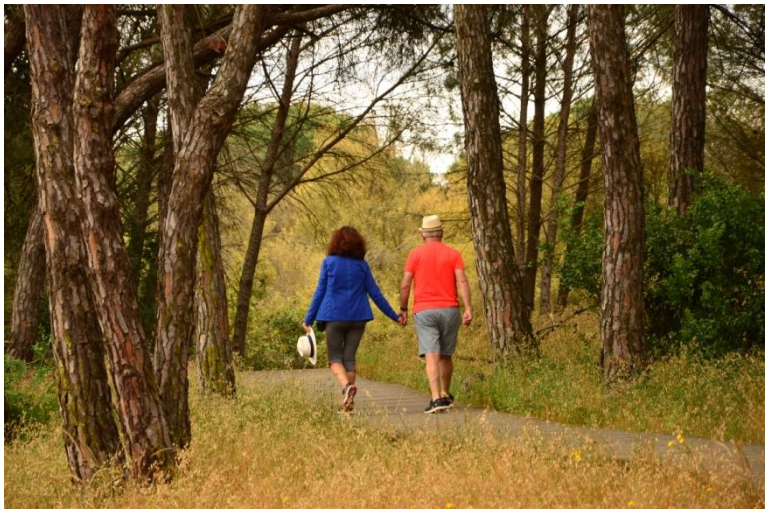
Alfred Toepfer Natural Heritage Scholarship, 2017

Study Visits Report



Ecological Restoration both for Ecological Health and Human Health

Zerrin KARAARSLAN

December, 2018

Acknowledgements

This report could not have been done without the collaboration of many people. First of all, I would like to thank the EUROPARC Federation for awarding me the Alfred Toepfer Scholarship invitation to the Europarc Conference in The Magic Mountains region in Portugal in September 2017, as well as to the Alfred Toepfer Foundation for making it possible for many young Europeans to pursue their dreams by funding their professional careers.

Hereby, I would also like to thank:

• Especially to my contact people;

Spain – Doñana National and Natural Park

Contact Person 1: José Juan Chans Pousada Gerente from Espacio Natural de Doñana Centro Administrativo El Acebuche

Contact Person 2: Pablo Méndez from Doñana BioIogical Station which is belong to the Spanish Research Council (central government) and hold the mandate to safeguard the conservation of the Park through research and monitoring

Spain – Sierra de Guadarrama National Park

Contact Person 1: Francisco J. Herrero and Juan Manuel Ceballos-Escalera, who are head of protected area management service.

Contact Person 2: On behalf of the Sierra de Guadarrama National Park Center for Research, Monitoring and Evaluation my reference NP Director, Juan Vielva Juez and forestry engineer Aurora de la Rosa.

Germany – Bayerischer Wald National Park

Contact Person: Jochen Linner (Naturschutz und LIFE+Projekt)

• And all the experts and staff from the National Park Administrations who I had the pleasure to meet and talk during my study visits;

• And finaly to my supervisor Prof. Dr. Nilgül Karadeniz from Ankara University, Faculty of Agriculture, Department of Landscape Architecture for supporting my idea and providing valuable comments on my project.

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1. INTRODUCTION

1.1 Background Information

In protected areas approach, the major task is to protect ecosystems and vulnerable nature qualities. All these activities for protection are also giving visitors an instructive experience.

Currently a growing body of research indicates that contact with nature has diverse and profound benefits on human health. For example Barton and Pretty (2010) stated that regular and short-duration physical activities in green spaces contribute to immediate mental health benefits, such as improved self-esteem and mood. Contact with nature also helps to promotes social relations and cope with and recover from stress (Maller et al. 2008). Plus green spaces improve motivation for exercise, resulting in higher activity levels (Karjalainen et al. 2010). Furthermore, natural settings provide inspirational spaces for recreation (Virkkunen et.al.2014). Thus popularity of nature tourism and outdoor recreation activities seems to be constantly increasing in modern society.

Nielsen and Hansen (2007) stated that since the early 1980s, environmental psychologists have studied the health effects of contact with nature (Townsend et.al.2010). However, Maller et al. (2008) have pointed out a lack of research demonstrating health opportunities and benefits specific to protected areas (Virkkunen et.al.2014).

Additionally there are billions of people and many interventions to the natural systems and so over the years environment has been damaged depending to the people activities. Current research show that about 80 percent of the land surface is under human effects. In reaction to these protected areas which are a positive response to many significant conservation challenges face with the degradation and a key for turning back to the natural processes is needed.

Thus protected areas that are exposed to pressure due to tourism and recreation can be evaluated by considering their conservation status as a meaning of

landscape integrity and landscape health. Ecological restoration in protected areas defined as a useful tool "to support societal goals such as poverty alleviation, sustainable livelihoods, human health etc." by IUCN.

At this point ecological restoration practices can be carried out at the lands that have detected degradation. Approaches that have offered for different IUCN conservation categories can be a guide for determination of the ecological restoration approaches. When evaluated in this respect all protected areas serve restoration through natural processes as a result of protection. Active, time-limited restoration can be carried out at national parks and nature parks.

There is a two-way relationship between restoration and health concept.

Firstly "restoration enables recovery of a healthy eco-system through ecosystem management".

Secondly there are also very close linkages between human health and ecological health.

Thus "a healthy ecosystem is one that provides the ecosystem services supportive of the human communities' health" and wellbeing

1.2 The purposes of study visits

•To see the best practices of ecological restoration in protected area and understand the philosophy of the ecological restoration approach at European protected areas

•To learn and evaluate benefits of ecological restoration on protected areas as means of ecosystem health and human health,

•To offer gained experience as an intention for restoration of degraded ecosystems in Turkey.

1.3 Methodology

Effects of restoration on different ecosystems were searched;

Selected Protected Areas;

Doñana National Park (Spain) – wetland restoration,

Sierra de Guadarrama National Park (Spain) – scrub and natural grassland formation habitats restoration

Bayerischer Wald National Park (Germany) – recovery of natural forest through assisted natural regeneration.

As a means of **ecosystem health** key indicators (like composition of flora and fauna; species diversity, biomass; primary production; proportion of exotic species etc.) for different kinds of ecosystems are specified.

Effects of restoration on these indicators are specified according to the face to face meeting and field studies with national park managers during the study visits.

Also questionnaires were applied with visitor for specifying effects of restoration on **human health**.

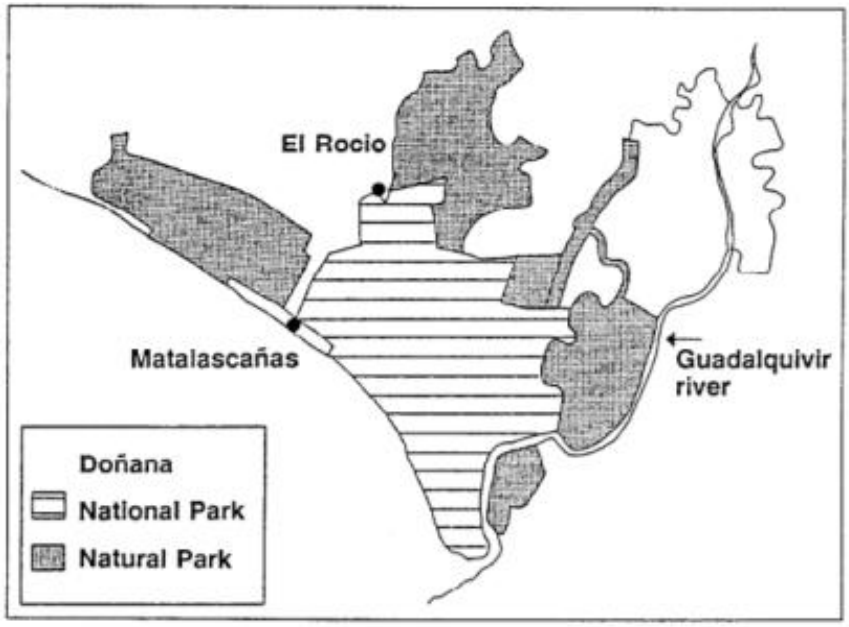
Visitor questionnaires were configured to evaluate effects of protected areas social, psychological and physical health and welfare

2. DOÑANA NATIONAL PARK (SPAIN)

Doñana National Park in Andalusia occupies the right bank of the Guadalquivir River at its estuary on the Atlantic Ocean. It is notable for the great diversity of its biotopes, especially lagoons, marshlands, fixed and mobile dunes, scrub woodland and maquis. It is home to five threatened bird species. It is one of the largest heronries in the Mediterranean region and is the wintering site for more than 500,000 water fowl each year.

With all these resources Doñana Natural Area is considered one of the most important natural protected areas in Europe and designated as a national park in 1994 with 54,251.7 ha area (https://whc.unesco.org/en/list/685).

Doñana is protected by several international conservation agreements, including the World Heritage Convention, the Ramsar Convention on the Conservation of Wetlands, and the European Commission's Birds and Habitats Directives (http://awsassets.panda.org/downloads/wwf_dalberg_saving_donana_lr_spreads.pdf).



Area of Doñana Natural Park and Nature Park (https://whc.unesco.org/document/154023)

The spectacular landscape of its flat plains is shaped by two primary ecosystems: pine forests and Mediterranean shrubs that grow in mostly sandy soil, and vast clay-lined marshes, subject to a highly seasonal water cycle.

Marshes: Doñana's freshwater floodplains, which dry out in summer, are the feeding and nesting habitat for countless waterfowl.

Mediterranean forest: Shrub lands depend on the largest aquifers in Spain to survive. Plant species such as rockroses, sage-leaved rockrose, rosemary and mastic offer shelter for mammals, such as the lynx.

Stone pine: Forests in the area are dominated by this species, which also create significant economic value through the pine nuts it produces (https://www.donanareservas.com/en/donana).

In general the state of conservation of the park is satisfactory, but it does face numerous threats including its increasing isolation by agricultural development, tourism and poaching, over-grazing and illegal exploitation of crayfish (https://whc.unesco.org/document/154023).

Changes to water inputs have reduced biodiversity, dried out lagoons, and resulted in negative changes to Doñana's natural value. Over 80 per cent of the marsh has been lost since the beginning of the 20th century. Lagoons that were temporary or seasonal have dried, and lagoons that were permanent – and critical for many plant and amphibian species during the dry season – are increasingly becoming temporary and rain-dependent. Alteration of river-aquifer dynamics and a reduction in water inputs has resulted in the replacement of water-dependant plant species by drought-resistant plants. Also, there has been a decline in certain bird species that used to breed in Doñana. For example, the marbled teal, a critically endangered bird that was once the most common breeding waterfowl in Doñana, now rarely is seen. Further, seven out of ten species of dragonflies and damselflies listed on the IUCN Red List of Threatened Species have disappeared from Doñana (http://awsassets.panda.org/downloads/wwf_dalberg_saving_donana_lr_spreads.pdf).

Also in April 1988 the Guadiamar River, the main water source for the Doñana salt marshes, suffered an environmental disaster of unprecedented dimensions. The failure of the tailing dam in Aznalcóllar released a mass of toxic muds and waters which resulted in an important reduction of the River's natural capacity. A 62 km. long section of the river was affected up to its point of entry in Doñana National Park, along with a surface area of 4,634 ha. in nine municipalities of Seville(http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=LIFE00_ENV_E_000547_LAYMAN.pdf).

2.1 Details of Restoration Activities in Doñana National Park

With the objective of recovering the natural water inputs, in 1981 was designed the "Doñana Water Regeneration Plan" (MMA, 2001). This plan was aimed to restore the functionality of the Guadiamar and Travieso channels, to incorporating the waters from the Guadiamar River and the restoration of the Montaña del Río (physical element that regulates the water flow between the marsh and the Guadalquivir River).

Two main projects had been put into operation; the Green Corridor of Guadiamar is a project at remediating the area of Guadiamar River and floodplain that was directly effected by mining disaster. Project was with the aim of establishing an ecological buffer zone between Doñana and the Sierra Morena. Despite the various initiatives undertaken in the 80 and 90, Doñana marshes had not recovered its water inputs. In these circumstances arises the ambitious project of the hydro-ecological restoration of the marsh called "Doñana 2005". The Ministry for the Environment initiated the this project to restore the hydrological capacity of the catchment basins for the salt marshes of the National Park(http://ec.europa.eu/environment/life/project/Projects/index.cfm?fuseaction=home.showFile&rep=file&fil=LIFE00_ENV_E_000547_LAYMAN.pdf).

This project was conceived as an open catalog of actions to curb the trends of degradation observed in previous decades, to restore their natural patterns of hydrological dynamics and the connectivity with the Guadalquivir estuary.

In restoration action number 6 (Caracoles Estate-Travieso Channel) **more than 2,600 ha of marshes, transformed decades ago into arable farmland,**

is being restored by removal of dykes and drainage ditches. The restoration is being carried out with an adaptive approach, placing great emphasis on the methodology used to monitor its success. The steps followed to design the methodology for monitoring vegetation changes have been;

1) Study of the **vegetation and seedbank present before the restoration** begins;

2) **Selection of reference sites** nearby and unaffected by agriculture;

3) **Prediction analysis of flooding regime** following restoration;

4) Study of **time-series of geo-referenced images** and **analysis of the vegetation index** (NDVI) of the **cultivated fields** (historical reconstruction) (http://www.ebd.csic.es/ricardo/publi/zaragoza_1.pdf).

