Forests, trees and resilient households

P. Dewees

Building greater economic and ecological diversity into landscapes is a key to increasing the resilience and therefore food security of rural households.

Peter Dewees is Forests Adviser, The World Bank, Washington, DC, USA.

Appreciation of the many ways in which forests and trees outside forests contribute to food security is growing, but their role in increasing the resilience of households and ecosystems is less well known. Yet resilience is an important component of food security and is likely to become more so as factors such as climate change and global population growth increase the likelihood of future shocks. This article explores some of the ways in which forests and trees contribute to the capacity of households to withstand tough times, and it describes policy responses to encourage the integration of forests and trees in agricultural systems to increase the resilience of both people and the environment.

People displaced by flooding in Pakistan shelter their livestock among trees. Forests and trees outside forests can contribute to the capacity of households to withstand tough times

©FAO/A. HAFEEZ


©FAO/J. MASICH

Chopped leaves of **Gnetum** *spp., an NTFP, are offered for sale in a market. NTFPs are part of many coping strategies in which households increase their NTFP extraction to smooth out consumption levels when agricultural or other outputs fall*

FOOD SECURITY AND RESILIENCE

Hollings (1973) used the term "resilience" to mean the ability of ecological systems to respond to external forces and to persist in the face of those external forces. He distinguished resilience from stability, which he defined as the ability of a system to return to an equilibrium state after a disturbance. He pointed out that ecological systems can be resilient and still fluctuate greatly.

Walker *et al*. (2004) noted that the stability of human and natural systems depends on three complementary attributes: resilience, adaptability and transformability, where adaptability is the capacity to modify a system in ways that increase the capacity for resilience, and transformability is the ability to make a radical change when the existing system is no longer viable.

Shocks at the household level – whether from drought, illness, the loss of employment, crop losses from disease, or fire, flooding and other natural disasters – can undermine household food security. Longer-term stresses, such as those associated with population growth and climate change, can interact with and exacerbate short-term stresses.

Time is an important variable in assessing resilience, adaptability and transformation, and it is possible that adaptation that increases food security in one time period can have a negative effect on resilience in another (Carpenter *et al*., 2001). For example, the advent of chainsaws and their incorporation into farming systems helped agricultural societies by enabling them to quickly clear large areas of forest to create new agricultural land. However, as the forest frontier became constrained and fallowing was no longer tenable for maintaining soil fertility, the resilience of the system was compromised.

THE ROLE OF FORESTS AND TREES IN RESILIENCE

The roles of trees outside forests are well known to farmers but tend to be poorly understood by technical specialists, planners and policy-makers and have mostly been overlooked in national statistics and economic accounts (Bellefontaine *et al*., 2002). Farmers have been incorporating trees into their farming systems – and increasing the resilience of those systems – for thousands of years through intensive management strategies, such as in the sophisticated homegardens of Indonesia (Michon, Mary and Bompard, 1986). They have also been retaining trees in less explicit processes of land-use change, for example by ensuring that valuable indigenous trees for food production, like the shea nut tree in western arid Africa, are retained in farm fields as new agricultural lands are cleared (Wilson, 1989).

There is growing awareness of the extent of tree-involved farming practices and their increasing prominence as a feature of agricultural land use. Even in modern agricultural systems, the boundaries between the forest and the farm have become increasingly obscured; there is a trend to revert land-use systems from their often highly simplified states towards more ecologically complex systems.[1] The potential impact of this trend on food security is profound. The resilience of complex land-use systems has analogues in ecological science, where empirical evidence shows that complex ecosystems are far more resilient than simple ones (although arguably less productive, at least in the short term; see Hollings and Goldberg, 1971). Land-use systems that incorporate the use and management of forests and trees can increase resilience in a number of ways, some of which are discussed below.

Trees and forests as safety nets

The view that trees and forests can provide important risk-reduction functions at the household level is well-established in the literature. Looking at the problem of risk management, Delacote (2007) distinguished the extraction of non-timber forest products

[1] In the European Union, for example, farmers are required to undertake actions to conserve critical natural habitats in farmland in order to receive subsidies under the Common Agricultural Policy.

