

## Valuing Alpine ecosystems: the recharge.green project will help decision-makers to reconcile renewable energy production and biodiversity conservation in the Alps

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### Abstract

Anthropogenic climate change threatens the global environment, including biodiversity, and with it continued human welfare. The European Union aims to increase its share of renewable energy (RE) to 20% by 2020 in an effort to reduce greenhouse gas emissions while enhancing energy security and providing opportunities for economic development. The Alpine region is expected to contribute significantly to RE expansion. The trade-offs between potential gains and losses, especially for biodiversity, from new RE developments are rarely fully considered even though biodiversity loss has significant economic costs for society. The EU Alpine Space recharge.green project develops tools to evaluate the *RE carrying capacity* of the biodiversity-rich Alpine ecosystems. The tools will aid in the analysis of siting decisions and in weighing up costs and benefits to enable rational energy implementation decisions. The developed tools will be tested in five pilot regions in Austria, Germany, Italy, and Slovenia.

### Background

There is now broad scientific consensus that climate change as a result of anthropogenic greenhouse gas (GHG) emissions is threatening the global environment, including biodiversity, and with it continued human welfare. By 2005 global atmospheric concentrations of the most important GHG carbon dioxide (CO<sub>2</sub>) had soared from about 280 ppm before the start of industrialization to 379 ppm and the average annual rate of increase has been accelerating. Fossil fuel use contributes most, while land-use change produces about 30%, of which 17.4% stem from deforestation and forest degradation (IPCC 2007).

The expansion of renewable energy (RE) is seen as one of the strategies to mitigate CO<sub>2</sub> emissions. The European Union aims to increase its share of RE to 20% by 2020 in an effort to reduce GHG emissions while also enhancing energy security and providing opportunities for economic development (EC 2009). The RE Directive (2009/28/EC) recognizes the necessity to adapt the 20% target for individual Member States depending on each state's starting point and potential. The Alpine Convention too states in its Energy Protocol that *the Alpine region will make a long-term contribution to meeting Europe's energy needs* (EC 2005, p. 37) and expresses a commitment to increase the use of RE sources in the Alpine region.

In addition, the political decisions to phase out nuclear power in Switzerland and Germany (Dempsey & Ewing 2011) and the Italian measure to delay national nuclear strategy development indefinitely (Pianigiani 2011) increase the pressure to exploit RE sources to provide the Alpine region with sufficient energy. The expansion of energy production and use affects ecosystem functions and nature conservation and should be supported by innovative decision support systems (DSS) and legal frameworks. An example of a gap in this field is Germany's new RE Law (EEG' (BMU 2012)), which offers different feed-



Figure 1 – Water reservoir for hydropower production © M. Revaz

in tariffs depending on the RE source (quite low for small hydro- and much higher for solar power, e.g. Lang & Mutschler 2012) but tends to disregard the ecological costs of production. Were one to consider the total economic value of energy produced by small hydropower plants, for example, its cost would often be exorbitant, given the ecological impacts and the plants' insignificant production capacity (BN 2012).

At the same time, over the past 50 years, biodiversity losses have been more dramatic than in all of previous human history and these changes continue and may be increasing in intensity (Hooper et al. 2012; MA 2005). The aims and provisions of global treaties and regional policy instruments, such as the Global Convention on Biological Diversity, the EU Habitats and Birds Directives, and, most recently, the EU 2020 Biodiversity Strategy, all reflect a shared concern about the decline of biodiversity. The Alpine Convention also acknowledges the need to *limit the negative effects of power plants on the environment and the landscape* (EC 2005, p. 38) and its Energy Protocol includes several clauses requiring the conservation of natural areas as habitats for wildlife.



Figure 2 – District heating plant on biomass. © CIPRA

However, despite declared commitments and policies for conserving biodiversity, in practice the trade-offs between the potential gains and losses from new developments are rarely fully considered. One of the underlying reasons why natural areas have been subject to continued decline is the *public good* nature of the types of *services* they provide, beyond directly marketable products such as timber and biomass fuel. The notion of *ecosystem services*, a term developed by Ehrlich and Ehrlich in 1981 to bridge natural and social science concepts (Braat & De Groot 2012), has become popular in science and policy debates in the last decade. As defined by the recent global study on the economics of ecosystems and biodiversity (TEEB) (Sukhdev et al. 2010, p. 34), ecosystem services include provisioning, regulating, habitat or supporting services, and cultural services. In other words, they embrace a very broad range of services that generate both material and non-material benefits for people. Because biodiversity and the ecosystem services tend to be undervalued, land users and owners, whether public or private, often do not have sufficient incentive to abandon the types of development that reduce biodiversity and degrade ecosystems. This is acknowledged in the European Parliament resolution of 20 April 2012, which states that biodiversity loss *has devastating economic costs for society which until now have not been integrated sufficiently into economic and other policies* (EP 2012). Daily et al. (2009) note that a better understanding of ecosystem production functions and the integration of research and experimentation into the development of new policies and institutions are needed for decision-makers to be able to evaluate costs, benefits, trade-offs and synergies of alternative investments in ecosystem service provision.