Prior to incorporation, a functional restoration was carried out. El Partido stream was building a depositional sandy delta on Doñana Marsh (now ca. 400 ha) with little or no vegetation. Restoration Project envisages:

- Building a hydraulic scheme favoring sand deposition upriver avoiding its transfer to the Marsh.
- Restoring natural ecosystems previously existing in the area.

The restoration project was divided into phases. First phase (342 ha) was based on self-organization of plant communities (self-design) during succession. Existing remnants of woody vegetation covering about 7.66 ha (2.2%) was restored, adding about a three-fold surface (26.8 ha, 7.8%) of new plantations. Also, 545 new vegetation patches, initially covering 20.53 ha (about 6% of the area) were planted, following composition and structure of the natural shrubbery. Each patch combines 5–10 perennial species: a core of a few trees, an inner area with some fruit–bearing scrub and the outer fringe with flower–bearing scrub. River banks also vegetated. Patch vegetation is attracting insects and vertebrates (mostly birds), the latter eventually performing as dispersers of seeds, thus expanding the shrubbery. Finally, the restored area will provide the menaced Imperial eagle and Iberian lynx an appropriate hunting ground

(https://www.researchgate.net/publication/257368667_The_restoration_of_El_Partido_stream_watershed_Donana_Natural_Park)

All these main interventions of hydrological restoration in the Doñana National Park between 1973-1998 may be seen in the following table (Nova and Carera (2006).

Year	RESTAURATION UNDERTAKING
1974	Marilópez, Lobo and Almajal wells. Artificial flooding.
1981	Hydrological regeneration.
1984	Restoration of *Montaña de Río* levee New sluices built. South-North intervention.
1986	Travieso Nuevo Canal
1986-1990	Old riverbeds regain flow. Restoration of Cangrejo Chico pond. Control of trenches in levees to Estuary.
1998 -	Doñana 2005 Project. Guadiamar "Green Corridor" Project.

Specified ecosystem health indicators for Doñana National Park;

- Composition of flora/fauna
- Species diversity/biomass
- Situation of target species,
- Landscape patches (vegetation cover/wetland area)
- Water-quality indicators,
- Decrease in erosion/sedimentation

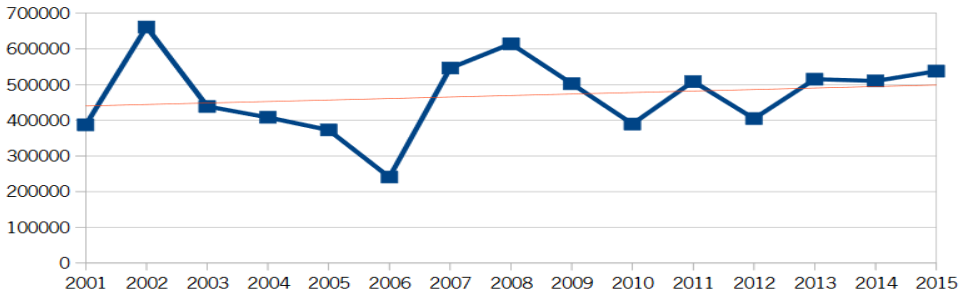
2.2 Development of ecosystem health indicators for Doñana National Park

To define the situation of the ecosystem health through the specified ecosystem health indicators intensive field and office works followed with the assistance of national park managers and experts. Also literature researches conducted.

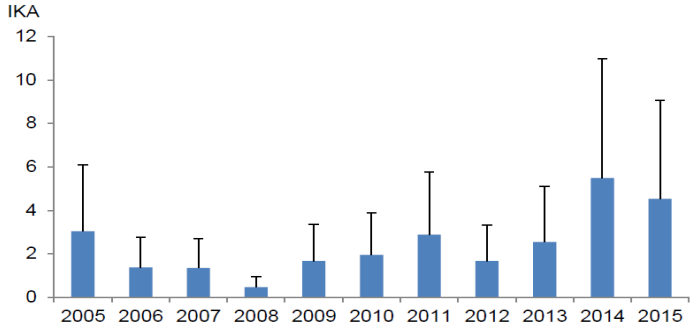
Resources show that during initial period of the Project, endangered species that had disappeared almost completely, or which only nested sporadically and in small numbers have been recovered as nesting species. The bittern disappeared as a nesting species in the 60s, but it returned to nest in the Marshes of the National Park in the springs of 2002 and 2003, with 7 and 8 breeding areas being located respectively. The crested coot has undergone a spectacular recovery, with 40-42 pairs nesting in 2002 to between 68 and 74 pairs in 2003. The marbled teal, a globally endangered species, seems to have started the process of recovering its breeding population numbers, with an estimated 86 to 103 breeding pairs identified in 2002 and between 68 and 84 in 2003. The negative aspects detected in this period include the appearance of the exotic fern species *Azolla filiculoides*, which is spreading alarmingly in the Doñana Marshes. On the other hand, there was an elevated mortality rate among flamingo chicks born in Doñana in 2000, caused by them eating toxic algae, hence confirming the danger that cyanobacteria can represent for the biological communities, highlighting the importance of water quality in this project.

The graphics is related to abundances of common waterbird and other non-passerine species present in the Doñana wetlands.

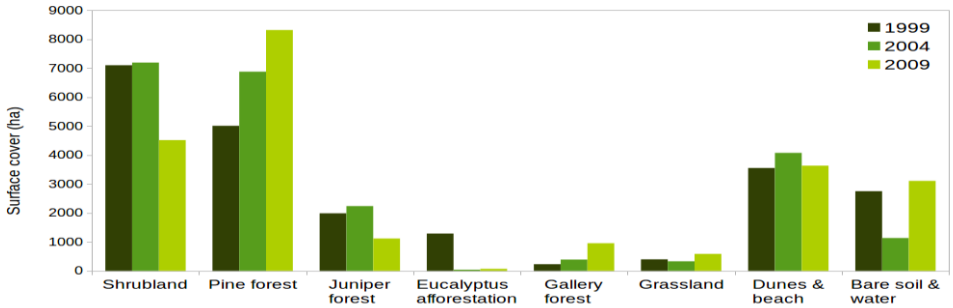
Total number of wintering waterbirds individuals in Doñana, as estimated in the January survey (IWC).



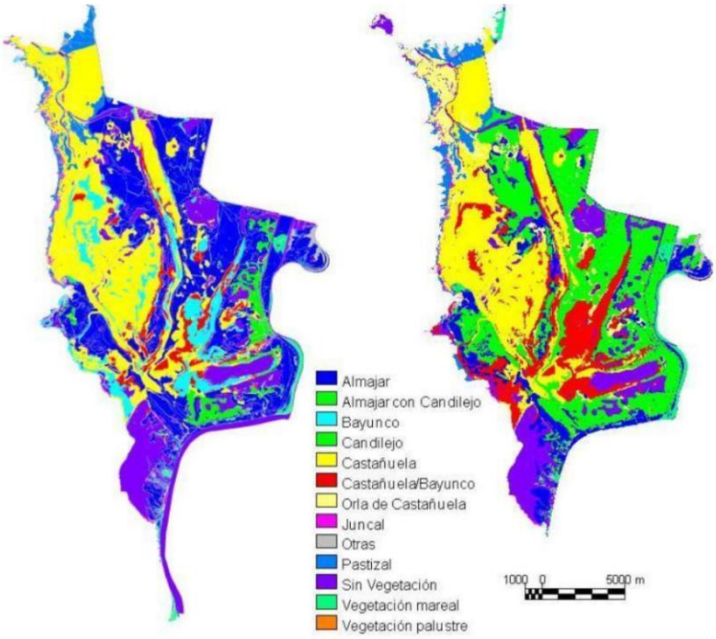
Relative abundance (IKA: number of individuals observed per kilometer) of red deer



Changes in the cover of terrestrial vegetation at the Doñana National Park between 1999 and 2009;



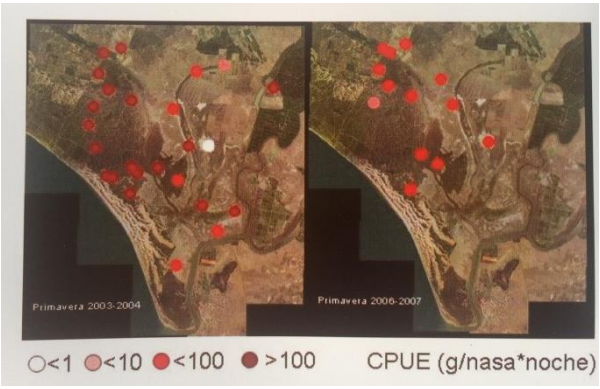
The vegetation of the Doñana marsh is monitored at 5-years intervals.



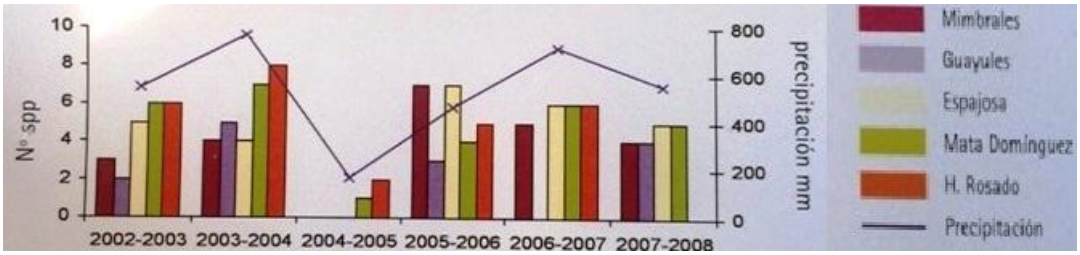
Marsh vegetation maps derived from a reclassification of available cartography. Left pannel: MVM (2004). Right pannel: MSNV (2009). MVM: Marsh vegetation map published by the Regional Government (Dirección General de Gestión del Medio Natural) in 2010, based on data from 2004-5. MVSN: Park vegetaiton map published by the National parks Office (Organismo Autónomo de Parques Nacionales) in 2014, based on data from 2009.

Also monitoring result for one alien species The Red Crafish is a good example of time series data monitoring.

Distribution and density of Red Crayfish in NP in 2003-2004 and 2006-2007 seasons. Dots indicate density and biomass values of captured individuals per trap and day.



A systematic monitoring of amphibian species community was started at area 2003 in order to assess the effects of restoration actions on amphibians. Comparison of amphibian species richness in the artificial and control ponds during the 2002-2008 periods.



Monitoring results indicate that wealth of wetland ecosystem in Doñana got better with restoration efforts. For example endangered species returned to nest in NP, and the number of alien species decreased while vegetation cover in NP increased thanks to restoration efforts.. Plus the artificial ponds have already attained a noticeable amphibians species richness close to control sites.

2.3 Development of human health indicators for Doñana National Park

2.3.1 Doñana National Park visitor facilities

There are plenty of healthy opportunities in Doñana National Park;

Trails are an excellent way to discover the qualities of this protected are, either hiking or on bike.

- Access riverbank forests along the Acebrón path,
- Bird watch following the route of La Rocina
- pleasant cycling routes, such as the one that crosses the Matalascañas and another that starts in the forest village of Cabazudos
- 4x4s with bi-lingual guides, where you can discover the countryside and its traditional uses, such as beekeeping, forestry, fishing and hunting
- sail in the Fernando Royal Ship, which sails down the Guadalquivir from Sanlúcar,

Sports: horse riding, kitesurfing, orienteering, kayaking, sailing, hot air ballooning, free flying, windsurfing, mountain biking, surfing

Visitor Centers;

- La Rocina Visitor Centre,
- El Acebrón Visitors Centre,
- El Acebuche Visitors Centre,
- José Antonio Valverde Visitor's Centre,
- Los Centenales Visitor's Centre,
- Fábrica de Hielo Visitor's Centre,
- Dehesa Boyal Visitor's Centre (http://www.andalucia.org/en/natural-spaces/national-parks/donana/)

