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Why are Incentives for Agrobiodiversity Conservation and Use Necessary?

The importance of agrobiodiversity and accounting for its total economic value

Agricultural biodiversity is the basis of human survival and well being. However, despite its importance, agricultural biodiversity at the ecosystem, species and genetic levels continues to be lost at an accelerating pace. Causes of such loss include indiscriminate replacement, changes in productions systems, changes in consumer preferences, market development and globalization, misguided government interventions (including preferential subsidies), disease epidemics, natural disasters and civil strife.

A key constraint to implementing conservation strategies is that while the benefits of agricultural biodiversity are increasingly recognized, their full value is often not fully accounted for by individuals and society. This is because many components of agricultural biodiversity provide a mixture of benefits to the farmer (i.e. private benefits, for example related to the production of food, fodder and fibres) and benefits to wider society (i.e. public benefits, for example related to agroecosystem resilience and the maintenance of evolutionary processes and future options). Markets capture only a part of this total economic value and thus underestimate the true value of these resources, thereby creating a bias against activities compatible with conservation and sustainable use. Much of the on-farm conservation of agrobiodiversity is being done by poor farmers around the world at their personal cost. Hence the costs of conservation tend to be local (i.e at the farm level), while the benefits tend to be regional, national or even global, poor farmers cannot be expected to be able to afford to conserve PAGR purely for the benefit of wider society without adequate incentives to do so. The following graphs and explanation help us to understand why this is so.

Quinoa varieties (Bolivia/Peru)

A conceptual framework for the loss of agrobiodiversity

The erosion of agrobiodiversity may be seen in terms of the replacement of the diverse existing pool of local plant and animal genetic resources (PAGR) with a smaller range of specialized improved ones. Such replacement takes place as part of a process of development through intensification, i.e. the manipulation of inputs and outputs in order to increase agricultural growth.

Local PAGR may be expected to perform better than improved PAGR in marginal production environments, which have only been slightly modified by external inputs. With agricultural intensification, improved PAGR (developed for productive traits under modified environments) become more productive because of their higher responsiveness to external inputs, especially in areas which are favoured in terms of agronomic potential and market access.

Finger millet (India)

As can be seen in Figure 1, the local PAGR would outperform the improved PAGR in terms of the income it generates for farmers up to a given level of production system intensity[1], I*(0). After I*(0) is reached, farmers find it increasingly attractive to replace the local PAGR with improved ones, as the Improved PAGR (0) curve is now above the Local PAGR (0) curve. Convincing farmers to maintain local PAGR beyond this point would require an adequate incentive or payment to compensate the farmer for the opportunity cost associated with not planting the improved variety. The size of the incentive required can be determined by the gap between the two curves beyond I* (0).

But why would the creation of such incentives be justified? Wouldn't such interventions interfere with the process of agricultural growth and the generation of income? In fact, there are a number of reasons which suggest that the replacement of local PAGR with improved PAGR is taking place too early when it occurs at I*. Instead such replacement should only take place at higher levels of farm intensification, as represented by I*'in Figure 2. These reasons include the fact that:

[1] The term 'intensity' is used here in a broad sense and includes, inter alia, factors related to the use of external inputs, access to markets and extension services.

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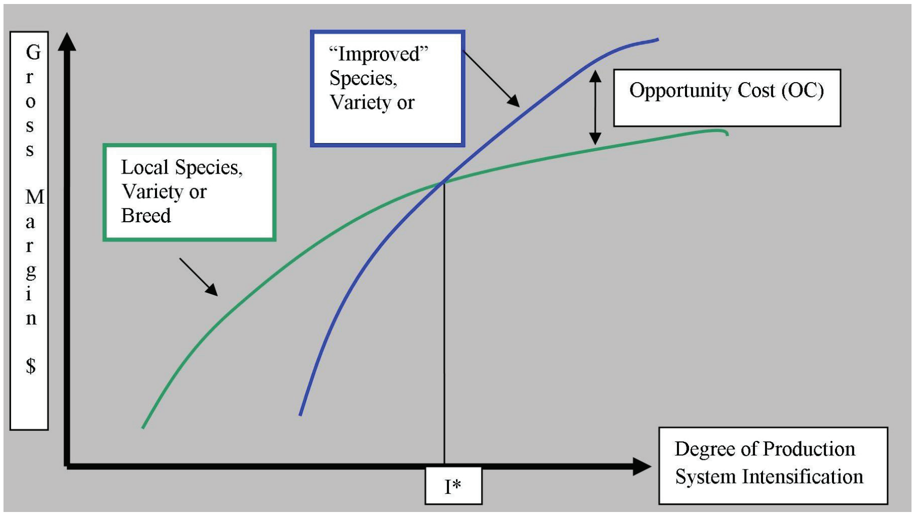

