The Index of Biodiversity Potential (IBP)

Science-based framework from 17 years of R&D program

Laurent LARRIEU

After Rio (1992) and Helsinki (1993), strong demand for biodiversity to be taken into account in forest management ; however, no tools available/suitable for use in routine work…

How to create a rapid habitat assessment method and decision-making tool tailored to forest managers in their routine work?

→ **2004… « Paleo-IBP »**

5 factors

- **A. Large snags**
- **B. Large logs**
- **C. Very large trees and trees bearing « defects »**
- **D. Large nests**
- **E. Aquatic habitats**

Field tests: 15 operators, about 80 000 ha, SW France

2008: Publishing the IBP tool as “A quick and easy method to assess the potential of forest stands for biodiversity»

OUTILS ET MÉTHODES

IBP-V0

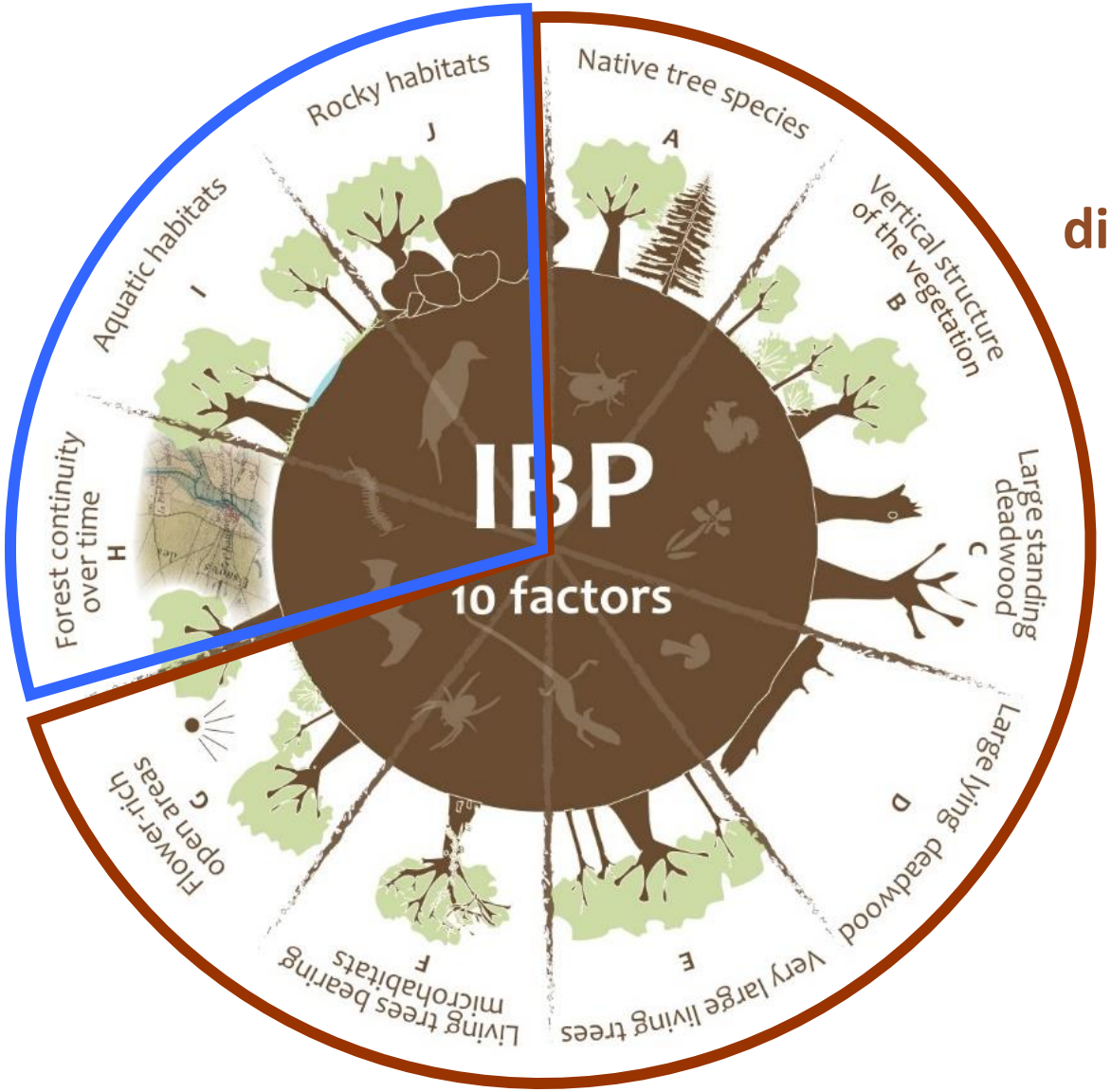
L’INDICE DE BIODIVERSITÉ POTENTIELLE (IBP) : UNE MÉTHODE SIMPLE ET RAPIDE POUR ÉVALUER LA BIODIVERSITÉ POTENTIELLE DES PEUPLEMENTS FORESTIERS