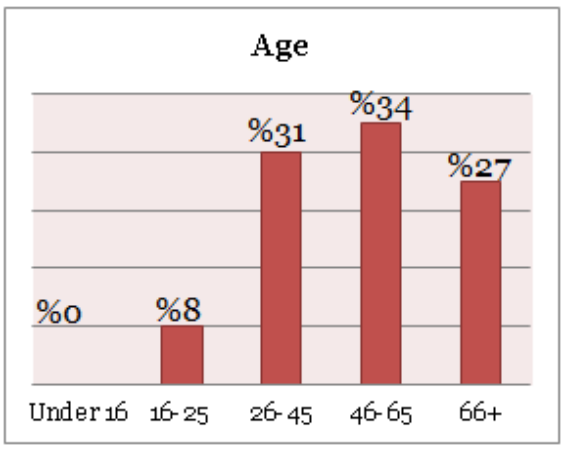


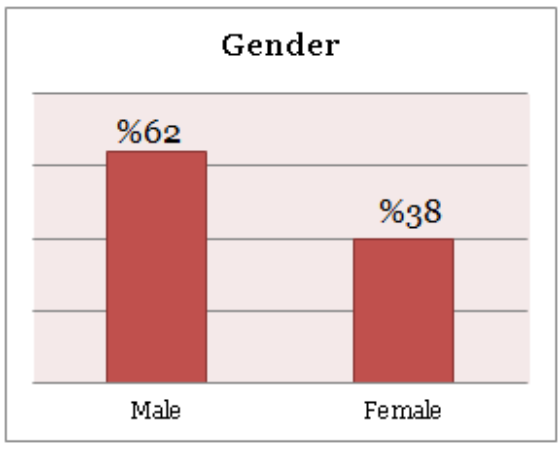


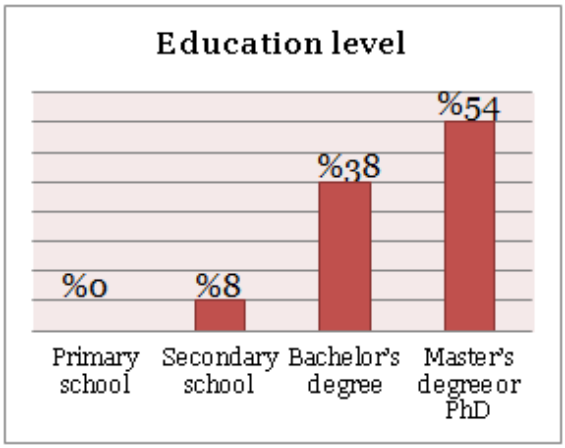

2.3.2 Evaluation of Doñana National Park visitor surveys

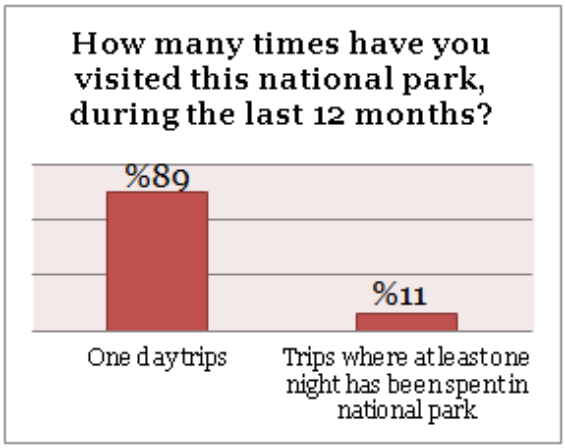
26 visitor surveys conducted to get visitors opinion on effects of restored protected wetland ecosystem on human health and well being. Surveys are conducted on especially areas which have high visitor potential like visitor centers, trails, vista and bird watching points.

A first part of surveys for to get general opinion on visitor profile and following result obtained from assessment of this part.

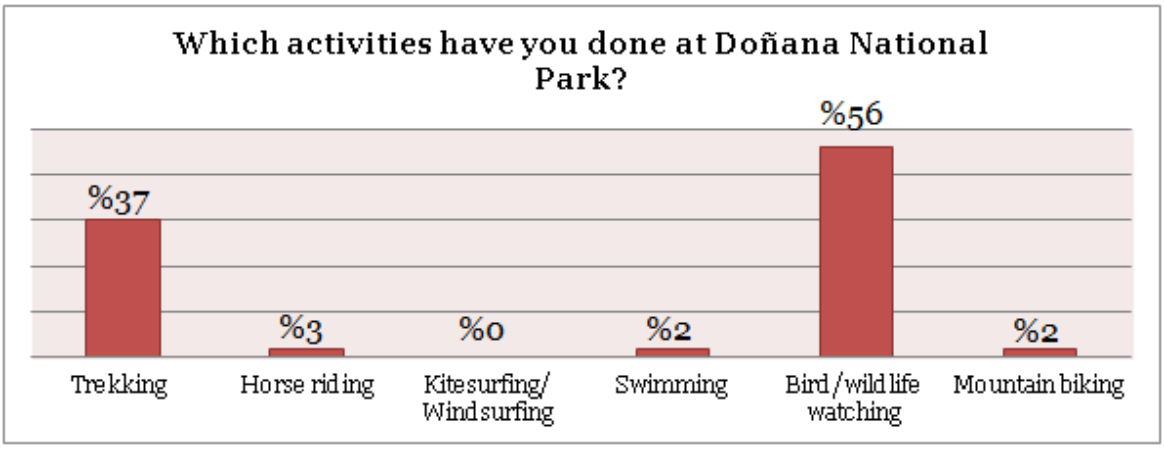


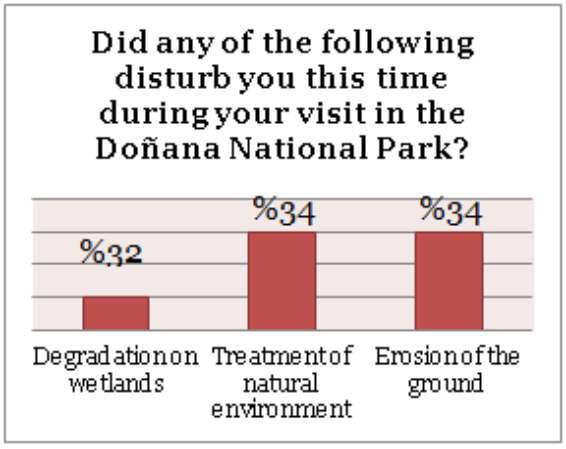


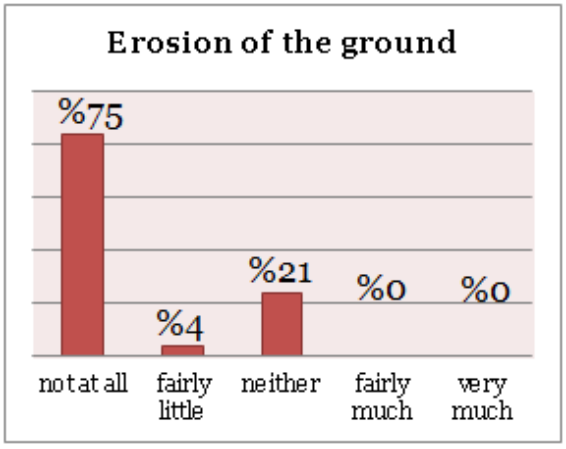


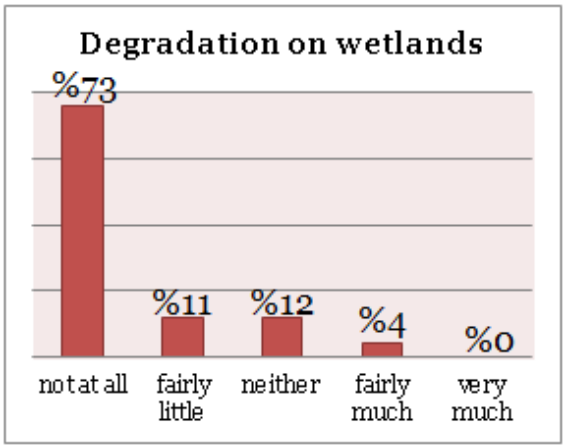


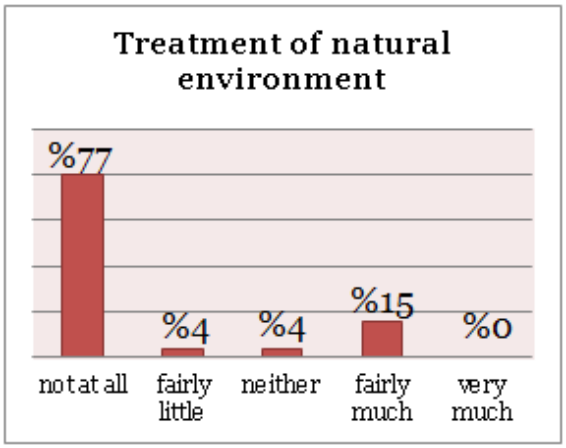
A big part of visitors have higher education and they are coming to the National Park for one day trips. Bird/wildlife watching and trekking is the most common activities for visitors.



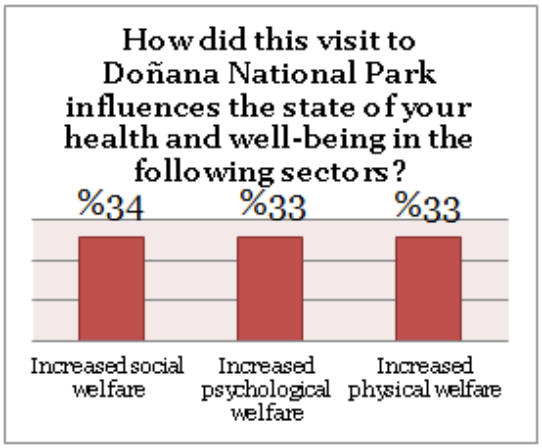


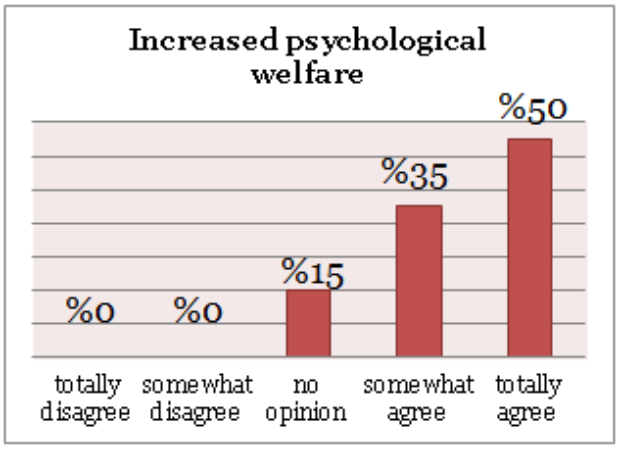


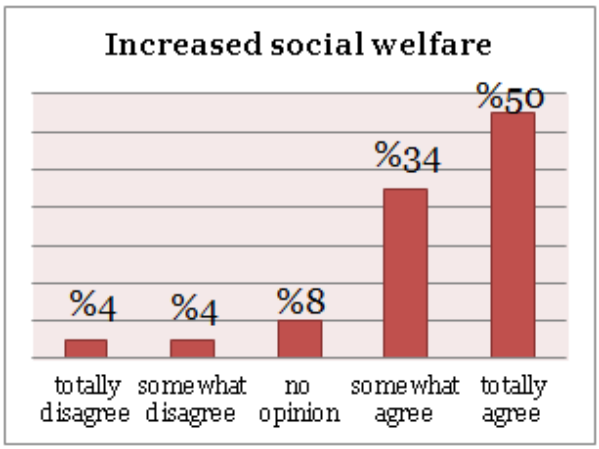


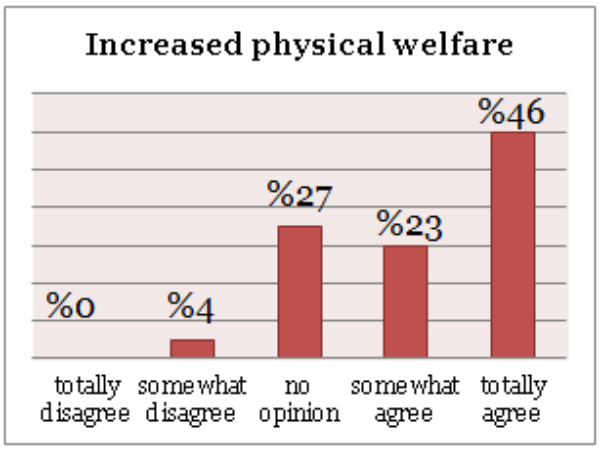


Treatment of natural environment and erosion of the ground has same effect on visitors and degradation of wetland evaluated less disturbing by them. Plus none of these three factors hadn't evaluated very much disturbing a big part of visitor thinking each factor disturbing them not at all.









A last part of visitor surveys were for to get visitors opinion on how did this visit to National Park influences the state of their your health and well-being in the psychological, social, physical way. Consequently surveys showed that Doñana

National Park have same high effect on visitor's psychological, social, physical health and welfare. A big part of visitors replied that visit to National Park influences the state of their psychological and social health and well-being totally agree and then physical health and welfare.

3. SIERRA DE GUADARRAMA NATIONAL PARK (SPAIN)

The Sierra de Guadarrama located in the Central Mountain Range halves naturally the north and the south mesetas shaping the centre of the Iberian Peninsula. It accounts for a representative sample of the **high-mountain Mediterranean natural systems**, such as **shrubs** and **Alpine pastures, pinewoods**, **Pyrenean oak** woods **peat lands** with **glacial** and **periglacial landforms**, and **mountains landscapes**.

The National Park encompasses 33.960 hectares and the majority of its surface is covered by heights where rocky outcrops, mountain pastures and shrubs dominate (https://www.parquenacionalsierraguadarrama. es/en/parque/info-pnsg/87-resumen-pnsg).

