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NATURA 2000 SITES AS AN ASSET FOR RURAL DEVELOPMENT: THE GERMAN-CZECH ORE MOUNTAINS GREEN NETWORK PROJECT

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ABSTRACT

Environmental quality and attractive landscapes are becoming ever more important as factors for the quality of life and the economy. Valuable ecosystems, often designated as protected areas, can be a precondition for sustainable rural development by providing the basis of various forms of economic activity. This applies also to the Ore Mountains which are characterized by outstanding natural assets and a typical cultural landscape on both sides of the border between the German state of Saxony and the Czech region of Northern Bohemia. They contain many NATURA 2000 sites, some of them extensive complexes which in some case straddle the border.

Starting from a SWOT analysis, which shows the strengths, weaknesses, opportunities and threats in the region, the assessment of the main economic, ecological and socio-cultural functions and potentials of the NATURA 2000 ascertained a wide variety of ecosystem services which such protected areas provide. In many cases, there are various hitherto unused potentials, which offer opportunities for further development, e.g. for sampling medicinal plants, or for eco-tourism. There are also cases of overexploitation, e.g. by tourism: the trampling of sensitive vegetation, or disturbance of such animals as the black grouse (*Tetrao tetrix*). On the other hand, some valuable areas, such as mountain meadows, suffer from land abandonment and deficits in landscape management.

On the basis of these results, the opportunities and risks for enhancing synergies between nature conservation and rural development are discussed. Favorable product-marketing, eco-tourism, and environmental education can improve acceptance for sustainable landscape management, especially among land users.

KEY WORDS: Ecosystem services, Agriculture, Environmental education, Eco-tourism, Black grouse

INTRODUCTION

Environmental quality is becoming ever more important as a spatial factor for the quality of life and the economy, and enhances the capacity of a region to compete economically. Protected areas such as national parks, biosphere reserves and others can be a framework for successful sustainable rural development, and can contribute to safeguarding jobs, especially in economically lagging areas. As many studies have shown (e.g. Getzner et al.

2002, IEEP 2002, Job & Metzler 2005, DVL 2007), they can provide the basis for various forms of economic activity in a region, such as in agriculture and forestry, nature-based tourism, and environmental education. It has been estimated that around 125,000 jobs in the EU were supported through conservation-related activities in 1999, and that the trend was increasing; around 100,000 of these were direct jobs and 25,000 indirect, with around two thirds of the direct jobs related to operational expenditures and one third related to investments (IEEP 2002).

The EU-wide network NATURA 2000 has been launched to ensure the long term survival of Europe's most important species and habitats. It is based on broad principles of conservation and sustainable use, and at the same time, it is a coordinating mechanism through which the partners can develop and implement cooperative actions (Vos & Verboom 2007). Since its creation, nearly 20% of Europe's territory has been included in the network – about 25,000 sites in all 27 member countries. NATURA 2000 represents one of the world's most ambitious approaches for halting the loss of biodiversity.

Though NATURA 2000 sites are designated according to ecological and bio-geographical criteria to meet specific conservation objectives that shall be achieved by appropriate conservation measures, they also provide a wide range of (provisioning, regulating and socio-cultural) ecosystem services. Many of these services depend on natural and semi-natural ecosystems as well as on ecologically sound forms of land use. Not only biological diversity, but also many of these services would be lost or reduced if these ecosystems were destroyed or converted to intensive use (IEEP 2002, Schweppe-Kraft 2008).

The concept of ecosystem services that was established in the international environmental discussion at least during the 1990s (e.g. De Groot et al. 1992, Costanza et al. 1997, Daily 1997) owes its great popularity and attractiveness to its integrative, interdisciplinary and transdisciplinary character, as well as its linking to environmental and socio-economic concepts (Müller & Burkhard 2007). Ecosystem services form the interface between ecosystems and human well-being (Neßhöver et al. 2007). The great policy relevance has been expressed, for example, in the Millennium Ecosystem Assessment (MA 2005) and in TEEB (2009).

Ecosystem services describe services rendered by nature and used by humankind. In its categories guidelines, the IUCN defines ecosystem services as: "services that are related to but do not interfere with the goal of nature conservation. These can include provisioning services such as food and water; regulating services such as flood and drought control, combating land degradation, and disease; supporting services such as soil formation and the nutrient cycling; and cultural services such as recreation, spiritual and religious use, and other nonmaterial benefits" (Stolton 2009).

According to the IEEP (2002), economic benefits from ecosystem services can lead to significant gains in local income and employment, as well as to broader regional development benefits. Local people can benefit from investments in NATURA 2000 sites by local, national and EU sources. NATURA 2000 sites can also be a key tourist attraction, generating external purchase of local products and services, and supporting diverse local economic activity, as well as helping visitors gain greater awareness of habitats and their function and value. Social benefits can include the diversification of rural employment opportunities, and the support of skill retention and development, leading to significantly higher numbers of local jobs, and to greater economic stability and improved living conditions; and also a strengthened sense of place and social identity, which can promote greater civic responsibility, safeguard the cultural and natural heritage, and provide opportunity for environmental education and leisure, health and amenity.

