Systematic Conservation Planning

Key reading

Margules, C. R., & Pressey, R. L. (2000). Systematic conservation planning. *Nature*, *405*(6783), 243–53. doi:10.1038/35012251

Review and highlights:

- A review paper laying out the nascent field of systematic conservation planning.
- A general review of the need and basic concepts in systematic conservation planning
- Step by step guide for systematic conservation planning

Sarkar, S., and P. Illoldi-Rangel. 2010. Systematic Conservation Planning: an Updated Protocol. Natureza & Conservação 08:19–26.

Review and highlights:

- A recent review of systematic conservation planning focusing on the protocol.

Further reading:

Langford, W.T., Gordon, A., Bastin, L., Bekessy, S.A., White, M.D., Newell, G. (2011) Raising the bar for systematic conservation planning. Trends in Ecology and Evolution 26:634-640

Review and highlights:

- A review of pitfalls associated with systematic conservation planning and general recommendations on how to better test methods, integrate uncertainty, and integrate errors associated with predictive models.

Species Distribution Models

General

Key reading

Elith, J., and J. R. Leathwick. 2009. Species Distribution Models: Ecological Explanation and Prediction Across Space and Time. Annual Review of Ecology, Evolution, and Systematics 40:677–697.

Guisan, A., Thuiller, W. 2005. Predicting species distribution: offering more than simple habitat models. Ecology Letters 8, 993-1009.

Review and highlights:

A thorough review of SDMs and their ecological basis, the niche concept,

- A general review of the assumptions of SDMs including discussion of equilibrium, biotic interactions, and spatial scale
- Review of fitting and evaluating SDMs and potential pitfalls when projecting into the future or using SDMs in conservation planning

Elith, J., Graham, C.H., Anderson, R.P., Dud'ık, M., Ferrier, S., Guisan, A., Hijmans, R.J., Huettmann, F., Leathwick, J.R., Lehmann, A., others. 2006. Novel methods improve prediction of species' distributions from occurrence data. Ecography 29, 129–151.

Review and highlights:

- Comprehensive evaluation of 16 presence-only (no absences) SDM models for over 226 species across 6 regions.

- One of the first studies to evaluate and compare performance of traditional modeling methods with newer methods such as machine learning, etc.

Further reading

Elith, J., Kearney, M., Phillips, S., 2010. The art of modelling range-shifting species. Methods in Ecology and Evolution 1, 330–342.

Review and highlights:

- Using an invasive species, an exploration of various methods to minimize extrapolation errors and assess and understand SDM predictions.

Wiens, J.A., Stralberg, D., Jongsomjit, D., Howell, C.A., Snyder, M.A., 2009. Niches, models, and climate change: Assessing the assumptions and uncertainties. Proceedings of the National Academy of Sciences 106, 19729–19736.

Review and highlights:

- A review of the niche concept in SDMs
- A review of the assumptions and uncertainties inherent in all SDMs, their effects, and general methods for dealing with them using example species in California.

Further reading for different algorithms

Maxent

Phillips, S. (2013). A brief tutorial on Maxent. AT&T research.

Elith, J., Phillips, S.J., Hastie, T., Dudík, M., Chee, Y.E., Yates, C.J. 2011. A statistical explanation of MaxEnt for ecologists. Diversity and Distributions 17, 43–57.

Review and highlights:

- A thorough explanation geared towards ecologists of the Maxent algorithm, its logistic output, and its components/parameters using case studies.
- Discussion of pitfalls of and how to deal with presence only data, sampling bias, background data, lack of species prevalence, and predicting outside the range of training data

Merow, C., Smith, M.J., and Silander, J.A. 2013.A practical guide to MaxEnt for modeling species' distributions: what it does, and why inputs and settings matter. Ecography 36, 1-12.

Review and highlights:

- Another description of how the maxent algorithm works with language that is targeted for ecologists
- Descriptions and recommendations for the important settings in Maxent

BRT models

Elith, J., Leathwick, J.R., Hastie, T. 2008. A working guide to boosted regression trees. Journal of Animal Ecology 77, 802–813.

Review and highlights:

- Thorough review of what BRTs are and how they work.
- Practical review of how to optimize a BRT models various parameters and settings, how to test the model, and how to review model results using a case study.

- Includes a tutorial and code to run a model using R.

MARS models

Leathwick, J.R., Rowe, D., Richardson, J., Elith, J., Hastie, T., 2005. Using multivariate adaptive regression splines to predict the distributions of New Zealand's freshwater diadromous fish. Freshwater Biology 50, 2034–2052.

GAM/GLM models

Guisan, A., Edwards, T.C., Hastie, T., 2002. Generalized linear and generalized additive models in studies of species distributions: setting the scene. Ecological Modelling 157, 89–100.

SDM Methods

Further reading

Fielding, A.H., Bell, J.F. 1997. A review of methods for the assessment of prediction errors in conservation presence/absence models. Environmental Conservation 24, 38-49.

