Poverty Reduction and Biodiversity Conservation: The Complex Role for Intensifying Agriculture

BY JOHN W. MELLOR
Preface

Agriculture practices in countries around the world have multiple and enduring impacts on the environment and on biodiversity conservation. Agriculture is one of the most widely-spread productive activities, using nearly 40% of the earth’s land surface, providing sustenance for us all and generating direct employment or livelihoods for the vast majority of rural dwellers worldwide. As a result, agriculture occupies a central place in the quest for economic betterment for a large proportion of the people who are poor and live in rural areas.

As stated in WWF’s Global Agriculture Network Initiative, expanding the agricultural frontier in countries around the globe is largely responsible for the destruction of nearly 17 million hectares of forests each year. That land use conversion process has consequently become a leading driver in loss of topsoil and sedimentation of freshwater and marine systems. Moreover, excessive use of chemicals in input-intensive production systems has caused pollution of freshwater reserves with attendant consequences for the world’s ecology and human health.

In this paper, John Mellor looks at this dilemma — at the need for supporting agricultural productivity growth, on the one hand, and the challenges and opportunities for biodiversity conservation on the other. His analysis examines the complex interplay in countries with different levels of national income and different potentials for intensifying agricultural production. John Mellor is uniquely qualified to offer this analysis. He brings a long and distinguished record of scholarship and policy advice in the field of agricultural development combined with a strong personal interest in nature and its protection.

Injecting controversy into the debate on the links between poverty and the environment is urgently needed because of the hold that preconceptions and biases exert over both the debate and programmatic interventions to address poverty-environment dynamics. We look forward to your comments and reactions and we hope that this Viewpoint series can contribute to breaking down some of the walls that restrain our collective efforts to address these complex, urgent issues.

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Introduction

Humankind has a responsibility to future generations to leave a world rich in biodiversity, filled with the plants, animals, and ecosystem processes on which all living things depend. However, for that to happen, we must take seriously our responsibilities to conserve Earth’s biodiversity, recognizing the complexity of our needs and carefully balancing those with the needs of future generations. Moreover, we need to make an effort to think and to act both globally and locally. While the world’s low-income nations possess a rich heritage of biodiversity, it is precisely in these countries where poverty and biodiversity conservation are often in conflict, and the pressing challenge is to resolve that conflict.

Of course, there is need to conserve the remaining biodiversity in the rich nations of the world, but the populations of these nations have already wreaked havoc on the natural resources. As is evidenced in the widespread loss of biodiversity in the Corn Belt of the United States, as well as in other rich agricultural lands, we have lost the large centers of biodiversity preservation in many high-income countries. While it is important to conserve the natural diversity that remains in the temperate latitude countries, the current focus should be on protecting areas of high biological diversity in the low-income, largely tropical countries of the world as many of these nations still possess abundant resources that have yet to be depleted.

People living in low-income, high-biodiversity areas can learn from the mistakes that the high-income countries have made with pursuing growth at any cost. It is now the time to build on lessons learned, and to move forward in partnership by working together to preserve biodiversity in increasingly threatened areas. This partnership should strive to conserve the rich natural heritage of many developing nations recognizing that biodiversity conservation will benefit their countries in the short term, as well as all of humanity in the long term. At the time when the now-rich nations were rapidly depleting their biodiversity, there were no other countries with which to partner in seeking better and more sustainable alternatives. However, now there are opportunities for partnerships, and future generations will be the beneficiaries.

Financial leadership must come substantially from the rich nations, as the poorer countries must dedicate scarce financial resources to
building political systems, initiating growth, and combating extreme poverty. Exercising stewardship through community participation, citizens of low-income nations can contribute to biodiversity conservation by using abundant labor resources to define and protect highly critical and diverse landscapes. The governments of poorer nations should consider making institutional changes in property rights to facilitate individual and community action, and leadership in this venture requires thought regarding four critical contrasting sets of considerations.

First, it is important to consider the population density factor in various areas. The employment and land-reserve opportunities available in densely populated areas that possess fertile agricultural lands (e.g., the great monsoon and irrigated plains of south Asia, as well as large portions of the east African highlands) are different from those in lands that support only sparse human populations (e.g., the farming areas bordering the Sahara Desert in Mali, the hill forest areas of south India, or the Appalachian countryside in the United States). Land prices in the densely populated rural areas tend to increase rapidly with development, while land prices in the sparsely populated rural areas tend to decrease. The rise in land values hinders expansion of reserves located in high population density areas, while the decrease in land values within areas of sparse human populations may facilitate wildlife reserve development. The high population density areas, in general, have the greatest potential for benefiting from globalization, and they are also the areas in which agricultural growth provides large employment multipliers. The expansion of employment and reduction of

The good news is that, with modern science and specialization, a given income or quantity of food and fiber can be produced within a much smaller area than without science and specialization. The bad news is the incentive to cultivate as much as possible of the high-productivity land.
poverty are facilitated through demand-driven linkages to the labor-intensive, rural, non-farm sector, which employs the very poorest elements of rural society. An understanding of the differentials in land value and development in the high-density versus low-density sectors of the rural landscape is critical as the next two factors derive directly from this phenomenon.

Second, the problem of small pockets of biodiversity (such as the Rwanda Gorilla Park) is different from that of large areas (such as the Congo Basin). In general, only small, relatively isolated patches of biodiversity remain in areas of high rural population density, yet these patches can be particularly rich in species endemism and diversity. In contrast, low population density areas still offer potential for preserving large, expansive tracts of land, which may also harbor a diversity of species while at the same time allowing for the continued provision of complex ecological services, such as water filtration, carbon sequestration, and soil stabilization. Imaginative approaches are needed, including corridors connecting high-biodiversity patches, combined with substantial financial investment to purchase ecologically important lands. However, local residents may resist the expansion of reserves unless measures are taken to provide them with alternative income opportunities, and those measures, as explained below, will tend to drive up the cost of reserve expansion. Because of this potentially harmful conflict between biodiversity preservation and economic opportunities for local residents, timing and coordination are important aspects of the reserve expansion process.

Third, short-run and long-run considerations must be distinguished as they relate to the underlying productivity of the resources. The distinction recognizes that small, incremental increases in income for poor people may be adequate in the short run, but in the long run they are not. Thus, while a strategy based on modest income increases may be appropriate in the short term, long-term strategies must incorporate large income increases. Achieving this long-term goal requires continuous intensification of agriculture in the high population density areas and substantial out migration from the low population density areas to the cities and market towns of the more dynamic areas.

Fourth, a distinction must be made between global and local action for both growth and biodiversity level. Both the necessary reduction in poverty and the protection of biologically diverse land require global action and leadership. Global policies that facilitate increased agricultural intensification and the subsequent drastic decline in poverty, along with international transfers of resources for both poverty abatement and biodiversity protection, are needed. The high-income nations of the world dominate these decision-making processes—and from them we require enlightened and responsible action.

Concurrently, both development and biodiversity conservation must be adapted to highly variable local conditions and the actions of diverse rural people. This adaptation requires rural people to become organized, local unit by local unit, to most effectively meet their economic needs while conserving local biodiversity. For that to happen, the governments of high-income nations and high-income people must think locally (recognizing the importance of local action in low-income countries) while acting globally (e.g., improving the environment for trade). The governments and people of low-income nations must act locally, as well as think globally, understanding that their actions can have implications for the world’s natural heritage. They must think globally so as to take advantage of and to encourage global actions in trade and capital flows that facilitate the local community’s development.

