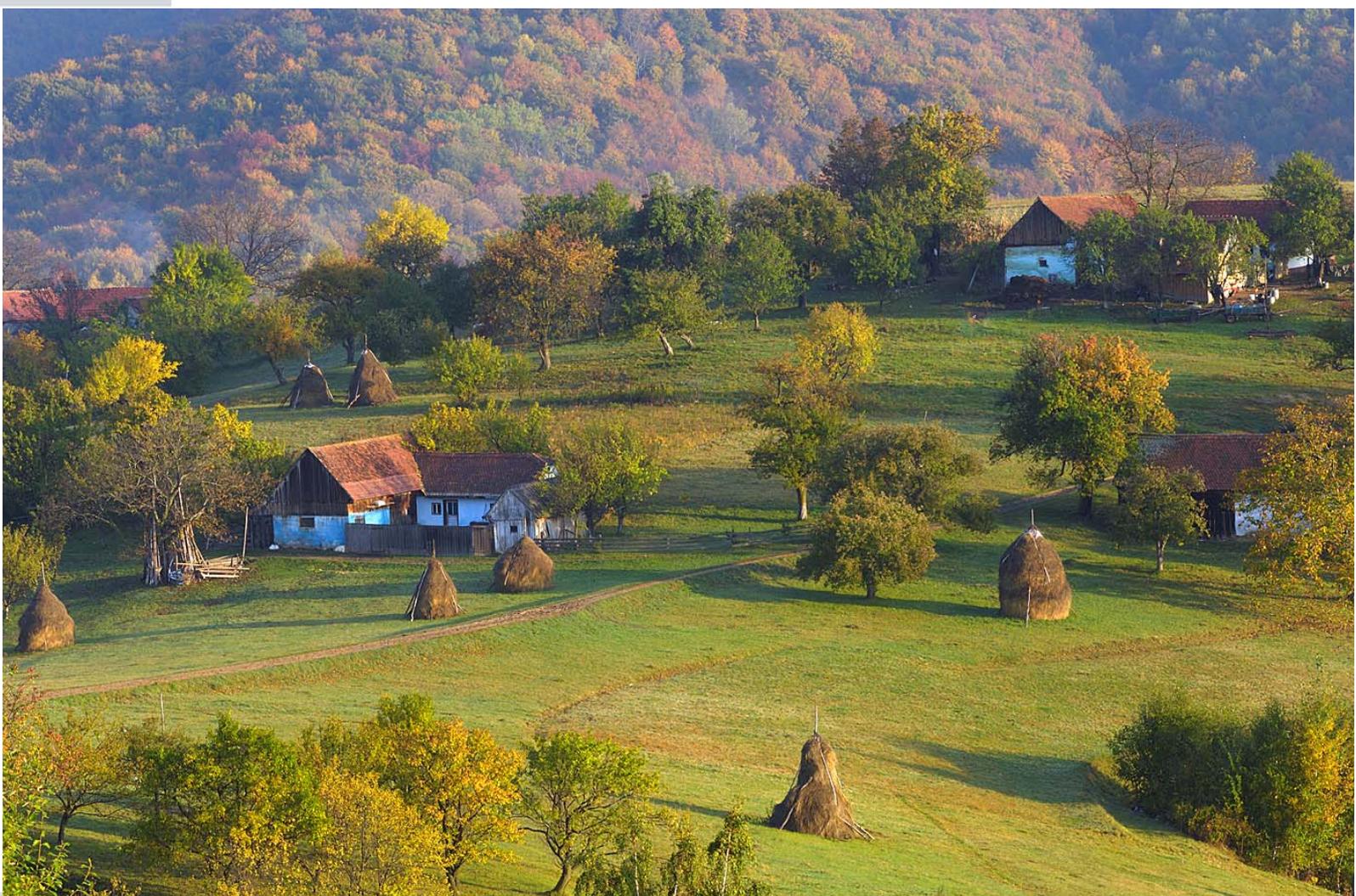


1251

NINA Report

An ecosystem services analysis of the Fagaras Mountains, Romania

John D. C. Linnell
Bjørn P. Kaltenborn



NINA Publications

NINA Report (NINA Rapport)

This is a electronic series beginning in 2005, which replaces the earlier series NINA commissioned reports and NINA project reports. This will be NINA's usual form of reporting completed research, monitoring or review work to clients. In addition, the series will include much of the institute's other reporting, for example from seminars and conferences, results of internal research and review work and literature studies, etc. NINA report may also be issued in a second language where appropriate.

NINA Special Report (NINA Temahefte)

As the name suggests, special reports deal with special subjects. Special reports are produced as required and the series ranges widely: from systematic identification keys to information on important problem areas in society. NINA special reports are usually given a popular scientific form with more weight on illustrations than a NINA report.

NINA Factsheet (NINA Fakta)

Factsheets have as their goal to make NINA's research results quickly and easily accessible to the general public. They are sent to the press, civil society organisations, nature management at all levels, politicians, and other special interests. Fact sheets give a short presentation of some of our most important research themes.

Other publishing

In addition to reporting in NINA's own series, the institute's employees publish a large proportion of their scientific results in international journals, popular science books and magazines.

An ecosystem services analysis of the Fagaras Mountains, Romania

John D. C. Linnell
Bjørn P. Kaltenborn

Linnell, J. D. C. & Kaltenborn, B. P. (2016) An ecosystem services analysis of the Fagaras Mountains, Romania - NINA Report 1251. 37 pp.

[Trondheim, June, 2016]

ISSN: 1504-3312

ISBN: 978-82-426- 2898-5

COPYRIGHT

© Norwegian Institute for Nature Research

The publication may be freely cited where the source is acknowledged

AVAILABILITY

[Open]

PUBLICATION TYPE

Digital document (pdf)

QUALITY CONTROLLED BY

Øystein Aas

SIGNATURE OF RESPONSIBLE PERSON

Signe Nybø

CLIENT(S)/SUBSCRIBER(S)

EEA Grants & Romanian Government

Programme RO02 Biodiversity and ecosystem services

CLIENT(S) REFERENCE(S)

ECOSS

COVER PICTURE

Cornelia Dor

KEY WORDS

Ecosystem services

Natural capital

Cultural heritage

Geoheritage

Fagaras Mountains

Romania

Muntii Fagaras

Piemontul Fagaras

NØKKEWORD

Økosystemtjeneste

Fagaras Mountains

Romania

Muntii Fagaras

Piemontul Fagaras

CONTACT DETAILS

NINA head office

Postboks 5685 Sluppen

NO-7485 Trondheim

Norway

Phone: +47 73 80 14 00

NINA Oslo

Gaustadalléen 21

NO-0349 Oslo

Norway

Phone: +47 73 80 14 00

NINA Tromsø

Framsenteret

NO-9296 Tromsø

Norway

Phone: +47 77 75 04 00

NINA Lillehammer

Fakkeltgården

NO-2624 Lillehammer

Norway

Phone: +47 73 80 14 00

www.nina.no

Abstract

Linnell, J. D. C. & Kaltenborn, B. P. (2016). An ecosystem services analysis of the Fagaras Mountains, Romania - NINA Report 1251. 37 pp.

This report builds on previous studies which have focused on biodiversity and the socio-economic context of the Fagaras mountains in Romania. The aim is to integrate the findings of these studies into an ecosystem services framework to help provide a holistic assessment of the costs, benefits and trade-offs associated with different development paths in the region. We categorised a diversity of provisioning, regulatory, and cultural ecosystem services that are currently being exploited, along with a range of services that have the potential to be exploited. Considerable trade-offs exist, with the choice to exploit some services leading to a severe reduction in the ability of the ecosystem to deliver on other services. To illustrate this we developed three scenarios called (1) Intensive use of provisioning resources, (2) Sustainable and extensive multi-use, and (3) Wilderness. Scenario 1 was largely incompatible with the other 2 scenarios, and with the Natura 2000 status of the site. In contrast, scenarios 2 and 3 showed a great deal of scope for integration given sufficient large-scale spatial planning and the introduction of best practice guidelines on all activities. A combination of scenarios 2 and 3 may in fact be necessary to deliver on the broad goals of these Natura 2000 sites, The possibility for turning these scenarios into viable community development pathways is discussed, and many social and institutional challenges have been identified.

Sammendrag

Linnell, J. D. C. & Kaltenborn, B. P. (2016). An ecosystem services analysis of the Fagaras Mountains, Romania - NINA Report 1251. 37 s.

Denne rapporten bygger på tidligere studier som omfatter biodiversitet og den sosio-økonomiske konteksten i Fagaras fjellene i Romania. Målsettingen er å integrere resultatene av disse studiene i et økosystemtjeneste-rammeverk for å bidra til en mer helhetlig vurdering av kostnader, goder og avveininger forbundet med ulike utviklingsretninger i regionen. Vi har kategorisert et mangfold av forsynende, regulerende og kulturelle økosystemtjenester som blir utnyttet, i tillegg til en rekke økosystemtjenester som har potensial for utnyttelse. Det finnes mange avveininger hvor noen valg av utnyttelsesmuligheter av økosystemtjenester vil gå på bekostning av andre typer tjenester. For å illustrere dette har vi utviklet tre scenarioer kalt (1) Intensiv utnyttelse av forsynende ressurser, (2) Bærekraftig og ekstensiv flerbruk, og (3) Villmark. Scenario 1 er stort sett uforenlig med de to andre scenarioene og med Natura 2000 status for området. Scenario 2 og 3 gir derimot gode muligheter for integrering, forutsatt arealbruksplanlegging over tilstrekkelig store områder og innføring av 'best practice' retningslinjer for alle typer aktiviteter. En kombinasjon av scenario 2 og 3 er sannsynligvis påkrevd dersom man skal oppfylle de brede målsettingene for denne type Natura 2000 områder. Vi diskuterer hvordan disse scenarioene kan nyttes i å utforme gode utviklingsretninger for lokalsamfunnene, inkludert en rekke samfunnsmessige og institusjonelle utfordringer.

Contents

Abstract	3
Sammendrag	4
Contents	5
Foreword	6
1 Introduction	7
2 Study area	8
3 Methods	11
4 Natural capital	12
4.1 Geo-resources	12
4.2 Cultural heritage	13
4.3 Biodiversity	14
5 Provisioning ecosystem services	15
5.1 Exploited	15
5.2 Potential	16
6 Regulating and supporting ecosystem services	17
7 Cultural ecosystem services	18
7.1 Exploited	18
7.1.1 Cultural services linked to provisioning services	18
7.1.2 Recreation	19
7.1.3 Tourism	19
7.1.4 Biodiversity and geo-heritage conservation	19
7.2 Potential	20
7.2.1 High impact tourism options	20
7.2.2 Low impact tourism options	20
7.2.3 Wilderness values	20
8 Flows of costs and benefits	23
9 Compatibilities and trade-offs for alternative futures	25
9.1 Scenario 1: Intensive use of provisioning resources	25
9.2 Scenario 2: Sustainable and extensive multi-use	25
9.3 Scenario 3: Wilderness	26
10 Social context	28
11 Land-use zoning for multiple objectives	30
12 References	33

Foreword

This report is the second of a series resulting from a project funded by the EEA Grants mechanism through the Romanian Government. The project is entitled "*A study into the economic and ecological potential of conservation enterprises to enhance the local economy, ecosystem services, and biodiversity in the Fagaras Mountains Natura 2000 site (ECOSS)*". The project was coordinated by the Foundation Conservation CARPATHIA and we are grateful to Christoph and Barbara Promberger, Daniel Bucur and Raluca Barbu for assistance at all stages of the project. Neil Bernie from Conservation Capital has been involved in many stimulating discussions along the way. George Iordachescu and Monica Vasile organised the fieldwork of a parallel survey of the socio-economic status of the region which provided many valuable insights that helped our work.

