

Where's the beef? The economics of AnGR conservation and its influence on policy design and implementation

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Summary

The field of economics of agrobiodiversity (ABD) conservation and sustainable use has developed rapidly during recent years. A state-of-the-art review found that advances have indeed eased methodological/analytical constraints. A wide range of decision-support tools and analytical approaches have been successfully tested. These have been shown to provide good estimates of value and be useful for answering policy-relevant questions.

Yet despite this, this field would appear to have had relatively little influence on “real-life” ABD conservation policy design and implementation. An analysis of the national reports in the FAO's (2007) State of the World's AnGR (SoW) supports this view and reveals, at best, a patchy recognition of the importance of valuation and the potential future role of economics in the design of cost-effective conservation programmes. Potential reasons for this include a lack of awareness regarding the existence of appropriate methods and decision-support tools, data availability issues and a lack of capacity to both collect the necessary data through participatory mechanisms as well as to carry out the subsequent analysis. Translating the existing recognition of the importance of economics within the Global Plan of Action on AnGR into a mainstream activity will require significant awareness raising and capacity building.

Keywords: *Economics, AnGR conservation, impact, policy design*

Résumé

Le domaine de l'économie de la conservation et de l'utilisation durable de la biodiversité agricole s'est rapidement développé au cours des dernières années. Un examen de l'état actuel des réalisations a indiqué que les progrès ont effectivement diminué les contraintes méthodologiques et analytiques. Un large éventail d'outils d'aide à la prise de décisions et d'approches analytiques ont été testés avec succès et ont montré qu'ils peuvent fournir des estimations adéquates de la valeur et être utiles pour répondre aux questions relatives aux politiques.

Pourtant, malgré cela, il semblerait que ce domaine ait eu une influence relativement faible sur la conception et sur la mise en œuvre de politiques concrètes de conservation de la biodiversité agricole. L'analyse des rapports nationaux soumis pour la préparation de L'état des ressources zoogénétiques dans le monde (2007) de la FAO soutient ce point de vue et révèle, au mieux, une reconnaissance irrégulière de l'importance de l'évaluation et du rôle potentiel, à l'avenir, de l'économie dans la conception de programmes de conservation rentables. Les raisons potentielles de cette situation sont, entre autres, le manque de sensibilisation concernant l'existence de méthodes appropriées et d'outils d'aide à la prise de décisions, les problèmes relatifs à la disponibilité des données et le manque de capacités tant dans la collecte des données nécessaires par le biais de mécanismes participatifs que dans la réalisation des analyses ultérieures. Pour transformer la reconnaissance actuelle de l'importance de l'économie dans le cadre du Plan d'action mondial pour les ressources zoogénétiques en une activité de premier plan, il faudra entreprendre des actions de sensibilisation et de renforcement des capacités considérables.

Mots-clés: *Economie, conservation des ressources zoogénétiques, impact, conception de politiques*

Resumen

El campo de la economía de conservación y utilización sostenible de la agrobiodiversidad se ha desarrollado rápidamente a lo largo de los últimos años. Una revisión del estado de las tecnologías de vanguardia ha evidenciado que los avances han dado pie a limitaciones metodológicas y analíticas. Se han probado con éxito una amplia variedad de herramientas para la toma de decisiones y enfoques analíticos. Éstos se han mostrado para proporcionar buenos cálculos de valor y para ser útiles a la hora de responder a las cuestiones políticas pertinentes.

Pero a pesar de esto, este campo parecería haber tenido relativamente poca influencia sobre el diseño e implementación de la “vida real” de políticas de conservación de la agrobiodiversidad. Un análisis de los informes nacionales en la Situación de los Recursos Zoogénéticos Mundiales para la Alimentación y la Agricultura de la FAO (2007) apoya esta visión y revela, en el mejor de los casos, un desigual reconocimiento de la importancia de la valoración y el potencial futuro papel de la economía en el diseño de

programas rentables de conservación. Las razones potenciales para esto incluyen la falta de conciencia relativa a la existencia de métodos adecuados y herramientas para la toma de decisiones, disponibilidad de datos y falta de capacidad, tanto para recopilar los datos necesarios, por medio de mecanismos de participación, como para llevar a cabo análisis posteriores. Extrapolando el reconocimiento existente acerca de la importancia de la economía dentro del Plan de Acción Mundial sobre los recursos zoogenéticos para una actividad dada, se requerirán grandes dosis de concienciación y creación de capacidad.

