INRA SCIENCES SOCIALES

N° 4-5 – SEPTEMBER 2008

RESEARCH IN ECONOMICS AND RURAL SOCIOLOGY

Biodiversity and international stakes: a question of access

Managing biodiversity requires analysis of the complex relations in the conditions of access to ecosystems and resources, including genetic resources. The definition of property rights is thus crucial. These rights will concern ecosystems, resources and also biotechnological innovations. We shall see, for instance, that the management of biodiversity will be linked with the conditions of access and remuneration of ecosystem services which are increasingly developing, and with the conditions of access to genetic resources, which will be easier as developing countries have improved access to innovations.

The global economic value of biodiversity is associated with various uses of natural biological resources: a) the values of direct uses (for instance the consumption of elements forming biodiversity such as plants, animals, trees….); b) the values of indirect uses (associated with the services that agents get out of biodiversity - water purification, pollination, carbon sequestration etc., most of these services being public goods); c) options values (long-term uncertain values linked to the conservation of biodiversity, for instance the probability of the presence of a molecule of interest); d) last, the values of non use (values of existence and legacy). Conflicts of use may emerge in relation to these various values and it is necessary to implement regulation mechanisms, which implies in particular the definition of property rights. The question of the definition of property rights and in a more general way of the rights of use (of access) is at the heart of the analysis aiming to favour effective management of biodiversity, economically, ecologically and socially. These rights may concern various elements: wild animals and plants, ecosystems taken as a whole, genetic resources, seeds and medicines….These rights may intersect and so the objective is to limit the risks of conflicts of rights potentially leading to blocking access to various resources.

How will the coexistence of various international conventions (Convention on biological diversity (CBD) signed in Rio in 1992, International Treaty on phyto-genetic resources of the FAO in 2001 , the 1994 WTO Agreement on trade-related aspects of intellectual property rights (TRIPs), etc.) act on biodiversity management in general and genetic resources in particular? The objective of the research presented here (Trometter 2005 and 2008) was to identify the conditions allowing fulfilment of a sustainable and fair balance between the holders and users of resources (classical situation) but also between the innovators and potential users of these innovations (the agent offering a resource may be requesting innovation). The implementation of the conditions of access to biodiversity will depend on the values associated with biodiversity and how these values will be shared between the various actors.

Local conflicts of uses

First, we analyse the use values of biodiversity and more particularly the direct uses of biodiversity with access to the ecosystems and resources, and the indirect uses, mainly access to ecosystem services and innovations.

Acceding to an ecosystem

In “the tragedy of the commons” published in 1968, the biologist Garret Hardin starts with the example of a village of livestock breeders where everyone can have their animals graze in a meadow that belongs to no one in particular. The use of the meadow being free and unrestrained, every breeder’s interest is to take his animals to the meadow as often, early and long as possible. Inevitably, the meadow is turned into a mud field and all the breeders lose out. Thus, the author suggests two solutions: either the meadow remains the common good of the village, but an authority with the power of sanction is given the responsibility of distributing use of the resource (the meadow) among breeders, or every breeder is given a property right to a plot and therefore will be in charge of resource management. It is the second option, that of "enclosures", which inspired most of the international texts concerning the common resources of humanity such as biodiversity.

However, to manage the direct uses of biodiversity, private properties are not always the most effective solution, economically, ecologically or socially, since the initial characteristics of the functioning of the human community in its ecosystems are not taken into account. In the case of private property, the other actors may be excluded from using the resources, which can lead to conflict. There are also limits to collective property: the authority who allocates the rights of access and use must be credible in the eyes of the community and acknowledged by the State. Calling credibility into question may be harmful to ecosystem management. There is not a single model of property rights. The definition of property rights, be they private or common, must then be drawn up according to economic, ecological and social objectives and local biophysical constraints.

Acceding to services originating from the functioning of ecosystems

In the approach by access to services, the question is not that of assessing "the total value of biodiversity", but of approaching it through the services that human beings get from biodiversity. The economic assessment of these services relies on the values of indirect uses, often assimilated with public goods, the access to which is completely free. Beyond these attempts to attribute a global value to ecosystem services, economists have several methods to assess the value of a project, using the resources affecting the ecosystems.
These methods are often based on analyses in terms of compensation by the destroyer of the service associated with the ecosystem. This compensation is measured according to the costs of substitutability between natural and manufactured assets, which gives a price for restoration. In the example of the water purification service, it is possible to substitute the services taken from a catchment area by building a water purification plant, which has a price and running costs. When the cost approach is impossible, we can use the contingent analysis methods using a hypothetical decision-making situation to have the agents reveal their willingness to pay for it. Another way to make these valuations is to use the "experimental choices" models where individuals choose between several development projects taking the environment in account.