All of the distinctions, solutions, and relative roles of rich and poor countries must take into account the immense poverty in and around many high-priority biodiversity conservation areas. In working to alleviate poverty, the driving force behind poverty reduction in low-income countries is linked to increased farm income. This increase
in farm income is based on a radical increase in resource productivity, which is multiplied through employment links to the rural, non-farm sector. Using agricultural intensification as a means of raising incomes of the poor has beneficial as well as detrimental consequences for biodiversity. One of the benefits is that agricultural intensification allows for drastic income increases to occur, using a smaller amount of land than is currently under cultivation. This potential reduction in the amount of land under cultivation creates an opportunity to open more land for biodiversity preservation. Those growth processes in the areas that respond to agricultural intensification open large migration potentials for the unresponsive areas, both to the market towns of the prospering areas and to the larger cities, to which people from the prospering areas no longer need migrate. (As described previously, rising farm incomes have large multipliers to rural non-farm employment.)

The drawback of this approach is that much reserve expansion (but not all) will become more costly, as the land’s value will be increased by its heightened productivity. In addition, rural people’s expectations for doubling and tripling incomes may encourage bringing land currently in forest reserves into cultivation to achieve economic gain. Thus, the key question that arises is how rural communities, supported by local and national governmental structures, should take advantage of the benefits of agricultural intensification without falling prey to the drawbacks of the approach.

In light of this challenge, two parameters define this paper.

First, the paper is concerned with the interaction of poverty-reduction measures and biodiversity conservation strategies. To date, the most successful income-raising measures have proven to be globalization and technological change in agriculture. In context of these measures, the paper deals briefly with sustainability of natural resources, particularly with respect to water, soil, and sanitation as they interact with agricultural intensification processes. Sustainability issues are critical to consider as important factors in long-term, effective growth, and they also help define and clarify points of potential conflict with resource use.

Second, the paper is concerned with issues of cost sharing between high-income and low-income nations. This issue leads to consideration of the need for larger, earlier action on biodiversity than the poor nations are likely to take on their own: Low-income nations will, in general, prefer to reduce poverty before they preserve biodiversity. The concomitant is the need for rich nations to not only assist in the efforts of poverty reduction through strategies including agricultural intensification, but also to pay direct costs of enlarging and protecting biodiverse areas, both small and large. However, let us not look for doing it “on the cheap,” diverting necessary poverty-reduction resources to support biodiversity conservation. For political, if not moral,
reasons the biodiversity costs are necessarily incremental to the poverty reduction costs. In this context, the paper deals briefly with the mechanisms for dispersing transferred funds, including those payments for environmental services and development of community-based resource management groups to provide efficient resource use and stewardship.

The partnership calls for high-income countries to help low-income countries achieve rapid income growth in agriculture (with its attendant employment multipliers) through technical assistance, and, even as incomes rise, to help finance land retirement and protection in biodiversity preserves. Organized and engaged community groups within low-income countries would use the total resource pool to reduce poverty while, at the same time, effectively enlarging and managing protected areas.

The Values—Poverty Reduction and Biodiversity

Underlying this paper are two value judgements: (1) a moral imperative to lift the mass of people in low-income countries out of abject poverty; and (2) a moral imperative to conserve for future generations the rich, dynamic biodiversity that we have inherited.\(^1\) If, perchance, rich and poor countries alike accept these imperatives, it will be necessary for them to partner on improving the quality of life for many of the world’s poor while, at the same time, working to protect the world’s biodiversity.

For poor countries, it is absolute poverty, rather than income distribution, that drives our concern. Amartya Sen describes the philosophical basis for that observation in saying that absolute poverty is defined in terms of both (1) the proportion of the population, and (2) the absolute number of people who live with insufficient incomes. Within this context, “sufficient” is defined as being an amount appropriate to provide the basic minimum food intake for an active life in addition to the other goods and services that ensure the provision of food, shelter, and basic health (Sen 1976). This sufficient amount is defined by the World Bank to be an income of $1 per person per day in 1993 purchasing power parity (World Bank 2001).\(^2\)

We will note later that lifting the poorest within a society above this established poverty line requires that the farming population is moved substantially above the poverty line. Within this framework, farmers will prosper, at least by the standards of low-income countries.

A Basic Distinction: Population Density

Areas of high population density generally have remaining only small pockets of biodiversity, but often that biodiversity is particularly rich. In these high population density areas, frequently the forces of development have worked to reduce poverty, which, in turn, opens opportunities for in-migration from the low population density areas. The migration to high-density areas also makes it less expensive to create biodiversity reserves in the low population density areas—and, subsequently, more expensive to create reserves in the high population density areas. This paper is explicit about both the complementarities and conflicts between the means for poverty reduction and biodiversity conservation, and provides suggestions for dealing with the issues that may arise as a result of conflicts.

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\(^1\) Biodiversity is defined as conserved when areas, both large and small, are left with little or no human impact to evolve in a natural manner. For a more complex and classic view, see Wilson (1988) and McNeely et al. (1990). According to this traditional view, the biodiversity that should be conserved is believed to be far greater than what is possible in the specialized contexts that define most high-income human economic activity. Furthermore, the larger scale land areas that are set aside for conservation tend to preserve a more representative sample of biodiversity.

\(^2\) The $1 per person per day measurement is the generally accepted measure of poverty in low-income countries. It is the one behind the OECD/DAC, Group of 8, World Bank, and IMF approaches to poverty reduction, and it is roughly analogous to the World Food Conference and FAO targets for hunger reduction by half (World Bank 2001, 2001a; IFAD 2000; FAO 2000; UNDP 2000; DAC 2000).
High Population Density

High rural population densities are usually associated with highly productive agricultural resources, as these resources provide the means of support for greater numbers of people. Not only are these areas the most productive initially, they also generally respond best to the opportunities of globalization and new biological technologies. They are areas in which the costs are low per person or per family for providing the physical infrastructure (consisting of roads, electrification, and water supplies) because of the large numbers of people per unit area. Thus, these are the areas where incomes are likely to rise most quickly.

Not surprisingly, areas of highly productive agricultural resources, particularly in the tropics, contain much greater biodiversity than areas of poorer or more arid resources (Vogel 2001). However, the areas tend to have, at best, small parcels of undisturbed lands, which are under severe threat as agricultural technologies and globalization increase land productivity several-fold. With globalization, land values in areas of highly productive resources increase substantially, more funds are spent on rapidly improving agricultural productivity, and the remaining small tracts of virgin land in those areas are quickly developed.

Recent research reported in the journal Science shows that, in Africa, areas of high human population density are also the areas of greatest biodiversity. For example, population density in some areas of the Kenyan highlands is comparable to that of Bangladesh. Andrew Balmford, a zoologist at Cambridge University and author of the study reviewed by Vogel, asserts that “you can’t do conservation and development in different places,” and “if your goal
is to preserve most of Africa’s biodiversity, you’re going to have to grapple with the challenges of preserving biodiversity where there are quite a lot of people.”

The findings of Balmford’s Africa study are confirmed by analyses in North America, “where some of the highest conservation priorities are in areas of the highest real estate values” (Vogel 2001). Conservation International’s Gustavo da Fonseca notes in the context of these studies that “we are going to have to bite the bullet and make some very strong choices, even if these are costly and difficult both economically and socially.” (Examples of these difficult choices include creating well-protected parks and compensating local residents for loss of income-generating activities because of biodiversity conservation initiatives.) (Vogel 2001) Presumably the fertile soil and well-timed rainfall regimes of Asia pose similarly difficult choices. Later sections of this paper discuss the complex interacting forces that must be dealt with in making those choices.

