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The Changes in Rural and Forest Landscape and Their Use in the Slovenian Alps in the Last Centuries – A "Back to Nature" Tourism with Impacts, a Case of Western Capercaillie

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1. Introduction

The historical agricultural, forestry and industrial activities changed the landscape drastically. In particular in the Alpine region over 70% of the naturally occurring forests were cut or otherwise changed and destroyed (Čas 1996, 2002, 2006; Čas & Adamič 1998, Johann 1998). Intensive exploitation of forests from 11th to 18th century resulted in massive shrinkage of forest cover and loss of virgin forest landscapes which were turned into pastures or degraded to torrential soil (Čas 1988, 2001; Eiberle 1984; Erjavec 1868; Granda 1985; Johann 2007; Valenčič 1970; Wessely 1853). The removal of forest vegetation for agricultural land and the lack of proper land management exposed the cleared areas to erosion (Čas 1988, 2001; Erjavec 1868). Felling of trees for firewood, iron industry, charcoal production, mining industry, glass making, etc. were the dominant causes for severe reduction in forest cover until 20th century (Čas 2006; Johann 1998; Medved 1967; Valenčič 1970). By 19th century natural structures of old mixed forests with autochthonous wildlife species (e.g. capercaillie, lynx, brown bear, etc.) mostly disappeared or were conserved only at inaccessible sites, in particular at high altitude areas, and embedded in the mosaic of devastated forests and wide pasture areas (Čas & Adamič 1998; Čas 2001a; Didier 2001; Erjavec 1868).

The drastically reduced forest cover in the 18th and 19th century in combination with increased awareness of the dangers of natural disasters (floods, soil erosion) urged for a development and introduction of systematic forest management in this area. The revolutionary societal changes following the "*Spring of nations*" uprising in 1848 and the advancement of traffic associated with the introduction of steam engine changed the demand for wood and its prices at the end of the 19th century. Consequently many people abandoned their fields and pastures in search of a more prosperous life style, which left these abandoned agricultural areas to the natural regeneration – e.g. the slow return of natural vegetation, the forest (Čas 1988, 2001, 2006; Didier 2001; Johann 1998, 2007; Medved 1967; Žumer 1976).

At the same time in the 19th century wealthy forest owners introduced plantations and cultivation of profitable coniferous trees, especially Norway spruce (*Picea abies* Karst.) and

began with a short-sighted forest management system in the form of 100-year-cycles of clear-felling with re-forestation (Čas 1979, 2001, 2006; Mlinšek 1954, 1968). Thus the native vegetation (beech and beech-fir forest associations) was not only removed but also replaced by profitable coniferous trees, which did not reflect the natural situation and was far from being suitable for many indigenous plants, animals and fungi. Today many sites covered by conifers are at the end of the 3rd cycle of such spruce monocultures (Čas 1979). These Norway spruce-dominated forest stands are labile and prone to further degradation of the forest ecosystem biodiversity and fertility (Čas 2001a, 2001b, 2002, 2006; Kutnar et al. 2005). In the middle of the 19th century spruce monocultures also began to invade the remote and mostly abandoned mountainous pastures and native primary forests – mixed beech-fir forests with increasing proportion of indigenous alpine larch (*Larix decidua*) towards the forest line at 1700 m a.s.l. (Čas 1988). The result of these processes was the formation of secondary coniferous forest landscapes of Norway spruce and European larch with some beech (*Fagus sylvatica* L.) and silver fir (*Abies alba* L.) covering the alpine region in most of Europe today (Čas 1988, 2001, 2006; Eiberle 1984; Didier 2001; Johann 1998; Robič 1998; Wraber 1969).

The continuing intensification of industrialisation following the Second World War led to a further mass abandonment of the farming way of life and emigration of people from rural (alpine high altitude) into urban areas. This phenomenon increased the overgrowing of rural landscapes at mid and high altitudes with forests even more. At the same time systematic forest management activities began in Slovenia with a natural thinning silviculture approach and intensive study of natural rejuvenation (co-natural multipurpose and sustainable forest management) (Mlinšek 1968). Such a practice was used in Switzerland in the past (Ott 1998), but it is currently only adopted in Slovenia.

The forests ecosystems were under an intense influence of human activities in the last 3–5 decades with fast (exceeding forest adaptation capacity) changes in their primary use and demands. The wood production oriented forest management was intensive, especially after 1960, and also included the construction of a dense network of forest roads (Robek & Kljun 2007). The construction of the network of forest roads has allowed not only the exploitation of forests but also increased the accessibility of mountain forests for mountain tourism with a consequently more intensive influence on forests by non-foresters and also a higher interest of wider scientific community. The last three decades also saw a change in peoples' mentality towards "back-to-nature" way of life. Consequently more and more people have started visiting rural areas – hiking, skiing, picking forest fruits, herbs and mushrooms or managing ecotourism activities. Additionally, many abandoned farms in the mountainous and forested areas were reconstructed or rebuilt into wooden or stone huts serving as weekend and holiday getaways. In some rural mountain areas people also found a new source of income in the form of tourist farms and ecotourism or ski and recreation centres which have developed into profitable businesses. The fast changes of forest use and management have resulted in an increased endangerment of many plant and animal species in the alpine forests, both those from the remnants of primary forests and those of all stages of secondary forests.

Western capercaillie (*Tetrao urogallus* L.), the largest member of the grouse family (*Tetraonidae*) will serve as an example of how human activities and swift changes thereof influence this rare species' habitat, sources of food and other requirements for living in the Alps (Adamič 1987; Čas 1999, 2006, 2010; Čas & Adamič 2007; Menóni et al. 2006; Purnat et

al. 2007; Thiel et al. 2007, 2008) and in the mountains of South-Eastern Europe (Gačić et al. 2009; Radović et al. 2003; Raguž & Grubešić 2006; Petrov 2008; Zubić 2009) and other regions of Europe (Storch 2007).

Western capercaillie population densities have been declining continuously over the last decades in Central Europe (Adamič 1987; Braunisch & Suchant 2008; Čas 1999, 2006; Klaus & Bergmann 1994, Storch 2007). Western capercaillie is considered a rare and endangered umbrella species of temperate and boreal forests in Europe (Angelstam 2004; Čas 2001b; Sachot et al. 2003; Suter et al. 2002). Several different habitat disturbances were recognised as causes of Western capercaillie decline in temperate Europe (Adamič 1987; Čas 2001a, 2010; Eiberle 1984; Klaus et al. 1997; Saniga 2002, 2004; Storch 1999, 2007; Thiel et al. 2007). The populations at the southern edge of the species' distribution range have suffered the most severe population reduction (Adamič 1987; Bajc et al. 2011; Blanco-Fontao et al. 2009; Čas 1999, 2010; Cattadori & Hudson 2000; Gonzales & Ena 2011; Poolo et al. 2005; Radović et al. 2003; Quedo et al. 2006; Storch 2007; Zeiler 2001; Zubić 2009), and shrinkage of habitat in the last decades due to forest and climate change (Anič et al. 2009; Čas 2006; Čas & Adamič 2007; Kutnar & Kobler 2011).

Habitat destruction due to forest cutting was recognised as one of the main causes for Western capercaillie population decline in the boreal zone as well (Angelstam 2004; Beškarev et al. 1995; Rolstad & Wegge 1987; Kurki et al. 2000), as were the impacts of climate changes on grouse habitats (Moos et al. 2001; Selas et al. 2011).

Western capercaillie habitat in Slovenia represents the south-eastern edge of its distribution range in the Alps (90% of total Western capercaillie habitat area in Slovenia) and north-western edge in the Dinaric Mountains (10% of total Western capercaillie habitat area in Slovenia). The most suitable Western capercaillie forest habitats are found in remote locations without human influences (Čas 2006; Erjavec 1868). The habitats in Slovenia are concentrated in old coniferous and mixed forests of spruce, fir and beech with some pastures (with bilberry) where leks are distributed in chains on the slopes or in networks on plateaus of the mountains (Adamič 1987; Čas & Adamič 1998; Čas 2001a, 2006; Purnat et al. 2007). The hunting of Western capercaillie in Slovenia has been banned by the Slovenian Hunting Association since 1984 and by law since 1993 (Official Gazette of RS 1993/57).

Finally the example of Western capercaillie will show us how an animal species can be the key factor for increasing the awareness of people of the delicate balance and sensitivity of Alpine forest ecosystems and how scientific community and general public can benefit from it.

1.1 Objectives and concerns

The main objective of the chapter is to sum and present the history of changes in cultural landscape and forests and their use in the Alpine region. Special attention is given to the forest cover dynamics as an indicator of changes in the use of the mountain landscape in relation to industrial, economic and societal development. Chapter provides an overview of the reasons behind the phenomenon of "back-to-nature" mountain tourism and its impacts on the sensitive mountain ecosystems. The results of this study present an important base for the long-term planning of the mountain landscape management and preservation of vital natural resources in Slovenian mountains. As an example of an organism that is highly dependent on suitable forest habitats and specific habitat conditions we reviewed the life of,

and researched the threats to the Western capercaillie (*Tetrao urogallus* L.), an endangered grouse species (*Tetraonidae*), in Slovenia.

The motivation for the chapter is primarily the maintenance of active countryside and to increase the awareness of the audience of the importance of forest ecosystems and landscape, their vulnerability and triggers that led to forest degradation associated with changes in the society and phenomenon of mountain tourism and ecotourism; benefits for inhabitants and influence on wildlife (Western capercaillie as an example of endangered grouse species).

The purpose of this study conducted in Slovenian Alps was to analyse (1) the changes in land use, lifestyle and forest cover in the last centuries; (2) demographic changes associated with changes in land use; (3) the history, the development and the impact of mountain tourism on natural environment; (4) the main reasons for the decline of Western capercaillie population, including the impact of mountain tourism on this species' habitat and (5) assess the importance of findings of this study for the development of conservation strategies with adapted forest and wildlife management and sustainable management and development of tourism in the SE Alps.

2. Methods

2.1 Cultural landscape and forest cover change in SE Alps in Slovenia since the mid-18th century until today

2.1.1 History of forest cover and land use

The history of forests and forested areas is relatively well preserved in archival documents with an intensive and thorough mapping dating back to 1763-1787 (Joseph II military cartographic measurements and maps). More ancient data is scarce while the bulk of the more recent documents are kept at the National Archive of Slovenia and at the Slovenian Forestry Institute. The analysis of land use are conducted by using customized GIS methods (digitizing old maps). The change of the extent and fragmentation of forest cover are a reflection of, and an indicator of changes in human life style and the use of cultural landscape (Čas 1988, 2006; Medved 1967; Švab 1996; Žumer 1976).

2.1.1.1 Forest covers change in Slovenia

We analysed changes in forest cover based on the available data for the territory of the Republic of Slovenia (20,273 km², Figure 1) in last 135 years (since 1875). Forest cover is associated with changes in people's life style and land use. The analysis was conducted by examination of available data for the studied territory in the period from 1875 to 2010 (Čas 2006).

