Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

Swiss Federal Institute for Forest,
Snow and Landscape Research

Ranger and visitor management systems in protected wetland areas in the Canton of Aargau

Master thesis in Environmental Sciences

Swiss Federal Institute of Technology, Zürich, Switzerland

Céline Graf

June 2016

Supervisors

Prof. Dr. Felix Kienast,

Swiss Federal Institute of Forest, Snow and Landscape Research WSL

PD Dr. Janine Bolliger,

Swiss Federal Institute of Forest, Snow and Landscape Research WSL

Pictures on front page:

Left: small prohibition sign along the Aabach near Hallwilersee, Céline Graf, 2016

Right: Information board „Umgehungsgewässer“ near Rupperswil, Céline Graf, 2016

Abstract

Visitor management is a common instrument to guide people along protected areas and to provide outdoor recreation activities. It consists of different measures that either control (direct) or aim to alter (indirect) the behavior of visitors and local residents. Many studies assessed the effectiveness of visitor management measures in protected areas, revealing that direct measures are more effective but indirect measures more appreciated by visitors. The main goals of this Master thesis were (a) to examine the current state of visitor management in five wetland areas in the Canton of Aargau and (b) to establish suggestions to provide both satisfying recreation experiences and protection of sensitive sites. Thus, a literature review, expert interviews with managers of the five study areas and a survey with visitors in two areas were applied.

The results of the expert interviews revealed that the visitor management in the five study areas all differ in the amount and distribution of the implemented measures. These differences can be explained by various types of protected habitats, the belonging to a decree area and the age of the visitor management.

The analysis of the survey showed that the visitors in the areas Aarau-Wildegg and Reussebene rated both direct and indirect measures as effective to protect nature from the negative impact of outdoor recreation. This outcome is in accordance to findings from other studies. However, there are differences between the areas: the respondents in the area Aarau-Wildegg rated the direct measures significantly less effective than the respondents in Reussebene. Also, the order of the measures that were rated the most effective differ between the two study areas and the suggestions for improvements or ideas on how the area would develop if no visitor management would be implemented in the area. Reasons for those different assessments and concerns might be that the visitors have different conceptions of nature conservation in mind and that the conservation history (either long established protected areas in Reussebene versus newly restored floodplains in Aarau-Wildegg) influenced the assessment of the measures.

This Master thesis reveals a number of practice-oriented results ranging from expert assessments of visitor management measures to visitors' views of the measures including suggestions for further measures and activities. Due to the small number of interviews, the results are not representative but show clear tendencies that would have to be confirmed or rejected in a representative survey.

June 2016

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1 Introduction

In the year 2014, 15.4% of the land and inland water areas and 3.4% of the ocean areas were under protection worldwide (Schulman, 2015). The International Union for Conservation of Nature IUCN defines protected areas as follows (Dudley and Stolton, 2008): "A protected area is a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values." Alcamo (2003) lists associated ecosystem services of nature as provisioning (e.g. food), regulating (e.g. water purification), cultural (e.g. recreation and ecotourism) and supporting services (e.g. soil formation). This recent definition of nature conservation areas deliberately includes the needs and rights of people to interact with nature and to use the areas for recreational purposes. This was not always the case and requires careful planning when and where people are a welcome part in nature reserves. This in turn requires a professional visitor management and ranger system, the topic of the present thesis.

1.1 Aim of the thesis and research questions

Studies explaining how the attitude of people towards protected areas and their use for recreation and leisure activities changed over time are rare. Some insight come from studies on the nature-people interactions presented by e.g. Mace (2014), see section 3.1.3. A few nationwide studies describe the development of recreational activities in protected areas. For instance, Lautenbach *et al.* (2011) examined the change of ecosystem services in protected areas in the district of Leipzig in Germany. They found out that the number of small recreation areas decreased during the period from 1964 to 1984. Afterwards, it increased again.

In Switzerland, Hunziker *et al.* (2012) examined the use of forests for recreational activities. They evaluated data of three comparable surveys from the years 1977, 1997 and 2010. A major finding was that the frequency of people using the forest for recreational activities slightly decreased since 1978. Another finding was that activities like walking, hiking and observing nature were performed more often in 2010 than in 1997, only the number of people walking their dogs slightly declined.

Additionally, the study by Cordell *et al.* (2008) showed that recreational activities in the National and State parks of the United States remained stable over the last 20 years. Similar to Switzerland, the activities changed: instead of hunting, fishing, moun-

tain biking and horseback riding, people used the areas more often for camping, backpacking, scenic experiences and photographing the nature and wildlife.

However, the use of nature for recreation can cause problems. Many studies examined the impact of humans' behavior on nature. Trampling, littering, disturbances due to noise and dogs running free are known to have negative impacts on plants and wildlife (Ballantyne *et al.*, 2014; Ikuta and Blumstein, 2003; Mason *et al.*, 2015). A common tool to reduce this negative impact is visitor management in the protected areas (Hall and McArthur, 1996; Mason, 2005; Tan and Law, 2015).

