Focus

Difficulties and outlook in formulating biodiversity indicators for the publication "Indicators for the sustainable management of French forests"

With the IFN and GIP Ecofor, the Ministerial conference for the protection of European forests (MCPFE) in 2005 was an opportunity to evaluate the national indicators for forest biodiversity and identify priority issues for future work.
This article presents the current situation.

Context and goals

France is a participant in the Ministerial conferences on the protection of forests in Europe (MCPFE) since the start of the process in 1990. In this framework, the Agriculture ministry published the 1995, 2000 and 2005 editions of a document titled "Indicators for the sustainable management of French forests" (Agriculture ministry, National forest inventory, 2006). Since 2000, the publication has been coordinated by the National forest inventory (IFN). The 2005 edition was an opportunity to examine the difficulties encountered in formulating the indicators and identify priority issues for future work (Hamza, 2005).

In parallel, GIP ECOFOR (public agency for forest ecosystems) launched a study on biodiversity indicators in 2006, in the framework of the "Biodiversity and forest management" programme. In the process, it asked IFN to manage an assessment of the national forest-biodiversity indicators used for the 2005 edition (Hamza et al., 2007), with the assistance of experts from Cemagref (Frédéric Gosselin and Marion Gosselin), INRA (National institute for agronomic research, Jean-Luc Dupouey), the National museum of natural history (Romain Julliard) and WWF (Daniel Vallauri). Catherine Cluzeau and Jean-Guy Boureau also participated in the evaluation for IFN.

The main goals were to:

- analyse in detail each biodiversity indicator used for the 2005 edition, notably its relevance for biodiversity, the definitions and methods employed, any implementation difficulties, its presentation and the proposed comments;
- judge the overall consistency of the biodiversity-indicator system, notably by confronting it with the Pressure-State-Impacts model and with the goals of the National biodiversity strategy (SNB) launched in 2006 and the 2006-2015 National forestry programme (PFN);
- propose suggestions for improvement;
- determine research needs over the short, mid and long term, to answer the questions raised by the definition, implementation and use of the indicators.

Difficulties encountered and suggestions for improvement

The biodiversity indicators in the 2005 edition were divided into sections covering the various approaches to biodiversity, i.e. genetic, specific, ecosystems and landscapes (see table 1). They include the indicators set up by the 2003 Vienna conference (CMPFE liaison unit Vienna, 2003, 2-digit numbers) and the additional indicators for specific French criteria (3-digit numbers).

The relevance of the 15 indicators (in terms of biodiversity in general and the MCPFE goals in particular) is generally high.

However, the proposed indicator is often not well suited to the topic indicated. There are a number of different problems.

- Unsuitable presentation or formulation. For example, for indicator 4.1.1., the wording "Percentage of main species in basal area of stands, by species" would be better.
- Limited or poorly defined scope. For example, indicator 4.1. could focus on stands considered mature.
- Unsatisfactory definitions or methods. For example, a national list of exotic species is not satisfactory (indicator 4.4.) and should be replaced by regional lists.
- Missing additional information. For example, indicator 4.3.1. could be filled out with an indicator on the presence and volume of habitat trees (hollow trees, old or large-diameter trees).

All the above elements limit the relevance of the indicators and make it more difficult to interpret them as best possible, which results in comments often deemed insufficient.

A number of improvement proposals have been made and are summed up below.

- Improve the presentation or formulation, i.e. the text of the topic or indicator, the variables analysed, breakdown criteria, standard deviations, maps, graphs.

1 2005-edition criteria and indicators addressed by the assessment.

MCPFE topic	No	Description	Origin
Tree species composition	4.1	Area of forest and other wooded land, classified by number of tree species occurring and by forest type	MCPFE Vienna
	4.1.1	Stand purity (basal-area percentage of main species)	France
Regeneration	4.2	Area of regeneration within even-aged stands and uneven-aged stands, classified by type of regeneration	MCPFE Vienna
Naturalness	4.3	Area of forest and other wooded land, classified by "undisturbed by man", by "semi-natural" or by "plantations", each by forest type	MCPFE Vienna
	4.3.1	Area of very old regular high-forest stands constituting specific habitats	France
Introduced tree species	4.4	Area of forest and other wooded land dominated by introduced tree species	MCPFE Vienna
Deadwood	4.5	Volume of standing deadwood and of lying deadwood on forest and other wooded land classified by forest type	MCPFE Vienna
Genetic resources	4.6	Area managed for conservation and utilisation of forest tree genetic resources (in situ and ex situ gene conservation) and area managed for seed production	MCPFE Vienna
Landscape pattern	4.7	Landscape-level spatial pattern of forest cover (area per forest size classification)	MCPFE Vienna
	4.7.1	Length of forest edge per hectare	France
	4.7.2	Length of forest edge per hectare by IFN type of stand	France
	4.7.3	Intensive cuts and clear cuts	France
Threatened forest species	4.8	Number of threatened forest species, classified according to IUCN Red List categories in relation to total number of forest species	MCPFE Vienna
Protected forests	4.9	Area of forest and other wooded land protected to conserve biodiversity, landscapes and specific natural elements, according to MCPFE Assessment Guidelines	MCPFE Vienna
	4.9.1	Cervid density per 100 hectares	France

• Draft certain definitions more precisely and develop data-collection methods:

– measurement protocols (IFN deadwood, improvement made in 2008);

– improvements in knowledge (regional lists of introduced species, naturalness classes, age thresholds for very old high-forest stands as a function of the forest ecoregion, list of forest trees, etc.);

– correct deficiencies (forests not inventoried by IFN, threatened species of Mediterranean flora, digitalise the perimeter of certain protected zones, size of clearcuts mapped by IFN, etc.);

– link IFN data with that of other sources (landscapes, etc.).