The goal of this paper is to apply the concept of ecosystem services to NATURA 2000 sites in the Ore Mountains on both sides of the border between Germany and the Czech Republic. The study carried out in the framework of the transboundary Ore Mountains Green Network project is to reveal the various services and benefits such protected areas provide. After a brief description of the project design and the study area, several ecosystem services provided by NATURA 2000 areas of the Ore Mountains ridge zone are characterized, using a mere descriptive or semi-quantitative way (expert judgment), and distinguishing between the potential or capacity to provide services on the one hand, and the actual use of these services on the other. Finally, we discuss the opportunities and also the risks of utilizing these services in the framework of sustainable rural development.

The Ore Mountains Green Network Project

The goal of the Ore Mountains Green Network project funded by the European Union (EFRE Objective 3 / INTERREG IV A) is to identify and strengthen synergies between nature conservation (NATURA 2000) and rural development, especially in the spheres of conservation-friendly agriculture and forestry, eco-tourism and environmental education, with a special focus on the many NATURA 2000 sites in the Ore Mountains.

The project partners are:

- The Leibniz Institute of Ecological and Regional Development (IOER); Lead Partner, Germany
- The Faculty for Environment of the J. E. Purkyně University, Ústí nad Labem, Czech Republic
- The Western Ore Mountains and the Central Ore Mountains Land Care Associations, Germany.

Starting from the present situation of selected NATURA 2000 sites along the ridge of the Ore Mountains, a SWOT analysis has revealed the strengths, weaknesses, opportunities and threats with regard to interdependencies between nature conservation and rural development. Strategies and concepts are to be prepared in close cooperation with local stakeholders, to enhance the status of NATURA 2000 in rural development. These concepts are designed to show how NATURA 2000 sites can be maintained in a favorable state by permanently integrating economic and educational aspects. The combination of nature conservation, product marketing, tourism, and environmental education is designed to improve acceptance of successful nature conservation, especially among land users and other stakeholders.

The project is targeted toward the ridge area of the Ore Mountains in the three districts of *Sächsische Schweiz-Osterzgebirge*, *Mittelsachsen* and *Erzgebirgskreis* in the German Free State of Saxony; and in the Bohemian districts of *Ústecký kraj* and *Karlovarský kraj* in the Czech Republic.

To describe ecosystem potentials and services of the NATURA 2000 sites to render consciousness for these values, also considering the risks arising from current and expected future human impacts, are one central part of the project and the main focus of this paper.

Study Area Ore Mountains

The Ore Mountains (*Erzgebirge / Krušné hory*) have the shape of a slanted writing desk some 150 km in length, formed by tectonic forces. On the southern side, the mountains slope steeply down toward the Ohře river valley. On the northern side, they drop away gradually over a distance of 30-45 km to the foothills. The ridge of the Ore Mountains, averaging 800-1000 m above sea level, has long constituted the border between Saxony and

Bohemia, and today between the Federal Republic of Germany and the Czech Republic. Acid rocks such as gneiss, phyllite and granite are typical, as is the raw climate, many raised bogs, mountain meadows and spruce forests. It is a traditional cultural landscape of European significance, especially shaped by ore mining.

The Ore Mountains are rich in beautiful landscapes and natural assets, with characteristic ecosystems, such as raised bogs and bog forests that give the impression of pristine nature, but also "man-made" mountain meadows with their blooming and smelling herbs, matgrass meadows, tall subalpine herbaceous vegetation, stone walls, mixed mountain forests and near-natural running waters.

Several rare and threatened species are among the remarkable flora, such as arnica (*Arnica montana)*, ragged pink *(Dianthus seguieri)* and several orchid species; and fauna, including the black grouse *(Tetrao tetrix)* and the corncrake (*Crex crex*). The black grouse, which is threatened with extinction, is very important at the European scale. The biggest Central European black grouse population outside the Alps lives in the Ore Mountains, especially on the Czech side of the border. The birds prefer large undisturbed landscapes covered by sparse woods with berry bushes (bilberries / *Vaccinium myrtillus*) and pioneer shrubs (rowan / *Sorbus aucuparia*, birch / *Betula pendula*). The major reasons for the decline of black grouse populations include the afforestation of clearings and forest meadows with spruce monocultures, the increase in predator populations (e.g. red fox, wild boar) and disturbance, e.g. by tourists and wind turbines.

Especially the Ore Mountains ridge on both sides of the border between Saxony and Northern Bohemia features many valuable natural areas. A large number of NATURA 2000 sites, both Special Areas of Conservation under the EU Habitats Directive and Special Protection Areas under the EU Birds Directive, are located here. In many cases, the NATURA 2000 sites form huge, even transboundary complexes (Figure 1, Table 1,2).

METHODS

A total of 24 NATURA 2000 sites of the Saxon side of the Ore Mountains (only SCI, size 14-1690 ha) and 15 NATURA 2000 sites of the Czech side (5 - >16,000 ha) were included in the analyses. The selected sites represent the typical spectrum of habitat types of the upper Ore Mountains: forests, raised bogs, mountain meadows and running waters.

The assessment of ecosystem services in the selected NATURA 2000 sites involved the differentiation between the actual use (expressed as function – cp. Bastian & Schreiber 1999) and possible future uses (based on existing potentials or capacities presently not used or under-used). Conflicts between present use and the goals of nature conservation were also taken into consideration, as were restrictions against or risks of more intensive forms of utilization.

The analysis of the potentials refers to the concept of nature potentials which focuses on nature's assets from the point of view of the potential user. The goal is to display the service capacities of an area as a field of options available to society for use, and also to take into account such categories as risks, carrying capacity and the capacity to handle stress (increasingly summarized today in the term "resilience"), which limit or may even exclude certain intended uses (Mannsfeld 1983).