The main landscape types on the Slovenian territory falling into the studied period were known by different names under the administrative authority of several basic countries in the studied period: as Carniola under the Austrian Empire (AuE) and then under the Austro-Hungarian Monarchy (AHM) 1867-1914; as the Drava Province in the Kingdom of Serbs, Croats and Slovenes (1918-1941) (KSCS); as the Socialist Republic of Slovenia (SRS) in the Socialist Federative Republic of Yugoslavia (1945-1991); as the independent Republic of Slovenia (RS) since 1991, which became a member state of the European Union (EU) in 2004.

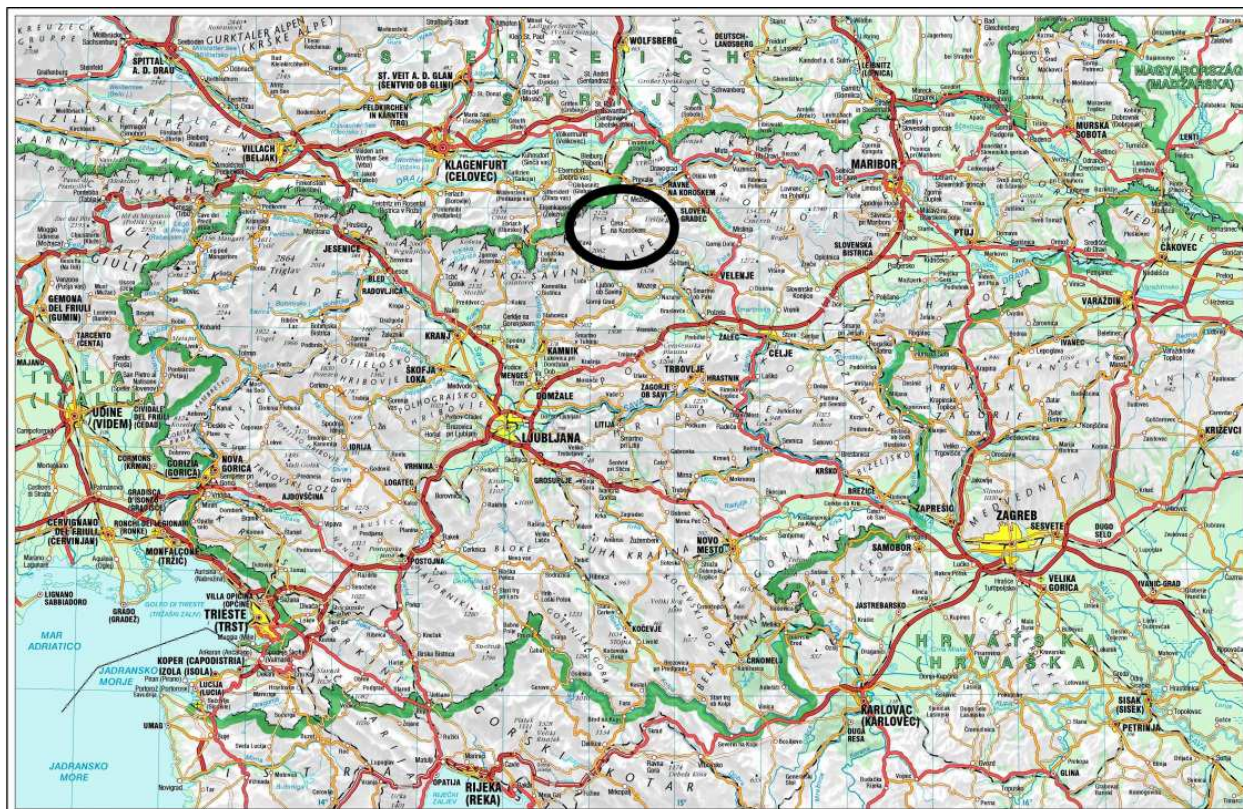


Fig. 1. Slovenia is situated in the transitional territory between Central and Southeast Europe. Vegetation conditions vary between different phyto-geographic regions: between the Alps and the Dinaric Mountains and between the Sub-Pannonian and Sub-Mediterranean regions considerably. The black circle on the map is the model research area covering the region of Mt. Peca and Mt. Smrekovec in Southeast Alps in northern Slovenia.

2.1.1.2 The change in landscape use and forest cover in a model region of the SE Alps and specifically in the rural research area of Topla at Mt. Peca in the last 240 years

We analysed the **changes of cultural landscape and forest cover since 1763**, changes of human lifestyle, people demography and also what effects these changes had on the forest structures and habitats of endangered grouse species (Čas 1988, 1996, 2006). Within the studied area we analysed **the northern slopes of Mt. Smrekovec** (1684 m a.s.l.) (52.64 km²) which are less suitable for farming and **the southern slopes of Mt. Peca** (2125 m a.s.l.) (51.92 km²) which are more suitable for farming. Both mountains are located in the South-east Alps in northern Slovenia (Figure 1). The total studied area measured 104.56 km² at 700–2125 m a.s.l with the forest line at 1650–1700 m a.s.l.

Basic research area (RA) comprised two representative surfaces with different suitabilities for agricultural use in the upland areas in the Upper Mežica Valley with a total surface of 104,56 km². RA on Mt. Peca (51.92 km²) included the following cadastral municipalities (c.m.) or their parts: Topla, Podpeca, Meža-Takraj -part, Koprivna-part and Črna -part. RA on Smrekovec (52.64 km²) included the following c.m. or their parts: Koprivna -part, Bistra -part, Ludranski Vrh, Črna -part, Javorje -part (Figure 2).

We also analysed demographic changes in the territory of municipality Črna na Koroškem (156 km²) in Carinthia (Koroška) in Republic of Slovenia for the period from 1869 to 1961 (Medved 1967, Čas 2006) and to 2010 (Mazej 2011) in relation to changes in people's life style and land use. We analysed population changes in the period from 1869 to 2010 separately for different sub-areas within the research area: (1) the rural cadastral municipalities (Topla, Podpeca, Koprivna, Bistra, Ludranski vrh, Javorje, Jazbina-Žerjav) with a total surface of 141 km²; (2) c.m. Črna na Koroškem (7.5 km²), an urban and trade centre; and (3) a specific area of c.m. Žerjav (7.4 km²), an industrial and mining centre that has been in the process of closing since 1988 (Ur.l. SRS, št. 5/1988) (Figure 2). Demographic changes were analysed by calculating the proportions of different segments (rural, industrial, urban) of the population and the relative changes of each segment and the total population.

Additionally we analysed the change of cultural landscape in one specific model rural territory – the c.m. Topla at Mt. Peca. The Topla region is a valley covering an area of 13.45 km² between 700-2125 m a.s.l. in the eastern part of Karavanke Mountains at Slovenian-Austrian border (Figure 1).

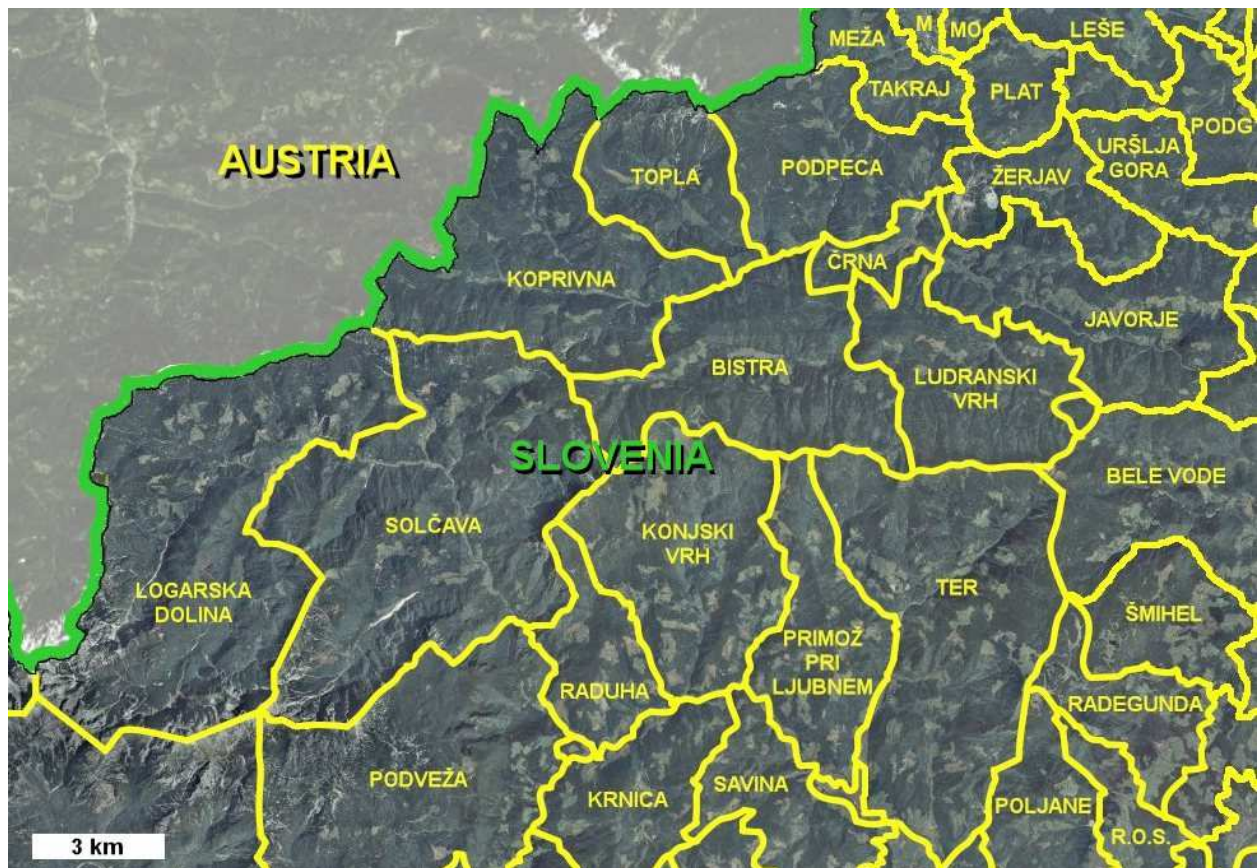


Fig. 2. Cadastral municipalities in the research area of eastern Karavanke and eastern Kamnik-Savinja Alps in SE Alps in Slovenia. The abbreviations mean: R.O.S - Rečica ob Savinji; M. - Mežica; MO - Meža Onkraj; Podg. - Podgora (Composite image produced by Marko Bajc using data from Surveying and Mapping Authority of the RS).

