Forest management cessation and biodiversity: a synthesis of a nationwide French project

Frédéric Gosselin, Yoan Paillet, Marion Gosselin, Laurent Larrieu, Anders Mårell, Vincent Boulanger, Nicolas Debaive, Frédéric Archaux, Christophe Bouget, Olivier Gilg, et al.

Forest management cessation and biodiversity: a synthesis of a nationwide French project

Gosselin, F. [*], Paillet, Y. [*], Gosselin, M. [*], Larrieu, L. [©], Mårell, A. [*], Boulanger, V. [#], Debaive, N. [@], Archaux, F. [*], Bouget, C. [*], Gilg, O. [@], Drapier, N. [#], Dauffy-Richard, E. [*]

[*] Irstea – Nogent-sur-Vernisson, France

[#] ONF, France

[@] RNF – Dijon, France

[©] INRA, Toulouse, France

Forest reserves for biodiversity enhancement

Forest reserves left unmanaged as **a central strategy for biodiversity enhancement**…

… even though other management approaches can improve biodiversity promoted by unmanaged forests (extending rotations, deadwood…)…

Hunter 1999 Cambridge U. Press
Lindenmayer & Franklin 2002 Island Press

Forest reserves for biodiversity enhancement

Forest reserves left unmanaged as **a central strategy for biodiversity enhancement**…

Land sparing

… even though other management approaches can improve biodiversity promoted by unmanaged forests (extending rotations, deadwood…)

Land sharing

Hunter 1999 Cambridge U. Press
Lindenmayer & Franklin 2002 Island Press

State of knowledge

European meta-analysis (Paillet et al. 2010 *Conserv. Biol.*)

- **Positive effect of forest management cessation on local species richness**
- **… with strong « taxonomic » variations…**
  - – negative effect on vascular plants
  - – positive effect for taxa related to deadwood & MH
- ***… but important knowledge gaps***
  - *– few temperate studies*
  - *– sampling often problematic (site type bias, pseudoreplication)*
  - *– explanatory factors often not incorporated*

Instigation of the French ***GNB*** project

Biodiversity *in* ***forest reserves*** *vs* ***managed forests***

1st Objective

Quantify and better understand the relationship between biodiversity and management cessation esp. in France