22nd June 2016

John D. C. Linnell – john.linnell@nina.no
Bjørn Kaltenborn – bjorn.kaltenborn@nina.no

1 Introduction

The quest for pathways to sustainable development which accommodates both long-term human needs and biodiversity has become the defining challenge of the last half century. During this period there have been a number of paradigm shifts in the way this effort is conceptualised. These shifts have followed a trend to try to embrace increasingly holistic views of ecosystems and human development needs. The most recent transitions have been from parallel natural resource management and biodiversity conservation strategies to a series of ecosystem management approaches to the present focus on ecosystem services (<http://www.millenniumassessment.org>; <http://www.teebweb.org>; <http://www.ipbes.net/>). The ecosystem services approach seeks to embrace all the ways in which humans and biodiversity interact within a single broad framework. One of the main goals of the approach is to help visualise all of the many ways in which human development depends on the ecosystem, including many of the processes (such as water quality and carbon storage) that are often taken for granted. By making the implicit more explicit the approach hopes to raise awareness of our total dependence on the ecosystem's structure and diversity. Ecosystem services traditionally use three or four categories of service. The first, termed provisioning services, covers all the concrete products that we extract from the ecosystem (e.g. timber, meat). Next are the regulating and supporting services (we pool them for simplicity) which covers the basic processes that make the ecosystem function (e.g. soil function, water quality maintenance). Finally, are the cultural services which embrace a wide range of topics, including the intrinsic value of nature, landscape aesthetics, cultural heritage and all forms of tourism. By adopting a holistic view it is easier to see the trade-offs that often exist between services, thereby helping decision makers to make more informed plans.

This report aims to apply a highly generalised ecosystem services approach to existing data on the Fagaras mountains in Romania. The Fagaras mountains are an area with a unique set of geoheritage, cultural heritage, biodiversity and ecological values which have led to their designation as Natura 2000 sites under European Union conservation legislation. The area is also at a cross-roads concerning the choice of development pathways which can have serious effects on the region. The primary objective of this report is to help identify the development options that exist and the consequences that these will have for the ecosystem so as to allow more informed decision making. While some ecosystem service assessments limit themselves to the biological aspects of the ecosystem, we adopt a more holistic approach and also include a focus on the underlying geology and physical properties of the landscape that are also crucial for understanding the functioning of the system, and the way people relate to it.

The data on the ecological situation of the area is taken from Linnell et al. (2016) and the socio-economic data from Iordachescu & Vasile (2016), in addition to multiple sources from the scientific and technical literature. Essentially this analysis has four goals;

- (1) Identify the natural capital and ecosystem values that exist.
- (2) Identify the services currently being exploited and those that could be further exploited.
- (3) Explore the extent to which multiple services can be extracted from the same ecosystem, as well as conflicts and trade-offs between different development paths.
- (4) Identify development paths that can best consider the needs for rural development and which remain compatible with the sites goals under their Natura 2000 designation.

2 Study area

The Fagaras Mountains consist of an uninterrupted 75 - 80 km long ridge orientated in an east-west direction (Fig 1). The ridge that runs at over 2000 m is topped by a series of peaks that reach up to over 2500 m, including Romania's highest mountain (Moloveanu 2544 m). Six peaks exceed 2500 m and 33 reach above 2400 m. Many secondary ridges branch off perpendicularly to the north and south. Those to the north are short, and drop more sharply down to the Fagaras depression (around 500 m in altitude). To the south, the secondary ridges extend much further and even branch, creating a more complex topography. Glacial geology is evident, in the form of glacial valleys, cirque lakes and moraines. The underlying geology is mainly metaphoric in origin, consisting of crystalline schists (Nedelea & Comanescu, 2011). This contrasts with the limestone dominated mountains to the east, for example in neighbouring Piatra Craiului National Park. The western edge is clearly defined by the Olt River which cuts a path through the range.

The Fagaras depression which lies to the north is largely flat and devoted to various forms of agriculture. The mountain slopes are largely forested, with mixed deciduous forests in the lower reaches, followed by a coniferous zone, and then an upper sub-alpine zone of dwarf pine and juniper. The alpine zone (above 2200 m) is largely composed of grasslands. The Fagaras Mountains have the largest continuous area of alpine zone habitats in the Romanian Carpathians (Hurdu et al. 2012). The southern slopes have the same altitudinal progression, but the difference in topography creates a more complicated transition, especially with respect to the lower edge where forest gradually gives way to agricultural land. Further details of habitats are presented in the results.

Streams descend through the valleys on both sides. Those on the north and west slopes flow into the Olt River, while those on the south slopes converge on the Arges River. Both rivers ultimately flow south and join the Danube. Streams of the north are generally short, fast and shallow, whereas the waters in the south are longer and richer. Only a few natural lakes are present. These are mainly high altitude corrie lakes of glacial origin. One of the largest is Balea Lake which covers 4.5 ha. In the south there are several large artificial lakes (Vidraru and Pecineagu) created for hydro-energy production.

The region has a long history of human land use (Cioaca & Dinu 2010). These traditional land uses include forestry (timber, firewood, crafts), hunting, gathering of non-timber forest products (like mushrooms and berries), livestock grazing (especially in the alpine grasslands during summer with sheep being moved to lower areas in winter), and agriculture (in the lower lying regions). In recent years these practices have been added to with the development of tourism (including hiking) and hydro-energy production (several large and many small installations). Forestry practices have also changed, with poorly regulated clear-cutting becoming widespread during the post-communist land restitution processes.

Historically these mountains formed the boundary between the northern area of Transylvania and the southern area of Wallachia. As this was Europe's boundary with the Ottoman empire the constant tensions and conflicts in the area also probably hindered its occupation and development in the pre-20th century period. However, the rugged terrain has also limited the extent of human impacts. There are no villages present in the central mountains, and only one major seasonal road (open in summer), the Transfagran highway, crosses the entire range. However, extensive networks of forest roads penetrate the valleys on all sides. The topography has led to the northern area being better developed and better serviced by transport infrastructure, while the southern areas remain more isolated and less developed.

The Fagaras Mountains are currently largely protected by two large Natura 2000 sites. To the north is Piemontul Fagaras (ROSPA0098), protected as a Special Protection Area (SPA) under the Birds Directive and extending over 71.256 ha. This area covers the interface between the agriculture areas in the Fagaras depression and the lower northern slopes of the Fagaras range. The 198.495 ha Munti Fagaras Site of Community Interest (SCI)(ROSCI0122) covers the entire

ride of the Fagaras range and the slopes on all sides, and is protected under the Habitats Directive. The Piemontul Fagaras SPA and the Munti Fagaras SCI overlap – such that the total protected area is 243.627 ha (Anonymous 2015).

These Natura 2000 sites directly adjoin other sites (all data from <http://natura2000.eea.europa.eu/>). To the east is the 15.867 ha Piatra Craiului National Park (ROSCI0194). To the south east is the 13.213 ha Raul Targului – Argesel – Rausor SCI (ROSCI0381). To the northeast is the 2.261 ha Persani SCI (ROSCI0352), while to the northwest is the 22.726 ha Hartibaciu Sud-vest SCI (ROSCI0304). To the west the area adjoins the 137.358 ha Frumoasa SCI (ROSCI0085).

This study was mainly limited to the Munti Fagaras and Pirmontul Fagaras sites, although we draw on some supporting information from the adjoining parts of Persani and Hartibaciu Sud-vest sites to include information on these low-lying areas which form integral parts of the Fagaras ecosystem.

Administratively, the study area is shared by four counties: Arges, Brasov, Sibiu and Valcea. These include a total of 27 municipalities; Turnu Rosu, Racovita, Avrig, Porumbacu de Jos, Cartisoara, Arpasu de Jos (in Sibiu county), Ucea, Vistea, Sambata de Sus, Dragus, Lisa, Recea, Harseni, Sinca, Sinca Noua, Victoria, Zarnesti (in Brasov county), Rucar, Valea Mare Pravat, Laresti, Nucsoara, Arefu, Bradulet, Salatrucu (in Arges county), Perisani, Boisoara, Caineni (in Valcea, county) (Fig 1).