In the classification of ecosystem services and potentials, we follow a trinomial scheme (e.g. Bastian 1997, Hein et al. 2006, Grunewald & Bastian 2010). This breakdown into productive (economic), regulatory (ecological) and socio-cultural services has the

advantage that it can be linked to the concept of sustainability using the established ecological, economic and social development categories.

We have included only those ecosystem services for which a sufficient stock of data is available:

Provisioning (economic) services

Supply of animal products

- *Livestock (products: milk, meat, wool)*
- *Fish*
- *Game*

Supply of plant products

- *Crops*
- *Timber*
- *Wild fruits (berries, mushrooms)*

Biochemical / medicinal resources

- *Spignel* (Meum athamanticum) *and other herbs*

Provision of genetic resources

- *Seeds of forest trees*
- *Seeds of herbs / grasses (e.g. for hay mulching)*

Drinking water

- *Water protection areas / headwaters*

Energy from water power

Regulation (ecological) services

Air quality regulation / local climate regulation (of forests and grassland)

Water balance regulation

- *Flood protection*
- *Erosion control*
- *Self-purification of waters*

Socio-cultural services

Esthetic values (e.g. scenery)

Services in the field of recreation and eco-tourism

Services in the field of environmental education

- *Cultural-historical aspects*

The information used stems from the management plans for the NATURA 2000 sites (SCI)(only for the German part) and nature reserves (elaborated – as a rule – by consultants by order of the state environmental authorities), from governmental agencies and from the personal knowledge of the project partners. We sampled the following data: habitat types and important species of the SCI, present land use and human activities and their conflicts with the goals of nature conservation, actual and expected threats and risks, management measures (incl. necessary and proposed measures not implemented, yet). By expert judgments of the project team, we assessed the significance of the SCI to provide services in three categories: high, medium, no significance, potentials for extended or additional

human (especially economic) activities (supporting rural development by gaining income or providing other benefits), risks and actual pressures on valuable ecosystems.

On the example of the provisioning service "supply of animal products / livestock" the approach shall be explained: Large NATURA 2000 sites dominated by grassland (especially mountain meadows) show a high significance for this ecosystem service if the biomass is used (as fodder). NATURA 2000 sites with only minor parts of grassland (or without any grassland) achieve only a lower (or no) significance of the service. Grassland sites presently not managed have potentials (for the future use). Over-use (e.g. by high nutrient inputs, cattle trampling) can bear risks for the maintenance of valuable species or the habitat type as a whole. The management of the meadows can provide income opportunities, e.g. by utilizing or selling grass and hay as fodder but also by payments from EU-funds for the management measures. Such income factos can be calculated in monetary terms.

Due to the huge number of NATURA 2000 sites involved, this paper can give a survey only to characterize the entire situation and the more or less general aspects (section Results). To give examples, we refer – if appropriate – to typical selected NATURA 2000 sites, especially to the SCI 263 "Moore und Moorwälder bei Satzung" (Bogs and bog forests near the village of Satzung). The size of this SCI is 161 ha. It was designated to protect a complex of raised bogs and wet forests (natural bog forests and mountain spruce forests).

RESULTS

For the category "animal products" (*livestock*), as part of provisioning services, it is important that numerous NATURA 2000 sites in the upper Ore Mountains contain grassland biotopes, especially mountain meadows, which depend on careful use or management: regular removal of biomass by mowing, including hay-making, or pasturing cattle and sheep. On the German side, regular management of valuable mountain meadows prevails, in many cases depending on payments for nature conservation. These payments can be an income factor for farmers and landscape managers (landscape care associations). As own analyses have shown, if the habitat improving and the regular management measures demanded in the management plans for the mountain meadows of 10 SCI sites of the upper Ore Mountains would be implemented, the costs would be about 220,000 €, among them labour costs. On the Czech side, many meadows became fallow land. Even if the mowing of mountain meadows can be organized, in some cases no customers for the harvest can be found. The results of insufficient grassland management are not only a decline in sensitive meadow species, but also unused economic potentials (Table 2).

Fishery is not very much developed in the Ore Mountains NATURA 2000 sites. Frequently, anglers are active, who can cause vegetation damage along the river banks. There is no potential for more intensive forms of fishery. The situation of *hunting* is quite different. Although hunting takes place in all forests, even in protected areas, the stock of game, especially red deer, row deer and wild boar, is too high, and exceeds the carrying capacity of the forest ecosystems. Vegetation damage due to peeling and reduced natural regeneration of forest trees, are the result. Red deer like to wallow in sensitive raised bog waters. Feeding game in higher altitudes of the mountains during winter can impair valuable biotopes (eutrophication, dissemination of invasive plant species) and sensitive animals (e.g. black grouse). Therefore, hunting should be intensified to reduce the stock of game, which would also develop economic potentials not sufficiently exploited to date.

Agriculture does not play any major role in the NATURA 2000 sites. Due to the unfavorable climate and soil conditions, it would not be very profitable. The expansion of agriculture would generally not be compatible with the goals of nature conservation. However, the cultivation of some special crops, e.g. oats, would support black grouse browsing.

