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Synergies and trade-offs between nature conservation and climate policy: Insights from the "Natural Capital Germany – TEEB DE" study

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ABSTRACT

Ecosystem-based approaches provide opportunities for climate policy to reduce greenhouse gas (GHG) emissions, to expand the adaptive capacities and resilience of land systems to a changing climate, and to simultaneously protect biodiversity and ecosystems services (ESS). However, knowledge about the economic benefits and cost-efficiency of ecosystem-based approaches is still limited. The objective of this paper is to enhance understanding of synergies and trade-offs between climate policy related measures and nature conservation and how ecosystem-based approaches can contribute to both climate as well as biodiversity and ESS conservation goals, through overall economic analyses to inform balanced decision making. The paper builds upon the current state of knowledge as brought together by contributors to the German national TEEB-study "Natural Capital and Climate Policy – Synergies and Conflicts". We present options and lessons learned from major land-use sectors of high relevance for ecosystem-based approaches to climate change, namely agriculture, peatlands, forests, wetlands and coastal and marine ecosystems. Based on these assessments, we argue that successful implementation of an ecosystem-based climate policy requires effective coordination and coherence between sectors and their respective policies, for example agriculture, forestry and energy. We identify specific targets for an ecosystem-based climate policy and options for achieving this coherent implementation.

1. Introduction

Climate policy affects ecosystems and land-uses in a variety of ways that may cause significant synergies and trade-offs with nature conservation policies. On the one hand, climate policy can negatively impact on biodiversity and ecosystem services (ESS). Mitigation efforts to increase renewable energy generation, for

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example, have contributed to the intensification of agriculture, intensified conversion of grasslands to cropland and the expansion of monocultures of energy crops (Gerbens-Leenes et al., 2009; Boll et al., 2014; Manning et al., 2014). In parallel, technical climate adaptation actions such as the fortification of dykes can inhibit natural processes in riverine and coastal ecosystems and may thereby diminish biodiversity. On the other hand, climate policy related actions can also be beneficial to nature conservation by employing ecosystem-based solutions to yield synergetic effects of policy goals.

The ecosystem-based approach to climate policy covers a range of climate change adaptation and mitigation strategies based on the natural abilities of ecosystems and developed from the Ecosystem Approach (EA) of the Convention on Biological Diversity (CBD, 2001). The Ecosystem approach defines a set of practical principles for the sustainable management of natural resources although their implementation remains weak and "stuck in the clouds" (Fee et al., 2009). Ibisch et al. (2010) suggest a new set of principles within their Radical Ecosystem Approach (REA) reinforcing the original message of the EA and focusing on the challenges of climate change. In terms of adaptation, ecosystem-based approaches aim at increasing the resilience of ecosystems and people to climate change and in terms of mitigation target the alleviation of climate change e.g. through the protection of natural carbon sinks and sources. Ecosystem-based approaches belong to the group of so-called nature-based solutions to climate policy (Nesshöver et al., 2016) defined as climate change mitigation or adaptation actions, which are inspired by, supported by or copied from nature (European Commission, 2015). However, they focus on the protection and restoration of natural abilities of ecosystems, whereas nature-based solutions also include for example technological solutions inspired by nature. Despite the opportunities these approaches may provide, synergistic and antagonistic impacts of climate policy on ecosystem-based approaches are only rarely assessed and explicitly addressed in actual climate policy making. In addition, knowledge about the economic benefits and cost-efficiency of ecosystem-based approaches is still limited.

The objective of this paper is to enhance the understanding of how ecosystem-based approaches can simultaneously contribute to climate change mitigation and/or adaptation, protect biodiversity and ESS, and to identify potential conflicts. The paper builds upon the assessment of the current state of knowledge in Germany, brought together by more than 70 contributors to the study "Natural Capital and Climate Policy– Synergies and Conflicts" (Hartje et al., 2015a,b), representing a German national follow-up assessment report of the international TEEB-initiative "The Economics of Ecosystems and Biodiversity" (TEEB, teebweb.org).