Glauser (2016) advises Switzerland to follow a "nature for itself" strategy (see section 3.1.3) as the protected areas are compared to those abroad smaller in size and negative impacts like trampling have strong influences on sensitive species and ecosystems.

But what does Glauser's (2016) advice mean for smaller administrative units that are densely populated such as the cantons of the Swiss lowlands? Is a "nature for itself" strategy feasible, wanted and sustainable in these areas where nature experience is a crucial issue for physical and mental health of people?

The agency "Abteilung für Landschaft und Gewässer ALG" from the "Departement Bau, Verkehr und Umwelt BVU" from the Canton of Aargau is exactly in this dilemma. Should nature be fully accessible to people to improve their nature experience, or should they enforce a restrictive visitor management? At the moment, the agency does not exactly know if the current visitor management in the different protected (wetland) areas is successfully protecting nature and if the visitors are satisfied. They would like to know how the visitor management can be improved to provide both a sound nature and satisfying outdoor recreational experiences for visitors.

The aim of this master thesis is to provide a scientific contribution for a socially accepted visitor management and supervision system in wetland areas in the Canton of Aargau. My main research question is:

> *What is the current state of visitor management in protected wetland areas in the Canton of Aargau and what kind of improvements are required to provide both satisfying outdoor recreational activities for visitors and a sound nature?*

To achieve the aim of this thesis and to answer the question above the following list of research questions was developed.

Literature review

To be able to compare the situation in the Canton of Aargau with visitor management a literature review was performed. The purpose was mainly to gain knowledge on different visitor management systems and how well they work.

1) What nature-people interactions are covered in conservation theories?
2) How did the recreational use of protected areas develop?
3) What ranger systems are worldwide / European wide / in Switzerland successfully implemented? Can those ranger systems be classified according to their ecosystems and societies? Do different ranger systems exist in different ecological and social systems?
4) What visitor management measures show effective impact on the reduction of negative impacts of recreational activities on nature?
5) What is the influence of environmental education on visitor management?
6) How can a visitor management reduce conflicts between different user groups?

Comparison of visitor management systems in the Canton of Aargau

To learn how the current visitor management work in the study areas and to compare them between each other several specific questions were asked.

7) What types of visitor management systems exist in the study areas?
8) How is the behavior of the visitors influenced by the visitor management and supervision systems?
9) Are the needs of the visitors regarding outdoor recreation and visitor management fulfilled?
10) How do the visitors rate the visitor management? Are there any suggestions for improvements or requests of the visitors?
11) How are aspects of environmental education implemented in the visitor management systems?
12) Do the visitors have the impression to be sufficiently informed?

Best practice

The last part is about suggestion for improvements for visitor management in the study areas. It aims to provide advice for the cantonal agency and the managers of the areas.

13) What visitor management is best for what type of protected (wetland) area in the Canton of Aargau?

1.2 Outline of this thesis

The next section describes the methods applied in this thesis as well as the study areas. In section 3 the literature review is reported. Afterwards, the results are presented and discussed (sections 4 and 5). In section 6, conclusions are deduced from the discussion. Finally, the acknowledgement is followed by the list of references, the declaration of originality and the appendix.

2 Methods and study areas

Three qualitative and quantitative methods from the social sciences were applied in this thesis to answer the research questions. First, a literature review was done to collect current findings on ranger systems and visitor management. Second, six expert interviews were performed to get more information about the current state of visitor management and problems in the study areas. Last, a survey was made to find visitor management measures that are accepted by visitors and to learn suggestions for improvements.

2.1 Literature review

First, a literature review on the topics of ranger systems, education, conflicts, visitor management and development of recreational use of protected areas was done. A broad database research with the three databases Web of Knowledge (https://apps.webofknowledge.com), Google Scholar (https://scholar.google.ch) and Scopus (https://www.scopus.com) was performed. Different keywords and combinations were used to find as many relevant articles as possible (Table 1). Using the tracking function of the databases helped to find articles cited in and articles citing the current one and thus find related papers. If the abstracts and / or conclusions proved relevant, the article was downloaded and added to EndNote. From reading the papers and using the tracking function more relevant articles were retrieved and added to the list to broadly cover the subject area. Using the papers the research questions 1 to 6 (see page 3) were answered.

Table 1: Keywords used for the database research.

Topic	Keywords
ranger systems	ranger, ranger system, park, protected area, warden, guard, activities, national park
education, conflicts and visitor management	visitor management, protected area, environmental education, education, interpretation, visitor behavior, impact, user group, conflict, visitor group, bike and hike, survey, visitor survey, satisfaction
human environment relationship in recreation	human environment relation, human nature relation, relationship, development, evolution, recreation, local recreation, change, recreation area
impact of humans on nature	impact, visitor behavior, protected area, river

Terms like visitor management or interpretation are used in different ways in literature. Therefore, the box below defines how they are applied in this thesis and during the interviews and the survey.

Visitor management: according to Glauser (2016)and Mason (2005) a visitor management has two purposes. First, it guides visitors through a protected area in order to reduce the negative impact of recreation on nature. Second, it provides possibilities for outdoor recreational activities in the protected area. Visitor management consists of a combination of direct and indirect measures.