Most of the NATURA 2000 sites are covered by *forests*, at least partially. The forests are used more or less intensively, with the exception of very small total reserves. Both the state and the private forest enterprises are geared towards economic benefits. Conflicts with nature conservation result from timber harvesting, including in valuable forest habitats, heavy machines, construction of excessively sized forest roads, the lack of lumbermen (who would be necessary for manual work), drainage, tillage of forest soils, afforestation with foreign tree species. Other threats (also in SCI 263) are caused by large-scale liming of acidic forest soils from aircraft, which damages the pH-balance and the vegetation of raised bogs and bog forests, and afforestation of open areas, including the black grouse habitats. The NATURA 2000 sites provide essential potentials for sustainable forestry, but almost no reserves for intensification. Conflicts result from the efforts of nature conservation to recover the original hydroregime in wet biotopes, and to close ditches in raised bogs.

Wild berries and mushrooms are collected in almost all forest areas, with sporadic threats to sensitive biotopes and animals. The exploitation of biochemical and medicinal resources has hardly been developed at all. Some mountain meadow reserves have potentials for harvesting spignel and other *medicinal plants* (e.g. SCI 039E, 283, CZ0414110). Dangers of overexploitation and risks for the biotopes and the populations should not be ignored. With regard to the high biodiversity of the NATURA 2000 sites, the use of *genetic resources* should be considered. At present, the seeds of such forest trees as bog pine, spruce, beech, and fir are harvested at several sites (e.g. SCI 012, 040).

SCI 263 and numerous other NATURA 2000 sites contribute to the provision of *drinking water*, since they are also water protection and headwater areas. Increased water recovery would conflict with the goals of nature conservation. Water authorities worry about the restoration of raised bogs (closing the ditches) referring to increased concentrations of humin substances in the bog rivulets (e.g. SCI 016E). There are, however, different opinions about these problems, mainly concerning actual or supposed correlations between the efflux of humin substances and bog renaturation (Grunewald & Sudbrack 2009, Veselá & Zahradka 2006).

Among the category of regulating services, *air clearance and local climate regulation* (especially by forests) should be mentioned. The vitality and filtering function of forests are threatened by diffuse inputs of nutrient and other matters (to be observed also in SCI 263), and supra-regional climate changes. Already today, spruces show essentially reduced growth in periods of extreme weather conditions (especially heat and drought) (SMUL 2009). Forest fringes around raised bogs can protect them from increased evapotranspiration and from drying up (e.g. SCI 007E).

Due to the steep slopes, the capacity for *runoff regulation* in mountain areas is very important. Natural forests, meadows, swamps and especially bogs balance water runoff, store water during dry periods, and prevent flooding. To increase the capacity for water balancing, various measures have been proposed and in fact carried out in SCI 263 and other NATURA 2000 sites: changing the tree composition in forests, closing ditches in raised bogs (see above for the conflicts with intensive forestry interests and with the drinking water concerns mentioned), but also providing necessary financial resources. Barrages and small power stations had been built on several rivers and creeks for water

retention (e.g. SCI 252, 265). As a result, the runoff regime and the permeability for water organisms have been reduced.

Forests have a high potential to prevent *soil erosion*. This capacity can be increased by restructuring the forests toward a more natural state. Such changes are proposed for almost all forest NATURA 2000 sites, sometimes in conflict with demands for more intensive forestry. Proposals include the planting of broad-leaf trees along roads and forest tracks, as well as in small groups along stonewalls in meadows, e.g. to support the feeding of the black grouse (e.g. SCI 263).

As natural, richly-structured streams are better suited for *self-purification* than canalized waters, their potential can be improved by establishing hydrological buffer zones, supporting water dynamics, and reducing nutrient inputs from adjoining farmlands and settlements. Presently, such objectives are conflicting e.g. with technical flood prevention measures (e.g. SCI 042E, 252).

In the category of socio-cultural services, *esthetic values* are very important, especially for enjoying the scenery and for eco-tourism. The large forests of the Ore Mountains at higher altitudes support such goals. Beech forests, to some extent spruce forests, and bog forests are of great interest. The landscape gains in attractivity, especially for tourism, through a small-scale pattern of various biotopes, e.g. raised bogs, bog forests, headwater areas, mountain meadows and pastures and stone walls, which are habitats for rare and beautiful species. Some NATURA 2000 sites include geomorphologic peculiarities, e.g. Mount Klinovec (1244 m) and Mount Fichtelberg (1214 m), the highest elevations of the Ore Mountains (SCI 071E, CZ0420528). There are also NATURA 2000 sites with historically valuable cultural landscape elements, such as monuments to transportation and mining history, but also ancient forests which are cultural monuments (SCI 007E, 083E, 252, 266, CZ0414110). The development of tourism can suffer from the construction of wind turbines on the mountain ridge (CZ0424127, CZ0420528).

There is a wide variety of touristic activities in the NATURA 2000 sites of the Ore Mountains: walking, cycling, mountain-biking, swimming, climbing, collecting wild berries, mushrooms and minerals. Additional opportunities for *nature-based tourism* arise especially from the networking between the German and the Czech side (e.g. SCI 004E, 283, CZ0424127). There are, however, already today problems with overexploitation (e.g. trampling valuable vegetation cover, disturbance of black grouse and other animal species, waste disposal). Conflicts result from the increasing utilization of the landscape for sports, especially for skiing, mountain-biking and even quad-biking. Especially NATURA 2000 sites with black grouse populations (SCI 263) are not suitable for touristy developments.