LAURENT LARRIEU - PIERRE GONIN

Rev. For. Fr. LX - 6-2008

The IBP is an indirect indicator that combines 10 key factors for forest-dwelling taxa that are easy to record without taxonomic skills (except trees)

3 factors related to the historical and environmental context



7 factors directly related to forest management

Emberger, Gonin, Larrieu 2023

Initiated in 2009, the French R&D programme is still ongoing

National steering committee
(Researchers, forest managers and owners, ministries, ONG…)

Field users
(managers, owners, teachers…)

Researchers
(Ecologists, sociologists, statisticians…)

Funder
(French ministry of the environment)

R&D program

Research **Development**

INRAE CNPF Centre National de la Propriété Forestière

IBP team


Other French national programs

Technical team
(INRAE Dynafor, CNPF, CEN, graphic designer, printer, etc.)

Clarification of the scope and limitations in order to prevent misuse

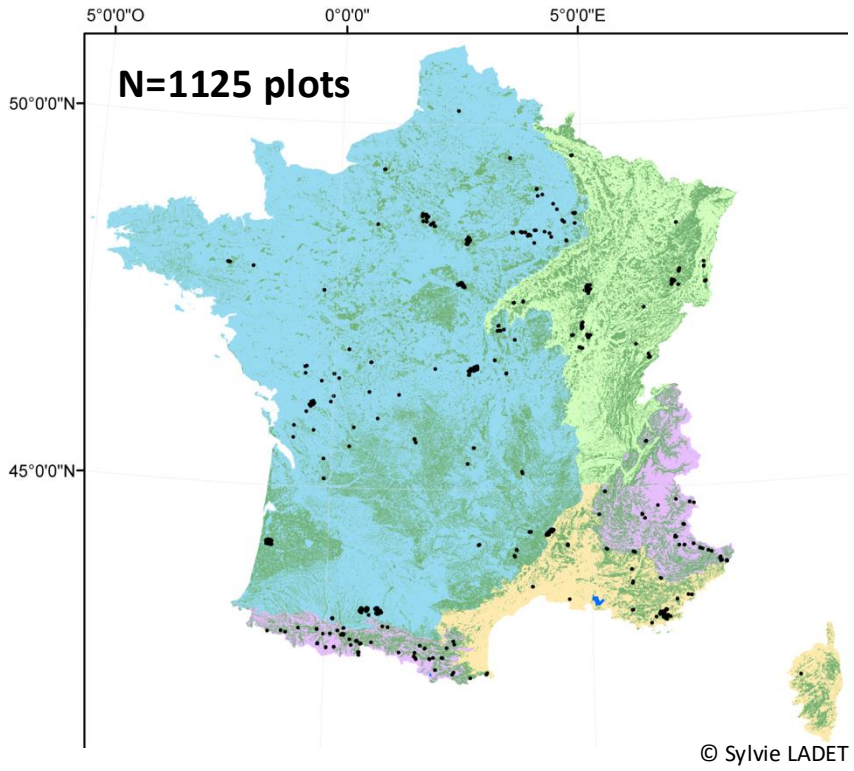
(« Application scope of the IBP »)

LE DOMAINE D'APPLICATION DE L'INDICE DE BIODIVERSITÉ POTENTIELLE (IBP)

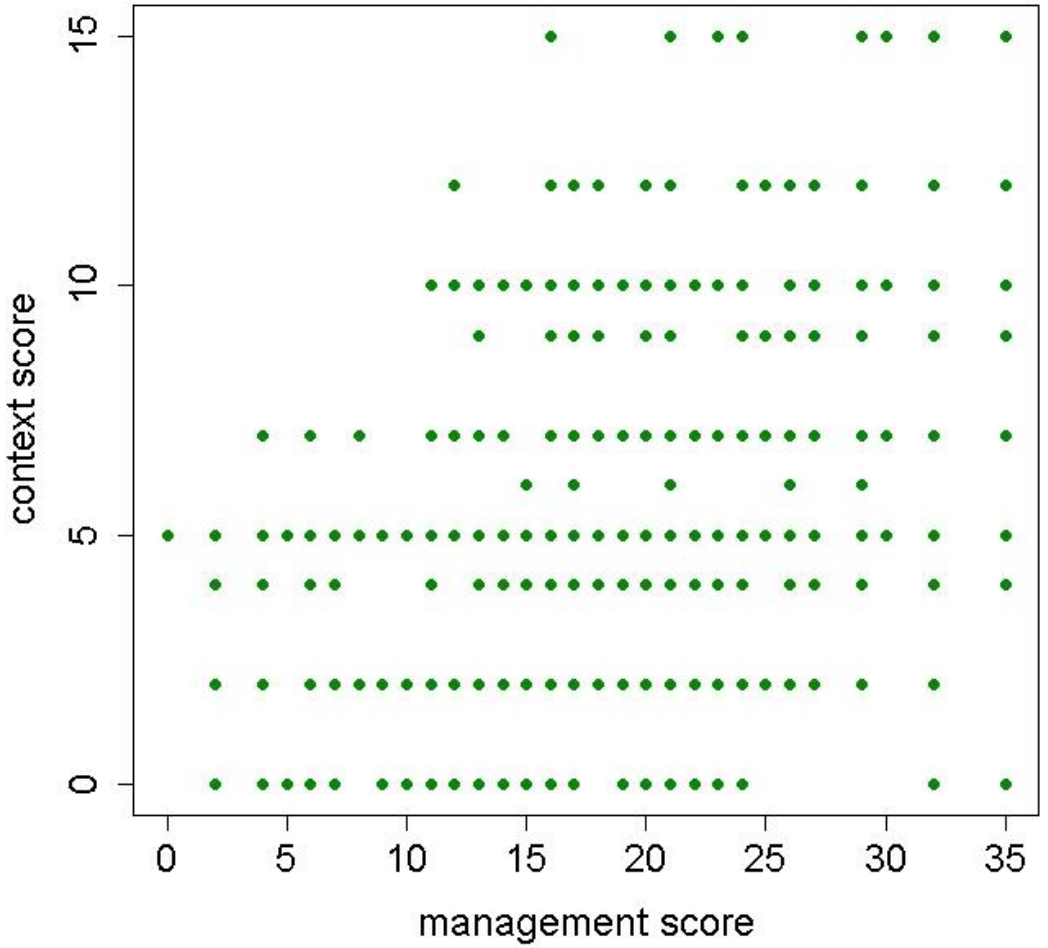
LAURENT LARRIEU – PIERRE GONIN – MARC DECONCHAT