In fact, various tools for ecosystem services valuation have existed for decades (see, *inter alia*, Atkinson et al. 2012; Martin-Lopez et al. 2008), but their practical application is often lacking. This is partly due to the complexity of ecosystems, which makes complete

accounting of their functions and the costs associated with the resulting services daunting. Braat and de Groot (2012) point out that it is generally difficult to show clear relationships between individual biodiversity components and the ecosystem services they supply, although changes due to biodiversity losses in important ecosystem processes have been documented in various instances (Hooper et al. 2012; Midgley 2012). While valuation tools can help decision-makers weigh different options, it is often difficult to obtain reliable empirical data for the calculations, since methods such as *willingness to pay* are inherently imprecise and vary widely when interests diverge. However, Sukhdev et al. (2010) argue that even if it is not possible to calculate precisely the value of all ecosystem services in a given area, an approximation is preferable to disregarding the economic cost of ecosystem degradation and can be helpful in achieving more efficient natural resource management. They claim that valuation can enable policy makers to correct biases that tend to favour private over public wealth and physical over natural capital.

#### The recharge.green project – decision-making support for mountain communities

The Alps are exceptionally rich in biodiversity, mainly due to geomorphological structuring with pronounced differences in altitude, geology and climate, which give rise to many different habitats. They host about 4 500 plant species and an estimated 30 000 animal species (Lassen & Savoia 2005, p. 4–5).

The recharge.green project, co-financed by the European Regional Development Fund within the framework of the European Territorial Cooperation Alpine Space Programme, analyses the impact of growing RE development and the associated land-use changes on habitats. It aims to provide tools to examine the *RE-carrying capacity* of Alpine ecosystems. How much RE can be produced without damaging biodiversity-rich ecosystems? Where might a new power plant reasonably be sited, and where should it be avoided? How can trade-offs, costs and benefits be weighted so that decision-makers can make fully informed rational choices?

16 partners from six Alpine countries, including members of national parks, local government, academia, civil society, and the private sector, will jointly develop strategies and tools to enhance the decision-making process on these issues.

Initially the project team will review the state of affairs of RE production in the Alps, identify scenarios, and compare the legal frameworks, stakeholders, energy market drivers and other relevant factors in different regions. This will be followed by an analysis of trade-offs between RE production and the conservation of biodiversity and associated ecosystem services. One of the key contributions of the project will be the design of a Multicriteria Spatial DSS (Ascough et al. 2002) for planning RE production sites. Not every lo-

cation will be ideal for every type of RE system. Some of the variables that will affect suitability include the *biodiversity ranking* of a given location, its particular ecological and geographical situation, but also the socio-economic needs. The project will draw on and further develop tools currently used by the project partners, such as IIASA's geographically explicit BeWhere model (e.g. Leduc et al. 2008) for optimal RE deployment and the open source GIS BIOMASFOR (Sacchelli et al. 2013) to assess the exploitability of forest biomass. The partners will expand the models to include hydro-, wind, and solar power. To analyse economic and ecological trade-offs, a *marginal protection cost curve* will be developed, which will be estimated using the model. This will take into account the protection status or biodiversity ranking of a location when calculating the per-unit costs of RE production. In areas with higher levels of biodiversity, energy production would be more costly than in those of relatively low biodiversity ranking. The use of such a tool will allow decision-makers to obtain full information about costs and benefits and a good representation of the trade-offs involved. The tool will also integrate the map-based online survey tool Jecami, which was developed within the ETC Alpine Space project ECONNECT (<http://www.econnectproject.eu>) to assess high biodiversity areas and ecological connectivity between them.

The project will test the developed tools in five pilot regions, with a focus on the areas' particularities: Alpi Marittime Nature Park (Italy), Bavaria (Germany), Triglav National Park (Slovenia), Veneto Region (Italy) and Vorarlberg (Austria). In general, activities within the pilot areas will test the instruments while involving local communities and integrating them into strategic environmental assessment processes for a choice of RE plans.

If the new tools can provide the basis within the pilot areas for balancing the demands for RE and for sourcing from those regions with the need to conserve their outstanding natural treasures, this would be an indicator of success for the recharge.green project.

The project began in October 2012 and will run until June 2015.

For more information: <http://www.recharge-green.eu>

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Figure 3 – Wind power plant. © Kenneth Brockmann pixelio.de

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