Location of Sierra de Guadarrama National Park (http://www.sierradelrincon.org/ pdf/Experiencies_to_enjoy_nature.pdf)

National Park also Special Protection Area (SPA) for birds, Site of Community Importance (SCI), Biosphere Reserve, Wetland of International Importance (RamsarConvention)http://www.sierradelrincon.org/pdf/Experiencies_to_enjoy_nature.pdf

Main ecosystems in the National Park are;

- ***Pinus sylvestris* pinewoods** on siliceous soils.
- **High-mountain wetlands and lakes**.
- High-mountain and mountain formations: **granitic rock geomorphology** emphasizing unique landscapes and forms.
- **Gall** and **Pyrenean oak woods**.
- **Supra-forest level shrubs**, high-mountain pastures, woody steppes in altitude and **pebbles** grounds.
- **Pinewoods, juniper** and **Spanish juniper fields.**

From the last century sixties years emerges a different approach to the use of the mountain, based on great resorts for the practice of alpine skiing. The making in 1969 of the Valcotos ski resort, caused the destruction or alteration of valuable ecosystems and unique formations having glacial origin, in the Peñalara area. Fortunately, the real estate development projects planned for this area were stopped since they disobeyed the urban legislation provisions, avoiding an even greater disaster. The figures on the ski resort give an idea of the extent the transformation suffered: opening of 6 Alpine ski tracks with a surface area over 24 hectares; 11 ski lifts lines were built, that is about 6 kilometers of path, a hundred bollards or posts for the route and more than 20 facilities. The damage included the removal of vegetation, the destruction of the glacial geomorphologic elements, removing and leveling land, soil erosion and gully formation, impact on the landscape, etc.

The area also accumulated garbage, the lake suffered recurrent eutrophication episodes and the banks were tremendously eroded. In addition, exotic fish species, the *Arctic char*, had been introduced and caused the disappearance of many aquatic species living in this lake.

All these environmental problems were the result of a disproportionate and inappropriate use of this enclave, initiated from the seventies

(https://www.parquenacionalsierraguadarrama.es/en/conservacion/action/216-elimination-valcotos)

3.1 Details of Restoration Activities in Sierra de Guadarrama National Park

In 1990, however, there is a turning point in the progressive deterioration of this high mountain wetland. In this date occurs the reclassification, from Natural Site of National Interest to the Natural Park (which would be later integrated into the current Sierra de Guadarrama National Park). With reclassification came the first emergency measures as to amend the detected environmental problems, more specifically the prohibition of bathing and camping.

As of that date, a number of limnological studies were conducted in the lake, which remains in limnological monitoring. These studies have served as a base to a series of actions aiming the ecological restoration of the lake (https://www.parquenacionalsierraguadarrama.es/en/conservacion/actuaciones/217%E2%80%90restauracion%E2%80%90laguna).

The project goals;

- The environmental restoration project was carried out with the following purposes:
- To restore the natural environment damaged elements: geomorphology, land cover, visual quality of the landscape, etc. with the smallest possible intervention.
- To check the environmental problems: minimizing the environmental impacts (erosion, proliferation of trails, preservation and maintenance of ecosystems).
- To adapt the facilities and hospitality areas around Los Cotos Pass for the Peñalara Massif visitors (conditioning of access points and car parking lots, spills treatment, landscape adaptation, installation of self-interpretative elements and signals).
- To regulate the uses consistently with the conservation of the natural environment.

The restoration project involves;

- **Sclerophyllous scrub and natural grassland formation habitats restoration**: In order to restore natural habitats such as Mountain Cytisus purgans formations (5120), Oro-Iberian Festuca indigesta grasslands (6160) and especially Species-rich Nardus grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) (6220), an ambitious project of restoration was initiated in 1999 at Peñalara Peak Area with the aim to dismantle the ski resort completely and restore the ecosystems altered during its construction and functioning. It has known as one of the pioneer restoration experience across Europe. Inside the framework of this project, scientific investigations are being carried out in order to support the management activities with an ecological point of view.

- **Fresh water habitats conservation. High mountain wetlands restoration**: Peñalara's massif wetlands are included in the Ramsar Convention List since 2006. There are several actions that are being conducted: 1) control of eutrophication through paleolimnology studies; 2) control of erosion; 3) non-native fish eradication (Salvelinus fontinalis); 4) amphibians and macroinvertebrate community monitoring.

- **Amphibians monitoring:**
    - Inventory of the current reproduction spots.
    - Continuous quantification of the relative abundance of each species and its health.
    - Amphibians breeding in captivity and emerging diseases treatment.

In 1999 the works to recover the affected ecosystems started, and although the most obvious were conducted between the turn of the century, revegetation work, improvement and follow-up of the proceedings remain at present. A summary of the work carried out would be as follows:

The project of ecological restoration was undertaken in three phases;

Phase 1: Dismantling the artificial infrastructure

The first phase of the Valcotos environmental restoration took place during 1999 and consisted on the elimination of facilities connected with the practice of alpine skiing. The dismantling process included the demolition and removal of the bollards, the foundation blocks, the buildings, and the ski resort lifts. Similarly, a large amount of debris and residues in the area, which had been accumulated during the construction and operation of the station, were removed.

A key factor in the dismantling was to avoid damage in the areas adjacent to the working points. For this reason, the heavy machinery use was restricted to those points which could be accessed through the proper affected areas. In the rest of the areas (for example, bollards located in relatively little altered or very isolated areas) manual machinery was used machinery in the demolitions. The evacuation of debris and remains of the station was carried out using helicopters and pack animals to avoid conditioning the tracks or opening new ones for the passage of trucks. The main factors affecting those jobs were the high gradients, the fragile soil, climatic conditions, and the high number of visitors while the works were on.

Phase 2: Topographic Refund

The Valcotos environmental restoration second phase was carried out between 1999 and 2000. It consisted on the original ridge restoration, the water flows recovery and the control of erosion. The fundamental goal of the ridge restitution was recovering the physiography of the area prior to the ski resort construction. To do this, three lines of work were defined:

- The elimination of esplanades, land clearing and embankments, avoiding changes in stable areas.
- The naturalization of artificial accumulations of stones (beads of stones on the sides of tracks).
- The control of gully erosion by installing dissipative energy barriers.

Of course, the topographic refund cannot restore the glacial deposits original layout, so it just aimed to stop the impact on the landscape, to control the risks of landslides, to minimize erosion problems and to prepare the ground as to help to the natural processes of colonization. In the same way, some streams were so radically transformed (burial, diversion to another basin) that the proceedings on them are limited to recover, as much as possible, the original path or its watershed.

All these works were developed with the added difficulty of not being entitled to use materials outside the National Park.

Phase 3: Regeneration of vegetation cover

The third phase of the Valcotos environmental restoration has been carried out since the year 2000, and it consists on the vegetation cover regeneration. This proceeding has succeeded in containing the intense erosion processes and encourage the development of vegetation similar to the one of the surrounding areas not affected.

The main tasks developed to achieve these goals are:

- The collection of seeds of woody and herbaceous plants for direct sowing or for plant production in the nursery.
- The transplantation of vegetative material between different areas in restoration.
- Fencing the restoring areas to promote the growth of seeds or species planted and natural regeneration.
- The contribution of organic matter and seed bank in the most affected areas (approximately 2 hectares) using the earth from the cleaning of the zone firewall.
- The spring and autumn manual plantation since 2001.
- The irrigation in the areas more difficult to regain.

It is noteworthy that during works, the fundamental criterion, to avoid the introduction of alien species and genetic material other than the Massif own populations, has been followed(https://www.parquenacionalsierraguadarrama.es/en/conservacion/actuaciones/216%E2%80%90eliminacion%E2%80%90valcotos#results)

Specified ecosystem health indicators for Sierra de Guadarrama National Park;

- Composition of flora/fauna
- Species diversity/biomass
- Situation of target species,
- Landscape patches (vegetation cover/wetland area)
- Decrease in erosion/sedimentation

3.2 Development of ecosystem health indicators for Sierra de Guadarrama Park

Similarly to define the situation of the ecosystem health of Sierra de Guadarrama Park through the specified ecosystem health indicators intensive field and office works followed with the assistance of national park managers and experts. Also literature researches conducted.





Outcomes/results of restoration efforts;

- Sclerophyllous scrub and natural grassland formation habitats restoration:
  - Control of erosion
  - Original orographic restitution and regeneration of the drainage system.
  - Improvement of natural regeneration
  - Increase of vegetation cover
  - Landscape restoration

- Fresh water habitats conservation. High mountain wetlands restoration and monitoring: thanks to active management (e.g. fencing) and continuous monitoring the restoration of Peñalara's massif main wetlands has been possible:
- Non-native fish eradication (*Salvelinus officinalis*); consequently improving the number of amphibians.
- Reduction of erosion and eutrophication.
- Boost of "*Nardus stricta* natural grassland" cover around the lake (inside de fenced area).
- Peñalara Lake is been established as a reference for its value to identify and determine the ecological characteristics of this habitat type, and as an example of perfect compatibility between active management, recreational use and enjoyment and ecological restoration

- Amphibians monitoring: General monitoring is conducted through counting the larvae abundance in the aquatic environments. The species subject to this surveillance are the following: *Salamandra salamandra, Mesotriton alpestris, Bufo bufo, Triturus marmoratus, Alytes obstetricans, Bufo calamita, Hyla arborea, Rana iberica* and *Pelophylax perezi*.
    - Natural expansion of *Pelophylax perezi* population.
    - *Rana iberica* reintroduction in certain natural wetlands and high mountain streams, accompanied by its spontaenous presence in wetlands where they have not been introduced or there is no previous sign of them.
    - *Alytes obstetricans* successful reintroduction Programme after having been treated from the fungus infection "quitridiomicosis".
    - Reduction of the mortality rate due to quitridiomicosis on *Bufo bufo* and *Salamandra salamandra* individuals.
    - Monitoring of protists microorganisms and their beneficial effect to fight against the fungus infection "quitridiomicosis".

- Amphibians breeding in captivity at the Breeding Center for Threatened Amphibians of the National Park (belonging to the Park Research Centre):

- Thermal treatment application to fight against the fungus infection "quitridiomicosis" on *Alytes obstetricans*.
- Analysis of adaptation processes to quitridiomicosis on *Bufo bufo*.

https://www.europarc.org/communicationskills/pdf/case_studies/Guadarrama%20National%20Park_A%20Mountain%20recovered,%20SP.pdf

Residues removal

For nearly two decades, there was in this high mountain area a remarkable accumulation of residues (plastic, bottles, batteries, aluminum foil, remains of clothing, canned food and soft drinks, organic waste, etc.). Perhaps the most obvious impact to the casual visitor was aesthetic, with an evident degradation of the quality of the landscape. However, the accumulation of residues had a much greater impact for its contribution to the eutrophication process.

The progressive implementation of different public use, and above all, the increase in the level of awareness of the visitors in general, has managed to significantly reduce this problem. However, it was necessary to carry out an intensive cleaning campaign that included removal of large debris from the bottom of the lake by divers.

Apart from the recommendations on residues that are made to the visitors, the National Park maintains a cleaning team which is responsible for removing any garbage.

Control of eutrophication

Eutrophication is the entry and enrichment in nutrients, primarily phosphorus and nitrogen in the water having in natural state very low concentration of these. Phytoplankton algae need these nutrients, along with sunlight and carbon dioxide (CO_2) to develop. In the lake, they have light and CO_2 in abundance, so that their growth is limited only by the availability of nutrients. When their concentration level increases artificially, there is a disproportionate growth of algae, so the water gets a characteristic green color. Ultimately, all the physico-chemical characteristics and virtually all the aquatic communities are affected.

The Peñalara Lake has had very low concentrations of phosphorus and nitrogen for thousand years. However, the massive influx of visitors since the end of the 70 triggered a progressive eutrophication process. The accumulation of garbage that has been commented previously contributed to this. The lake banks eroded and caused much of these soils organic substances, another source of nutrients, dropping into the lake. In addition, bathing in the lake, a very common activity before the nineties, promoted the resuspension of nutrients stored in the sediment. The introduction of the arctic char could have contribute to the recycling of nutrients within the lake and therefore to the stimulation of the eutrophication.

After the ban on bathing and camping at the beginning of the nineties, the hydro-chemical analysis revealed that in only 3 or 4 years the nutrient concentration reduced to the levels expected in this type of lakes (oligotrophy). For example, in 1990 the amount of phosphorus in the lake reached of 427 µg P/l and an annual average of 242 µg P/l, while from 1995, the maximum phosphorus annual total has not exceeded the 150 µg P/L, with an average of 24 µg P/l.

Erosion Control

The excessive influx of visitors was also the cause of the lake banks erosion by the continuous trampling. In a certain area of the moraine, there was a soil decrease of almost a meter thick, only in a period of less than 10 years, which is equivalent to almost half of the height the moraine reaches over the lake water level. It is important to note that, given that the estimated rate of soil formation in mountain areas is around 0.5 - 1 mm/year, the decapitation and loss of soil in the lake moraine meant the disappearance, in just one decade, of soil formed during centuries.

On the other hand, the banks erosion has resulted in a significant increase of the sedimentation rate in the lake. Aquatic ecosystems evolve over thousands of years, filling up with sediment until closing. However, as part of the eroded material in the lake banks dropped bottom and sedimented, the erosion accelerates the lake ecosystem natural aging process.