TABLE 1. Coping strategies employed by households in response to anticipated and unanticipated risk, two villages in South Africa

Coping strategy	Percentage of households employing coping strategy			X^2	Significance
	Total	Wealthiest	Poorest		
Kinship	85	80	90	1.9	> 0.05
Reduced spending	74	84	64	5.2	< 0.05
Changed diet	72	84	60	7.1	< 0.05
Saving/budgeting	72	88	56	12.7	< 0.05
Sale of NTFPs	70	68	72	0.2	> 0.05
Selling livestock	44	58	30	7.9	< 0.05
Savings clubs	41	64	18	21.9	< 0.05

Source: Paumgarten (2007)

(NTFPs)[2] in two ways: as a *diversification strategy*, in which households increase their participation in a wide range of possible welfare-improving activities; and as a *coping strategy*, where households increase their extraction of NTFPs to smooth out consumption levels when agricultural or other outputs fall. A number of studies have examined the role of NTFPs from a diversification perspective (addressing the question of the share of household income and consumption that is met by NTFPs), but relatively few have reported findings about how NTFPs contribute to smoothing consumption as a coping strategy.

Paumgarten (2007) examined the safety-net function of NTFPs in two rural villages in South Africa by looking at how households coped with expected and unexpected crises over a two-year period (Table 1). The most important coping strategy used by all classes of household was a reliance on kinship groups and community support networks to help compensate for income losses. More generally, however, the study showed that differences in how the wealthiest and poorest households responded to stress were a function of differences in their access to assets: wealthier households were more able to sell livestock or rely on savings than were poorer households. The study also showed that while poor and wealthy households were both likely to sell NTFPs, this was an especially important strategy for poor households because NTFPs were among the few marketable assets at their disposal.

These findings are echoed elsewhere. Shackleton (2006), Kayambazinthu *et al*. (2005), FAO (2005) and Barany *et al*. (2004) all pointed to the importance of NTFP sales to households afflicted by HIV/AIDS. Tairo (2007) and Ngaga, Munyanziza and Masalu (2006) showed the role of southern Africa's miombo woodlands as providers of "famine foods" and as natural insurance. Using seasonal household data for rural Malawi, Fisher and Shively (2005) found that households experiencing an income boost (e.g. from remittances or a good harvest) depended less on forest product extraction than those not receiving such a boost. Hegde and Bull (2008) documented the role that miombo resources play when shocks hit household assets: households experiencing illness shocks increased their consumption of environmental resources (including the sale of NTFPs) by 42 percent. In their study of rates of forest extraction in mountainous parts of Viet Nam, Volker and Waibel (2010) showed that households affected by health shocks to economically active household members and severe weather shocks were more likely to extract forest products, especially woodfuel, than other households. A common finding in many of these studies is that, during times of stress, NTFPs are sold to generate income that can be used to purchase food, especially by the very poor.

It seems clear, therefore, that forests and trees outside forests can act as crucial safety nets for food security and are often important components of coping strategies for the very poor. However, their use in short-term coping strategies may jeopardize their role in diversification strategies, as is explored below using the case of woodfuel.

Income, risk management and woodfuel

Reliance on woodfuel markets to generate income during periods of stress has been widely observed but seldom well-documented. In his assessment of household responses to food shortages in Malawi in 2003, Zulu (2010) identified a range

TABLE 2. Strategies to adapt to famine employed by households in southern Malawi, 2003

	Strategy	Percent (n = 381)
1	Reduced number of meals per day	48.0
2	Substituted maize with non-staple foods (e.g. pumpkins, potatoes and wild foods)	45.9
3	Engaged in piece-work to earn income to buy food	39.1
4	Used food grants from the government and other agencies	32.8
5	Produced or sold charcoal to buy maize	29.7
6	Sold livestock to buy food or exchanged livestock for food	16.8
7	Sold other crops (e.g. vegetables, cassava and potatoes) to buy maize	16.0
8	Sold firewood to buy maize	11.8
	Did not encounter a food deficit	14.2

Source: Paumgarten (2007)

[2] NTFPs encompass all biological materials other than timber (but may include woodfuel) which are extracted from forests for human use.

