

Forests and food security

Although long considered mutually exclusive, biodiversity conservation and food security are two sides of the same coin. Although ecologists and conservation biologists focus primarily on biodiversity conservation in non-agricultural lands it has been recognised that a strictly conservation focus is limited in scope, particularly in terms of fulfilling production requirements. This is pertinent given that the majority of the world's biodiversity remains outside of protected areas, often in complex, multi-functional landscapes occupied by people and their associated farming systems, particularly in the tropics.

Terry C.H. Sunderland



THE CONVENTIONAL MODEL to achieve food security has been to convert wild lands to intensive commercial agricultural use, leading to the increased homogenisation of natural landscapes. An immediate result of this model of land use has been a drastic loss of wildlands, the biodiversity they contain and the ecosystem services they provide; some suggest that society has “traded off biodiversity” to achieve food security. Approximately 30-40% of the earth's surface is now under some sort of agricultural system. Although the Green Revolution was intended to intensify production in existing agricultural lands, it is estimated that 20% of the yield increases resulted in direct land conversion. In addition, these increases in production have been achieved through industrial agriculture that is heavily dependent on fossil fuels and agro-chemicals, further indirectly affecting biodiversity and a wide range of ecosystem services, arguably contributing to climate change processes. With the human population estimated to grow to nine billion by the year 2050, it is suggested that there is a concomitant need to increase agricultural production two- to three-fold and that any marked increase in production will undoubtedly be at the expense of currently unproductive lands. However, further expansion of industrial agriculture through land conversion could have a continuing devastating effect of the world's remaining biodiversity. This is no less the case in SE Asia.

Biodiversity: a fundamental feature of agricultural systems and human well-being

Biodiversity at three levels – ecosystems, the species they contain and the genetic diversity within species – underpins much of modern agriculture as well as the livelihoods of many millions of people. The majority of today's modern crop and livestock varieties are derived from their wild relatives and it is estimated that products derived from genetic resources (including agriculture, pharmaceuticals etc.) is worth an estimated \$500 billion/annum. Biodiversity provides an important safety-net during times of food insecurity, particularly during times of low agricultural production during other seasonal or cyclical food gaps or during periods of climate-induced vulnerability. Wild harvested meat provides 30-80% of protein intake for many rural communities, particularly in the absence of domesticated alternative sources of protein. The World Health Organisation estimates that in many developing countries up to 80% of the population relies on biodiversity for primary health care and the loss of biodiversity has been linked to the increased emergence and transmission of infectious diseases with deleterious impacts on human health.

Many female farmers lack access to credit, despite evidence suggesting that investment aimed at women leads to the increase of both farm and non-farm incomes at the household level.

Around one billion people rely on wild harvested products for nutrition and income and the “invisible” trade in wild resources is estimated to generate \$90 billion/annum. In India alone the livelihoods of around 6 million people are maintained by the harvest of forest products. In many rural locations, particularly areas that lack basic infrastructure and market access, the collection of wild resources provides considerable subsistence support to local livelihoods. In addition, the harvest and sale of wild products often provides one of the only means of access to the cash economy. Access to markets is particularly important for food security; it is not enough to be able to collect or grow food, but the ability to purchase food is also a major factor in ensuring food security, hence the more vulnerable and poorest members of society are particularly at risk from lack of access to food. Highly urbanised societies such as Hong Kong and Singapore that have no agricultural base are food secure because of their considerable purchasing power, while India, although self-sufficient in agriculture, has much of its population that is food insecure primarily due to social inequity and poverty.

Challenges to biodiversity-friendly agriculture

Population growth

The world's population is expected to grow to nine billion by the year 2050. If the current model of commercialised monoculture is to be followed, feeding the global population is stated to require the conversion of yet more wild lands, at the expense of biodiversity and ecosystem service provision. Demand for meat is increasing globally, particularly from the burgeoning urban populations of India and China, and as the world becomes increasingly prosperous. Meat production is a notoriously inefficient use of resources and the implications of this are that a greater proportion of grains and oilseeds are being used to feed livestock and poultry, rather than people. A significant rise in greenhouse gas emissions is also a major side effect of the increased production in meat and dairy products. The diversion of foodstuffs to biofuel production also has an impact on food security. For example, nearly a third of all corn produced in the United States is now used for fuel and in 2010 this diverted more than 100 million tonnes of corn to ethanol production. Fuelled by considerable subsidies, ethanol production also contributes to price rises in grain and meat. Overall, it is argued, biofuel production does not improve energy security, increases environmental degradation, raises basic food prices and thus threatens food security. Finally, a considerable proportion of food is simply wasted in both developing and developed countries, but for different reasons. Loss of food in developing countries is often the result of pre- and immediate post-harvest losses due to pests and disease and poor market access, while waste in

developed countries is primarily due to the availability of large quantities of relatively cheap food, which is simply uneaten and discarded once it has reached the table, be it within the household or the commercial kitchen. Reappraising the non-consumptive uses of agricultural produce and mitigating food waste could result in an equivalent rise in agricultural output, lessening the need for further land conversion and further biodiversity loss.

Climate change

Climate change and its potential impacts represent one of the greatest contemporary threats to food security. Extreme and unpredictable weather will affect crop yields and it is estimated that agricultural yields in Africa alone could decline by more than 30% by 2050. Such yield declines will primarily affect the world's poor, who will not only lose direct access to food, but are less capable of absorbing the global commodity price changes that characterise a reduction in supply.