Rev. For. Fr. LXIV - 5-2012

Check of the relevance of the IBP for all French forests

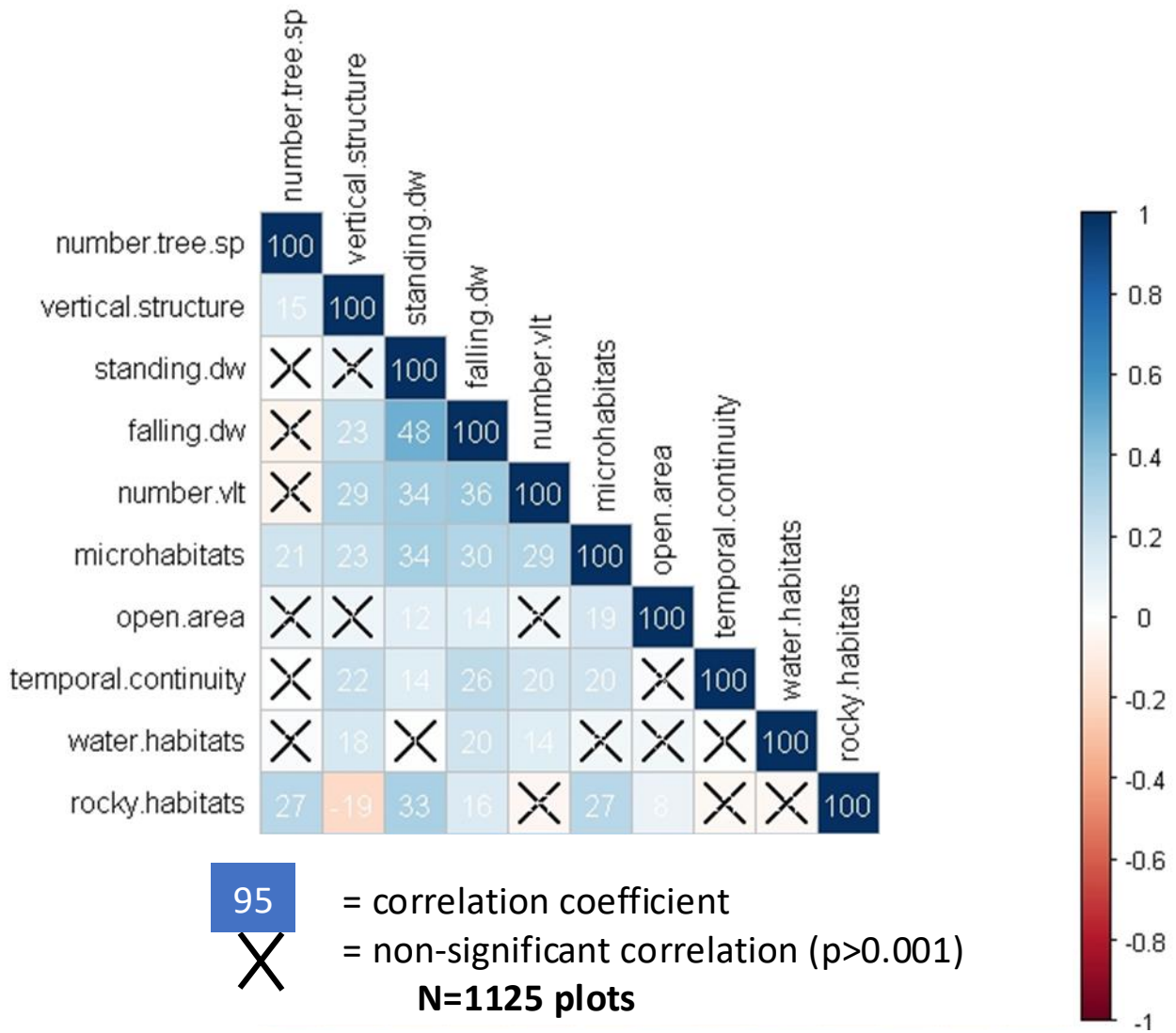


Median IBP score=27 points



The total IBP scores cover almost the entire range of possible values (i.e. 0-50 pts)