©FAO/G. BIZZARRI

A beneficiary of an FAO project implemented in the wake of Hurricane Ivan in Grenada mills a tree trunk to be used for local house-building. Forest-based employment can be important in coping strategies in the face of disaster

of adaptation strategies (Table 2). More than 40 percent of surveyed households reported that, under famine conditions, they used income from the sale of charcoal or firewood to purchase maize.

There is a risk that reliance on woodfuel markets in hard times might mitigate the short-term risk at a longer-term environmental (and economic) cost. Thus, two questions emerge about the role of woodfuel in food security: do woodfuel markets generate sufficient income to mitigate food insecurity, and what is the impact of this on the resource base?

Woodfuel fits two risk-management niches in rural households – as a diversification strategy some of the time, and as a coping strategy during times of environmental or other stress. The impacts and outcomes of woodfuel production and sale on poverty and the resource base should be considered from both perspectives. If, as Delacote (2007) suggested, risk-diversification strategies are likely to be more forest- and tree-conserving (by raising the value of NTFPs and therefore the incentive to conserve forests to ensure continued NTFP production), we would expect to find cases where woodfuel markets have stimulated the development of sustainable forest and tree management systems.

There are such examples. On the plains of the Gran Chaco in the Argentine province of Salta, management systems have been devised to bring large areas of degraded woodland into production, with one objective being charcoal production (Bucher and Huszar, 1999). The system relies on integrating livestock management with woody biomass management, over a 20–40-year cycle, with the objective of landscape restoration. In the longer term, however, the system will need to better serve the interests of local farmers, who continue to depend on agricultural land clearance to meet livelihood objectives.

The conventional wisdom in much of Africa is that charcoal markets drive deforestation and forest degradation. Mwampanda *et al*. (2013) pointed out, however, that charcoal itself is seldom the culprit because deforestation tends to be driven more by agricultural expansion, of which charcoal is a byproduct. The capacity of dry woodlands to regenerate and recover is well known, for example in Senegal (Ribot, 1999) and Zambia (Chidumayo and Gumbo, 2013). In his assessment of forest degradation in Senegal, Wurster (2010) found that forests in areas managed for charcoal production were equally degraded compared with areas where charcoal production was absent.


©FAO/ KOELEN

A man and a woman sell firewood in a wood market in Phnom Penh, Cambodia. There is a risk that reliance on woodfuel markets in hard times might mitigate the short-term risk at a longer-term environmental and economic cost

Nevertheless, the most vulnerable people, who may depend on burning charcoal as a safety net during times of environmental stress, often live in areas that are ecologically highly fragile. It is this combination – low ecological resilience combined with high economic vulnerability – that can bring the temporal dimension of risk management into play. As a coping strategy, risk management that depends on cutting woodlands to produce charcoal may simply shift the risk to a period in the future, before the woodlands have had a chance to recover, and resilience in one period may be gained at the expense of resilience in another.

Ambiguous relationship between income and food security

Higher income may not lead to improved food security if households choose to spend the additional income in ways that do nothing to improve food security, such as on social events or clothing. Moreover, markets for some NTFPs are seasonal and may coincide with peak food production periods, when food insecurity is less of an issue. By the time of the next lean season, earlier income surpluses gained by the sale of NTFPs may have been disbursed among household members (Haglund *et al*., 2011). These observations point to the importance of incorporating detailed seasonal and other time-related data into analyses of the extent to which the use of NTFPs form part of coping strategies at the household level.

