Long-term studies: detecting and understanding trends in biodiversity

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Background/question/methods: Understanding directions, rates and causes of recent trends in biodiversity is vital to planning conservation actions. State of Environment Reports turn to map statistics and aggregated indices to infer general trends, while empirical data are considered too patchy or inconsistent to contribute to an overview. Using examples from Australian heathlands, we asked what further insights on the status of biodiversity can be gained from available empirical studies. We reviewed a selection of long-term ecological experiments of 10-30 years duration. We aimed to identify major drivers of ecosystem dynamics, determine trends in different biota and diagnose causes of change.

Results/conclusions: The studies were continental in coverage and identified land clearing, fire regimes, climate processes and disease as major influences on heathland dynamics. Fire regimes are the most ubiquitous driver, but the mechanisms and nature of fire-driven changes vary among biota and across the continent. Land clearing caused severe historical losses of biodiversity in the south-west and continues to threaten coastal heathlands. Plant disease is driving the most rapid recent declines, primarily in southern Australia. Observed sensitivities of heathland biota to climatic factors signal potential losses of diversity under future climates. All of the studies advanced understanding of heathland dynamics. Concordance between studies with varied approaches suggests robustness of inferred trends. We conclude that long term ecological studies are under-utilised in conservation reporting and planning. Further investment in them will greatly strengthen capacity to detect and interpret trends in biodiversity. Similar insights could not be achieved with any certainty by short cut methods.

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