Individual and systematic historical records, land use inventories, records, maps and descriptions of forests are of great importance for the studies of change of forest cover, history of land use, changes in forest management etc. The most important sources of

information for the studied period and area used in this study were: Joseph II Military Cartography records (maps) (1763-1787), Francis Joseph cadastre (1827) and its adaptation from 1863 and 1877 (Archives of Slovenia), Statistical Yearbook (Statement of land ..., 1927, Statistical Yearbooks of the SRS 1947-1990 and later of the RS). Additionally, individual records and research of change in land use and forestry in the wider Alpine area were analysed (Čas 1976, 1979, 1988, 1996, 2006; Medved 1967; Mlinšek, 1954; Valenčič 1970; Wessely, 1853; Žumer 1976), as were some historic sightings in the field (Erjavec, 1868; Rebolj, 1940) and data obtained from experts through personal communication (Johann, 2005; Košir, 2003). Joseph II military maps and descriptions were the most authentic and accurate historical records of the forest cover until introduction of the Francis Joseph cadastre (Korošec, 1993; Rajšp & Ficko, 1994).

Information gathered from archival documents were analysed and combined in a single spatial comparison analysis aimed at detecting changes of cultural landscape and habits of people.

The forest cover for the RA in the second half of 18th century was assessed by measuring the surface of forest patches in digitalised maps (1:25,000) from Joseph II military maps for the period between 1763 and 1787. Land use and forest cover for the period from 1825 to 1828 were determined from data in Francis Joseph register for Carinthia and from digitalised maps (1:2.880) for the areas not covered in the register. For the parts of c.m. Črna and c.m. Koprivna in RA, we considered the average for each c.m. data.

2.1.2 The changes in rural lifestyle and land use in SE Alps since 1763: c.m. Topla on Mt. Peca as a case study

The past land use (including many non-forest habitats in particular period), local and regional economy, demography of people and their lifestyle, yields of their crops and livestock inventories at larger (over 50-200 ha) and economically independent mountain farms prevailing in region of RA (Čas 1988; Medved 1967; Vrišer 2005) with several (5-8) buildings were investigated based on a descriptive part of the cadastre (Cadastre of Francis Joseph) for the cadastral municipalities included in the study, mostly dated from 1827 (Čas 1988). Descriptive parts of the old registers from Austrian monarchy for the analysed region of c.m. Topla were translated from the old German writing and language.

For the more recent decades we gathered information on population census, forestry, livestock numbers, farm economy and field inventories for the period from 1987 to 2011 performed by the author and Mr. Janez Končnik, a farmer from Topla.

2.1.3 Tourism and mountain tourism in Slovenia and in research area of SE Alps

We had done overview of available data enriched with author's own observations and experiences about the tourism and the mountain tourism and their impact on the natural habitats (mainly forests) in Slovenia. Also, we verified information on the number of tourist visits and their recorded activities with special emphasis on their influence to natural habitats in the research areas on Mount Peca and Smrekovec today, in 2011. Types and purpose of mass tourism in the natural mountain area was studied in a series of survey in mid 80ies (1982-1984) at the Peca Mountain above Črna and Mežica city (Čas 1988).

2.1.4 Western capercaillie population decline and impacts of different disturbances in relation to mountain tourism in since 1979

Due to various causes the Western capercaillie numbers in Slovenia have been in decline since 1961 (Adamič 1987; Čas 1999, 2001, 2006). The impact of various forms of mass tourism on vulnerable mountain forest ecosystems was examined in the case of an endangered and sensitive indicator animal species, the Western capercaillie. Additionally we assessed the relative contributions of the most prominent threats to the decline of the Western capercaillie expressed as a percentage of affected leks at which population decline had been observed.

The study area covered about 1,588.6km², mainly represented by the all Alpine (86 %) and the Dinaric potential habitat area (14%) in Slovenia (Čas 2006). We included all altitudes in this area from the low elevation of today's population distribution (above 800 m a.s.l.) to the high altitude at the forest line (about 1700 m a.s.l.) (Čas 1999, 2001). The capercaillie population fluctuations and causes for the decline were studied in two 3-year large-scale monitorings with, the first concluded in 1980 and the second in 2000 (Čas 2001a, 2006, 2010), and in a smaller-scale monitoring conducted in 2009. The 315 Western capercaillie leks were inventoried in 2009 in Slovenia, with similar methods of birds counting and lek habitats survey near sunrise in the spring mating time as Western capercaillie in Central Europe (Braunisch & Suchant, 2008) or the Sharp-tailed Grouse (*Tympanuchus phasianellus*) in Alberta (USA) (Hamilton & Manzer, 2011). Western capercaillie leks and subpopulations densities were monitored in several research projects at the Slovenian Forestry Institute since 1979 (Adamič 1987, Čas 2000, 2006, 2010-unpublished). Disturbances at leks were defined as descriptive parameters of the monitoring questionnaire, where each expert filled in the main reasons for lek or subpopulation decline for each endangered or extinct lek. All together 460 voluntary experts (hunters and foresters) studied leks for consecutive years in all monitoring periods (Čas 2008). From the returned questionnaires we extracted and summarised the most frequent reasons for lek subpopulation disturbance and devastation (Table 6) and used them for statistical analysis and comparison between different monitoring periods.

The impact of different causes behind the population decline was ranked according to the proportion of endangered leks they affected.

For the purpose of this chapter we also assessed the impact of mountain tourism on endangered Western capercaillie subpopulations for the last 30 years by comparing the Western capercaillie leks inventory data from 1980 (1979-1981 monitoring), 2000 (1998-2000 monitoring) and 2010 (2009 monitoring).

This review was based on the published original research of the author and other professional or amateur researches of the topic (land use changes, forests, human habits, Western capercaillie, mountain tourism).

3. Results

3.1 Forest cover and land use change

3.1.1 Forest cover change in Slovenia between 1875-2010

The change in cultural landscape and in rural lifestyle has resulted in overgrowing of abandoned pastures and farm fields and an increase of forest cover since 1875. The rate of

increase of forest cover fluctuated over the studied period, due to different societal-economic events and reasons, but increased from 37,0 % in 1875 to 58.5 % in 2010, that is 21,5% of the total surface area (Table 1).

Year	Forest cover in Slovenia (%)	Reference	Year	Forest cover in Slovenia (%)	Reference
1875	37,0	Žumer, 1976	1961	46,6	Statist. Yearbook, SRS
1880	38,7	"	1970	50,2	"
1890	41,2	"	1980	51,6	"
1900	41,0	"	1990	52,0	Statist. Yearbook, RS
1910	41,8	"	1995	53,7	Bončina / Mikulič, 1998
1930	43,7	Žumer, 1976, by Mohorčič	2000	53,9	R. Ogrizek, SFS, 2000
1950	44,5	Statist. Yearbook, LRS	2010	58,5	Report of SFS, 2011

Table 1. The change in forest cover in Slovenia between 1875 and 2010

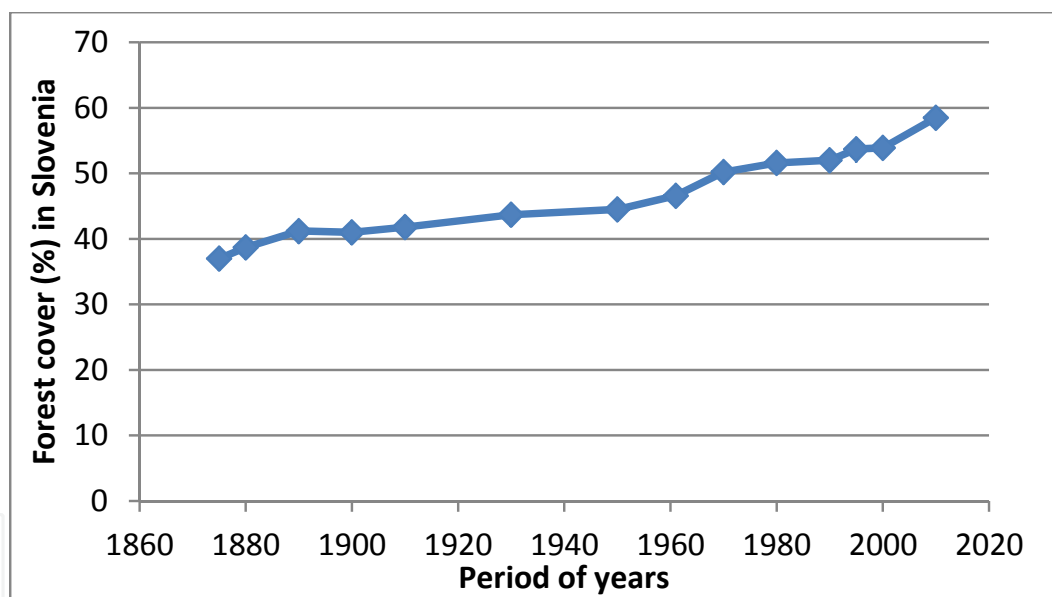


Fig. 3. The change in forest cover in Slovenia between 1875 and 2010

The increase in forest cover has been slower during the world economic crisis and during the 1st and 2nd World War and in the period of increased reliance on agrarian activities (the period of Drava Province in KSCS). Consequently the rate of increase in forest cover stagnated or slightly increased in sixty years period after 1890 (for 3,3 percentage points /p.p./), contrary to the sixty years period after 1950 with markedly increases (for 14,0 p.p.) (Table 1, Figure 3). Assessment of forest cover based on remote sensing data conducted in 2010 showed an even higher forest cover – over 63%, corresponding to an increase of 26 percentage points since 1875. The increasing forest cover and planning development of forest vegetation caused erosion reduction and the revitalization of soil fertility including the improving wildlife habitats, biodiversity and multipurpose forest functions.

3.1.2 Landscape use and forest cover change in a model region of the SE Alps and inside them in the rural research area of c.m. Topla at Peca Mt. since 1763

3.1.2.1 Landscape and forest cover change at two different agriculturally suitable areas in SE Alps

Forest cover in the research area of the Upper Mežica valley in eastern Karavanke and eastern Kamnik-Savinja Alps was only 25.8% two centuries ago (1763-1787). The Forest cover in both mountain ranges has increased by 53,6 percentage points in the last 240 years to 79,4% by the end of the 20th Century (Table 2). The increase in forest cover in this period followed different dynamics in these two neighbouring areas: (i) On agriculturally less suitable shady and silicate rock (tuff) northern slopes of Mt. Smrekovec, the forest cover had increased to over 70% already by the early 19th century (1827) (Čas 1996, 2002, 2006) and to 83,5% at present time resulting in an overall increase of 48,9 percentage points (Table 2); (ii) on agriculturally more suitable carbonate rock southern slopes of Mt. Peca, the forest cover only reached 70% in 1960s, that is at least 135 years later than on Mt. Smrekovec, and increased to 79,4% by present time for an overall increase of 53,6 percentage points (Table 2).

