Index of Biodiversity Potential (IBP): How to extend it to Mediterranean forests?

by Pierre GONIN, Laurent LARRIEU & Marc DECONCHAT

The sustainable multifunctional management of forests entails taking into account biodiversity. Biodiversity has various facets all of which are difficult to apprehend, hence the usefulness of proposing relevant, easy-to-use tools such as the Index of Biodiversity Potential (IBP).

The IBP has been worked out for France's European mainland forests, including its part of the Mediterranean Rim. Its application in other Mediterranean countries requires reflection in collaboration with associated partners. This question was the object of an event taking place in parallel to the 5th Mediterranean Forestry Week held at Agadir (Morocco).

Introduction: brief presentation of the IBP

The IBP was created in 2008 (Larrieu & Gonin, 2008) in order to enable managers of forest ecosystems to evaluate easily the capacity of a stand to accept diverse species and to identify the factors that management policy and methodology could improve. It is based on an analysis of ten key factors observed in the field (see Fig. 1; Larrieu &

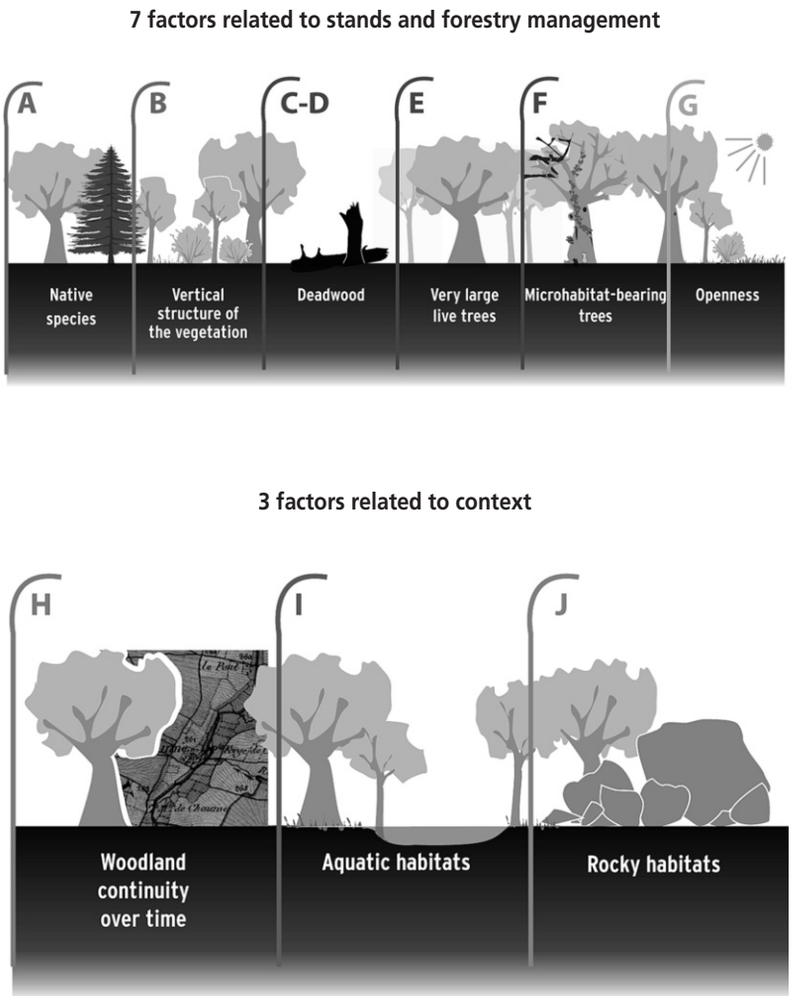

Figure 1: The ten factors of the IBP. *Following Emberger* et al., *2016.*

1 - www.foretpriveefrancaise.com/ibp

Figure 2 (below): The French logo has been registered as a trade mark.