In the short run, the urge to encroach upon protected areas can be contained by directing limited financial resources for infrastructure development, such as roads and waterworks, to the already-farmed areas, as is called for in Nepal’s Agricultural Perspective Plan. As an additional benefit of this strategy, the returns to investment will be higher in the farmed areas as they already have much of the necessary physical and institutional infrastructure for more rapid economic development (Government of Nepal 1995). However, it is by no means certain that such investment policies will be followed and, therefore, efforts need to focus on biodiversity preservation in light of the expanding pressures of development.

As discussed previously, in the long run, the high return realized from intensified farming will tempt people to move onto the reserves to gain larger agricultural plots. While the intensification will reduce poverty radically (as outlined in the intensification section on page 11), making it...
unnecessary for people to farm additional land within reserves, the same process will also make it highly profitable (and tempting) to encroach on fertile, protected lands. A critical question to explore at this juncture is what will happen when the unnecessary abuts the profitable. Over the next few decades, with an increased focus on agricultural intensification and biodiversity conservation, many such examples will be evidenced in developing countries.

In the high population density areas, the total economic benefits and the proportion of people benefiting from reserves are seemingly small compared to those that benefit directly from agricultural growth. In this situation, external funding is required to protect the reserves and to enlarge their size. Poverty-reduction efforts increase the acceptability of such funds because the preserve is to be enlarged in the context of rising incomes of the poor. Nevertheless, there is a conflict that must be faced.

Often at least small pockets of biodiversity remain in the high population density, highly productive resource areas. These pockets are frequently associated with the heterogeneity within the areas, with some land being less appropriate for high-intensity agriculture than others (such as plains that flood frequently or steep slopes). Increasing attention is being given to linking small patches of high-biodiversity habitats through the use of corridors.

The requirements for biodiversity conservation are clear.

First, agricultural development strategies that reduce poverty must be pursued vigorously; otherwise the poor will be forced to encroach on the remaining areas of biodiversity, and there will be little local or national political support for holding them back.

Second, in the context of declining poverty and increasing agricultural productivity, land must be acquired to enlarge and connect areas of biodiversity. The cost of doing so will escalate as agriculture becomes more profitable; therefore, the sooner such expansion of protected areas takes place, the less costly it will be.

Third, as will be discussed in the section on protecting high-priority conservation areas (see page 22), local people must be organized and given the incentive to protect the reserves.

Low Population Density

In general, the remaining large, high-biodiversity areas are located on relatively low-productivity resource bases, with low population densities. The agriculture in those areas responds only modestly to breakthroughs in agricultural and biological science. These areas are also not only deficient in physical infrastructure that facilitates

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specialization, but their low population densities also result in higher per family and per worker infrastructure-provision costs than in high population density rural areas. Therefore, the economics of providing infrastructure to these low-density areas are not favorable: Some politicians and residents of those areas will call for subsidizing that infrastructure. That is a position that should be resisted on economic, poverty reduction, and biodiversity conservation grounds. Development and intensification of other areas will tend to draw population away from these low population density lands, and will, consequently, reduce the value of land and decrease the costs of enlarging and protecting those areas.

In the short run, growing population and subsequent increasing poverty press for exploitation of

MAKING WAY FOR WILDLIFE: THE MESO-AMERICAN BIOLOGICAL CORRIDOR

One of the boldest efforts to connect fragments of biodiversity is the Meso-American Biological Corridor project, which aims to link numerous preserves through an extensive corridor system that cuts across several national boundaries (Kaiser 2001). The project has been controversial, however, with criticism arising because of its supposed emphasis on rural development aspects rather than on preservation and conservation components. (Later sections of this paper attempt to develop a framework for analyzing such controversies.) While conservation biologists continually argue over whether corridors positively affect all species, the evidence is clear that at least some are helped (Kaiser 2001).
limited resources to make marginal improvements in living standards. As a result of this, the impact on biodiversity is likely to be devastating. Partly because the population density is low and partly because the potentials for intensification of agriculture are severely limited, the benefits from activities complementary to preserving biodiversity can be attractive for a substantial portion of the population. Community participation and engagement, in the context of well-understood community and individual property rights, will be important tools for facilitating those benefits.

Organizing local populations to benefit from niche markets for products from diverse environments, participate in the protection process itself, and combine these activities with more traditional activities can add up to a substantially attractive income increase. The enterprise development branch of the Biodiversity Conservation Network (BCN), financed by USAID for work over a wide range of conditions in Asia, gives many examples of a successful search for niche markets and other economic activities to help support people living in or near areas of high biological diversity (John Mellor Associates, Inc. 1996). Such income-augmenting activities demonstrably increase the incentive for conservation. The activities will be valuable and relevant to local communities and individuals for at least a decade or two and maybe somewhat longer. However, as incomes in the rest of the nation greatly surpass these incomes, such marginal improvements will cease to be attractive. The section on protecting conservation areas (on page 22) discusses the need for using these strategies to work toward income generation along with biodiversity conservation.

However, these income-generating activities in the low population density areas will not keep pace with rapidly rising incomes in the high population density areas. In fact, in the face of rapid population growth, it is doubtful that activities such as those demonstrated or tracked by the BCN program will continue to generate substantial incomes into the next generation. Migration to more favored rural areas and to urban areas will be essential for achieving the necessary decline in population density in certain rural areas. The achievement of appropriately low density in certain areas, of course, cannot occur without the accompanying income increase through intensification in the more favored, more highly populated areas. Thus, in the long
run, rapid development of the more-favored areas (responding to globalization and new technology) is just as essential to the less-favored areas. Migration is a complement to the efforts to increase incomes of the remaining population, not a substitute.

Out-migration will create a smaller number of people to share the earned income related to the reserves, hence providing more economic support per person. The migration will be to the market towns of the areas prospering through intensification as well as to bigger cities, which will no longer be attracting people from the increasingly prosperous rural areas. In both cases, the migration opportunity for people in the low-productivity areas is enhanced by intensification in the more responsive areas.

The requirements for biodiversity conservation in the low population density areas are similar in broad outline but differ in detail compared to those for the high population density areas. First, in the short run, the many opportunities for small increases in income must be capitalized upon. Second, in the long run, measures to assist migration to other areas, including increased education and other human capital investments, are needed. Third, in the context of the preceding two points, a vigorous program of reserve expansion is needed. The reserve expansion initiative will be facilitated by the likely decline in land values associated with increased production in the more favored areas. Fourth, as discussed in a later section, community education and participation are vital to engage local people in protecting the reserves and deriving benefits from them. In areas of low population density, the reserves have the potential to become the major source of income for the small remaining local population. Throughout, it is essential that the agricultural development potential of high population density areas be vigorously pursued. Because agricultural intensification will be the necessary means of further reducing population density in the low population density areas to better fit the poor resource base, it will also serve to take pressure off the reserves and allow substantial income increases.

The Role of Agricultural Intensification in High Population Density Areas

To understand why so much of the income and poverty reduction burden is placed on the high population density rural areas requires understanding the basic elements of their development. Those elements can be categorized under three interrelated headings: specialization, technology, and linkages to rural non-farm employment. All three of these topics relate to various aspects of agricultural intensification.

Specialization, Trade, and Physical Infrastructure

In the late 1700s, Adam Smith postulated that specialization and trade are the roots of the productivity increase that drives the “wealth of nations.” In the intervening centuries, those basic economic principles are still subscribed to by mainstream economists. However, because of the less advanced state of science then, as compared to now, Smith no doubt underemphasized the role of technological advance. In modern times, however, technological advance, specialization, and trade interact and powerfully reinforce each other.