Year		RA Mežica valley	Peca-south	Smrekovec-north	Reference
1763-1787 (1775)	Forest cover (%)	25,8	16,8	34,6	GIS-analysis
1827		52,1	29,3	74,5	Francis cad. (AS)
1874-1890 (1882)		62,7	41,6	83,6	Medved, 1967
1927		62,5	47	77,7	Statement, 1927
1962		75,8	70,3	86,3	Medved, 1967
1985-1992 (1990)		79,4	75,3	83,5	Čas, 1996
Difference (percentage points)		53,6	58,5	48,9	

Table 2. The forest cover change at northern slopes of Mt. Smrekovec and southern slopes of Mt. Peca in South-Eastern Alps in Slovenia between mid-18th century and the end of the 20th century

The natural overgrowing of abandoned mountain pastures and promotion of coniferous species (Norway spruce, Alpine larch) has led to an increase in the area of suitable habitats for grouse species such as Western capercaillie and hazel grouse (*Bonasa bonasia*) till 95% cover of management forests in areas (Čas & Adamič 1998; Čas 2001a, 2006).

3.1.2.2 Change in cultural landscape and forest cover in rural cadastral municipality Topla since 1763

The area of c.m. Topla in the period from 1763 to 1787 was characterised by a generally low forest cover, rustic lifestyle and a stabile structure of different types of agricultural land (Table 3, Figures 4 and 5). The forest cover in this period fluctuated between 11% (1763–1787) and 22.8% (1827) (Table 3). According to Francis Joseph cadastre for 1877 the proportion of land used for pasture was 67.6%, while forest cover was 16.4%. Major societal changes and changes of lifestyle starting in 1848 led to a massive emigration of people from countryside to industrialised urban areas (Medved 1967, Čas 1988) resulting in an abandonment of mountain pastures and an increase in forest cover which reached 66.7% by 1962 (Table 3, Figure 5).

Since 1962, the land use has not changed significantly and the proportion of agricultural land has stabilised once again. In 2000 forest cover in c.m. Topla was 66.8%, 16.3% of the land were pastures, 4.1% fields and 12.9% infertile open land (rocky slopes). In the c.m. Topla the proportion of land used for pasture and farm fields decreased by 55,0 and 1,1 percentage points respectively, while forest cover increased by 55,8 percentage points since 1763 (Table 3, Figures 4, 5 and 6). The proportion of fields and meadows in c.m. Topla has not changed dramatically and has remained at about 5%, as has not the proportion of infertile open land which fluctuated between 12,5% and 12,9%.

Year	Forest (%)	Pastures (%)	Fields (%)	Reference
1763-1787	11,0	71,3	5,2	digitalization
1827	22,8	58,5	6,2	Čas, 1988
1877	16,4	67,6	3,5	Čas, 1988
1890	19,0	62,2	6,3	Medved, 1967
1927	45,9	36,0	5,6	Statement, 1927
1962	66,7	15,9	4,9	Medved, 1967
1992	66,8	15,6	5,1	Čas, 1996
2000	66,8	16,3	4,1	Košir, 2003
Difference 1763 to 2000 (percentage points)	55,8	-55,0	-1,1	

Table 3. Change of land use and cultural landscape in c.m. Topla between 1763 and 2000

3.2 The change of lifestyle and livelihood of the rural community in a model region in SE Alps since the 19th Century

3.2.1 The change of lifestyle and people demography in a model region of municipality Črna na Koroškem in the SE Alps in Slovenia from 1869 to 2010

There have been considerable changes in lifestyle and people demography in municipality (m.) Črna na Koroškem (156 km²) in the period from 1869 to 2010. At the middle of the 19th century, rural population was predominant with 64,2% (2742) of people, while urban population and industrial workers in settlement and trade center Črna represented 15,0% (641 individuals) of the total population of 4273 inhabitants in municipality Črna in y. 1869. The mining and industrial settlement Žerjav accounted for 20,9% of all inhabitants (890) in the region in 1869 (Table 4, Figure 7).

By the 21st century proportions of people associated with specific activities in m. Črna changed dramatically: rural population decreased by 43,1 percentage points (equivalent to a decrease of 72%) from 1869 to 2010 and represented only 21,1% of the total population of 3602 people in m. Črna in 2010, whereas urban population in c.m. Črna increased by 52,9 percentage points (equivalent to an increase of 283%) in the same period (Table 4).

Proportion of people in industrial and mining settlement of c.m. Žerjav decreased in the period from 1869 to 2010 from 20,9% to 11,0% of all people in m. Črna (a decrease by 56%). The number of all people in the research area of m. Črna decreased from 4273 in 1869 to 3602 in 2010, that is by 671 individuals (a decrease by 16%) (Table 4).

Changes in the demographics of the population of municipality Črna in the last 140 years were associated with economic and societal changes which resulted in abandonment of rural lifestyle and migration of people to villages and urban areas in the valleys. Overgrowing of agricultural land and pastures in the studied area by forest vegetation can be considered as a direct consequence of the above mentioned demographic changes.

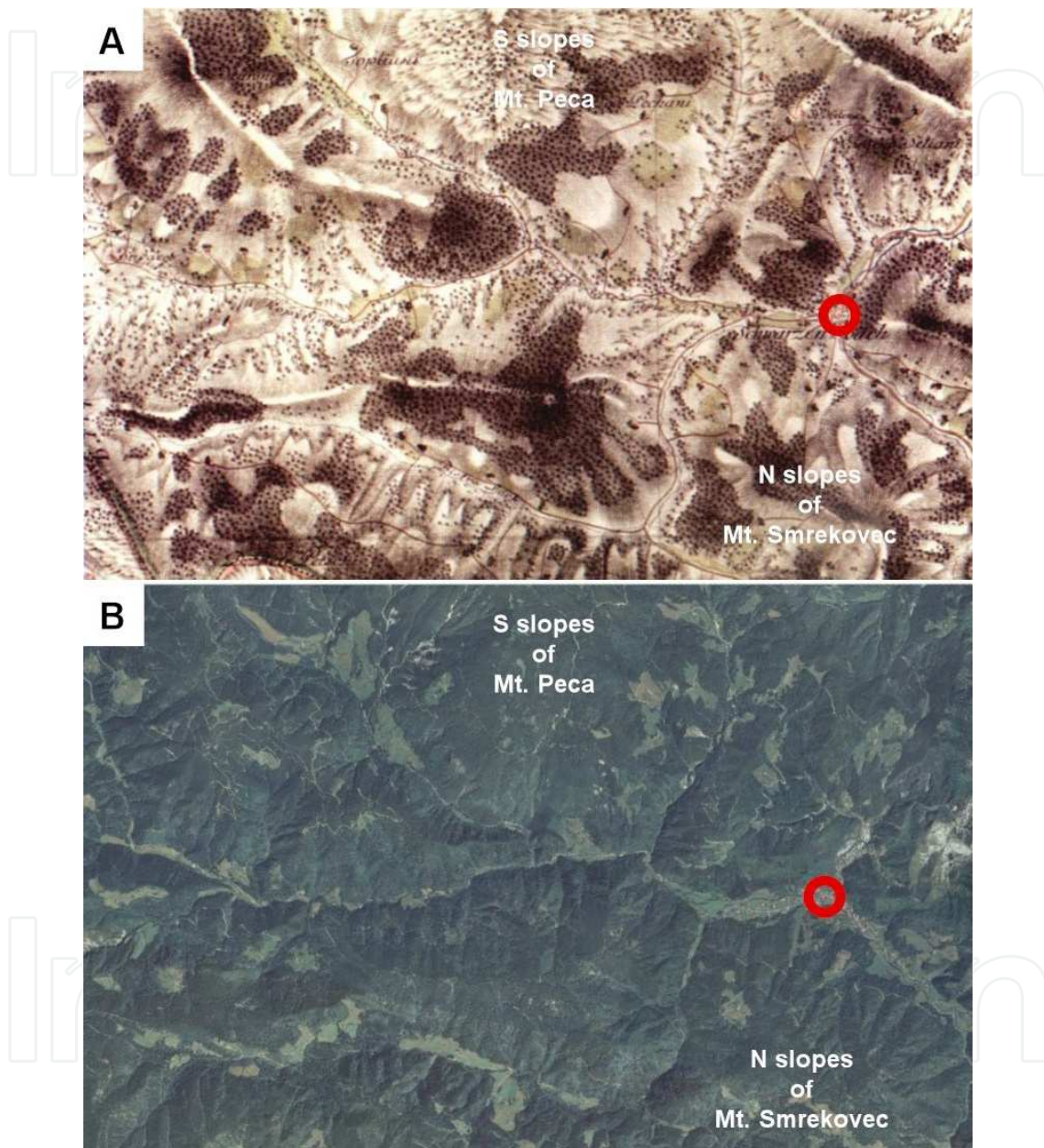


Fig. 4. Research area of c.m. Topla (Mt. Peca) and c.m. Bistra (Mt. Smrekovec) in the Upper Mežica valley. A: Joseph II military map of the research area in 1763-1787. Significant reduction in forest cover (to between 11% and 25%) as a result of agricultural (pasturing) and industrial (iron and lead-zinc ore processing) activities is evident; B: Satellite imagery of the research area in 2011. Today the forest cover in this area is between 70% and 85% (Photo B: Surveying and Mapping Authority of the Republic of Slovenia, 2011). The village Črna (Schwarzen Bach) is marked with a red circle in both images (images juxtaposed and edited by Marko Bajc).

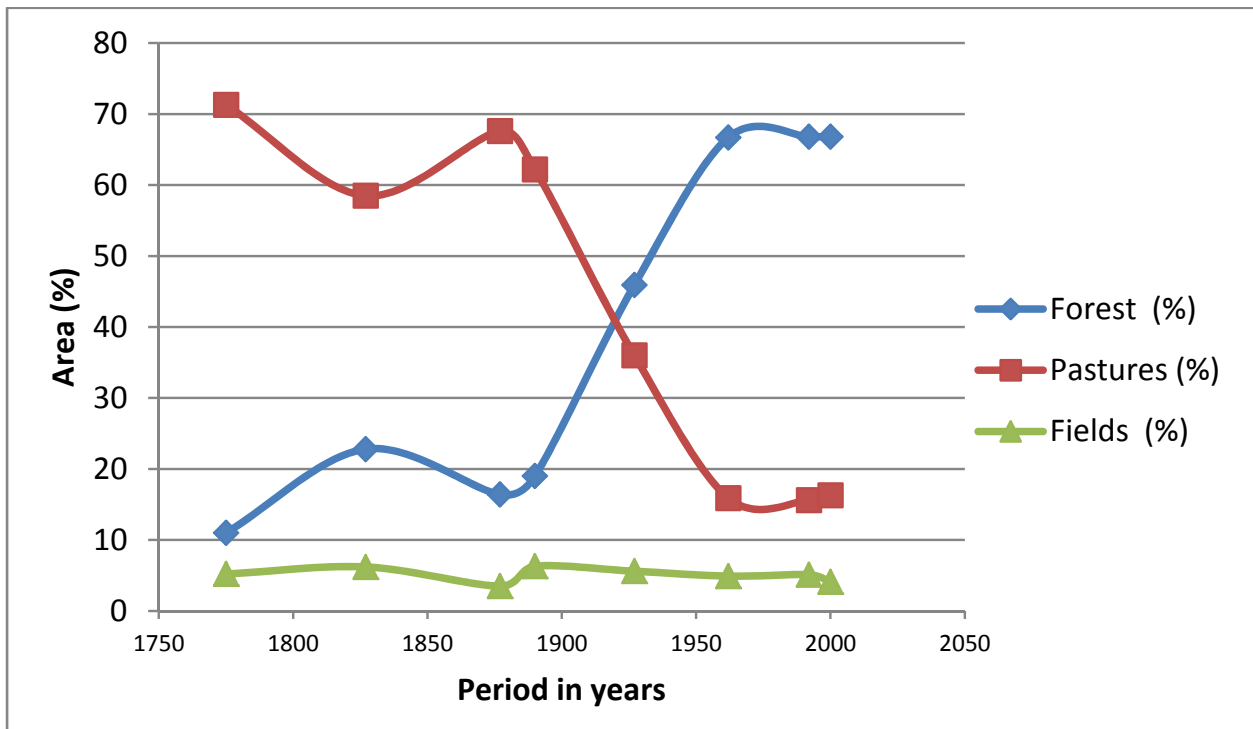


Fig. 5. Changes in land use and cultural landscape (% of area) in c.m. Topla in the period between 1775 and 2000



Fig. 6. Secondary larch-spruce forests with some red pine (*Pinus silvestris* L.) in the present-time Topla area on Mt. Peca that have been overgrowing abandoned pastures since 1848 (photo: M. Čas, 2003).