Figure 1: Economics of Agrobiodiversity Replacement (Financial/Private Perspective)

1) Significant non-market and/or public good values associated with conservation are ignored. This is particularly likely to be relevant in the case of agrobiodiversity. Private good characteristics are not only limited to the direct use values associated with the production of food, fodder and fibres, but also include the private benefits associated with using agrobiodiversity to minimise risks related to external shocks, such as climatic events and pest and diseases. However, at the landscape level, the use of agrobiodiversity also plays a public good role in supporting agroecosystem resilience, maintaining socio-cultural traditions, local identities and traditional knowledge, as well as the maintenance of evolutionary processes, gene flow and global option values.

2) An overestimation of the performance of improved PAGR may have occurred, for example, as a result of lower than expected on-farm yields compared to those on experimental stations and the existence of unanticipated environmental impacts.

3) The existence of preferential subsidies for improved PAGR use makes them artificially more attractive. Such subsidies can take many forms, including the free availability of improved seeds, capital subsidies for inputs such as fertilizer or pesticides, free or subsidised support services, or subsidized market prices for selected crops.

As a result of such reasons, farmers are likely to face financial (i.e. private) incentives that are not be in accordance with economic values ((i.e. public values that include non-market benefits and costs), so that what would be the socially optimal replacement point may well be to the right of I*, meaning that current replacement is resulting in the maintenance of a less than socially optimal amount of agrobiodiversity. While the precise distance between I* and I*' is determined by the relative elasticities (slopes) of the local and improved PAGR curves, it is possible to draw some general conclusions from this simple analytical model.

a. To the left of I* farmers may be assumed to have financial incentives not to replace local PAGR and thus conserve that what provides high economic values.

b. Only beyond I*', replacement of local PAGR by improved PAGR would be financially and economically justified (although this cannot be used to justify replacement to the point of extinction).

c. A replacement that takes place between I* and I*' is associated with a sub-optimal loss of local PAGR, insofar as while the replacement appears financially desirable from a private/farmer perspective, it cannot be economically (socially) justified. This is because the additional loss of non-market values outweighs the benefits of the replacement.

As shown in Figure 2, policy interventions to reach the optimal replacement point and thus optimal level of agrobiodiversity conservation services, would include: (a) accounting for negative externalities and removal of preferential subsidies (in order to address [2] and [3] above), which would shift the curve for improved PAGR downwards to the right (to IMPROVED'); and (b) where significant non-market and public values of local PAGR exist (as per [1] above), further mechanisms need to be put in place to permit the 'capture' of the total economic values associated with local PAGR so as to shift the curve for local PAGR upwards to the left (to LOCAL').

Such mechanisms could include:

- Niche product market development for products associated with local PAGR
- PES-like rewards for the on-farm utilization of local PAGR, so-called PACS.

The latter could also be applied in order to reach I*' even when not correcting for (2) and (3), or to motivate farmers to conserve local PAGR at points to the right of I*' –e.g. for the purposes of avoiding irreversible losses by establishing a sustainability constraint-, as long as they compensate farmers at least for their opportunity costs[2] of using local PAGR.

Niche product market development and its complementarity with PACS

Niche product market development for agrobiodiversity-related products is increasingly being promoted as a means of sustainably achieving conservation through

[2] In this context, opportunity costs are the forgone benefits of cultivating local PAGR instead of more financially attractive improved PAGR.

