



One hundred priority questions for landscape restoration in Europe

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ABSTRACT

We present the results of a process to attempt to identify 100 questions that, if answered, would make a substantial difference to terrestrial and marine landscape restoration in Europe. Representatives from a wide range of European governmental and non-governmental conservation organisations, universities, independent ecologists and land managers compiled 677 questions relating to all aspects of European landscape restoration for nature and people. The questions were shortlisted by an email vote, followed by a two-day workshop, to produce the final list of 100 questions. Many of the final questions evolved through a process of modification and combination as the workshop progressed. The questions are divided into eight sections: conservation of biodiversity; connectivity, migration and translocations; delivering and evaluating restoration; natural processes; ecosystem services; social and cultural aspects of restoration; policy and governance; and economics. We anticipate that these questions will help identify new directions for researchers and policy-makers and assist funders and programme managers in allocating funds and planning projects, resulting in improved understanding and implementation of landscape-scale ecological restoration in Europe.

1. Introduction

Ecological restoration, defined as the process of assisting or allowing the recovery of an ecosystem that has been degraded, damaged, or destroyed (Society for Ecological Restoration International Science and Policy Writing Group, 2004), has been the focus of increasing recent political and research attention. Restoration is of particular importance in densely-occupied and ecologically-transformed Europe, in order to retain and enhance the capacity of ecosystems to provide for the present and future needs of millions of people, enable the function of natural processes, and conserve threatened biodiversity. The creation of large restored areas has been given heightened urgency by recent international policy targets (Aronson and Alexander, 2013). The Convention on Biological Diversity identified restoration as key to delivering essential ecosystem services (Aichi Biodiversity Target 14), and has a global target of restoring at least 15% of degraded ecosystems by 2020 (Aichi Target 15; CBD, 2014). This has been adopted as Target 2 of the EU's 2011-2020 Biodiversity Strategy (EU, 2011), which is of especial relevance to this paper. However, the mid-term review of the EU's progress towards meeting this target reported that there had been 'progress but at an insufficient rate', with some restoration activities having occurred, but without a halt in the degradation of ecosystems and services (European Commission, 2015). Other global initiatives calling for increased attention to landscape restoration include the Global Partnership for Forest Landscape Restoration and its Bonn Challenge to bring 150 million ha of the world's deforested and degraded land into restoration by 2020, and 350 million ha by 2030 (Suding et al., 2015). The impending deadline for these targets has created impetus for moving forward with large-scale restoration programmes across Europe, but their success will depend on our capacity to implement them effectively.

As well as policy drivers, recent progress in a range of relevant areas have provided additional momentum to the landscape restoration movement. Ecological and technological advances (Perring et al., 2015), new dynamics in green and sustainable finance (FAO and Global Mechanism of the UNCCD, 2015), and approaches incorporating the commodity supply chain into sustainable landscapes all have implications for restoration. Concepts of restoration are also evolving rapidly; these include the desired target state for restoration projects (whether aiming for a historic baseline, or a novel enhanced system), the approaches employed and level of management intensity needed, and how to incorporate human impacts on landscapes into restoration programmes (Corlett, 2016; Bowman et al., 2017).

Landscapes are large, heterogeneous and multifunctional environments that provide diverse services and values to multiple stakeholders. Landscape restoration therefore refers to restoration of biodiversity and natural processes within degraded lands and seas on a scale that may vary from a few square kilometres to ecological corridors that traverse continents. Such restoration projects are typically complex, covering a mosaic of habitats and species' ranges, and affecting a wide range of people in many different ways. They may also cross political boundaries and involve a large number of private and public landowners working in often complex partnerships. Consequently, restoration success at such scales is commonly dependent upon a wide range of interacting cultural, social, political and economic factors, in addition to ecological considerations. This is particularly well illustrated in the Mediterranean Basin where different legal frameworks exist between EU and non-EU countries, and information availability and cultural attitudes have variously assisted or constrained the development of landscape restoration projects (Nunes et al., 2016).

Given the current significance of landscape restoration in Europe, and the complexity of the ecological and socio-economic factors involved in large-scale initiatives, it seems valuable to take stock of relevant information needs. Although there is much individuality in landscapes and restoration schemes, there are many knowledge gaps with wider relevance which need to be tackled if restoration targets are to be achieved in the most effective manner. This exercise aimed to identify these knowledge gaps, in order to encourage researchers, funders and programme managers to focus funding and research energy towards addressing these gaps. We also hoped to contribute towards improving the integration of science and policy (Koetz et al., 2012), by seeking input from experts in both areas, to identify questions that satisfied both scientific rigour and policy relevance.

In order to identify 100 questions that, if answered, would make a substantial difference to landscape restoration in Europe, we brought together 37 practitioners, policy-makers, academics, landowners and managers from a range of backgrounds across Europe. The criteria for identifying and prioritising these questions specifically stipulated that answering them should make a demonstrable difference to our ability to carry out landscape restoration in Europe. We hope that by specifying and publicising these questions, identified by a diverse set of participants using a structured and transparent process, we are providing an agenda and justified rigorous basis for those involved in restoration projects to undertake field experiments, literature reviews or meta-analyse to answer one or more of these priority questions. Our aim in presenting these results is to stimulate debate and, more importantly, to

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