Segments of population of municipality Črna by year	1869	1900	1931	1948	1961	2010	Difference 1869-2010 (percentage points)
Rural population (proportion of total)	2742 (64,2%)	2584 (61,8%)	2482 (58,8%)	2009 (45,5%)	1720 (34,8%)	760 (21,1%)	-43,1
Change in rural population in comparison to 1869 (%)	0	-5,8	-9,5	-26,7	-37,3	-72,3	
Industrial workers in c.m. Žerjav (proportion of total)	890 (20,9%)	933 (22,3%)	688 (16,3%)	998 (22,6%)	1028 (20,8%)	396 (11,0%)	-9,9
Change in the number of Industrial workers in c.m. Žerjav in comparison to 1869 (%)	0	+4,8	-22,7	+12,1	+15,5	-55,5	
Urban population of c.m. Črna (proportion of total)	641 (15,0%)	665 (15,9%)	1051 (24,9%)	1408 (31,9%)	2199 (44,5%)	2446 (67,9%)	+53,0
Change in Urban population of c.m. Črna in comparison to 1869 (%)	0	+3,7	+64,0	+119,7	+243,1	+281,6	
Total population	4273	4182	4221	4415	4942	3602	-15,7
Change in total population (%)	0	-2,1	-1,2	+3,3	+15,7	-15,7	

Table 4. Demographic changes in municipality Črna between 1869 and 2010

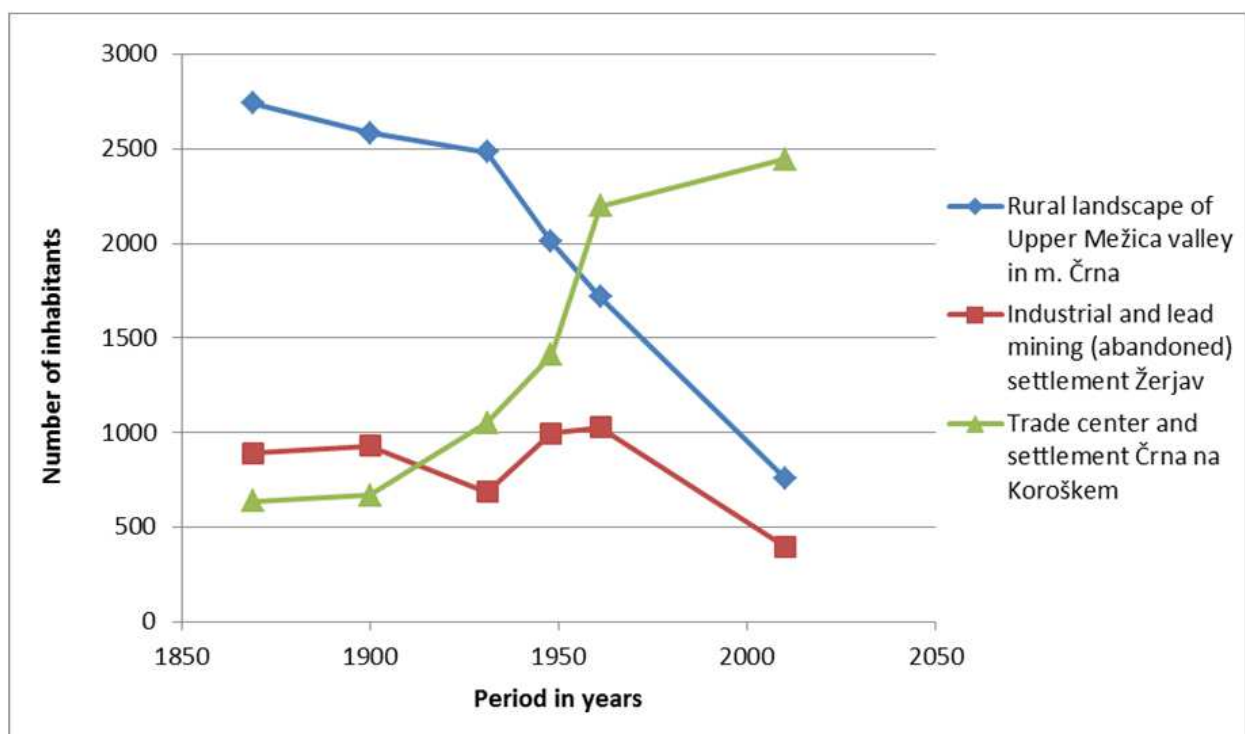


Fig. 7. Demographic changes in municipality Črna from 1869 to 2010

3.2.2 The change of lifestyle and livelihood of the rural community in a model region of the c.m. Topla from 1827 to 2011

There have been considerable changes in lifestyle and land use in c.m. Topla in the period from 1827 to 2011. At the beginning of the 19th century, crop cultivation and livestock breeding represented a major part (80%) of income for the rural community of c.m. Topla, while forestry represented only 20% of income. By the 21st century this has changed completely as crops cultivation has been almost completely abandoned with forestry and timber sales (80%) and intensive livestock breeding (20%) becoming the main sources of income (Table 5).

Human population	Year	1827 Carniola in AuE	1987 SRS in SFRY	Change in 1827-1987	2011 RS in EU
household	No.	6	6	0	5 (8) ¹
farms	No.	5	5	0	5
families	No.	11	9	-2	7 (10) ¹
People - all	No.	57	29	-28	27 (34) ¹
of servants	No.	30	0	-30	
Livestock					
cows and bulls	No.	15+2	25+0	+10, - 2	30
young cattle	No.	10	71	+61	35
pigs	No.	25	25	0	10
sheep	No.	300	20	-280	30
Working cattle/machines					
oxen	No.	24	0	-24 +38 machines +15 connectors	0 a little more - similar
horse	No.	2	0	-2	0
Agriculture					
cereals (wheat, rye, oats, barley)	Estima- -tion	many	market	- many	market
flax, hemp	- "-	many	market -shop	- many	market
cabbage	- "-	many	market -shop	- many	market
potatoes	- "-	a little	medium- market	+ medium	+ medium
Land yields					
Agriculture	80%	Many	Very little	- many	only potatoes
Livestock		Medium	Many 25%	+ many	20%
Forestry	20%	A little	Many 75%	+ many	80%

¹Number of all inhabitants, not only farmers (Mazej, 2011)

Table 5. The changes of rural lifestyle on farms in c.m. Topla on Mt. Peca from 1827 to 2011

Because southern slopes of Mt. Peca are agriculturally suitable, the number of farms, households and families remained fairly stable in 1827-1987, but registered a severe decline in total population. Changes in lifestyle associated with liberties installed by societal

changes starting in 1848 resulted in 30 servants leaving the area in search of better life in the valleys and urban areas reducing the total population from 57 in 1827 to only 29 people in 1987. Due to the lack of manpower grazing was abandoned (Čas 1988; Medved 1967) with a resultant drop in sheep numbers from 300 heads in 1827 to only 20 heads in 1987. Farmers have also completely stopped using working cattle that were replaced by machines – 24 oxen and 2 horses in 1827 were replaced by 38 machines and 15 implements by 1987.

The situation of the rural community of c.m. Topla has changed very little from 1987 to 2011. Due to EU regulations and subsidies, farming has become more bureaucratic from 2004 on. There has been a slight increase in the number of sheep and a reduction in number of pigs and young cattle for sale. The importance of forestry has increased and currently represents 80% of income with livestock breeding representing the remaining 20% of income (Končnik J., pers. comm., October 2011) (Table 5).

Stressful and busy everyday life in urban and industrial centres has led many people to seek relief in the nature. Such activities, including ecotourism, mean that more and more people venture into the mountains and their vulnerable forest ecosystems.

3.3 Mountain tourism and its potential impacts on the nature in Slovenia

3.3.1 Past and recent mountain tourism in the Alps

The Alps are with the 50 million holiday guests and more than 100 millions of visitors the largest continuous and ecologically rounded tourist region in the world (Jeršič, 1999). Since the end of the 19th Century Alps have been considered a major attraction due to their aesthetic values, expressed as an effect of the dominating mountain scenery with a mosaic of agrarian land, rugged rock and glacial areas. Today's tourists visiting the region in majority still appreciate Alps for the same aesthetic reasons as the visitors two centuries ago did (Bätzing, 1991). The adventurous quality of the landscape remained the major tourist attraction of the Alps also in the first stage of the modern mass tourism starting around 1955. In this stage of the modern mass tourism, summer time was the key period for visiting Alps (Jeršič 1999). The second stage of modern mass tourism in the Alps, starting around 1965, was closely associated with the popularisation of alpine skiing, consequently attracting tourists to Alpine region also during the winter. Since the onset of the second stage of mass tourism, not only the aesthetic, but also, if not primarily, the sporting and recreational potential of the Alps attracted most visitors. The past mountaineering tourism can be regarded as an extensive influence on the Alpine region.

With the advent of mass tourism in the Alps a number of tourist regions developed with accompanying facilities dedicated to sport activities during the day and entertainment during night (discotheque, restaurants, swimming pools). These were mainly accumulated in several mountain tourism regions and sites of special interest. By the mid-1970s the number of sports and entertainment oriented visitors sharply increased in contrast to the "traditional" mountaineers and hikers. Later, in 1980s, the sport activities diversified to various summer time sporting activities of "Back to nature", including extreme (adrenalin) sports. The mountain sports tourism increased the competition for alpine space in the Alps and also a competition among tourist facilities. The Alpine landscape is now developed as a bi-seasonal (summer and winter) tourist area. The most important area for mass tourism is

located at altitudes between 1200 and 2000 m a.s.l., rarely any higher (Jeršič 1999). In the last three decades the tourism pressure in Alps started to stagnate or even decrease, causing an increase in competition between tourist centres and a subsequent increase of investments and diversification of the activities aimed at attracting more visitors (Jeršič 1999). As a consequence we have observed an increasing pressure on and in many cases also the destruction of some Alpine ecosystems for the sake of tourism promotion and development (Čas 2010; Thiel et al. 2007).