Palabras clave: *Economía, conservación de AnGR, impacto, diseño de políticas*

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The economics of AnGR conservation

Animal genetic diversity contributes in many ways to human survival and well-being. In spite of its importance, livestock diversity continues to be lost from many production systems throughout the world. Sixteen percent of livestock breeds were lost over the last 100 years and over 20 percent of the remainder are at risk. Such AnGR erosion is much more serious than in crops given that the gene pool is much smaller (6 000–7 000 breeds/strains of some 40 species) and the fact that there are few wild relatives. Major reasons for this loss include indiscriminate breed substitution and replacement, changes in production systems, changes in consumer preferences, market development and globalization, misguided government interventions (including subsidies), disease epidemics, natural disasters and civil strife (Hall and Ruane, 1993; Rege and Gibson, 2003; FAO, 2007).

For ecological economists, such loss is the result of a conversion process (Swanson, 1997) from diverse to specialized production systems that allow different types of economic value to be more easily appropriated by humans and hence underlies the process of economic growth. However, this conversion process may go well beyond its optimum point due to the fact that the goods and services provided by agrobiodiverse resources have significant non-market values associated with them. The inadequate assessment of the total economic values of indigenous breeds (i.e. beyond just meat and milk production, but also including manure, traction, finance and insurance functions, socio-cultural values and future option values – e.g. for confronting future climate change and new diseases) means that the (private) financial profitability and the (public) economic value to society as a whole of indigenous breeds is frequently underestimated. This generates a bias towards investment in specialized genotypes, which in turn results in underinvestment in a more diverse set of breeds.

Farmers nevertheless cannot be expected, nor can afford, to safeguard public good values (e.g. the conservation of unique genes and breeds for their global/national option and existence values) without the appropriate incentives to do so. The fact that such incentives are largely absent or even heavily biased towards non-indigenous breeds (a below average \$265 billion was spent on support to

producers in the OECD area in 2008 [OECD, 2009, p. 5]) is a failure of national policy frameworks, as well as associated underfunding and lack of capacity. The existence of both bias and a lack of incentives means that as the development process proceeds and farmers can afford more and often subsidized inputs (e.g. fertilizers, mechanization, feed, veterinary care artificial insemination and transport to market), they will find it profitable to move away/convert from using breeds (usually indigenous) appropriate for low-input/low-output systems. Furthermore, they will tend to do so at a much earlier point in the development process than they would have otherwise and may even do so in inappropriate situations (Drucker and Rodriguez, 2009).

Effective policies to stem this loss require improved tools and the capacity to both properly account for the values associated with the services and benefits derived from agrobiodiversity (ADB), as well as to design appropriate instruments to capture such values. The capture and channelling of such values back to the local level in the form of conservation incentives¹ are necessary to overcome a spatial mismatch, where conservation costs incurred are largely local, whereas the benefits are often national and global. Without such tools, cost-effective interventions can neither be designed nor implemented. Economic analysis might be expected to play an important role in orienting such policy design and implementation, including with regard to: (i) Determining which traits and functions (both marketed and non-marketed) are the most important and to what extent can they be traded off against each other? (ii) How important particular local breeds are to livelihoods and how such values can be harnessed to support poverty alleviation efforts? (iii) Which breeds should be conservation priorities (given that we cannot save everything)? (iv) What the costs of ABD conservation programmes are and how we can minimize them?