Review and highlights:

- Recommendations for the selection of model error assessment techniques
- Introduction of the ROC AUC in an ecological setting

Liu, C., Berry, P.M., Dawson, T.P., Pearson, R.G., 2005. Selecting thresholds of occurrence in the prediction of species distributions. Ecography 28, 385–393.

Liu, C., White, M., Newell, G., 2013. Selecting thresholds for the prediction of species occurrence with presence-only data. Journal of Biogeography.

Review and highlights:

- Review and evaluation of methods to select presence/absence thresholds from species distribution model outputs

Dormann, C.F., Elith, J., Bacher, S., Buchmann, C., Carl, G., Carré, G., Marquéz, J.R.G., Gruber, B., Lafourcade, B., Leitão, P.J., Münkemüller, T., McClean, C., Osborne, P.E., Reineking, B., Schröder, B., Skidmore, A.K., Zurell, D., Lautenbach, S., 2012. Collinearity: a review of methods to deal with it and a simulation study evaluating their performance. Ecography

Spatial Prioritization

General

Key reading

Sarkar, S., R. L. Pressey, D. P. Faith, C. R. Margules, T. Fuller, D. M. Stoms, A. Moffett, K. a. Wilson, K. J. Williams, P. H. Williams, and S. Andelman. 2006. Biodiversity Conservation Planning Tools: Present Status and Challenges for the Future. Annual Review of Environment and Resources 31:123–159.

Further reading

Wilson, K. a, J. Carwardine, and H. P. Possingham. 2009. Setting conservation priorities. Annals of the New York Academy of Sciences 1162:237–64.

Kukkala, A. S., & Moilanen, A. (2013). Core concepts of spatial prioritisation in systematic conservation planning. Biological reviews of the Cambridge Philosophical Society, 88(2), 443–64. doi:10.1111/brv.12008

Wilson, K.A., Westphal, M.I., Possingham, H.P., Elith, J., 2005. Sensitivity of conservation planning to different approaches to using predicted species distribution data. Biological Conservation 122, 99–112.

Zonation software

Key reading

Lehtomäki J. & Moilanen A. (2013) Methods and workflow for spatial conservation prioritization using Zonation. Environmental Modelling & Software, 47, 128–137.

Moilanen, A. Landscape Zonation, benefit functions and target-based planning: Unifying reserve selection strategies (2007) Biological Conservation 134, 571-579

Review and highlights:

- Introductions to the Zonation approach and a review of the workflow for using Zonation.

Marxan software

Key reading

Watts, M.E., Ball, I.R., Stewart, R.S., Klein, C.J., Wilson, K., Steinback, C., Lourival, R., Kircher, L., Possingham, H.P., 2009. Marxan with Zones: Software for optimal conservation based land- and sea-use zoning. Environmental Modelling & Software 24, 1513–1521.

Review and highlights:

- Introducing Marxan with Zones.

Stralberg, D., Cameron, D.R., Reynolds, M.D., Hickey, C.M. et al. (2011) Identifying habitat conservation priorities and gapsfor migratory shorebirds and waterfowl in California. Biodiversity Conservation 20:19-40.

Review and highlights:

- Linked estimated bird density models to Marxan.

Conservation planning with climate change

General

Key reading

Kujala, H., Moilanen, A., Araújo, M.B., Cabeza, M., 2013. Conservation Planning with Uncertain Climate Change Projections. PLoS ONE 8, e53315.

Schwartz, M. W. 2012. Using niche models with climate projections to inform conservation management decisions. Biological Conservation 155:149–156.

Veloz, S. D., N. Nur, L. Salas, D. Jongsomjit, J. K. Wood, D. Stralberg, and G. Ballard. 2013. Modeling climate change impacts on tidal marsh birds: Restoration and conservation planning in the face of uncertainty.

Ecosphere 4.

Review and highlights:

- Challenges to systematic conservation planning with climate change
- Two examples of how to handle uncertainty in future climate change projections

No-analog climates

Key reading

Williams, J.W., Jackson, S.T. 2007. Novel climates, no-analog communities, and ecological surprises. Frontiers in Ecology and the Environment 5, 415-482

Review and highlights:

- Description of no-analog communities using a conceptual framework.
- A review of the problems and implications no-analog communities pose to species distribution models
- Projection of global novel climates by 2100 AD

Further reading

Hof, C., I. Levinsky, M. B. Araújo, and C. Rahbek. 2011. Rethinking species' ability to cope with rapid climate change. Global Change Biology 17:2987–2990.Review and highlights:

Review and highlights:

- Alternative thoughts concerning the ability of species to adapt to climate change

Fitzpatrick, M.C., Hargrove, W.W. 2009. The projection of species distribution models and the problem of non-analog climate. Biodiverity Conservation 18, 2255-2261

Review and highlights:

- Description of the problems with SDMs being projected onto novel environments (i.e. outside the range of where the model was calibrated).
- Suggestions for how to identify and report areas with no-analog or novel environments

Invasive species

Ward, D. (2007) Modelling the potential geographic distribution of invasive ant species in New Zealand. Biological Invasions 9:723–735.