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Management of Protected Areas: Comparison of Etosha (Namibia) and Krkonoše National Park

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Declaration

I declare that I have made my bachelor thesis on my own using literature and sources listed in the references.

The 25th of May 2008, Prague …….

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Abstract

The bachelor thesis is oriented on nature conservation, protected areas and their importance. It rests on comparison of the two worldwide known national parks – The Krkonoše National Park (Czech Republic) and The Etosha National Park (Namibia). The first part includes the general description of both parks, especially the information about climate, geography, plant and animal species, which are the subjects of conservation.

The main aim was to compare the nature conservation strategies. Both of the parks have long and successful tradition of conservation. The Krkonoše National Park as well as The Etosha National Park, try to combine high level of nature protection with ensuring the park accessible for tourist. Both parks support researches in any field of nature and species protection. The differences lie in the settlement and possibilities of living and resting in the park, Etosha National Park is not accessible at any time of the day and accommodation possibilities are limited. Complicated organisation structure and lack of detailed management plans makes development of the Etosha National Park more difficult. Further there is a difference in providing information to public, publishing materials about the park and its protection and in organising educational programmes. Although the Etosha National Park has made a progress in this field, the offer of the Krkonoše National Park is much wider. The financing of the parks lies in both cases mainly on government, but the possibilities of donor or other funding in the Krkonoše NP are quite broad. The Etosha National Parks is often visited place in Namibia and thanks to the fact that the park is fenced the evidence of visiting rate is easier. The Krkonoše National Park is also an attractive tourist place. Other dissimilarities results from different location of the parks, so they have to solve different problems concerning the climate and weather, as fire management in Etosha or problems with snow avalanches in Krkonoše.

Both national parks significantly contribute to better nature and species preservation.

Key worlds: national park, Etosha National Park, Krkonoše National Park, nature conservation, park management, conservation strategies

Abstrakt

Bakalářská práce je zaměřena na ochranu přírody, národní parky a jejich význam. Zabývá se porovnáním dvou celosvětově známým parků – Krkonošský národní park (Česká republika) a národní park Etosha (Namibia). První část se věnuje jejich obecnému popisu, zejména klimatu, geografii, rostlinným a živočišným druhům, které jsou předmětem ochrany v parku.

Hlavním cílem bylo porovnat strategie jednotlivých parků v ochraně přírody. Oba parky mají dlouhou v této oblasti dlouhou a úspěšnou tradici. Krkonošský národní park, stějně jako Etosha se snaží kombinovat vysoký stupeň ochrany s možnostmi přístupnosti parku pro turisty. Oba parky podporují výzkum v jakékoliv oblasti ochrany přírody. Rozdíly leží zejména v možnostech přístupu do parku a možnostech ubytování nebo trvalého bydlení v oblasti národního parku. Etosha není přístupná kdykoliv a možnosti přímého ubytování jsou omezené. Složitá organisační struktura a nedostatek detailních plánu managementu parku, činí rozvoj národního parku Etosha složitým. Dale jsou patrné rozdíly v poskytování informací pro veřejnost, v publikační činnosti a v organizování vzdělávacích programů pro širokou veřejnost. Ačkoliv i Etosha udělala v této oblasti výrazný pokrok, nabídka programů v Krkonošském NP je mnohem širší. Financování obou parků leží ve větší míře na vládních dotacích, ale možnost získat peníze od jiných donorů a organizací je u Krkonošského parku o něco větší. Etosha patří mezi nejnavštěvovanější místa v Namibii a evidence návštěvnosti je díky přesnému ohraničení snažší. I Krkonošský národní park patří mezi atraktivní turistická místa. Další rozdíly vyplývají z geografického umístění parků, proto musí parky řešit rozdílné problémy týkající se klimatu a počasí jako problematika ohně v Etosha nebo lavinová nabezpečí Krkonoš.

Oba parky významně přispívají k celosvětové ochraně přírody.

Klíčová slova: národní park, národní park Etosha, krkonošský národní park, ochrana přírody, management parků, strategie ochrany přírody

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Table of contents

1 Introduction

The influence of people on our planet is indisputable. Finding the way how to avoid devastation of the landscape and nature is necessary. The theme of nature preservation has become more and more actual these days. Our nature environment consists of great deal of different elements, such as atmosphere, hydrosphere, biosphere, complex of soils and minerals. All in all they form collection of conditions, which are essential for creation and continuation of life on the Earth. The nature environment is influenced by various stress factors resulting from increasing population rate, developing of industry, wasteful exploitation of natural resources and consumer lifestyle of humans. The purpose of nature conservation is to preserve individual components of our environment and the whole ecosystems against enormous chemical pollution and mining devastation. Further more strengthen the ability of environment to face extreme natural disasters as a result of climate changes (draughts, floods, fires, hurricanes...). Among other targets belongs reducing the rate of biological diversity loss, equal and sustainable use of benefits flowing from its components in order to increase human well-being and building balanced environment for future generations (Convention on Biological Diversity, 2002).

Conservation biology has been developed in order to preserve large-scale biodiversity on our planet. Sphere of action of this branch is wide, it cooperates with other science branches like biology, taxonomy, ecology, genetics and many other. It also derives benefit from people and institutions, which have practical experiences with breeding animals in captivity and reintroducing them into the wild. The main aims of conservation biology are monitoring, describing and including species in taxonomical classes; then understanding human impact on species, their population and the whole ecosystem and finally creating detailed plans for maintaining and increasing biodiversity (Primack *et al*., 2001).

Important is to maintain the diversity not only at the level of species, but to keep the diversity of population and ecosystems as well. Individual components (biotic and abiotic) influence each other and form complicated system of relationships. Long and intricate trophic chains are created. This must be taken into consideration when species are breed in captivity or they are introduced in new areas.

Extinction of species signifies irreversible waste of unique sequences of DNA. Wide biological diversity is important for wide genetic diversity. Large and varied population means large and varied gene pool. That declines the possibility of lethal genetic situations as genetic drift, inbreeding and outbreeding depression. Genetic variability guarantees also better

adaptability and evolutionar flexibility. Not to forfeit valuable genes (genes for adaptability, for resistance to diseases…) gene banks were established. They provide source of genes for breeding new species.

Preservation of nature and species has references to many countries all over the world. With a view to find the most effectual method of solving the environmental problems, the countries started to cooperate with each other. Individual questionable parts of nature conservation are intercepted in international agreements. After signing them, laws of the agreements become part of the juridical system of each country.

Among the most important agreements considering problems of nature conservation and species protection belong CITES, World Heritage Convention, Convention on the Conservation of European Wildlife and Natural Habitats, International Convention for the Regulation of Whaling and others.

The spin of the Czech legislation dealing with conservation of nature is the act No. 114/1992 Coll. of 19February, 1992 for nature and landscape protection. This law discuses not only the protection of endangered animal and botanical species, but also the general principles of saving their natural habitats and ecosystems as a whole. This law is replenished with the act No. 16/1997 Coll. of 22January, 1997 for import and export of endangered wildlife animals and plants. After entering the European Union the Czech Republic joins NATURA 2000 system – network of protected areas.

The important component in system of nature conservation is establishing areas with special protection, because only health and unharmed environment can ensure high biological diversity. State authorities or private organisation can proclaim these protected areas or they are founded within the cooperation among individual subjects at international level. Allowed natural resources management, system of agriculture and measure of human intervention are punctually set for each protected territory.

The International Union for Conservation of Nature and Natural Resources IUCN creates international system of protected areas (Tab.1) (IUCN, 1994):

- Category I: Strict Nature Reserve/ Wilderness Area – high level of protection, conserves nature in its wild and unharmed form, mainly for scientific purposes
- Category II: National Park – extensive areas, where one or more unique ecosystems are protected, for scientific, educational and recreational purposes
- Category III: Natural Monument – smaller areas with characteristic valuable features
- Category IV: Habitat/Species Management Area – areas with controlled management in order to keep well- functioned ecosystems

- Category V: Protected Landscape/Seascape – land or sea areas allowing undestructive management and exploitation of natural resources
- Category VI: Managed Resource Protected Area – area with sustainable production of resources, that is conformable to maintaining the biodiversity

The Czech Republic has its own system of protected areas (Tab. 2 and 3), which does not include the same categories as the classification of IUCN (Act No. 114/1992 Coll.):

- National Park – extensive areas with national or international significance, where ecosystems, animals and plants have special scientific and recreational meaning, often divided into several parts with different strategy of care, park presented in The Czech Republic are shown in Tab. 1
- Protected Landscape Area – wide areas with characteristic ecosystems, economic and recreational exploitation is acceptable, but must not be at variance with nature protection
- National Nature Reserve – smaller areas, where ecosystems are connected with unique relief, national and international significance
- National Natural Monument – small areas, where only one significant part of nature is protected
- Natural Reserve and Natural Monument – similar to the both previous, but protected areas or parts have regional value

Tab. 1 Global Number and Extent of Protected Areas (IUCN, 2003)

Category	Amount	Area (sq km)	% Proportion on Total Area Protected
Strict Nature Reserves	4,731	1 033 888	5,5
Wilderness Areas	1,302	1 015 512	5,4
National Parks	3,881	4 413 142	23,6
Natural Monuments	19,833	275 432	1,5
Habitat/Species Management Areas	27,641	3 022 515	16,1
Protected Landscape/Seascape	6,555	1 056 008	5,6
Managed Resource Protected Areas	4,123	4 377 091	23,3

Tab. 2 Review of Protected Areas in the Czech Republic (AOPK)

Category	Amount	Area (ha)	% Rate
National Parks	4	119 489,0000	1,51
Protected Landscape Areas	25	1 086 737,0000	13,77
National Naturals Reserves	112	28 714,7992	0,36
National Naturals Monuments	105	2 826,5912	0,03
Natural Reserves	785	37 546,2222	0,47
Natural Monuments	1198	27 455,9324	0,34

Tab. 3 Total Area of the National Parks in the Czech Republic (AOPK)

National Park	Area (ha)
Krkonoše National Park	36 300
České Švýcarsko National Park	7 900
Šumava National Park	69 030
Podyjí National Park	6 259

2 Aim of the thesis

The main aim of my bachelor thesis rests on pointing out the differences in conception of nature conservation. Even if the World Conservation Union (IUCN) created classification of protected areas, this kind of sorting is not common in the whole world. Conception of nature conservation is different in each country and as a result many different categories of protected areas are used. Countries choose their protective strategy with regard to the rate of nature devastation, financial potentialities and organisation abilities. Various criteria for creation of protected areas are set in variant parts of the world. Protected areas of individual countries differ also in focusing, system of management and in a rate of exploitation of resources.