This paper reviews and highlights impacts of Germany's climate policy on ESS and biodiversity, using case studies and lessons learned from the following major land-use sectors: agriculture, peatlands, forests, wetlands and coastal and marine ecosystems. Based on an analysis of synergies and trade-offs, we draw conclusions on the potential of an economic perspective to identify positive and negative impacts of ecosystem-based climate policy on biodiversity and ESS, and provide policy recommendations for harnessing ecosystem-based approaches to meet both climate and conservation policy targets.

2. Impacts of climate policy in Germany

The core of German climate policy has been to transform the energy system to higher efficiency and building it on a sustainable renewable energy basis, by reducing its fossil fuel basis, in line with the 2° target on the global level. The German government and the majority of the electorate have therefore decided to substantially reduce the use of fossil energy by 80 to 95% by 2050 and to foster renewable energy (COM, 2011). This is in line with GHG-emission targets, and in October 2014, the European heads of state and government agreed on the new "40–27-27 goals" to be achieved in 2030 for the EU (European Commission, 2014).[1] In Germany, the GHG-emission reduction targets are – 40% for 2020 and – 55% for 2030 (compared to 1990 levels) according to Germany's "Integrated Climate and Energy Program" (DB, 2007). In addition in 2011, the federal government decided to exclude nuclear power as an option of this transformation and quit the existing electricity nuclear generation by 2022.

These substantial policies all support the use of renewable energy sources, summarized under the heading of the German *Energiewende* (energy transition) and have already had significant effects: By the end of 2015, 12.5% of the German primary energy consumption was generated by renewable energies – more than three times as much as in 2003 (BMWi, 2016). About 167 Mio. tons of CO_2 emissions could be avoided in 2015 compared to the emissions in 1990 (BMWi, 2016).

The *Energiewende* has had significant consequences for other dimensions of the environment, most prominently for land-use implications. Land-use demands vary for the specific renewable energy sources and the associated infrastructure, and generate specific environmental effects (see Table 1). Especially for the agricultural production of renewables, land-use demands are very large and some of the associated land-use changes, such as conversion of grassland, gained critical attention of nature conservationists. Land-use demands of technical facilities, such as wind turbines, biogas facilities and solar panels, and their related infrastructure are relatively smaller, while their environmental effects, caused by soil sealing, noise and light emissions, disturbances of landscape views and its recreation value and detrimental effects on bird and bats populations caused numerous conflicts at the local level, leading to restrictions by a range of planning and conservation policies.

At the beginning of implementing the German *Energiewende* policies to support renewable energy, the focus of analysis and debate has been on the physical, engineering and economic potential of the various energy sources in relation to the substitution objectives for fossil energy sources. With different speed, some of the land-use implications and their environmental effects were identified and regulated. For some bioenergy sources, environmental requirements for the related energy crop provision have been integrated into the renewable energy support policies, by making the support and the price level dependent on environmental performance criteria of the plants in Germany (for example EEG, 2012; Directive 2009/28/EC, 2009). New hydropower plants with new dams and pumped hydropower stations are excluded from the support. However, as long as environmental requirements are limited to the national energy supply, this policy will subsequently induce leakage effects and indirect land-use change on areas for food and fodder production (van Stappen et al., 2011). It was early on recognized, that the GHG-balance of bioenergy can worsen considerably if indirect effects are taken into account (van Renssen, 2011). In addition, the siting of individual plants is based on regional and local planning regulations requiring permits subject to minimum distance requirements and environmental impact assessments.

The consideration of nature conservation interests as well as social and infrastructural conditions on-site is crucial for the evaluation of environmental impacts of renewable energy production.

[1] The "40-27-27 goals" refer to the new 2030 climate and energy framework for the EU, which in particular endorsed three important targets: 40% less greenhouse gas emissions, at least 27% renewable energy consumption and at least 27% improvement in energy efficiency by 2030 (European Commission, 2014).