INDICATORS TO COMMUNICATE THE STATE OF AGRO-BIODIVERSITY TO POLICY MAKERS

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INTRODUCTION

Many countries have developed national biodiversity strategies and policies dealing with conservation and sustainable use of genetic resources. The relationship between agriculture and biodiversity is often called agro-biodiversity. National policies on agro-biodiversity, or biodiversity in general, require indicators to measure the performance of national policies and help monitor progress in fulfilling international obligations.

Indicators for biodiversity have been developed in the framework of the Convention on Biological Diversity (CBD 2003) and by the Organisation for Economic Co-operation and Development (OECD 2001). These sets of indicators are mainly directed towards wild biodiversity at the ecosystem and species level. For agro-biodiversity the genetic level is the most relevant. Diverse genetic resources are important for sustainable development in various fields such as biodiversity, the environment, agriculture and biotechnology. Thus there is a need to develop indicators for agricultural genetic diversity.

Indicators have to fulfil several criteria in order to be useful. First of all they have to be policy relevant and analytically sound, and in addition they should be easy to measure and interpret. In this paper existing indicator sets, as well as two new proposed sets, are analysed against these criteria, using case studies of chicken biodiversity in an industrialized and a developing country.

INDICATOR SETS

Existing indicator sets. Several indicators have been proposed for biodiversity of livestock. In the framework of the CBD only the total number of livestock breeds was proposed (CBD, 2003). The OECD proposed to restrict this indicator to breeds certified for marketing and in addition to monitor the share of key breeds (= high input breeds dominating the market), and the status (endangered or not) of native breeds (OECD 2001). Wetterich (2003) proposed to add the population size of native breeds, the number of breed associations per breed and whether high selective breeding methods such as embryo transfer are in use.

Extended set. Although the Wetterich set covers more aspects than the other two sets several gaps remain. Notably this set is mainly directed towards the present state of diversity. For biodiversity policies it is also relevant to cover aspects of pressures influencing biodiversity

and aspects of responses to biodiversity threats. Therefore we have proposed an extended set that covers these aspects:

- Number of key livestock breeds (native endangered, native not-endangered, non-native)
- Share of the three major livestock breeds
- Native breeds (population size, status of endangerment, in situ conservation)
- Ex-situ conservation (number of breeds conserved, number of accessions characterised)
- Intensification and use of modern breeding strategies and high-selective breeding methods (such as embryo transfer)
- Average size of farms (area, number of animals, animals / ha)
- Number of breeders/ breeders associations per breed
- Number of different breeding goals

The last four indicators cover pressures influencing diversity, while in and ex-situ conservation is added to cover responses. Policy analysts typically formulate recommendations on allocation of resources and targeting of programmes that respond to pressures and changes in the state of genetic diversity. These specialist advisors require therefore a wider range of indicators for describing the status at specific levels and identifying priorities, and they may prefer to use the extended set.

Restricted set. The extended set covers several aspects of diversity and therefore consists of 8 indicators. It is less useful for summarizing the state of agro-biodiversity at a glance. Policymakers at higher levels of government usually require a more concise set of indicators to summarize overall status and to set goals. The general public also needs a small set to be able to follow or participate in policy making processes. Therefore we formulated a restricted set of three indicators for this purpose.

- Number of breeding males of breeds characteristic for landscapes/production environments important for biodiversity and /or characteristic for a region or country
- Number of breeding males of the three major (high production) breeds
- Number of breeding males in gene bank(s) of characteristic breeds

The first indicator can be limited to a breed representative for the trend in biodiversity among all breeds of a species. It takes considerably less effort to follow the trend of a single species and it is easier to interpret than a whole list of native species. Moreover, the breed can be chosen such that difficulties with breeds with uncertain status (e.g. breed or line, native or not, unknown numbers etc.) are avoided. By choosing a breed characteristic for a high biodiversity environment, there is also a link to the relationship between wild biodiversity and agriculture. For wild species a very similar indicator is proposed in order to avoid problems with taking into account numbers of pest species etc.