On the ground of existence of several different classification dealing with protected areas I would like to compare European and African conception of nature preservation by confrontation of two national parks – Krkonoše National Park (The Czech Republic) and Etosha National Park (Namibia). The goal is not only to compare the natural condition and biological diversity of their environment but especially to find the differences in management, function and conservation priority in the parks.

3 Methodology

This bachelor thesis is conceived as a literary recherché with the aim of giving the possible best look in nature conservation conception of two different national parks (Krkonoše and Etosha).

For finding the general information about the geographical and natural conditions, weather and climatic characterization of the parks books, journals and internet servers are used. Periodical, articles and all available literature publishing by specialized workplaces of the national parks serve to seeking more detailed information about individual problems in each park. Scientific articles and databases, web-sides of international organizations dealing with nature preservation and statistics dates provided by administration of the parks or other bodies are used for deeper study of nature conservation conception and the whole management of the parks.

4 Krkonoše National Park

Brief History

Krkonoše National Park (KRNAP) was officially founded in 1963 as a first national park in the Czech Republic. Nevertheless the efforts of preserving the charming nature and valuable botanical and zoological species began much earlier. The nature was mainly endangered by tourism. In 1923 first concept of the Krkonoše national Park was made, but it was not realized (Lokvenc, 1978).

Proclaiming of KRNAP proceeded in two phases. In the first phase (1952) eight reserves with strict protective regime were established. Thanks to continuing researches, improving of legal framework and creating detailed ground plan, Krkonoše National Park could be proclaimed on 17.5.1963. The original area was 40 000 ha. As a governing organ the KRNAP Administrational was ordained.

Further important dates are the year 1978, when the KRNAP Administration became a member of IUCN. And in 1992 Krkonoše Mts. were include in the international net of biosphere reserves within UNESCO programme Man and Biosphere. In this year bilateral biosphere reserve Krkonoše/ Karkonosze was founded. The main aims are preservation of biological diversity, monitoring and research and the sustainable development of the reserve.

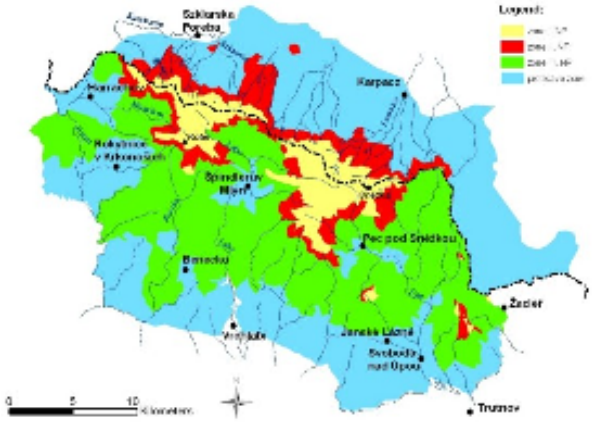
Conservation Priorities and Zoning of the National Park

According to the act No. 114/1992 Coll. of 19February, 1992 every national park in the Czech Republic is obligated to create The Plan for Maintaining. It contains conservation strategy of unique and valuable parts of the park - both short and long-term measures and targets. They are further used as a background for setting individual research projects. The Plan is created by the KRNAP Administration and it is approved by the Ministry of the Environment of the Czech Republic.

Accordingly to the Plan for Maintaining the Krkonoše National Park and the requirements for nature conservation the park is divided into four zones. They are 1st zone – strict virgin, 2nd zone – virgin controlled, 3th zone – marginal / buffer like and the last is the protective zone (Fig. 1). The first and second zones cover the most unique and most vulnerable parts of the park. To this zones belong mountain peaks, meadows with high diversity of flora, montane or sub-alpine wetlands and other significant geological or nature shapes. The area of fist and second zones also include various interesting and endangered animal and plant species (*Alcedo atthis, Luscinia svecica svecica, etc.*), glacial relicts *(Rubus chamaemorus, Sphagnum lindbergii, etc.*) or

Krkonoše endemits (*Campanula bohemica, Sorbus sudetica*, etc.). In that zones all interference action are done with regard to conservation of this valuable species and parts of the nature. The visitors there are obligated to observe the Visiting regulations (Štursa, 2003).

Fig. 1 Map showing the size and location of individual zones (Správa KRNAP, 2008 a)



4.1 Geographic characteristic

The Krkonoše Mountains are significant component of the Czech Republic. They represent the higher mountain range of our republic and they also have remarkable position in the Central Europe. They belong to Hercynian group – old non- lime European mountain formed in the Primary, 600 million years ago.

Krkonoše creates natural border between The Czech Republic and Poland. The total area is 631 sq km, 454 sq km is in the Czech part and in Poland they occupy area of 177 sq km. The high of the mountain starts with the altitude of 300 m and ends at the point of 1602m (Štursa, 2003).

The whole mountains are divided into morphological units, both on Czech and Polish side. In the Czech Republic there are two significant units –chins and saddlebows. The chins form two parallel ranges (inner and outer) and they pretend the higher parts of the mountains – Sněžka, Svorová hora, Violík, Luboch and others. The saddlebows are lower – Zadní planiny, Rýchory and Žalý (Sýkora, 1983).

4.2 Geological development and soil characteristic

Geological development of Krkonoše Mountains was long and complicated procedure going back to the Agnotozoic era. On formation of present face of Krkonoše mountains many various factors have taken place. Tectonic activity, folding, volcanic eruption, climate changing, water and wind erosion and also anthropogenic activities have given birth to unique mountain formation.

Upheaval of sea bottom in the area of Krkonoše had slowly started in the Agnotozoic era. During the first folding, sedentary rocks (sandstone, lime stone, clay shale) were transformed. In the Primary era was the area several times flooded with sea, which resulted in sedimentation of new material on metamorphosed layer. Following Hercynian folding had two phases and during this process granite massif was created. At the Tertiary time Krkonoše got roughly present shape thanks to breaking of Czech massif and lifting of individual parts. The Quaternary era was important because of the effect of glacier. The glacier withdrew approximately 10 000 years ago and following post-glacial era is characteristic mainly by wind and water erosion, snow avalanches and mountain-slide (Sýkora, 1983).

Remarkable relief forms

Interaction of individual natural elements during the geological development give a birth to various interesting relief forms. The most significant forms came from the Tertiary and Quaternary era. The main factors in Tertiary were rivers and their flows. In the Quaternary essential factor was a continental glacier, which did not cover all parts of the Krkonoše mountains but influenced the whole area in many ways (Štursa, 2003). The main forms are following:

- Glacial cirque
- Moraine
- Glacial valley – with characteristic shape U
- Glacial lakes – occur only on Polish side of the mountains, Wielki a Maly Staw
- Periglacial detritus and polygonal soils

Soil characteristic

Development of soil classes is significantly influenced by altitudinal level, geological sub-soil and by rough climate, which rule over the Krkonoše mountains. Soils are mainly poor in nutrients. The most common are brown acidic soils and podsols. In the upper parts there are alpine soils – polygonal soils, stony detritus. Around the rivers we can find soil with alluvial layer. Special soils with thickness of 3m occur near mountain wetlands and mires.

4.3 Climatic characteristic

Position of Krkonoše Mountains in the Central Europe predestines them to rough, cold and wet climate. They lie in the temperate zone with characteristic season changing. They are situated in the meeting point of huge air masss, which means frequent weather changing. Significant is also influence of Atlantic Ocean and altitude.

Measurement of individual meteorological quantities is ensured by net of observatories. Professional observatory is situated in Pec pod Sněžkou (Tab. 4). Among other observatories belong Labská bouda, Rýchorská bouda, Horní Mísečky, Harrachov. Further data are provided by automatic stations placed in the national park. Measured are basic items and also quality of water and atmosphere.

Temperature is mainly influenced by altitude, cloudiness and duration of sunlight. Average annual temperature moves between 0 to 6 Celsius degrees. The coldest month is January and the hottest is July (Štursa, 2003). Other climatic informations are shown in Tab. 5.

Remarkable share on rain and snowfalls have event called anemo-orographical system of air circulation. Circulation is influenced by relief of the mountains. Snow is deposit on leeward side of the mountains, what is also one of the several reasons of avalanches. In the sphere of the snow and avalanches many measurements and research are carried out. Snow is examined not only because of sports and tourist purposes, but also as a prevention of avalanche disasters. Historical and contemporary data are collected in avalanche register and daily predictions are provided to public.

Tab. 4 Climatological Information from Pec pod Sněžkou (Meteorological Station Pec pod Sněžkou, 2008)

Average annual temperature	4,9 °C
Average annual rainfalls	1303,1mm
Sunshine duration	1435,5 h
Max. daily temperature	31,4 °C
Min. daily temperature	-22,7 °C
Max. daily rainfalls	133,3mm

Tab. 5 Basic Facts about Climate Condition in Krkonoše Mts. (Štursa, 2003)

Average annual temperature	0-6 °C
Average annual rainfalls	800 - 1200mm
Sunshine duration	1444 - 1733 h/year
Duration of snow cover	70 - 180 days/year
Wind	mainly W, SW

4.4 Species, populations and significant ecosystems

4.4.1 Plant ecosystems

Forest ecosystem

One of the most characteristic ecosystems in the Krkonoše National Park is forest. There are several types of forests situated into different zones of the park. According to the zone suitable management is practiced. Species composition is dependent on various natural conditions (e.g. altitude, weather conditions, soil type). Four altitudinal vegetation zones are distinguished in the Krkonoše National Park:

1. Submontane – to 700 m
2. Montane – 700 – 1300m
3. Subalpine – 1300 – 1450m
4. Alpine – over 1450m

Six of total nine of forest vegetation zones can be found in Krkonoše. Structure of the species is a result of diffusion of these zones – altitudinal and forest (Vlček, 2007). The total area of the forest ecosystems is 37 000 ha.