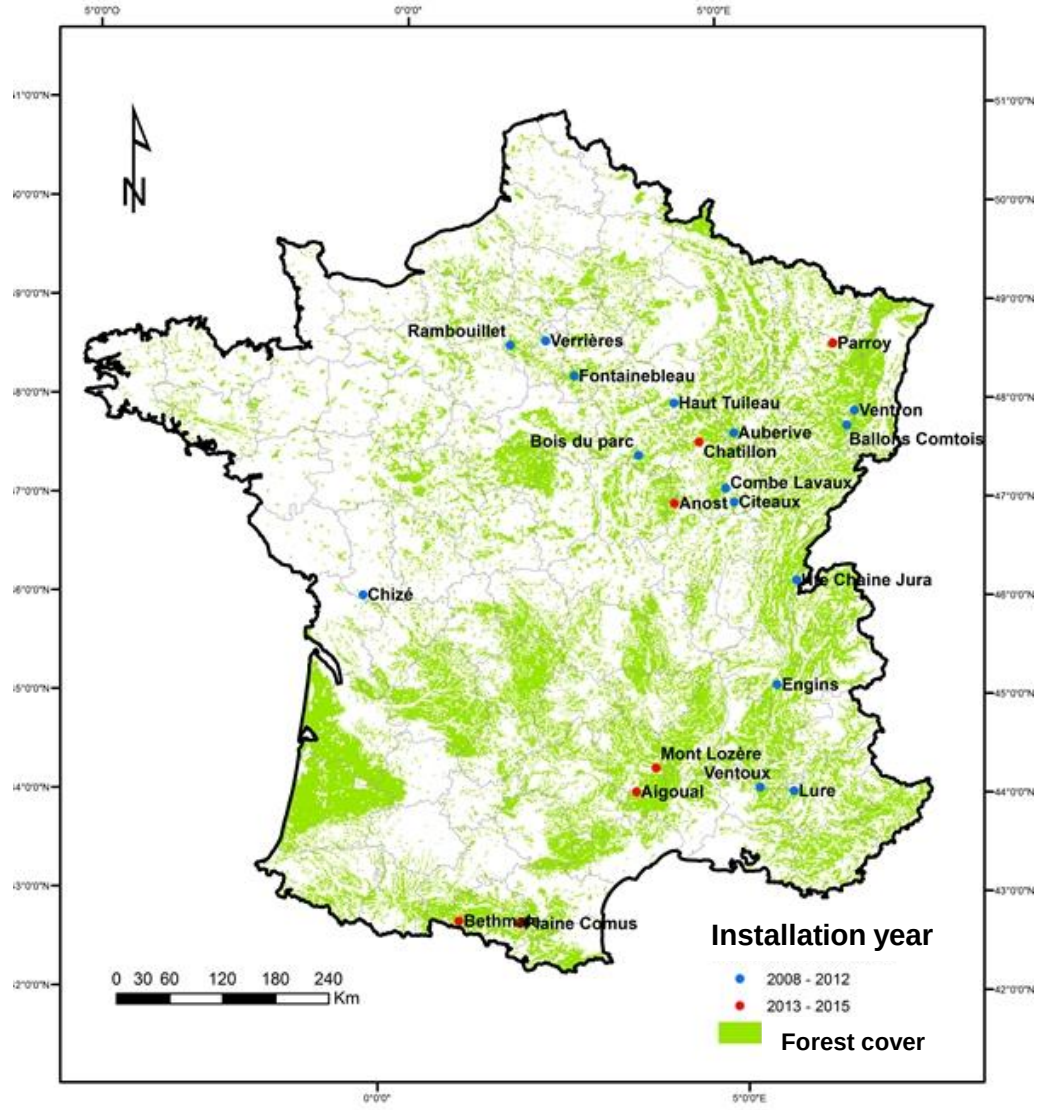
2nd Objective

Test biodiversity indicators (SoEF, EEA…) on an extended gradient of forest management intensity

3rd Objective

Methodological developments (protocols, statistical tools…)

A multi-site research project



- From 2008 to 2017: **282 stands studied once in 22 French forests**
- Balance between **managed and unmanaged stands**, **in similar site types** (topography, soil)

Time since last harvesting

MAN: 9 ±12 years

UNM: 46 ± 38 years

Dendrometric characterization: combined fixed angle, surface & transect techniques…