CASE STUDIES

The indicator sets have been evaluated both in the Netherlands and Vietnam for agro-biodiversity of chicken (Table 1). In Vietnam biodiversity in chicken is probably much larger due to the large number of rural households with some chicken of the native Ri breed. In the Netherlands native breeds have been marginalised. The high production breeds in both countries are to a large extent the same.

Table 1. Values found for relevant indicators of chicken biodiversity in two case studies in the Netherlands and Vietnam.

	the Netherlands	Vietnam
Number of breeds	169	31
Number of breeds certified for marketing	24	9
Average size of farms, number of animals	28000	57
Number of key livestock breeds, native endangered	17	9
native not endangered	3	6
not native	4	16
Share of the three major livestock breeds	99.9%	85%
Share of three major native breeds	0.01%	85%
Population size native breeds	50-1100	20-125 million
No. of breeds conserved *ex situ*	6	5
No. of accessions characterised	3000	0
Intensification and use of modern breeding strategies	Yes	Yes
Application of high-selective breeding methods	Yes	Yes
Number of breeding males of characteristic breed	150	25 million
No. of breeders associations per breed	2 - 100	1 – 12 million
No. of different breeding goals	3	7

The number of breeds gives the false impression that diversity in the Netherlands is larger than in Vietnam. This is due to the large number of exotic fancy breeds that are kept in the Netherlands. The number of breeds certified for marketing on the other hand excludes native Vietnamese low-input breeds. Share of native breeds, population size of native breeds and status of a characteristic breed are all a better representation of the biodiversity. The extended set also gives information on pressures and responses. The latter indicates that the gene bank for chicken is more developed in the Netherlands. Care must be taken when using the official statistics which tend to ignore chickens outside large commercial farms.

EVALUATION OF INDICATORS

In table 2 the indicator sets are scored with respect to four criteria. Additionally the molecular diversity is scored for the same criteria, for comparison with a scientific study that evaluates breeds with molecular markers.

Policy relevance. The relevance of indicators can be compared in terms of the extent to which they address policy issues of international relevance. While all of the sets of indicators are relevant for policy, the larger sets (Wetterich and extended) score better, because these sets also include indicators that attempt to assess the pressures behind genetic erosion.

Analytical soundness. Indicators should be well founded based on international consensus, scientifically valid and comparable across states. In this respect a molecular analysis is the most relevant. The number of breeds (CBD and OECD indicators) is scientifically unsound as

it is often not clear what a breed is and it does not take into account that some breeds are less diverse while others may be very similar to another breed.

Measurability. The data needed for the indicator sets should be available now or in the near future. For most species in most countries a molecular analysis of diversity is not available and can only be performed after considerable investments of time and money. Hence the negative score for measurability for molecular diversity. The other indicator sets are easier to gather, but the larger the indicator set the more difficult to measure.

Interpretation. Indicators should be clearly understandable for policy decision makers, stakeholders and the general public. Due to its complexity a molecular analysis is less suitable for such purposes. Larger data sets are also more difficult to interpret. The restricted data set receives the highest score as it is not always clear how a large number of breeds should be interpreted.

Table 2. Evaluation of five different indicator sets for four criteria.

	Policy relevance	Analytical soundness	Measurability	Interpretation
CBD	+	- - -	+++	++
OECD	+	- -	++	++
Wetterich	++	+	+	+
Extended set	+++	++	+	+
Restricted set	++	+	++	+++
Molecular diversity	+	+++	- - -	- - -

CONCLUSIONS

Diversity in chicken in Vietnam is considerably larger than in the Netherlands but not all indicators capture this difference adequately. The number of breeds is a poor indicator for genetic diversity of livestock. A better single indicator is the status of an example low-input breed representative of the native breeds. An extended set of indicators developed in this paper can be used when threats to biodiversity and responses to these threats need to be monitored as well.

REFERENCES

CBD, 2003. *Provisional global indicators for assessing progress towards the 2010 Biodiversity Target*. Convention on Biological Diversity, Montreal, Canada.
OECD, 2001. *Environmental Indicators for Agriculture. Volume 3*. OECD, Paris, France.
Wetterich, F., 2003. In *Agriculture and Biodiversity: Developing Indicators for Policy Analysis. Proceedings From an OECD Expert Meeting, Zurich, Switzerland, November 2001*. OECD, Paris, France.