CO_2-abatement costs in peatland-conservation areas

L. Schaller und J. Kantelhardt[1]

Abstract - **Using a significant amount of public funding, large-scale nature-conservation projects in Germany aim to secure and develop ecologically valuable areas and endangered habitats and species. Due to the substantial land-use changes accompanying these projects, their implementation can also have relevant climate effects. Our study analyses major cost positions in implementing such projects. We link public funding to relevant climate effects and derive CO_2 abatement costs. Our study takes place in regions where changes in agricultural land-use for conservation purposes have been implemented in the past and where climate effects are expected to be high. Our results show that land-use changes for conservation purposes can lead to positive climate effects. The efficiency as regards "abatement costs" lies within the range of costs for alternative measures of climate change mitigation.**

INTRODUCTION

Large scale conservation projects in Germany are funded by high amounts of public money, provided either by the state or by the European Community. A major part of funding is used for land acquisition, compensatory payments for agriculture, management and development planning or habitat-structuring measures. Until now, costs were first and foremost contrasted by their benefit to aspects like biodiversity, habitat conservation, or the protection of natural resources. As the implementation of such projects usually involves significant land-use changes, a new benefit could be included: as recent science has shown, land-use changes especially in "hotspot areas", such as peatland, have significant effects on the emission of greenhouse gases (GHG) (Byrne et al., 2004). Therefore, as many conservation projects are carried out in such "hotspot areas", the high cost in particular of compensation for agricultural losses and land acquisition could also be offset by a significant decrease in GHG emissions. Our study focuses on analysing how public funds used for "hotspot area" conservation projects can contribute to GHG emission reduction. Furthermore, we assess "abatement costs" of such climate-change mitigation and if they appear to be competitive.

MATERIALS AND METHOD

As our study objects, we look at three different German peatland regions where large-scale, public funded conservation projects have been implemented or are about to be finished. We analyse flow of funding channelled into the projects by determining amounts, sources and designated use. To be able to compare our different study objects which took place during different periods of time, we add accrued interest of a long-term capital investment to the money spent in the past, using the reference year 2012. To derive annual costs, we use the net present values of investment as basis, considering an observation period of 20 years. Annual investment costs are calculated under two scenarios: Scenario 1 assumes net present value of investments for land acquisition not to be subject to devaluation, scenario 2 assumes that the land purchased will lose its initial value, since the usability for agriculture will decrease after the implementation of conservation measures. We use a 40% reduction to the net present value, corresponding to the prices for agricultural land with comparable quality and depreciate the reduction assuming a depreciation period of 20 years. For the remaining cost positions like habitats structuring measures, planning etc., we assumed that after a period of 20 years new investments such as adaptation measures or the restoration of infrastructure will become necessary again. We depreciate the net present values of these positions over the observation period. Furthermore, taking into account the opportunity costs of capital, we calculate the annual interest of the money invested. As regards the data basis for economic calculation we use project-related statements of implementation costs which are provided by the respective regional project management and by the German Federal Agency for Nature Protection (BFN). Data is analysed within an Excel based own calculation model. For the analysis of land-use changes and the derivation of changes in GHG-emissions, we use data provided by our project partners (Drösler et al, in prep.).

RESULTS

Describing our results, we use the example of our "most expensive" project. The targets of restoration for this project were the reestablishment of the original water tables, the termination of peat cutting and the environmentally sustainable reorganisation of grassland management within a buffer zone. Figure 1 presents the effects of the restoration measures in this region on the main target "reestablishment of groundwater tables".

[1] L. Schaller and J. Kantelhardt are both from the University of Natural Resources and Life Sciences Vienna, Institute of Agricultural and Forestry Economics, Vienna, Austria (Lena.Schaller@boku.ac.at ; Jochen.Kantelhardt@boku.ac.at).

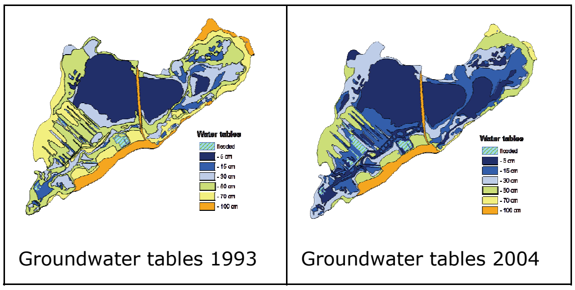

Figure 1. Change of groundwater tables resulting from restoration measures.