Forests are dynamic ecosystems passing through continuous development. The forest development is significantly influenced by people. Negative consequences of improper husbandry of forests was so extensive, that Krkonoše National Park was in 1984 included in the IUCN list of most endangered national parks in the world (Schwarz, 1997).

Since 14th century consumption of wood increased rapidly. Huge amount of wood was absorbed in ore mining industry. Further more the need of agricultural land was increasingly higher, so method of clear cutting was used. For securing fluent supplies of wood material new trees were artificially planted. For planting of monoculture genetically unoriginal seeds were used (often seeds of alpine provenance) and also new species were tried to introduce (maple, birch, *etc*.).

Monocultures, genetically unoriginal composition of species, geometrical system of planting and destructive forest management together form extremely unstable ecosystem (Vlček, 2007). Devastation of forest ecosystems is caused by complex of abiotic and biotic stress factors. Among the main abiotic factors belongs immission from power stations placed in surroundings of Krkonose Mountains (the black triangl). West side of the mountains is under the immission stress since the year 1972 and the east side since the year 1959. The power stations at the west side of Krkonoše mountains (near borders with Poland and Germany) used to produced 900 kt of sulphur dioxide per year (at the end of eighties). As a harmful concentration for spruce monoculture 20 microgramme/cubic metre/ per day (annual average) is set (Schwarz, 1997). Other factors causing forest damages are wind, snow and snow avalanche, floods, physiological dehydration and late frosts. The most significant biotic factors are deer (*Cervus elaphus*) and roebuck (*Capreolus capreolus*). They cause harm mainly by browsing on samplings. Another danger is a rodent (*Microtus agrestis*), whose main part of feed in wintertime is cortex of young trees. Several times over was forests ecosystems affected by proliferating of bark beetle (*Ips typographus*). Pales weevil (*Hylobius abietis*) and gall midge (*Thecodipisis brachyntera*) are other insect species causing problems in monoculture forests. Harmful effect has also fungus pathogens living on rotten wood (Vacek *et al*., 2007).

Species composition

Unfitting species composition together with the other stress factors create ecosystem with lowered ability of self-regulation. That is why one of the most important targets of forest management is to renew original species composition (Tab. 6). To stability of forests contribute also various age and area structure. Due to the pollen analysis we know which species used to be in Krkonoše eight thousands years ago.

Examples of geographically original species in the Krkonoše mountains (Schwarz, 1997):

- *Abies alba*
- *Acer pseudoplatanus*
- *Alnus glutinosa*
- *Betula pendula, Betula carpatica, Betula pubescens*
- *Cerasus avium*
- *Fagus silvatica*
- *Fraxinus excelsior*
- *Picea excelsa*
- *Pinus mugo, Pinus silvestris*

- *Quercus petreea. Quercus rubur*
- *Salix alba, Salix caprea, Salix silesiaca*
- *Sorbus aucuparia*
- *Tilia cordata*
- *Ulmus glabra*

Tab. 6 Comparison of Contemporary and Ideal Species Composition of Krkonoše Forest (Gebas *et al*., 2004)

Species	Contemporary composition (in %)	Natural composition (in %)	Optimal composition (in %)
Abies alba	0,10	15,50	9,19
Pinus mugo	6,90	6,13	6,13
Larix decidua	0,90	0,00	0,00
Picea excelsa	86,70	49,44	49,03
Fagus silvatica	2,60	26,68	30,43
Sorbus aucuparia	2,20	1,30	2,37
other deciduous	5,40	0,90	2,85

Non-forest ecosystems

1. Montane and submontane florid meadows
2. Alpine meadows
3. Wetland and bags
4. Water-flows, river springs
5. River flood-planes
6. Tundra and "Hercynian desert"
7. Localities of endangered species

The extraordinary position of the Krkonoše mountains in Europe gives a birth to other unique and varied non-forest ecosystems. These ecosystems cover area about 12 500 ha – 23 ha in the I.zone, 37 ha in the II.zone, 3000 ha in the III.zone and 9 500 ha in the transition zone (Baláček, 2004). They form great part of Krkonoše nature and from the view of preserving biodiversity they are also very important. Management of these ecosystems results from their position in individual zones of the park and from their climatic, cultural and biological functions as well.

The main effort in ecosystems of the first zone (alpine meadows, wetlands and bags…) is restriction of human activities. They will be left untouched with dominancy of natural processes. Considerably degraded meadows of the second zone should be agriculturally used. Mainly as regularly cutting areas serving for hay production or as grazing land for cattle (strict regulation of amount per ha). Similar is preference of permanently profitable agricultural exploitation to expanding of recreational centres in the third zone of the national park. The intention of re-introduction of traditional (mainly organic) ways of farming is slow, complicated and require financial support (Baláček, 2004).

Financial aspect of reconstruction, maintaining and other interventions ensures the Ministry of Environment of the Czech Republic.

The Krkonoše Mountain contains over 1300 species of vascular plants. Among them several glacial relicts (Fig. 2), Krkonoše endemits and orchids (Štursa, 2003).

The Red List of KRNAP species

Together there are 244 of species of vascular plant, which are put on the Red List. They are in various level of threat. According to the Red List of 1966 there are: A1 (extinct) – 20, A2 (probably extinct) – 19, A3 () – 9, C1 (critically endangered) – 28, C2 (endangered) – 25, C3 (vulnerable) – 66, C4 (lower risk) – 77 species (Štursa, 2003).

Fig. 2 The Glacial Relict of Kronoše Mountains – *Rubus chamaemorus* (Krkonošský rozcestník, 2008)

4.4.2 Animals and Their Populations

The distribution of the species diversity is given by the development of the Krkonoše Mts., altitudinal vegetation zones and ecosystems, which occur in the mountains. During the time of

formation of the relief many unique and varied species developed. Among the most interesting belongs glacial relicts and endemic species.

The total amount of individual species is not known, but the monitoring and research works still continue. The amount of vertebrate species is about 320 and invertebrates more then 15 000. There are 60 mammals, 6 reptiles, 6 amphibians, 2 fishes and 250 birds in the Krkonoše National Park (Štursa, 2003).

The Red List

The Red List of extinct and endangered animal species in the Czech part of the Krkonoše Mts. was created in 1987 to inventory the threatened species in the Krkonoše region. For systematic structuring the criteria and categories of IUCN together with zoological system common for Czech literature were used. The Red List includes 566 species. From this 109 species are vertebrates. There are 72 endangered species of birds (Fig. 3), 24 mammals, 4 reptiles, 6 amphibians and 2 fishes (Tab. 7).

Invertebrates are not so good investigated and some species may not be identified. But there are 457 species put on the Red List (Vaněk, 1987).

Fig.3 The example of endangered bird species – *Luscinia svecica* (Ergis, 2008)

Tab. 7 Numbers and categories (A-extinct, C 1-critically endangered, C 2-endangered, continually decreasing, C 3-vulnerable, C 4-rare) of threatened species (Vaněk, 1987)

Pisces	2	C 3
Amphibia	6	C 2, C 3
Reptalia	4	C 3, C 4
Aves	72	A, C 1, C 2, C 3, C 4
Mammalia	57	A, C 2, C 3, C4

4.5 Management

4.5.1 Structure of KRNAP administration:

The administration of KRNAP is allowance organization established by the Ministry of Environment of the Czech Republic. At the head is a director, who is elected by the same ministry. The organization ensures fluent run of the park, strict observance of all its rules and fulfilling of targets given by the park. Further it provides informative, scientific, educational and recreational services. The administration consists of five departments – Department of Nature Conservation and Informatics, Forest Management Department, Public Relation Department, Economic Department, State Administration Department. Each of the departments works independently and focuses on different sphere of action. The departments are further divided in individual subdivision and working compartments located in the whole territory of the national park.

- Department of Nature Conservation and Informatics – creates conception for protection of individual segments of nature, carries out research and monitoring of development in ecosystems, provides expert consultancy, preserves genes ex situ or in situ, publishes KRNAP Yearbook and magazine Opera Corcontica, operates official web-side and creates informational database
- Forest Management Department – keeps in custody all forests vegetation, includes also maintaining of forest roads, buildings and water flows, cares for forest gene pool and correct functioning of forest ecosystems, then provides guarding and inspectional services, supplies equipment for visitors
- Public Relation Department – includes publishing of periodical Krkonoše - Jizerské hory, activities of network of museums (collection of historical, ethnographic and natural artefacts, local library, research and survey in local region…), educational services as excursions, lectures and study visits
- Economic Department – cares for accounting, wages, financing and investment activities
- State Administration Department – deals with actions relating Act No.114/1992 of 19 February, 1992 (fishing, nature protection, agriculture in area of national park…)

To Administration of KRNAP belong also the Advisory bodies, which have two sections – research and regional (KRNAP Yearbook, 2006).

4.5.2 Financing and economic activities

Handling with financial resources fall within the competence of KRNAP Administration. Among the main financial sources belongs The Ministry of Environment of the Czech Republic as establishing body of KRNAP Administration. Responsibilities of both sides are set by laws.

Huge part on financing have programmes setting by individual ministries. Ministry of Environment of the Czech Republic provided subsidies within Taking Care of our Landscape Programme. The aims of this programme are ensuring natural and cultural values of landscape. There are two types of applicants. Firstly protected areas – administrations of individual national parks and AOPK (Agency for Nature Conservation and Landscape Protection in the Czech Republic), which represents other types of protected areas. Further territories outside protected areas are supported. Financial contributions are provided for conservation of protected areas, wild birds areas and endangered species. Further more for building and maintaining of technical equipment, buildings, roads and other necessary objects. Important are also financial supports for implementing of traditional ways of agriculture, which helps to conserve unique ecosystems or species (Directive 2/2007).