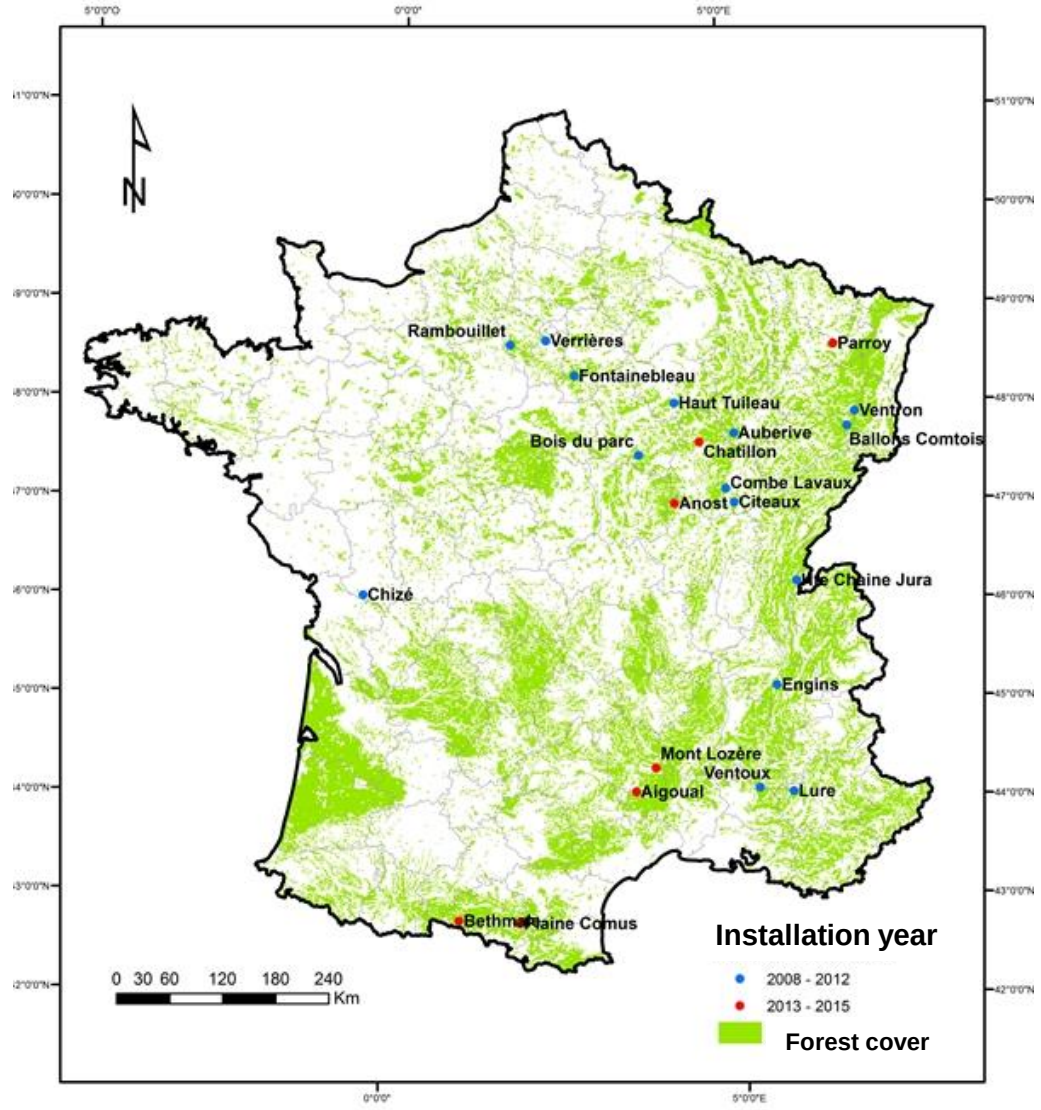
Living wood
DBH>7.5cm
(max: 2% or 3%)

Snags
DBH>7.5cm
(max: R=20m)

Logs D>5cm
(max: R=20m)

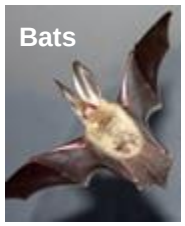
… as well as/compared to **rapid habitat assessment (IBP)**