BUILDING RESILIENT LANDSCAPES FOR IMPROVING FOOD SECURITY

The analogues between ecological resilience and the role of diversification strategies in food security are obvious: more diverse ecosystems are more resilient to environmental and other shocks. Greater economic diversity in terms of assets that can be used for income and consumption creates households that are more resilient to food insecurity. So the roles of forests and trees in building household resilience and increasing food security come from these two dimensions: enabling more diverse and resilient farming ecosystems, and creating greater economic diversity in terms of assets that can be used for income and consumption.

Forests and trees undoubtedly act as food-security safety nets in times of crisis, especially for the very poor. In the long term, however, the value of forests and trees in this role could diminish if the resource becomes degraded, for example if social and environmental shocks become more frequent. So how can farming ecosystems be made more robust, and how can diversification be used to do this?

There is a clear need to take a broader perspective about how trees and forests are part of rural landscapes. The term "landscape" has permeated recent discussions on rural development (see Rietbergen-McCracken, Maginnis and Sarre, 2007).[3]

[3] This section is derived from Dewees *et al*. (2011).

A landscape is often defined as a geographical construct that includes biophysical features of an area and also, potentially, its cultural and institutional attributes. It describes a mosaic of land-cover and land-use types relevant to the processes or services being considered or managed – a dynamic, complex patchwork of overlapping political, economic, social and ecological systems that are individually relatively homogeneous.

A landscape approach is a conceptual framework that allows a structured view of the broader effects of major interventions in the rural sector. It describes such interventions at a spatial scale that encourages attempts to optimize interactions among a range of land-cover types, institutions and human activities. The ideas of landscape restoration, landscape planning and eco-agriculture all build on landscape approaches and principles.

Trees in landscapes can increase the resilience of food-production systems and therefore household resilience. They can help even out a household's use of seasonal labour and create reserves of capital for new investment, and they can help clarify land tenure. Trees in landscapes can range from contiguous, large tracts of forests used for multiple purposes, to mosaics of forests and blocks and other configurations of trees and agroforestry systems within rural landscapes.

A tree-oriented approach to landscape restoration complements and enriches more narrowly defined approaches to afforestation, reforestation and land and water conservation, with the central aim of improving both human livelihoods and ecological integrity. Among other things, landscape restoration aims to:

- restore a balance of environmental, social and economic benefits from forests and trees within a broader pattern of land use;
- increase the functionality of landscapes and the supply of ecosystem services across the range of land uses, not just maximize new forest cover;
- have an impact on whole landscapes, not just individual sites;
- stimulate grassroots economic development that supports sustainable livelihoods and thus diminishes some of the drivers of landscape degradation and increases resilience;
- involve people as central elements of landscapes and increase their involvement in decision-making.

Examples of landscape approaches

Some countries are incorporating landscape strategies as a central part of national development policies. In Rwanda, for example, the Land Husbandry, Water Harvesting and Hillside Irrigation Project, supported by the World Bank, is using a landscape approach to address challenges created by uneven rainfall,

©FAO/A. ODOUL

A farm and forest landscape in the Kiseny region in northeastern Rwanda. Trees in landscapes can increase the resilience of food-production systems and therefore household resilience

production variability, small landholdings, limited commercialization and land constraints due to population growth. It is providing infrastructure for land husbandry (e.g. terracing and downstream reservoir protection), water harvesting (e.g. valley dams and reservoirs), and hillside irrigation (e.g piping, fittings and field application for basin and furrow irrigation), all in a manner consistent with the principles of a landscape approach.

In Albania, a project that integrates the management of forests, pastures and agriculture shows that with the strong involvement of local communities, whole landscapes can recover, with dramatic results. Improved forest governance, local management, small-scale investments and managed grazing measures have halted unsustainable land use, thereby reducing carbon emissions and protecting key watersheds. As a result, incomes from forestry and agriculture have increased by 50 percent in targeted microcatchment areas (The World Bank, 2012).

POLICIES FOR BUILDING RESILIENT LANDSCAPES AND RESILIENT HOUSEHOLDS

Various policy responses have been shown to increase the incorporation of trees and forests in managed landscapes to improve social–ecological resilience. Some of these are described below.

