

# A Variational Bayes approach to the analysis of site-occupancy models.

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**Abstract:** Presence-absence data is often used to investigate the range and range shifts of animal populations using an occupancy model that contains covariates assumed to capture the probability of species occurrence as well as covariates assumed to capture the probability of species detection. To date, likelihood as well as Bayesian methods have been developed for the standard model (none-spatial) as well as the model that incorporates spatial random effects (spatial models). Bayesian models that include logistic link functions are often analysed using WinBugs or OpenBugs since Markov chain Monte Carlo methods are required to sample from the posterior distribution of the required parameters. In this article we develop a variational Bayes approximation to the posterior distribution of the parameters of a standard occupancy model which uses logistic link functions to model the probability of species occurrence at sites as well as species detection probabilities. A fast iterative algorithm that does not use Markov Chain Monte Carlo methods is developed. The effectiveness of the proposed technique is investigated via simulations and suggestions are made on how the technique could be extended to the case of the probit link function. Data extracted from Southern Africa Bird Atlas Project (SABAP) is used to illustrate the usefulness of the variational Bayes technique.

## References

Dorazio, R. M. and Rodríguez, D. T. (2012). A Gibbs sampler for Bayesian analysis of site-occupancy data. *Methods in Ecology and Evolution*, 3(6): 1093-1098.