Technology advances specialization and trade in four ways.

First, technological improvements in transportation have constantly reduced transportation costs.

Second, technology has decreased the perishability and bulkiness of many products.

Third, because technological advance can be uneven, over time and across commodities, a few specific crops may suddenly become much more profitable than others, encouraging specialization in those crops and varieties.

Fourth, the cost of generating new technology encourages specialization, which allows for higher payments and the subsequent accrual of greater benefits.
Investment, institutions, and policies that reduce transaction costs are favorable to resource conservation because they allow each area to specialize in the products for which their natural resources are best suited. Thus, without trade, Nepal’s hill farms must cultivate annual subsistence crops, which are not well suited to hilly terrain and, therefore, the accompanying agricultural processes often result in much erosion. Trade allows those farms to specialize in tree fruits, which are more suited to the resource base but for which the local market is insufficient. Note that, in the case of the hill regions of Nepal, population densities are already high, reducing the cost of infrastructure per family; thus, intensification is economically feasible. Such cases should be distinguished from low population density areas that have poorer initial infrastructure. In these cases, the costs of migration and protection of biodiversity conservation areas will be much lower than the costs of providing an intricate grid of physical infrastructure.

Policies that favor specialization and trade fall in two categories: international policies that keep governments from impeding trade through inhibiting laws and taxes, and national policies that improve the physical infrastructure. The
urban bias of so many developing countries, and in recent decades, most foreign aid donors as well, has resulted in gross under-investment in rural physical infrastructure, such as the building of roads and the improvement of communications. The change in foreign aid focus, away from agriculture, is one of the most important reasons for relatively low poverty declines in the 1990s compared to impressive rates of poverty reduction the 1980s. Fortunately, the U.S. foreign aid program is now leading the way back to an emphasis on agriculture and, consequently, on rural development.

Specialization that increases income, reduces poverty, and conserves soil is not necessarily beneficial for biodiversity. Specialization and trade, especially when reinforced by technology, result in greatly reduced biodiversity within agriculture. By increasing the value of output, specialization and trade result in escalating land values, making it substantially more costly to expand reserves and connecting corridors. Those processes that increase land values can be expected to continue into the foreseeable future. High-income countries, by providing for reserve expansion, can take advantage of the lower current land values.

Structural adjustment programs pushed by international financial organizations are designed to encourage market forces that accelerate growth. Structural adjustment attempts to eliminate government-imposed distortions in prices, and it can be good for the environment in encouraging specialization in what is most suitable to the area’s agro-ecology. Structural adjustment can help agricultural growth by eliminating the many price biases against agriculture that are often imposed by urban-focused governments in low-income countries. However, structural adjustment, in attempts to control inflation, has sometimes fostered budget cuts that disproportionately harm rural areas.

Thus, because of budget cuts associated with structural adjustment programs, many activities that directly benefit rural people, such as education and outreach, are the first to lose funding. Positions and funds that deal with sustainability, as related to rapid agricultural intensification, are particularly vulnerable as these programs often require highly trained personnel and relatively expensive educational initiatives. As the government and international financial institutions recognize the harm from severe budget cuts, they may begin to make exceptions for social
programs, but often still neglect the needs of agriculture, not recognizing the special problems of a small farming sector. Urban-biased budget balancing also leaves little scope for expenditure on the biodiversity-focused reserve expansion and protection programs that should accompany successful agricultural intensification. Thus, in Africa, for example, the net effect of structural adjustment has been more harm than good for poverty reduction—but that need not be the case.

The baby does not have to be thrown out with the bathwater. What is needed is a push for open markets and private activity, recognizing that the rural sector needs government programs to help support rural roads, research, education, and carefully chosen institutional development. In that context, biodiversity conservation can play an integral role in efforts for rural development, combined with efforts to set aside protected areas. (For a detailed treatment of structural adjustment as related to environmental issues, see Reed 1996.)

Technology and Modern Science

Technological advance is essential to agricultural growth because agriculture is, inherently, characterized by a land constraint. Agricultural production cannot be increased, as in manufacturing, by a proportionate increase in all inputs. Thus, agriculture illustrates the classic problem of diminishing returns to labor and capital, unless science and technology develop ways to address and mitigate the land constraint.

Farmers have always understood the need for technological improvements and have done their best to select seed carefully and to gradually improve cultural practices as well as the varieties grown. However, such trial and error methods give at best a one-half percent per year rate of growth of productivity, while, at the same time, population grows at two to three percent and levels of living decline. Scientific advances, on the other hand, have been shown to increase agricultural efficiency, reaching up to two and three percent per year rates of yield increase.

As stated previously, modern science works unevenly, raising the productivity of certain crops far more than that of others. Consequently, specialization is boosted in only a few crops and, among those crops, only within a few varieties. Even as modern agriculture depends on biodiversity for the gene pool to provide increased yields, it pushes toward specialization and away from biodiversity. In this move toward specialization, we see a conflict with biodiversity—a conflict that has been present since the beginning of agriculture, but that has also been greatly reinforced by modern science and transportation technology. Yet there is another problem, too: with dynamic advances in major production areas, prices may decline and reduce incomes for people who must farm on poorer resources or who cannot otherwise benefit from technological improvements.

The good news is that, with modern science and specialization, a given income or quantity of food and fiber can be produced within a much smaller area than without science and specialization. The bad news is that the consequent higher land prices provide the incentive to cultivate as much as possible of the high-productivity land. That is why, in productive areas of rich countries, few patches of biodiversity remain, most of which are quite small. Low-income countries today may be headed down this same path that higher-income countries have traveled in the past, leading toward drastic declines in biodiversity while preserving only a few, small remaining islands.

As rapidly rising crop yields do not come naturally, a great deal of research and funding is required from the public sector as well as the private sector. In high-income countries, private companies tend to conduct an increasing proportion of agricultural research, playing a particularly important role when partnering with public sector entities. In contrast, in low-income countries, the private sector is much smaller and less willing to make long-term investments; consequently, the public sector plays a more important and visible role in conducting agricultural research.
Sustainability, Intensification, and the Environment

Although farmers may believe it is important to preserve their farms for their children and grandchildren, in conditions of extreme poverty they may feel forced to sacrifice future benefits in favor of present needs. Intensification, and the accompanying higher incomes, can relieve the pressure of extreme poverty and give a freer rein to achieving sustainable agriculture. Reduced poverty provides a favorable environment for education programs that reinforce sustainable practices, and such educational efforts can have a lasting impact on rural populations.

However, the processes of intensification bring to light additional issues that should be addressed through public action. Because of their rapid growth rates, high-yielding crops require substantially more plant food than low-yielding crops. Improved transportation options not only increase crop specialization, but they also help address the plant nutrient problem by facilitating production of plant nutrients off the farm. With low-cost fertilizer, it is common for farmers to err on the side of using too much, rather than too little, which may increase the chances of ground water pollution, as is evidenced in many Western countries. Public action can provide the necessary impetus to search for and implement improved management techniques.

Similarly, specialization, particularly in high-value crops, increases the profitability of using pesticides. While the same problem of overuse is likely to occur, increased education focused on using integrated pest management techniques may help improve the efficiency and effectiveness of pest control chemicals. For example, in wet tropical areas, heavy pesticide applications are not an effective method of pest control as high levels of rainfall wash away most of the chemicals; therefore, integrated pest management practices may be more useful and readily accepted by local farmers.

