# Flexible Density Surface Estimation for Spatially Explicit Capture-Recapture Surveys

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**Abstract:** Although maximum likelihood methods for spatially explicit capture-recapture (SECR) survey were formulated by Borchers and Efford (2008) using a general nonhomogeneous Poisson process to model animal home range (or activity centre) locations, all published implementations of this SECR method to date assume a homogeneous Poisson process for locations - which implies uniform animal distribution in space. Although such a model is statistically convenient, in many applications a homogeneous Poisson process is likely be unrealistic, as animal density is seldom uniform in space.

Efford (2013) has implemented nonhomogeneous Poisson process models with parametric models for the dependence of density on explanatory variables, but this kind of model has limited scope for flexible modelling of animal density surfaces. In this talk I develop and illustrate maximum likelihood-based SECR methods with flexible nonhomogeneous Poisson process animal density models, using a generalized additive model formulation for the dependence of density on explanatory variables. I consider both additive univariate smooths and multivariate smooths of explanatory variables. The strengths and vulnerabilities of the methods are illustrated by application to a variety of SECR datasets.

## References

Borchers, D.L. and Efford, M.G. 2008. Spatially explicit maximum likelihood methods for capture-recapture studies. *Biometrics* **64**, 377–385.

Efford, M. G. 2013. secr: Spatially explicit capture-recapture models. R package version 2.7.0. http://CRAN.R-project.org/package=secr