

UC Merced

Frontiers of Biogeography

Title

commentary: Effects of community invasion across multiple spatial scales

Permalink

<https://escholarship.org/uc/item/2546n5kv>

Journal

Frontiers of Biogeography, 2(1)

Author

Pearse, William D.

Publication Date

2010

DOI

10.21425/F5FBG12272

Copyright Information

Copyright 2010 by the author(s). This work is made available under the terms of a Creative Commons Attribution License, available at

<https://creativecommons.org/licenses/by/4.0/>

proxies themselves, and in the multiple dimensions of climate that are integrated into any one proxy. Shuman et al. (2009) conducted a large literature review of proximal records to support the existence of drought at the time of Big Woods expansion. However, a more recent reconstruction (Tweiten et al. 2009) of vegetation, climate, and fire at sites 160 km northeast of the Big Woods is not in total agreement and shows that more work is needed. The climate record of Tweiten et al. (2009) is based on moisture-sensitive testate amoebae in peat bogs, and shows great decadal-scale variability during the past 2000 years but less longer-term variability, as found in their vegetation history or in the Big Woods lake-level study. Rather, the bog record indicates the onset of drought at ca. 1100 AD but then shows increased moisture at 1300-1500 AD during the Big Woods expansion period. Inconsistencies among these records suggest the climate story remains incomplete.

Tweiten et al. (2009) make the important point that each proxy measured in sediment cores, whether it is lake levels, vegetation, fire, or surface moisture in peat bogs, has its own form of persistence over time based on its functional relationship with climate. They note that change in forest vegetation may be slow and integrative of century-scale patterns in climate, while groundwater hydrology is more sensitive to climate. Thus, long-term patterns in vegetation could be explained by “white noise”-like climatic variability that sets vegetation on long-term trajectories. Given the positive feedbacks operating in the fire-vegetation relationship at the forest-grassland transition, the dynamics of the Big Woods provides an excellent setting for revealing the transient effects of short-term or long-term climate

change. Together, the studies by Shuman et al. (2009) and Tweiten et al. (2009) show that insights from multiple sediment proxies, although challenging to obtain, will continue to provide fruitful insights into vegetation dynamics.

References

- Bond, W.J., & Keeley, J.E. (2005) Fire as a global 'herbivore': the ecology and evolution of flammable ecosystems. *Trends in Ecology & Evolution*, 20, 387-394.
- Craine, J.M., & McLauchlan, K.K. (2004) The influence of biotic drivers on North American palaeorecords: alternatives to climate. *Holocene*, 14, 787-791.
- Gill, J.L., Williams, J.W., Jackson, S.T., Lininger, K.B., & Robinson, G.S. (2009) Pleistocene megafaunal collapse, novel plant communities, and enhanced fire regimes in North America. *Science*, 326, 1100-1103.
- Shuman, B., Henderson, A.K., Plank, C., Stefanova, I., & Ziegler, S.S. (2009) Woodland-to-forest transition during prolonged drought in Minnesota after ca. AD 1300. *Ecology*, 90, 2792-2807.
- Tweiten, M.A., Hotchkiss, S.C., Booth, R.K., Calcote, R.R., & Lynch, E.A. (2009) The response of a jack pine forest to late-Holocene climate variability in northwestern Wisconsin. *Holocene*, 19, 1049-1061.
- Umbanhowar, C.E. (2004) Interaction of fire, climate and vegetation change at a large landscape scale in the Big Woods of Minnesota, USA. *Holocene*, 14, 661-676.

Daniel G. Gavin

Dept. of Geography, University of Oregon,
USA

e-mail: dgavin@uoregon.edu

<http://geography.uoregon.edu/gavin/gavin.html>

Edited by Joaquín Hortal

commentary

Effects of community invasion across multiple spatial scales

Species do not exist in isolation, and to understand their distribution in space we must understand the biotic environment in which they live. Community phylogeneticists examine whether an area's biota is phylogenetically clumped or

overdispersed, where the former's close phylogenetic relatedness between species is assumed to reflect habitat filtering according to shared traits, and in the latter these same shared traits bring close relatives into 'excluding competition'. Such

studies can be conducted at biogeographic and local spatial scales, and have recently been reviewed in Cavender-Bares et al. (2009).