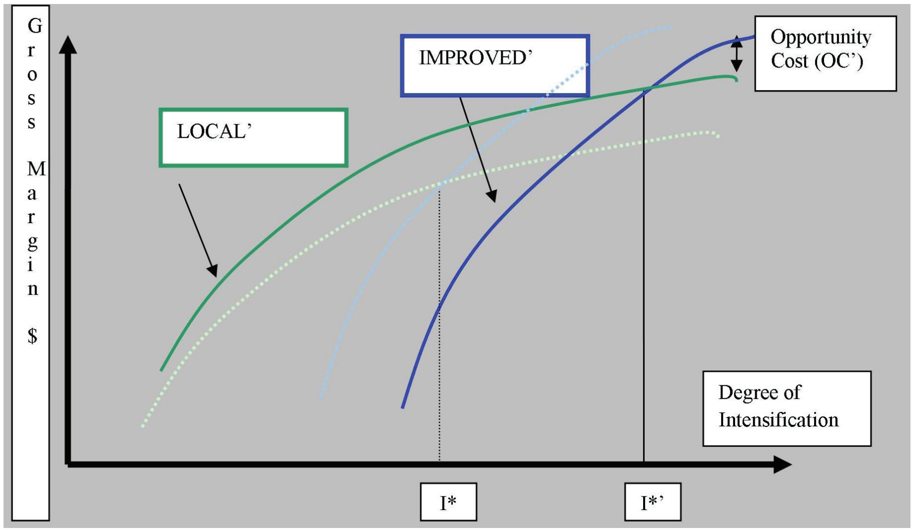

Figure 2: Economics of Agrobiodiversity Replacement (Economic/Social Perspective)

use. Such "conservation-linked value chain development approaches" can potentially be more sustainable, as they build on existing agricultural market channels and thus could be used to generate a sustainable source of funding.

But it should be noted that relying solely on market development might be a dangerous strategy for the conservation of a diverse genetic resource pool, especially as market conditions can change rapidly and generally consumers and agribusiness tend to favour a narrow suite of crop species/varieties or animal breeds.

Market chain approaches may also require relatively high initial investments to generate appropriate product volumes, with such volumes being far in excess of those required to achieve modest conservation goals, and where overly successful may even displace other threatened PAGR (leakage effect).

In this context, PACS schemes might be capable of providing a stronger and more flexible longer-term foundation for conservation activities, and may be better suited for ensuring the *in-situ* conservation of safe minimum populations of PAGR.

Niche market development and PACS can thus be viewed as complementing each other. In fact, a broader conservation strategy could incorporate a mixture of incentive instruments, and as such could combine niche market development with PACS schemes.

Key Points:

Agricultural biodiversity needs to be properly valued and mechanisms put in place to permit the "capture" of those values by the farmers who incur the conservation costs, thereby providing them with an incentive to conserve that which benefits wider society. This requires the development of appropriate economic methods, decision-support tools and policy intervention strategies.

While one potential instrument for non-domesticated biodiversity conservation - i.e. "payment for ecosystem services (PES) - has been hailed by some observers as "***arguably, the most promising innovation in conservation since Rio 1992***", payments for ecosystem services (PES) schemes have, to date, not addressed agrobiodiversity issues per se. Instead they have tended to focus on carbon sequestration and storage; non-domesticated biodiversity protection, watershed protection and protection of landscape aesthetics.

The ability of agrobiodiversity-related PES, so-called "payment for agrobiodiversity conservation services" (PACS) schemes to permit the "capture" of public conservation values at the farmer level, thereby creating incentives for the conservation of agrobiodiversity and supporting poverty alleviation, therefore, appears to be well-worth exploring.

Further suggested reading and full citations:

Narloch, U., Drucker, A.G. and Pascual, U. (Forthcoming). Payments for agrobiodiversity conservation services for sustained on-farm utilization of plant and animal genetic resources. Ecological Economics.

The above is part of Bioversity International's Payment for Agrobiodiversity Conservation Services programme of work, which has support from the Syngenta Foundation for Sustainable Agriculture (SFSA) and the CGIAR's System-wide Program on Collective Action and Property Rights (CAPRi). Research was carried out in collaboration with the M S Swaminathan Research Foundation (MSSRF), India; the Fundación para la Promoción e Investigación de Productos Andinos (PROINPA), Bolivia; the Centro de Investigación de Recursos Naturales y Medio Ambiente (CIRNMA), Peru; and the Department of Land Economy, University of Cambridge, United Kingdom.