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Letters

Nature is changing in more ways than one

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As wild habitats continue to dwindle and native species continue to decline in abundance, conservation biologists have begun to document the patterns of these declines. In a recent issue of *TREE*, Balmford *et al.* [1] review the current state of our ability to track trends in the status of populations and habitats. They emphasize the need to track both population and habitat losses across taxonomic groups and broad spatial scales. Their synthesis reveals roughly similar losses (0.5–1.5% per year) across biomes and vertebrate groups. In contrast to habitat-based estimates of expected future extinctions, estimates of biome and population loss translate directly into lost ecosystem functions and probable economic losses [2,3].

We applaud efforts to develop synthetic indicators of habitat and population losses and Balmford *et al.*'s challenge to expand the scale, scope and consistency of these monitoring schemes. We particularly urge researchers involved with WWF's and UNEP's 'Living Planet Index' efforts to expand their tallies beyond vertebrates and to consider metrics beyond population trends. Although many vertebrates are sensitive to anthropogenic disturbance, statistics on their population declines provide less than a complete picture of ecological change.

In contrast to tracking populations of vertebrates, tracking changes in plant populations demands far less effort. Studies of herbaceous plant populations in temperate prairies and forest woodlands reveal losses similar to those documented for vertebrates (Table 1). These studies further reveal increases in exotic species [4–6] and declines in habitat specialists [6]. The replacement of specialists by habitat generalists caused average species similarity among sites to increase by 31% in northern

Wisconsin, USA over 50 years, in comparison to average population losses of 18.5%. Such biotic homogenization might be as widespread as habitat and species losses, but it is clearly a distinct phenomenon that demands separate monitoring [6,7]. Both population losses and homogenization in northern Wisconsin appear to be unrelated to the direct effects of habitat loss.

These examples make clear that different mechanisms might be driving habitat loss versus the loss (or homogenization) of populations within extant habitats. If we are to understand these mechanisms, we must track the various patterns of change separately and in more detail. Unfortunately, the broad metrics reported by Balmford *et al.* [1] can conflate habitat loss with population declines, making it difficult to diagnose the mechanisms threatening species persistence. We therefore urge biologists to develop metrics that distinguish these processes and go beyond simple tallies of habitat and population loss to reflect significant shifts in community composition or structure. Metrics based on species identities such as the 'Floristic Quality Index' [8] appear particularly sensitive for tracking changes in community composition. We also urge biologists to think carefully about how best to merge data when reporting broad trends. Averaging values across taxonomic groups and regions can obscure important processes occurring at smaller scales.

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Table 1. Losses of herbaceous plant species in historical studies^a

Location (period)	No. of species lost per site	% loss per year	Refs
Bialowieza forest, Poland (1969–1992)	45% of 133 species	2.2	[11]
Middlesex Fells, MA, USA (1894–1993)	37% of 422 species	0.37	[4]
Staten Island, NY, USA (1879–1991)	41% of 1082 species	0.36	[5]
Heart's Content, PA, USA (1929–1995)	59% and 80% (2 stands)	1.12–1.21	[9]
N Wisconsin, USA (1950–2000)	18.5% (average over 62 sites)	0.37	[6]
S Wisconsin prairies, USA (32–52 years)	8–60% (54 sites)	0.5–1	[10]

^aAll but the last study focused on temperate forests.

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Letters Response

Response to Waller and Rooney: nature is changing in more ways than one

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Waller and Rooney [1] agree with our call [2] for the monitoring of habitats and species populations to be improved and synthesized to provide better information about rates of change of the state of wild nature. However, they make two main points of criticism: that existing syntheses of time series on population size are mostly of vertebrate animals and do not reveal what is happening to the rest of biodiversity, and that broad indicators based on syntheses of data on habitat area and population sizes of many species will miss changes in the species composition of ecological communities that would help to identify the causes of change.

We agree wholeheartedly with the first point and add to it the fact that, as well as being taxonomically biased, existing indicators are unrepresentative in terms of habitat and geographical location. Like them, we advocated a substantial increase in the representativeness of coverage [2]. One route would involve the carefully targeted collection and synthesis of new data. A second would be to make best use of currently available information about non-vertebrate groups, and we would strongly encourage botanists (and indeed entomologists) to follow the lead shown by Waller and Rooney in synthesizing existing time-series data.

As for Waller and Rooney's second point, we think that they have not recognized the main reason for having broad indicators of the state of wild nature based on a combination of population and habitat data. We agree with them that broad indicators might not be of much help in diagnosing the detailed causes of change. However, this need could be accommodated by designing indicators that

are hierarchically arranged, such that detailed data on individual trends remain available. As for the broad composite indicators, their primary purpose is very different: to provide a summary of changes that is comprehensible to people whose decisions largely drive those trends, such as the business community, the public, and their elected representatives.

For a long time, many conservationists and ecologists have thought that people ought to want such indicators, but only recently have governments asked for them. The World Summit on Sustainable Development in 2002 called for a significant reduction of the current rate of biodiversity loss at global, regional and national levels by 2010. Broad indicators at all of these levels are the only practical means for measuring progress toward this objective. To begin with, such indicators will inevitably be far from ideal in their scope, but we believe that they can still be valuable in educating people whose interests are affected by losses of biodiversity and wild nature. That means everyone [3].

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