3.3.2 Slovenia and its tourist potential

Slovenia is an independent country in the European Union covering the area of about 20,000 km² with about 2 million inhabitants. The majority (but not all) of the country belongs to the Alpine or Sub-Alpine area. The Alpine and the Dinaric Alpine (Sub-Alpine) areas pass through hilly and lowland areas in central Slovenia towards the SE and to the lowland region of the Pannonian basin in NE. In the SW the country descends to the Adriatic Sea forming a region with Mediterranean characteristics. The majority of the country is situated on the young geologic sediments forming the famous Karst structures. The particular plateau of Kras (Karst) even gave the name to these typical geological structures (sharp mountain peaks, caves,...) which are among important tourist attractions. From the biotic part of view this diverse climatic area results in four different vegetation types: Alps and the Dinaric Mountains, the Subpannonian and Submediterranean regions (Wraber 1969).

These come together in the central part of the country resulting in an array of important natural habitats and high potential for nature-related tourism.

Cultural and natural heritage, including the biodiversity of natural ecosystems is still relative well preserved and depicted by many rare habitats and plant and animal species. Consequently, the area of Slovenia is characterised by natural beauty and pristine nature scenery. Highly preserved natural sites cover over 1/3 of the country area and are mainly represented by forested areas. The system of these sites is organised into several levels of official protection, from the natural park to a system of Natura 2000 sites and locations (Kutnar et al. 2011).

Slovenia is considered a medium developed tourist country. Statistics show that tourism in Slovenia represents 11.8% of gross domestic income (Statistical Office of the Republic of Slovenia (SORS), Banka Slovenije), 2011. The annual number of tourist arrivals (transit tourists) and overnight lodgings has been gradually increasing in the last decade. The number of transit tourists increased from approximately 2 to approximately 3 million in addition to an increase of overnights from 7 million in 2001 to 8.9 million in 2010 (SORS, 2011). Over 56 % of all tourist nights are represented by the visitors from abroad (WTTC - World Travel and Tourism Council). Among other reasons for satisfactory tourism development in the country is a high level of safety of the country. According to the index of global security position Slovenia is at the 11th place Global Peace Index). The International index of tourism competitiveness positioned the country at the 33rd place with increasing index in year 2010 (The World Economy Forum, Competitiveness index in 2011). Terrain with numerous streams and rivers, taking over 63% forest cover countries rising from the sea coast over decorated and impressive karst caves to the high alpine peaks over 2000 m above sea level, up to the highest mountain in Slovenia the Triglav (2864 m) (www.slovenia.info/rr 2011).

3.3.3 Mountain tourism in Slovenia 2010

The Alps represent 84% of the mountain area of Slovenia while the Dinaric Mountains represent only 16% (Čas 2006). Overall the high mountain tourism contributes up to 25% of all transit tourists and tourist overnight stays in the country (SORS, 2011). The main activity of mountain tourists in the winter season is skiing. In the summer, hiking and mountaineering were traditional activities. In recent years other possibilities have been discovered or organised, such as mountain biking, kayaking, rafting, climbing, paragliding, and also tennis, golf and camping in organised tourist centres. New activities such as hiking and cross country skiing, snowboarding, ice climbing, driving snowmobiles, paragliding are quickly gaining popularity in the winter as well (Jeršič 1997). Several of the recently introduced activities represent an aggressive invasion into the fragile mountain environment, mainly the off-road motor vehicles use, motocross motorcycles, quads, and in winter snowmobiles. The current legislation in Slovenia strictly limits these disturbing activities. The enforcement of these laws is, however, rather lax and there is a strongly lobbied tendency to loosen the regulation and allow even more aggressive human impact on this fragile mountain environment.

3.3.3.1 Mountaineering in Slovenia

The popularisation of mountaineering in Slovenia can be traced back to the 19th Century. The Mountaineering Association of Slovenia is celebrating the 110th anniversary and includes about 245 mountaineering clubs, with more than 50,000 members and managing over 170 mountain huts and maintaining approximately 7,000 km of mountain trails. Most tourists come to the mountain area in July, August and September, totalling 80% of annual overnight lodgings (approximately 93,000 in 2003) (Černič 2011). Mountaineering and hiking on managed and marked hiking trails generally has negligible impact on natural environment, which is also a consequence of a high level of nature conservation awareness of Slovenian mountaineers. A more negative impact on natural environment can be observed in mountain areas close to urban centres due to the high volume of traffic and hiking off the marked trails and also forms of tourism and recreation involving different types of vehicles and overharvesting of forest berries, herbs and mushrooms.

3.3.4 "Back to nature" - The development of mountain tourism - The threats and impact

In the Slovenian Alps, the tourism is of much lower intensity when compared to other alpine countries. In this context, Slovenia has a benefit of hindsight and an opportunity of taking into account the negative experiences of other alpine countries when planning future strategies for the development of mountain tourism, which undoubtedly should be ecologically and socially sustainable (Jeršič 1999). It is very important to coordinate the interests of tourism enterprises with the local rural population, which has been subject to disturbance and conflict, and often placed in an unfavourable position in the marketing of mountain tourism. Thus we have been observing an increase in rural-tourism and eco-tourism in the mountain areas of Slovenia in recent times, for example on Pohorje Mountains (Jug et al. 2007).

In addition to the economic activities involving sustainable use of natural resources in the Alpine area (forestry, agriculture, hunting, fishing, hydropower and small hydropower

plants) there is also a new activity which is often disruptive to forest and other fragile mountain ecosystems – the mass tourism.

Unregulated use of the mountain landscape for human recreational and tourist activities is negatively impacting the sensitive habitats of many rare, endangered and protected plant and animal species (Official Gazette of RS 1993/57). Among the most sensitive and endangered species in the Alpine mountain region are certainly the forest grouse species (*Tetraonidae*): Western capercaillie (*Tetrao urogallus* L.), hazel grouse (*Bonasa bonasia* L.), black grouse (*Tetrao tetrix* L.) and rock ptarmigan (*Lagopus mutus* Montin) (Čas 1999, 2001, 2006; Eiberle 1984; Storch 1999, 2007; Thiel et al. 2007).

Jeršič (1999) states that tourism experts determined that the area between 1200 to 2000 m a.s.l., is the most interesting for the development of mountain tourism, especially around 1500 m a.s.l. This area, however, has been reported as the major and long-standing core area of preserved habitats for rare species of forest grouse at the southern edge of their distribution (Čas 2006; Adamič 1987).

3.3.5 Mountain tourism in the research area of Peca and Smrekovec mountain

Smrekovec and Peca mountain range is annually visited by 31 to 35-thousand visitors, of which over 90% are mountaineers or hikers. Visitors come mostly from the surrounding towns and villages along the marked hiking trails. In recent decades, the number of visitors has increased, but more importantly so has the number of sports enthusiasts, especially mountain bikers and drivers of motor vehicles (2- and 4-wheeled) or snowmobiles in the winter. But there is a detectable increase of visitors in a form of a new genre of mountain tourists, using roads accessible by cars to visit the mountain huts in last decade. Overview of visitors of the mountain hut Travnik (1548 m a.s.l.) on Mt. Smrekovec has shown that of the 3000 total annual visitors, only 30% were mountaineers and hikers, with the other 70% being visitors using motor vehicles (Vrčkovnik B., manageress hut, pers. comm., October 2011). Similarly, Smrekovec hut (1377 m a.s.l.), where the mountain range is annually visited by about 13000 people, most of the cars. Especially in the summer and early autumn are a mass visit gatherers blueberries and cranberries, mushrooms and herbs that occupy forests and pastures throughout the mountain ridge and strongly disturb the natural environment and habitats (Fika- Povsod V., manager of the hut, pers. comm., October 2011).

Based on the analysis of entries in the log book in the mountain cottage on Mt. Peca (1665 m a.s.l.), (Mountaineering Club Mežica, 1982, 1983, 1984) conducted in 1982, 1983 and 1984, between 3,000 and 5,000 people visited Mt. Peca annually (Čas 1988) and in year 2010 about 15,000, (no road to the hut) with at least half an hour of hiking (Blatnik V., former manager of the Alpine Association Mežica, pers. comm., October 2011).

The analysis of 267 survey sheets filled by visitors of the cottage on Mt. Peca in 1983 and 1984 revealed that most people visit Mt. Peca from June to September, 72% of which during weekends. Most visitors came from the neighbouring Mežica valley (42%), 40% from the lowland region of NE Slovenia, 13% from the more distant regions of Slovenia, 3% from other republics of the former Socialist Federative Republic of Yugoslavia and 2% from other countries (2%). The number of visitors from the neighbouring Austria was insignificant (Čas 1988). 56% of the visitors were young people, the group most likely to take on different sport activities in the mountains.

Most visitors (50%) came to Mt. Peca to enjoy the beauty of the mountains and the natural environment, and the tranquillity of the locale, some to visit the cave of King Matjaž (a figure in Slovenian mythology), some for the company and due to the general popularity of the site, and some for hunting, forestry and recreation. In 75% of cases the weather was nice. Most visitors complimented the staff on homeliness and service, while a few expressed criticism of forest roads roughly intersecting the hiking trails (Čas 1988).

According to local mountaineers, the structure of visitors has not changed significantly by 2010, except for a higher number of visitors using motor vehicles and mountain bikes (on marked and managed bike trails). Unfortunately, a growing number of visitors using wheeled motor vehicles or snowmobiles off-road have been recorded in the last decade, causing disturbance and destruction of the natural environment on both mountains (Maks Potočnik, pers. comm., October 2011).

3.4 Causes for the Western capercaillie population decline and shrinking of the habitat between 1980 and 2010 in relation to the impacts of mountain tourism

Western capercaillie population size in Slovenia has been constantly decreasing since 1961 (Čas 2006, 2010). Results of intensive monitoring conducted in 1980 and 2000 revealed that the number of Western capercaillie individuals dropped by 37% and the number of active lek sites by over 50% in the studied period (Čas 2001a). In 2000 there were 1250 reported individuals in Slovenia (Čas 2001a). Preliminary results of monitoring conducted in 2009–2010 by voluntary participation of hunters and foresters suggested the continuing decline of Western capercaillie population in Slovenia (Čas 2011, unpublished). Some Western capercaillie populations in SE Europe remain poorly studied and call for an investigation into their demographic and genetic status and a review of potential threats (Čas 2001a, 2010; Bajc et al 2011).