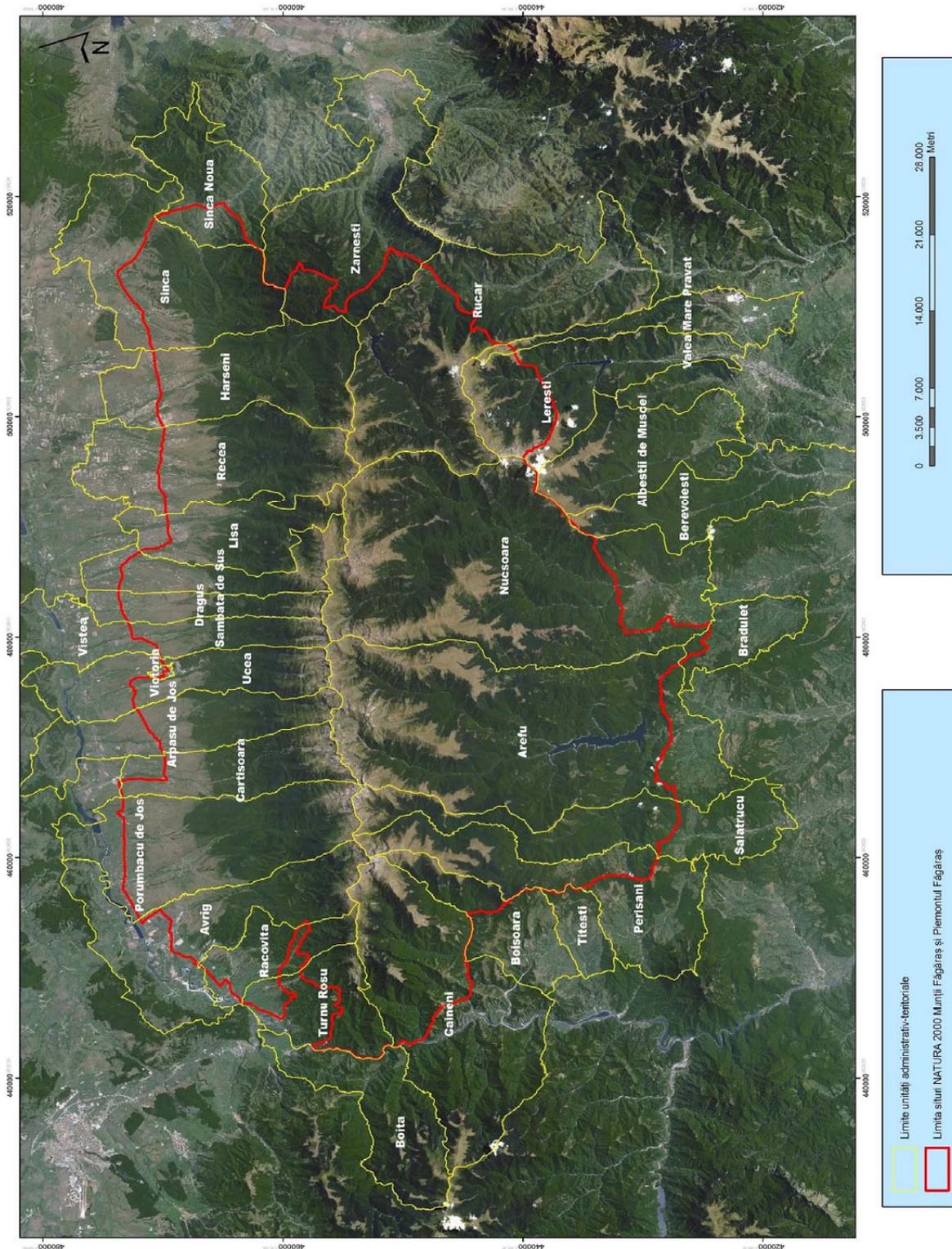


Figure 1. Map of the study area, showing the borders of the 27 municipalities (in yellow) and the combined outline of the Piemontul Făgăraș and Muntii Făgăraș Natura 2000 sites (in red). North is upwards

3 Methods

Data was obtained from four main sources.

(1) Biodiversity data was taken from Linnell et al. (2016) which summarises available data on the biodiversity of the area collected from various sources, including scientific publications, unpublished reports, and online databases.

(2) Socio-economic data on the region was taken from a survey conducted in the period July to September 2016. A team of six social scientists conducted 331 interviews with key local informants across 81 villages in 21 of the municipalities that overlap with the study area. In addition, they collated available statistics on population size and agricultural production, tourism, forestry, energy production and other aspects related to human use of natural resources from the town halls and central statistical sources (Iordachescu & Vasile 2016). This survey provides insights into both the actual way which local people draw ecosystem services from the region and how they perceive their relationship with the ecosystem.

(3) A management plan for the Natura 2000 sites was published in late 2015 (Anonymous 2015) and contained large amounts of information about the two Natura 2000 sites.

(4) We surveyed the scientific and technical literature on the study area using online databases such as ISI Web of Science, Google Scholar and Google, as well as collecting reports and publications known to the authors, their colleagues and project partners.

Unfortunately, almost none of the data was in a format which allowed for spatial mapping of specific natural capital or ecosystem service exploitation or for quantification of any parameters. However, we reviewed available data and as far as possible interpreted the various data sources according to the ecosystem services framework. This was sufficient to come up with a good qualitative overview of the ecosystem and the way it is exploited by humans.

There are many different conceptualisations of the ecosystem services framework, and we have adopted a rather generic model. For the sake of simplicity, we have pooled regulatory and supporting service categories, and thus operate with only three broad categories – provisioning, regulatory and cultural services. For each category, we identify the services, which are currently in use, and others that have the potential to be used.

4 Natural capital

The ecosystem services framework originally stems from the ecological sciences, and has been further developed in conjunction with economics (<http://www.teebweb.org>). Within the ecosystem services framework, the common way to frame natural resources is to consider them as natural capital. Virtually all ecosystem services and benefits depend on some form of natural capital. The ecosystem services framework also includes social capital (networks, competence, shared norms, ideas and values, institutions) and built capital (infrastructure, physical facilities and physical management interventions, like for instance visitors centres in protected areas which again build on natural capital). In this survey, we include a focus on three aspects of the natural capital. The most obvious is the biodiversity of the region and this constitutes the most commonly assessed component in ecosystem service assessments. Most ecosystem services assessments overlook the underlying geology / topography. However, there is a very strong focus on geo-resources and geo-heritage within the traditional natural resource management literature, from which the ecosystem services approach springs, and we consider it crucial to consider this often overlooked foundation in our assessment. Finally, the Carpathians are an area that have been utilised by humans for millennia, and it is therefore natural to consider that certain aspects of this linked social-ecological system have a cultural heritage value, which is in line with emerging concepts of bio-cultural system conservation.

4.1 Geo-resources

The fundament for most of the natural capital and resulting ecosystem services provided by the Fagaras Mountains lies in its underlying geological structure. The extreme topography of the area, reaching from 500 m up to 2544 m, is the important foundation for the following aspects;

Biodiversity values. The altitude gradient provides variation in climatic conditions that support a diversity of habitats along the resulting ecological gradient. The high altitude of the main ridge is essential for the existence of the large area of alpine grasslands. The rugged nature of the terrain has provided a buffer against a lot of human development, which has allowed some fragments of virgin forest to persist.

Scenery values. The high ridge and mountain peaks constitute dramatic scenery, which is an essential component for much of the tourism in the area. It is important to note that the dramatic limestone ridges and cliffs of the neighbouring Piatra Craiului National Park, which lies on the eastern border of the Fagaras Mountains, is an important contribution to the scenery of the eastern part of the Fagaras Mountains.

Geoheritage values. Geological heritage conservation is a widespread activity that occurs in parallel to the more widely known biodiversity and cultural heritage conservation (Imbledon & Smith-Meyer 2012). Geoheritage conservation is a topic of both international and national focus. For the Fagaras Mountains the main geoheritage values lie in the highest peak in Romania, and the fact that it constitutes the largest area of continuous alpine conditions, with associated glacial features. These include a series of small glacial lakes (many of which are legally protected as natural monuments), ridges and peaks (Nedelea & Comanescu 2011; Pop et al. 2012). There is very limited limestone within the Fagaras Mountains, resulting in relatively few karstic features. The exception is the Ox pothole and the Cave of the Black Peak located in the west of the range. There are also some fossil deposits in the region of Turnu Rosu (Anonymous 2015). The gorge of the Arges river along the western edge of the Fagaras Mountains also constitutes a geological feature of interest.

Hydrology. The topography of the Fagaras Mountains also triggers rainfall and provides the gradient for water to flow, which influences freshwater habitats and provides the basis for hydro-electric production and water supply. The presence of waterfalls (including Bâlea Cascadă,

Valea lui Stan, Cascada Capra, Cascada paraului Zbuciumatu) also constitute scenic and geoheritage values. Sulphur springs also exist at Bradulet.

4.2 Cultural heritage

Cultural heritage is a salient cultural ecosystem service in Romania. In keeping with the rest of the Carpathian range, the Fagaras Mountains have been exploited by humans for millennia. This has resulted in a rich cultural heritage that is linked to the physical and biological attributes of the ecosystem, and is maintained in the form of monuments, cultural practices, and intangible values linked to identity.

The following biocultural practices are associated with cultural heritage values;

Village lay out. The village lay-outs and village architectural styles of the region are diverse, representing the diversity of ethnic groups that have occupied the region and the diverse ways that they have interacted with the landscape and its natural resources (Muica et al. 1999; Rosculeț 2013).

Pastoralism. The Carpathian Mountains as a whole are intrinsically associated with pastoralism. The traditional style of livestock raising involved transhumance, with herds grazing the alpine pastures in summer and migrating to lower lying areas to the north and south during winter (Huband et al. 2010; Draganescu 2013; Buza et al. 2009; Juler 2014; Micle 2013; Mirela et al. 2013). Although somewhat modified, these traditions continue in the region. Pastoral traditions and transhumance have been gaining a large heritage and touristic focus in Europe.

Forestry and hunting. The forests of the Carpathians have long been associated with forestry and hunting. Both activities are associated with considerable heritage value and are still practiced through the mountain range.

Non-timber forest products. The forests have also long been associated with the production of a range of non-timber products. These include the collection of herbal, aromatic and medical plants as well as berries and mushrooms (Sabo 2012). These practices and the knowledge that they embody are the subject of considerable cultural heritage conservation focus across south-eastern Europe.

In addition to these aspects of cultural heritage that are directly linked to the environment there are a number of historical monuments and structures that are associated with varying degree of tourism. The following monuments occur within, or directly outside, the ecosystem.

Monasteries. The northern slopes of the Fagaras Mountains are associated with many monasteries and other religious sites. These include; Brancoveneanu, Sambata de Sus, Sinca Veche, Berivoi, Dejani, Namesti, Valeni monasteries and Arsenie Boca's hermitage. These religious sites are associated with a moderate degree of religious tourism, which is an increasing activity in Romania (Alecă 2010; Tirca et al. 2010; Vorzsak & Gut 2009). Although the sites are located in the forests there are few explicit connection between the sites' religious qualities and the natural environment beyond the presence of springs that provide drinking water to pilgrims / visitors.

Battlefield. In the southwestern part of the Fagaras Mountains lies the Posada battlefield. A battle was fought in 1330 between a small local Wallachian army led by Basarab I of Wallachia and an invading Hungarian army led by Charles I of Hungary. Although outnumbered the Wallachians won the battle, and thus halted Hungarian expansion into southeastern Europe.

Castles. Poienari Citadel (Cetatea Poienari) is located along the Transfagararian highway on the southern slopes of the Fagaras Mountains. It was built in the 13th -15th centuries and was linked to Vlad Drăculea (Vlad the Impaler) who is also associated with Bram castle located to the east

of mountain range (Theodorescu 2012). The historical significance of the castle and the region is linked to it being on the borderlands of multiple kingdoms and empires, including the border between the Ottoman empire and the Austro-Hungarian empire.

Resistance fighters. In the period 1948-56 the Fagaras Mountains were the hold out of a group of anti-communist resistance fighters led by Ion Gavrilă-Ogoranu. The group made extensive use of the mountains and forests of the mountain range to hide from the communist forces.

Transfagarian highway. Built between 1970 and 1974 the Transfagarian highway is the second highest road in Romania, with its highest point at 2040 m. With its series of switchbacks and tunnels the road has become a major tourist attraction in the region. It is only open in summer because of snowfall and avalanche risks during winter. The northern section is paralleled by a cable car.

Vidraru dam. The Vidaru dam is located on the Arges river that flows from the south slopes of the Fagaras Mountains. It was completed in 1966 and is a tourist attraction because of its engineering and the presence of a statue of Prometheus (Prăvălie 2011).

4.3 Biodiversity

The available data on the habitats and biodiversity of the Fagaras Mountains has been recently summarised in a companion report (Linnell et al. 2016). The following is a brief summary of these findings.