However, there is a fundamental problem with intensive agricultural techniques in low-income countries: the new processes require relatively knowledgeable resource managers, while most farm-worker populations are often poorly educated. Because of this, far more emphasis should be placed on developing educated farm workers with the knowledge and capacity to most efficiently use agricultural chemicals. Through research, extension, and education, the old belief that erring on the side of using too much fertilizer (or too many chemicals) is better than using too little must change. Unfortunately, neither research nor extension is being pursued sufficiently or vigorously in low-income countries, yet this is an opportunity for resource managers and farmers in Africa to learn from previous mistakes made in Asia. To do so requires thoughtful public policy and appropriate foreign technical assistance.
Intellectual Property Rights

The discovery of valuable genetic resources in areas of high biological diversity should provide greater incentives for conservation. As companies are often rewarded for developing useful chemical compounds derived from natural substances, countries and communities should also be rewarded for preserving areas of high diversity, which often contain unique, endemic species that may provide these substances. Intellectual property rights laws should be developed and upheld to provide incentives for land conservation. These legal rights can also work to ensure payments to rural community organizations, which often play a major role in biodiversity preservation. Much needs to be done to realize these potentials.

Powerful Multipliers and Linkages to Rural Non-Farm Employment: A Key to Poverty Reduction

Somewhat surprisingly, recent statistical studies, as well as earlier analyses, suggest that agricultural growth has a dominant role to play in poverty alleviation (Ravallion and Datt 1996, Timmer 1997, Mellor 1976, Ahluwalia 1978). This suggestion runs contrary to initial appearances as farmers are generally not the poorest people in rural areas. While smaller-scale farmers may not seem to benefit as much as larger-scale farmers from increased production, farmers at both levels do tend to make a better living than extremely poor people, who are generally employed by the rural non-farm sector in the same areas. However, new biological technology increases

Poverty reduction creates an economic environment within which areas of high biological diversity must be enlarged and protected. The requirement for enlarging protected areas will differ between high population density and low population density areas.
labor productivity, which means that a 10 percent increase in agricultural output may only require 3 to 6 percent more labor (Mellor 1976). The explanation of why agricultural growth is critical to poverty reduction lies with understanding where the poor are located and what they do for a living.

More than 75 percent of the poor of low-income countries live in rural areas (IFAD 2000), where they derive a modest portion of their income from farming. The rural poor may have very small landholdings or, more likely, are landless, and the families are comprised of minimally skilled individuals. Much of what they produce is low-quality non-farm goods, which are not suitable for export and would require high transportation costs to arrive at an appropriate market setting; therefore, the goods and services they produce are described as non-tradable. By extension, demand is necessarily local and, in rural areas, the income fueling that demand comes dominantly from farming (Liedholm and Meade 1987). Therefore, a linkage can be assumed: Without a massive increase in farm income, poverty will not decline. (These powerful connections between growth in farm incomes and increased production and employment in the rural non-farm sector are discussed extensively in numerous studies including Delgado 1998, Mellor 1976 and 1995, Bell and Hazell 1980, Hagblade et al. 1989, Hazell and Roell 1983, and Lee 1971.) Even microcredit and microenterprise programs for the poor fail unless farm incomes rise, which serves to create the necessary and subsequent increase in total demand for output (Hossain 1988).

Fortunately, but not surprisingly, in low-income countries the greatest concentration of poverty is in areas of high potential for growth in agricultural productivity and output, which are also the areas with substantial landless populations. It is these areas that must initially drive the process of poverty reduction as their rapid development relieves pressures to migrate, leaving people living in less-favored areas with income-generating activities. Furthermore, rapid growth in high agricultural production areas will allow absorption of in-migrants from less-favored areas, providing these people with economic opportunities in rapidly expanding market towns. Thus, development of these high potential areas is vital not only to the people of those areas, but also to the people of less favorably situated areas.

One further relationship should be noted. Agriculture itself is less capital intensive than even the labor-intensive export manufacturing industries, and the rural non-farm sector requires very little capital. Resulting from this low capital requirement, the benefits of agricultural growth, and accompanying multipliers to the rural...
non-farm sector, go largely to labor. Consequently, the impact of agricultural growth is far more evident in rising employment rates than in rising national income levels. 

Table 1 provides examples of the relationships between gross domestic product (GDP) growth and employment growth for two quite different countries: Egypt and Rwanda. In the table, the rural sector is divided into two parts: the farming sector and the rural non-farm sector, for which the bulk of incremental demand, and thus the basis for output growth, comes from rising farm incomes. By contrast, all components of the urban sector are lumped together.

In Egypt, under a fast-growth scenario as depicted in Table 1, agriculture (labeled “farm”) and the rural non-farm sector (for which agriculture provides the effective demand) comprise only 32 percent of the initial gross domestic product (GDP), account for an even smaller proportion of incremental growth in GDP (22 percent), but are linked to 56 percent of employment growth.

By contrast, in Rwanda, agriculture represents a far greater portion of GDP, accounting for 40 percent, with another 25 percent comprised of the agriculture-driven rural non-farm sector. However, in Rwanda, the rural sector accounts for an even larger 86 percent of employment growth.

Through the processes that lie behind Table 1, rapid agricultural development has been shown to eliminate poverty within the high-potential areas within a few decades of instigating this rapid growth. But, as will be shown in the following section (titled The Challenge of Poverty Reduction in Low Population Density Rural Areas), poverty in the less favored areas is much more intractable. Pockets of poverty remain in such areas not only in middle-income countries, but also even in high-income countries including the United States.3

Through agricultural intensification, better employment opportunities become available for the landless labor class. While employment in the farming sector does not rise proportionately with output, as the incomes of peasant farmers rise, these farmers do tend to reduce the input of family labor and instead substitute hired labor. Farmers’ children are relieved of fieldwork so they can attend school, and wives are allowed more time for household and child-rearing tasks.

TABLE 1: Incremental Growth of GDP and Employment in Egypt and Rwanda: Fast Growth Scenario (All numbers represent percentages.)

<table>
<thead>
<tr>
<th>Sector</th>
<th>Egypt</th>
<th>Rwanda</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial GDP (percent)</td>
<td>Share of GDP Growth</td>
<td>Share of Employment Growth</td>
</tr>
<tr>
<td>Rural</td>
<td>32</td>
<td>22</td>
</tr>
<tr>
<td>Farm</td>
<td>(16)</td>
<td>(10)</td>
</tr>
<tr>
<td>Non-farm</td>
<td>(16)</td>
<td>(12)</td>
</tr>
<tr>
<td>Urban</td>
<td>68</td>
<td>78</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Note: The “farm” and “non-farm” categories are sub-components of rural and, therefore, the values are contained within parentheses. The numbers not in parentheses add up to 100 percent.

Source: Mellor and Gavian 1999 and Mellor 2001

3 For example, in the United States, areas of Appalachia and much of the southeastern Piedmont have, until very recently, remained impoverished.
The Challenge of Poverty Reduction in Low Population Density Rural Areas

It is difficult to increase farm incomes and reduce rural poverty in areas of low population density. The people in such areas tend to be quite uniformly poor, even though population per square mile is less than in the high population density areas. Improved technology, in general, raises incomes less in these areas than in the high population density areas, and the cost per family of providing infrastructure is far higher because of the dispersion of the population. As population increases in these areas, people are driven to intensify unsustainably and, sometimes, to encroach on protected areas.