KRNAP participates also on programme Interreg III A – this is a programme for better developing of border districts and cooperation with neighbourhood countries. Guarantee of Czech-Polish programme is Ministry for Regional Development. Financial subsidies are provided by ERDF. Programme focuses on development, modernization and reconstruction of infrastructure, agro-technical precaution for prevention of floods, soil erosion and other activities serving for nature protection. Development of tourism and cultural actions are also supported (MMR, 2004). For example within this programme, information materials, booklets, guidebooks, CD and DVD material both in Czech and Polish language were printed.

Major subventions from Ministry of Agriculture of the Czech Republic can obtain farmers managing in the area of national park and also in areas of NATURA 2000. Programme Horizontal Plan for Rural Development supports agriculture in less favourable areas (LFA) and agro-environmental activities.

New opportunities are offered with entering new period 2007-2013. EAFRD – European Fund for Rural Development provides financial subsidies for rural development of all European Union countries. Condition and rules for obtaining subsidies are specified in two documents, The National Strategic Rural Development Plan and Rural Development Plan for the period 2007-2013.

KRNAP Administration can also utilize income resulting from tourist using of the park and selling magazines and other products of the park.

Total evaluation of financial managing provides KRNAP Administration in its Yearbooks, which are available on web-sides.

4.5.3 Services

4.5.3.1 Routes, footpaths and tourist facilities

Expansion and development of all services offered in the mountains started with its more frequent recreational using. First records about summer hiking came from 16th century. Walking and wandering became much more popular in 18th under the influence of romanticism. Making all interesting places accessible required expansion of footpaths. First two known routes across Krkonoše mountains were Silesian and Czech routes, serving mainly for business purposes. Building of other routes and paths was necessary for wood transporting, hunting and food supplying (Lokvenc, 1978). Major initiators of improvement of roads were highlanders, owners of local farmhouses and individual clubs (Czech Tourist Club). In the year 1905 there were about 100 km of tourist routes.

Nowadays there are more than 700 km of tourist routes and paths thought all zones of the park. In the I. and II. zone it is prohibited to walk outside the routes. Visitors can also use educational routes, which lead through the most wonderful places of Krkonoše Mountains and they are equip with information boards. Huge demand for mountain cycling give a birth to 27 cycling routes in the national park (500 km) with one educational route. They are placed mainly in the third zone of the park. For transporting bikes to upper parts visitors can use lifts or buses.

Tourist routes are marked with bars, classic symbols of Czech Tourist Club (red, blue, yellow, green) and with symbols of chalets, peaks and other nature dominants.

4.5.3.2 Tourist Guards and Wardens

The field and Guard Service

For closer communication with visitors and for maintaining the park in good condition The Field and Guard Service started its activity in the 1970‘s. The area of the park is divided into three sections – Špindlerův Mlýn, Pec pod Sněžkou, Harrachov. These three sections further consist of individual departments (17). Every department has its own guard, who is responsible for its fluent operation.

Each section has its own building, which is at the same time an information centre for tourists. The employees are divided in those who work inside the centre and provide the information or advices for visitors and those, who are in the terrain – guards and road-menders. The centres provide not only necessary information but also sell maps, publications about KRNAP and souvenirs. In the Špindlerův Mlýn there is special exposition dealing with nature

and history of this region. And the building is also equipped with audiovisual room for arranging conferences or lectures (Dvořák, 2006a). Similar possibilities provide also the two remaining centres.

Into the competence of The Field and Guard Service belong maintaining of roads, information desks, benches and other field equipment, then watching and monitoring of animal and plant populations. They also supervise whether the visitors keep the rules of the park and they can also punish offences. The amount of light offences in the year 2006 was more than 1 800 and the fines given by the guards reach almost 21 000 Czech crowns (KRNAP Yearbook, 2006).

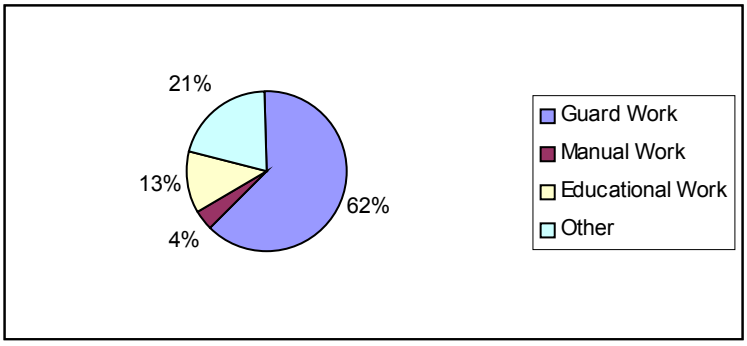
Voluntary Ranger Service

Beside the professional guards there is The Voluntary Ranger Service. The voluntary guards have the same duties and responsibilities as the professionals (Fig. 4). They mostly work together and contribute to better services for visitors (Dvořák, 2006b).

The guards of the Krkonoše National Park are mostly the members of the professional non-governmental organization - Nature Guard Association of the Czech Republic's Protected Areas. Within this organisation the training and lecturing of guards is ensured.

During the main season there are Field Information Centres on the main roads in the park.

Fig. 4 Share of the voluntary services on the work of Field and Guard Services (KRNAP Yearbook, 2006)



Junior Ranger Project

The Krkonoše National Park cooperates with the Europark Federation, what is a non-governmental organisation gathering more then 400 protected areas across the Europe. It was founded with the view of improving the cooperation among the parks, to interchange the skills and information and to improve the management of protected areas. This organisation provides

several projects and one of them is also The Junior Ranger Project (JRP) and its continuation The JRP Follow-Up. It is held to educate the youth, to support their awareness of endangered nature, to bring up potential specialists and to motivate them to ensure sustainable development of tourism and use of natural resources (Hotham, 2003). Individual actions are carried out not only in the Krkonoše National Park but also in the other European Park, where can youngsters change their experiences and improve their language skills.

4.5.3.3 Accommodation Possibilities and Settlement

The Krkonoše National Park is a popular tourist destination both in winter and summer. According to the Czech legal enactment living and resting in the national park is not forbidden, so during the time many resorts and accommodation possibilities have grown up.

With the development of tourism and winter sports in the mountains the characteristic mountain chalets were used for overnight visitors. Today there are various types of accommodation, from hotels and pensions to mountain cottages or chalets.

Visiting rate of the Krkonoše Mts. is not negligible. Mainly in the winter visitors from different part of Czech Republic and also from other countries come to enjoy skiing. The developing of tourism together with continuously higher demand of visitors force operators of ski centres to expanse.

According to the Act No. 114/1992 Coll. the new buildings must fit with its surrounding and must not devastate the nature or extremely change its character. Frequently are overbuilt places with unique items and the wild face of nature is slowly disappearing. New buildings should respect the characteristic architecture style, which is typical for the mountain areas (solitary building, two-storey houses…). Majority of new-built houses are used only seasonally and compete with local citizen in hiring their flats for tourists. It is necessary to reach a compromise between the expanding of tourist centres and nature protection. One trend is to reduce the influence of tourism on the nature by building the tourist background under the hills. The mountain peaks will provide only the most necessary facilities and the amount of ski slopes will be not increased (KRNAP Administration, 2007).

4.5.3.4 Museums, Exhibitions and Publication Activity

Under the KPNAP Administration several museums and exhibitions are operated. The employees of the park and local citizens try to preserve not only the nature but also the historical and cultural individuality of the mountain region.

The tourists can visit museum in Vrchlabí where is also the library of the Krkonoše National Park. The history of the library came back to 1884 and since 1966 the library is managed by the

KRNAP Administration. The library consists of more then 34 000 of different types of documents and every year about 300 new materials are filed. The library contains books, magazines, journals and scientific articles dealing with the different themes about Krkonoše Mts. and the national park. The significant materials are books and magazines from 19th century (Dvořák, 2006c). In the museum there is also ecological exposition "Stone and Life" and historical exposition "Man and Mountains".

The other expositions are in Jilemnice, Paseky nad Jizerou, Vysoká nad Jizerou, Žacléř and other. The museums are situated either on the Polish side of the mountains. Exhibitions familiarize the visitors with nature, its significance and the need of its protection. Further with the development of skiing, with arts and crafts in the mountains, architecture and with famous personalities of the Krkonoše region.

The KRNAP Administration edits information brochures dealing with various problems of Krkonoše National Park. Every month there is a periodical journal Krkonoše –Jizerské hory. Scientific and research works are published annually under the name Opera Corcontica. For children, youth and also for teachers there is Andromeda Magazine. And also ornithological newsletter Prunella is published.

4.5.4 Forestry

Since 1994 all forests of Krkonoše Mountains are under the care of Forest Management Department of KRNAP Administration. The head of the department is a deputy director, who is responsible to the director of KRNAP administration. The department is further more divided into four divisions. Forest administrations (Rokytnice, Harrachov, Rezek, Špindlerův Mlýn, Vrchlabí, Černý Důl, Pec pod Sněžkou, Maršov, Svoboda n.Úpou) take care for individual part of forest falling within their competence (Správa KRNAP, 2008 b).

For better concretisation of target of forest management Forest Economic Plan is created.

Main targets (Gebas *et al*., 2004):

- Saving of biodiversity at the level of ecosystems and species and also keep diversity of animals by leaving old trees or trees suitable for nesting and breeding in the forest
- Saving of rare species (gene bank)
- Return of forest ecosystems in their primary form, increase the amount of deciduous trees and also genus *Abies*, decrease of spruce monoculture
- Create stable ecosystems, which are able to resist the pests, immission and natural conditions, ecosystems with high level of self-regulation

- Decrease the acidification of the soil, increase the microbiological activity in the soil, improve the circulation of organic and inorganic elements
- Ensure genetically appropriate propagation material
- Forestation can not influence other ecosystems
- Preference of non-productive functions of forest

I. zone – minimisation of human interventions, only interventions connecting with reconstruction and biodiversity protection, sequential reduction of geographically and genetically non-original species (full-area clear cutting prohibited), wood mining forbidden – necrotic wood left in the forest, maintaining of contemporary infrastructure, new roads and paths are not built

II. zone – well-judged and soft interventions leading to the same management as in I. zone, effort of consolidation with some parts of I. zone

III. zone – sustainable forest management with low economical effect, net of selected botanical localities – rare and valued species and representative flora

4.5.5 Science and Research within the Park

The exploration of the Krkonoše Mts. started about five hundred years ago. Firstly the notes about mineral richness appear. Among the important personalities, who were engaged in the research in the Krkonoše region belong I. P. A. Mattioli, K. Schwenckfelt. Research works continued in the 18th century with the scientific expedition of T. Haenke, J. Jirásek, T. Gruber and F. J: Gerstner. To comprehensive knowledge of the Krkonoše Mts. and all its components contributed many others (Sýkora, 1983).