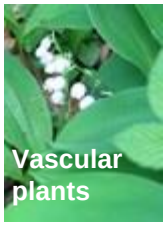
A multi-taxa research project



Seven taxonomic groups

being investigated

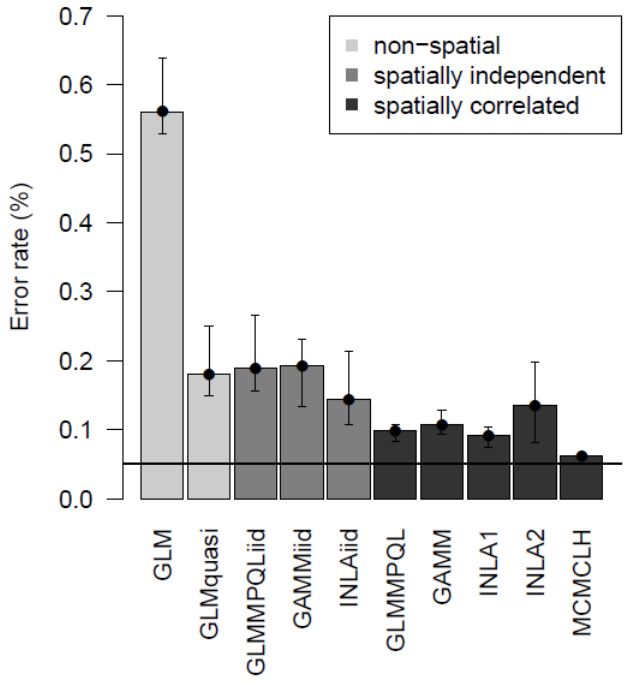




Some methodological results

↳ available spatially-explicit Bayesian methods more adequate to account for spatial pseudoreplication than frequentist ones for count data

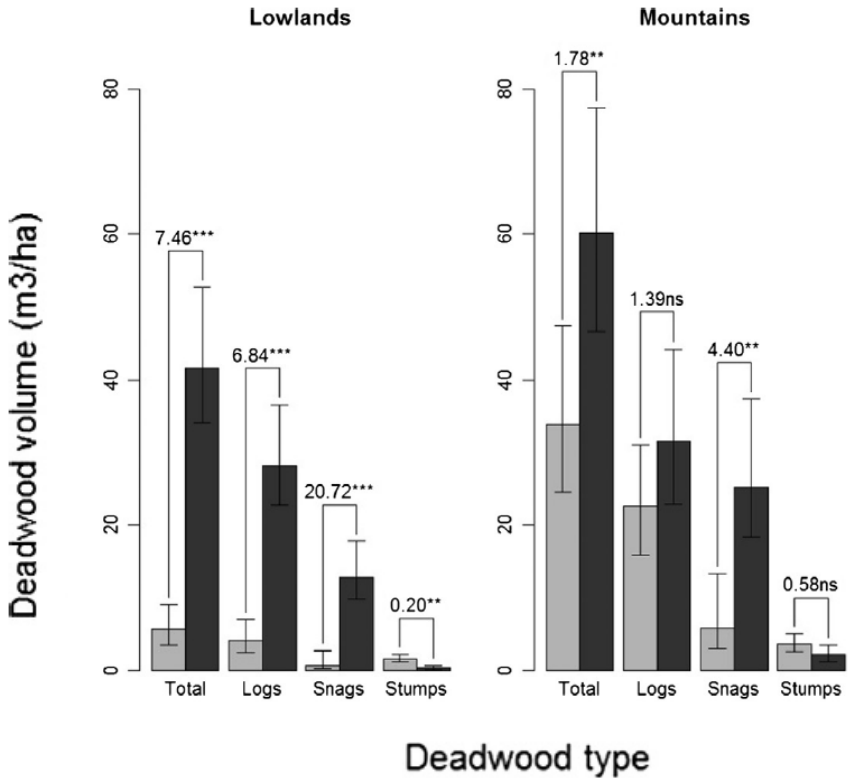
↳ importance of incorporating spatial autocorrelation