Areas of low rural population density are diverse—some suffer from low rainfall, some from extraordinarily nutrient-poor soils, and others from unfavorable topography. Each of these issues, which impact negatively upon an area’s ability to be optimally agriculturally productive, calls for a different solution. Nevertheless, in most situations, increasing soil productivity will improve the agricultural opportunities, which will subsequently increase incomes. But two problems slow that process. First, poor infrastructure makes the transportation of goods costly. Second, the total returns on the items produced are less. Even though the rate of return to small quantities of inputs may be as high as in the more responsive areas, it rarely pays in such areas to use more than a small quantity of inputs. As a result, the impact on total income is small. Sometimes investment returns to improved farming technology are higher in the low population density areas than in high-density areas—a phenomenon that usually occurs because the research for the high-density areas has slowed and the poorer, low-density areas have the chance to catch up. That slackening of the research effort rarely happens in high-income countries and it is not desirable in low-income countries.

In some cases, the resource base in areas of low population density is in fact highly responsive to the forces of modernization. Particularly, this may be the case when low-density areas begin to produce commercial export crops; however, even in such events, the low population density areas often will have poorly developed physical infrastructure, which will hinder commercial production and transport and, thus, prevent prosperity. In that case, the high cost of infrastructure per family and per unit of land will be an economic barrier to development, as is evidenced in areas of the Congo Basin. In these situations, biodiversity conservation is best served by not investing in the physical infrastructure (such as building roads that would open these areas for intensification)—and, most certainly, such infrastructure in areas of low human population density and high biological diversity should not be subsidized. One can argue that the global interest is best forwarded by taking advantage of the low population densities...
and lack of infrastructure by making payments to the sparse population for environmental services, encouraging out migration, and avoiding infrastructure investment.\(^6\)

On the other hand, in some protected areas, natural commodities—from herbs to honey—can be produced and removed without significantly disturbing natural biological processes (Peters 1994). Approaches that rely on local, natural products, and that remove products without harming the ecosystem, are attractive as their economic viability is intimately linked with the health of the ecosystem, which encourages local people to invest in protecting biological diversity. As a result, USAID has documented considerable success stories linked to these approaches. (For examples, see the box titled *The Use of Community Enterprises to Increase Rural Incomes*.)

**Enlarging and Protecting Areas for Biodiversity Conservation**

Poverty reduction creates an economic environment within which areas of high biological diversity must be enlarged and protected. The requirement for enlarging protected areas will differ between high population density and low population density areas.

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**THE USE OF COMMUNITY ENTERPRISES TO INCREASE RURAL INCOMES: CASES FROM INDIA AND NEPAL**

The Tere project in South India is located in a sparsely populated, somewhat dry, hilly area. In an effort to increase local incomes, a foreign aid-supported effort is organizing producers of non-timber resources from the area and helping to develop high-value markets for the products. The incremental income increase derived from producing the non-timber products clearly increases the incentive to preserve the resource base. However, in the longer run, incomes will not be able to keep up with higher population density areas. At that time, the extensive use of forest resources will most likely drop off, out migration will occur, and income from tourism will begin to substitute for the current non-timber sources. This process will be complicated by the ethnic differentiation of many of the people of the area, which is quite common in low population density, low-income areas.

In Humla, Nepal, which is a low population density district in the far northwest and near the Tibetan border, a community-organized integrated approach to local enterprise development is successfully raising incomes. Again, this success is from an initially low income base and the extensive development of the resources will soon hit a ceiling or increase only slowly. Development of other agriculturally favored areas, such as the low hills and the terai plains, will facilitate out migration to allow for the spreading of incomes over a smaller population. In addition, a high percentage of the remaining people in the low population density areas will engage in activities associated with tourism—an industry that is expected to increase in economic importance as facilities improve and incomes elsewhere rise.

In each of these cases, significant income enhancements will accrue to the low population density residents, although those incomes will not increase at a level on par with the continuously rising incomes of the high population density areas. To achieve the higher income levels available to people in high-density areas, low-density residents will need to out-migrate, allowing a concentration of the environmental services and tourism income to go to a smaller number of people.

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\(^6\) The Amazon and Congo Basins provide examples of low population density areas that harbor important pockets of biodiversity.
Enlarging Biodiversity Reserves

In high population density areas, the value of land is high and will continue to be driven higher by the processes of intensification. Those areas tend to have a long history of cultivation so patches of high biodiversity are small, but they do exist: for example, parks and national forests in the terai grasslands of Nepal, Corbett Park in the terai grasslands of India, the Gorilla Parks in Rwanda and Uganda, and Nairobi National Park in Kenya, among others. While these parks tend to be small, the biodiversity they protect is important as it is representative of the productive soils and forests of the area. In addition, these relatively urban parks provide important benefits to the nearby human populations, including ecosystem services and recreational opportunities.

Given rapidly rising land values, it is urgent to enlarge reserves before the costs become prohibitive. In areas of high population density, land values are initially higher than in low population density areas. Even so, development of agriculture greatly increases the difference in prices. That makes for difficult decisions about where to allocate resources for reserve expansion. For example, conservation groups and governments must make choices such as whether to protect small parcels of land in high population density, productive areas or larger parcels located in lower productivity, less populated areas.

However, it is important to note that, even within responsive production areas, there are often modest-sized areas of low agricultural productivity (e.g., in temperate latitudes, farmers may leave clusters of trees in areas of intensive agriculture). Because these areas are not optimal for agriculture, they may represent parcels of land that could be, relatively easily, set aside as biodiversity preserves. Moreover, linking these small areas of biodiversity using corridors may improve opportunities for species preservation through allowing for genetic diversification, habitat enlargement, and migration pathways. While the cost per unit area tends to be high for wildlife corridors, this method can ensure significant benefits to biodiversity.

One can argue that global interest is best forwarded by making payments for environmental services in low population density areas, encouraging out migration, and avoiding infrastructure investment.

Once priority conservation areas have been identified, implementation considerations should include substantial financial reimbursements to ensure that market-related levels of compensation are provided to the small farmers who are asked to reduce their claims to land.\footnote{\textsuperscript{5} The taking of land by government, without proper compensation for the landowners, is neither an ethical nor a sustainable approach, although it does occur in many low-income countries.} And because the conservation of these diverse areas benefits not
only the local, immediate populations but truly
the entire world, wealthier local citizens, as
well as conservation groups and international
governmental organizations, should help support
these efforts.

As shown previously, land values are low in the
low population density areas. The processes of
intensification in more responsive areas tend to
further lower land values in the low population
density areas as productivity and labor are drawn
away from those areas. Thus there is less urgency
to enlarge reserves in the low-population areas.
However, the sooner reserves are enlarged, the
sooner the potential for tourism will be realized
and the sooner local people will start to see
benefits from conservation.

Protecting High-Priority Conservation Areas

Areas of high biological diversity must be
conserved, which requires monetary resources in
addition to a well-organized and committed
community. Several key questions arise from
these needs, including how funds specifically
earmarked for conservation should be transferred
and, once they are transferred, who will provide
custodianship for the funds. Clearly, the most
appropriate people to administer the conservation
fund are community members, working together
within a community-based management organiza-
tion. If that is the case, formal measures need to
be developed, including those that regulate
payment for environmental services and a
process for providing the funds for protection.
As in the case of reserve enlargement, protection
has somewhat different circumstances in high
and low population density areas.

In the high population density areas, with rapidly
increasing farming intensity, protection occurs in
a context of increasing value of the land and
hence increasing incentive to encroach.
Concurrently, the value of destruction by animals
moving out of the preserves is increasing rapidly
with farming intensification.

