

Paleoecology and the path ahead



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At the time of America's bicentennial, the Smithsonian Institution – very aptly, I thought – used the phrase, “Look back, lest you fail to mark the path ahead”. It is a thought of central importance as we face unprecedented environmental change, and is the focus of this Special Issue of *Frontiers in Ecology and the Environment*. What information about past environments can guide us on the uncharted paths ahead? How can paleoecology inform us, and when are the insights it provides either incomplete or incongruent with respect to the changes we have set in motion? One Special Issue can scarcely cover the topic in its entirety, of course, but the contributions herein help us to think more about the challenges we face.

The paleoecology of the Amazon has been the subject of two ongoing controversies. One has been over the extent to which the glacial-period climate affected Amazonian vegetation, but the other has been about the extent to which Amazonia supported indigenous populations. This latter debate has been polarized, with one side arguing for small, ecologically limited human populations, and the other arguing for large populations with few ecological checks on growth. If the former camp is correct, it would imply serious limitations on Amazonian development; if the latter group is correct, major development of this last great rainforest would presumably be acceptable in terms of the environment's capacity to recover. It would seem the answer lies somewhere in between (Bush and Silman p 457): Amazonia is not homogeneous and a truly thoughtful approach to development is in order. The object lesson here is the need for caution before applying results and interpretations to what could be irreversible decisions. The need to maintain the hydrological cycle that generates perhaps half of the Amazon's rainfall should encourage additional caution.

Paleoecology can also help us to tease out reality from the data before us. In a grand example of Ruth Patrick's method for distinguishing human-induced from natural change by examining the response of biodiversity, the diatoms and other organisms preserved in Arctic lake sediments clearly point to recent warming (Smol and Douglas p 466). They are a disturbing precursor to the rapid change now being recorded in the Arctic. We needn't wait to take action, because paleoecology tells us enough to make it clear that we need to act now.

The contribution by Williams and Jackson (p 475) raises the very disturbing prospect that climate change could well lead us into a world of novel ecosystems. Changes after the last glacial period very clearly demonstrate that species move individually and that ecosystems do not – that communities will disassemble and novel ones emerge. With novel climates, we can anticipate no-analog communities. This would not seem to be a very sensible thing to base or maintain a civilization upon.

The study by Burney and Burney (p 483) is helpful in two respects. First, it reminds us that indigenous people around the world had already had negative effects on local and regional biodiversity and ecosystems long before recorded history. The Rousseauian notion of an indigenous person living in harmony with the environment is generally a false one. Similarly inadequate is the notion of restoration to a supposed equilibrium state of centuries past. Paleoecology can thus suggest a larger context for planning successful restoration.

There is a similar trap in defining restoration goals and strategies using immediate baselines, which themselves are but points in longer-term fluctuations. The Everglades and Chesapeake Bay restoration efforts (described by Willard *et al.* p 491) are excellent examples of this, but these ecosystems face different challenges from global change, with sea-level rise a threat to the Everglades and loss of eelgrass communities endangering the Bay.

In the American west, and in the southwest in particular, longer and warmer summers plus earlier snowmelt have resulted in more frequent wildfires and even threshold change in western pine forest ecosystems (Gavin *et al.* p 499). How can paleoecology help to explain the changes we are observing? The paleo-picture is not entirely complete, but hopefully it will soon be fleshed out, and will help natural resource managers to make informed decisions about managing these ecosystems.

Thus, the Smithsonian Institution's phrase might require some modification: “Look back, lest you take an unknown path ahead”. The power of paleoecology to guide us toward a more sensible future for humanity is considerable.