by the pruning
- Poor species adaptation and lack of planting materials
- Insecure land tenure.

New approaches were apparently needed. Some farmers had in the early 1990s begun to experiment with an alternative technology: natural vegetation strips (NVS). These are buffer strips laid out on the contours, in which natural vegetation is allowed to re-grow into a thick protective cover. The land between the strips was cultivated with crops. The soil in-between the strips moved and soon created terraces, with a minimum of labour. ICRAF worked with the farmers in Mindanao to study and improve this technology and, importantly, to find ways by which this technology could be 'scaled up'.

This work led to further development of the technology. Farmers enriched the natural vegetation strips with crops such as pineapple or fodder grasses, or with fruit or timber trees. Conservation farming soon spread among the farmers in Mindanao. 'Landcare groups' played an important role in dissemination of the technology.

Originating from Australia, Landcare is a grass-root movement of farmer-led organizations supported by the local government. Independently, farmers in Claveria, Mindanao started their own Landcare groups to share knowledge of sustainable and profitable agriculture on sloping lands, while conserving natural resources. Conservation farming with NVS as a main ingredient soon spread to new farmers. It grew into a dynamic voluntary movement—the Landcare movement. There are now more than 3000 farmers involved in Landcare in Mindanao. As the Landcare groups emerged, the local government units gave enthusiastic support, involving contributions of funds, technical assistance and policy support to the movement. Today, the Landcare movement has grown to more than 250 groups in five municipalities in Mindanao, and it is now spreading to other parts of the Philippines. The success of the Landcare approach for agroforestry development in the Philippines depends on how the three main players work together (Table 1).

Table 1. Actors in Landcare and their role and function

Actor	Role and function
Farmers/ communities	• Usually resource-poor farmers who want to prove their livelihood • Willingness to acquire and share knowledge and experience with other farmers • Committed to resource conservation • Creating work groups for nurseries, establishment of conservations farms, etc
Local government units	• Provide policy support: institutionalising conservation farming and agroforestry • Leadership: facilitation of the forming of Landcare groups and Landcare activities • Capacity building, including training • Financial support
Technical facilitators (ICRAF and line agencies)	• Assist in technology development and analysis: soil and water conservation, agroforestry, nursery management, etc • Facilitation in forming Landcare groups and conducting Landcare activities • Germplasm • Information and education

Current agroforestry research and development take place in a complex setting where technologies, policies and institutions are equally important. The Landcare example from Minda-nao shows that an integrated approach, which builds on farmers' local knowledge and involves multiple stakeholders can deliver where top-down technology dissemination failed.

References

CGIAR. 2000. *Integrated natural resource management research in the CGIAR.* A brief report on the INRM workshop held in Penang, Malaysia 21-25 August 2000.

De Foresta H, Michon G. 1997. *The agroforest alternative to Imperata grasslands: when smallholder agriculture and forestry reach sustainability.* Agroforestry Systems 36: 105-120. Dordrecht: Kluwer Academic Publishers

FAO 2001. *Forest resource assessment 2000.* http:/www.fao.org

ICRAF 2000. *Paths to prosperity through agroforestry research.* ICRAF's corporate strategy 2001-2010.

Mercado AR, Patindol M, Garrity D. 2000. *The Landcare experience in the Philippines: technical and institutional innovations for conservation farming.* In: International Landcare conference, Melbourne, Australia 2-5 March 2000. Conference proceedings.

Wood S, Sebastian K, Scherr SJ. 2000. *Pilot analysis of Global Ecosystems: Agroecosystems.* Washington: International Food Policy Research Institute and World Resources Institute.

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