Even on high-productivity, high population
density lands, the local population can benefit
from preserving areas of biological diversity.
These protected lands can provide aesthetic
and utilitarian values, potentially even helping to
mitigate the effects of predators within agricul-
tural and pastoral systems. However, the largest
gain is most likely to come from watershed
protection as forested lands and particularly
wetlands provide natural filtration services,
helping maintain healthy and functioning hydro-
logical systems. Local people need to work to
protect natural areas, while also supporting the
expansion of land for corridors and enlargement
of existing protected areas. Payment to local
residents for protection of resources that provide
environmental services can encourage more
sustainable and intensive local support of biodi-
versity conservation measures (Reed 1996, 2001).
In many respects, ensuring the conservation of biodiversity in low population density areas is much easier than doing so in high population density areas. Given the less intensive farming methods and less extensive agricultural lands in the low-density areas, the damage by wandering animals is less and hence the costs of compensation and protection are less. Also, because the populations adjacent to protected areas tend to be small in low-density areas, a higher proportion of that population will receive economic benefits from environmental service payments—a phenomenon that will only increase as out migration further reduces the population of low-density areas.

However, it will be difficult even to protect low population density areas without concurrent efforts to raise local incomes. In these areas, economic benefits derived from the protected lands accrue to a considerable portion of the population, whether through the harvest of timber or non-timber products, gathering of food-stuffs for subsistence purposes, or providing grazing and fodder for livestock. Many of the timber and non-timber products have a market in high-income countries (Peters 1994); therefore, technical assistance is needed to organize communities to protect their resources at the same time as drawing upon the flow of goods from the areas. In addition, better access to high-income markets is crucial for developing a long-term, sustainable flow of timber and non-timber microenterprise products from low population density, low agricultural intensity areas. Products that can be harvested from these areas and then sold in high-income markets include a wide range of medicinal products, honey, and exotic fruits and berries.

In recognizing that these small niche markets cannot support an income increase for large numbers of people, it becomes clear, though, that the bulk of the poverty problem must be solved elsewhere, as discussed in previous sections. However, for the relatively small number of people living in the low population density areas, a doubling of incomes, due to small business development focused on non-extractive products, may be conceivable.

Tourism is another example of an income-generating activity that cannot raise the incomes of large numbers of people, but that may be successful in low population density areas, where economic gains from tourist activities can make a major impact on raising the income of the poor. Again, technical assistance and thoughtful organization are needed as tourism is generally a capital-intensive business. Tourist enterprises require a great deal of capital to develop the transportation and hotel facilities to address the needs and wants of visitors. On the other hand, low-cost and low-end tourism may not require as many capital inputs, but it is also lower in employment requirements so, in the end, the ratio of capital input to employment benefits is comparable. Examples of successful tourism enterprises would include those in Nepal's rain shadow areas, which also possess low population density. However, in the higher population density areas of Nepal, tourism has provided little economic benefit for the mass of local people, which is similar to the situation in high population density areas surrounding the major tourist attractions of Luxor, Egypt.

Community Organization

As the rural economy grows and differentiates, increasing opportunities arise for people to join together and organize to realize mutual benefits. At the farm operator level, organizations may include groups focused on marketing strategies and technology provision. In the rural non-farm sector, organizational opportunities may include groups that work to recognize, promote, and equitably distribute benefits from nearby protected areas, including benefits from activities such as tourism, marketing of niche commodities from the protected areas, and credit programs to support expanding small industries.
Conservation and development projects have now had a great deal of experience in organizing community groups to manage forest resources (e.g., Shilling and Osha 2002). These experiences need to be expanded and drawn upon to pull out lessons applicable to biodiversity conservation strategies. The proximity and close personal identification with local resources allow community groups an advantage in understanding and lobbying for protection and conservation of high biological diversity areas. And an additional benefit to having local groups take the lead on protection efforts is that costs are inevitably lower than when outside groups are involved. Finally, experience with forestry groups suggests that local community groups have a clearer and stronger conviction regarding the importance of protecting resources for the future, as compared to less connected and more economically driven populations. Local community groups have been shown to highly value the conservation of natural resources, holding the resources in trust and managing them wisely for future generations.

As there may be costs involved with organizing local groups, some outside input and support are generally needed to get them off the ground. Also, the local groups often need continuing, subsidized funding to cover operating costs and environmental services payments may be a logical way of covering those costs (Balvanera 2001).

**Land Tenure and Titling**

The driving force of rural employment growth, linked to intensified agriculture, comes from the increased income expenditure by farmers. However, if agricultural lands are concentrated in the hands of wealthy people—particularly wealthy
people who do not actually live in the local area—local expenditures will not help reduce poverty. Because the driving force of rural employment growth is the expenditure of increased farm incomes on locally produced, employment-intensive goods and services, rich landowners who spend their money on imports and capital-intensive goods and services do not contribute to alleviating local poverty. However, because there is not a good alternative to agricultural growth for reducing poverty, poverty reduction has proven to be relatively intractable in places such as in Latin America, the Sindh of Pakistan, and a few places in Africa, particularly southern Africa, where large landholdings by people who do not spend much locally are quite common.

In countries where this problem is prevalent, development efforts should focus on areas dominated by small farms, which are often concentrated in upland areas. These upland small-farm holdings represent potential for increased productivity, particularly in export markets.\(^6\) When working for poverty alleviation through this method, the emphasis must be on measures to increase incomes by large multiples. That requires producing commercial crops and solving the difficult problems of smallholder access and success in such crops.

Of course, land reforms that divide large holdings among numerous small farmers represent a boon to poverty reduction. Unfortunately, policies that support this type of land reform are difficult to create and enforce. In such areas, political systems are mainly dominated by wealthy and corporate interests, and the foreign policy of rich countries is often not sympathetic to radical change in power structures. Compounding the problem, institutional structures in areas of great inequity in landholdings are traditionally suited to more easily manage and reward large holdings. For these reasons, major institutional change must accompany land reform. From both a growth and equity point of view, radical land reform is a good idea. However, this type of land reform, which drastically shifts political and economic structures toward favoring multiple, small landholdings, does not seem to happen except when foreign armies are involved, such as in Japan and Taiwan.\(^7\)

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\(^6\) For example, the highest quality coffee is produced at higher elevations where the farms tend to be small (such as in the highlands of Guatemala), and these represent areas that also possess potential for producing high-value horticultural crops.

\(^7\) In the case of Japan, General Douglas MacArthur imposed land reforms as part of the post-World War II peace process. In Taiwan, land reform was instigated by the military following China’s communist takeover in 1949.
In noting the negative effect of large landholdings, a critical issue is the expenditure patterns of those benefitting from agricultural advance. For example, peasant farmers with holdings two or three times the average do increase production rapidly in response to new income opportunities and their expenditures drive the local economy and local employment. On the other hand, large absentee landowners do not spend their money locally.\(^8\)

A complex yet related issue is the titling of land. At its simplest, providing community title to conserved land undoubtedly encourages cooperation and organization of community members. Title to land also leads to a longer-term view of the income from and use of land, both of which support future-oriented conservation mentalities and approaches. However, if the local people are not properly educated about the benefits and procedures associated with individual titling of land, the process may lead to land grabs by the wealthier, more informed political elite. While the principle of individual title to farmed land and community title to shared resources makes sense, great care has to be taken to ensure that the benefits of applying the principles are realized equally by all people.

\(^8\) For example, in Guatemala, many landowners do not spend in the local rural economy, but rather in the capital city and abroad.
Foreign Aid, Agricultural Development, and Biodiversity

The primary problem in the pursuit of biodiversity in low-income countries is the urban bias of the political systems. This bias leads to inattention to critical public goods, such as rural roads and agricultural research, required to accelerate agricultural production in a manner that will sharply reduce poverty. Further, within urban-focused political agendas, rural poverty reduction is not a priority, which makes it difficult to develop biodiversity conservation policies that are linked to poverty reduction.