FORÊT ET BIODIVERSITÉ
CENTRE NATIONAL de la PROPRIÉTÉ FORESTIÈRE

GONIN, 2016b). Its implementation has been facilitated by the use of various documents available on the internet [1]: definition sheet (LARRIEU & GONIN, 2016b), document of methodology and data sheets (LARRIEU & GONIN, 2013), Excel table® software for recording data and drawing up standardised graphs (LARRIEU *et al.*, 2011), an online database.

The IBP is usable in a range of contexts, as much in productive forests as in areas given over to conservation (LARRIEU *et al*., 2012). It can also be used as a teaching aid in that it permits making certain principles that govern taking biodiversity into account easier to understand.

Since 2008, the IBP has been enhanced and strongly developed thanks to an original research and development (R&D) programme, led by the UMR Dynafor unit of the French National Agricultural Research Institute (INRA) along with the National Center of Forest Landowners (CNPF) and supported by the Ministry in charge of ecology (GONIN *et al.*, 2015). This work has permitted the extension of the initial IBP, designed for the Atlantic and continental forests and woodlands, into a version for the Mediterranean region (GONIN *et al.,* 2012).

A similar programme can be proposed for all the forests of the Mediterranean Rim; however, the current definition of the IBP can only be applied without modification to other forests like those found in France (e.g. in the north of Spain and Italy). For other forests, new versions will have to be made to take into account their special characteristics: not only climate, forest localisation and tree species present but, also, their uses and their users. To this end, we propose a methodological framework made up of a specifications and guidelines document, a methodology in six stages and an organisational template.

Specifications and guidelines document: a reference framework

The specifications and guidelines document establishes the framework for drafting and modifying the IBP. Every subsequent version which derives from it will be able to use the IBP appellation along with the logo which has been registered as a trade mark (see the French logo in Fig. 2, its international equivalent is pending) and will serve to identify the IBP.

For the manager: an indirect forestry indicator

Of all the facets involved in biodiversity, the IBP focuses only on the ordinary diversity of forest species at the level of a forest stand (local scale, alpha diversity). By "ordinary" is meant the totality of species, but with reference to animals, plants and fungi only, without taking into account their status, their importance as heritage (protection...) or their degree of rarity; the Index is thus not taxon-centered. The species known to be from woodlands group together "*species that are strictly forest-based or mostly present in forest and woodland habitats, as well*

as those displaying mixed behaviour, occcuring more or less as much in other habitats as in woodland and forests" (MAAF, IGN, 2016).

The IBP is an indirect indicator which evaluates not the actual presence of species but the capacity of a stand to host them. Thus, the index is built up from the characteristics of the trees, the stand and the biotope and not from a taxonomic inventory. Even for the "Native species" factor, the diversity evaluated is not that of the tree varieties themselves but, rather, that of the species associated with them.

This diagnostic tool aims to help the manager in his or her choice of silvicultural and land use policy and methods. Hence it is not a mesure of biodiversity nor a norm for management: recommendations that emerge from a IBP audit can differ (EMBERGER *et al.* 2016), final choices taking into account management objectives along with other parameters (stands, plots, socio-economic or statutory contexts...).

A composite indicator

The IBP is a composite indicator. At present, it includes ten factors but this number could well rise to adapt its use in a new context - though not unduly so to avoid rendering the data records over-complicated. The factors chosen should be among those which have a positive impact on species diversity, which best describe the facets of a woodland ecosystem and which, therefore, best represent the requirements of the different taxinomic groups while avoiding redundant or correlated factors.

The factors should be easily observable by the manager and capable of interpretation in management terms so that they can be taken into account in the technical choices to be made; this explains their classification in two groups: factors related to stand on the one hand and those related to the context on the other.

For each factor, there are three classes with thresholds based on an increasing capacity to host forest species and given the scores 0, 2 or 5. These classes reflect a gradient of this capacity, going from poor to high (and not from nil to maximum) in reference to the capacity of a "natural" ecosystem to host forest species, with the concern to discriminate the studied stands.