In 1995 the perimeter of the lake was fenced as to avoid visitors trampling. This fence consists of a steel cable on picket lines, in which advices, explaining the reason for this limitation of access, have been placed. In addition, the moraine that closes the lake, the most severely affected, was fenced with an electric shepherd to prevent the entry of livestock.

In only a few months, there was a remarkable recovery of grazing vegetation in the moderately eroded areas, as well as an improvement condition of the soil. However, in the most affected area there was no spontaneous recovery and several systems had to be tested as to retrieve the vegetative cover. The most successful method was the matgrass (*Nardus stricta*) nursery production, from seed collected in the area. These plants were used in the moraine to form small

“islands”, and the rest of the area has been colonized by the effect of vegetative growth.

The effectiveness of these actions is under evaluation, with the following-up to the lake eroded material sedimentation rate, by means of sediment traps. These traps allow knowing the eroded material existing in the basin and transported into the lake, getting an indicator of the degree of erosion in the basin. The evolution of the sedimentation rate obtained with sediment traps has been changing in recent years, with a decreasing trend of sedimentation. From 1.9 Kg/m^2 in 1997, to 0.83 Kg/m^2 in 1998 and to less than 0.56 kg/m^2 since that moment.

Eradication of Arctic char

The arctic char (*Salvelinus fontinalis*), is a salmonid native to the NE of North America which was introduced around 1970 in the Peñalara Lake. Previously there was no fish in this lake, which due to their greed led to the disappearance of numerous species of aquatic organisms inhabiting the lake.

After a series of studies to determine the extent of the impact, will be held on a plan for the eradication of this specie with the purpose of allowing the recovery of the aquatic populations affected. The eradication project was carried out between summer 1999 and summer 2004, although with different effort in different years. Five gill nets were used (30 m long) composed of 12 panels of 2.5 m x 1.5 m, with a 5 to 55 mm mesh size. The last scan was conducted in the spring of 2002, counting from the start of the eradication a total of 550 individuals, aged up to 4 years.

The eradication has been a remarkable change in the populations of aquatic organisms, with a rapid settlement of new species. As well, it has gone from 9-13 aquatic family organisms with arctic char living in the lake, to 23-26 families

following the eradication project. All these species appear in ponds, which have served as recolonization farms (https://www.parquenacionalsierraguadarrama.es/en/conservacion/actuaciones/217%E2%80%90restauracion%E2%80%90laguna

Comparative advantages before and after restoration

All these results show that *Nardus stricta* cover around the lake boosted, natural grassland natural regeneration improved and vegetation cover increased, erosion and eutrophication reduced, number of amphibians improved thanks to restoration efforts.

3.3 Development of human health indicators for Sierra de Guadarrama National Park

3.3.1 Sierra de Guadarrama National Park visitor facilities

There are plenty of healthy opportunities in Sierra de Guadarrama National Park;

Points of interests;

- Recreational areas,
- Parking lots,
- View points,
- Visitor centers
- Visitors Centers

The Sierra de Guadarrama National Park Visitors Centers; which offers the following basic services: visitors' information desk, welcome centers at the main National Park entrances and basic explanations to encourage the understanding and appreciation of the protected zone main values.

- Peñalara Visitors Center,
- Valle de la Fuenfría Visitors Center,
- La Pedriza Visitors Center,
- Valle de El Paular Visitors Center,
- Valsaín Visitors Center (Boca del Asno)

Walking routes;

- Hiking areas suitable for kids,
- Thematic routes
- Geology hikes,
- Botanic hikes,
- Ornithology hikes
- Sports activities;

Mountain bike (bike routes)

Mountaineering and climbing (rock climbing)

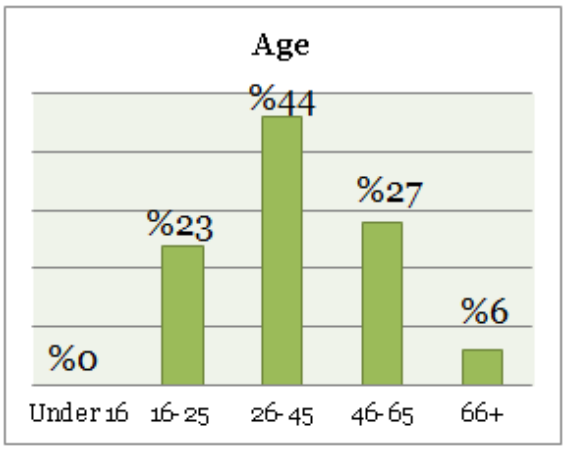
Winter activities (winter ascents Nortic skiing and snowshoeing, sleds, snowboard (https://www.parquenacionalsierraguadarrama.es/en/visit/info-act)

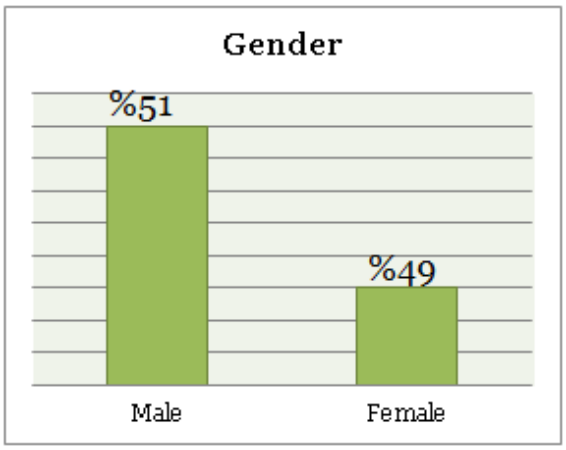


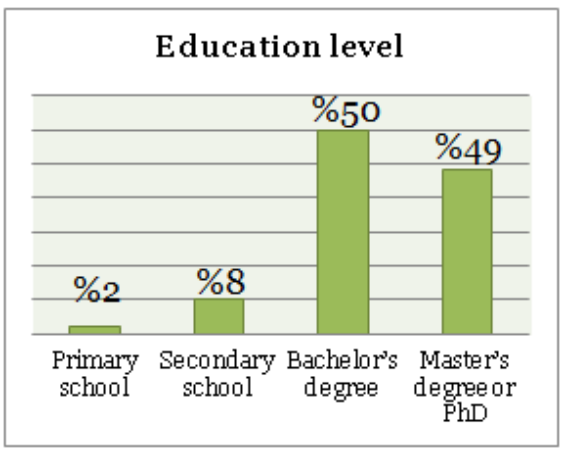


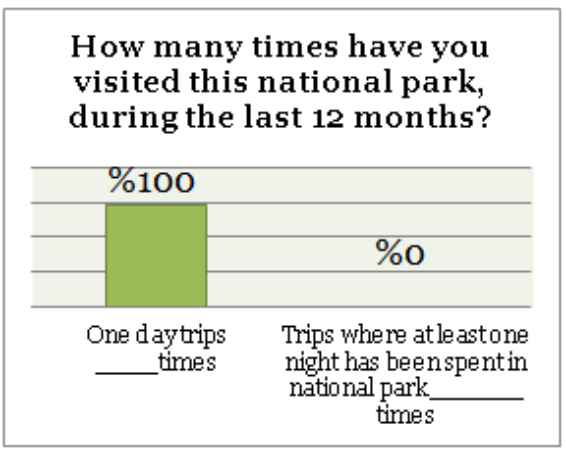
3.3.2 Evaluation of Sierra de Guadarrama National Park visitor surveys

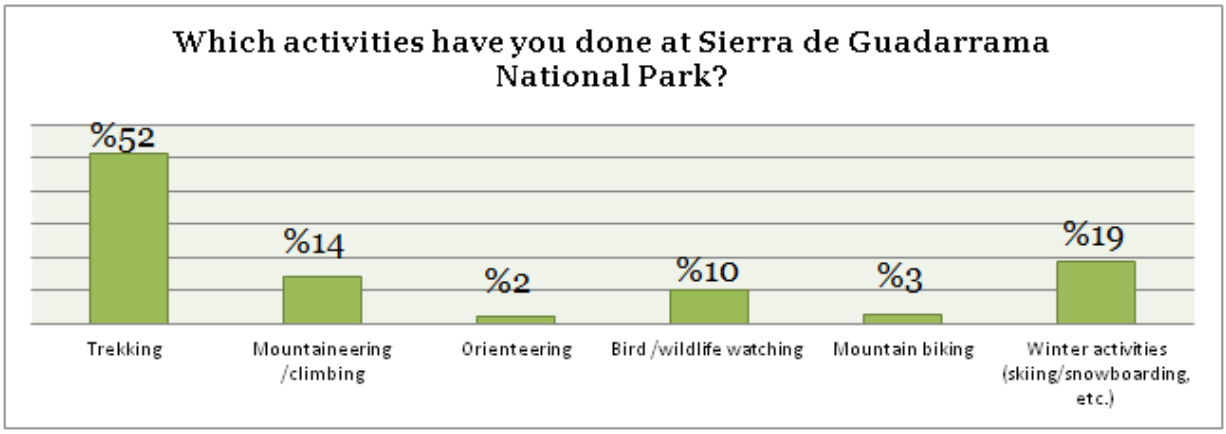
52 visitor surveys conducted to get visitors opinion on effects of restored protected *Sclerophyllous* scrub and natural grassland formation habitats on human health and well being. Surveys are conducted on especially areas which has high visitor potential like visitor centers, trails, vista and wildlife watching points.


Age
%0
%23
%44
%27
%6
Under 16
16-25
26-45
46-65
66+

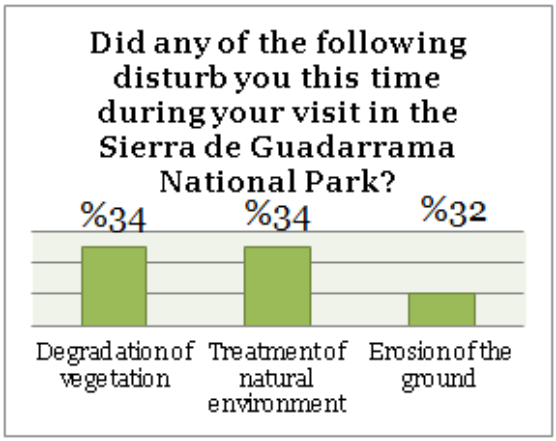

Gender
%51
%49
Male
Female

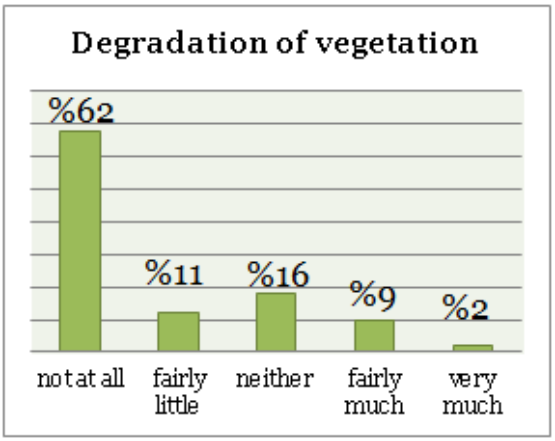

Education level
%2
%8
%50
%49
Primary school
Secondary school
Bachelor's degree
Master's degree or PhD

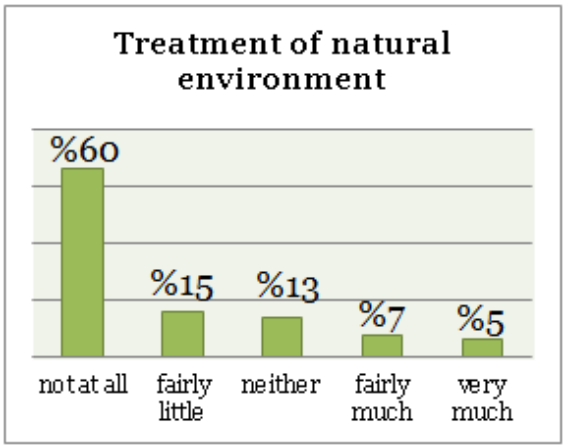

How many times have you visited this national park, during the last 12 months?
%100
%0
One day trips _____ times
Trips where at least one night has been spent in national park_____ times

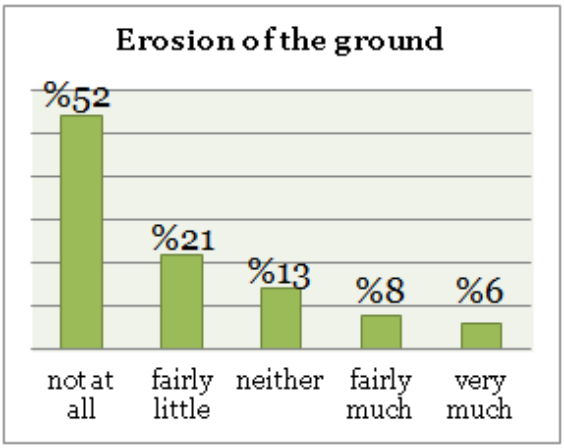


A big part of visitors have higher education and they are coming to the National Park for one day trips. Trekking is the main activity for visitors and they also do mountaineering/climbing, bird/wildlife watching and winter activities like skiing, snowboarding etc.

