Enhancing Environmental Types Using Museum Data and ED Models Improves Assessments of Climate/Land-use Change Impacts

Daniel P. Faith[1], Kristen J. Williams[2], Simon Ferrier[3] and Ben E. Lawson[4]
[1]Austalian Museum, Sydney, N.S.W., Australia; [2] CSIRO Sustainable Ecosystems, Atherton, Queensland, Australia; [3]CSIRO Entomology, Canberra, A.C.T., Australia; [4]Griffith University, Brisbane, Queensland, Australia

One strategy for assessing biodiversity losses due to climate and land-use change is based on estimated area losses for different biomes, vegetation types, or other environmental classes. Fractional area loss can be linked to fractional species loss within each class through species-area curves. Studies such as the Millennium Ecosystem Assessment simply take the sum, over all classes, of the estimated fractional species losses to determine total species losses. A weakness is that species overlap among classes is ignored. An alternative method estimates overlap (dissimilarities among classes) using museum collections data, places the classes in environmental space, and applies the ED approach. ED methods use p-median and related criteria to optimally sample environmental space, under an assumption of unimodal response of species to gradients. ED can use probabilities or fractions assigned to each site. When the points in environmental space are classes, the fractions may be inferred from species-area curves. We explore simple scenarios to compare ED and the separate-classes approaches. For 3 classes, i, j, and k, suppose that estimated dissimilarities imply that j and k are 1 unit apart, while i differs from these two by 100 units. Each class is equally species rich. Species-area curves produce valid estimates for the fractional species losses in each class. For some scenarios of species fractional losses, the classes-only approach can indicate that biodiversity has *increased*, when in fact it has *decreased*, as indicated by taking overlap into account through the ED method. ED provides a general strategy for calibrating given classes or types, based on species collections data from GBIF and other sources. The approach may assist global biodiversity monitoring within GEO BON (http://www.earthobservations.org/cop_bi_geobon.shtml), where remote sensing could provide temporal information on changes in land condition/extent, for input into ED calculations for different biomes.