Each factor is defined accurately and without ambiguity to avoid errors of interpretation (e.g. the IBP lists in detail the native species to avoid differences between the personnel doing the recording) and minimise as much as possible the inevitable individual bias.

Simple, rapid recording makes for routine processing

The factors need to be defined in such a way that a manager can do a diagnosis as a matter of routine. Recording the data should be:

– simple, able to be done by anyone familiar with forestry management, not involving specialist taxinomic knowledge nor complex measurements;

– rapid and easy to integrate into standard management operations. For example, a practiced recorder can do a IBP survey in 15-20 min/ha, a period that varies depending on the characteristics of the stand. To maintain such a duration, the data are estimated and not extracted from an exhaustive inventory, though at times a measurement may be necessary (e.g. to verify the diametre of a tree) or an observation made (go round a tree to observe the tree-related microhabitats [TreMs]);

– susceptible to field verification: this permits finalising the audit after data recording and interpretion of the results. As of today, only one factor of context ("Continuity of wooded state through time") requires supplementary office research.

A single indicator, with certified alternatives

To cater for the diversity of situations, it is necessary to tailor the IBP to the context of use. Two levels of variation have been retained:

– area of use corresponding to major variations related either to the bio-geographical context (divided up into regions or domains) or to marked anthropogenic impact (e.g. open grazing land surrounded by woodlands);

– distinctions within an area of use pinpointing minor variations related to vegetation zonage, fertility of locations or the species' rates of growth.

Thus, the territory of metropolitan France has been divided into two areas of use (Mediterranean *vs* Atlantic/continental) with distinctions related to vegetation zones (hill and moutane *vs* sub-alpine), fertility of the locations (fertile to fairly fertile *vs* unfertile to very unfertile) and to the species' rates of growth (some fruit trees never acquire a big diameter).

To facilitate the use of the IBP and maintain an overall coherence, it is best to avoid multiplying the areas of use or distinctions by overdoing geographical sub-divisions: a certain homogeneity should be kept as regards habitats, growth of stands and associated biodiversity.

The definition of the IBP can evolve so as to integrate new knowledge, enhance its relevance and its ergonomics. Such evolution might concern only one area of use (e.g. Mediterranean species added to the version designated as Mediterranean) or be integrated into all areas to maintain an overall coherence (e.g. the new typology of TreMs integrated simultaneously into both areas of use).

The versions are numbered by a combination of:

– letters identifying the domain of use (e.g. M for the French Mediterranean region);

– digits indicating modifications, codified as follows:

* 1st digit = major evolution in factors and thresholds (e.g. from 1.x to 2.0: standardising the versions for the two French areas of use),
* 2nd digit = minor evolution (e.g. from 2.6 to 2.7: modification of the typology of TreMs),
* 3rd digit = evolution limited to form (e.g. from 2.6.1 to 2.6.2: simplification of the definition of the factor "Openness").

To maintain coherence throughout its areas of use, the IBP must not be modified by users to adapt it to such local contexts as a forest or a massif. For example, the rarity of very large trees in a forest does not justify lowering the threshold for "Very large live trees". Similarly, a factor little present in an area does not justify supressing it: the absence of rocks does not justify erasing "Rocky habitats".

Any new version will be able to use the IBP certified appellation after the CNPF, backed up by its partners, has validated that it is in accordance with the present specifications and guidelines document.

Extension of the IBP in six stages

The extension of the IBP to an area as vast as the Mediterranean region entails carrying out several complementary studies, either within the framework of international programmes or arising from local initiatives. Such studies involve six stages.

Stage 1: Choosing the area for study

Geographic zone and woodland/forest profile.

