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Authors: Boffa, Jean-Marc, Turyomurugyendo, Levand, Barnekow-Lillesø, Jens-Peter, and Kindt, Roeland

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Jean-Marc Boffa
Levand Turyomurugyendo
Jens-Peter Barnekow-Lillesø
Roeland Kindt

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Insights from the Kigezi Highlands, Southwestern Uganda



The appropriateness of targeting conservation landscapes that include biodiversity sanctuaries within a matrix of agricultural and other land uses is being increasingly recognized as a method for achieving both biodiversity conservation and livelihood improvement. An assessment of on-farm tree diversity in the Kigezi Highlands in a transect from Kabale town to Bwindi Impenetrable National Park in southwestern Uganda reveals the current contribution of farming systems to landscape tree diversity and raises questions about various constraints and opportunities for enhancing the role of agroforestry in landscape-based biodiversity conservation.

"Conservation landscapes" and agroforestry

Protected areas cannot do the job of conserving biodiversity alone; they do not contain sufficiently large populations to maintain all species. Because many protected forest ecosystems of global value are often located in areas with high population growth rates, widespread poverty, and intensive agricultural land use, prospects for expanding their number or surface area are limited. Increasingly, therefore, conservation approaches need to be based on wider "conservation landscapes" that include mosaics of multiple land use (Figure 1). Planning and management of conservation landscapes require that attention be paid to the twin objectives of biodiversity conservation and sustainable local livelihoods, as underlined by McNeely and Scherr. These objectives are often seen as contradictory, sparking intense conflict between conservation agencies and local communities. One approach that has promise for resolving the contradictions is agroforestry. According to a study by G. Schroth and others, the deliberate planting and management of trees by rural communities can contribute to biodiversity conservation by:

- Reducing pressure on forests or reducing forest conversion;
- Enhancing habitat for wild biodiversity;



FIGURE 1 Conservation landscapes combine functions of strict biodiversity protection in selected natural areas and biodiversity conservation through use, on agricultural land that enhances the landscape connectivity of these protected areas. Shown here are individual Kigezi farm landholdings that typically include some plots located near the homestead and some located as far away as a neighboring parish. (Photo by Levand Turyomurugyendo)

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- Enhancing landscape connectivity.

Studying use and conservation of trees in Kigezi

This paper presents results from a recently conducted study of farm tree diversity in the region surrounding one of the richest forest reserves of East Africa, providing insights into constraints and opportunities for promoting landscape biodiversity through the combined approach of forest protection and tree cultivation by farmers on adjacent farmland. The study specifically explored the scope for increasing the diversity of indigenous woody species in farming systems. It took place in the mountainous farmlands of Kigezi in southwestern Uganda in a transect between Kabale town and Bwindi Impenetrable National Park (BINP), a World Heritage Site. The area supports a high human population density (over 250 people per km^2), an exceptional diversity of flora and fauna of very high conservation value, and is home to half of the world's remaining population of mountain gorillas (*Gorilla gorilla beringei*). Accordingly, park laws exclude all resource extraction except for minor non-wood forest products, through multiple use agreements with selected community groups. BINP belongs to a network of protected areas in the Albertine Rift, stretching across parts of Uganda, the Democratic Republic of Congo, Rwanda, Burundi, and Tanzania.

Local agricultural production systems in the Kigezi Highlands consist of rainfed mixed annual cropping, including cereals (maize, sorghum, wheat) and pulses (beans and peas), as well as Irish and sweet potatoes for home consumption and cash. Land apportioning through inheritance and sales have resulted in a patchwork of farm plots scattered across a ragged terrain of flat-topped hills dissected by steep-sided valleys. Despite the high average population density, farmers own over 7 ha on average, but face serious challenges in managing highly fragmented landholdings scattered among more than 10 half-hectare plots on average (see Figure 1). Land fragmentation coupled with population pressure leads to the continuous cultivation of plots—resulting in a decline in soil fertility and productivity, heavy pressure on wood and other tree products, and incidences of intense soil erosion and general land degradation (Figure 2).

The potential of agricultural landscapes for tree growing and tree diversity conservation

Studies in other parts of Africa and Asia have also shown that 'more people' often come with 'less forests' and 'more trees' on farm. An earlier comparison of land uses in the Kigezi Highlands by Lindblade and others showed that over the 1945 to 1996 period, woodlots more than doubled in size, fallow had significantly increased in terms of land area and duration, and grazing on steep slopes had been replaced by trees and fallow.

Our study confirms the active tree planting culture of Kigezi farmers in that 50% of trees inventoried on farms were deliberately planted. Planted trees are composed of 69% exotic and 31% indige-



FIGURE 2 Sheet erosion on cultivated slopes. Promoting trees in heavily cultivated watersheds can reduce erosion and also create a habitat for biodiversity. (Photo by Levand Turyomurugyendo)

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FIGURE 3 Farmers derive a large number of products and services from trees, including bark for traditional medicine. (Photo by Anke Weisheit)

nous species. Likewise, 49 species or 41% of the total of 119 woody species identified on the 80 farms studied were actively planted. As evidenced by the high percentage of tree coppicing, farmers also make intensive use of their trees for a range of wood uses including fuelwood, construction material, tool handles, household items, bean stakes, and non-wood uses such as animal fodder, fencing, fruits, and medicinal products (Figure 3). Household use and sale of these tree products make an essential contribution to their livelihoods.