Krkonoše Mts. belongs among the most explored ranges in the Europe. The research work falls into the competence of The Department of Nature Conservation and Informatics. This department also operates the database of all researches carried out in the park. The results of the research works and also graduation or dissertation thesis are stored and eventually published. In the year 1996 there were 156 research projects concerning different problems of the KRNAP. 25 in zoology, 71 in botany 39 in geology, 12 geomorphology, 12 pedology and other dealing with history and agriculture (KRNAP Yearbook, 2006).

During the existence of the Krkonoše National Park many interesting books and articles were published. Together there are about 5 500 pieces of scientific literature (Štursa, 2003).

Examples of Forest Researches Carried Out in the Park

Major attention pays KRNAP administration to research in the sphere of saving and reconstruction of forest ecosystems. The filling of scientific researches carried out in Krkonoše national Park is firstly monitoring of the forest areas, than categorization of the area according the rate of damage. The research result provides useful information while suitable management for individual forest areas is chosen.

From the year 1992 to 2000 participated on recovery project Dutch foundation FACE – Forest Absorbing Carbondioxide Emission. The organisation was founded with a view to restrict the green house effect by protecting forest. Thanks to this organisation 5000 ha of forest was reconstructed with using modern method and technologies.

Within the international projects KRNAP takes place in ICP forest programme – International Co-operative Programme on Assessment and Monitoring of Air Pollution Effect on Forests. This organisation practises systematic observation of forest condition across Europe. There are two levels of monitoring. Level I (plots of 16x16 km) – 2 in KRNAP and Level II (select ecosystems of Europe) – 1 in KRNAP.

Frequently KRNAP Administration cooperates with Forestry and Game Management Research Institute Jiloviště – Strnady – Forest Research Station Opočno. Projects are focused on forest ecology, tree planting in changing conditions, chemical analysis of concentrations of harmful gasses, soil conditions and monitoring of rate of damage caused by both biotic and abiotic factors. Examples of contemporary projects (since 2004):

- Stabilization of the Forest functions in biotopes disturbed by anthropogenic activity under changing ecological conditions
- Complex analysis of long-term changes of the tundra in Krkonoše Mts. – Development of dwarf-pine stands reproduction in various environmental conditions, study of structure and development of native dwarf pine stands populations with various space and age structures

Within the research of Forest Management Department there are nowadays two practically oriented projects (since 2005):

- VaV/610/8/01 – dealing with measuring of atmosphere deposition and their critical amount for forest ecosystems, possibilities of planting deciduous trees
- VaV/620/06/03 – dealing with categorisation of forest ecosystems according the possibility of minimal intervention, creation of individual zones corresponding with management categories of national parks according IUCN

On financing of research projects aimed at health and development of forest ecosystem participated KRNAP Administration, FACE foundation, Ministry of Agriculture of the Czech Republic, Ministry of the Environment of the Czech Republic.

Examples of Zoological Researches Carried Out in the Park

Grant GA ČR č. 310/06/1546 – Experimental Verification of Changes in Altitude Spreading of Tick (*Ixodes Ricinus*) and the Risks of Transmitted Infections by It into the Mountain Ecosystems

Monitoring Abundance of Bats

Monitoring Abundance of Small Mammals

Examples of Plant Researches Carried Out in the Park

Monitoring of Geographically Unoriginal Vegetation Species (*Reynoutria* and *Rumex*)

GPS Monitoring of *Dactylorhiza sambucina* in Sklenářovice

Mapping, Inventory and Preservation of Old Fruit Trees in the Krkonoše

Seed Bank of Threatened Species

Examples of Researches in Other Fields

Detailed monitoring of Snow Conditions

Evaluation of Current Level of Ski Slopes

Monitoring Avalanches and Snow Conditions

Measuring Amount of Snow

The complex Analyses of Long-term Changes in the Giant Mountains Tundra

Project on Tourism in the Krkonoše Mounatins

On the research projects carried out in the park many different institutions and organizations participate, for example The Ministry of Environment of the Czech Republic, The State Health Institute, The Academy of Sciences of the Czech Republic, Institute for Environmental Studies UK and many others.

4.5.6 Tourism and Visit Rate

The area of the Krkonoše Mountain and at the same time The Krkonoše National Park are frequently visited area with the balanced visiting rate both in winter and summer.

To the high visiting rate also contributes the fact that the towns and villages form the community – The Community of Towns and Villages and together support the development of the Krkonoše region. They create the Programme for Development of the Tourism in the Krkonoše Region. The main goals are to attract more visitors through providing better services

for them. They also focus on improving of infrastructure (both internal and external) and increasing the offer of different programmes and services. Important is also improving of information services given in individual tourist centres. Great emphasis is put on developing of tourism, which is in harmony with the nature conservation (SMO, 2006).

The average annually visiting rate of tourist region Krkonoše is 6 million tourists. Among the most visited towns belong Pec pod Sněžkou, Vrchlabí and Špindlerův Mlýn.

Monitoring of tourist stress and its influence on the nature is watched in the park, but set the exact number of visitors in the park is not easy. The statement of amount of visitors are gained by recording of people passed through chosen place, evidence of tourists transported by cable railway or by installing automatic counting devices. The park is attractive both for Czech and foreign tourists (Fig. 5 and 6).

Fig. 5 Percentage share of nationalities on visiting rate in summer 2006 (SMO, 2008)

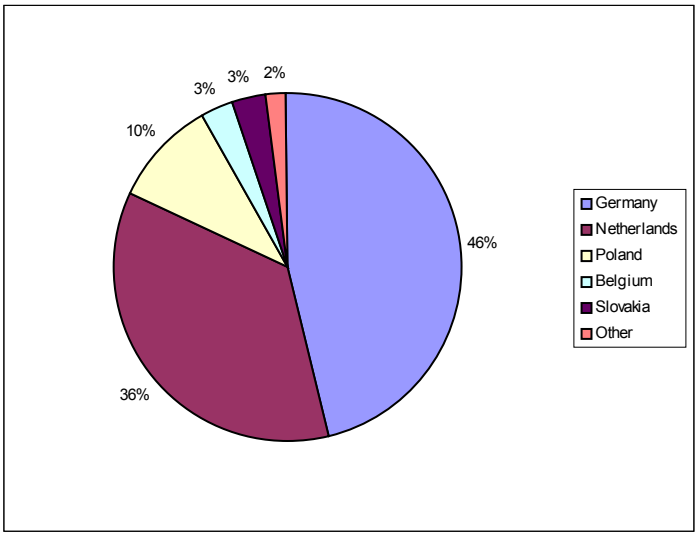
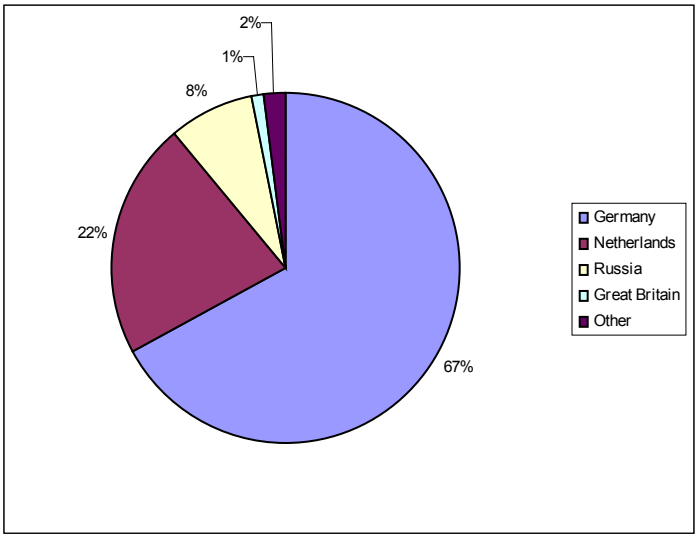


Fig. 6 Percentage share of nationalities on visiting rate in winter 2006/2007 (SMO, 2008)



5 Etosha National Park

Etosha National Park is situated in Namibia in the South West Africa (Fig. 7). The west side of the country is washed with the Atlantic Ocean, on the north it borders with Angola and Zambia. The east and south neighbouring countries are Botswana and Republic of South Africa. Etosha National Park lies about 400 km north of the capital city Windhoek and it is not far from the border with Angola.

Fig. 7 Map of Namibia – The yellow point shows the location of Etosha (Safarimappers, 2007)

Brief History

First mention of Etosha and its glamorous nature came from 1851 when two scientists visited the eastern part and described their experiences in the book The Narrative of an Explorer in Tropical Africa. Etosha Game Park was established in 1907 by the German government, especially the Governor Friedrich von Lindequist. Together with Etosha two other game reserves were proclaimed – Grootfontein and Namib Desert (Hocking, 1990). With its area of 93 240 square km it was the largest national park of the word, but only until 1975. Later the park underwent some size reduction and presently it occupies 22 912 square km. It was officially proclaimed as Etosha National Park in 1958 (UNEP-WCMC, 2008).

5.1 Geographic Characteristic

The Republic of Namibia is composed of Namib desert in the west coastal part of the country, Kalahari desert in the central part and mostly of high plateaus. The most outstanding component of the Etosha National Park is the Etosha Pan. It is a vast endorheic basin, which covers the area of 4 760 square km (the fifth of the park). The pan is up to 129 km long and 72 km (Hocking, 1990) wide and it has North- East to South- West orientation.

Etosha Pan lies on the Owambo basin. And they are together a part of greater Kalahari basin, which interferes also other states as Congo, Gabon and Zimbabwe. The drainage system of the Etosha Pan is ensuring mainly from the northeast side by Cuvelai System of rivers (Cuvelai, Caundo…).