Saas & Gosselin (2014)
Ecography

Some ecological results

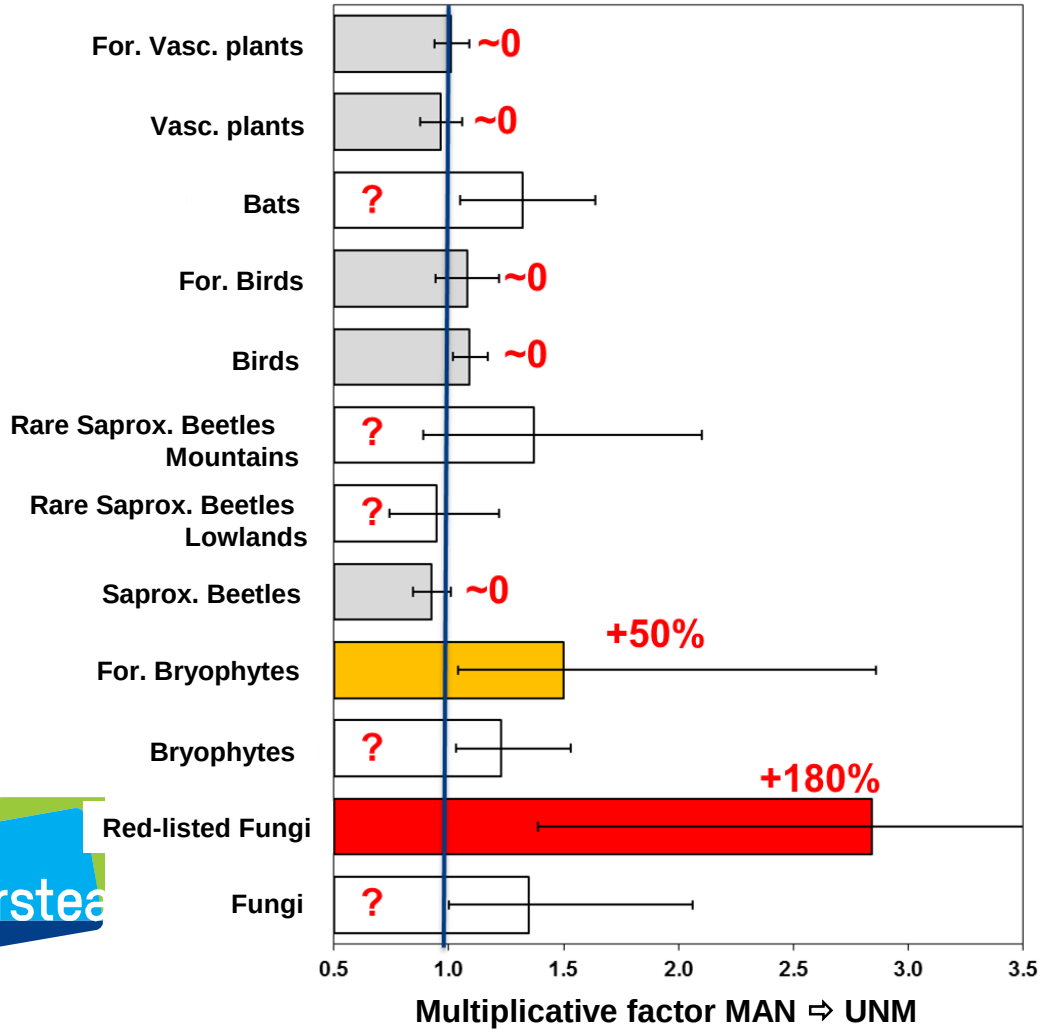
1- **Strong dendrometric differences** (very large trees, deadwood) between managed and unmanaged stands, but not uniformly



Paillet et al. (2015) *FEM*

Some ecological results

2- Effect of **management cessation** on species richness



Strong positive effect for red-listed fungi & forest bryophytes

Negligible effect for birds, vascular plants, saproxylic beetles

Uncertain magnitude category : bats, rare saprox. beetles, bryophytes and fungi

Gosselin et al. (2014) *Research Report*

Some ecological results

3- **Indicators** that best explain species richness variation

Volume of large deadwood

Deadwood volume

% Protected area

Strong effects

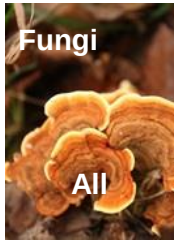
Other best indicators (without strong effects):

- Deadwood metrics (birds, bats, all bryophytes)
- Living tree metrics (vascular plants, carabid beetles, all sap. beetles)
- TreMs (rare sap. beetles)