In the area of *environmental education*, the experience of rare and valuable species and ecosystems is the main emphasis. There are nature trails (e.g. across raised bogs – SCI 174, CZ0414110) and presentation signboards. Guided tours are offered, and school education includes NATURA 2000 sites. "Scientific" tourism has also developed, with in some cases serious threats to the fragile ecosystems (mountain meadows – SCI 039E, 071E) and sensitive species (black grouse – SCI 263). Since 2004, the Dresden University of Applied Sciences has organized annual practical training courses for the students of landscape management at NATURA 2000 mountain-meadow sites. In the framework of the UNESCO-UNEP post-graduate course Ecosystem Management, students from more than twenty countries studied problems with NATURA 2000 sites in the Ore Mountains. Thus, the NATURA 2000 concerns have been widely disseminated in the world. As part of university courses of study, a large number of practical exercises, diploma theses and dissertations have been carried out in the context of the two major research and management projects dealing with mountain meadows (SCI 039E, 042E, 044E).

Job opportunities have also been developed from the implementation of management plans, care for the sites and monitoring activities. Several management plans for NATURA 2000 sites on the German side of the Ore Mountains propose to engage special managers (rangers), which would mean the direct creation of local jobs in nature conservation (SCI 039E, 044E).

Table 1: Special Protection Areas (SPA) in the ridge area of the Ore Mountains
(see Fig. 1)

Number	**Name**
SPA at the German side	
DE 5047 - 451	Weißeritztäler
DE 5048 - 451	Osterzgebirgstäler
DE 5050 - 452	Linkselbische Fels- und Waldgebiete
DE 5144 - 451	Flöhatal
DE 5145 - 451	Großhartmannsdorfer Großteich
DE 5148 - 451	Weicholdswald
DE 5244 - 451	Zschopautal
DE 5247 - 451	Waldgebiete bei Holzhau
DE 5248 - 451	Fürstenau
DE 5343 - 451	Geyersche Platte
DE 5344 - 451	Mittelgebirgslandschaft östlich Annaberg
DE 5345 - 451	Wälder bei Olbernhau
DE 5441 - 451	Westerzgebirge
DE 5543 - 451	Fichtelberggebiet
DE 5640 - 451	Elstergebirge
SPA at the Czech side	
CZ 0421004	Novodomské rašeliniště – Kovářská
CZ 0421005	Východní Krušné hory

Fig. 1: Distribution of the NATURA 2000 sites in the ridge area of the Ore Mountains

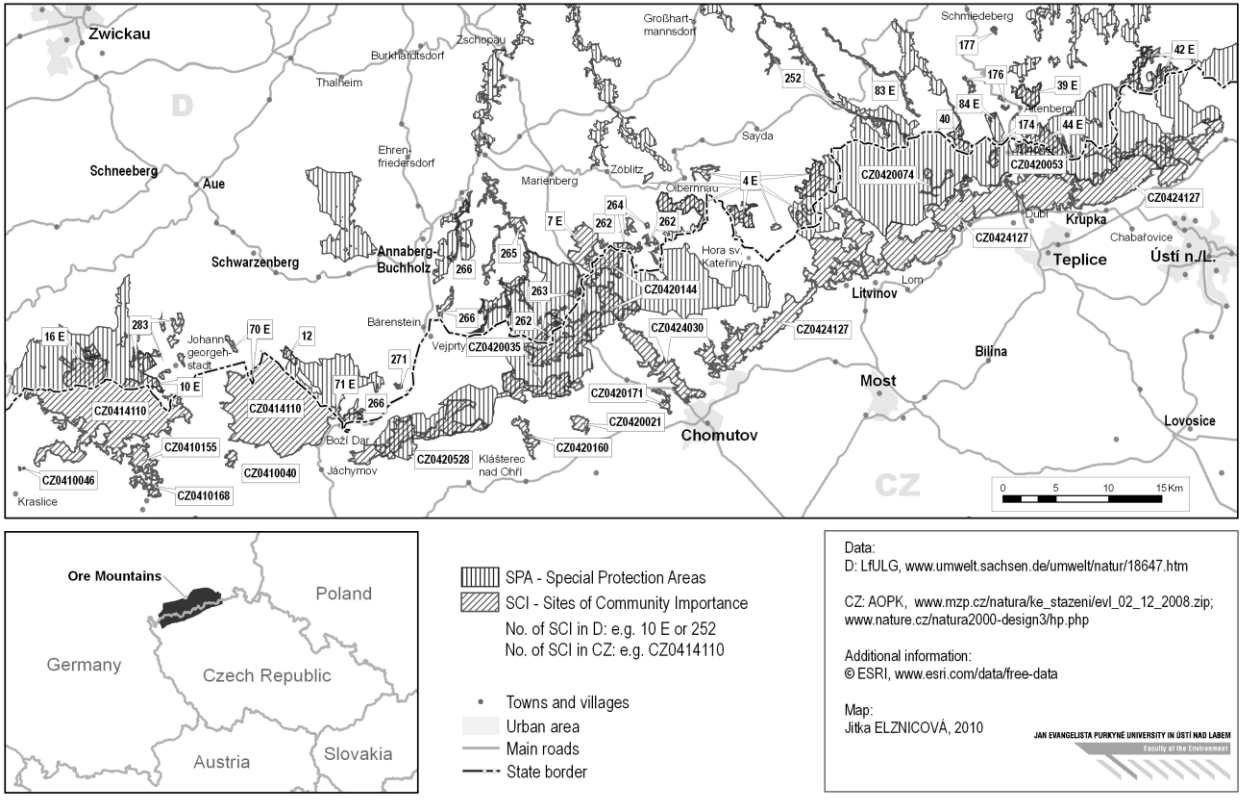

Table 2: Special Areas of Conservation (SCI) in the ridge area of the Ore Mountains (see Fig. 1), their significance to provide services (incl. potentials and risks)