State of the art

Spurred by the growing concern regarding genetic resource erosion and in order to address such questions, the field of

¹ The utility of one such incentive mechanism is being explored through on-going work at Biodiversity International related to the application of payment for environmental services concepts to ABD conservation *per se*.

economics of ABD conservation and sustainable use has developed rapidly during recent years, with the applied economics literature related to plant genetic resources (PGR) having a somewhat longer history than that of AnGR. A state-of-the-art review (Drucker, Smale & Zambrano, 2005; Smale and Drucker, 2007²) of the literature, commissioned by the CGIAR's System-Wide Genetic Resources Programme, covered over 170 publications (both livestock and plants). See also the SoW (FAO, 2007, pp. 429–442) for an additional review of the AnGR economics literature. These reviews found that advances in economic valuation have indeed eased methodological/analytical constraints. A wide range of decision-support tools and analytical approaches have also been successfully tested on a number of crops/species and breeds, in a number of production systems and locations, both *in situ* and *ex situ*. An impressively lengthy list of these tools and methods includes: econometric methods; optimization models (including Weitzman); Monte Carlo simulations; search theoretic frameworks; contingent valuation and choice experiments; production loss, opportunity cost, least-cost and safe minimum standards methods; economic surplus methods; cross-sectional farm and household methods; farm simulation and breeding programme evaluation; and the use of genetic production functions. This body of research consequently provides a useful, but as yet largely unapplied, framework of knowledge on the ways in which improved valuation of the components of ADB (i.e. crop, livestock, forest and aquatic) can contribute to optimal investment allocations and policy decisions.

Yet despite the apparent policy relevance of economics in supporting ABD policy, there would appear to be relatively little uptake and use of such tools and methods. Consequently, the influence of economics in ABD conservation policy³ design and implementation appears to have been limited to date.

National reports and the economics of AnGR conservation and use

An examination of the 174 SoW national reports (FAO, 2007) tends to confirm this view. The limited influence may be considered within the context of the following two types of economic analysis: (a) economic characterization (e.g. value of productive and adaptive traits; contribution to livelihoods) and (b) cost-effective conservation policy (prioritization of what to conserve and types of intervention mechanism). Consequently, we considered the following key words as search terms.

² Available at www.biodiversityinternational.org/fileadmin/biodiversity/publications/pdfs/1060.pdf. For an annotated bibliography and searchable database of the applied AnGR and PGR economics literature (last updated 2008) see <http://ifpri.catalog.cgiar.org/ecogenlit.htm>.

³ Considered distinct from the frequent consideration of economics and market values in commercial breed improvement programmes.

Economic valuation

A search for key words relating to “economic valuation”, “economic value”, “evaluation” and “valuing” reveals less than ten relevant country-distinct references, all of which largely refer to the importance of carrying out such valuation work in the future.

For example, Germany (Sections 2.3.3 and 2.3.4, p. 18) recognizes the range of economic and ecological values that make up the total economic value of AnGRs. Indonesia (Section 4.1.1. Awareness, p. 23) notes that there is “an urgent need to undertake realistic economic valuation of farm domestic animal genetic resources so that their economic and social significance is realized. This would also help bring the issue of conservation of farm domestic animal genetic resources into the mainstream of national program aimed at improvement of livestock productivity.” Similarly, Pakistan (p. 14 and elsewhere) notes that work on economic valuation is limited but is needed to draw attention to the socio-economic significance of these resources thereby helping to bring the issue of conservation of AnGR into the mainstream of national programmes aimed at improving livestock productivity, with increased awareness expected to convince policy-makers to allocate more funds for conservation and better utilization of AnGR (p. 24). A call for international assistance specifically mentions breed characterization (phenotypic and genetic) and economic valuation (p. 30). The limited use of economic valuation is also mentioned in The Netherlands (Section 4.2. Policy Priorities, p. 58), which notes that “in general, the insight into the value of old breeds and conservation of genetic diversity is quite limited, or the value has a limited definition. An increase in appreciation and valuation of economic, ecological, cultural and historical values is required.” Similarly, Malaysia (Section 3.3. Alternative Strategies [not yet feasible], p. 48) notes that future strategy should include exploring options for funding mechanisms (e.g. a tax on animal and animal product imports or tax incentives for livestock conservation and AnGR development activities) and the “undertaking of economic and technical studies to evaluate marginal breeds with economic value thus encouraging the conservation of threatened breeds”. Fiji (p. 29), Kiribati (p. 30), Samoa (p. 43), Dominica (p. 21) and Syria (p. 40) all recognize the “economic valuation of breeds” as one of the priorities for future characterization work. The United States (Section 4, p. 35) considers that continued development of the National Animal Germplasm Program also requires understanding “the current and future economic valuation of genetic resources”.