Check of the complementarity of the 10 factors



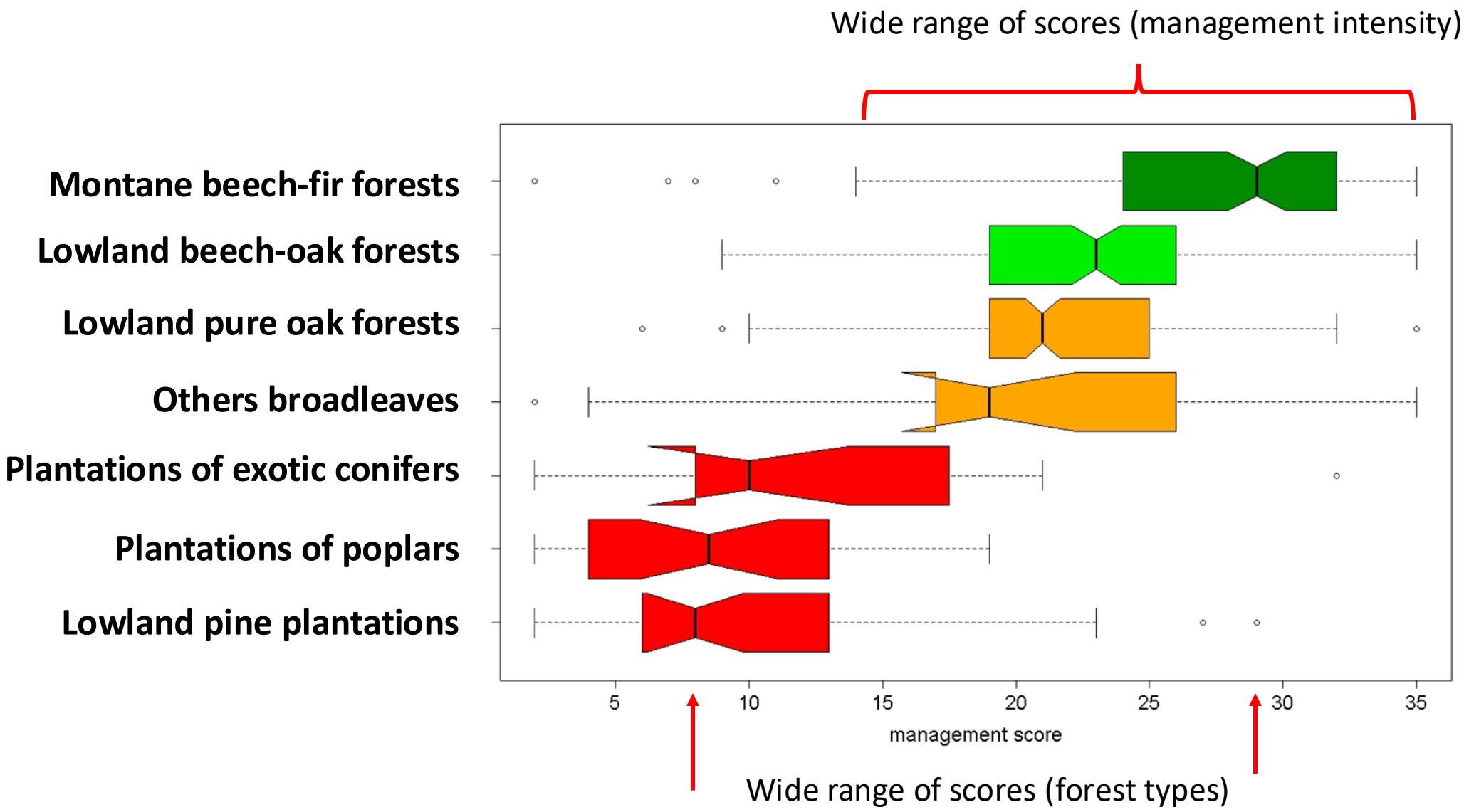
95 = correlation coefficient

X = non-significant correlation (p>0.001)