Number	Name	L	G	T	M	B	S	W	A	F	Ec	SF	Es	R	E
SCI at the German side															
004E	Buchenwälder und Moorwald bei Neuhausen und Olbernhau	s	Sp	Sr	s			S	Sr	S	S		Sr	Sr	s
007E	Mothäuser Heide		Sp	sr				S	s	S			sp	Sr	Sp
010E	Erzgebirgskamm am Kleinen Kranichsee	sp	S	sr				S	S	S	s		Sr	Sr	s
012	Zweibach		Sp	sr	r		s		S	sp	Sp		Sp	s	p
016E	Erzgebirgskamm am Großen Kranichsee	sp	Sp	Sr	s			S	S	S	S		S	Sr	s
039E	Geisingberg und Geisingbergwiesen	Sp	s	sr		pr	p		s	sp	sp	s	Sp	Sr	sp
040	Hemmschuh	sp	Sp	Sr			s		S	Sp	Sp	sp	Sp	Sr	p
042E	Mittelgebirgslandschaft um Oelsen	Sp	Sp	sr		pr	sp	S	S	Sp	Sp	Sr	Sp	Sr	Sp
044E	Fürstenauer Heide und Grenzwiesen Fürstenau	Sp	s				p	s	s	Sp	s	S	Sp	Sr	sp
070E	Wiesen um Halbmeil und Breitenbrunn	Sr						S	s	sp	s	Sp	Sp	S	sp
071E	Fichtelbergwiesen	Sr				pr	p	Sp	Sr	s	S	S	Sr	Sr	s
083E	Gimmlitztal	Sr	s	sr				S	S	Sp	Sp	S	Sp	Sr	s
084E	Kahleberg bei Altenberg			sr				s	sr	sp	sp		s	Sr	sp
174	Georgenfelder Hochmoor	s						S	sr	Sp	sp		sp	Sr	Sp
176	Bergwiesen um Schellerhau und Altenberg	Sr				pr	p	s	sr	s	sp		Sp	Sr	sp
177	Bergwiesen um Dönschten	Sr							s	s	s		sp	S	s
252	Oberes Freiberger Muldetal	sr	Sp	Sr				S	S	sp	sp	sr	Sp	S	s
262	Bergwiesen um Rübenau, Kühnhaide und Satzung	Sr						s	s	s	s		Sp	Sr	sp
263	Moore und Moorwälder bei Satzung		sp	r	s			S	S	Sp	sp		Sr	S	sp
264	Kriegwaldmoore		Sp	sr				S	s	S	s		S	S	
265	Preßnitz- und Rauschenbachtal	Sr	Sp	Sr			p	S	S	Sp	S	Sp	Sp	S	s
266	Pöhlbachtal	Sr		Sr				S	S	Sp	Sp	S	Sp	S	Sp

Number	Name	L	G	T	M	B	S	W	A	F	Ec	SF	Es	R	E
271	Kalkbruch Hammerunterwiesenthal							s					s	sr	s
283	Mittelgebirgslandschaft bei Johanngeorgenstadt	Sr	s	Sr			p	S	S	Sp	Sp		Sp	S	S p
SCI at the Czech side															
CZ0410040	Pernink	sr		r				S	s	F	s		S	p	p
CZ0410046	Šibeniční vrch									S			s	sr	p
CZ0410155	Rudné	Sr		r				s	s		s	s	sp	Sp	p
CZ0410168	Vysoká Pec	sp		sr		p	p	s	s	s	s		sp	sp	p
CZ0414110	Krušnohorské plató	sp	sp	Sr		p	p	S	Sp	s	sp	s	Sr	Sr	sp
CZ0420021	Kokrháč - Hasištejn		p	sr		p		S	s	Sp	S	s	S	s	p
CZ0420035	Na loučkách	sp	p	sr			p	s	sp	S	sp	s	S	s	p
CZ0420053	Rašeliniště U jezera - Cínovecké rašeliniště			r		p	sp		s	sp		Ss	s	sr	sp
CZ0420074	Grünwaldské vřesoviště		sp	r	sr			s	sp	sp	sp	sp	Sp	sr	p
CZ0420144	Novodomské a polské rašeliniště		sp	sr		p		s	sp	sp	sp	sp	Sp	sr	sp
CZ0420160	Podmilesy	s		sr		p		s	sp	sp	s	s	s	s	p
CZ0420171	Údolí Hačky	s		sr		p		s	sp	S	s	S	S	s	p
CZ0420528	Klínovecké Krušnohoří	sp	sp	Sr		p		S	S	Sp	sp		Sp	Sr	p
CZ0424030	Bezručovo údolí			r			p	s	s	s	s	s	s	s	p
CZ0424127	Východní Krušnohoří	sp	sp	Sr		p	p	S	sp	Sp	sp	sp	Sr	sp	sp

DISCUSSION

As the results show, the NATURA 2000 sites of the Ore Mountains provide a wide range of ecosystem services. Thus, the benefits from these areas go far beyond the original purpose of maintaining threatened species and habitats. Of course, several services (and potentials) are not restricted to the NATURA 2000 sites, they are provided also in wide parts of the mountain range but frequently to a lower extent. There are also potentials, so far unused, which could be developed, but only if the various restrictions for nature conservation are respected.