Prioritization and cost-effectiveness

A search for key words relating to “prioritisation/prioritization/priority”, “cost-effective/cost effective” and

“Weitzman”⁴ also reveals less than ten relevant country-distinct references.

The United Kingdom (Sections 4 and 5, various pages) recognizes the importance of prioritization, noting that “because resources are limited, prioritisation of breeds is necessary”. Although recognizing the existing rare breed categorization, it is considered that additional criteria such as distinctiveness and local adaptation might also usefully be used to prioritize breeds at risk which are not necessarily rare but may still need to be conserved. Greater national-level coordination, as well as cooperation at the European and international level to ensure that conservation activities are managed cost effectively (pp. 3–4) is also mentioned. Similarly, Iran (Section 5) also notes the future importance of “identification, evaluation and prioritization of native breeds in every country, region and even at global level to achieve more effective conservation programmes of native AnGR.” Germany mentions cost effectiveness a number of times, including in Section 4.1. Objectives (p. 45) noting the requirement of “long term *in-situ* and *ex-situ* conservation of the diversity of animal genetic resources by means of scientifically underpinned and cost-effective programmes”. As part of Finland’s National AnGR Programme (p. 46), it is considered that the most important form of conservation is the keeping of live animals (*in situ* conservation) and that the most cost-effective way is to keep using animals for production purposes and to improve their use in production.

However, having mentioned the importance of prioritization and cost effectiveness, there is but a single mention of the Weitzman⁵ approach. Germany (pp. 59–60) notes that “one relatively new research area involves economic assessment of strategies for the conservation of genetic diversity, as explored by Weitzmann (1992 and 1993)”. Research priorities for the implementation of this approach in current conservation programmes include the following:

- The identification of base parameters to present reliable functions between conservation efforts and yields in genetic diversity.
- Relative economic weighting of within-breed diversity, current production value and special performance of the endangered breeds.
- Expansion of the analysis approach to include consideration of diversity within and between breeds.

⁴The Weitzman approach is a specific prioritization decision-support tool that attempts to address “the Noah’s Ark question” of how to prioritize. According to Weitzman (1992, 1993) and an AnGR application by Simianer *et al.* (2003), it is possible to combine measures of diversity, current risk status and conservation costs so as to permit the identification of a cost-effective diversity-maximizing set of breed conservation priorities. Hence, for any given quantity of conservation funding available, it is possible to identify a priority conservation portfolio that maximizes the diversity than can be conserved, thereby providing an answer to “which breeds should we take on-board the Ark?”

⁵“Weitzman” is used here as a proxy for diversity-maximizing cost-effective optimization models in general. While some authors have suggested improvements to the diversity metric suggested by Weitzman (e.g. to take account of intra-breed diversity) (Ollivier and Foulley, 2005), the overall method is robust and can be applied using a number of alternative diversity measures.

Subsidies and compensation

A search for key words relating to “subsidy/subsidize/subsidise” and “compensation” payments for conservation again reveals less than ten relevant country-distinct references. Although it is recognized that there are many more active AnGR-support programmes than this (particularly across the EU), many lack accounting for the degree of threat faced and provide subsidy levels too low to cover farmer opportunity costs (Signorello and Pappalardo, 2003).