The habitats of the Faragas mountains are shaped by the strong altitudinal gradients. Most of the slopes of the mountains are **forested** with the higher areas above the treeline dominated by **alpine grasslands**. Treeline is likely maintained by a combination of climate and livestock grazing. Forests have been exploited for centuries, but some patches of virgin / **old growth forest** remain (Biris & Veen 2001). At lower altitudes, the forest gives way to agricultural land, including extensive areas of high-nature value **hay meadows**, grazing pastures and low intensity agriculture. Freshwater habitats include a series of high altitude glacial lakes and many streams. Riparian forests occur along many streams. Some small areas of bogs and mires also exist.

The region has an almost **intact European Holocene large mammal fauna** including all large herbivores (red deer, roe deer, chamois, wild boar; only bison are missing) and large carnivores (brown bear, wolf, Eurasian lynx). Species registration in the area is far from complete, but the available species lists include; mammals (57 species), birds (130 species), amphibians (17 species), reptiles (13 species), fish (12 species), freshwater crayfish (2 species), butterflies and moths (563 species), beetles (125 species), dragonflies (15 species), spiders (40 species), water-bugs (22 species), water-mites (28 species), lichens (144 species) and plants (895 species).

5 Provisioning ecosystem services

Provisioning services include many of the activities that were formally referred to as natural resources. Because we seek to reflect a holistic view of all activities that influence the ecosystem we have chosen to expand the conventional ecosystem service view and also include energy production activities like hydro, solar and wind power that exploit the physical properties of the site and will impact both the ecology of the ecosystem and its ability to deliver other services such as cultural services.

5.1 Exploited

The following are the major provisioning services that are exploited from the Fagaras Mountains ecosystem.

Forestry – resulting in the production of saw wood, logs, pulp and firewood. Most of the area is forested and almost all has been used for timber production at some stage. Virgin forest is limited to some areas with poor access.

Crafts from wood – including roofing shingles, baskets, brooms and sculptures (Mirela et al. 2012).

Non-timber forest products – include berries (blueberry, raspberry, blackberry) and mushrooms.

Game meat and trophies – mainly from hunting of red and roe deer, wild boar, wolves and brown bears (Micu et al. 2010).

Grazing for livestock – mainly of cattle and sheep on alpine pastures and lowland pastures around the villages.

Agriculture – the flat land of the Fagaras depression at the northern base of the Fagaras Mountains is used for a diversity of small to medium scale agriculture, including dairy and milk production, vegetables and crops. The areas around villages are used for small-scale agriculture and orchards.

Livestock products – the main products are meat and milk products, with some very limited use of sheep wool.

Hay meadows – located in the lowlands near villages produce hay for winter, and grazing in spring / autumn.

Bees – many villagers keep bees for honey production, and the area is used seasonally by migratory bee-keepers from other areas.

Fish farming – widespread although on a small scale throughout the region, trout and sturgeon (species not identified) are the main fish maintained.

Energy – is extracted from two large scale **hydropower plants**, and many small scale hydropower plants (different sources give different numbers – but some list up to 53 plants). In addition, there is at least one large **solar power plant** in the lowlands of the Fagaras depression.

Drinking water – water for all villages and for livestock is drawn from local sources (springs and wells) that have their origins in the Fagaras Mountains.

5.2 Potential

The main potential provisioning service that is not currently exploited is **wind-based energy**.

Wherever there is forestry there is the potential to include a focus on **biofuel** production.

6 Regulating and supporting ecosystem services

Regulating and supporting services underpin all other services; however, their quantification requires detailed studies, which have not been conducted within the study area. These services are currently being delivered – but their values are neither articulated nor captured in any manner. The following are just some of the most obvious examples of key services that need further study.

Carbon storage in forests. Increasing recognition of the existence of climate change is leading to an increased focus on the potential of different ecosystems to store carbon. The forests of the Carpathians are a carbon sink with considerable potential to store greater amounts of carbon (Keeton & Crow 2009; Kuemmerle et al. 2011). The ongoing trends to establish economic mechanisms for carbon trading have the potential to create income sources from forests without the need to cut trees.

Water. Water is essential for all biological processes and economic activities. In the face of climate change, it is highly likely that there will be a greater focus on water supplies across southern and central Europe. Based on the limited studies within the Fagaras, and other studies elsewhere, a number of relevant issues can be identified.

Water supply from the Fagaras is directly linked to its topography, which is likely to trigger precipitation. However, the degree to which precipitation enters aquifers and becomes ground water is likely to be highly linked to forest cover. High forest cover, especially along stream and river banks is likely to be essential for (1) slowing evaporation loss and enhancing the proportion of water that becomes ground water, (2) slowing run-off following precipitation to protect against floods and create a more even flow, (3) improving water clarity in streams and rivers, improving their ability to house biodiversity, and increasing the quality for human and agricultural use, as well as reducing silt which causes erosion in hydro-electric turbines.

7 Cultural ecosystem services

Cultural ecosystem services are a diverse category of services, which do not fit neatly into the other categories (Daniel et al. 2012; Bernues et al. 2014). They are in many cases less tangible and produce a range of social and psychological benefits linked to well-being. Hence, they are often associated with non-monetary types of values. Because of this diversity they have proven to be hard to categorise. They include a range of services and benefits such as tourism, heritage, identity, learning, spirituality, sense of place and aesthetics, which have both monetary and non-monetary aspects. They are associated with a wide range of other social and cultural values (recreational and heritage values, intrinsic values, aesthetic values) which are often challenging to value in monetary terms, since they are both market- and non-market mediated. Despite this valuation challenge, experience from across Europe indicates that the cultural services are often those that the public value the most, and they certainly have a very strong role in land use planning and land use conflicts.

Another key issue in Europe is the intertwining of cultural services with provisioning services, such that the same activity contains diverse values (Bastian et al. 2012; Fischer et al. 2013; Mirela et al. 2012). Failure to recognise these multiple values, and the fact that different stakeholders may have very different perceptions of whether resources, locations or experience opportunities represent positive or negative values, is a common cause of conflict over natural resource management (Redpath et al. 2013). The key point, which often complicates policy and planning, is that cultural ecosystem services are constituted in place-specific human-environment interactions. This means that it is difficult to use a standardised typology (as is more relevant for regulating, provisioning and supporting services) in their classification.

7.1 Exploited

7.1.1 Cultural services linked to provisioning services

Hunting. In addition to the previously identified provisioning services (game meat / trophies) provided by hunting, the activity also provides a range of recreational and heritage values, often deeply linked to local identity and rural lifestyles in Europe. These latter aspects focus on the process of hunting with its multiple motivations (companionship, thrills and skills, appreciation of animals and the excitement of tracking and capturing, feeling united with nature, etc.) rather than the products (Fischer et al. 2013).

Livestock grazing. Extensive livestock grazing, especially that linked to transhumance, has become a flagship for cultural heritage across many parts of southern Europe. This is linked to the lifestyle, the products, the structures (cottages, transhumance tracks), and the landscapes which are produced by grazing (Draganescu 2013). The idea that specific landscapes created by human activities (such as grazing-dependent grasslands) should be treated in the same way as other cultural monuments (like buildings) has been recently made explicit in the European Landscape Convention. These landscapes are also often associated with high biodiversity (see section 4.3, and Linnell et al. 2016). Transhumance is increasingly being used as a focus for rural tourism and rural identity building.

Forestry. Forestry is an activity like hunting which has significant cultural heritage components, although they are not so often as clearly articulated as in, for example, hunting. This may be in part due to the widespread integration of modern technology into forestry, which has stripped away many of the connections with a more extensive, and labour intensive, past.

Crafts. The production of crafts from resources harvested within the Fagaras mountains is another clear example of a provisioning service that is associated with heritage values (sense of place, local skills and traditions, symbols of stories and myths, unwritten knowledge), and which is increasingly being used within the tourism sector. The products include; weaving, knitting,

embroidery, sculpture, household items made from wood, brooms, and baskets, in addition to food products such as berries, mushrooms, meat, and dairy products.

7.1.2 Recreation

Recreational activities by local residents within the Fagaras Mountains seems to be rather limited. The major activity seems to be having **picnics** in the low-lying parts of the forest, especially close to streams and rivers. In addition, there is an obvious development of **second homes** which are used by residents of nearby towns and cities. These second homes involve both the construction of new structures and the conversion of existing village / rural buildings.

7.1.3 Tourism

Like in the region as a whole tourism is currently not particularly well developed in the Fagaras Mountains. The main tourism activity consists of a form of **rural tourism** that is widespread across Romania (Blaj et al. 2012; Brychtova & Fratu 2011; Dorobantu & Nistoreanu 2012; Iorio & Corsale 2010), which is built up around the following elements;

- Bed and Breakfast or small hotel accommodation.
- Sightseeing from cars, especially along the Transfagarian highway.
- The search for clean air and rural food.
- Spa activity.
- Visiting sites such as monasteries and other cultural heritage sites.

Most of these activities are centered outside the actual Fagaras Mountains Natura 2000 sites, apart from along the Transfagarian highway. The detailed survey by Iordachescu & Vasile (2016) revealed a tourist sector that was poorly developed, which had rather low rates of bed occupation, and which struggled to obtain competent staff.

The main touristic activity which is of real significance within the borders of the Natura 2000 sites is **hiking**. The main Fagaras ridge, with associated peaks, is a major attraction for hikers. There is an extensive network of mountain refuges and lodges close to the main ridge, and the subsidiary ridges that provide access to the main ridge. The system is well developed with marked trails and guidebooks.

Additional nature-based tourism activities include a few **bear watching** operators, some **horse-back riding** operators, and **team-building** activities.

This is in contrast to the adjoining tourism areas of Piatra Craiului National Park which has more developed ecotourism (Candrea & Bouriad 2009; Popescu 2007).

7.1.4 Biodiversity and geo-heritage conservation

The conservation of all of the habitats and species listed in Linnell et al. (2016) and the underlying geoheritage summarised under the natural capital section (4.1) constitutes a major repository of cultural ecosystem services via its **aesthetic, intrinsic, existence and cultural values**. The inclusion of these sites as Natura 2000 sites explicitly recognises that these are values at a European scale (Natura 2000 sites are by definition sites of community interest) as well as at a Romanian scale (recognised by their red data book status and the existence of multiple nature reserves).

7.2 Potential

There are multiple options for developing the tourism sector in the region. However, some of these options are mutually incompatible with each other, and with other possible cultural ecosystem services that can be derived from the region.

7.2.1 High impact tourism options

Local discourses (Iordachescu & Vasile 2016) concerning tourism development focus heavily on infrastructure dependent approaches. This includes building **hotels** and developing **ski slopes**. The ski slope plans are quite well developed (Lesenciuc et al. 2013; Popescu 2010). These forms of tourism are believed to provide salaried jobs in both construction and operation stages and are more familiar to local residents than alternative, low impact, options.