In 1993 – halfway through the project – only a small amount of the area held high water tables. In 2004 the extent of area showing "wet" conditions has significantly increased and "dry" areas with low water tables are limited to a very small extent. Table 5 shows the results of Drösler et al. (in prep.). It numbers the change in area extents characterised by the different groundwater levels (Columns 4 and 5). The table also shows the site-specific emissions associated with the water levels.

Table 1. Extents of area with specific ground-water levels and related emissions for the years 1993 and 2004.

Water-level (m)	GWP*	Extent 1993 (ha)	Extent 2004 (ha)	TE* 1993	TE* 2004
0,20	10,48	15	35	154	370
-0,05	-0,05	405	600	-20	-30
-0,15	5,04	93	355	467	1.789
-0,30	14,14	298	307	4.212	4.340
-0,50	22,72	437	245	9.925	5.569
-0,70	26,99	280	24	7.556	647
-1,00	29,33	120	80	3.516	2.356
		1647	1647	25.810	15.040

*Global Warming Potential (GWP) and Total Emission (TE) in t CO_2-eq.ha^{-1}a^{-1} (source: Drösler et al. (in prep)

Compared to the situation before the project, area holding high water tables inducing low GHG emissions (-5 to -15 cm) has increased by nearly 70 %. Area with low water tables inducing high emissions has decreased by about 41 %. The region achieved an annual emission reduction of about 10.770 t CO_2-eq. Table 2 outlines the corresponding annual costs resulting from the investment.

Table 2. Annual costs of investment (in €).

	Land acquisition	Peat cutting rights	Rewetting/habitat structuring	Planning costs	Overhead land acquisition
S1	403.000	85.350	450.220	18.000	31.900
S2	645.000	85.350	450.220	18.000	31.900

For the two scenarios, the sum of annual costs differs by €242.000. As regards "abatement costs", under Scenario 1 the measures of the conservation project create a monetary value of €90 per t CO_2-eq. If one only considered the money spent on rewetting – actually causing the emission reduction – the cost is €42 per t CO_2-eq. The share of this position is with almost 47% the biggest, whereas land-acquisition costs are make up only 43%, however high the net capital value of the initial investment. Under Scenario 2, "abatement costs" are naturally higher. Here the total sum of annual investment leads to costs per ton Co2-equvalent of about €112. The share of costs causing emission reductions decreases to 37% of total annual costs – while the costs for land make up 53% of the whole sum.

Discussion

Our results indicate that costs per ton CO_2-eq. associated with emission reductions due to conservation measures lie within an acceptable range of abatement costs: Common abatement strategies within the transport sector cause abatement costs varying from €20 to €400 up to more than €1000 per ton CO_2-eq. (WBA, 2007). Also the "Methodological Convention for Estimates of Environmental Externalities" (German Federal Environment Agency, 2007), promotes best estimated value of €70 per ton CO_2 and suggests sensitivity calculations based on the values of €20 and €280 per ton CO_2. However, various important points must be considered when interpreting our results. When gathering our data it became clear that no full record of the amounts of money and the flow of funding are kept. In part information about personnel and follow-up costs is missing, which can have significant effects on the derivation of abatement costs. Furthermore the system boundaries within which our study is conducted are narrow. Large-scale changes in area-structures and -functions of extensive ecosystems can have far-reaching consequences within the surrounding area, for example leakage effects as regards agricultural production and GHG Emissions. Last but not least, it has to be said that the high level of public funding which is necessary for implementing the projects cannot only be contrasted by the benefits of GHG emission reduction. As the projects have been implemented in favour of conserving ecologically valuable areas to save biodiversity, endangered species or cultural landscapes further benefits such as biodiversity, water conservation etc. have to be included in the monetary evaluation.

Acknowledgement

We thank the German Federal Agency for Nature Conservation granting our work. FKZ: 3509850500

References

Byrne, K., Chojnicki B., T.R. Christensen,T., Drösler, M. Freibauer, A. (2004). EU peatlands: Current carbon stocks and trace gas fluxes. *CarboEurope-GHG Concerted Action – Synthesis of the European Greenhouse Gas Budget, Report 4/2004, ISSN 1723-2236.*

Drösler et al., (in prep.). Monetäre CO_2 -Bilanzierung von ausgewählten Naturschutzgebieten

German Federal Environment Agency (2007). *Economic Valuation of Environmental Damage - Methodological Convention for Estimates of Environmental Externalities,* available at (04.2011): http://www.umweltdaten.de

Wissenschaftlicher Beirat Agrarpolitik (WBA) (2007). *Nutzung von Biomasse zur Energiegewinnung,* available at (04.2011): http://www.bmelv.de