Notwithstanding the very similar natural conditions on both sides of the border, there are distinct differences, e.g. in management planning, but also in the awareness and acceptance of NATURA 2000, the implementation of conservation measures and related environmental education and publicity activities. Nevertheless, ecosystem services provide a suitable approach for managing the entire area. Incidentally, monetary valuation is not absolutely necessary, since available findings are suited to demonstrate various stakeholders the importance of the ecosystems within the NATURA 2000 sites for rural development.

Risks and opportunities resulting from an increased use of some natural potentials will be discussed in greater detail: Thus, the production and marketing of hay from mountain meadows could be developed, as could the utilization of biomass from landscape management, e.g. for energetic purposes. But there are several obstacles: the cost-benefit ratio, technological problems, or the lack of ability or willingness among some farmers to meet the stringent requirements of nature conservation, e.g. dispensing with fertilizers. Greater attention could be paid to pasturing if the grassland types concerned tolerate grazing, e.g. with support for old livestock breeds, as a contribution to maintaining livestock diversity.

There is considerable potential for ecological agriculture. The maintenance and extension of flowering meadows is desirable, not only for the conservation of biodiversity but also for the scenery and for tourism. Unfortunately, this vision is not very realistic; on the contrary, it is difficult to maintain the present level. As detailed analyses (especially in SCI 042E) have shown (LfL 2007, Walczak & Wilhelm 2009), nature-friendly grassland management can cause economic losses for farmers, which must be compensated by other branches of the enterprise. The goals of nature conservation in NATURA 2000 grassland ecosystems are connected with profitable dairy farming, which is not assured under the complicated mountain-site conditions and the contemporary framework of European agricultural policy. Some management measures, like the removal of the upper soil layer with the dense grass layer, special species protection measures, and the application of special techniques actually involve large costs which are not completely covered by subsidies. Without appropriate financial support, the long-term maintenance of valuable grassland ecosystems in the Ore Mountains cannot be guaranteed. A special situation can be found in the Czech part of the Ore Mountains, where the traditional land-use pattern ended abruptly after World War II, due to the politically motivated depopulation of the region.

Regarding the stock of game, which is excessive from the point of view of forestry, it is necessary to find an appropriate level that does not exceed the carrying capacity of the forests, without ignoring aspects of tourism (game watching). Reduction in game stocks can considerably increase the gross margin of forest enterprises (Walczak & Wilhelm 2009).

The large forests of the Ore Mountains, mainly in the higher altitudes, afford opportunities for both local and transboundary experience of nature and landscape. Limits are set by nature conservation, the more so as disturbance of sensitive species and ecosystems has already been ascertained today. An intelligent guidance of visitors is

absolutely necessary. The outstanding natural value of the Ore Mountain ridge zone – in general – is a strategic advantage for tourism and environmental education. Eco-tourism is showing world-wide annual growth rates of 20-30%, compared with 9% for tourism in general (European Commission 2008). NATURA 2000 is a signal, and even a label, for an attractive landscape at the European level. Far-sighted tourism managers have recognized this fact, and are using it for advertising (DVL 2007). Eco-tourism provides a wide range of possibilities to protect valuable landscapes through uses compatible with the objectives of nature conservation. These positive potential effects in the German-Czech border zone should not be underestimated, particularly since this area is suffering from crucial social and economic problems, such as demographic change (exodus and ageing), unemployment, low economic power, and structural change in agriculture.

Though tourism has become a major growth sector for many rural regions, it needs to be managed sustainably, so that it can provide significant and sustained benefits for local communities, and an important incentive for the long-term conservation of natural and semi-natural habitats, species and landscapes. Tourism can not only generate jobs and income for the local area, but also lead to an increase in visitors' awareness and knowledge of nature (IEEP 2002). Sustainable tourism activities are compatible with the management of most NATURA 2000 sites. Some sites, particularly those which are ecologically more fragile, such as raised bogs, or the habitats of the black grouse, are unsuitable for tourism (e.g. SCI 263). There is a need for sophisticated tourism concepts that take the protected areas, and the peculiarity and beauty of the landscape into consideration. It should be relatively easy and effective to ensure the inclusion of a NATURA 2000 site in local, regional and national tourist plans and promotional material and campaigns, yet this is often sadly lacking in practice. As NATURA 2000 sites are of European importance, nature conservation has precedence over economic interests – including those of tourism.

The development of environmental education can be achieved by various measures such as the inclusion of children and youths in the management of biotopes, e.g. during transboundary German-Czech summer camps, or the organization of partnerships for biotopes, by means of guided tours, presentations and training courses, and with the aid of informational materials, nature trails and centers of competence in the field of landscape management. For many people, however, NATURA 2000 is still a mere catchword, it symbolizes a system of scientific terms that cannot be communicated easily to laymen. It would be more successful to generate pride in such treasures of nature as the raised bogs, the mountain meadows, the rare species and the typical landscape of the Ore Mountains. The natural heritage should be a part of the identification of people in the Ore Mountains, like their mining history, or the Christmas customs.