N=1125 plots

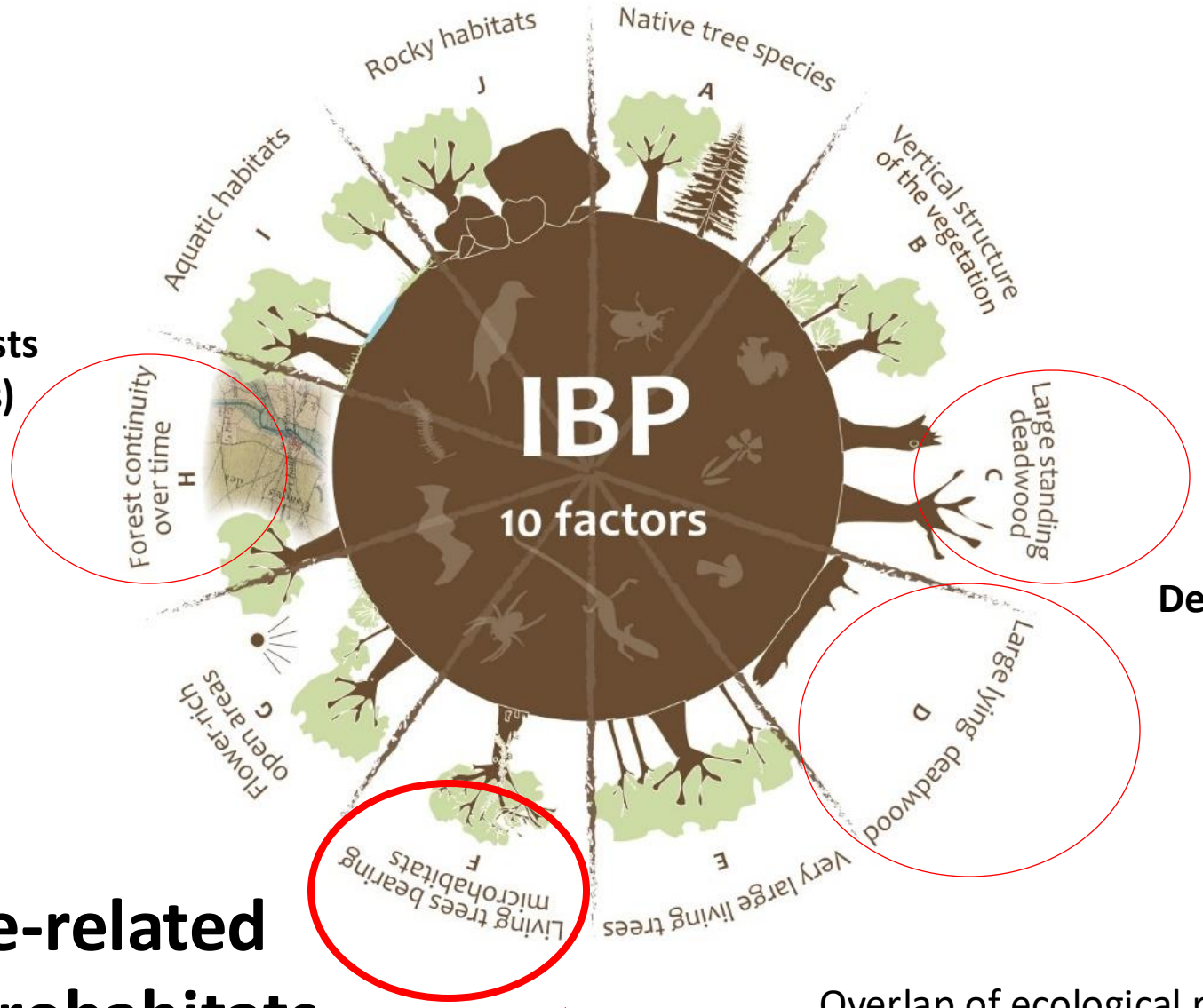
Few correlations and of low magnitude

Check of the sensitivity of the IBP to forest type and management intensity



To improve knowledge of factors for which there was little literature

Vegetation of ancient forests (focus on mountain areas)