5.2 Geological Development and Soil Characteristic

There are several theories about development of the Etosha Pan and one of them expected that Etosha used to be a perennial lake. But under climatic changing during geological development and related changing in water feeding led to evaporation. The main minerals in the pan are dolomites, limestone, siltstone, quartzite and gneiss (Hipondoka, 2005).

Nowadays the pan provides water only occasionally. The springs and seepages are located prevailingly on the south side of the pan. The water- holes and shallow depressions are filled with water mainly from November when the rainy season begins.

Eight soil types are identified in the Etosha National Park. They are mainly shallow with pH from slightly acid to alkaline. Solonchaks and solonetz occur in the Etosha Pan. North part composes of arenosols, regosols and calcisols. South part is created of leptosols and vertisols (Hipondoka, 2005).

5.3 Climatic characteristic

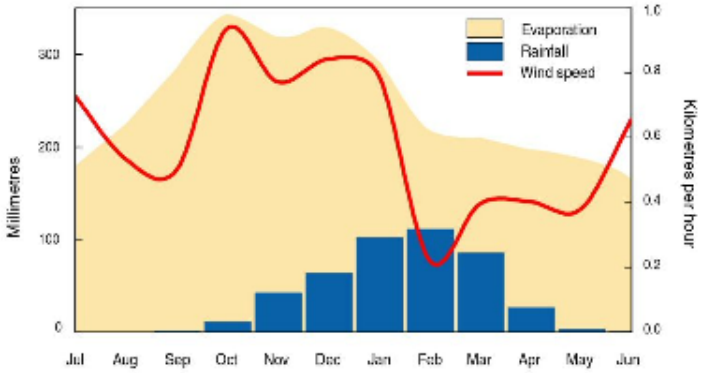
Climate in North- Central Africa, where Etosha lies is semi-arid. There are three characteristic seasons during the year. Four months are cold and dry, four are hot and dry and the last four are hot but also wet.

Limiting factor not only for agriculture but also for life in the parks is rainfall and its distribution. It differs a lot in its amount and timing. Most of the rainfalls occur from November to April when the temperature is highest (MET, 2008 a). Eastern parts gets high amount of water

than western parts. The average annual rainfall moves between 300 and 500 mm (UNEP-WCMC, 2008). Compared to this, potential evaporation is estimated to 2600 – 2800 mm (Fig. 8).

Temperature varies from 35 Celsius degrees in the summer to temperatures bellow zero. December and January are mostly the hottest months of the year while coldest weather is in the June and July (Hipondoka, 2005).

Fig. 8 Average Evaporation Rate at Mahane and Winspeed and Rainfall at Ondangwa (MET, 2008)



5.4 Species and ecosystems in the park

5.4.1 Fauna

Etosha National Park is rich in animal species and there are also many endemic or endangered species. Etosha attracts visitors mainly by high concentration of big mammals (Fig. 9 and 10) and various birds, which can be seen near the waterholes throughout the park. There are about 114 mammal, 110 reptile and 380 bird species located in the park (Nafidi, 2007). Further there can be found 16 amphibian species and also one fresh water fish (UNEP-WCMC, 2008).

History of conservation

In the Etosha National Park threatened species are successfully conserved during the hundred year of the park existence. Among them belong lions (*Panthera leo*), elephants (*Loxodonta africana*), black and white rhinos (*Diceros bicornis, Ceratotherium simum*), giraffes (*Giraffa camelopardalis*), endemic black-faced impala (*Aepyceros melampus petersi*) and others. These animals used to be extinct or nearly extinct, but nowadays their amount increase rapidly. There are about 2 400 elephants in the park, newly were reintroduced rhinos species and black-faced impala. Lion population recovered from hard disease, which affected lions throughout the South Africa (MET, 2007).

Fig. 9 The endemic black-faced impalas (*Aepyceros melampus petersi*) drinking from the waterhole (NWR, 2007)

Fig. 10 Black rhino (*Diceros bicornis*) – example of successful conservation in Etosha National Park (WWF, 2008)

Significant Species

Around the waterholes there can be found various ungulates species as Burchell's zebra (*Equus burchelli*), Hartmann's mountain zebra (*Equus zebra hartmannae*), blue wildebeest (*Connochaetus taurinus*), hartebeest (*Alcelaphus buselaphus*), springbok (*Antidorcas marsupialis*), kudu (*Tragelaphus strepsiceros*), eland (*Taurotragus oryx*), roan antelope (*Hippotragus equinus*), gemsbok (*Oryx gazella*), damara dik-dik (*Madoqua kirki*) and many others.

Further there are important predators such as lions (*Panthera leo*), cheetah (*Acinonyx jubatus*) (Fig. 11), leopard (*Panthera pardus*), brown and spotted hyenas (*Hyaena brunnea, Crocuta crocuta*), black-backed jackal (*Otocyon megalotis*) and so on. The park is also rich in bird species, they can be seen mainly when the water holes are filled. There are ostriches (*Struthio camelus*), pelicans (*Pelecanus onocrotalus*), both greater and lesser flamingos (*Phoenicopterus rubber and minor*), hornbills (genus *Tockus*), weaver (*Philetairus socius*) and red-eyed bulbul (*Pycnonotus nigricans*) etc. (WWF, 2001). The representatives of reptiles are for

example African python (*Python sebae*), dwarf python (*P. anchietas*), southern bird snake (*Thelotornis capensis*), leopard tortoise (*Geochelone pardalis*), star tortoise (*Psammabates oculipes*) and Etosha agama (*Agama etoshae*) (UNEP-WCMC, 2008). All species, herbivores, carnivores and their predators create together with the local flora sensitive ecosystem with different links. This mechanism maintains the dynamic balance among the individual populations.

Fig. 11 The two Etosha's cheetah (*Acinonyx jubatus*) in the savannah (The Cardboard box travel shop, 2008)

The Red List of Threatened Species

According to the IUCN there are nine categories for evaluating threatened species- extinct, extinct in the wild, critically endangered, endangered, vulnerable, near threatened, least concern, data deficient and not evaluated. The examples of significant species that occur in the Etosha National Park are shown in Tab. 8.

Tab. 8 Examples of threatened specie according to the IUCN Red List (IUCN, 2007)

Critically endangered	Black rhino
Vulnerable	Lion, cheetah, elephant
Conservation dependant	Spotted hyena, kudu, roan antelope, springbok
Near threatened	White rhino, brown hyena, lesser flamingo
Least concerned	Burchell's zebra, leopard, damara dik-dik

5.4.2 Flora

The vegetation of Etosha National Park differs from savannah vegetation and grassland to woodland parts. Several types of vegetation are distinguished in the park. They are grassland, steppe, grass savannah, shrub savannah, low-tree savannah and high-tree savannah. The Etosha vegetation must adapt to the low rainfall and its irregular distribution. In the dry period when the pan and water holes dry out, a salty layer remains, so huge part of the vegetation is halophytic.

The grass vegetation provides a grazing for large herbivores during the whole year. In the dry season the pasture is not so rich but there are still perennial grass species. Among the most significant belong: *Cynodon dactylon, Eragrostis micrantha, Chloris virgata*.

Far from the pan there are shrub and tree savannah. The dominant tree species is mopane *(Colophospermum mopane*) (Fig. 12). This tree disposes of high quality wood and in some parts of Namibia is intensively mind. Further there are species of genus *Acacia, Sporobolus, Suaeda*, *Salsola, Terminalia, Moringa, Euphorbia and Commiphora* (FAO, 1984).

Fig. 12 The typical tree of Etosha's vegetation *Colophospermum mopane* (Aubray, 2004)

5.5 Nature Conservation in Namibia

The need of conservation unique and valuable species of animals and plants leads to creating vast area with special protection regime. There are 21 parks and nature reserves in the Namibia proclaimed under the Nature Conservation Ordinance (No 4 of 1975). This Ordinance was adjusted in 1996 as the Act 5 of 1996. The area protected in Namibia creates 14% of total area of the country.

The protected areas are divided into several groups, what is a result of land tenure system. There are protected areas under the tenure of state, then private owned nature reserves (148) and communal area conservancies (MET, 2000).

5.6 Management

5.6.1 Institutional and Legal Framework of Protected Areas

The covering body of nature conservation in Namibia is The Ministry of Environment and Tourism (MET), which was established in 1990. The Headquarter of this Ministry is in the capital city Windhoek and at the head there is the Minister together with The Deputy Minister and Permanent Secretariat.

Part of the Ministry is The Department of Natural Resource Management (Fig. 13). Within this department there are three Directorates included:

- Directorate of Parks and Wildlife Management
- Directorate of Scientific Services
- Directorate of Forestry

Further MET includes Directorate of Environmental Affairs, Directorate of Tourism and Directorate of Administrative and Support Services.

Directorate of Parks and Wildlife Management is further divided into two Divisions – Park Division and Wildlife Management Division. The Park Division includes four Subdivisions, which are controlled by Chief Control Warden.

