

Studying climate effects on ecology through the use of climate indices: the North Atlantic Oscillation, El Niño Southern Oscillation and beyond

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Abstract

Whereas the El Niño Southern Oscillation (ENSO) affects weather and climate variability worldwide, the North Atlantic Oscillation (NAO) represents the dominant climate pattern in the North Atlantic region. Both climate systems have been demonstrated to considerably influence ecological processes. Several other large-scale climate patterns also exist. Although less well known outside the field of climatology, these patterns are also likely to be of ecological interest. We provide an overview of these climate patterns within the context of the ecological effects of climate variability. The application of climate indices by definition reduces complex space and time variability into simple measures, 'packages of weather'. The disadvantages of using global climate indices are all related to the fact that another level of problems are added to the ecology–climate interface, namely the link between global climate indices and local climate. We identify issues related to: (i) spatial variation; (ii) seasonality; (iii) non–stationarity; (iv) nonlinearity; and (v) lack of correlation in the relationship between global and local climate. The main advantages of using global climate indices are: (i) biological effects may be related more strongly to global indices than to any single local climate variable; (ii) it helps to avoid problems of model selection; (iii) it opens the possibility for ecologists to make predictions; and (iv) they are typically readily available on Internet.