Global Ecology and Biogeography

Volume 15, Number 6, November 2006

Contents

Front cover: White stork (*Ciconia ciconia*) migration routes (orange: 1996; yellow: 1997; purple: 1998; blue: 1999). See pp. 541–552, this issue, for a study on the connection between weather and the timing of migration of soaring birds. Map supplied by Judy Shamoun-Baranes, photograph by Hadoram Shirihai, IOC.

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JSTOR

1466-822X(200611)15:6;1-L

Global Ecology and Biogeography Volume 15 Number 6 November 2006 Pages 537–636

Blackwell

ISSN 1466–822X

Volume 15
Number 6
November 2006

Global Ecology and Biogeography

A Journal of Macroecology

Editor-in-Chief:
David J. Currie

Blackwell Publishing

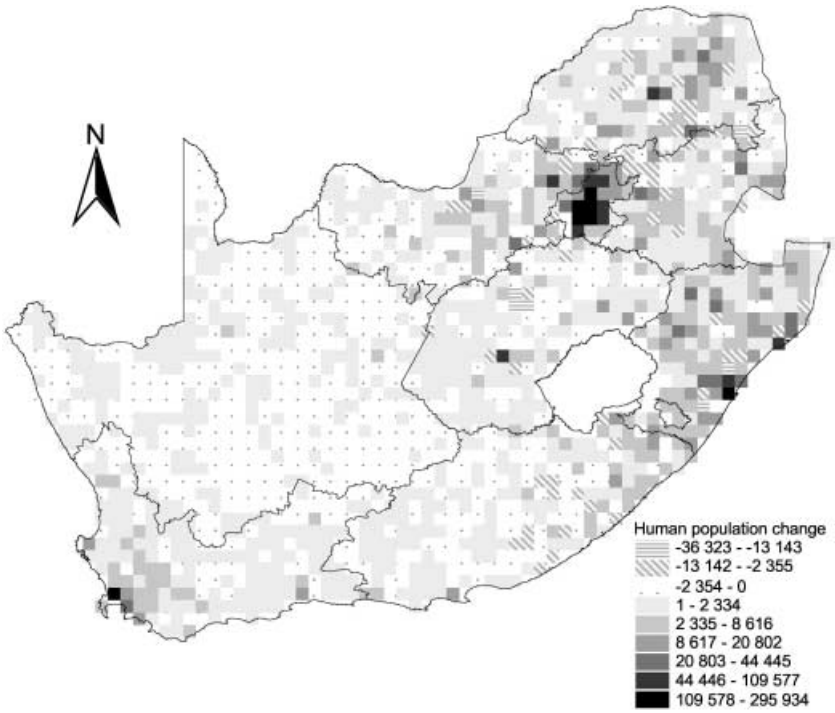

Figure 1 Spatial variation in change in human population size between 1996 and 2001.

by under-sampling. Results using these two data sets were qualitatively similar and thus we present only those from analyses that used the entire data set. These data have been successfully used in many macroecological analyses (e.g. Gaston *et al.*, 2001; van Rensburg *et al.*, 2002, 2004; Chown *et al.*, 2003; Bonn *et al.*, 2004; Storch *et al.*, 2005). Data on South African frog distributions were obtained from Minter *et al.* (2004) for 1572 quarter-degree grid cells. The majority of these data were collected between 1996 and 2003. Surveys in some mountainous areas were largely limited to localities close to roads, and in the arid western regions survey work was often hindered by the lack of rainfall during the survey period. Therefore, for the rarer species inhabiting these areas the data set probably contained some false negatives, i.e. incorrect absences. To reduce the magnitude of this problem, data were supplemented with records from museum specimens, and the atlas accurately records the distributions of most species and thus the overall spatial pattern in species richness (Minter *et al.*, 2004). Data on the size of human populations in 1996 and 2001 were supplied by Anonymous (1996, 2001) at the resolution of quarter-degree grid cells. The proportion of protected land in each cell was obtained by overlapping the quarter-degree grid with all 637 national level protected areas mapped in the World Database on Protected Areas (WDPA, 2004).

There are two main forms of environmental energy (Evans *et al.*, 2005). First, productive energy availability concerns the amount of resources available for consumers to turn into biomass and is frequently recorded using the Normalized Difference Vegetation Index (NDVI), which is strongly positively correlated with net primary productivity in South Africa and elsewhere (Woodward *et al.*, 2001; Kerr & Ostrovsky, 2003). We used mean January NDVI values, averaged from 1982 to 1999, obtained from the African Real Time Environmental Monitoring using the Meteorological Satellites program (Artemis) of the Food and Agriculture Organization (FAO; see http://metart.fao.org/default.htm). January NDVI was used because compared to other NDVI metrics it exhibited the most marked spatial variation, and, as assessed by F ratios and Akaike Information Criteria (AIC) values, could explain more of the spatial variation in human population size, and avian and frog species richness in both independent error and spatial models. The selection of this NDVI metric also follows the methodology of other work investigating spatial variation in South African avian species richness (Bonn *et al.*, 2004; Storch *et al.*, 2005). Secondly, solar energy metrics record the amount of solar radiation reaching the earth's surface and can be measured by surrogates such as temperature. Temperature data were obtained from pre-1995 weather stations across the country with observations on temperature spanning at least 5 years or more. The South African Computing Center for Water Research calculated monthly temperature values based on interpolated climate surfaces (see Schulze, 1997). From these we calculated the average monthly minimum and maximum temperatures (°C) across the entire year. We found that, as assessed by F ratios and AIC values, minimum rather than maximum temperature was a better predictor of human population size and avian and frog species richness in all models, with the exception of the spatial models of frog species richness. In the interests of consistency, minimum temperature was thus selected as an independent variable.

Analyses

To reduce heteroscedasticity, species richness, January NDVI, human population size, change in human population size and