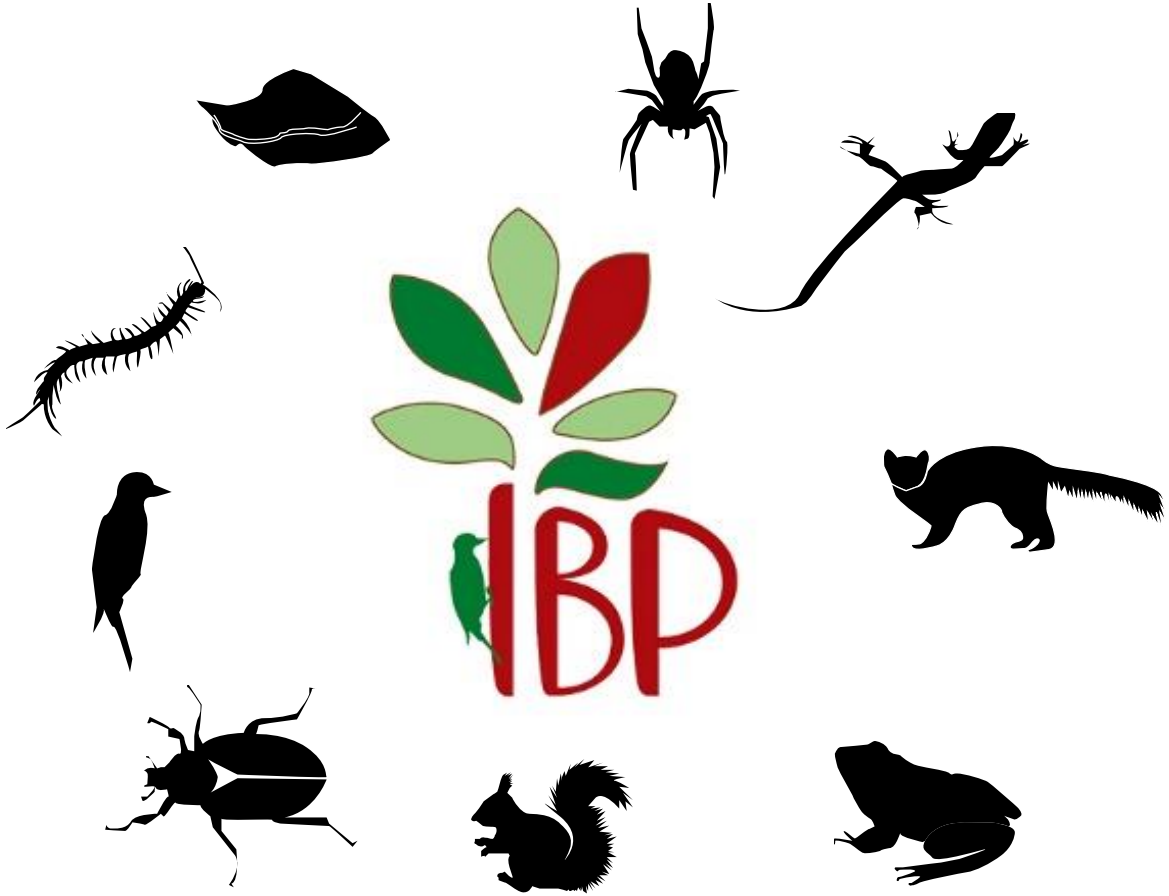


Deadwood

Tree-related microhabitats

Overlap of ecological resources

Calibration of the IBP with taxonomic data



Variations in IBP values *vs* variations in taxon communities

Two ways to calibrate the IBP

1. Calibration of each IBP factor (uncapped data)

Relationships between each factor and variations in biodiversity

- **Species richness**
- **Composition of species assemblages**
- **Looking for significant threshold values**

2. Calibration of the IBP scores

Relationships between scores (factors, total) and variation in biodiversity

- **Species richness only**
- **Effect size**

1. Assessment of the relationship between <u>each IBP factor (counting values)</u> and taxonomic data in <u>temperate</u> forests

- **Species richness**
- Composition of **species assemblages**
- Looking for **significant threshold values**

Contents lists available at ScienceDirect
Ecological Indicators
2019
journal homepage: www.elsevier.com/locate/ecolind

Assessing the potential of routine stand variables from multi-taxon data as habitat surrogates in European temperate forests

Laurent Larrieu[a,b,*], Frédéric Gosselin[c], Frédéric Archaux[c], Richard Chevalier[c], Gilles Corriol[d], Emmanuelle Dauffy-Richard[c,1], Marc Deconchat[a], Marion Gosselin[c], Sylvie Ladet[a], Jean-Marie Savoie[a], Laurent Tillon[e], Christophe Bouget[c]

Sampling design: 19 forest counties in France; **487 x 1ha-plots**
Taxonomic data: **9 taxa** covering a wide range of habitat requirements

Main results

✓ **High congruence between IBP factors and both taxon species richness** and **composition**

✓ **7 significant threshold values** above which species richness was significantly higher, **consistent with IBP thresholds**

2. Assessment of the relationship between IBP scores and taxonomic data in temperate forests

- **Species richness**
- Looking for the **effect size of an increase in IBP score**

Contents lists available at ScienceDirect
Ecological Indicators
2022
journal homepage: www.elsevier.com/locate/ecolind

Index of biodiversity potential (IBP) versus direct species monitoring in temperate forests

Laura Zeller [a,*], Charlotte Baumann [a], Pierre Gonin [b], Lea Heidrich [c], Constanze Keye [d], Felix Konrad [a], Laurent Larrieu [e,f], Peter Meyer [d], Holger Sennhenn-Reulen [g], Jörg Müller [h,i], Peter Schall [a], Christian Ammer [a]

Sampling design: 3 forest counties in Germany; **147 x 1ha-plots**

Taxonomic data**: 13 taxa** covering a wide range of habitat requirements

Main results

✓ **Positive relationships** between IBP score and species richness of **birds, fungi, true bugs, lichens, and moths**

✓ **+ 5 points IBP → + 3-12% species richness,** depending on both forest type and taxon

3. Assessment of the relationship between <u>each IBP factor</u> and taxonomic data in <u>Mediterranean</u> forests

- **Species richness**
- **Species abundance**
- **Full groups vs forest sub-groups**

Contents lists available at ScienceDirect
2025
Forest Ecology and Management
journal homepage: www.elsevier.com/locate/foreco
ELSEVIER