As the area of use of a version of the IBP is defined in the light of data on bioclimate, plot location and forests, the limits of a study will be defined on a bio-geographical basis with choices made of the forest profiles concerned. If the area of use displays great variability (e.g. an entire country), it will be necessary to draw up several versions of the IBP. On the other hand, if the selected area shows little variation or if the study zone is limited (e.g. the cedar stands in Morocco), the resulting version of the IBP will not be applicable to a wider area (e.g. all the cedar forests around the Mediterranean Rim) without additional work for extending it or suitably combining it with other versions certified for cedar forests elsewhere (e.g. in Algeria, Lebanon...).

Types of plant community.

A IBP is aimed at that stage of forest formations when actual trees are present, whatever the silvicultural or silvigenetic stage, including that of regeneration. Its use at other stages in the dynamics of the vegetation (e.g. matorral with bush or shrubs) or in habitats combining woodland and open land (e.g. agri-forestry plots) will only give an account of the diversity in forest species in relation to the trees present. In the case of other objectives, in particular giving an account of the diversity in open non-forest habitats, a specific version of the IBP will be necessary or another index will have to be designed.

Issues of biodiversity and the context of use.

The IBP only takes into account the ordinary taxonomic diversity at the local level.

For the other facets of biodiversity (genetic or ecosystemic diversity, overall scale of the landholding or massif, outstanding diversity or that of certain taxonomic groups), it is preferable to create other indexes or methods, using when possible all or some of the factors of the IBP so as to favour complementarity between the various tools (e.g. the WWF's naturality indicator which includes all the factors of the IBP: cf. ROSSI & VALLAURI, 2013). This applies also to uses other than a diagnosis carried out in a routine fashion: any such application would no doubt require precise measurements of diversity (e.g. volume and characteristics of dead wood).

The description of the area to be studied will include its specific features and its similarities with the IBP's current area of use in order to highlight the factors that should be retained, modified or added to. Particular attention should be given to describing the characteristics of the actual forests and their growth.

Stage 2: Identification of the factors

The factors of biodiversity should be studied to pinpoint those that have the greatest positive impact on the diversity of forest species. The starting point should be to verify whether the factors of the existing IBP are relevant to the new area of use or need modification. Thereafter, further significant factors should be looked for.

This stage will combine an analysis of the bibliography, expert advice and, when necessary, additional taxinomic studies.

Stage 3: Designing and testing a new tool

By "tool" is understood an index or method arising from the study which will acquire the IBP certification if it corresponds to the specifications and guidelines document of the IBP appellation. The provisional version will thus be drawn up by choosing the identified factors which correspond to the specifications and guidelines while retaining an overall coherence with the previously-existing versions of the IBP. Eventual variations may concern:

– the definition of the factors (e.g. modification of the typology of aquatic habitats);

– the choice of thresholds (e.g. for the factor "Native species": modification of the number of genera beyond which the score 5 will be given);

– additional factors.

This version will be submitted to expert opinion for a judgement as to its relevance. It will then be tested by its authors in different types of stand and forest, notably to check that the definition gives an accurate report of the stands' capacity to host new species. The test will be widened to include other users in order to identify any problems of understanding or errors in interpretation.

The definitive version will be drafted to integrate the corrections made during this stage. This final version will be validated by the study's Steering Committee (SC), when it exists.

Stage 4: International validation and certifying the IBP appellation

The finalised version must validated at the international level by a two-stage process:

– in its scientific and technogical aspects, by a Committee of experts (CE);

– for the IBP appellation, by the CNPF and its partners to check conformity to the IBP specifications and guidelines document. This validation will be manifested by displaying the logo.

Stage 5: Availability to users

The IBP will be widely disseminated thanks to various measures:

– training: the IBP is an easy-to-use tool, accessible to everyone familiar with forestry matters, but the speed and quality of the recording process depends on the recorder's experience. Short training sessions of one day adapted to the public involved (professionals, landowners, decision-makers, teachers) are usually enough to master the IBP;

– technical back-up: this enables users to round out their training and basic information in order to deal with specific or complexe problems, thus adequately covering the diversity of contexts;

– communication: it should be designed to address a wide public and cover all the issues. It should adopt various forms: publi-

cations, presentations during technical meetings, participation in seminars and workshops... Internet should be used to ensure documents reach the widest audience possible.