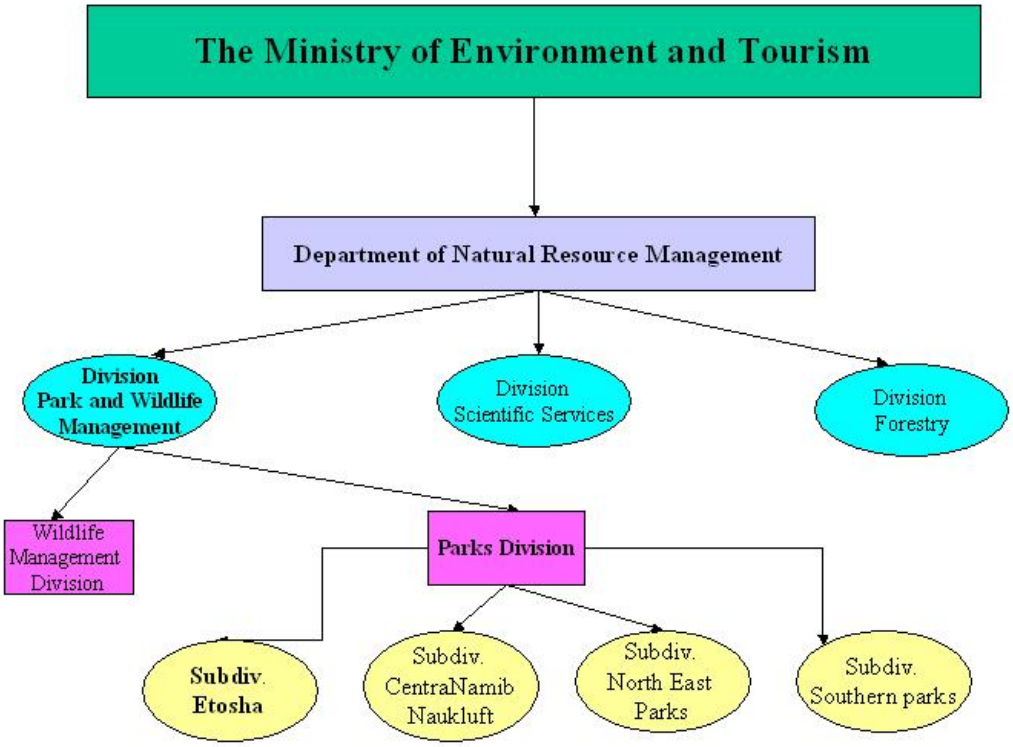
- Subdivision Etosha
- Subdivision Central/Namib Naukluft
- Subdivision North East Parks
- Subdivision Southern Parks

Etosha Subdivision

Etosha Subdivision includes Etosha National Park and the Skeleton National Park. For these two parts a Chief Control Warden is responsible. Etosha National Park consists of two sections – West and East. Each section has its own Chief Warden. Together there are seven Wardens in the both parts of the park and each Warden has a group of rangers and assistants.

Otherwise there are deputies of other directorates of MET presented in the park. Etosha Ecological Institute operates in the park, for tourism and its matters is responsible Namibian Wildlife Resort and all together it creates really complicated structure (Booth, 2004)

Fig. 13 The institutional framework of protected areas in Namibia (Booth, 2004)



5.6.2 Fire management

Fire is natural phenomenon that occurs throughout Namibia. Although it has its own essential ecological effect, the area burnt every year is wide as in 1997, when about three million hectares have been burnt (Trigg and le Roux, 2001). In 1981 a strategy of controlled fire was accepted. The beneficial effect of fire lies in removing of moribund grass, recycling of nutrients and supporting the natural cycle among large herbivores, their predators and grass and shrub vegetation in the park. The park is divided into 25 blocks, which are burnt one after another with the frequency as a natural fire occurs. Fire maps and statistics are created to provide sufficient information for choosing the best fire strategy for individual blocks of the park.

The fire data are provided by AVHRR (Advanced Very High Resolution Radiometer) and are evaluated by Etosha Ecological Institute within the Etosha National Parks Fire and

Vegetation Management Programme (Roy *et al.,* 2005). Formally the fire strategy in Etosha National Park is managed by the Directorate of Resource Management of MET.

5.6.3 Financing of Protected Areas

National parks and all protected areas have indisputable importance for the whole country. The national parks have both ecologic and economic influence on Namibia and its economy. Protected areas take huge part on Namibian tourist industry and they have a high potential to support the development of the country.

But the value of the parks is often underestimated and the financial support for the parks is insufficient. Without financial sources parks cannot increase its attraction, provide better service or extent its research activities. Within the Strengthening the Protected Area Network in Namibia the financing plan is going to be prepared.

Government is the large source of funding the protected areas. But only 40 % of requested grants are positively handled, although the most of direct revenues generated by the parks go to Government. Donor funding directed to national parks is not high and it is obvious that it must be made more attractive.

Main part of parks revenues comes from entering fees and accommodation. The fees are often lower then they could be. Visitors are willing to pay more for visiting the park. Several studies concerning the WTP (willingness to pay) were carried out and the results are rather positive. The WTP for visiting Etosha increase during 1997 – 2002 from 16 to 34 dollars (the current fee was 15). It shows that the fees must be set on the basis of serious investigation of current demand (Turpie *et al.*, 2005).

5.6.4 Services

5.6.4.1 Accommodation possibilities

The area of Etosha National Park is fully fenced and it is also equipped with firebreaks. According to the Nature Conservation Ordinance, 1975 (No. 4 of 1975) no person shall enter or reside in a game park without the written permission of Executive Committee. The purpose of visiting Etosha must be health, study or recreational. Further business or and other activities are allowed on special permission. For park visitors there are only three possibilities to stay directly in the park. But on the other hand the park is easily accessible and the accommodation in the nearby of the park is ensured.

Visitors can enter the park through three main gates – Von Lindequist Gate, Adoni Gate and Andersson Gate. The three gates lead to the three rest camps provided by Etosha. Namutoni lies in the east, Okaukuejo in the west and between these two Halali rest camp is situated (Fig. 14).

At the end of 19th century Okaukuejo and Namutoni was under the occupation of German troops. Near the Namutoni spring there used to be a fort, which was later reconstructed and Namutoni rest camp came into existence in 1957. Okaukuejo was founded as a rest camp in 1955. Halali is the youngest tourist rest camp, which was set in 1967 (NWR, 2007).

Okaukuejo offers different chalets or double rooms, which are fully equipped. The main attraction of this camp is its location near permanent water holes, which provide spectacular view also in the night. The camp further provides bar, kiosk, shop and swimming pool.

Namutoni (Fig. 15) provides double rooms and bush chalets. Manutoni has its own character thanks to the old fort, which is a national monument. There is also an elevated walkway around the waterhole. Shops, restaurants, bars and swimming pool are also presented.

In the last camp Halali there are similar accommodation facilities as in the previous cases. It differs in the location of waterholes. The waterholes are not directly in the camp and visitors must walk toward them. This fact ensures less noisy and undisturbed conditions for the animals and also better experience for tourists.

All three camps are under the direction of Namibian Wildlife Resort and they underwent several reconstructions and now they provide comfortable accommodation and wide range of services (NWR, 2007).

Enter fees are the main source of financial revenues to Government.

Fig. 14 Location of the gates and rest camps in Etosha (Rhino Africa Safaris, 2008)

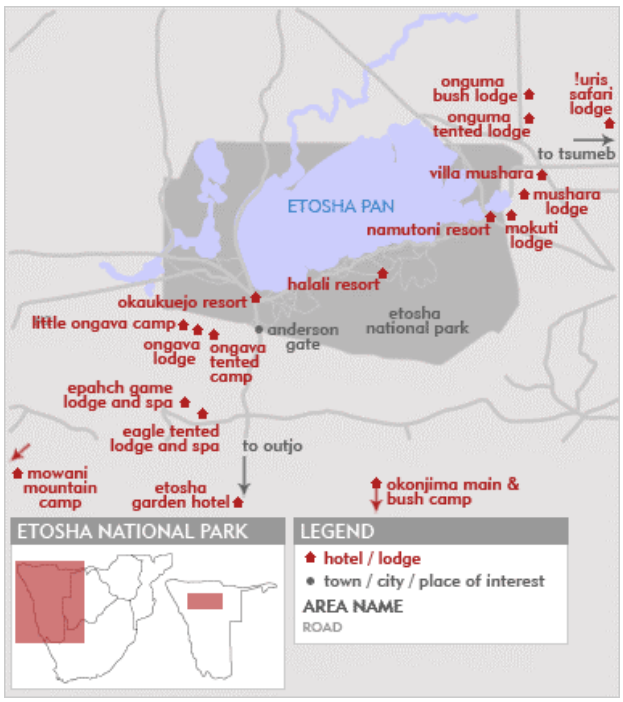


Fig. 15 Namutoni rest camp (Namibian travel net, 2008)

5.6.4.2 Routes and Tourist Possibilities

The park is accessible through the three gates. To the park lead two national roads B1 and C38. C38 is the main road to Etosha. The park has system of roads that linkage the main rest camps with the water holes. The roads leading from Okaukuejo to Namutoni contour the white pan and provide wonderful view. In the pan itself driving is not allowed. The roads are mainly gravel but they are kept in good condition. Maintaining and improving of infrastructure in the park is important point of the management plan of MET. Financial support is ensured by Game Products Trust Fund within the preparation for Etosha centenary celebrations. Some roads will be re-gravelled, limit speed will be lowered to 50 km/h and its observance will be watched by radar. Hides for parking the cars will be built, road signs, fences and other equipment will be upgrade (MET, 2007).

The only way how to travel through the park is in car or minibus. You can hire a car directly in the park. Cycling, walking, hiking and motorcycling are disallowed. The offer of services includes either car hiring and driving on your own or guided tours in buses. The floodlit waterholes allows even night safari.

5.6.5 Tourism and Visit Rate

Namibian nature and wildlife attract every year many tourist and visitors from the whole world. Tourism become an essential part of Namibian economy and provides benefits to the both sides, to country and also to visitor. So-called nature-based tourism includes wide range of activities in undisturbed nature and Namibia provides a great opportunity for it. Among the most favourite leisure activities according to visitors belong game viewing (45%), landscape touring (50%), trekking and bird watching. On the other hand hunting is now of less importance (4%) (Turpie *et al*., 2004).

In 1992 the Tourism Plan was created and tourism was considered as a priority sector with a huge development potential. Later in 1994 The White Paper on Tourism was approved. This

document contains detailed tourist strategy and main its goals. The tourism takes part on national income, provides revenues to government and also generates new labour opportunities for local people. For dealing with tourist matters The Namibian Wildlife Resort (NWR) was established.

According to the statistics 2003 Etosha National Park was fourth most visited place in Namibia. Visitors are not only foreigners, but Etosha is also the final destination for Africans. In 1999 the Namibian residents created 37% of all visitors. Next year it slightly decreases to 20% (Turpie *et al*., 2004). The data are provided by statistics of NWR, which register over-nigh visitors. Other information is obtained from entrance book of two main gates (Anderson and von Lindequist Gates). NWR mention that in 1955 there were about 6 210 visitors in the park and in 2005 it was about 165 000 (Tab. 9).