Evaluating habitat structural variables as reliable indicators of biodiversity in Mediterranean forests

Marc Rota [a,b,c,*], Míriam Piqué [a,b], Victor Sazatornil [a], Mariano J. Feldman [a], Teresa Baiges [d], David Guixé [a], Laurent Larrieu [e,f], Roser Mundet [g], Mar Pallarés [a], Jordi Vayreda [h], Jordi Camprodon [a,i]

Sampling design

- Spain (Catalonia)
- 22 forests **/ 3 forest types**
- **85x0.33ha plots**
- **7 taxa** covering a wide range of habitat requirements

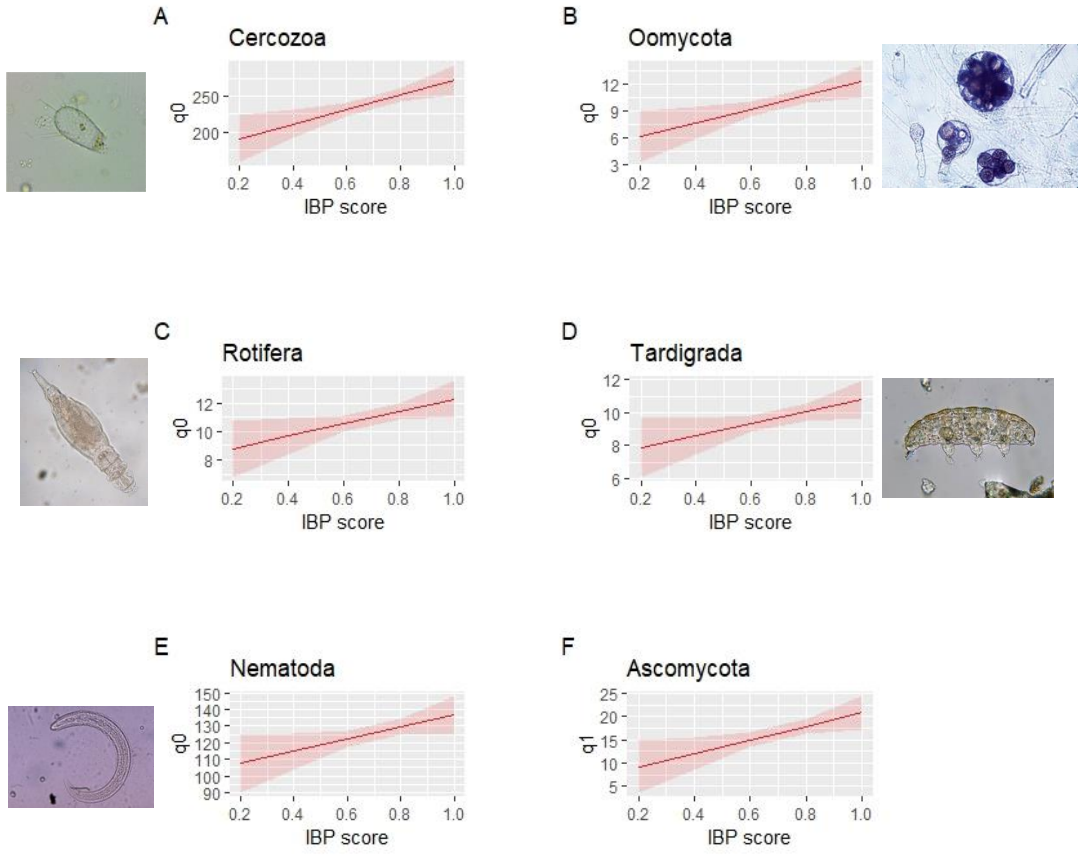
Main results

- ✓ **Each IBP factor is linked to at least one taxonomic group or subgroup**
- ✓ **Densities of logs and habitat-trees, ancientness and diversity of rocky macrohabitats show the greatest number of relationships with taxa**
- ✓ **Forest sub-groups showed more significant relationships with IBP factors than full groups**

4. Assessment of the relationship between IBP score and soil Eucaryotes in temperate forests (although no IBP factor focuses on soil taxa…)

Sampling design

- SW France
- Lowland + highland forests
- **86 x 1ha plots**
- Soil **environmental DNA**



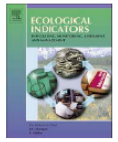
Main results

Numerous significant and positive relationships

Raimbault et al. (FEM, ongoing revision)

Assessment of observer effect on IBP scores

Contents lists available at ScienceDirect
Ecological Indicators
journal homepage: www.elsevier.com/locate/ecolind
2020



Developing and using statistical tools to estimate observer effect for ordered class data: The case of the IBP (Index of Biodiversity Potential)

Frédéric Gosselin[a,*], Laurent Larrieu[b,c]

+ Gosselin, Gonin, Larrieu (in prep.)