In the 1979–1981 period we examined 39 endangered leks (8.4%) of a total of 466 observed leks to determine the causes of Western capercaillie population decline and habitat destruction. The main threats to Western capercaillie at the examined leks were: (1) cutting of old forests (affecting 71.8% of endangered leks or 28 leks), (2) construction of forest roads (7.7%), (3) overgrowing of pastures in mountain forest areas (7.7%), (4) picking of forest fruits (5.1%), (5) human disturbance by mountain tourism activities (motor vehicles, sledges, recreation) (5.1%) and (6) predators (fox, marten, wild boar, lynx, hawk, eagle, etc.) (2.6% or one lek) (Table 6) (Čas 2010).

In the 1998–2000 period we examined 92 endangered leks (15.4%) out of 599 observed leks. The main threats to Western capercaillie at the examined leks were: (1) different forms of mountain tourism (affecting 26.1% or 24 of endangered leks), (2) cutting of old forests (19.6%), (3) predators (18.5%), (4) forest management in spring mating and nesting time (9.8%), (5) wild pasturage of sheep in forests (6.5%), (6) overgrowing of pastures in mountain forests (5.4%), (7) picking of forest fruits (5.4%), (8) construction of forest roads (4.3%), (9) “disrupted reproductive cocks and hens” (3.3%) and (10) infrastructure (power lines) (1.1%) (Table 6) (Čas 2010).

In the most recent monitoring started in 2009 we examined 151 endangered leks (47.9%) out of 315 observed leks. The main threats to Western capercaillie at the examined leks were: (1) different forms of mountain tourism (41.6% of endangered leks or 63 leks), (2) cutting of old forests (16.6%), (3) overgrowing of pastures in mountain forests (15.2%), (4) predators (12.6%),

(5) forest management in spring mating and nesting time (8.6%), (6) wild pasturage of sheep in forests (5.3%), (7) construction of forest roads (0.7%), (Table 6) (Čas 2009, unpublished data).

When comparing the three studied periods (1979-2009), the highest changes in contributions of different threats to Western capercaillie at leks were linked to (1) an increase in the negative impact of mountain tourism (motor vehicles, sledges, etc.) by 36 percentage points; (2) overgrowing of pastures in mountain forests, the impact of which increased by 10.1 percentage points; (3) an increase in negative impact of predation by 10.0 percentage points; (4) an increase in the negative impact of forest management in the spring mating and nesting time (openness of forests with roads) by 8.6 percentage points and (5) an increase in negative impact of pasturage of cattle and sheep in forests by 5.3 percentage points. On the other hand, (1) a significant decrease in negative impact of the cutting of old forests at leks by 55.2 percentage points, (2) a decrease by 7.7 percentage points in impact of picking of forest fruits (bilberry, cranberry, raspberry) and a decline in negative impact of forest roads construction by 7.0 percentage points were observed in the last 30 -years period (Table 6, Figure 8). Among the reasons for the decline of capercaillie leks in the last ten years since 2000 the tourism had the most negative impact (15.0 p.p).

Threats at leks	Relative contribution in 1979-1981 (%)	Relative contribution 1998-2000 (%)	Relative contribution in 2009 (%)	Changes (p.p.), 1980-2000	Changes (p.p.), 1980-2010
Cutting of old forests	71.8	19.6	16.6	-52.2, - 3.0	-55.2
Construction of forest roads	7.7	4.3	0.7	- 3.3, - 3.6	-7.0
Forest management at the time of mating and nesting	0.0	9.8	8.6	+9.8, -1.2	+8.6
Mountain tourism (motor vehicles, sledges, hikers, m. bikes, skiing, camping etc.)	5.1	26.1	41.1	+21.0,+15.0	+36.0
Predators (fox, martens, wild boar, raptors)	2.6	18.5	12.6	+15.9,- 5.9	+10.0
Picking of forest fruits (bilberry, cranberry, ...)	7.7	5.4	0 ¹	- 2.3,- 5.4	-7.7
Wild pasturage of cattle and sheep, wire fences	0.0	6.5	5.3	+6.5,- 1.2	+5.3
Overgrowing of pastures in mountain forests	5.1	5.4	15.2	+0.3,+9.8	+10.1
No normal cocks and hens	0.0	3.3	0 ²	+3.3, 3.3	0.0
Infrastructure (power lines)	0.0	1.1	0	+1.1, -1.1	0.0
Common number of observation leks	100.0	100.0	100	/ /	/

¹ Picking forest fruits disturbance is frequent but not the main cause for population decline

² No normal males on leks were sporadically present, thus not recorded

Table 6. Disturbance of Western capercaillie at leks in Slovenia by causes and their contributions in 1979-1981, 1998-2000 and 2009 (2010)

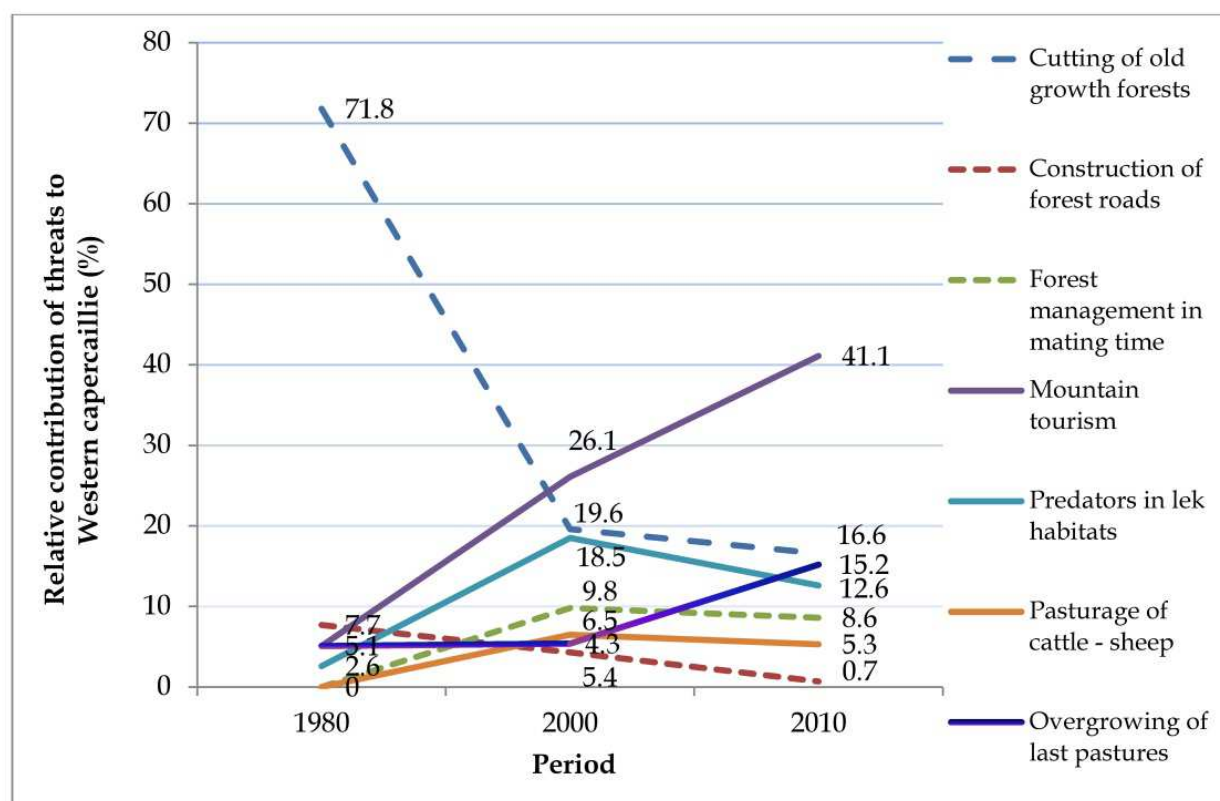


Fig. 8. The main threats and their contributions to endangerment of Western capercaillie at leks in Slovenia between 1979 and 2010

4. Discussion

Humans are evolutionarily intimately interlinked with manual labour and farming and hunting lifestyle and have survived millennia through cognitive adaptation to the natural environment. This study is an overview of human activities and land use, and changes in lifestyle in the Alps in the past centuries including mountain tourism, and their impacts on natural environment.

The Alpine region has long been influenced by human activities which caused severe and in many cases irreversible changes of the Alpine landscape, in particular of the high altitude forests. As a consequence of unregulated exploitation of forests starting as early as in 11th to 13th century, only remains of primary forests exist today in Slovenia, while most of the present forests are in various stages of secondary forest succession. In the area researched in this study, the abandonment and overgrowing farmland began first on the less fertile northern slopes of non-carbonate mountain ranges (Mt. Smrekovec) towards the end of 18th century and 130 years later also on the more fertile southern slopes of calcareous mountains (Mt. Peca). Changes in forest cover can thus be considered as a good indicator of changes of the rural lifestyle and the use of land in Slovenia in last centuries.

The intensity and frequency of human activities in the mountain areas have lately been constantly increasing and there appears to be no let-up therein in the foreseeable future. Demographic analysis in the SE Alpine research area of municipality Črna na Koroškem in

northern Slovenia revealed that the population structure had changed inversely in the period from 1869 to 2010. The rural population decreased from 2742 in 1869 to 760 individuals in 2010 (by 72%), while the number of inhabitants of the local urban commercial and industrial center of Črna increased from 639 inhabitants in 1869 to 2446 in 2010 (by 283%).

The forest cover in the research area of common region on northern slopes of Smrekovec Mt. and southern slopes of Peca Mt. in the Alpine region (104.6 km²) of Slovenia has increased since the end of the 18th century to the early 21st century from 26% to 80%. In the last two centuries the extent of pastures in the rural research area of c.m. Topla (13.4 km²) decreased from 71 % to 16% of the total area mainly due to the natural (non-managed) reforestation, and forest cover increased from 11 to 69 %. The key reasons behind the reduction of agricultural land were fast changes in the demands of the industry and financial value of the forests in different periods. Since the beginning of the 19th century the income from agriculture and livestock in the research rural area decreased from 80 % to 20% of the total income by the beginning of 21st century. Inversely, the income from forestry (wood) increased from only 20% in 1827 to 80 % in 2010.

Overgrowing of the abandoned farmland and forest development in the studied region in the SE Alps in the last two centuries is the result of societal and economic development, development of and changes in forestry and timber trade, the abandonment of extensive and the promotion of intensive forms of farming and forestry. The changes of population structure and size in the studied region can also be attributed to changes in lifestyle and livelihood.

Development of urban trade and industrial centres in valleys and planes has been increasing intensively, and urban people have begun seeking relief from the stressful daily routine in the form of recreational and leisure activities in the nature, including the sensitive ecosystems of the Alps.

Today the tourism is a promising »industry« for the Alpine region but also a problem in terms of negative environmental impacts. The majority of visitors of the Alps are younger people from industrial and urban centres and can be regarded as rather poorly educated about the proper behaviour in Alpine forests. This can inattentively lead to conflicts with natural processes in the Alpine forest, as is the example of the endangered Western capercaillie, habitats of which are severely affected by the mountain tourism, especially by the use of motor vehicles or mass visits in the improper time of the year.

