Observer effect on tree microhabitats censuses

Observer effect may bias results of scientific studies. It should be quantified and limited in biodiversity assessment. Such quality insurance is crucial to obtain unbiased ecological data and validate biodiversity indicators.

Strong observer effect on number and occurrence of tree microhabitats

The mean number of microhabitats per tree observed vary widely between observers (from 1.4 to 3.2). Only 3 observers were statistically equivalent to the reference census (fig. 1).
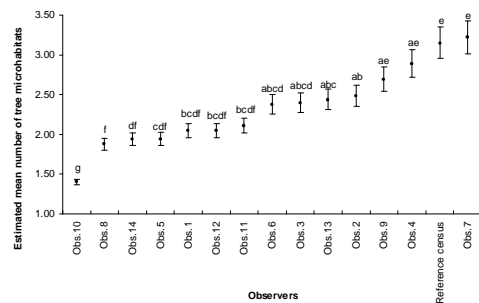

Fig. 1 Mean number of microhabitats per tree for each observer. Different letters mean significant differences between observers

At the microhabitat level, similarly high variations in detection and invention probabilities were observed for the 6 most common microhabitat types (fig. 2).
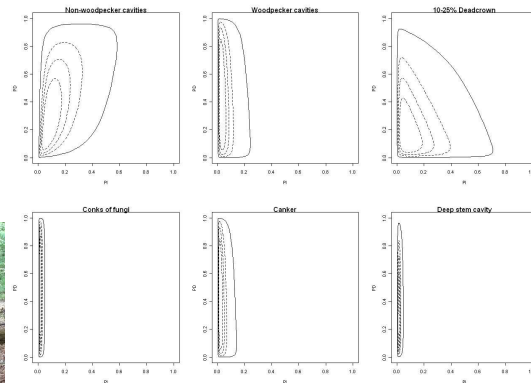

Fig. 2 Probabilities of detection (PD) and invention (PI) for the six most abundant microhabitat types. Plain lines represent the 95% confidence intervals. Dotted lines represent the 70, 50 and 30% CIs.

MATERIALS & METHODS

Two 0.5ha plots in the strict forest reserve of Fontainebleau (France)
- 28 microhabitat types
- 106 trees
- 14 observers
- Reference census by 3 independent observers

Statistical analyses
- Total number of microhabitats per tree: generalized mixed modelling
- Probability of detection (PD) and invention (PI): Bayesian analyses

Ref	ObsX	PD	PI
1	1 →	1	0
0	1	0 →	1
...	...	...	...

Solutions to constrict observer effect on microhabitat censuses
- Multiply training sessions and reference census
- Record microhabitats with 2 observers
- Avoid confounding observers and modalities of interest in experimental designs
- Integrate observer effect in statistical analyses

A sample of microhabitats observed (up to bottom): conks of fungi, woodpecker cavity, bryophytes, bark characteristics, canker

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ABSTRACT TITLE:	Towards the validation of a new forest biodiversity indicator: observer effects on tree microhabitats censuses in a French unmanaged forest
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Abstract:
A growing field of forest research deals with the improvement of forest biodiversity indicators. Validation of biodiversity indicators requires an analysis of their applicability, their range of validity and the magnitude of the correlation with the biodiversity they are supposed to represent. In this process, assessing the magnitude of observer effect is an essential step. In this context, we tested observer effects (probability of detection, probability of invention/false detection) on the censuses of tree microhabitats related to woodpecker cavities, cracks and bark characteristics. Within two 0.5ha plots in a forest reserve that has not been harvested for at least 150 years, 14 observers visually observed microhabitats on 106 Oak (Quercus petraea and Q. robur) and Beech (Fagus sylvatica) trees. We compared the censuses of these observers with an independent consensual census using parametric and Bayesian statistics. The mean number of microhabitats per tree varied widely between observers from 1.4 to over 3. Only three observers reported a mean number of microhabitats per tree statistically equivalent to the consensual census. The probability of detection also varied between observers among microhabitats (from to 0 to 1) as well as the probability of invention (from 0 to 0.7). These results show that microhabitats censuses are particularly prone to observer effects and should be used with caution. Such strong observer effects raise the question of the relevance of microhabitats as biodiversity indicator. However, we recommend to control for observer effects by (i) multiplying the number of training sessions and consensual censuses; (ii) recording microhabitats with two observers whenever possible, but the efficiency of this method remains to be tested; (iii) planning the fieldwork so that the factors of interest are not merely confused with observer effects and; (iv) integrating observer identity in statistical models whenever analysing such data.