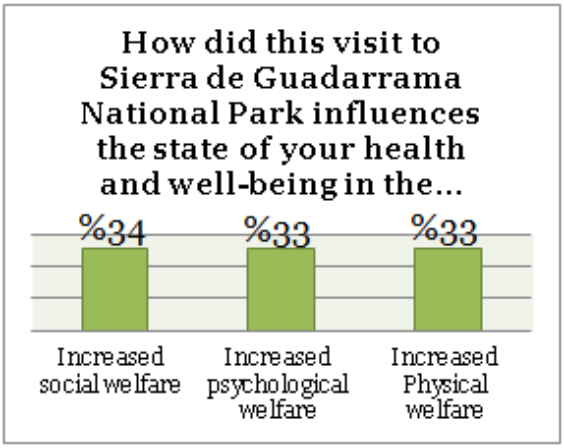


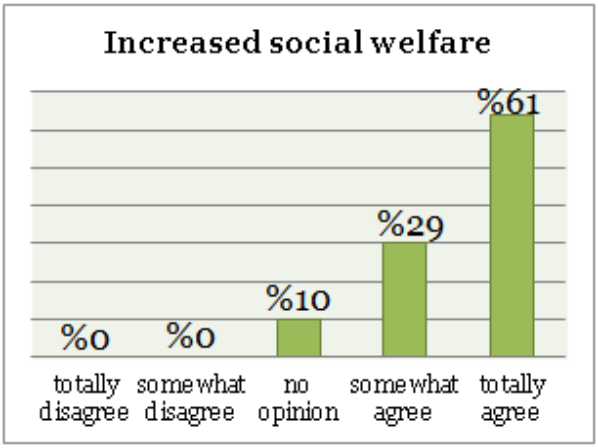


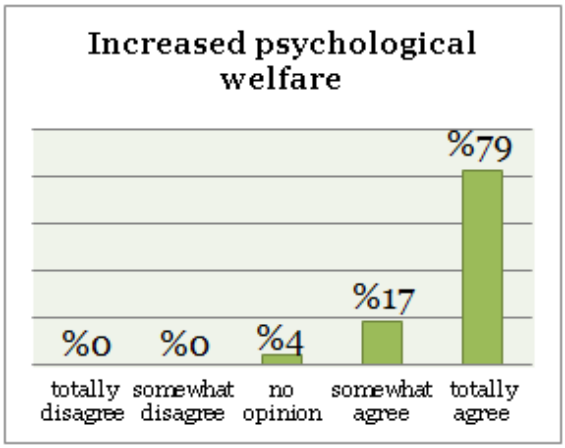


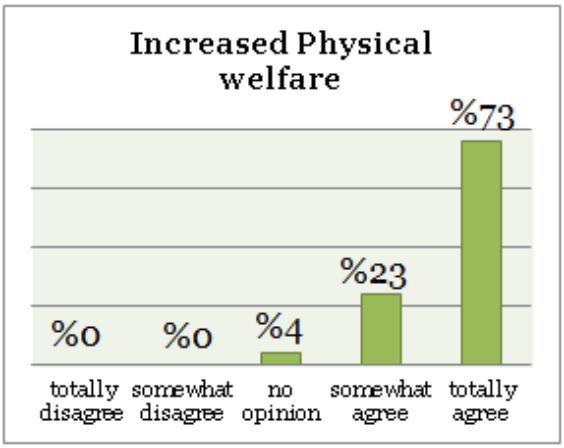


Degradation of vegetation and treatment of natural environment has same effect on visitors and erosion of the ground evaluated less disturbing by them. Plus none of these three factors hadn't evaluated very much disturbing a big part of visitor thinking each factor disturbing them not at all.





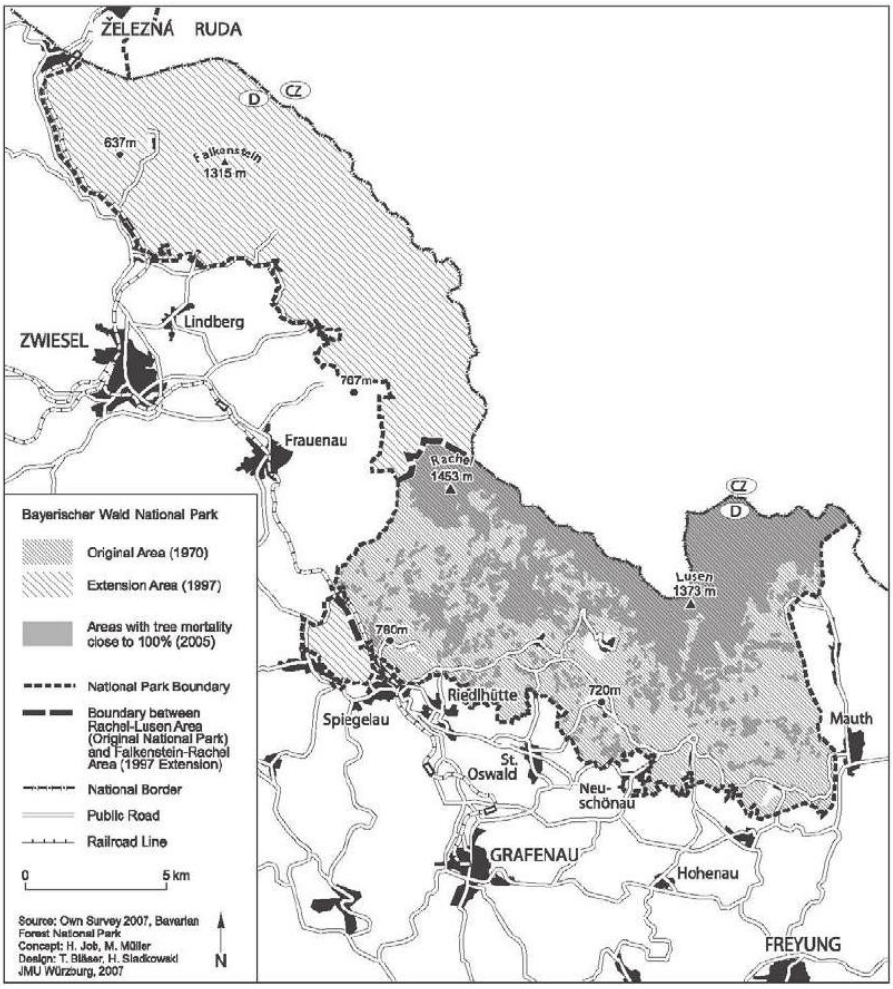




Sierra de Guadarrama National Park have same effect on visitor's psychological, social, physical health and welfare according to the last part of surveys which is for getting visitors opinion on how did visit to National Park influences the state of their health and well-being in the psychological, social, physical way. A big part of visitors replied that visit to National Park influences the state of their social and physical health and well-being totally agree and then psychological health and welfare.

4. BAYERISCHER WALD NATIONAL PARK (GERMANY)

The Bavarian Forest National Park (German: Nationalpark Bayerischer Wald) is a national park in the Eastern Bavarian Forestimmediately on Germany's border with the Czech Republic. It was founded on 7 October 1970 as the first national park in Germany. Currently National Park involves 24 250 hectare with the extension that may seen at map.



https://www.researchgate.net/figure/Map-of-Bayerischer-Wald-National-Park_fig3_256615346

The border mountains range with its woodlands, moors, mountain streams and former upland pastures (Schachten) is one of the most important spots of biodiversity. A broad range of rare animals, plants and fungi grow under optimal living conditions. Therefore not just nearly extinct mammals and birds, such as lynx, capercaillie, otter or Ural owl live in the Bavarian Forest, but also a vast

number of fungi and bugs, which can only be found here in this National Park - nationwide.

In total, about 14.000 species call Germany's oldest National Park their home and evolve between Falkenstein, Rachel and Lusen - unimpaired. They make the number of about 22 percent of species known throughout Germany.

The year 1993 was the beginning of a development that has dramatically altered the subalpine Norway spruce forests of the Bavarian Forest National Park. The spread of the Norway spruce bark beetle *(Lps typographus*) began in small, scattered patches that were soon distributed throughout much of the subalpine forest. In 1995 the beetle population virtually exploded. Within one year, 310 ha of the subalpine Norway spruce stands had died off. The development of the beetle population reached a peak the following year when 583 ha of matured forest were "consumed". Afterwards, the rate of infestation in the subalpine ranges decreased because most of the mature Norway spruce had already died-off. Meanwhile, 2031 ha of the subalpine range had been affected by spruce bark beetle (HEURICH 2001, HEURICH & RALL 2006).

4.1 Details of Restoration Activities in Bayerischer Wald National Park

After the die-back of the old stands in the National Park, it was questioned whether regeneration of the forest would be able to proceed. Such uncertainties were based especially on the extremely rapid rate and large extent of the area in which the trees had been killed, as well as the unfavourable conditions prevalent at the high elevations. Considering the often tempered discussions, that have been going on among forestry experts for well over a century, on how to best manage the subalpine forests, this question seems justified. Just as it does today, the discussion has always revolved around the question of how it would be possible to guarantee sufficient regeneration of the forest stands. And just as they were then, opinions on the mater are divided as to whether any measures – and if so, what kind – are necessary to preserve the forest.

The guiding principle in the Bavarian Forest National Park on more than 24,000 hectare is: "let nature be nature".

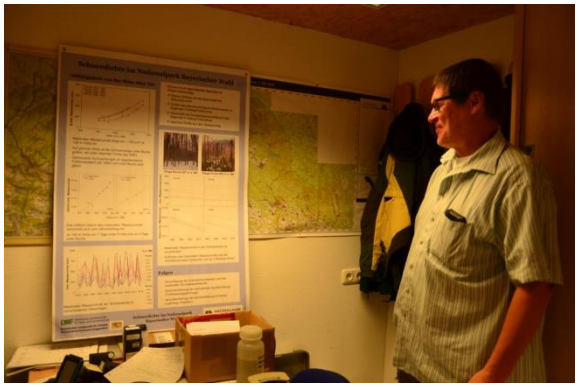
According to this philosophy, the forest with its bogs, mountain streams and summits may develop into a limitless forest wilderness according to its very own laws. In this way, yesterday's economic woodlands become the native jungle forests of tomorrow. Unique biodiversity is a result. Rare animals, such as *lynx, otter, capercaillie* or *ural owl* are able to find a habitat again. In addition, there are 15 species of beetles, which are considered to be primeval forest relics and only occur in extremely pristine forests. The strong biodiversity is based, among other things, on the high percentage of deadwood, which serves as basis and habitat for hundreds of insects, fungi and birds. Natural processes of growth and decay within the forest ecosystem are permitted in the national park, also by leaving behind those dead or windthrown trees in their natural environment.

Specified ecosystem health indicators for Bayerischer Wald National Park;

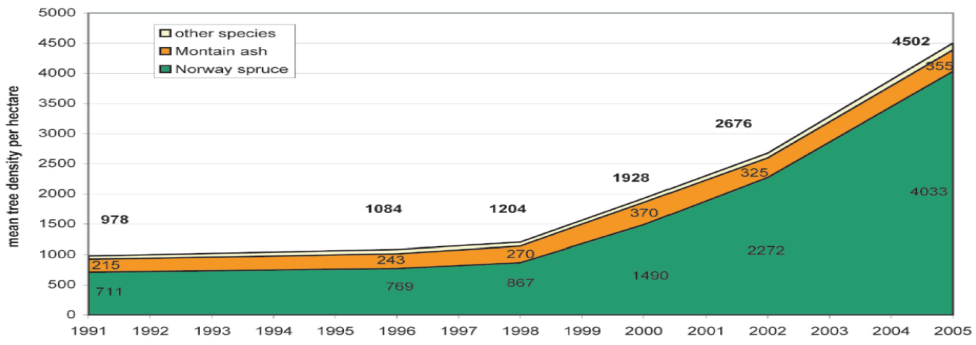
- Composition of flora/fauna
- Species diversity/biomass
- Situation of target species,
- Landscape patches (vegetation cover/wetland area)
- Decrease in erosion/sedimentation

4.2 Development of ecosystem health indicators for Bayerischer Wald National Park;

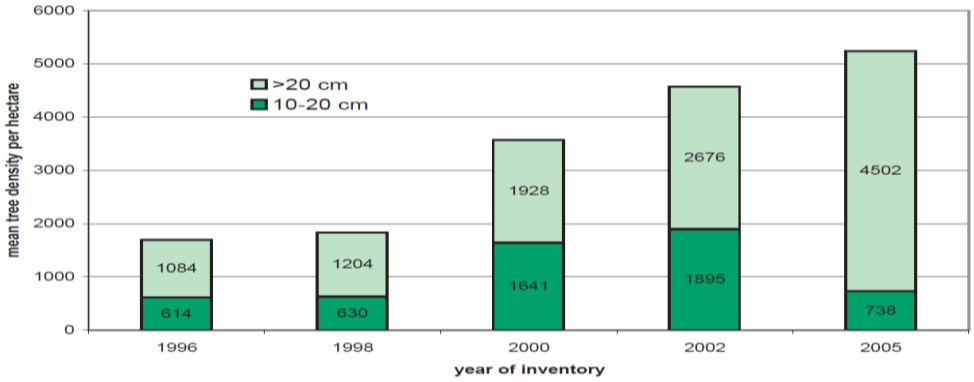
For defining the situation of the ecosystem health of Bayerischer Wald National Park through the specified ecosystem health indicators intensive field and office works followed with the assistance of national park managers and experts. Also literature researches conducted.