The free-market view is exemplified by the United States (p. 24), which notes that “given the lack of subsidy programs and the relatively rapid contraction of some genetic resources in the livestock sector, the development of cryopreserved collections needs to proceed immediately. Such an effort may be the most cost effective mechanism to protect and preserve genetic diversity.” Section 2.3 (Strategies) notes that “there is no legislation which provides producers with a subsidy for raising minor, rare or endangered breeds. Therefore, for unique genetic resources to remain stable or increase in usage they will have to compete in the marketplace. While, at this point in time, some breeds may have difficulty in competing, changes in consumer preferences may encourage the raising of diverse breeds.” Section 2.4 (Future Policy) goes on to note that “subsidies for rare or unique genetic resources are not viewed as an effective conservation strategy. Rather, market forces are the major driving variable controlling genetic resource utilization.”

However, given that the scale of agricultural subsidies means that such market forces are likely to be distorted and, together with the widespread recognition of the many non-market values encapsulated within the total economic value of AnGR, there would appear to be strong arguments for interventions that help to at least level the playing field somewhat. Germany (Section 3.1.2. Breeding Associations) considers that both the Animal Breeding Act and the relevant authorities lack defined rules related to the obligation and commissioning of breeding organizations at adequate levels of compensation to undertake socially desired conservation responsibilities alongside their actual breeding-related activities. There is thus an urgent need to establish special legislation on the conservation of animal genetic resources and to set out nationwide provisions that are currently lacking. Latvia (Section 4.3. Needs for Use and Development of AnGR, p. 24) considers that to prevent disappearance “breeders that rear native breeds must receive compensations for the difference between the indigenous, less productive breeds and imported high productive breeds.” Sweden (Section 6.3. Targeted measures, p. 43) argues that “particularly threatened breeds, should be conserved as this forms part of the conservation of genetic resources, which is a national responsibility. In the case of breeds where the financial returns for managing and breeding them are small, special incentives may be needed to

maintain population size and to support the breeders' associations in their work. The only incentives currently provided in support of conservation efforts are compensation grants for endangered breeds. No priorities have been established other than the actual classification of certain breeds as threatened⁶. Little evaluation or comparison of existing breeds to ascertain their distinctive characters or identify potentially interesting traits is carried out". Finally, The Netherlands (Section 2.1. Lessons from the past, p. 38) recognizes that 'the Government has formulated very little policy regarding *in situ* farm animal conservation. Apart from a limited subsidy scheme for rare breeds of farm animals, *in situ* conservation is left to private initiative'. There is also the difficult matter of deciding 'whether animals from the same or similar breed in another country should be taken into account during the subsidy decision' (p. 64).

Discussion and conclusion

A wider number of economics-related search terms may increase the number of identifiable relevant references in the national reports. There may also have been further developments since the elaboration of the national reports in 2001–2007. Nonetheless, based on the current evidence, it is clear that the consideration of economic analyses and the underlying methods and decision-support tools is patchy at best. Furthermore, those references that do exist, while revealing some awareness of the importance of such analyses and its potential contribution to characterization and cost-effective prioritization activities, tend to highlight the importance of such applications in the future rather than in the context of current policy design and implementation. The existing compensation payments tend to ignore measures of distinctiveness (potentially making interventions inefficient) and can be insufficient to cover opportunity costs.

These and other significant gaps in the capacity to manage AnGR were identified in the SoW AnGR (FAO, 2007). In response, the international community adopted the Global Plan of Action for Animal Genetic Resources (GPA), which includes 23 strategic priorities for action grouped into four priority areas: (1) characterization and monitoring; (2) sustainable use and development; (3) conservation; and (4) policies, institutions and capacity building. A number of these recognize the important role that the economics of AnGR conservation can play. Direct references can be found under the following actions:

- 1.2.1⁷ (Standards and protocol development): Develop agreement on methods to assess environmental, socio-economic and cultural factors related to animal genetic resources management.
- 1.2.2 (Standards and protocol development): Including in the context of the assessment of comparative breed performance in different production environments, development of methods for the assessment of functional traits and economic valuation.
- 2.3.2 (Policy strengthening): Develop, as necessary, national policies that incorporate the contribution of animal genetic resources to sustainable use, which may include (...) conducting economic and cultural valuation of animal genetic resources.
- 2.6.1 (Support indigenous and local production systems): Assess the value and importance of indigenous and local production systems.
- 3.7. Rationale (establish national conservation policies): Policies should serve to ensure the maintenance of animal genetic resources with direct values for human use, including production, ecological, social and cultural values, as well as option values for future use and adaptation. Production and functional traits, and national capacity, should be taken into consideration in setting conservation priorities.