Tab. 9 The Estimated total number of people that visited Namibia's protected areas (in 2003) in comparison with visiting rate of Etosha and other protected areas (Turpie et al., 2004)

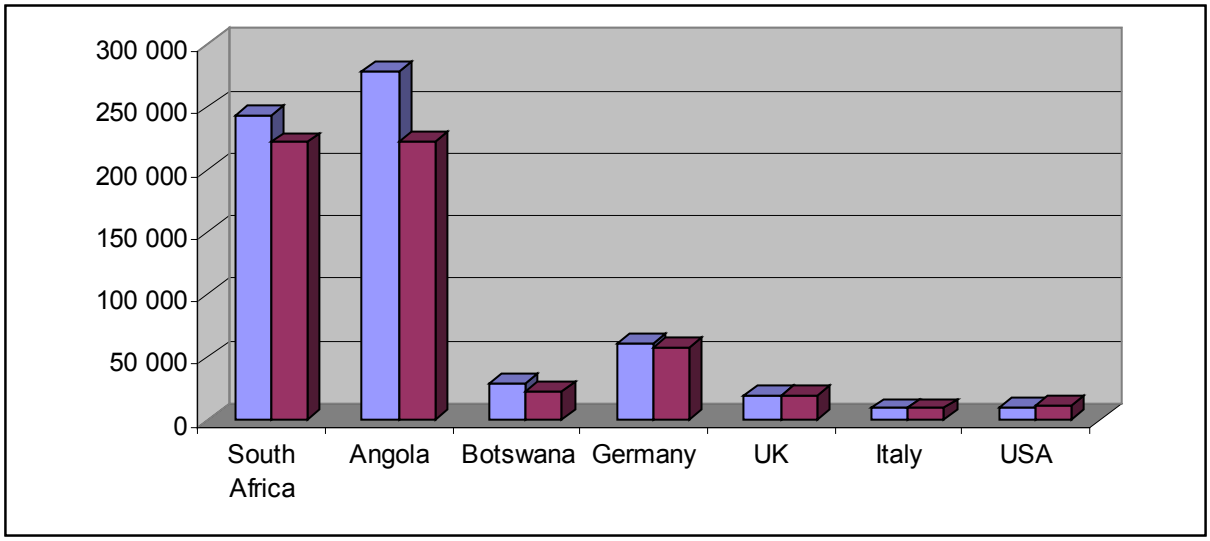
Total number	382 439
Etosha National Park	155 794
Namib Naukluft	58 813
Skeleton Coast	1 819
Mahango	10 500

When it comes to nationalities the major share on Namibian visitors have Africans (South Africa and Angola), then European (Germany, UK, Italy) and further the visitors from USA (Tab. 10 and 11) (MET, 2003)

Tab. 10 Amount of visitors according to the nationalities in 2003 (MET, 2003)

South Africa	222 009
Angola	222 752
Botswana	22 679
Germany	58 036
UK	19 291
Italy	8 809
USA	11 775

Tab. 11 Comparison of visiting rate in 2002 (blue column) and 2003 (red column) according to the nationalities (MET, 2003)



5.6.6 Research Facilities in the Park

In 1965 a permanent Research Section was founded in Etosha National Park. Till then there was a veterinary control post, which was turned into nature conservation camp.

Etosha Ecological Institute

Nowadays research is carried out under the direction of Etosha Ecological Institute (EEI) situated in Okaukuejo (founded in 1974). The EEI falls within The Directorate of Scientific Services of MET. This Directorate has two divisions – Division of Monitoring, Research and planning and Division of Wildlife Utilisation. The first one has three subdivisions and one of them is Subd. Etosha Ecological Institute (NWR, 2007).

The EEI ensures proper management of current research and all related activities. And it is also responsible for monitoring of wildlife species. The staff is created by 13 persons – four scientists, four wardens, one veterinarian, labourers and scout (MET, 2008 b).

Namutoni Environmental Education Centre

The Educational Centre is one of the two MET Educational centres in Namibia. The second one is situated in Okatjikona (Waterberg Plateau Park). The centres were founded to motivate people to be interested in their nature and wildlife diversity, to provide sufficient information and practice experiences, to educate youth and to contribute to better nature protection. The centre provides accommodation for 40 people and is equipped for conferences, workshops and other scientific events (MET, 2008 c).

6 Discussion

6.1 Categorization

Although both protected areas, Etosha National Park and Krkonoše National Park, hold the title national park, they differ in several points. While the Etosha National Park belongs to the category II – National Park according the classification of IUCN, the case of the Krkonoše National Park seems to be not so clear. The Krkonoše National Park has consistent characters with the definition of national park – it is an extensive area with one or more characteristic ecosystems, containing representative fauna and flora on high biodiversity level and serves for scientific, educational or recreational purpose, the ecosystems of national parks should not be significantly altered by human occupation and exploitation. But Krkonoše National Park corresponds in some points to category IV – Habitat/Species Management Area, mainly in the statement that the protection of habitats and some management activities are necessary for conservation of the valuable species.

6.2 Delimitation of Boundaries

The Etosha National Park is contrary to the Krkonoše NP fully fenced area and the access to the park is restricted. It has punctually given opening hours (approx. from sunrise to sunset) and visitors are obliged to keep them. The Etosha is accessible only through the three gates, which enable the better monitoring of people moving in the park and also evidence of visiting rate. On the other hand the Krkonoše NP is an unbounded area, which create a transboundary park with the Karkonosze National Park in Poland and the movement of people is without larger restraint.

6.3 Park Settlement

With staking out the area of the national park and its fencing relates the question of living and resting in the park. The Etosha National Park does not offer the possibilities of living direct in the area of the park with the exception of the employees of the park. The possibilities of accommodation in the park are only three, but they provide all services. The left majority of accommodation is situated outside the park. It ensures higher control over the activities of tourist and prevents illegal hunting and devastation of the nature. The Krkonoše National Park is the area, where permanent settlement is allowed. There are both local residents and tourist living directly in the mountains. But in recent years there are also tendencies to remove the major part of human settlement from the most valuable parts of the park and to build the tourist background

down the hills in the buffer (marginal) zone of the park. Building of new tourist accommodation possibilities is not easy and meets there the interests of nature conservation and interests of development of the tourism and the whole region.

6.4 Moving Facilities

The facilities of moving through the park are different. Moving of tourist in the Krkonoše National Park is not remarkably restricted, but tourist must keep the Visitors regulations and in the parts with the highest level of protection use only marked paths and routes. Visitors can also utilize the educational paths. Walking, cycling and in some cases, with special permission, using a car is allowed. The Etosha National Park prefers moving throughout the park by car or special minibuses to walking. Walking is supposed to be very dangerous because the wild animals are moving freely in the park and meeting them is highly possible. Hiring cars is possible in the park and tourist can move with or without wardens. When driving visitors must keep the regulations of the park. Not all the park is opened for public, but making the western Etosha available for visitors is in preparation.

6.5 Staking the Conservation Goals and Management Plan

The Krkonoše National Park is divided into individual zones with different degree of nature conservation. Each of the zones covers various ecosystems and includes species on the different level of threat. The species and ecosystems are valued and categorized and according their needs the conservation strategy and activities are planned. The conservation goals and the strategy are worked up in the Plan for Maintaining of the park. Here are appointed not only the conservation strategies for the nature, but also the duties and activities for field and guard services, information services and for internal bodies of nature conservation. Monitoring and evaluating of species proceed in the Etosha National Park as well. The park is not separated into zones, but some places are not accessible for visitors. One of the goals set within the Centenary activities to complete the Management and development plan with more detailed conservation strategy. Since that there were some proposed plan for managing the park, but none of them received officially approval.

6.6 Organisation structure

The Krkonoše National Park has its own Administration (appointed by the Ministry of Environment), which is responsible for the running of the park and it is the main directional organ. The organ is further separated into individual department with punctually defined sphere of action. Although the department are subdivided and the structure is quite branched, it is not so complicated as in the case of Etosha, where the organisation structure is really unclear. All parks are under the control of MET and there are several departments and their sub-divisions presented in the Etosha National Park. Further there are independent structures as EEI, NWR and Regional services. The complicated net brings problems in communication, sharing information and make the governing of the park more difficult.

6.7 The Level of Services

The services in both parks are on very good level. They provide good accommodation services, wide range of activities for visitors and they try to attract more and more tourists by improving the spectrum of offered facilities. The Etosha NP for example introduced the guided night drives through park, built new roads and refreshments on the roads and so on.

6.8 Information Centres and Wardens

Insufficient in the Etosha NP is the amount of information centres for tourists. New three centres are going to be built in the rest camps. On the other hand information services in the Krkonoše NP are good. Wardens and guards must be in the both parks educated and trained in the field of nature conservation. The Krkonoše National Park has except professional staff also the voluntary rangers and participated on Junior Ranger Project for youth.

6.9 Research and Educational Programmes for Public

Both Krkonoše and Etosha belong to well-explored palace and they have quite long tradition of nature and species conservation. In the recent years the attention of the Krkonoše NP was focused on the recovery of forest ecosystems and due to that the natural habitats for plant and animal species are nowadays ensured. The park carries out researches in different field and cooperates with other scientific workplaces, research institutes or universities. In the Etosha NP research work has also long tradition, what is demonstrated through the successful conservation

of many endangered species. The park has its own research centre and on the scientific work participated also other institutions, often foreign. The essential difference lies in publication of the research results. While Krkonoše NP makes most of its material available for public, the Etosha Ecological Institute does not provide information about the researches running in the park. Publication of the results is together with the reconstruction of the EEI one of the Etosha Centenary goals.

The Krkonoše NP cooperates also with public and supplies the tourist and other people with basic or scientific information about the park and nature protection. The KRNAP Administration operates museums, expositions (permanent or temporary) and has its own library dealing with the topics connecting the park or the Krkonoše region. They have environmental education centres and secure environmental education for children, youth or adult. The KRNAP Administration public several periodical journals and books and many materials dedicated not only to the tourists. Although the Etosha does not regularly publish any information, there is also an educational centre operated in the park. It offers also various programmes and lectures for public.

7 Conclusion

Both parks belong to highly visited protected areas and attract annually many tourists thanks to the high biodiversity and untouched nature. Whether Etosha or Krkonoše National Park has proved their interest for nature conservation and their efforts has brought success. Both of them try to continue and even improved their work and create in every way functional and beneficial integer.

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