An additional approach is to avoid the destruction of the service by the remuneration of the maintained service. For instance, the landscape maintenance or restoration services by farmers are almost exclusively paid for with public funds. Extending the circle of backers may be achieved by having tourists pay taxes in the hotels that benefit financially from the "landscape" service. We progressively pass from public funding of the service to private funding (by the beneficiary) or a combination of the two. The upper ceiling for the remuneration by private actors is calculated according to the costs which are avoided and which would have been associated with the destruction of the service (the estimation of avoided costs is difficult). The question of the remuneration of other services, such as water purification, brings with it new questions that are well known in economics: does the Polluter Payer Principle (PPP) leave room for a Beneficiary Payer Principle (BPP)?

In the framework of an experiment in Vittel (Vosges, France), the Vittel Waters Company subsidised and organized the conversion of the areas supplying the water tables it runs into organic farming. The firm compensates farmers for a service - the reduction of concentrations in nitrates in the ground water - in order to continue its activity of mineral water production in accordance with the regulations on maximum nitrate contents.
Taking into account ecosystem services involves a new paradigm in which the farmer would possibly have to remunerate (resp. compensate) other actors for the maintenance (resp. destruction) of the services. Two classical examples of services that the farmer gets out of biodiversity are pollination and quality of soils. Therefore, biodiversity becomes a strategic element of the farm at the same level as the choice of economic variables in the strategic decisions of the firms and in their consequences for society (Leroux et al. 2008) This assumption opens up the way to the elaboration and implementation of ecosystem accounts

as suggested by the European Agency for the Environment in 2006.

Global conflicts of uses

The conditions of access to genetic resources may lead to global conflicts of uses. Access to genetic resources may be achieved at three levels: *in situ* or *ex situ*, in collections ("genes bank") but also through the innovations into which they were integrated. Access to genetic resources is associated with future and uncertain values of uses: "quasi-option values".

Acceding to genetic resources in situ

In the case of management of genetic resources in situ, the Convention on biological diversity (CBD) recognizes the sovereignty of States. They will allocate property rights, and consequently define the **suppliers of genetic resources**. These rights are allotted either to an institution (ministry, agency for the environment …) or to the local populations (collective right of property) or to individuals by conferring upon them a private property right to resources. For the species concerned, the implementation of rights will be done within bilateral contracts, either within company / State relationships (or local community or individuals) or within inter-company relationships.

For the list of species specified in the FAO treaty of 2001, access to genetic resources is linked to a model based on collective management within a multilateral exchange agreement. This means that in this treaty, easy access to genetic resources is guaranteed for the different countries. A harmonized system for the management of contracts for access to genetic resources (material transfer agreements, MTA) has been created to limit the transaction costs.

Within good management of biodiversity, in parallel to access to genetic resources, it is important to be able to accede to the knowledge of the local populations (autochthonous in particular) on these genetic resources, which can increase the probability of finding a gene of interest.

To accede to genetic resources in situ, the ecosystem in which they are must be maintained. The management of genetic resources, then, may justify the non-destruction of an ecosystem. There are two options: develop a site; or maintain it in the hope of finding a molecule of interest. We compare a present certain value (linked for example to direct uses) with a future and uncertain value. This arbitration is not new in itself but what is new is that once the "utility" of a genetic resource is shown, its use is independent of its abundance, or even of its existence. Therefore, the valorisation does not guarantee the conservation of the site, which poses the question of whether the quasi option-value is a good tool to manage biodiversity.

In the same way, how can populations be encouraged to develop by taking into account the conservation of biodiversity in general and the value associated with the quasi option-value, which may be contrary to their present development mode? Moreover, research shows that it is not up to seed manufacturers or pharmaceutical companies to pay for biodiversity conservation since the "marginal value" of the genetic resources is close to zero. However, due to assumptions on the quasi-perfect substitutability of the resources, these approaches are much debated. The consideration of the quasi option-value brings to the fore the matter of social management of the period of transition before the possible valorisation through genetic resources.

The "maintenance of genetic resources" and "upkeep of knowledge on these resources" services are not usually remunerated at their true value. The implementation of property and access rights in the management of resources has ended up in conflicts of uses which have sometimes led a country to refuse all access to its genetic resources (Andean Pact countries, for instance).

Acceding to genetic resources ex situ: *the issue of genetic collections*

There are several statutes for collections according to the material incorporated and the date of constitution of the collection.

For collections made before 1992, we identify private and public collections, the access to which is formalized by contract by the collection holder.

For collections made after 1992, the access supply is more complex. Access first requires the explicit agreement of the "resource owner" in the country where prospecting is done (this clause is included in the bioprospecting agreement).

For collections of genetic resources for agriculture and food, in addition to the elements presented above, the FAO international Treaty of 2001 encourages countries to create national collections (NC) within the multilateral system of exchange. Their condition of access also relies on harmonized MTA which are usually free access rights to collections (or with minima port-fees).

The quasi option-value concerns two events: the identification of new characteristics (with consequently an increase in welfare) or the identification of characteristics of resistance against mutations of pathogens (with, as a consequence, the avoidance or limitation of a drop in welfare). This is the paradigm of biodiversity seen as an insurance for the future, as much in relation to mutations of pathogens as to more global changes like climate change. Conservation is then understood within a rationale of insurance and of "Safe Minimum Standard": it is necessary to prove that conservation costs are prohibitive in order to give it up.