These actions should give rise to a network of users, a platform for sharing information.

Stage 6: Future evolution of the IBP and R&D programmes

The various versions of the IBP may well evolve via R&D programmes, with validation by the same process as described above. These programmes should also make possible:

– the improvement of the scientific understanding of the factors of biodiversity used in the IBP, or of other factors not considered by reason of inadequate knowledge;

– a taxonomic calibration of the IBP by associating certain taxons with IBP scores;

– an improvement in the survey methods and the implementation of the IBP, particularly in regard to observer bias in awarding scores.

An organisational template for the co-construction of a IBP

Taking steps to extend a IBP adds up to a co-construction involving numerous stakeholders. Such an effort will be more effective at an international level if a *modus operandi* is established to coordinate studies, associate the various partners and foster scientific and technological exchange (cf. Figure 3):

– the International CE recommends lines of study and synthesis, coordinates projects and gives international validation to newly-finalised tools (indexes or methods). It brings scientists and users together. The CE is led by a coordinating committee which also takes part in creating a dynamic for the theme-based networks which is where the projects' main leaders/backers meet;

– those organisations who are the projects' main leaders/backers are responsible for carrying out the studies and the syntheses. A project's configuration is defined in the light of the needs expressed by the users (managers, decision-makers, landholders...) and scientists. An SC specific to the project in question can be set up to ensure its smooth working;