Lessard et al. (2009) have used a well-established phylogeny of ant genera to study the effect of alien invasion on ant communities, taking data from 12 studies throughout the world. They show that previously phylogenetically overdispersed regional communities became more clustered after invasion by an alien ant species, without a concomitant reduction in diversity at the genus level. Taken together, these two lines of evidence suggest that the alien species were altering the structure of the ant communities by selectively filtering them according to some phylogenetically conserved trait.

However, interpreting these results when “a region varied in size from 32 ha ... to a 2000-km transect that spanned several eastern U.S. states” is difficult since these communities are of such different sizes. Conversely, the local scale results (where “sampling area ranged from 50 to 200 m²”) are interesting in that they show no general pattern, which the authors claim reflects a general trend for phylogenetic structure to vary with the spatial scale of a study. Indeed, Vamosi et al. (2009) have suggested that competition can only be detected within a particular ‘Darwin-Hutchinson zone’ where the spatial and taxonomic scales of a study are sufficiently resolved to detect individuals’ interactions. Thus Lessard et al.’s phylogeny, with no resolution below the genus level, may have been insufficient for the small scale of their local-region data.

The assumption that phylogenetic overdispersion reflects excluding competition between close relatives, and not facilitation between distant relatives, is frequently ignored in community phylogenetics (but see Valiente-Banuet & Verdú, 2007), and as such it is refreshing that Lessard et al. explicitly state that no facilitation has been documented in the communities they analyse.

Moreover, they thoughtfully suggest that future work involving the traits of the species in question might provide further insight, as it has in Cavender-Bares et al.’s (2006) study of Floridian oak communities.

Studies of invaded systems are a new development for community phylogenetics, and it is pleasing to read such a strong contribution that, unlike much of the current literature, is not focused on plant communities. More work is now needed to improve the phylogenetic resolution of study systems, see how established results generalise to other systems and taxa, and finally to investigate the impact of alien invasion at a number of phylogenetic and spatial scales.

References

- Cavender-Bares, J., Keen, A., & Miles, B. (2006) Phylogenetic structure of Floridian plant communities depends on taxonomic and spatial scale. *Ecology*, 87, S109–S122.
- Cavender-bares, J., Kozak, K., Fine, P.V.A., & Kembel, S.W. (2009) The merging of community ecology and phylogenetic biology. *Ecology letters*, 12, 693–715.
- Lessard, J.P., Fordyce, J.A., Gotelli, N.J., & Sanders, N.J. (2009) Invasive ants alter the phylogenetic structure of ant communities. *Ecology*, 90, 2664–9.
- Valiente-Banuet, A., & Verdú, M. (2007) Facilitation can increase the phylogenetic diversity of plant communities. *Ecology Letters*, 10, 1029–36.
- Vamosi, S., Heard, S.B., Vamosi, C., & Webb, C.O. (2009) Emerging patterns in the comparative analysis of phylogenetic community structure. *Molecular Ecology*, 18, 572–592.

William D. Pearse

Division of Biology, Imperial College London,
and NERC Centre for Ecology & Hydrology
Wallingford, UK

e-mail: william.pearse08@imperial.ac.uk

<http://www.bio.ic.ac.uk/research/apurvis/will.htm>

Edited by Joaquín Hortal

Did you know that by submission of a petition signed by at least twenty-five voting members of the Society, members may request that an item proposed by a member of the Society during the Governing Board of Directors meeting will be voted on as an initiative by the full Society membership by electronic mail ballot? The results of any such ballots shall be reported to the membership.