Based on trends in other parts of Europe it can be expected that motorised forms of recreation like **ATV** driving and **motorbike** driving will begin to develop in the area, attracted by the extensive network of logging roads and trails.

All of these options have the potential to seriously erode the natural values of the sites, as well as create conflicts among users groups (e.g. between hikers and off-road motorized recreation), and may cause significant conflicts with the objectives of the Natura 2000 sites.

7.2.2 Low impact tourism options

Globally there is a growth in low impact nature-based tourism, not the least in European mountain regions (Balmford et al. 2009, Moss 2006). Although there has been no specific study of this potential in the Fagaras Mountains, the assessment of natural capital (section 4) and knowledge of tourist activities across Romania and Europe as a whole, permits the identification of several possible resources in the area that can provide the basis for new tourism activities and products. Furthermore, there have been several studies in the neighbouring Piatra Craiului national park that have transfer value (Candrea & Bouriaud 2009; Popescu 2007).

The values that can be utilised include all the species, habitats and scenery. It is surprising how little quantitative research has been conducted on species preferences among nature-based tourists, but the groups that are likely to be attractive are the large mammals (large carnivores, large herbivores, beavers), the birds, butterflies, and flowers. All the habitats (old growth forest, lowland hay meadows, alpine pastures) are potentially of interest to tourists.

However, deriving monetary benefits from tourism based around these values is not straightforward. The market is for a rather specialised customer. This includes those categorised as eco-tourists or sub-groups such as bird-watchers, nature photographers or eco-volunteers. Also, the process of showing these values to tourists is not easy. Very little of the Fagaras wildlife is easy to view, or easy to identify. It would therefore require specialised guides to help tourists find and identify species. For some species such as bears there is a need for hides and bait sites – for both logistical and safety reasons.

Despite these constraints, the natural values of the Fagaras Mountains are clearly such that they have the potential to be commercialised to a greater degree than today.

7.2.3 Wilderness values

There is an ongoing initiative which focuses on promoting the Fagaras Mountains as a wilderness area (<http://www.carpathia.org/en/>). Wilderness areas are increasingly rare in Europe, and their conservation, or restoration, has become an increasingly visible part of European nature management discourses (Coleman & Aykroyd 2009; Lupp et al. 2011; Selva et al. 2011). The

extent to which the Fagaras can be viewed as a wilderness depends very much on which environmental or anthropogenic attributes are being focused on. 'Wilderness' is essentially a culturally defined concept, sometimes framed as 'a state of mind' (Oelschlager 1991). The implication is that different nations and cultures attach different meanings to the concept and use different operational definitions to identify wilderness (Aplet et al. 2000; Lupp et al. 2011). Therefore, the idea of wilderness in Romania must be defined according to a combination of landscape- and biophysical attributes, level of management intervention and human impacts, as well as socio-cultural perceptions of what is seen as attractive and relatively untouched by human activities.

In the Fagaras Mountains, some of the key attributes (Aplet et al. 2000; Longcore & Rich 2004; Lupp et al. 2011; Selva et al. 2011) that could be included in such an assessment include the following, either alone or in combination;

- Solitude, low levels of encounters with other people
- Silence
- Unique nature experience opportunities
- Roadlessness.
- Lack of visible technical structures and infrastructure (viewscales).
- Nighttime darkness (absence of visible glow of lights).
- No human intervention in habitats irrespective of their current state ("let nature take its course"). Includes no logging or grazing.
- No human manipulation of animal populations. Includes no hunting.
- Conservation of specific habitat categories such as old growth or virgin forest.
- Conservation of specific species, such as large carnivores or large herbivores.
- Spectacular scenery.
- Low degree of habitat conversion.

Some of these attributes refer to specific bio-physical and psychological states, and some refer to ecological processes. The extent to which different attributes are used to define wilderness is partly a policy and management question (use indicators that can be easily measured) and partly a question of different value sets. It can also reflect differences in language as the term has very different meanings in different languages.

The ecosystem services provided by wilderness are diverse, but also often poorly defined. Some habitats, like old growth forest, with associated specialist species, clearly benefit from wilderness, and can often only survive under non-intervention management systems. However beyond these specific species the ecological aspects of the cultural services provided by wilderness tend to be more orientated towards the way ecological processes function rather than towards the ability of different species to survive or not. These arguments therefore reflect different aesthetic, moral or ethical standpoints. Other values that are often mentioned in the literature include the education and scientific value of wilderness, the possibility for spiritual development, self-development and for wilderness therapy. Therefore, the services provided by wilderness are very much in the form of non-material values (White & Hendee 2000).

Wilderness tourism is a growing area within nature-based tourism and there is clearly a niche market for wilderness experiences. However, in many ways it is a form of tourism for which it is hard to capture economic benefits as it often involves low impact and self-sufficient activities like hiking and camping (at least in its American incarnation). Value can be captured if outfitters and guides assist tourists in accessing remote areas, and through the provision of often up-market accommodation.

Another common issue concerning the definition of wilderness is that of scale. When looking at specific habitats for example, such as old growth forest, it is possible to consider wildernesses on a scale of square kilometres. If considering viewscales then wilderness can be achieved in a single valley or watershed of some tens or hundreds of square kilometres. However, if

wilderness is meant to embrace the spatial and population dynamics of mobile species like red deer, wolves or lynx without human influence, and disturbance processes like floods, fire and disease outbreaks in forests, there will be a need for areas in the order of many thousands of square kilometres – beyond the area of the Fagaras Mountains.

By most European standards the Fagaras mountains today are very "wild" in that they are a very large continuous area with a low degree of human presence (no villages inside the Natura 2000 sites) and are still covered in natural or semi-natural habitats. However, most of the area has been subject to multiple extensive human land uses (forestry, hunting, grazing, collecting non-timber forest products) for centuries or millennia and a low density of infrastructure is present throughout the area (forest roads, hiking refuges, hydro-electric plants, shepherd camps). It is therefore hard to call the area a true "wilderness" as it stands, especially if using the definitions that are more commonly used in North American land management.

Depending on which attributes are focused on it is certainly one of the areas in Europe with the most wilderness-like attributes, and where there is the greatest potential to restore more of these attributes. However, it is important to mention that promoting wilderness values can potentially have negative impacts on some other natural values with high biodiversity such as hay meadows and grazing dependent grasslands (Baur et al. 2006).

8 Flows of costs and benefits

When considering the exploitation of ecosystem services it is important to consider the way that both the costs and benefits are distributed across space (i.e. local vs non-local), time (i.e. short term vs long term) and society (i.e. across social groups). This is especially important when considering ecosystem services within the context of sustainable rural development. Rural development is best supported by patterns of flow that bring most benefits to local communities. Sustainability is usually promoted when costs and benefits are internalised, i.e. felt at the same levels and on the same time scales. The political and administrative structures of societies and their institutions are important in ensuring that costs and benefits are shared in a fair and equitable manner.

The interviews conducted by Iordăchescu & Vasile (2016) (section 8 above) revealed widespread discourses concerning perceptions of institutional failure (corruption at all levels, incompetence, cronyism). This implies that many of the structures which are needed to achieve fair and equitable distributions of costs and benefits and ensure sustainability are not in place.

As a result it is obvious that many of the benefits being extracted from the Făgăraş ecosystem are flowing to non-local beneficiaries, while many of the costs (both direct costs and opportunity costs) are being borne by local residents.

For example, firewood cutting for use in local villages may bring benefits locally, and carry small costs because of low impact on the forest, the large scale and often illegal clear-cutting which has been ongoing in the recent past has almost certainly mainly brought benefits to external actors and the cost of serious destruction of the state of the forests is carried by local residents who have to live with the degraded forest, decreased water quality, and degraded scenic value. Even when ignoring the illegal logging, the way benefits flow from forestry is highly complex depending on the form of landownership. Iordăchescu & Vasile (2016) describe a diversity of forest ownership structures in the different parts of the range, with each having a different flow of benefits. Generally speaking, there appears to be little timber processing in the area, such that little value is added to the logs that are cut.

Hunting also has complex benefit flows, with some local hunters deriving meat, recreation and cultural heritage values from the activity, but it appears that some hunting clubs mainly contain non-local members, such that benefits flow outside the area.

Similarly, agriculture, livestock grazing and beekeeping benefit both local actors and those from outside the region (if they practice transhumance). However, agriculture is very complex due to the massive transfers of external funds in the form of inputs from the European Union's subsidies.

The small-scale hydro-power stations could in theory bring monetary benefits to the municipalities via taxes or license fees, but there are many rumours of corruption, so that it is not clear how much of this potential benefit is actually shared with the local population. The costs are carried by local communities in terms of reduced water quality, loss of scenic value, and lost opportunities if they attempt to market the wilderness values of the area.

The collection of non-timber forest products is one very special area where most benefits flow to local communities, especially to otherwise marginalised communities, and where there are some good examples of value being added via local processing of the products.

Maintaining water resources clearly brings many local benefits as all drinking water is extracted from local sources. The water is also used for local fish farms. In addition, maintaining good hydrology in the Făgăraş brings many benefits downstream in terms of maintaining an even flow of clear water.

Tourism presently appears to be mainly run by local actors, bringing benefits locally.

There is an overall impression that relatively little value is being captured from the ecosystem, that little value is being added through processing or strategic marketing, and that benefit distribution mechanisms and institutions are not functioning optimally. There are also ongoing services for which no monetary benefits are being extracted, such as carbon storage and water quality.

The study was not designed to investigate all these benefit (and cost) flows in detail. However, we want to underline the point that in future work to evaluate the relative benefits of alternative development paths it will be essential to move beyond calculating overall benefits and explore in detail where these benefits fall in space.

9 Compatibilities and trade-offs for alternative futures

We have identified a very long list of ecosystem services that the Fagaras Mountains are providing, and other services which they could potentially provide. It is important that this list is not regarded as an à la carte menu from which services can be picked at will in any combination. For many services, there is a high degree of interdependence. For example, for livestock grazing it is almost impossible to separate the provisioning (meat, milk, wool), regulatory (habitat maintenance) and cultural services (cultural heritage, tourism value, biodiversity in grazing dependent habitats) they provide. In contrast, there are also many conflicts between services, where the exploitation of one effectively excludes others. For example, an investment in wind power could destroy the scenic value and reduce wilderness qualities of the area. The result is that there is a limited combination of services that can be exploited at the same time in the same place. These sets of compatible services are referred to as "bundles" in the terminology of ecosystem services.

A useful way to visualise these bundles is in the form of scenarios (Fischer et al. 2015; Hartel et al. 2014). Below, we present three contrasting scenarios to illustrate alternative development paths, identifying which services can be bundled together, and which exclude each other. Each of these scenarios is possible for the Fagaras Mountains and each may well be sustainable along many of the dimensions that combine to make up a holistic understanding of sustainability. It should be noted that these scenarios are not predictions of the future, they are simply illustrations of what could be achieved, given active choices made today.