• Target more relevant items, e.g. the most sensitive zones or species, the most representative forest stages, zones undergoing major evolution.

• Obtain missing information (whether variables or breakdown criteria):

– tree species composition, i.e. gather information on forest species abundance, break down the indicator according to forest site, habitat, forest type, forest stage, management type;

– regeneration, i.e. break down the indicator according to cut size, regeneration stage, soil preparation;

– naturalness, i.e. integrate the signs of forestry work (now available at IFN), old forests, presence and volume of habitat trees (hollow trees, old or large-diameter trees);

– introduced tree species, i.e. determine the abundance of invasive species and introduced herbaceous species;

– IFN deadwood, i.e. break down the indicator according to type of deadwood, size, decomposition level (improvements made by IFN in 2008), type of forest site;

– genetic resources, i.e. evaluate genetic diversity of forest reproduction material, indicate region of provenance;

– landscape pattern, i.e. indicate the interior surface of forests and the size of clearcuts;

– protected forests, i.e. add high-value forests for conservation.;

• Develop comments. This should be made easier by the proposed improvements. Addition of further information to warrant indicator selection is recommended.

It is still necessary to determine the feasibility of these improvement suggestions, notably by having IFN, the main data supplier, test the system to acquire measurements and/or observations. Other more specific projects could be developed (search for native-species areas, mapping of old forests, etc.). These proposals also made clear the need to establish groups of experts for certain topics, notably to define naturalness levels, a list of forest trees or native-species areas.

Focus

Outlook

In addition to the improvement proposals, our study attempted to determine the main research priorities. They are listed below.

- Line up additional knowledge for further work on certain indicators (science advice/development or in-depth research, reference values);
- Clarify how the indicator is linked to forest biodiversity (new studies and/or existing data analysis), i.e.:
  - list the taxonomic groups, ecological groups or even the species that are linked, positively or negatively, to the indicator;
  - quantify the relationship, by major type of forest site, dominant species and major forest stage;
  - determine precisely the relevance and validity scales for the indicator.
- – Study the underlying mechanisms governing the link between indicators and biodiversity, that could concern the topics "regeneration", "introduced tree species", "deadwood" and "protected forests", notably the link between dying wood, deadwood and biodiversity.

In short, the goal is to improve monitoring of dendrometric or ecological variables used as indicators and to obtain direct monitoring of species to validate the relationships between the two via statistical analysis. This proposal was developed by Gosselin et Gosselin (2008) to test the validity of pressure indicators and the effectiveness of public policies.

Moreover, the assessment of the overall consistency of the biodiversity indicators showed that it is necessary to reconsider all the indicators (for all criteria) for sustainable forest management, in view of setting up a solid conceptual framework. Concerning the biodiversity indicators alone, use of the Pressure-State-Impact model was the means to fill out the analysis of each indicator, but further in-depth work is required.

Finally, the set of 15 indicators in the French publication and the additional indicators proposed during the study would seem to encompass most of the concerns raised by the SNB and PFN.

Conclusion

The proposals formulated during the study have shown the value of in-depth analysis of the national biodiversity indicators. It would now be useful to test the feasibility of the proposals, notably the acquisition of certain data by IFN, to establish groups of experts (naturalness, native-species areas, etc.) and to redesign the system of sustainable-development indicators in a solid conceptual framework. Some of the proposals will be used for the 2010 edition of the indicators for sustainable forest management.

Concerning data availability, a certain number of recommendations are proposed.

- Continuously adapt the existing measurement/observation networks to new needs and to the new knowledge (feasibility, cost/effectiveness of missing data, etc.).
- Improve coordination between existing networks and surveys.
- Study whether it would be worthwhile to set up additional networks.
- Improve mutual access to data in a suitable format.

This implies that all available partners be mobilised. The creation of a permanent steering committee for sustainable forest-management indicators on the national level, approved in September 2009 by the steering committee for the 2010 indicators, should facilitate the process and make it possible to put the above proposals into effect in future editions.

The foreseeable results on the French, European and international levels would be significant. They would consist of developing a rigorous monitoring system for the Forest programme set up by SNB and PFN, improving coordination of French replies to international questionnaires (Convention on biological diversity (CBD), MCPFE indicators, etc.) and creating a source of proposals within the "biodiversity" groups of experts working in the CBD and MCPFE programmes. ■

Key bibliographical references

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