Policies and institutions can be reoriented to ensure that trees, forests and landscape restoration are addressed. The devolution of full control over land and other natural resources to local institutions and organizations is increasingly seen as a requirement for bringing about better natural resource management. The challenges are to increase the legitimacy of local management organizations, ensure that these organizations can put in place effective management mechanisms, and see that local organizations have the capacity to limit elite capture. At the same time, centralized government forest authorities, which have tended to resist change, need to be reoriented from their earlier role, which was largely regulatory, towards service delivery aligned with poverty mitigation. Government- and donor-led initiatives must go beyond the forest sector and engage a wide range of public and private stakeholders, including water, agriculture, livestock, energy, land and environmental finance and planning authorities; producer groups; civil-society organizations, including business associations; food companies; and private investors.

Landscape approaches work better if rights to land and trees are secure. Secure rights create incentives for individual farmers, households and communities to invest in improved land and water management and protect trees and forests. Appropriate pricing regimes encourage the rational use of scarce resources.

Improving value adding at the local level can increase incentives for the better management of landscapes and trees in farming systems. Local value added can be boosted by simplifying the regulatory regime to reduce transaction costs for poor producers and developing a framework to improve support for producer organizations and user groups. Trade associations have shown that they can play a role in promoting market diversification, improving the prospects for niche market entry and establishing product standards.

Payments for ecosystem services can help. Markets for ecosystem services from trees and better-managed farming landscapes could be developed more fully. Experience suggests that these types of initiative are most successful when they are integrated with other rural development activities; they can lead to productivity increases and improve climate resilience.

Policies that improve land, water and tree governance can minimize the risks associated with large-scale land acquisitions. Large-scale land acquisitions are increasingly a reality in Africa and elsewhere, and present both risks and opportunities. Policies that strengthen access to information and protect existing land rights can help ensure that land transfers are voluntary and beneficial for local people. A sound policy framework can help attract responsible agro-investors and strengthen food security. Legislation that recognizes farmers' rights to the trees on their farms can provide incentives for land restoration and sustainable land management practices.

Acknowledgement

This article is adapted from: Dewees, P.A. 2013. *Bouncing back: forests, trees, and resilient households*. Working paper prepared for the International Conference on Forests for Food Security and Nutrition, Rome, May 13 to 15, 2013. Washington, DC, Program on Forests. ◆

References

Barany, M., Hammett, A.L., Stadler, K. & Kengni, E. 2004. Non-timber forest products in the food security and nutrition of smallholders afflicted by HIV/AIDS in sub-Saharan Africa. *Forests, Trees and Livelihoods*, 14: 3–18.

Bellefontaine, R., Petit, S., Pain-Orcet, M., Deleporte, P. & Bertault, J.G. 2002. *Trees outside forests: towards better awareness*. FAO Conservation Guides No. 35. Rome, FAO.

Bucher, E.H. & Huszar, P.C. 1999. Sustainable management of the Gran Chaco of South America: ecological promise and economic constraints. *Journal of Environmental Management*, 57: 99–108.

Carpenter, S., Walker, B., Anderies, J.M. & Abel, N. 2001. From metaphor to measurement: resilience of what to what? *Ecosystems*, 4: 765–781.

Chidumayo, E.N. & Gumbo, D.J. 2013. The environmental impacts of charcoal production in tropical ecosystems of the world: a synthesis. *Energy for Sustainable Development*, 17: 86–94.

Delacote, P. 2007. Agricultural expansion, forest products as safety nets, and deforestation.

Environment and Development Economics, 12: 235–249.

Dewees, P., Place, F., Scherr, S. & Buss, C. 2011. *Investing in trees and landscape restoration in Africa: what, where, and how*. Washington, DC, Program on Forests.

FAO. 2005. *Miombo woodlands and HIV/AIDS interactions – Mozambique country report*. Forestry Policy and Institutions Working Paper No. 2. Rome (available at: www.fao.org/docrep/008/j5251e/j5251e00.htm).