Potential reasons for limited uptake and influence

From the above, it is clear that a *lack of awareness* may only be partly responsible for the limited uptake and influence of the economics of conservation on actual policy design and implementation. At the international level (e.g. in the SoW report and the GPA), there is clearly a recognition that economics does indeed have an important role to play. However, relatively few national reports document actual application or explicitly recognize the importance of applying such methods and concepts in the future. Hence, there would appear to be a need under the GPA's capacity-building activities to further raise awareness among relevant stakeholders regarding the existing work that has been carried out in this field and how to apply it. Stakeholders include not only policy-makers but also aid agencies, NGOs, national agricultural research and extension agencies etc.

Even where such awareness exists, there may well be a *lack of capacity* to carry out relevant research and/or consider existing work when ABD conservation policy is being designed or implemented. There are relatively few people with an economics of conservation background within national livestock programmes. Even at the international level, this is the case. For example, within the CGIAR there are only a handful of scientists working on economics of genetic resources issues (even when considering both AnGR and PGR). Given that there are so few people in key positions at national levels with an appropriate economics background, there would appear to be a strong argument for related training with national livestock development programme personnel to be carried out in a way appropriate for personnel with non-economics backgrounds. Additional support could be provided through facilitating access to and strengthening national/international research hubs that can provide analytical expertise when necessary.

⁶ As already noted above by Signorello and Pappalardo (2003).

⁷ Strategic Priority Area 1, Strategic Priority 2, Action 1. Subsequent item numbers also follow the same coding.

An additional closely related reason relates to a *lack of data*. Data for economic analysis are either not available or perceived as expensive to obtain, perhaps also contributing to a (mis)perception that the tools are too technically complex to apply. There are also cases where data exist (e.g. related to distinctiveness) but has not crossed disciplines and been applied within an economic context (e.g. the Weitzman decision-support tool). However, data considerations mainly arise as there is a lack of availability of data related to farmers' preferences for different genetic resource attributes and the value placed on these across breeds and production systems. Until breed-level data are routinely collected as part of the national statistics, there will continue to be a need to undertake intensive primary data collection. This is likely to require the application of participatory rural appraisal techniques, for which once again capacity is limited in many countries.

Finally, we hypothesize that there are *multiple deficiencies* impeding the uptake of economic tools and methods. ABD conservation programmes tend to be deficient in their design as a result of a lack of consideration of a broad range of technical issues, of which economics is just one. The national reports and GPA would tend to confirm this view as future characterization strategies identify priorities that not only go well beyond economic valuation, but also include molecular analysis, performance measuring and monitoring. Given that economics of AnGR work is best carried out within a production systems' context and requires informational inputs from a range of disciplines, overcoming other deficiencies influencing the conservation and use of AnGR will also play a contributory role.

Conclusions

Despite the conceptual basis having been developed for important economic methods and decision-support tools, the challenge remains for such multidisciplinary multi-methodology approaches to be applied widely to the issue of AnGR conservation and sustainable use, especially within the context of ongoing conservation policy design and implementation.

Until we do so, the world will continue to lose its local livestock breeds at an alarming rate due to a lack of informed decision-making and the elaboration of effective policy frameworks. The inefficient use of scarce conservation resources is particularly worrying as, in some cases, genetic erosion is occurring because of the lack of

relatively small amounts of funding to provide the required conservation incentives to maintain even just an unthreatened (i.e. safe) minimum population (Drucker, 2006). The creation of mechanisms to provide such incentives are urgently needed, including through an exploration of the effectiveness of AnGR-focused payment for ADB conservation services schemes.

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