Exacerbating the issue, many high-income countries have pursued foreign aid programs that have also neglected agriculture and supported the existing urban bias. Foreign aid agencies have done little clear thinking about how to preserve biodiversity in the several quite contrasting types of situations of high and low population density and therefore have failed to capitalize on complementary relationships between agricultural development and biodiversity conservation.

Typically, developing countries of Asia and Africa achieved independence under urban-based movements and, consequently, the resulting governments have been highly urban biased. Since independence, governments have maintained the urban bias, often reinforced by fear of unrest by urban populations, which can mobilize against political systems more easily than can rural populations. The urban focus of many governments has resulted in under-investment in rural infrastructure, lack of funding for institutions related to technology generation and dissemination, continuously rising rural poverty levels, and massive encroachment on protected areas.

The primary problem in the pursuit of biodiversity in low-income countries is the urban bias of the political systems.
In the early decades of foreign aid, many programs were particularly interested in funding national groups involved with agriculture and related issues, which resulted in much more emphasis on agriculture than the governments would naturally have provided. This emphasis, in fact, accelerated overall growth and had dramatic effects on poverty reduction. In Asia, typically, poverty declined by one-half or more in the 1970s and 1980s (Ravallion 1995), and statistical analyses show that on the order of 85 percent of that decline in poverty was due to the direct and indirect effects of agricultural growth (Ravallion 1995; Ravallion and Datt 1996; Timmer 1997).

Just when the green revolution was at its peak impact, foreign aid started turning sharply away from the agricultural emphasis. Between 1987 and 1997, USAID reduced by 80 percent its support for agriculture and released the bulk of its agricultural technicians. Other donors, including the World Bank, followed suit. As a result, poverty reduction in Asia has slowed and poverty has increased in Africa, as well as in those Asian countries that were at an African stage of development (e.g., Nepal). It is notable that, as overall foreign aid has declined in the past decade, agricultural programs have absorbed all of the budgetary reductions, while other sectors have actually seen an increase in their collective budgets.

What explains the decline in funding for agricultural programs? First, the decline can be traced to the very success of the Green Revolution, which prompted thoughts that it was time to move on to second-generation problems, such as emphasizing broader participation and social programs. However, aid agencies and development organizations did not realize that the first-generation problems had not yet been fully solved in Asia, and they had not even been approached in Africa. Second, agricultural surpluses in the wealthier countries lessened enthusiasm for further developing agricultural solutions in poor countries. And, some environmentalists, observing problems with fertilizer in countries like the Netherlands, which applies 800 kilograms of nutrients per hectare, applied those same concerns to developing countries such as Rwanda, which uses only 2 kilograms per hectare. However, now aid agencies and development organizations are finally reverting to a focus on agriculture in foreign aid, recognizing the important role played by agriculture in poverty alleviation and food production.

The Action Program to Preserve Biodiversity

The action program for low-income countries and foreign aid donors that follows from the preceding analysis includes the subsequent five components.

1. Agricultural development, based on intensification, globalization, and rapidly improving technology, is a primary factor in poverty reduction and enlarging biodiversity conservation areas.

2. In the context of intensified agricultural development, protected areas that house high concentrations of biological diversity need to be enlarged. Enlarging protected areas will rapidly become more expensive in the areas of agricultural intensification, which are also often the areas of greatest biodiversity. The rising land values add urgency to this task, which is one that will fail if large transfers of funds from rich countries to poor countries are not made. By contrast, in areas of low population density, opportunities remain for obtaining large tracts of land at declining cost; but, for that to occur, short-term opportunities for raising the incomes of poor people living in low-density areas must be grasped. Strategies for raising rural incomes include modest improvements in farming technologies, coupled with providing income for working in, as well as protecting, biodiversity-rich areas. In the longer run, migration to urban
areas and prospering rural areas will be essential because, as migration occurs, the remaining families will see an increase in the incomes gained from conservation-oriented uses of protected areas (including appropriate forms of tourism).

3. As areas of biodiversity are enlarged, good stewardship becomes increasingly important. Community participation and management rely on encouraging local people to organize and provide efficient and effective stewardship at low cost. Another key aspect of community management is that channels and funds must be developed to ensure that the costs that are incurred are covered through appropriate payment for environmental services. For organized community groups to succeed, the local people must have legal and uncontested ownership of the land of which they are stewards, which is likely to require lifting and related political actions.

4. To grasp fleeting opportunities, foreign aid must be attuned to the technical and financial needs of agricultural intensification in high population density rural areas. At the same time, foreign aid must be earmarked to support expansion of reserves and to finance community organizations. In particular, as international financial institutions pursue macro-level policy reforms, they must be sensitive to the interacting public goods requirements for agricultural intensification (e.g., rural roads, agricultural research, teaching improved management, and developing rural financial markets), poverty reduction, and biodiversity conservation.

5. Large environmental NGOs, focused on biodiversity, land preservation, and species conservation, need to broker compacts between foreign aid donors from high-income countries and governments of low-income countries pursuing poverty reduction and biodiversity conservation. The involved low-income countries must also work with major international financial institutions while also enlisting their own bilateral programs. However, conservation NGOs must recognize that a single-minded approach to enlarging protected areas, without a major assault on poverty and cooperative programs in the buffer zones, will not work. The compact between high-income and low-income nations must clearly ensure that substantial benefits will accrue for all parties that are essential to the compact’s long-term success.

Partnerships between rich and poor countries, achieved in the context of understanding the needs and the urgency of addressing biodiversity conservation and poverty alleviation at the same time, will ensure success and work toward a more global sense of responsible stewardship.


Agriculture practices in countries around the world have multiple and enduring impacts on the environment and on biodiversity conservation. Agriculture is one of the most widely-spread productive activities, using nearly 40% of the earth’s land surface, providing sustenance for us all and generating direct employment or livelihoods for the vast majority of rural dwellers worldwide. As a result, agriculture occupies a central place in the quest for economic betterment for a large proportion of the people who are poor and live in rural areas.

As stated in WWF’s Global Agriculture Network Initiative, expanding the agricultural frontier in countries around the globe is largely responsible for the destruction of nearly 17 million hectares of forests each year. That land use conversion process has consequently become a leading driver in loss of topsoil and sedimentation of freshwater and marine systems. Moreover, excessive use of chemicals in input-intensive production systems has caused pollution of freshwater reserves with attendant consequences for the world’s ecology and human health.

In this paper, John Mellor looks at this dilemma — at the need for supporting agricultural productivity growth, on the one hand, and the challenges and opportunities for biodiversity conservation on the other. His analysis examines the complex interplay in countries with different levels of national income and different potentials for intensifying agricultural production. John Mellor is uniquely qualified to offer this analysis. He brings a long and distinguished record of scholarship and policy advice in the field of agricultural development combined with a strong personal interest in nature and its protection.

Injecting controversy into the debate on the links between poverty and the environment is urgently needed because of the hold that preconceptions and biases exert over both the debate and programmatic interventions to address poverty-environment dynamics. We look forward to your comments and reactions and we hope that this Viewpoint series can contribute to breaking down some of the walls that restrain our collective efforts to address these complex, urgent issues.

David Reed
Director

John W. Mellor

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Poverty Reduction and Biodiversity Conservation: 
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BY JOHN W. MELLO