While analyzing rural areas in thirty countries, the OECD (2006) recognized the considerable opportunities for sustainable economic development in the areas of landscape management, rural tourism, marketing of agricultural products and renewable energies. A study in Germany showed that rural areas can better compete with urban agglomerations if they have a functioning social structure and a near-natural landscape (Kroehnert et al. 2006). Restraints can be identified in short-term economic interests, in the dependency of subsidies and in the lack of regional marketing structures. In addition, deficient awareness of the environment and of the values of nature and the cultural landscape, not only of the Ore Mountains, can be ascertained. For the area of agriculture, especially mountain meadows, dependency on subsidies must be overcome in the long run. Only economically viable farms or land care associations will be able to manage NATURA 2000 sites reliably. The management of NATURA 2000 sites should not only cover the costs, but should yield financial gains.

The conservation of biodiversity is often perceived as implying costs or restrictions to local people and local economies, but in reality, NATURA 2000 sites can provide significant economic and social benefits. This applies mainly to the vast majority of NATURA 2000 sites situated in rural areas, which in general have a lower economic activity and less income diversity than urban areas. According to the IEEP (2002), the challenge is to ensure that NATURA 2000 will be integrated as a core element of an economically viable rural strategy. By broadening economic activity to include nature conservation, tourism, and both new and traditional products and services, the region will also be better placed to cope with future changes, and will therefore be more sustainable in the long term. The IEEP (2002) has also stressed the fact that the socio-economic benefits to be derived from a site are not limited to that site itself, but are spread throughout the local and regional economy, partly due to the fact that there is direct expenditure en route to or from a site, and also to the fact that money spent at a site flows through the local economy, providing "multiplier" benefits.

The challenge is to move away from subsidy dependence, and to encourage sustainable farming practices and other appropriate economic activities. Support for the development of niche markets for local products, and developing brands that can obtain ecological accreditation can often be very important. In many cases, NATURA 2000 "labeling" or "branding" can be a very helpful tool, both in the labeling of the products and in the tourist branding of a site or region. Factors of success of regional marketing are known from numerous studies (e.g. Wörler et al. 2006).

As a study from the eastern Ore Mountains (SCI 042E) has shown (Walczak & Wilhelm 2009), the income from forest enterprises can be increased by developing a local processing and marketing chain, the production of seed from certified stocks, the certification of timber production, and the production of wood chips from thinning material. The IEEP (2002) referred to many opportunities for pro-active and committed stakeholders to realize benefits from NATURA 2000 but noted that these could be hampered by a lack of awareness of how to use the particular assets of each site to stimulate appropriate socio-economic development. A constructive dialogue is, it stated, needed that moves away from a "costs to us" approach. Awareness raising and training can help land managers to find more suitable practices that fit in with NATURA 2000 requirements. A broad appreciation of the full range of benefits, concerns and trade-offs can lead to the identification of how a NATURA 2000 site can become a driver for sustainable development of the local community.

In the Ore Mountains, especially in the area of nature conservation and landscape management, more efforts are needed towards transboundary cooperation, especially in the ridge zone along the German-Czech border, where the ecosystems are especially sensitive to disturbances.

It is also necessary to assess the impact of climate change. Yet the NATURA 2000 network's planning process is based on a static view of the distributions of habitats and populations, as Vos & Verboom (2007) have criticized. In human dominated landscapes, natural or semi-natural ecosystems have become fragmented and are embedded in unsuitable landscapes, with low permeability. In the Ore Mountains, the preconditions are rather good, because there are relatively large, hardly fragmented protected areas that can achieve even greater effectiveness due to their transboundary character (e.g. SCI 010E and 016E together with CZ0414110; 044 with CZ0424127; 263 with CZ0420144). There are last line from below: several measures that contribute to the linking to the linking of ecological networks (cp. Leibenath et al. 2010), e.g. enlarging existing habitat patches, creating new habitat patches, creating robust corridors, improving matrix permeability, and mitigating barrier effects.

CONCLUSION

The NATURA 2000 sites of the Ore Mountains ridge along the German-Czech border constitute not a pristine but a human-influenced natural area, marked by long-term economic and other human activities. Today, they are used for several purposes, and they provide a broad range of economic, ecological and socio-cultural services. As the analyses of 24 Special Areas of Conservation (SCI) on the German side and 15 SCI on the Czech side show, they offer considerable potentials for a careful cross-border rural development in the areas of agriculture – incl. forestry and landscape management – tourism and environmental education. But there are also essential threats and risks caused by land use intensification, abandonment of extensive land management forms, afforestation of valuable open areas, unsuitable development for tourism, and the establishment of wind turbines at sensitive sites on the mountain ridge.

The application of the ecosystem services concept can help to reveal the manifold benefits NATURA 2000 sites provide – besides their main task, to support biodiversity – for human well-being. It can also help to convince decision-makers, land users, tourism managers and the lay public by alternative, additional arguments, and it can underpin the justification of nature conservation.

Although the data availability for NATURA 2000 is quite good, it is very difficult and expensive to valuate a large set of ecosystem services for the many NATURA 2000 sites of a whole mountain range quantitatively or even in monetary terms. The results of this study can be a starting-point for a more detailed analysis and valuation of selected ecosystem services. Such an intention can not be realized without a very specific objective, for example a touristy preference analysis or a calculation of water resources, though.

To strengthen the synergies between nature conservation and rural development, it is necessary to develop long-term management schemes, better marketing (e.g. product labeling), and a due consideration for the goals of nature conservation. Especially, closer cooperation between the German and the Czech parts of the Ore Mountains would afford many new opportunities for both nature conservation and rural development.

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