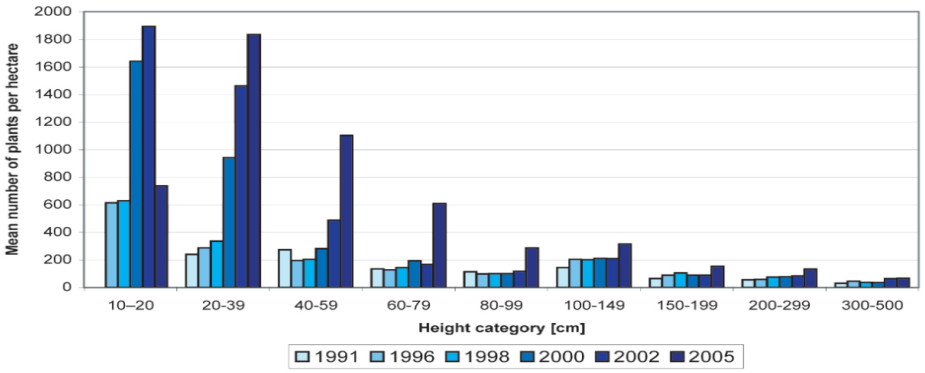
Development of regeneration density for the trees taller than 20 cm (Heurich, 2009)



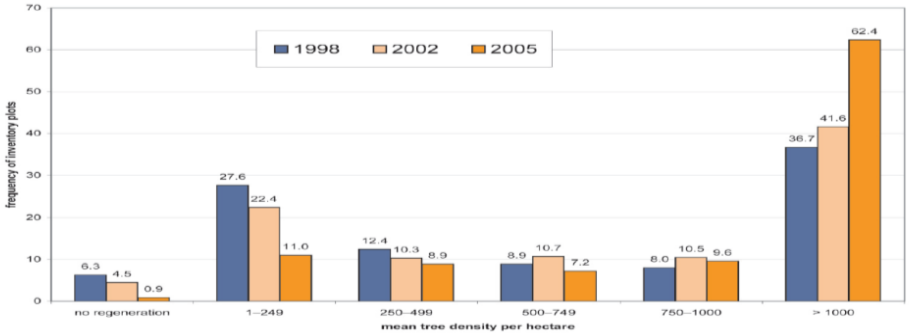
Development of the regeneration density of trees taller than 10 cm in height since 1996 (Heurich, 2009)



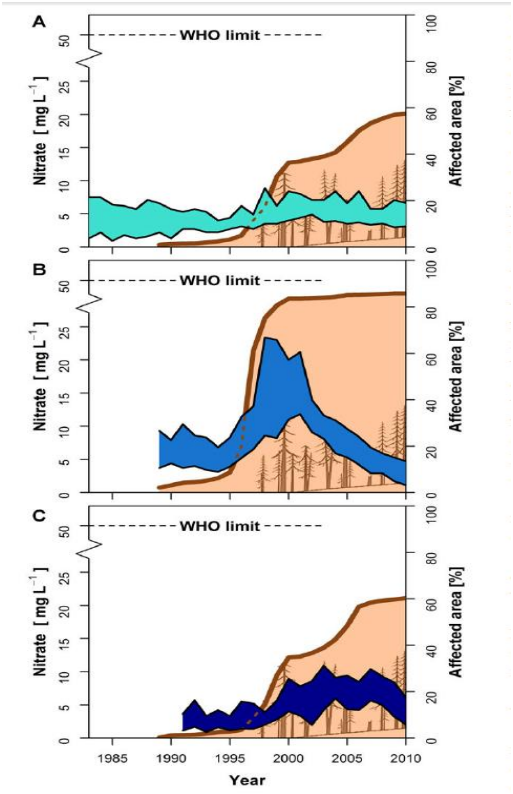
Development of height composition in the forest regeneration(Heurich, 2009);



Frequency distribution of regeneration density in the 500 m2 sample plots(Heurich, 2009);



Times series of bark beetle-affected areas and nitrate concentrations.



Brown shaded area represents cumulative percentage of bark beetle-affected areas of each catchment, while blue colored areas indicate the respective annual ranges of nitrate concentrations in runoff water.

The World Health Organization (WHO) drinking water guideline limit is 50mgL−1.**A**, Large catchment (Große Ohe), significant increase (GLS) with cumulative beetle area with (t = 2.59∗) and without (t = 2.26∗) temporal autocorrelation. **B,** Medium subcatchment (Markungsgraben), significant increase with cumulative beetle area with (*t* = 2.84∗) and without (*t*=5.84∗∗∗) temporal autocorrelation.**C**, Small subcatchment (Forellenbach), significant increase with annual affected area without temporal autocorrelation (*t* = 2.22∗) (Beudert et.al. 2015).

All these results show that development of regeneration density of trees and height composition in the forest regeneration increased by "let nature be nature" approach. Distribution of regeneration density in sample plots also developed. These also ensure increase in biodiversity. Moreover drinking water quality and amount of water in catchment also increased.

4.3 Development of human health indicators for Bayerischer Wald National Park

4.3.1 Bayerischer Wald National Park visitor facilities

There are plenty of healthy opportunities Bayerischer Wald National Park too;

Visitor and environmental education institutions:

- National park center Lusen with Hans-Eisenmann-Haus, animal, plant and rock outdoor areas and treetop path
- National Park Center Falkenstein with house to the wilderness, animal outdoor area and stone age cave
- Forest History Museum St. Oswald
- Forest playground and Naturkneippanlage in Spiegelau
- Deer enclosure Scheuereck
- Information points in Bayerisch Eisenstein, Zwiesel, Frauenau, Spiegelau, Mauth and Freyung
- Youth Forest Home near Schönbrunn am Lusen
- Wilderness camp on Falkenstein at Zwieslerwaldhaus

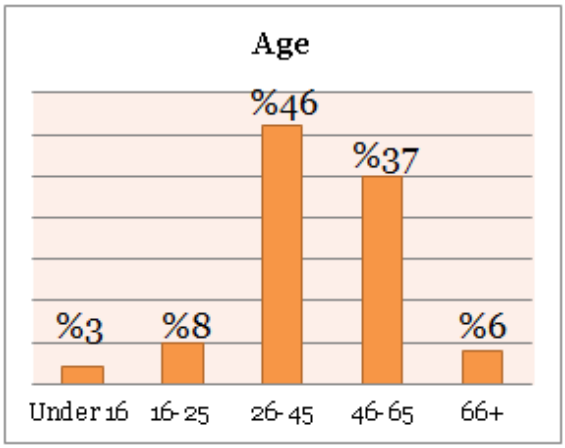
Other activities;

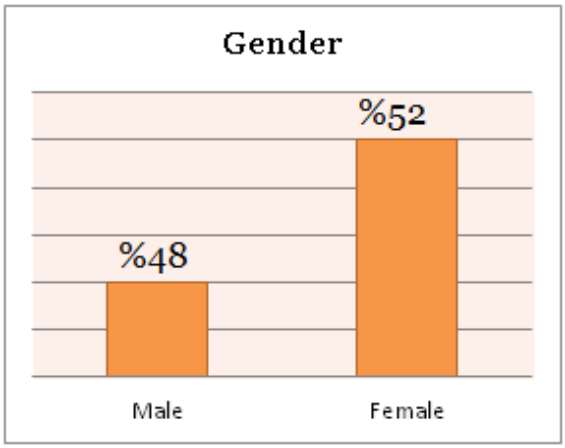
- Hiking
- Bicycling
- Cross-country skiing
- Snowshoeing
- Bird/wildlife watching,
- Orienteering,
- Berrying/collecting mushrooms (https://www.nationalpark-bayerischer-wald.bayern.de/english/visitor/facilities/index.htm)

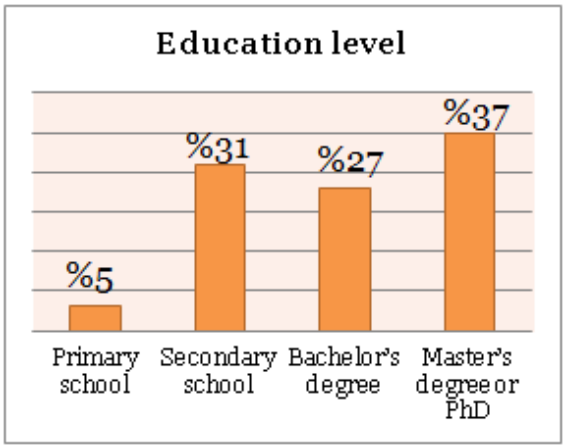

HANS-
EISENMANN-
HAUS
Nationalpark-
zentrum Lusen

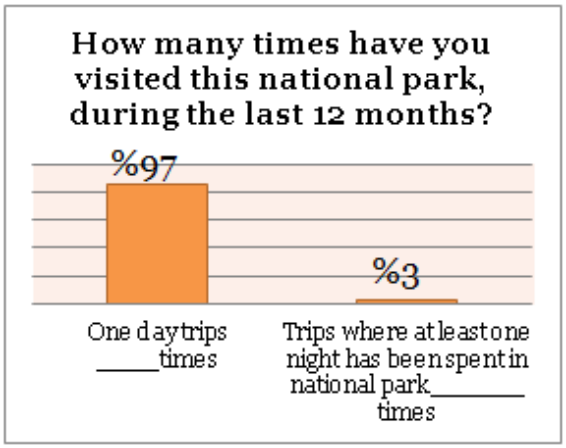
4.3.2 Evaluation of Bayerischer Wald National Park visitor surveys

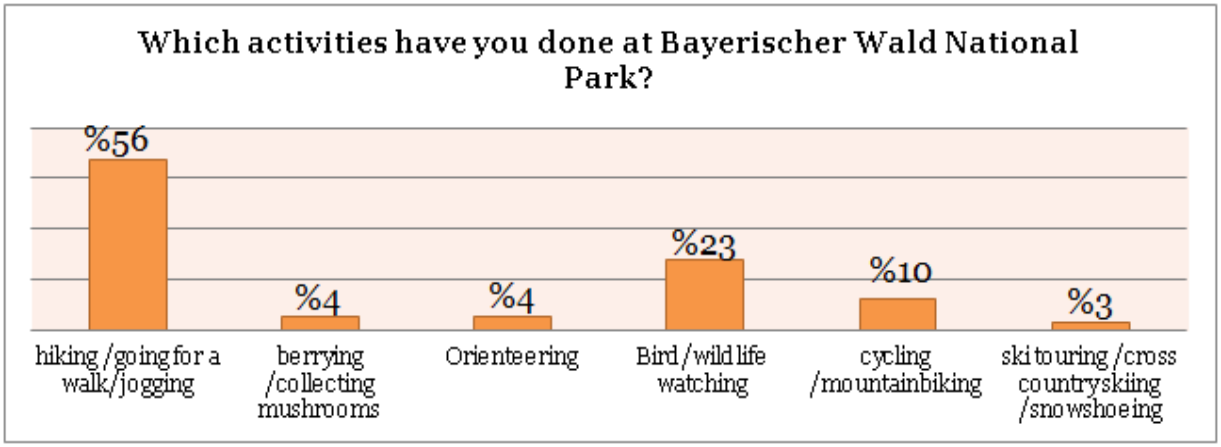
67 visitor surveys conducted to get visitors opinion on effects of restored/regenerated protected forests health and well being. Surveys are conducted on especially areas which has high visitor potential like visitor centers, trails, vista and wildlife watching points.