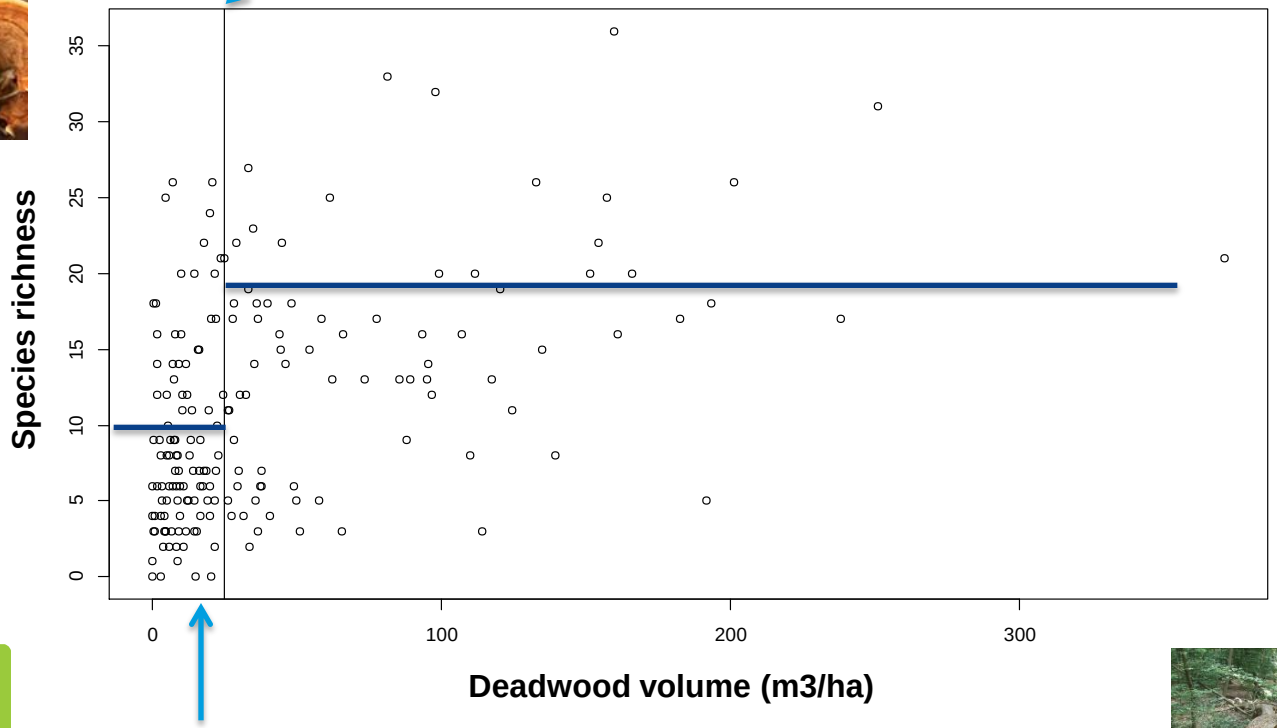
Gosselin et al. (2014)
Research Report

Some ecological results

3- **Indicators** that best explain species richness variation



Threshold : 25 m3/ha **[9; 60]**



Mean in managed stands : 20 m3/ha

Discussion

- ⇨ Some evidence for **land sparing** and related variables (deadwood, %protected area) on a delimited part of bodiversity (bryophytes, lignicolous fungi, specific ecological groups)
- ⇨ Some evidence for **land sharing** through deadwood related variables for this delimited part of bodiversity (but would require substantial increases)
- ⇨ Some **surprising results** (e.g. no clear/strong response of **saproxylic beetles**)

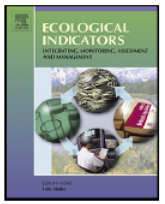
Discussion: main limits/characteristics

- Mainly species richness analyzed at stand scale
- Simple biodiversity measurements (sometimes closer to sampling than inventory)
- Not experimental: no (complete) randomization, no control of initial states
- Few very old/very big reserves (recent policy, difficulties/pressures to find big areas)

Discussion: perspectives

- **Further analyses to come**:
  - All the data
  - Other metrics (abundance…) & levels (species, groups…)
  - Other scales (tree level, gamma…)
  - Other ecological questions (multi-trophic…)
  - Improved statistical tools (sigmoid functions…)
- Updating of **management guidelines**?
- **Going back to the stands**: from coupled inventories to spatio-temporal monitoring?