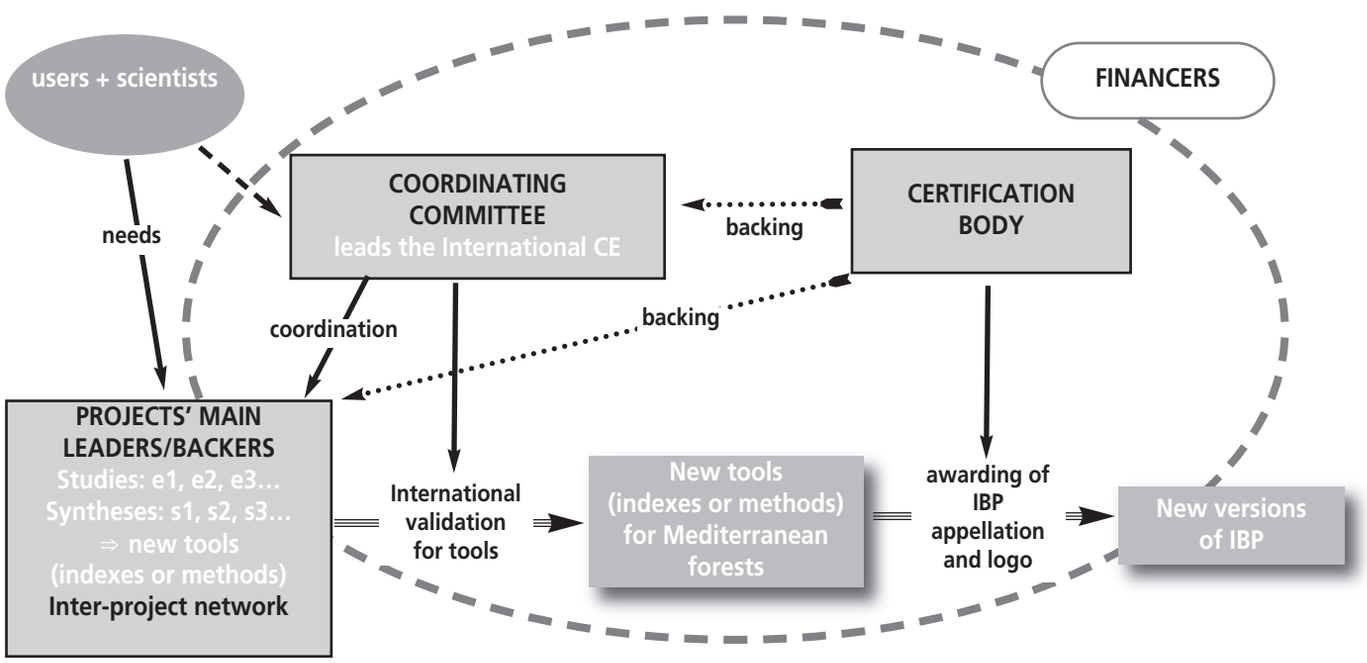

Figure 3: The stakeholders in a IBP extension programme in the Mediterranean region.

– the certification body (the CNPF in association with its partners) which gives backing to the projects' main leaders/backers and to the coordinating committee;

– the financers contribute to implementing the project and to carrying out the programme's general operations.

Conclusion: sharing for mutual benefit

As had already been the case at the BIODIVMEX seminar held in Marseille in 2016, during the IBP event that took place in parallel with the 5th Mediterranean Forestry Week held at Agadir (Morocco, 2017), the stakeholders from different Mediterranean countries made clear their interest in acquiring a IBP adapted to their own contexts. Work to this end is now under way in the north of Spain and in the cedar forests in Algeria. Other projects are on the drawing-board, for example in Italy and Morocco.

To foster these initiatives, it would be useful indeed and to everyone's benefit to set up some kind of formal international coordination; this would permit the enrichment of the current version of the IBP and facilitate the creation of new versions. It would also contribute to generating synergy at an international level on a common issue: taking into account biodiversity in forest management.

P.G., L.L., M.D.

Bibliography

Emberger C., Larrieu L., Gonin P. : 2016 - *Dix facteurs clés pour la diversité des espèces en forêt. Comprendre l'Indice de Biodiversité Potentielle (IBP).* Paris : Institut pour le développement forestier, déc. 2016, 58 p.

Gonin P., Larrieu L. : 2013 - *Méthodes de relevé de l'Indice de Biodiversité Potentielle (IBP).* CNPF-IDF, INRA Dynafor, v3.3, mars 2013, 13 p.

Gonin P., Larrieu L., Deconchat M. : 2015 - Recherche & Développement sur un outil de gestion forestière : l'Indice de Biodiversité Potentielle (IBP). *In : Actes du XIVe Congrès Forestier Mondial*, 7-11 sept. 2015, Durban, Afrique du Sud, 9 p. [En ligne]. URL : http://www.fao.org/about/meetings/world-forestry-congress.

Gonin P., Larrieu L., Martel S. : 2012 - L'indice de biodiversité potentielle (IBP) en région méditerranéenne. *Forêt Méditerranéenne* t. XXXIII, n° 2, juin 2012, p. 133-143

Larrieu L., Gonin P. : 2016a - *Fiche de définition IBP. Domaines atlantique et continental. Domaine méditerranéen.* v2.9. CNPF-IDF, INRA Dynafor, mise à jour du 01/09/16, 2 p.

Larrieu L., Gonin P. : 2016b - *Présentation de l'Indice de Biodiversité Potentielle (IBP).* CNPF-IDF, INRA Dynafor, v2.9, mise à jour du 01/09/16, 4 p.