9.1 Scenario 1: Intensive use of provisioning resources

Under this scenario the Fagaras Mountains could be used to produce energy (biofuel, solar, hydro and wind power), timber (intensive forestry in monocultures), livestock products (from grazing alpine pastures and intensive agriculture), hunting and some tourism (ski slopes, ATV and motorbike driving on forest road network). Depending on definitions, many of these activities could have been viewed as sustainable, at least from the point of view of continuing to provide the provisioning services (e.g. renewable energy sources). However, it would result in a dramatic loss of the area's ability to provide regulatory (carbon storage, water quality) and cultural services. The latter includes a loss of much biodiversity, a significant reduction of nature-based tourism potential, a loss of much of its rural tourism potential, and a total loss of wilderness values. It would not be compatible with maintaining the Natura 2000 status of the site. Some benefits would fall locally in the form of salaried jobs in both extraction and service sectors, however, many benefits would leave the area as the technical and infrastructure dependent development would require a strong investment and involvement from external actors, which would draw many profits out of the area.

9.2 Scenario 2: Sustainable and extensive multi-use

Under this scenario, the Fagaras Mountains could be used to produce a wide range of provisioning, regulatory and cultural services through a focus on sustainability and multi-functional landscapes. Forestry could be harvested using very careful methods, with selective logging and the fostering of diverse species. Old growth forest patches could be conserved if they were identified and then set aside from active management. Grazing could continue at lower stocking densities to prevent over-grazing. Bee-keeping could continue as today. Hunting could be continued with careful monitoring and adaptive quota setting. Agriculture could be continued using ecological farming methods. Non-timber forest products could be collected using carefully regulated quotas and best practices with picking / gathering. By using best practices and not harvesting any resources at maximum all these uses could be combined, although it would require adjustments to present practices for all activities. This management regime would also allow the existing biodiversity values to be maintained, and would be compatible with rural

tourism, cultural tourism and nature-based tourism. Regulatory services like maintaining water quality would still be provided, and depending on the details of forestry set-aside carbon storage services could be included. It would even be possible to allow some hydro-power and solar energy production to proceed given discrete construction and best practices with ensuring minimum water flows and conservation of streamside vegetation to reduce run-off. Wind power could be integrated into this system, although the visual disturbance of ridgetop turbines and associated road access would likely lead to a reduction of nature-based tourism values and some ecological values. The only values that would be lost would be the wilderness values. This scenario would be perfectly compatible with the goals of its Natura 2000 designation.

9.3 Scenario 3: Wilderness

This scenario would prioritise one specific form of cultural service, and the regulatory services. This would include the conservation of specific biodiversity components (species and habitats associated with forest) and ecological processes (with minimal anthropogenic influence). It would also enhance the moral and aesthetic values associated with this specific form of landscape and ecological state. Wilderness would probably enhance most of the regulatory services associated with carbon storage and hydrology. Wilderness has the potential to provide a platform for highly specialised forms of nature-based tourism, although the extent of this depends on the degree of facilitation and the specialised infrastructure / guiding which is needed. It would lead to declines in biodiversity components associated with grazing dependent (alpine pastures) and management dependent (hay meadows) grasslands (Baur et al. 2006). It would also lead to declines in the cultural heritage values. Furthermore, it would result in the near cessation in all provisioning services (forestry, hunting, energy production, non-timber forest products), and the cultural services that are based around human – nature interactions (i.e. linked to provisioning services). It would also require the removal of some infrastructure. Lastly, it would require major management efforts in information to all affected stakeholders as well as stringent regulatory- and law enforcement measures to limit human impacts. Wilderness would be generally compatible with the management goals for the Munti Fagarasi Natura 2000 site, but would be problematic for the Piemontul Fagaras Natura 2000 site whose goals partly require maintaining the open habitats through the use of extensive agricultural practices (e.g. Papp et al. 2013).

Table 1. Trade-offs between different provisioning, regulatory and cultural services that would be alternately favoured or disfavoured under different development scenarios in the Fagaras Mountains, Romania.

	Intensive use of provisioning resources	Sustainable and extensive multi-use	Wilderness
Services favoured			
<i>Provisioning</i>	Timber Energy (hydro, wind, solar) Game meat and trophies Livestock products	Timber Game meat and trophies Livestock products Non-timber forest products Small scale renewable energy production	None
<i>Regulatory</i>	None	Carbon storage Water quality	Carbon storage Water quality
<i>Cultural</i>	Infrastructure dependent tourism (ski slopes, hotels, ATV driving)	Biodiversity Nature-based, eco-, cultural-heritage and rural tourism Cultural heritage associated with human-nature interactions	Forest associated biodiversity Wilderness ideals Wilderness based eco-tourism
Services disfavoured			
<i>Provisioning</i>	None in the short term – although long term sustainability is a question	None	All
<i>Regulatory</i>	All		None
<i>Cultural</i>	Most biodiversity All nature-based and eco-tourism, plus many rural tourists. Cultural heritage values associated with human-nature interactions	Wilderness values	Human-nature interactions Cultural values associated with hunting, forestry, grazing and picking / gathering Some rural tourism segments
Impact on Natura 2000 site	Incompatible	Favours most goals	Favours forest centric goals, potentially negative for grasslands and hay meadows.

10 Social context

In order to understand the issues associated with operationalising the results of this analysis and guiding the development of the Fagaras Mountains into a sustainable future it is important to understand the social context of the ecosystem. The socio-economic survey of the region by Iordachescu & Vasile (2016) identified many key characteristics of the rural communities that surround the Fagaras Mountains as well as picking up on the social discourses within them. These findings also aligned with the large body of research on the social conditions of rural Romania / Carpathians.

The region is still undergoing many of the changes that started with the post-socialistic transition from 1989 and EU succession in 2007 (Dorondel 2007; Knorn et al. 2012; Lawrence & Szabo 2005). These changes have led to factory closure, changes in agricultural subsidy and rural support structures, and a resultant out-migration of rural people to urban areas and overseas. The result is an ageing of the rural population and a loss of the young and dynamic age groups. As such, the region, especially the southern part, is suffused with a sense of decline and hopelessness. This has been enhanced by poor institutional function, characterised by perceptions of widespread corruption, inefficiency, nepotism and cronyism. The land restitution process is a case in point (Knorn et al. 2012; Bouriaud 2005). The sub-optimal institutions provide poor leadership, and are not effective at redistributing costs and benefits associated with the use of ecosystem services throughout the communities. This is enhanced by widespread tax evasion and the fact that many benefits disappear from the area due to the involvement of non-local actors. Many of the communities are also characterised by low degrees of social capital and poor social cohesion, which is often enhanced by issues related to marginalised social minorities (such as the Roma and Rudari) or party political divisions.

While many of the people interviewed by Iordachescu & Vasile (2016) had hopes for tourism to provide an alternative income to natural resource extraction, they seemed to have a poor understanding of the types of low impact rural or eco-tourism activities, which would be most compatible with sustainability and biodiversity conservation. Rather, they had faith in infrastructure dependent forms of tourism like ski-slopes and hotels. While unemployment is a major problem, many of the regional tourism entrepreneurs complained about the difficulty of gaining access to suitable staff.

There was a degree of pride in cultural heritage, expressed in traditional activities like livestock production, agriculture and forestry, which could be utilised to develop these into more sustainable directions. However, there was little understanding, and even some concrete opposition, to nature protection strategies that lean in the direction of wilderness. This is not a unique situation. International experience shows clearly that new tourism developments will only succeed if they are compatible with local identity and the biophysical and social carrying capacities of the area (Furze et al. 1996, Stevens 1997). They will also require different types of professional competence in the hospitality services than the pre-existing skills.

Combined, these factors represent considerable challenges for any form of transition towards a different development path than the one which has been ongoing since 1989. This finding is consistent with other scenario processes that have been run in the Carpathians and with the bulk of the rural sociology studies that have been conducted in mountain areas across Europe. There is going to be a need for a lot of outreach, communication, capacity building and demonstration of "proof of concept" to convince people that a sustainable use or a wilderness option is both desirable and viable. The former can be problematic if it is interpreted as being old-fashioned, and the latter is problematic if it is perceived of as being exclusionary or elitist.

Some grounds for optimism were evident, however. There are signs that corruption is being addressed on a political level, the era of massive illegal clear cutting seems to be ending, some of the diaspora are returning and bringing back new ideas and savings with them in search of investment opportunities, and there is a widespread feeling among local people that something

needs to be done to turn the region's fortunes around. Many interviewees also expressed a clear opposition to the large-scale clear cutting of forests and the unplanned development of hydropower plants which have occurred during the last 10-15 years. This would indicate that there is potential support for less destructive and more sustainable development paths.

11 Land-use zoning for multiple objectives

The different scenarios presented in section 9 indicate that there are multiple potential development paths for the Fagaras Mountains ecosystem and that some choices need to be made concerning which values are to be given preference because it is not possible to reach all goals at the same time in the same place. Exploitation of some services could also have irreversible negative impacts on the potential to exploit other services in the future.

However, given suitable land-use planning it is possible to combine diverse goals at a larger scale (Angelstam et al. 2013; Keeton & Crow 2009; Popa et al. 2013a,b). The Fagaras Mountains are a very large ecosystem so that it is perfectly realistic to establish different priorities for the services being exploited in different parts of the ecosystem. The extreme exploitation of provisioning services as outlined in scenario 1 is largely incompatible with the elements in the other two scenarios, and would directly conflict with the existing legislation concerning Natura 2000 site goals and Romanian endangered species management.

In contrast, scenarios 2 and 3 can be combined to a very high degree, for example to create a sustainable multi-use landscape with a wilderness core. Such an approach has multiple advantages in that it builds on a broader range of services that may provide a greater degree of resilience for local communities. The inclusion of traditional and ongoing activities may also make the overall enterprise more acceptable to local people. These multi-use approaches fall within a much more familiar frame for local communities (Fischer et al. 2015; Hartel et al. 2014) and build on existing experience from other regions that seek to link nature and society in sustainable forms (Kozak et al. 2013; Mikukcak et al. 2013). Presented in such a frame, the idea of having wilderness core zones appears as a far less radical departure from existing practices. For tourism, this diverse set of zones allows for a more diverse experience.

In fact, including elements of both scenarios 2 and 3 may be necessary to achieve the diverse goals of the two Natura 2000 sites which cover the Fagaras mountains. While the wilderness scenario may cover the needs of specialist species and old growth forest, other species and habitats (meadows and grasslands) require constant forms of extensive human intervention. This is especially true for the Piemontul Fagaras site. By far the majority of Natura 2000 sites contain human activities like extensive agriculture and forestry (Tsiafouli et al. 2013), and many European habitats of conservation interest require constant intervention. Studies have shown that multiple criteria are needed to select a diversity of zones within Natura 2000 sites if they are to achieve their diverse goals (e.g. Ceausu et al. 2015).