Ecological Indicators 49 (2015) 14–23



ELSEVIER

GESTION FORESTIERE, NATURALITE ET BIODIVERSITE
FOREST MANAGEMENT, NATURALNESS AND BIODIVERSITY

Coordinateur scientifique :
Frédéric GOSSELIN
Irtsea, UR EFNO, équipe biodiversité
Domaine des Barres, 45290 Nogent-sur-Vernisson
frederic.gosselin@irstea.fr

Auteurs du rapport :
Gosselin, F. [1], Paillet, Y. [1], Gosselin, M. [1], Durrieu, S. [5]
Larrieu, L. [6,7], Marrell, A. [1], Lucie, X. [5], Boulanger, V. [2], Debaive, N. [3,4],
Archaux, F. [1], Bouget, C. [1], Gilg, O. [3], Rocquencourt, A. [1],
Drapier, N. [4], Dauffy-Richard, E. [1]

[1] Irstea, UR EFNO, Domaine des Barres, 45290 Nogent-sur-Vernisson, France
[2] Office National des Forêts, Département Recherche et Développement, Boulevard de Constance, 77300 Fontainebleau, France
[3] Réserves Naturelles de France, 6 bis, rue de la Gouge CS 60100, 21803 Quétigny Cedex, France
[4] Office National des Forêts, Direction Forêts et Risques Naturels, 6, avenue de Saint-Mandé 75570 Paris Cedex 12, France
[5] UMR TETIS - Irstea, Maison de la Télédétection en Languedoc-Roussillon 500, rue J.F. Breton BP 5095, 34196 Montpellier Cedex 05, France
[6] UMR 1201 Dynafor, INRA, INPT/ENSAT/EIPURPAN, Castanet-Tolosan, France
[7] CNPF-IDF, Auzeville Tolosane, France

Synthèse du rapport final
8 novembre 2014

Numéro de contrat MEDDE/MAAF : 10-MBGD-BGF-1-CVS-092, n°CHORUS 2100 214 651

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE
Ministère de l'Écologie, du Développement durable et de l'Énergie

ECOFOR
ECOSYSTEMES FORESTIERS

Liberté • Égalité • Fraternité
RÉPUBLIQUE FRANÇAISE
MINISTÈRE DE L'AGRICULTURE DE L'AGRO-ALIMENTAIRE ET DE LA FORÊT

Strong obse
A case study

Yoan Paillet*, P

Irstea, UR EFNO, Nogent-s

ARTICLE IN

Article history:
Received 10 February 201
Received in revised form
Accepted 19 August 2014

Keywords:
Data quality
Tree microhabitats
Observer effect
Detectability
Bayesian analysis

Quant
reserv

Yoan Pa
Frédéric

[a] Irstea, UR EF
[b] Office Nationa
[c] Réserves Natu
[d] Office Nationa
[e] Irstea, UR EM

ARTICLE INFO

Article history:
Received 8 January 2015
Received in revised form 16 February 2015

AB

Over
scape-
1950s

Article history:
Received 1 March 2012
Received in revised form 18

sselin

licability, their range of validity and
represent. In this process, assessing
on-specialist observers are involved.
cteristics – are reputed to be easily
quire prior forestry or ecology knowl-
sitive detections made by observers

ed for at least 150 years, 14 observers
06 oak (*Quercus petraea* and *Quercus*
Bayesian statistics to compare these
census.
rids, researchers still
al. (2010)'s work to
in ecological studies.
ist and two Bayesian

st biodiversity, such as forest
t be more dependent on spe-

Mark

t protocols

ce to analyze
beetle diver-
lic fungi, tree

☺☺ Many thanks to ☺☺

☺ Your attention!

☺ French Ministry of Ecology & ONF for funding

☺ All the persons (~100) that were involved at some point in the GNB project

GNB *stands for (forest) management, naturalness & biodiversity*

« Gestion, Naturalité, Biodiversité »

A diverse interface between forest management and research