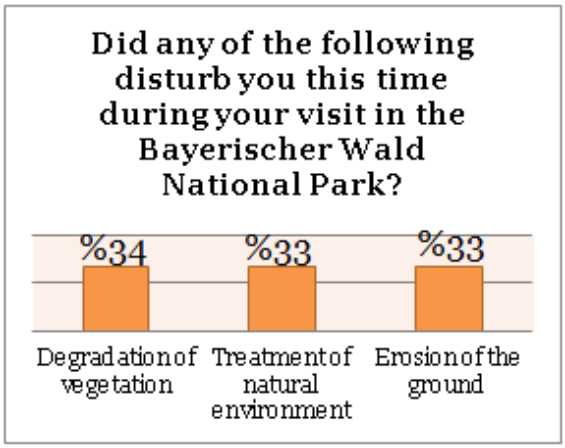


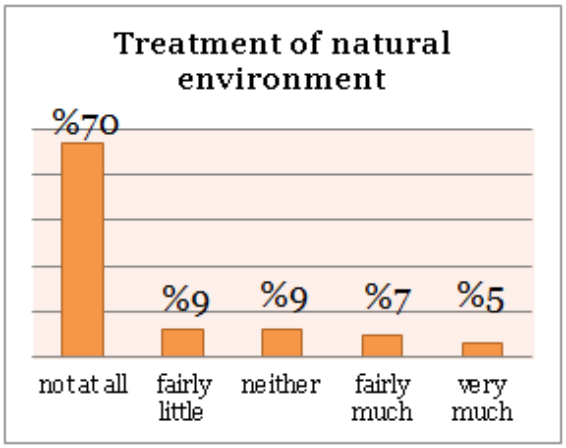




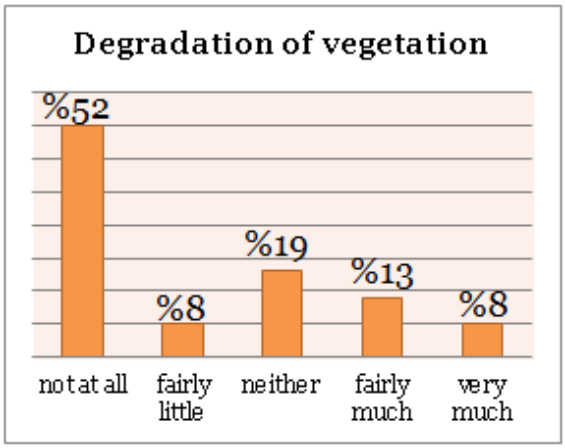


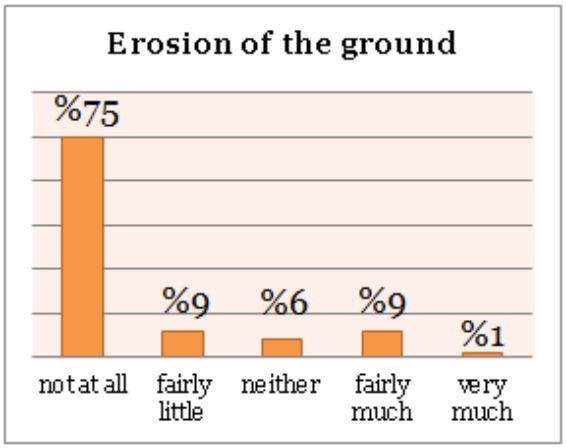
A big part of visitors have higher education and they are coming to the National Park for one day trips. Hiking/going for a walk/jogging are the main activities for visitors and they also do bird/wildlife watching and cycling/mountainbiking.



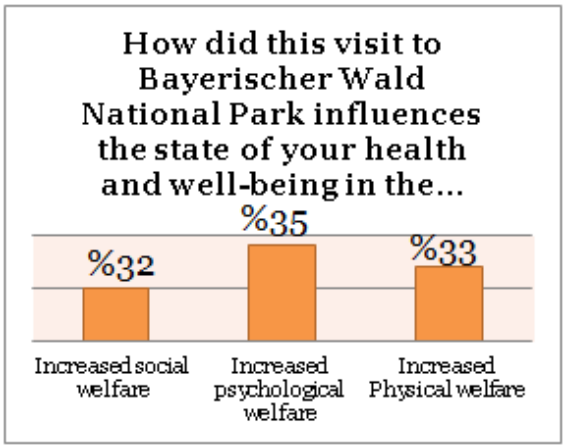


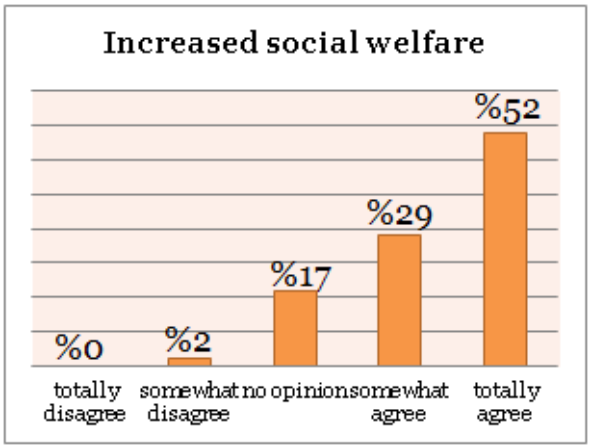
Degradation of vegetation, treatment of natural environment and erosion of the ground has same effect on visitors.

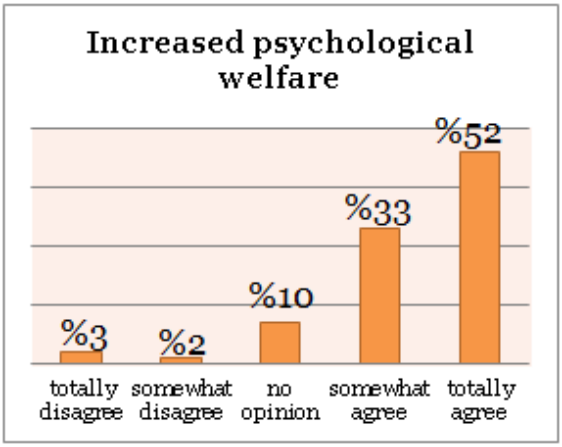


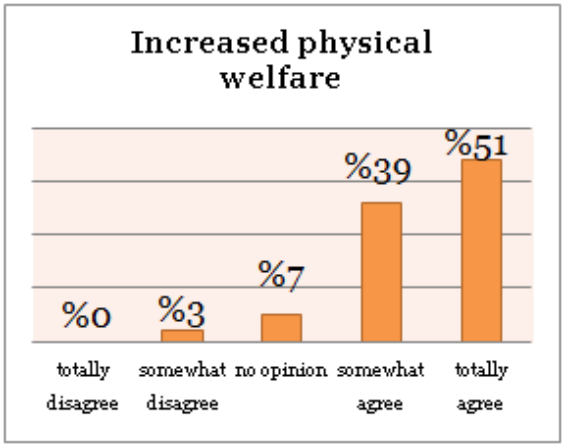


None of these three factors evaluated very much disturbing by visitors.









Bayerischer Wald National Park has highest effect on visitor's psychological health and welfare then on physical health and welfare and lastly on social health and welfare. A big part of visitors replied that visit to National Park influences the state of their social and physical health and well-being totally agree and psychological then health and welfare.

5. CONCLUSION

Research consistently documents positive links between human contact with nature and health and well-being. Recent works have explored the role of visitation to parks and protected areas in providing health and well-being benefits (Romagosa et al _2015).

The concept of “ecosystem health” has been applied widely in ecology and the environmental sciences over the past 25 years (Costanza, Norton and Haskell,1992; Lackey,2001). Environmental degradation (i.e. air and water pollution, forest and wetland destruction, etc.) frequently causes poor human health, while environmental protection (i.e. creation of parks and protected areas, appropriate environmental management, etc.) contributes positively to human health. Hence, according to Millennium Ecosystem Assessment (2003) the key contributions of ecosystems to human well-being through the provisioning, regulating, cultural, and supporting services are increasingly recognized (Romagosa et al _2015).

In this context the aim of the research project was bringing together ecosystem health and human health within the scope of ecological restoration in protected areas.

Consequently results of ecological monitoring programs shows that ecological restoration in protected areas restoration enables recovery of a healthy eco-system through ecosystem management.

This paper shows increasing understanding of the positive relationships between park and protected area visitation and the associated health and well-being benefits to the visitors.

According to evaluation of visitor surveys it also supports societal goals such as human health and wellbeing. Thus visitors feel socially, psychologically and physically healthier in restored protected areas.

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7. ANNEXES

Doñana National Park Visitor Survey

The Aim of Questionnaire;

The information collected by this Visitor Survey will be used in evolution of effects of restoration efforts in Doñana National Park on human health and welfare.

THANK YOU IN ADVANCE!

Personal Information						
+ Age	Under 16					
	16-25					
	26-45					
	46-65					
	66+					
+ Gender	Male					
	Female					
+ Education level	Primary school					
	Secondary school					
	Bachelor's degree					
	Master's degree or PhD					
How many times have you visited this national park, during the last 12 months?	One day trips ____times					
	Trips where at least one night has been spent in national park_____ times					
Which activities have you done at Doñana National Park?	Trekking					
	Horse riding					
	Kitesurfing/ Windsurfing					
	Swimming					
	Bird/wildlife watching					
	Mountain biking					
	Other					
Did any of the following disturb you this time during your visit in the Doñana National Park? (5 = very much, 4 = fairly much, 3 = neither, , 2 = fairly little, 1= not at all)						
Degradation on wetlands	5	4	3	2	1	
Treatment of natural environment	5	4	3	2	1	
Erosion of the ground	5	4	3	2	1	
Other (……)	5	4	3	2	1	
How did this visit to Doñana National Park influences the state of your health and well-being in the following sectors?						
(Answer, please, each point and choose the alternative, which describes your feeling the best.) 5 = totally agree, 4 = somewhat agree, 3 = no opinion, 2 = somewhat disagree, 1 = totally disagree)						
Increased social welfare (f. ex. strengthened social relations, improved working capacity, enjoyed doing things alone or together)	5	4	3	2	1	
Increased psychological welfare (f. ex. satisfaction with life, improved mood, recovery from mental stress, learned something new)	5	4	3	2	1	
Increased Physical welfare (f. ex. enjoyed sensing the nature, maintained the fitness, learned new skills, physical well-being)	5	4	3	2	1	

THANK YOU FOR ANSWERING THIS QUESTIONAIRE!

If there is anything else you would like to tell us, please use the space below.

Sierra de Guadarrama National Park Visitor Survey

The Aim of Questionnaire;
The information collected by this Visitor Survey will be used in evolution of effects of restoration efforts in Sierra de Guadarrama National Park on human health and welfare.

THANK YOU IN ADVANCE!

Personal Information					
+ Age	Under 16				
	16-25				
	26-45				
	46-65				
	66+				
+ Gender	Male				
	Female				
+ Education level	Primary school				
	Secondary school				
	Bachelor's degree				
	Master's degree or PhD				
How many times have you visited this national park, during the last 12 months?	One day trips ____times				
	Trips where at least one night has been spent in national park_____ times				
Which activities have you done at Sierra de Guadarrama National Park?	Trekking				
	Mountaineering /climbing				
	Orienteering				
	Bird/wildlife watching				
	Mountain biking				
	Winter activities (skiing/snowboarding, etc.)				
	Other				
Did any of the following disturb you this time during your visit in the Sierra de Guadarrama National Park? (5 = very much, 4 = fairly much, 3 = neither, , 2 = fairly little, 1= not at all)					
Degradation of vegetation	5	4	3	2	1
Treatment of natural environment	5	4	3	2	1
Erosion of the ground	5	4	3	2	1
Other (……)	5	4	3	2	1
How did this visit to Sierra de Guadarrama National Park influences the state of your health and well-being in the following sectors?					
(Answer, please, each point and choose the alternative, which describes your feeling the best.) 5 = totally agree, 4 = somewhat agree, 3 = no opinion, 2 = somewhat disagree, 1 = totally disagree)					
Increased social welfare (f. ex. strengthened social relations, improved working capacity, enjoyed doing things alone or together)	5	4	3	2	1
Increased psychological welfare (f. ex. satisfaction with life, improved mood, recovery from mental stress, learned something new)	5	4	3	2	1
Increased Physical welfare (f. ex. enjoyed sensing the nature, maintained the fitness, learned new skills, physical well-being)	5	4	3	2	1

THANK YOU FOR ANSWERING THIS QUESTIONAIRE!

Bayerischer Wald National Park Visitor Survey

The Aim of Questionnaire;
The information collected by this Visitor Survey will be used in evolution of effects of restoration efforts in Bayerischer Wald National Park on human health and welfare.

THANK YOU IN ADVANCE!

Personal Information		
+ Age	Under 16	
	16-25	
	26-45	
	46-65	
	66+	
+ Gender	Male	
	Female	
+ Education level	Primary school	
	Secondary school	
	Bachelor's degree	
	Master's degree or PhD	
How many times have you visited this national park, during the last 12 months?	One day trips ____times	
	Trips where at least one night has been spent in national park_____ times	
Which activities have you done at Bayerischer Wald National Park?	hiking/going for a walk/jogging	
	berrying/collecting mushrooms	
	Orienteering	
	Bird/wildlife watching	
	cycling/mountainbiking	
	ski touring/cross country skiing/snowshoeing	
	Other	

Did any of the following disturb you this time during your visit in the Bayerischer Wald National Park? (5 = very much, 4 = fairly much, 3 = neither, , 2 = fairly little, 1= not at all)					
Degradation of vegetation	5	4	3	2	1
Treatment of natural environment	5	4	3	2	1
Erosion of the ground	5	4	3	2	1
Other (……)	5	4	3	2	1

How did this visit to Bayerischer Wald National Park influences the state of your health and well-being in the following sectors?					
(Answer, please, each point and choose the alternative, which describes your feeling the best.) 5 = totally agree, 4 = somewhat agree, 3 = no opinion, 2 = somewhat disagree, 1 = totally disagree)					
Increased social welfare (f. ex. strengthened social relations, improved working capacity, enjoyed doing things alone or together)	5	4	3	2	1
Increased psychological welfare (f. ex. satisfaction with life, improved mood, recovery from mental stress, learned something new)	5	4	3	2	1
Increased Physical welfare (f. ex. enjoyed sensing the nature, maintained the fitness, learned new skills, physical well-being)	5	4	3	2	1

THANK YOU FOR ANSWERING THIS QUESTIONAIRE!
If there is anything else you would like to tell us, please use the space below.