Climate-related events are being blamed for the recent spike in the price of staple foods, which are now at an all-time high. Extreme weather can have a devastating effect on crops as the recent droughts in Russia and China, and floods in Australia, India, Pakistan and Europe indicate. The impacts of rising temperatures and more-extreme weather events will likely hurt the poor, especially rural farmers; the World Bank estimates that 44 million more people have slipped back into poverty since June 2010. Urban populations who are more vulnerable to reductions in purchasing power are particularly vulnerable to increases in basic food prices. Food riots in Cameroon and Haiti in 2008 and the recent regime changes in Tunisia and Egypt have been directly linked to increased prices of basic foodstuffs.

Biodiverse multi-functional landscapes are more resilient to extreme weather effects and can provide a natural insurance policy against climate change. Greater crop diversification by integrating a diversity of crops and varieties into small-holder systems in particular will increase resilience to severe changes in weather patterns leading to calls for “sustainable agriculture”.

Gender inequity

Women are pivotal to ensuring food security. It is estimated that women produce more than 50% of the food grown worldwide, primarily in small-scale farming systems. Indeed women tend to grow a greater diversity of products, experiment more with folk varieties and landraces and are often reliant on biodiversity for the family herbal. Although women comprise up to 80% of farmers in sub-Saharan Africa and 60% in Asia, ratios that are increasing due to male out-migration, their access and control over land and resources is generally inferior to that of men in the



same household or community. Where women do have access to land, they will generally use it for food production and income generated from such land is more likely to be utilised for the well-being of the household, whether for nutritional, health or other benefits. Women are also primarily responsible for food preparation and allocation and, as such, are usually the guardians of household food security.

However, many female farmers lack access to credit, despite evidence suggesting that investment aimed at women leads to the increase of both farm and non-farm incomes at the household level. Although development policy makers and agencies increasingly recognise the crucial contributions of women farmers to food security, contemporary agricultural policies and research do not often directly address the needs of women farmers, focusing more on traditionally male dominated cropping practices. Such “gender blindness” in the context of agricultural development is a major risk to future food security.

Tenure

Although it is argued that tenure rights in agricultural landscapes are less ambiguous for forested regions, greater clarity of tenure is needed across the entire biodiversity-agriculture nexus. Tenure rights have figured prominently in debates surrounding conservation; land tenure and food security have both, separately, been the subject of extensive research yet critical links between the two remain somewhat unexplored. Secure tenure is critical for food security in a number of ways. The lack of secure access rights and land tenure may be a disincentive for many poor or marginalised communities to invest in managing land more productively, investing in required inputs and making the raising of capital that much more difficult. Inadequate or unclear tenure regimes also limit the efficient delivery of payments for environmental services and other reward mechanisms.

Agricultural investment

International funding for agricultural development has dropped significantly over the last decade and is now at an historic low, representing around 3% of total overseas aid. Crop yields have fallen in many regions primarily due to declining investments in agricultural research, irrigation and infrastructure and the lack of agricultural development investment has led to yield declines in Africa of ca. 10% since 1960. National investment in agricultural development also remains very low, often representing less than 0.5% of agricultural GDP, despite the significant contribution of farming to most developing countries' economies. This is primarily due to the gradual withdrawal of state support to

agriculture under structural adjustment conditionalities. Structural adjustment programmes also disaggregated agriculture from wider natural resource management (NRM) initiatives. Thus NRM and agriculture have been artificially divided. Unfortunately for the millions of small-holder farmers who are responsible for the vast majority of food production, bio-cultural diversity and agricultural production, these lines are considerably less well-defined.

Conclusion

Although food security is dependent on issues of sustainability, availability, access and utilisation, and not production alone, it is evident that a “new agriculture” needs to be found to feed the world's population both efficiently and equitably. Increases in food production over the past fifty years have been at the cost of biodiversity and ecosystem service provision, yet there is considerable evidence that diverse agro-ecological systems can be equally productive, if not more so in terms of actual yield outputs, notwithstanding the biodiversity benefits of such approaches. As such, the United Nations envisions an “agro-ecological” approach that combines biodiversity concerns along with food production and provides a more compelling vision of future food production. The integration of biodiversity conservation and agricultural production goals must be a first step. Conservation and restoration in human dominated ecosystems must strengthen connections between agriculture and biodiversity. Managing landscapes on a multi-functional basis that combines food production, biodiversity conservation and the maintenance of ecosystem services should be at the forefront at efforts to achieve food security.

In order for this to happen, knowledge from biodiversity science and agricultural research and development, need to be integrated through a systems approach. This provides a unique opportunity for forestry and agricultural research organisations to coordinate efforts at the conceptual and implementation levels to achieve more sustainable agricultural systems. A clear programme of work on managing landscapes and ecosystems for biodiversity conservation and food security should be central to development aid.

Terry Sunderland is a senior scientist with CIFOR's Forests and Livelihoods programme, and leads the research domain 'Managing trade-offs between conservation and development at the landscape scale'. Terry holds a Ph.D. from University College London and has published extensively on conservation and livelihood issues. CIFOR, Situ Gede, Sindang Barang, Bogor 16680, Indonesia. (t.sunderland@cgiar.org)