Larrieu L., Gonin P. : 2008 - L'indice de Biodiversité Potentielle (IBP) : une méthode simple et rapide pour évaluer la biodiversité potentielle des peuplements forestiers. *Rev. For. Fr.* 06-2008, p. 727-748

Larrieu L., Gonin P., Deconchat M. : 2012 - Le domaine d'application de l'Indice de biodiversité potentielle (IBP). *Rev. For. Fr,* LXIV, 5-2012, p. 701-710

Larrieu L., Gonin P., Martel S. : 2011 - *IBP. Indice de Biodiversité Potentielle. tableur* v2.1. CNPF-IDF, CRPF Midi-Pyr., INRA Dynafor, 08/12/11, fichier Microsoft® Office Excel

MAAF, IGN : 2016 - *Indicateurs de gestion durable des forêts françaises métropolitaines*, édition 2015, Résultats. MAAF-IGN, Paris, 343 p.

Rossi M., Vallauri D. : 2013 - *Evaluer la naturalité. Guide pratique,* version 1.2. Marseille : WWF, 154 p.

Pierre GONIN
Forestry Engineer
CNPF-IDF
pierre.gonin@cnpf.fr

Laurent LARRIEU
PhD Engineer
INRA UMR Dynafor /
CRPF Occitanie
laurent.larrieu@inra.fr

Marc DECONCHAT
Research Director
INRA UMR Dynafor
marc.deconchat@
inra.fr

Summary

Index of Biodiversity Potential (IBP): How to extend it to France's Mediterranean forests?

Biodiversity is an important factor in the sustainable management of forests. However, taking it into account is a difficult matter because its description demands a lot of time and requires specialists. A tool has been developed for French forests in order to enable managers themselves to carry out a diagnosis of the ordinary taxonomic biodiversity: the Index of Biodiversity Potential (IBP).
The IBP is already available for France's Mediterranean forests and it can be used in other forests around the Mediterranean Rim similar to those in France. However, its extension to all Mediterranean forests is much hindered by such forests' special bio-geographical and historical features. The drawing up of new versions of the IBP based on the existing methodology and definitions will make it possible to benefit from the experience of the last ten years, share the efforts and pool the use at an international level of a commonly-held tool.

Résumé

L'Indice de biodiversité potentielle (IBP) : comment l'étendre à l'ensemble des forêts méditerranéennes ?

La biodiversité est un critère important pour la gestion durable des forêts. Cependant, sa prise en compte est une tâche difficile car sa description prend beaucoup de temps et nécessite des spécialistes. Un outil a été développé pour les forêts françaises afin que les gestionnaires puissent eux-mêmes faire le diagnostic de la biodiversité taxonomique ordinaire : l'Indice de biodiversité potentielle (IBP).
L'IBP est déjà disponible pour les forêts méditerranéennes françaises. Il peut aussi être utilisé dans d'autres forêts méditerranéennes semblables à celles présentes en France, mais son extension à toutes les forêts méditerranéennes se heurte aux particularités biogéographiques et historiques de ces forêts.
L'élaboration de nouvelles versions s'appuyant sur la méthodologie et les définitions existantes permettrait de bénéficier de l'expérience des dix dernières années, de mutualiser les efforts et de partager un outil commun à l'échelle internationale.

Resumen

El Índice de Biodiversidad Potencial (IBP): ¿cómo extenderlo a todos los bosques mediterráneos?

La biodiversidad es un criterio importante para la gestión forestal sostenible. Sin embargo, tenerlo en cuenta es una tarea difícil porque su descripción requiere mucho tiempo y necesita especialistas. Se ha desarrollado una herramienta para los bosques franceses para que los propios gestores puedan hacer el diagnóstico de la biodiversidad taxonómica ordinaria: el Índice de Biodiversidad Potencial (IBP).
El IBP ya está disponible para los bosques mediterráneos franceses. También puede utilizarse en otros bosques mediterráneos similares a aquellos presentes en Francia, pero su extensión a todos los bosques mediterráneos se ve obstaculizada por las peculiaridades biogeográficas e históricas de dichos bosques.
El desarrollo de nuevas versiones basadas en la metodología y las definiciones existentes permitiría aprovechar la experiencia de los últimos diez años para unir esfuerzos y compartir una herramienta común a nivel internacional.