Based on the results of monitoring of Western capercaillie leks, at which a decrease in the number of individuals was detected in Slovenian Alps in 2010, we identified four major groups of threats to Western capercaillie and classified them according to their relative contribution expressed as a percentage of affected leks: 1st Mountain tourism (41,1%); 2nd Forestry (cutting of old forests, construction of forest roads, forest management in mating and nesting time) (25,9%); 3rd Agriculture with pasturing (dangerous wire fences) in forests and overgrowing of pastures causing deterioration of habitat suitability (e.g. availability of bilberry, herbs, ant -hills, etc.) (Čas 2006; Bollman et al. 2005; Storch 1993, 2002) in forests (20,5%) and 4th Predation at leks (12,6%) and lack of hunting for predators (especially red fox, martens, wild boars) in winter time (Čas 2010), when reduced the core of grouse populations (Sandercock et al. 2010). Because Western capercaillie is considered an indicator

species of well-preserved forest habitats and sensitive to disturbances thereof, the above listed threats probably also negatively affect forest ecosystems and their biodiversity in general, named the umbrella species (Angelstam 2004; Čas & Adamič 1998; Čas 2001b; Sachot et al. 2003; Suter et al. 2002).

By 2000 mountain tourism with its many different forms, has become the activity with the most negative impact on Western capercaillie in Slovenian Alps. Similar findings were reported for other Central European countries as well (Menóni et al. 2006; Storch 1999; Thiel et al. 2007; Thiel et al. 2008). The biggest increase of relative contribution of negative impact on lek habitats suitability in Slovenia since 1979 was identified for mass mountain tourism (motor vehicles, sledges, mountain bikes, skiing off the managed slopes, hiking, camping, gathering of forest berries, herbs and mushrooms, etc.) with an increase of 36 percentage points (p.p.) – from 5.1% in 1980 to 41.1 % in 2010. The increase in negative impact of mountain tourism on Western capercaillie was further supported by the results of ongoing surveys of mountain tourism in the Alpine research area in northern Slovenia since 1982 (Čas 1988, sub-chapter 3). The construction of forest roads at the beginning of the 1980s (Robek & Kljun, 2007), increased the accessibility of forests for mountain tourism which has been developing the most intensively, in the area between 1000 and 2000 m a.s.l. (Jeršič 1999), the core habitat area for grouse species in the Alps (Čas 1999, 2006; Storch 1999, 2007).

Agricultural activities and the changes in use of farmland ranked as the second in the term of negative impacts on Western capercaillie habitat in the Alps in the last 30 years. The general reduction in intensity of agricultural activities and the decline of the rural population (Tables 4 and 5) resulted in an increase of forest cover by overgrowing of abandoned farmland, the contribution of which to the combined negative impact on Western capercaillie habitat increased from 5.1% to 15,2% in the 1980–2010 period (Table 6; Čas 2006). Although the negative impact of the expansion of forest cover on behalf of the abandoned farmland on Western capercaillie appears counterintuitive, previous studies confirmed that forest landscape intersected by 3–5% of open land (including farmland) is the most favourable for Western capercaillie (Čas 1996, 2006; Gulič et al. 2003), considering there were no dangerous wire fences present or toxic agro-pharmaceutical agents applied (Catt et al., 1994; Čas 2010; Gačić et al. 2009; Purnat et al. 2007; Zubić 2009). Findings relating to negative impacts of agriculture on Western capercaillie habitat suitability underline the need for the adoption of a more sensitive planning of and a more sustainable management of rural landscape in the mountainous regions of Slovenia.

Forestry has a potential to dramatically affect the forest landscape, its habitat suitability and biodiversity. The results presented in this study (Table 6) showed that the negative impact of cutting of old well preserved forests on Western capercaillie decreased by 55.2 percentage points in 1980–2010 period, it however still had a reasonably high impact by affecting 16.6% of endangered leks in 2010. The negative impact of construction of forest roads became negligible in 2010 as most of these roads were constructed in 1980s and therefore do not affect the surviving Western capercaillie leks (Table 6, Figure 8). Furthermore, forest roads can have a beneficial effect on the suitability of forest habitat for Western capercaillie, particularly in managed dense mixed forest stands dominated by Norway spruce and European beech. Forest can roads provide Western capercaillie with the necessary open space and access to bilberry, insects and gastrolites (Čas 2006).

The impact of forest management in mating and nesting time increased to 9.8% in 2000 and only marginally decreased by 2010 (to 8.6%) (Table 6; Figure 8). The curbing of the impact of forest management in Western capercaillie mating and nesting time is very likely a consequence of the implementation of national policy of management of natural forests outside the mating, nesting and breeding time of wildlife animals (Regulations on the Protection of Forests, 2000). The process of forest development towards more deciduous stands and the shrinking of habitat due to the climate and vegetation change is affecting Slovenian forests (Čas & Adamič, 2007; Kutnar & Kobler 2011) and the wider European territory as well (Anić et al. 2009; Fanta, 1992; Marrachi et al. 2005; Stutzer, 2000).

The overall increase (by 10.0 percentage points) in negative impacts of predation (fox, martens, wild boar, lynx, raptors, etc.) at Western capercaillie leks in the last 30 years (Čas 2010) can be attributed to the combined effects of habitat fragmentation (Kurki et al. 2000; Storch et al. 2005), change of land use, negative consequences of nature conservation policies resulting in less intensive hunting of generalist predators in post-industrial society (Čas 2010; Angelstam et al. 2001).

The human disturbances at the southern edge of Western capercaillie distribution area and habitat suitability in combination with the impact of air pollution and climate change on forests in the region (Anić et al. 2009; Čas & Adamič 1995, 2007; Klaus et al. 1997; Kutnar & Kobler 2011) and predator pressure (Čas 2010) are detrimental for the survival of Western capercaillie (Angelstam et al., 2004; Blanco-Fontao et al. 2009; Čas 2006, 2010; Gonzales & Ena 2011; Poolo et al. 2005; Storch, 1999, 2007).

The combined findings of studies presented in this chapter have the potential to serve as important guidelines for future planning of forest and rural landscape, hunting and tourism management strategies and sustainable use of natural resources ensuring the persistence of autochthonous wildlife species, including the endangered Western capercaillie (Bajc et al. 2011; Čas & Adamič 1998; Čas 2001a, 2002, 2006, 2010; Golob & Polanšek 2009; Kutnar et al. 2005) and other grouse species.

5. Conclusion

Overgrowing of the abandoned farmland and forest development in the studied region in the SE Alps in the last two centuries is the result of societal and economic development, development of and changes in forestry and timber trade, the abandonment of extensive and the promotion of intensive forms of farming and forestry. The changes of population structure and size in the studied region can also be attributed to changes in lifestyle and livelihood. Changes in forest cover can thus be considered as a good indicator of changes of the rural lifestyle and the use of land. Demographic analysis in the SE Alpine research area of municipality Črna Na Koroškem in northern Slovenia revealed that the population structure had changed inversely in the period from 1869 to 2010. The forest cover in the research area of common region on northern slopes of Smrekovec Mt. and southern slopes of Peca Mt. in the Alpine region (104.6 km²) of Slovenia has increased since the end of the 18th century to the early 21st century from 26% to 80%. Since the beginning of the 19th century the income from agriculture and livestock in the research rural area decreased from 80% to 20% of the total income by the beginning of 21st century. Inversely, the income from forestry (wood) increased from only 20% in 1827 to 80% in 2010. Development of urban

trade and industrial centres in valleys and planes has been increasing intensively, and urban people have begun seeking relief from the stressful daily routine in the form of recreational and leisure activities in the nature, including the sensitive ecosystems of the Alps. Today the mountain tourism is a promising »industry« for the Alpine region but also a problem in terms of negative environmental impacts. This can inattentively lead to conflicts with natural processes in the Alpine forest ecosystems and landscapes, as is the example of the endangered Western capercaillie (*Tetrao urogallus* L.), habitats of which are severely affected by the mountain tourism, especially by the use of motor vehicles or mass visits in the improper time of the year. Based on the results of monitoring of Western capercaillie leks, at which a decrease in the number of individuals was detected in Slovenian Alps in 2010, we identified four major groups of threats to Western capercaillie and classified them according to their relative contribution expressed as a percentage of affected leks: 1st Mountain tourism (41,1%); 2nd Forestry (cutting of old forests, construction of forest roads, forest management in mating and nesting time) (25,9%); 3rd Agriculture with pasturing (dangerous wire fences) in forests and overgrowing of pastures causing deterioration of habitat suitability (e.g. availability of bilberry, herbs, ant-hills, etc.) in forests (20,5%) and 4th Predation at leks (12,6%) and lack of hunting for predators (especially red fox, martens, wild boars) in winter time, when reduced the core of grouse populations. Because Western capercaillie is considered an indicator species of well-preserved forest habitats and sensitive to disturbances thereof, the above listed threats probably also negatively affect forest ecosystems and their biodiversity in general, named the umbrella species.

In conclusion, the sustainable dynamic conservation of the remaining old and well preserved forests with a moderate road density and pastures combined with unaggressive and sustainable mountain tourism directed outside of the sensitive ecosystems areas is crucial for sustenance of forest habitat suitability in the mountains. Based on the results presented in this study we can assume a threat of positive correlation between the development and intensification of mountain tourism and an increase of endangerment of rare and protected forests species.

The combined findings of studies presented in this chapter have the potential to serve as important guidelines for future planning of forest and rural landscape, hunting and tourism management strategies and sustainable use of natural resources ensuring the persistence of autochthonous wildlife species, including the endangered Western capercaillie and other grouse species.

Analysis of the existing data and future monitoring of habitats of endangered forest grouse species in mating time should also include the spatial analysis of the impact of mountain tourism by type of activity as a guide for a more coordinated planning of sustainable use of mountain landscape.

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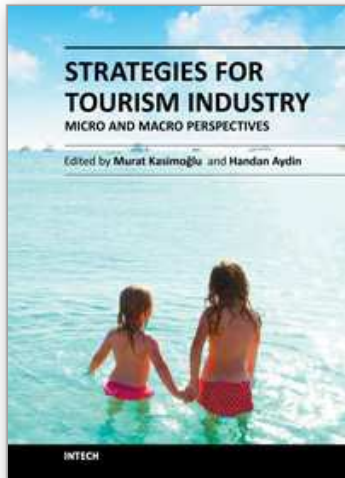
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Today, it is considered good business practice for tourism industries to support their micro and macro environment by means of strategic perspectives. This is necessary because we cannot contemplate companies existing without their environment. If companies do not involve themselves in such undertakings, they are in danger of isolating themselves from the shareholder. That, in turn, creates a problem for mobilizing new ideas and receiving feedback from their environment. In this respect, the contributions of academics from international level together with the private sector and business managers are eagerly awaited on topics and sub-topics within Strategies for Tourism Industry - Micro and Macro Perspectives.

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