Integrating multiple goals requires detailed planning so that they do not interfere with each other. For example, for nature-based tourism it is crucial to consider the scenic values of an area – such that infrastructure development does not interfere with the viewscape (the area that can be seen) from areas that focus on wilderness values. All activities in such a scenario would require the adoption of diverse best practice codes (e.g. Voskarova 2014).

Unfortunately, existing spatial data is of too low resolution to design the details of this zoning system. Grazing, hunting, and forestry are conducted all over the area. There are no clear biodiversity hotspots (apart from poorly mapped old forest patches and meadows). However, based on the existing spatial data there are several arguments for focusing wilderness in the southeastern part because of low road density, the spectacular view to Piatra Craiului National Park, and the existence of the ongoing Carpathia wilderness project. This area offers quite a large amount of space to foster many, but not all, wilderness attributes. The disadvantages of this area are that it does not overlap with some of the large patches of virgin forest on the northern slopes and there is a high degree of conflict potential with ethnic minorities, which depend heavily on non-timber forest products with established sales outlets. It would be logical to focus high volume tourist traffic along the Transfagarian highway because of the existence of the road, hotels and the cable car. The southern part may offer the best options for sustainable multi-use and classical rural tourism because of the settlement patterns and landscape. The northern area

where the northern forest slopes meet the Fagaras depression is the logical area for developing productive farming activities that are compatible with biodiversity conservation.

It must be remembered however, that the Fagaras Mountains are currently being used for multiple purposes such that the zoning is not being imposed on a blank page. It is crucial that a large-scale management plan for the area recognises the existing institutional, social, economic and legal structures (including land ownership and other use-rights) and moves forward in an open and transparent manner. There have been many stakeholder projects conducted in the Carpathians and other European mountain areas that have found ways to open for stakeholder dialogue concerning alternative development paths (e.g. Milcu et al. 2014; Zahvoyska & Bas 2013).

It is very difficult to predict the economic impacts of the different land-uses because of the central importance of external funding sources. Agricultural is very much dependent on the payment of subsidies from the European Union. Changes to how these are allocated, especially concerning the parts that run through the rural development pillar of the Common Agricultural Policy, can potentially be used to incentivise many different activities. Biodiversity conservation, including the wilderness agenda, is also an activity for which there is a potential to obtain significant amounts of external funding, which can greatly influence the cost-benefit calculations for alternative pathways. Furthermore, there are several emerging markets built on the logic of Payment for Ecosystem Services that could radically transform land-use economics. Payment for carbon storage for example, has the potential to stimulate a decrease in forest harvest in favour of conservation. Finally, there is enormous variation in the market value for forest and agricultural products depending on the extent to which they are branded or certified (organic, sustainable etc), processed (added-value) and marketed. The up-shot is that there is a very good chance that many different alternatives can be made profitable given sufficient creativity and utilisation of existing and emerging incentive schemes. The implication is that the most important steps will be at the stage of determining a common vision for the desired development direction of the region. This vision will require the detailing of many issues associated with which dimensions of sustainability are to be given preference, which wilderness attributes are desired, and the desired flow of the costs and benefits of the different development options. Once this is done, it will need to be followed up by the process of operationalising this vision.

The Fagaras Mountains have the potential to deliver multiple ecosystem services to the rural communities that surround them in a way that can provide a solid foundation for rural development. It is possible to see multiple ways that these can be managed such that they favour sustainable development and take care of some of the unique natural values of the region. However, looking at some of the development that has been ongoing for the last 20 years it is also possible to see development paths that severely destroy long term opportunities for local communities in favour of short term greed. Effective planning and enforcement at the scale of the whole ecosystem is essential. In fact, for many highly mobile species such as large carnivores it is essential to view the Fagaras within the context of the whole Carpathian chain (van Maanen et al. 2006) as the area alone is probably too small to ensure their medium to long term survival.

This series of project reports have provided a solid starting point for future work. They have identified the general state of the environment, the broad outlines of the socio-economic situation in the region, and the potential development paths. However, in order to succeed in bringing about the transition to a carefully planned development path there will be a need for both large amounts of spatial data on both ecological and socio-economic factors and an open stakeholder process to bring local communities onboard (Berbues et al. 2014; Milcu et al. 2014). The challenge of planning the future for the Fagaras Mountains lies in its size. The mountain range spreads across 27 municipalities distributed across four counties. Upscaling any consultation or deliberative process to this scale is a formidable challenge (Linnell 2015) because of the sheer number of people that are affected, as is dealing with the fragmented administrative authority. But this is also where the value of the Fagaras Mountains lies. Such a large area of continuous

forest and alpine habitat with its associated biodiversity value and wilderness attributes is exceptionally rare in a European context. The opportunities to conserve these values will not come again, and they risk being lost unless action is taken within what is a rapidly closing window of opportunity.

12 References

- Alecu, I.C. 2010. Epistemological aspects of religious tourism in rural areas. - *International Journal of Business, Management and Social Sciences* 2: 59-65.
- Angelstam, P., Elbakidze, M., Axelsson, R., Cupa, P., Halada, L., Molnar, Z., Patru-Stupariu, I., Perzanowski, K., Rozulowicz, L., Standovar, T., Svoboda, M. & Törnblom, J. 2013. Maintaining cultural and natural biodiversity in the Carpathian mountain region: need for an integrated landscape approach. - In Kozak, J., Ostapowicz, K., Bytnerowicz, A. & Wyzga, B., eds. *The Carpathians: integrating nature and society towards sustainability*. Springer, Berlin. Pp. 393-424.
- Anonymous. 2015. Planul de management integrat al ROSCI0122 Muntii Fagaras si ROSPA0098 Piemontul Fagaras. - Natura 2000 Site Management Authority.
- Aplet, G., Thomson, J. & Wilbert, M. 2000. Indicators of wildness: using attributes of the land to assess the context of wilderness. - In McCool, S. F., Cole, D. N., Borrie, W. T. & O'Loughlin, J., eds. *Wilderness science in a time of change conference—Volume 2: Wilderness within the context of larger systems*. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Pp. 89-98.
- Balmford A, Beresford J, Green J, Naidoo R, Walpole M, Manica A (2009) A Global Perspective on Trends in Nature-Based Tourism. *PLoS Biol* 7(6): e1000144. doi:10.1371/journal.pbio.1000144.
- Bastian, O., Walz, U. & Decker, A. 2013. Historical landscape elements: part of our cultural heritage - a methodological study from Saxony. - In Kozak, J., Ostapowicz, K., Bytnerowicz, A. & Wyzga, B., eds. *The Carpathians: integrating nature and society towards sustainability*. Springer, Berlin. Pp. 441-459.
- Baur, B., Cremene, C., Groza, G., Rakosy, L., Schileyko, A.A., Baur, A., Stoll, P. & Erhardt, A. 2006. Effects of abandonment of subalpine hay meadows on plant and invertebrate diversity in Transylvania, Romania. - *Biological Conservation* 132: 261-273.
- Bernues, A., Rodriguez-Ortega, T., Ripoll-Bosch, R. & Alfnes, F. 2014. Socio-Cultural and Economic Valuation of Ecosystem Services Provided by Mediterranean Mountain Agroecosystems. - *Plos One* 9.
- Biris, I.A. & Veen, P. 2001. Inventory and strategy for sustainable management and protection of virgin forests in Romania. - *PIN-MATRA /2001 / 018*.
- Blaj, R., Sand, C., Stanciu, M. & Tanase, M. 2012. Silvo tourism, eco tourism, durable tourism. - *Journal of Horticulture, Forestry and Biotechnology* 16: 13-17.
- Bouriaud, L. 2005. Causes of Illegal Logging in Central and Eastern Europe. - *Small-scale Forests Economics, Management and Policy* 4: 269-292.
- Buza, M., Cojocariu-Costea, M. & Turnock, D. 2009. Mărginenii Sibiului: The Historical Geography of a Transylvanian Carpathian Community. - *Geographica Pannonica* 13: 137-158.
- Candrea, A.N. & Bouriaud, L. 2009. A stakeholders' analysis of potential sustainable tourism development strategies in Piatra Craiului National Park. - *Annals of Forest Research* 52: 191-198.
- Ceausu, S., Gomes, I. & Pereira, H.M. 2015. Conservation Planning for Biodiversity and Wilderness: A Real-World Example. - *Environmental Management* 55: 1168-1180.
- Cioaca, A. & Dinu, M.S. 2010. Romanian Carpathian landscapes and cultures. - In Martini, I. P. & Chesworth, W., eds. *Landscape and societies*. Springer, Berlin. Pp. 257-269.

- Coleman, A. & Aykroyd, T. 2009. Proceedings of the conference on wilderness and large natural habitat areas. - Wild Europe, Prague.
- Daniel, T.C., Muhar, A., Arnberger, A., Aznar, O., Boyd, J.W., Chan, K.M.A., Costanza, R., Elmqvist, T., Flint, C.G., Gobster, P.H., Gret-Regamey, A., Lave, R., Muhar, S., Penker, M., Ribe, R.G., Schauppenlehner, T., Sikor, T., Soloviy, I., Spierenburg, M., Taczanowska, K., Tam, J. & von der Dunk, A. 2012. Contributions of cultural services to the ecosystem services agenda. - Proceedings of the National Academy of Sciences of the United States of America 109: 8812-8819.
- Dorobantu, M.R. & Nistoreanu, P. 2012. Rural Tourism and Ecotourism – the Main Priorities in Sustainable Development Orientations of Rural Local Communities in Romania. - Economy Transdisciplinarity Cognition 15: 259-266.
- Dorondel, S. 2007. Agrarian transformation, social differentiation, and land use change in postsocialist Romania. - Humboldt University, Berlin.
- Draganescu, C. 2013. Pastoralism and the Romanian history, sheep breeds, people, language, genes in Northern Carpathians and Pannonia Basin. - Scientific Papers, Series D, Animal Science 56: 16-24.
- Fischer, A., Sandstrom, C., Delibes-Mateos, M., Arroyo, B., Tadie, D., Randall, D., Hailu, F., Lowassa, A., Msuha, M., Kerezi, V., Reljic, S., Linnell, J. & Majic, A. 2013. On the multifunctionality of hunting an institutional analysis of eight cases from Europe and Africa. - Journal of Environmental Planning and Management 56: 531-552.
- Fischer, J., Horcea-Milcu, A.I., Hartel, T., Hanspach, J. & Mikukcak, F. 2015. The Future of People and Nature in Southern Transylvania. - Leuphana University Lüneburg.
- Furze, B, De Lacey, T., & Birkhead, J. 1996. Culture, Conservation and Biodiversity. The Social Dimension of Linking Local Level Development and Conservation through Protected Areas. Wiley; New York, 269 pp.
- Hartel, T., Fischer, J., Campeanu, C., Milcu, A.I., Hanspach, J. & Fazey, I. 2014. The importance of ecosystem services for rural inhabitants in a changing cultural landscape in Romania. - Ecology and Society 19: 42.
- Huband, S., McCracken, D.I. & Mertens, A. 2010. Long and short-distance transhumant pastoralism in Romania: past and present drivers of change. - Pastoralism 1: 55-71.
- Hurdu, B.I., Puscas, M., Turtureanu, P.D., Niketic, M. & Coldea, G. 2012. A Critical Evaluation Of The Carpathian Endemic Plant Taxa List From The Romanian Carpathians. - Contribuții Botanice 47: 39-47.
- Iordăchescu, G. & Vasile, M. 2016. The socio-economic context of the communities neighbouring the Făgăraș mountains. - Report submitted to Fundația Conservation Carpathia.
- Iorio, M. & Corsale, A. 2010. Rural tourism and livelihood strategies in Romania. - Journal of Rural Studies 26: 152-162.
- Juler, C. 2014. După coada oilor: long-distance transhumance and its survival in Romania. - Pastoralism 4: 4.
- Keeton, W.S. & Crow, S.M. 2009. Sustainable Forest Management Alternatives for the Carpathian Mountain Region: Providing a Broad Array of Ecosystem Services. - In Soloviy, I. P. & Keeton, W. S., eds. Ecological economics and sustainable forest management. UNFU Press. Pp. 109-126.