Sampling design

14 x 1ha plots, broadleaves/mixed/coniferous stands, **38 observers**, winter & summer; **Ntot=789 IBP**

Main results

- ✓ **The IBP can be measured throughout the year, but attention should be paid to 4 factors that show a "seasonal" effect:** *Native tree species* (Factor A), *Vertical structure of the vegetation* (B), *Large standing deadwood* (C) and *Openness* (G)
- ✓ **A (short) training course is necessary to ensure the quality of recordings** (particularly for factor B)
- ✓ **Possibility of assessing the expected observer effect using simple tools to evaluate the observer's 'skills' (e.g. Quiz)**

A social study aimed at better understanding why the IBP is being used by a wider audience than initially targeted

- **Intrinsic features** of the IBP + **active individual strategies** have supported its **translation through multiple actors' networks**

  → **Broad dissemination of the IBP among a wide range of stakeholders**, who were not all initially targeted: e.g. managers of natural areas, regional development officers, scientists,…

- The IBP as a "**boundary object**" (sensu Star & Griesemer 1989)

  → Facilitates **discussion and negotiation between actors with different beliefs and interests**

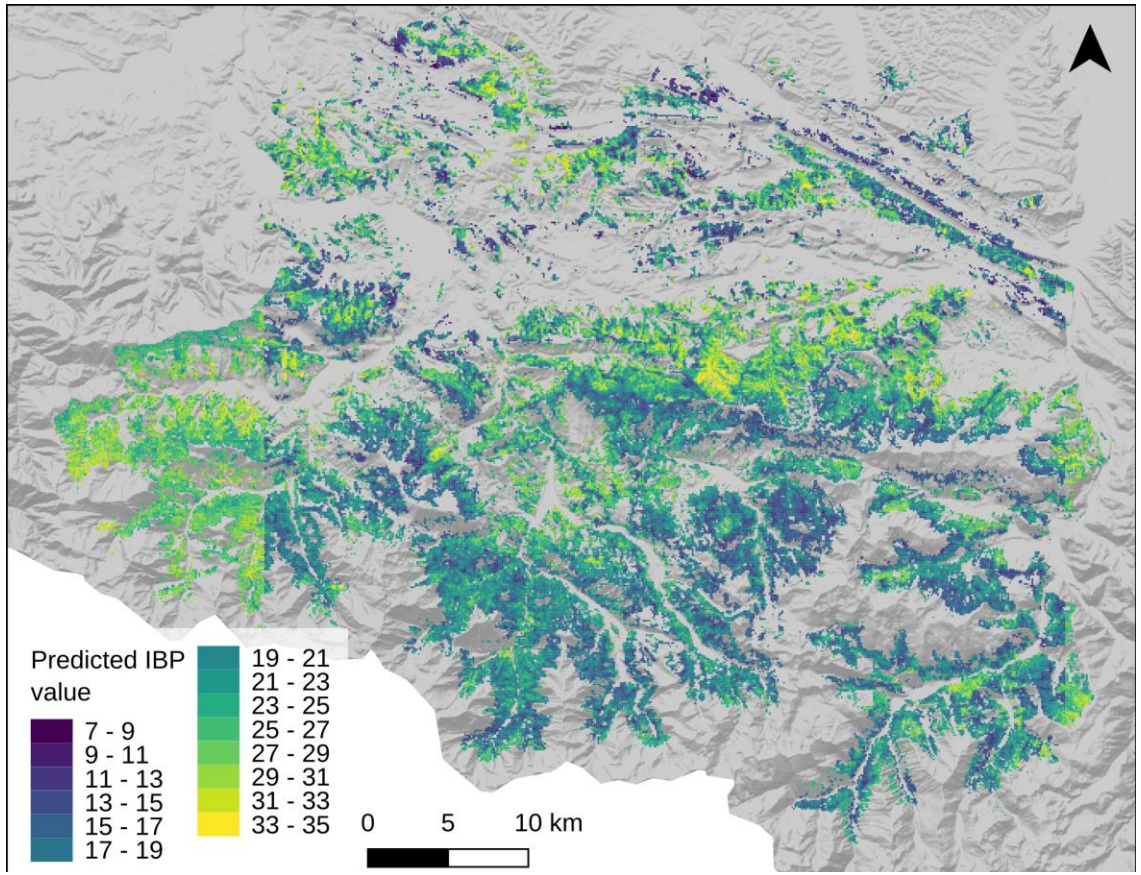
Gauvreau et al. 2024 (submitted to Nov'AE)

Research prospects

Collard et al. 2024 (FEM; ongoing revision)

❑ **The assessment of the IBP at large spatial scale using remote sensing data (LIDAR) is promising**

Main goal: classify stands on a broad spatial scale and select stands for more detailed field surveys



Average root mean square error (RMSE) around 5-6 points of IBP

The IBP in a nutshell…

- Easy-to-use tool for biodiversity-friendly forest management
- Suitable for all temperate and Mediterranean forests
- Calibrated with a wide range of taxa (both factors and total score) for temperate and Mediterranean contexts
- Observer effect is assessed, allowing training sessions to be fitted and time series to be used
- “Boundary object” that allows for discussion and negotiation between actors with different beliefs and interests

- Large-scale IBP assessment based on remote sensing data coming soon…

Thanks for your attention