

The pattern-based analysis provided an opportunity to test a variety of dispersal and refugia scenarios that have been proposed for the Pacific Northwest, because it has three categorical areas: coastal non-glaciated, southern interior non-glaciated, and northern interior glaciated. Species with the highest dispersal capacity had the largest ranges and were more likely to have dispersed to the northern interior glaciated (recently unglaciated) zone. The study also found that the northern interior zone had been colonized by species from both the coast and from further south in the interior. Less dispersive capable species showed more restricted range, including six endemic species from Idaho, which had not moved to the north.

This last finding led the author to conclude that plant characteristics are likely an important component in the effort to determine what species may be able to successfully shift range across

a fragmented landscape under future climate change. The author points to the importance of including phylogeographies in future work, but has done a remarkable job of identifying vulnerabilities of plant species to climate change using more traditional biogeographic techniques.

Gavin, D.G. (2009) The coastal-disjunct mesic flora in the inland Pacific Northwest of USA and Canada: refugia, dispersal and disequilibrium. *Diversity and Distributions*, 15, 972-982.

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update

More uncertainty with BIOMOD

Species distribution modeling (SDM) has grown in importance over the last decade to become a powerful tool in conservation planning, global change forecasting, ecological hypothesis testing, and characterization of niche properties in phylogenetic analyses. Many scientists have contributed to the conceptual, statistical and technical development of this field. While I believe that further development has asymptoted in many domains of SDM research, it is clear that BIOMOD is a significant contribution.

A decade ago, we faced numerous uncertainties and limitations in building SDMs. Few statistical techniques were available and no comparative studies existed. Generalized Linear Models were a standard method, and key issues included how best to fit response shapes, how to evaluate competing models, and what statistical methods to use to get “the best model” of a target species. Climate change projections were usually established by simply adding 2-4°C to annual mean temperature maps, and “the best model” was then projected into the future. BIOMOD, in its

first version of 2003, was a huge step forward. It included four different statistical methods to model hundreds of species automatically. Further, it used a simple method to identify the model that best fit the general trend among the resulting models.

At the same time modeling and forecasting of a range of scenarios, including the assessment of projection uncertainty, became an important aspect of research on climate change impacts. This has dramatically increased the demand for model building, model averaging, ensemble forecasting, and analysis of complex output. We are no longer interested in identifying “the best model”, but rather the mean and variation of models – currently and when projected to the future.

Ensemble forecasting is so complex that most of us will only include a fraction of the possible uncertainty sources when modeling potential climate change effects upon species distribution patterns. Over the last 6 years BIOMOD has been developed, improved, and extended. It now offers

the capacity to deal with numerous statistical models, ranges of initial conditions, different climate projections, and many more effects. Personally, I never liked the idea of automatically processing hundreds of species without careful consideration of predictor sets with regard to a specific species. However, I will now use BIOMOD even for single species projections, simply because the general framework makes ensemble forecasting so easy for us. And if one chooses to use only a few carefully chosen predictors, then BIOMOD can successfully process many species simultaneously.

Thuiller, W., Lafourcade, B., Engler, R., & Araújo, M.B. (2009) BIOMOD – a platform for ensemble forecasting of species distributions. *Ecography*, 32, 369-373.

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commentary

Geographic patterns of establishment success among exotic bird populations

Human-mediated species invasions are a major component of global environmental change and there remains a pressing need to understand the mechanisms by which a species becomes invasive. With this in mind, the key stage in the invasion pathway (*sensu* Williamson and Brown 1986) is species establishment. It is at this stage, when a species has been transported outside its native geographic range and released in a novel recipient environment, that a species either fails or succeeds to establish an exotic population. However, while much attention has been focussed on what species-level traits determine establishment success in exotic bird populations (Blackburn et al. 2009), relatively less research has concerned the role of location-level variables.

The most obvious reason for this relative 'lack of research' is that in most cases, comparative analyses have consisted of large datasets of good quality records of different species to single specific locations (e.g. Hawaii, Moulton et al. 2001; Australia, Duncan et al. 2001; New Zealand, Duncan et al. 2006) rather than repeated introductions of the same species to multiple locations. Bird species are conspicuous elements of the environment and their distribution and abundance have attracted considerable research attention in the discipline of biogeography (e.g. Gaston and Blackburn 2000). It is therefore somewhat surprising that autecological studies of exotic birds have received disproportionately limited research attention within invasion biology (Pyšek et al. 2008).

A recent article in the *Journal of Biogeography* (Strubbe and Matthysen 2009), provides a timely example of a study that addresses this bias.

Diederik Strubbe and Erik Matthysen compiled data on the introductions and establishment success of two parakeet species (ring-necked *Psittacula krameri* and monk *Myiopsitta monachus* parakeets) across their exotic European distribution. In doing so, the authors provide one of the first comparative biogeographic studies to test environment-level features of establishment success among exotic birds. In total, 181 introduction events were used for their analysis in the exotic range. In their native ranges, parakeet occurrence was estimated using the presence-only method MAXENT (Phillips et al. 2006). For both parakeet species, individually, their establishment success in Europe was 53%. Data from environmental and climatological variables were used to test the relative influence of alternative 'climate-matching' and 'human-activity' hypotheses. The authors found that parakeet establishment success was greater in areas of more dense human population settlement and, both in the native and exotic ranges, their distribution was associated with a smaller number of annual frost days. Further examination revealed that both species were equally sensitive to frost in their exotic range, the majority of failed introductions occurring in regions with more than 50 frost days per year. Human activity can influence establishment success both indirectly, through habitat modification and provision