Fisher, M. & Shively, G.E. 2005. Can income programs reduce tropical forest pressure? Income shocks and forest use in Malawi. *World Development*, 37(7): 1115–1128.

Haglund, E., Ndjeunga, J., Snook, L. & Pasternak, D. 2011. Dry land tree management for improved household livelihoods: farmer managed natural regeneration in Niger. *Journal of Environmental Management*, 92: 1696–1705.

Hegde, R. & Bull, G. 2008. Economic shocks and Miombo woodland resource use: a household level study in Mozambique. *In*: P. Dewees, ed. *Managing the miombo woodlands of southern Africa* (Technical Annex 4). Washington, DC, The World Bank.

Hollings, C.S. 1973. Resilience and stability of ecological systems. *Annual Review of Ecology and Systematics*, 4: 1–23.

Hollings, C.S. & Goldberg, M.A. 1971. Ecology and planning. *Journal of the American Institute of Planners*, 37(4): 221–230.

Kayambazinthu, D., Barany, M., Mumba, R. & Holding Anyonge, C. 2005. *Miombo woodlands and HIV/AIDS interactions: Malawi country report*. Forestry Policy and Institutions Working Paper No. 6. Rome, FAO (available at: www.fao.org/docrep/008/j6038e/j6038e00.htm).

Michon, G., Mary, F. & Bompard, J. 1986. Multistoried agroforestry garden system in West Sumatra, Indonesia. *Agroforestry Systems*, 4(4): 315–338.

Mwampanda, T.H., Ghilardi, A., Sander, K. & Chaix, K.J. 2013. Dispelling common misperceptions to improve attitudes and policy outlook on charcoal in developing countries. *Energy for Sustainable Development*, 17: 75–85.

Ngaga, Y.M., Munyanziza, E. & Masalu, H.E. 2006. The role of wild mushrooms in the livelihoods of rural people in Kiwele village, Iringa, Tanzania: implications for policy. *Discovery and Innovation*, 18: 246–251.

Paumgarten, F. 2007. *The significance of the safety net role of NTFPs in rural livelihoods, South Africa*. Rhodes University, Grahamstown, South Africa (MSc thesis).

Ribot, J.C. 1999. A history of fear: imagining deforestation in the West African dryland forests. *Global Ecology and Biogeography*, 8: 291–300.

Rietbergen-McCracken, J., Maginnis, S. & Sarre, A. 2007. *The forest landscape restoration handbook*. London, Earthscan.

Shackleton, S.E. 2006. *Forests as safety nets for mitigating the impacts of HIV/AIDS in southern Africa*. Forest Livelihood Brief No. 4. Bogor, Indonesia, Center for International Forestry Research.

Tairo, V.E. 2007. The composition and regeneration status of wild food plants in Chenene miombo woodland, Dodoma Rural District, Tanzania. *Discovery and Innovation*, 19: 107–111.

The World Bank. 2012. Albania Natural Resources Development Project. Implementation Completion and Results Report (ICR1859). Washington, DC, Europe and Central Asia Department, Sustainable Development Department, The World Bank.

Volker, M. & Waibe, H. 2010. Do rural household extract more forest products in times of crisis? Evidence from the mountainous uplands of Vietnam. *Forest Policy and Economics*. DOI:10.1016/j.forpol.2010.03.001.

Walker, B., Hollings, C.S., Carpenter, S.R. & Kinzing, A. 2004. Resilience, adaptability and transformability in social–ecological systems. *Ecology and Society*, 9(2): 5.

Wilson, K.B. 1989. Trees in fields in southern Zimbabwe. *Journal of Southern African Studies*, 15(2): 1–15.

Wurster, K.W. 2010. Management matter? Effects of charcoal production management on woodland regeneration in Senegal. PhD thesis, University of Maryland, College Park.

Zulu, L.C. 2010. The forbidden fuel: charcoal, urban woodfuel demand and supply dynamics, community forest management and woodfuel policy in Malawi. *Energy Policy*, 38(2010): 3717–3730. ◆