What does biodiversity imply?

On the whole, close to one-fourth of the 324 woody species found in the BINP were also encountered in the agricultural landscape. This illustrates that the surrounding landscape already makes some contribution to overall biodiversity conservation in the Kigezi Highlands. However, diversity is not only reflected in the number of species, but also in how frequently these species are encountered throughout the landscape. As commonly found on East African farms, the abundance of tree species is very uneven. Eucalyptus spp., probably the fastest growing species available locally, and Black wattle (*Acacia mearnsii*), both of which are used for firewood and construction, together currently constitute 60% of the total tree population in the landscape. In contrast, most other tree species encountered in the survey are only represented by a few individuals. Because functions that farmers assign to trees for various products and services are met by many individual tree species, this narrow range of common (and exotic) species cannot meet the whole array of their cultural and socioeconomic needs. Farmers should have access to a great diversity of species that can in turn provide a high diversity, quality, and quantity of products for farmers.

Much untapped potential remains for native tree species in the BINP to enhance farm tree diversity, woody cover, and the livelihoods of local farmers. A comparison of the study results with the literature shows that about a third of the woody species found in the BINP are used for agroforestry purposes by farmers elsewhere in East Africa. Many more of the species are probably used by farmers, but have not yet been documented. It is therefore very likely that a number of these species are promising candidates for improving the livelihoods and incomes of poor Kigezi farmers—and at the same time increasing the biological diversity of agricultural landscapes and conserving the genetic diversity of candidate species. Of course, a number of Bwindi species are restricted to the forest interior and cannot be considered for on-farm conservation.

Enhancing the potential of agricultural landscapes for tree and other diversity conservation while improving livelihoods requires a focus not only on increasing the overall number of tree species in the agroecosystem but also on making a much larger set of currently infrequent indigenous species more common in the landscape. At the same time, awareness needs to be created among farmers that many indigenous species they can plant on their farms have potential for producing products that can generate income.

Limited availability of indigenous species to farmers

A study of non-governmental (NGOs) and community-based organizations (CBOs) in southwestern Uganda (mainly in the Kigezi Highlands) indicated that farmers do not have access to diversity, quality, and quantity of species. It diagnosed the following shortcomings in the tree seed system:

- Almost all seed distribution is based on free handouts;
- Matching species with sites is rarely done;
- Species selection by CBOs and local NGOs is almost exclusively based on the availability of seed in the agricultural landscape (except for a few exotic shrubs promoted by research organizations) and draws only partially on knowledge of a range of useful species that could be grown;
- Seed of only very few species is used;
- The genetic quality of seeds is not considered.

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The study conducted by the World Agroforestry Centre (ICRAF), the Danish Centre for Forest and Landscape, and the Ugandan National Tree Seed Centre indicates that, as in all other African sites surveyed, no efficient formal or informal production and distribution pathways for tree seed are in place in the Kigezi Highlands. One should therefore ask whether the current approach by development organizations is the most efficient and appropriate way to get quality planting material out to farmers. The question becomes even more pertinent for indigenous species because of their rarity in the Kigezi agricultural landscapes. Very few of the indigenous species occur in the landscapes at densities that can ensure good pollination, and for most of these species, efficient pollinators are not even known.

Challenges in promoting commercial seed networks and better seed quality practices

Solving the problem of production and distribution of species (exotic and indigenous) lies in the establishment of efficient and decentralized networks of commercial seed producers and nurseries handling a range of tree species. Input markets need to be developed in place of free handouts by extension and development agencies. A very important part of such a network would be the establishment of seed sources—trees occurring on farmland and in natural forests for short-term production, and planted seed orchards for longer-term production. These seed sources and good genetic quality of introductions are necessary to mobilize the potential of species from the natural forest for agricultural landscapes. Rational utilization of high-quality tree seed from natural forests should involve collection from a sufficient number of trees and thus might be a relatively costly venture for a single development agency. A collaborative investment by several development organizations might solve this problem.

Adapting tree diversity conservation strategies for the Kigezi Highlands

Most of the cultivated land area in the Kigezi Highlands is found on steep parts of the landscape. Agriculture is intensive and tends to take place from the bottom to the top of the hills (Figure 4) with variations in management intensity along the toposequence. The Kigezi study revealed that back and foot slopes harbor larger fields and a greater diversity of tree species, while steep back slopes tend to have higher tree density than other parts of the hillside. Most woodlots are in fact planted on these steep slopes. In contrast, valleys and hilltops are more intensely cropped; valleys have the lowest number of trees and species. Farm management practices are also highly influenced by land fragmentation and the resulting distance between homestead and fields. Lindblade and others also noted that fallow and other practices requiring little labor are more common on distant fields. The opposite was found on fields at short distances from the homestead (Figure 5).