- Kozak, J., Ostapowicz, K., Bytnerowicz, A. & Wyzga, B. 2013. The Carpathians: integrating nature and society towards sustainability. - Springer, Berlin.
- Kuemmerle, T., Olofsson, P., Chashovskyy, O., Baumann, M., Ostapowicz, K., Woodcock, C.E., Houghton, R.A., Hostert, P., Keeton, W.S. & Radeloff, V.C. 2011. Post-Soviet farmland abandonment, forest recovery, and carbon sequestration in western Ukraine. - *Global Change Biology* 17: 1335-1349.
- Lawrence, A. & Szabo, A. 2005. Forest restitution in Romania: challenging the value system of foresters and farmers. - Environmental Change Institute, University of Oxford.
- Longcore, T. & Rich, C. 2004. Ecological light pollution. - *Frontiers in Ecology and the Environment* 2: 191-198.
- Linnell, J.D.C. 2015. Defining scales for managing biodiversity and natural resources in the face of conflicts. In: Redpath S, Young J (Eds). . Cambridge, UK: Cambridge University Press. - In Redpath, S. M., Guitiérrez, R. J., Wood, K. A. & Young, J. C., eds. *Conflicts in conservation: navigating towards solutions*. Cambridge University Press, Cambridge. Pp. 208-218.
- Linnell, J.D.C., Kaltenborn, B., Bredin, Y. & Gjershaug, J.O. 2016. Biodiversity assessment of the Fagaras Mountains, Romania. - NINA Report 1236: 1-90.
- Lupp, G., Hoechtl, F. & Wende, W. 2011. "Wilderness" - A designation for Central European landscapes? - *Land Use Policy* 28: 594-603.
- Micle, I.C. 2013. From Carpathians to Pindus. Transhumance - a bridge between Romanians and Aromanians. - *Central European Regional Policy and Human Geography* 3: 27-33.
- Micu, I., Nahlik, A., Negus, S., Mihalache, I. & Szabo, I. 2010. Ungulates and their management in Romania. - In Apollonio, M., Andersen, R. & Putman, R., eds. *European ungulates and their management in the 21st century*. Cambridge University Press, Cambridge. Pp. 319-337.
- Mikukcak, F., Newig, J., Milcu, A.I., Hartel, T. & Fischer, J. 2013. Integrating rural development and biodiversity conservation in Central Romania. - *Environmental Conservation* 40: 129-137.
- Milcu, A.I., Sherren, K., Hanspach, J., Abson, D. & Fischer, J. 2014. Navigating conflicting landscape aspirations: Application of a photo-based Q-method in Transylvania (Central Romania). - *Land Use Policy* 41: 408-422.
- Mirela, S., Ciortea, G., Blaj, R., Sand, C., Antonie, I. & Todericiu, R. 2012. Conservation of natural resources based on exploitation of local/traditional products, and those important for nature conservation. - *Journal of Horticulture, Forestry and Biotechnology* 16: 112-115.
- Moss, L.A.G. 2006. *The amenity migrants: seeking and sustaining mountains and their cultures*, CABI, Wallingford.
- Muica, N., Roberts, L. & Turnock, D. 1999. Transformation of a border region: dispersed agricultural communities in Brasov County, Romania. - *GeoJournal* 46: 305-317.
- Nedelea, A. & Comanescu, L. 2011. Present day relief-shaping systems acting on the southern slope of the Fagaras Mountains (Romania). - *Journal of Earth System Science* 120: 1023-1032.
- Oelschlager, M. 1991. *The Idea of Wilderness –From prehistory to the age of ecology*. Yale University Press; New Haven, 477 pp.
- Papp, T., Daroczi, S., Zeitz, R., Hegyeli, Z. & Komaromi, I. 2013. Lesser Spotted Eagle friendly habitat management guidelines. - Grupul Milvus.

- Pop, A.I., Mihaiescu, R., Mihaiescu, T., Muntean, E., Tanaselia, C., Malos, C., Oprea, M.G. & Ozunu, A. 2012. Study on Bâlea and Călțun Glaciar Lakes, from Făgăraș Mountains. - *ProEnvironment* 5: 260-265.
- Popa, B., Coman, C., Borz, S.A., Nita, D.M., Codreanu, C., Ignea, G., Marinescu, V., Ioras, F. & Ionescu, O. 2013. Total Economic Value of Natural Capital – A Case Study of Piatra Craiului National Park. - *Notulae Botanicae Horti Agrobotanici Cluj-Napoca* 41: 608-612.
- Popa, B., Pascu, M., Nita, D.M., Borz, S.A. & Codreanu, C. 2013. The value of forest ecosystem services in Romanian protected areas - a comparative analysis of management scenarios. - *Bulletin of the Transilvania University of Brasov Series II: Forestry, Wood Industry & Agricultural Food Engineering* 6: 53-62.
- Popescu, F. 2010. Spatial Patterns Of The Ski Areas From The Făgăraș Massif And The Bucegi Mountains. - *Analele Universității din Oradea – Seria Geografie* 20: 284-299.
- Popescu, F. 2010. Tourism In The Bâlea Valley: The Tourists' Perspective – Opportunities Of Development For Local Stakeholders. - *GeoJournal of Tourism and Geosites* 3: 184-195.
- Popescu, R.M. 2007. Ecotourism in Piatra Craiului National Park, Romania A Policy Analysis. - MSc Thesis, Wageningen University.
- Prăvălie, R. 2011. Considerations regarding the impact of the Vidraru hydro facility on biodiversity. - *Cinq Continents* 1: 170-183.
- Prăvălie, R. 2011. Vidraru tourist region in the context of sustainable development: 288-299.
- Redpath, S.M., Young, J., Evely, A., Adams, W.M., Sutherland, W.J., Whitehouse, A., Amar, A., Lambert, R.A., Linnell, J.D.C., Watt, A. & Gutierrez, R.J. 2013. Understanding and managing conservation conflicts. - *Trends Ecol Evol* 28: 100-109.
- Rosculeț, G. 2013. The Social Process Of Village - Swarming. The Background Of Founding Șinca Nouă Village (Făgăraș County). - *Bulletin of the Transilvania University of Brașov Series VII: Social Sciences and Law* 6: 179-184.
- Sabo, H.M. 2012. Some Medicinal Plants From Wild Flora Of Romania And The Ecology. - *Research Journal of Agricultural Science*, 44: 226-232.
- Selva, N., Kreft, S., Kati, V., Schluck, M., Jonsson, B.-G., Mihok, B., Okarma, H. & Ibsch, P.L. 2011. Roadless and Low-Traffic Areas as Conservation Targets in Europe. - *Environmental Management* 48: 865-877.
- Stevens, S (ed.). 1997. Conservation through cultural survival. Island Press, Washington D.C., 361 pp.
- Theodorescu, N., Stancioiu, A.F., Botos, A., Arsene, O. & Ditoiu, M.C. 2012. Means of assessing a sport tourism destination's competitive advantage sources. - *Journal of Physical Education and Sport* 12: 498-506.
- Tirca, A.M., Stanculescu, G.C., Chis, A. & Bacila, M.F. 2010. Managing The Visitor Experience On Romanian Religious Sites: Monasteries Abbots' Perceptions. - *Management & Marketing* 8: 5-16.
- Tsiafouli, M.A., Apostolopoulou, E., Mazaris, A.D., Kallimanis, A.S., Drakou, E.G. & Pantis, J.D. 2013. Human Activities in Natura 2000 Sites: A Highly Diversified Conservation Network. - *Environmental Management* 51: 1025-103
- van Maanen, E., Predoiu, G., Iaver, R.K., Soule, M., Popa, m., Ionescu, O., Jurj, R., Negus, S., Ionescu, G. & Altenburg, W. 2006. Safeguarding the Romanian Carpathian Ecological Network.

A vision for large carnivores and biodiversity in Eastern Europe. . - A&W ecological consultants, Veenwouden, The Netherlands. and Icas Wildlife Unit, Brasov, Romania.

Vorzsak, M. & Gut, C.M. 2009. A Strategic Diagnosis of Religious Tourism in Romania. - Proceedings of the 2nd WSEAS International Conference on Cultural Heritage And Tourism 2: 29-34.

Voskarova, M. 2014. Good practices of sustainable tourism in the Carpathians. - Carpathian Convention.

White, D.D. & Hendee, J.C. 2000. Primal hypotheses: the relationship between naturalness, solitude, and the wilderness experience benefits of development of self, development of community, and spiritual development. - In McCool, S. F., Cole, D. N., Borrie, W. T. & O'Loughlin, J., eds. Wilderness science in a time of change conference—Volume 3: Wilderness as a place for scientific inquiry. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. Pp. 223-227.

Wimbledon, W.A.P. & Smith-Meyer, S. 2012. Geoheritage in Europe and its conservation. - ProGEO, Norway.

Zahvoyska, L. & Bas, T. 2013. Stakeholders' perceptions of mountain forest ecosystem services: the Ukrainian Carpathians case study. - In Kozak, J., Ostapowicz, K., Bytnerowicz, A. & Wyzga, B., eds. The Carpathians: integrating nature and society towards sustainability. Springer, Berlin. Pp. 353-367.



The Norwegian Institute for Nature Research (NINA) is Norway's leading institution for applied ecological research.

NINA is responsible for long-term strategic research and commissioned applied research to facilitate the implementation of international conventions, decision-support systems and management tools, as well as to enhance public awareness and promote conflict resolution.

ISSN: 1504-3312
ISBN: 978-82-426-2898-5

Norwegian Institute for Nature Research

NINA head office

Postal address: P.O. Box 5685 Sluppen, NO-7485 Trondheim, NORWAY

Visiting address: Høgskoleringen 9, 7034 Trondheim

Phone: +47 73 80 14 00

E-mail: firmapost@nina.no

Organization Number: 9500 37 687

<http://www.nina.no>

Cooperation and expertise for a sustainable future