Acceding to genetic resources integrated into an innovation

Access to the genetic resources contained in an innovation depends on its mode of intellectual protection.

In industrial applications, the patent and secret are usually authorized by the State. The patent holder for an innovation containing genetic resources may then, under certain conditions, forbid the use of the genetic resource by others.

In agricultural applications, the protection is either the secret or the C.O.V. (Certificat d'Obtention Végétale, or plant breeder's right). While Europe protects the varietal creation resulting from a classical breeding scheme by secret or COV, the United States usually protect their varieties by patent or secret, even though they adhered to the COV. In agricultural biotechnologies, access to patented sequences is governed by the patent law of the different countries and by licence agreements. Unlike the patent which potentially blocks access to genetic resources, the COV is at the origin of spillovers because it allows the use (by anyone, free of charge, automatic and without contract) of the genetic arrangement corresponding to a variety in selection programs. Trommetter (2008) shows that due to technological changes, the COV is not so effective and he suggests some options to reform it while conserving its basic philosophy, i.e. easy access to genetic diversity.

Better sharing of the local resources through easier access to innovations

Within the framework of access to genetic resources and sharing of benefits defined in the CBD, the definition of advantages is vast, since beyond royalties, it includes the transfers of valorisation technologies towards the Southern countries, and the implementation in Northern countries of innovations for the South (Trometter, 2008). The existence of different rights to protect innovations must permit, as much for the Northern countries as for the Southern ones, limitation of the perverse effects of property rights which are too generic and inadaptable. Nevertheless, the coexistence of various rights will impact future research capacities and markets for innovation.

Encouraging access by Southern countries to innovations by Northern countries

In practice, there is little in the way of transfer of the seeds produced in the North towards Southern countries. Every Southern country usually relies on public seed research (national or international, International centres for agronomic research depending on the CGIAR) and possibly private research, at national level and has a few relations with large multinational groups (established in every country through subsidiaries). This low transfer rate is often presented as being due to the absence of well-defined property rights on the plant varieties grown in these countries. Such a situation leads to the farming of more lands because of less effective seeds and to the destruction of forests, so less biodiversity, when it allows an increase in farmed areas. We have seen that, even in the Southern countries which have implemented intellectual property rights, there can be a low rate of transfer of the varieties selected.

Encouraging access to Northern technologies by Southern countries.

The implementation of intellectual property rights must be understood in a strategic way: according to the capacity of demand of the country (solvent demand) and according to the research capacity of the country. Therefore, implementing excessively strict property rights may restrict future research in the country. If a Southern country chooses the COV option rather than the patent, this will allow its seed companies to use the genetic variability of the seeds of the Northern countries in their own selection programs. This situation, a priori, looks more favourable. The FAO multilateral system of exchanges (easy access to genetic resources) was accepted by Southern countries because at the same time it provides for the mutualisation of resources and the sharing of benefits, and the restriction of research which limits access to genetic resources by making the payment of a tax on the sales of these products compulsory.

Creating innovations in the North for the South

In many developing countries, there is very little in the way of research capacity. In 2007, a FAO report suggests favouring the improvement of local varieties in order to resolve the food and poverty problem. For the poorest countries, is it better to use genetic selection to improve maize or manioc? The most effective solution is to mobilize the best performing tools in molecular biology for research on manioc, which is a strategic species for the food in these countries. These agricultural productions for local or regional use would not be in competition with the productions available on the world market and the research would be neutral in relation to the farmers of the developed countries. The poorest countries could therefore have access to the progress in techniques without having to implement intellectual property rights to accede to the technologies that they are unable to implement.

Conclusion:

Before 1992, genetic resources were considered as a part of the common heritage of mankind. In the 1980s, the patentability of organisms and the conditions of access to innovations of the North for developing countries are partly at the origin of the Southern countries' claim for sovereignty on their genetic resources and on a more restrained access to resources for Northern countries.

We have shown the complex relationships in the conditions of access to resources, including genetic resources. In particular, we have seen that mobilizing the quasi option-value is effective if the remuneration of the services it favours is known. Moreover, we have seen that access to genetic resources will be more greatly favoured if developing countries have easy access to innovations. The definition of the conditions of access and sharing of advantages plays an essential role. The sharing of advantages may be monetary or in the form of royalties or non monetary with the training of researchers in the latest technologies and access to technologies within selection works in/or for Southern countries.

The objective of facilitating access to genetic resources or to the ecosystem services and of encouraging innovation has consequences on biodiversity as it limits: a) the extension of agricultural areas faced with the world population increase in order to limit the fragmentation of zones; b) the use of pesticides and fungicides via the classical selection of varieties (assisted or not by biotechnologies) or by the mobilization of technologies such as transgenesis.

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For further information

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Published by the INRA Social Sciences, Agriculture and Food, Space and Environment
Publishing unit: Editorial Director: Bertrand Schmitt– Editor: Didier Aubert (Chief Editor),
Translation and composition: Ariel Gille