These patterns indicate that efforts to enhance tree cover and diversity may focus on intensifying tree planting on the back and foot slopes of the landscape, where



FIGURE 4 A typical view of the intensive agricultural land use on the steep Kigezi hills. (Photo by Levand Turyomurugyendo)

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FIGURE 5 Fields located close to the homestead tend to be more intensely managed (as indicated by the vegetable crop) than distant fields. (Photo by Levand Turyomurugyendo)

farmers do not expect as much crop produce, and then diversifying to a wider range of farm niches and uncultivated spaces. Landscape connectivity should be enhanced wherever possible. Tree diversity conservation with species adapted to these slopes and good ground cover has the potential to simultaneously contribute to retention of soils and improvement of water quality. Relatively remote farm plots may also be targeted for indigenous timber trees that do not require intensive management. Therefore, the fragmentation of Kigezi landholdings seems to offer both opportunities and constraints to tree growing and conservation.

Alleviating challenges to agroforestry investment at the forest margin

The role of trees that farmers can use in the forest or on adjacent farmland is particularly critical for communities living at the edge of protected areas (Figure 6). Our study found that farms located next to the Bwindi Park tended to host a larger diversity of indigenous tree species but a lower overall tree density and proportion of planted species such as Eucalyptus and Black wattle than farms closer to Kabale, the main local town. The lower on-farm tree cover at the edge of the forest may reflect a mixture of technical and policy challenges faced by farmers.

Recent research conducted in the area by R. Ashley, D. Russell, and B. Swallow revealed that externally enforced laws limiting access to forest resources create disincentives and uncertainty for farmers adjacent to the park, who hesitate to deliberately invest in agroforestry. Land shortage and/or fragmentation, adult male emigration, lack of access to forest tree seeds, and the fact that trees may provide a favorable habitat for problem animals further constrain investment in improved farming and tree growing on the forest margin. Future agroforestry development in areas immediately adjacent to the park needs to give careful consideration to interactions between trees, wildlife, crops, and people, as it will seek to maximize the benefits of increased landscape connectivity and reduced human–wildlife conflicts.

The way forward

Overall, in order to realize the potential positive impact of farmer agroforestry practices on the conservation of landscape biodiversity in southwestern Uganda, some key elements are worth emphasizing:

- A landscape planning approach to biodiversity conservation will need to increasingly integrate agriculture and farmer decision-making into conservation policy and practice. This will require greater collaboration among institutions with distinct mandates.
- Because they transfer local demand for wood products to farmland, highly restrictive protected area management policies should be complemented by policies that promote a range of agroforestry land use options in surrounding areas. Options with a minimal risk of increasing human–wildlife conflicts should be selected.
- Access to tree-based technology packages and information for a great diversity of tree species needs to be facilitated through stronger extension and information services. This will require more integration of agroforestry and natural resource management into agri-

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FIGURE 6 The sharp boundary between the Bwindi protected area and surrounding farmland shows the need for an integrated landscape conservation approach. (Photo by Levand Turyomurugyendo)

cultural extension, and the development of effective seed production and distribution systems.

- Increased awareness is needed among farmers and practitioners that realizing the potential of species introduction depends on the genetic quality of the species. Seed collection and plant propagation from only a few trees are shortcuts that undermine farmers' abilities to fully benefit from the promoted species.
- Increased access to markets for agricultural as well as wood and non-timber products from the farming landscape can provide incentives for local communities to link tree conservation and sustainable use, as this will improve their livelihoods and generate new income. However, interventions will need to ensure that illegal forest extraction is not encouraged.
- The exceptional diversity of indigenous tree species in the Bwindi Impenetrable National Park and other protected areas in the region represents not only a source of invaluable resources for contributing to local community livelihoods. Their active promotion and cultivation by southern Ugandan farmers can also significantly contribute to the overall biodiversity of these intensively used landscapes.

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AUTHORS

Jean-Marc Boffa
ICRAF-Uganda, PO Box 26416 Kampala, Uganda.
j.boffa@cgiar.org

Jean-Marc Boffa is a tree scientist conducting research and development on enhancing the contributions of agroforestry to biodiversity conservation in priority agroecosystems. He coordinates the ICRAF program in Uganda.

Levand Turyomurugyendo
ICRAF-Kabale, PO Box 311, Kabale, Uganda.
l.turyomurugyendo@cgiar.org

Levand Turyomurugyendo is a tree domestication and biodiversity specialist with ICRAF based in Kabale, southwestern Uganda. His work focuses on applied tree crop research for diversification of Kigezi farming systems.

Jens-Peter Barnekow-Lillesø, Roeland Kindt
ICRAF, United Nations Avenue, Gigiri, PO Box 30677, Nairobi, Kenya.
jpbl@cgiar.org; r.kindt@cgiar.org

Jens-Peter Barnekow-Lillesø is a seed systems specialist at ICRAF working on sustainable seed and seedling systems for the sound conservation and use of the genetic resources of agroforestry trees.

Roeland Kindt is an ICRAF ecologist working on landscape diversification through greater utilization of indigenous tree species in agroecosystems.

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