Supervision service / ranger: this term is used according to the definition of the Swiss Rangers (2016). It includes people and institutions that are in charge of supervising protected areas as mediators between people and nature. They perform tasks such as visitor management, environmental education, maintenance of protected areas, their natural elements and infrastructures or the enforcement of rules and laws. The supervision service of a protected area can be carried out by rangers with a professional education but also by men doing civilian service or volunteers. The supervision service is understood as a part of the visitor management in a protected area.

Environmental education: The major goal of environmental education is to create a willingness to act and to support competences to handle natural resources in a social, ecological and economical balance (Fachkonferenz Umweltbildung, 2014).

Interpretation: According to Mason (2005) and Stewart *et al.* (2001) interpretation is a process that rises awareness through the explanation of a place or topic. In addition, interpretation seeks to alter the behavior of visitors in a way that they are more concerned about the environment. Interpretation is applied as an instrument of environmental education.

2.2 Expert interviews

The expert interviews were performed as qualitative interviews according to Mayer (2013). The goal of the expert interviews was to define the current situation in the five study areas in the Canton of Aargau and to find answers to the research questions 7, 8 and 11 (see page 3). The expert interviews consisted of open questions answered by the experts. The answers were analyzed and interpreted to compare the different visitor management in the study areas.

The open interview questions were divided into three sets: one about the visitor management in general, one about the ranger and supervision service in the area and the last one about environmental education. In each set several questions were

asked to cover the entire content of the research questions. Matthias Buchecker from the WSL reviewed the set of questions and provided helpful input. The questions were sent to the experts prior to the interview. The interviews were performed in Swiss German. The questions can be found in the appendix I, page i.

Expert selection: In the qualitative phase relevance is more important than representativeness. The sample of experts should cover all aspects of the subject, i.e. all the different dimensions of protected areas and their visitor management. Sebastian Meyer and Erik Olbrecht, two people responsible for the cantonal agency "Abteilung Landschaft und Gewässer ALG" within the "Departement Bau, Verkehr und Umwelt Kanton Aargau BVU", provided a list of possible experts from which the most relevant ones were chosen (according to the theoretical sampling of Glaser *et al.* (1968)) and invited for an interview. See Table 2 for more details on the experts.

Table 2: Characterization of the experts.

Name	Study area	Function
Thomas Burkard	Reussebene	Manager of the group "Information und Aufsicht Reusstal", employed by the "Stiftung Reusstal"
Ambros Ehrensperger	Chly Rhy	Supervisor, employed by creaNatira
Bruno Fürst	Hallwilersee	Manager of the "Hallwilersee Ranger"
Bruno Schelbert	Aarau–Wildegg	Project leader for the cantonal agency
Philipp Schuppli	Wasserschloss and Chly Rhy	amongst others: Supervisor, employed by creaNatira
Ulysses Witzig	Wasserschloss and Chly Rhy	Manager of creaNatira

Evaluation: The interviews took place from the 31st January to the 16th February 2016. They were recorded, transcribed into High German and analyzed. The statements were collected according to the questions in the guided interviews and compared. The different characteristics of the visitor management were summarized in several tables (appendix V, page xix) and factors explaining the differences in the visitor management systems were identified.

2.3 Survey

The survey was developed and realized according to Mayer (2013), Porst (2014) and Raab-Steiner and Benesch (2012).

The aim of the survey was to test the visitors' perception of visitor management and ranger systems and to gain suggestion for improvements of the current measures.

Survey questions (appendix II, page iii): the questions were formulated as closed, semi-open or open questions. The bullet points below list the topic of the questions.

- Introductory question: motivation of visitors to visit this area
- Definition of the term "visitor management"
- General satisfaction with the visitor management in the area
- Evaluation of effectiveness of twenty-one measures
- Evaluation of attractiveness of seven measures
- Evaluation of available information, suggestions for improvements
- Evaluation of needs, suggestions for improvements
- Development of the area with no visitor management
- Need of a supervision service in the area
- Demographic data

As a response to the currently implemented measures the visitors were asked to rate the effectiveness or attractiveness of visitor management measures. The aim of those questions was to compare the visitors' opinion about visitor management measures with the currently implemented measures. Table 3 describes how effectiveness and attractiveness was checked for twenty-eight measures.

Table 3: Standardized questions to learn how the visitors assess the effectiveness or attractiveness of the measures.

Measure	Question	Assessment
effectiveness: measures controlling or altering behavior (21 measures)	The measure … **provides the best protection** for nature from the negative impact of human activities.	1: no agreement at all 2: no agreement 3: neutral 4: agreement 5: full agreement
attractiveness: visitor infrastructure (7 measures)	The measure … **makes the area more attractive** for recreational activities.	

Survey: A pre-test was conducted in the area Wasserschloss to test if the survey works out and is reliable. The actual survey took place in the areas Aarau-Wildegg and Reussebene as those two areas represent the two most different visitor management (Table 4).

Table 4: Dates and areas of the survey.

Date	Where	Comments
Sunday, 20.03.2016	Wasserschloss	Pretest
Saturday, 26.03.2016	Reussebene	near the bridge in Rottenschwil
Monday, 28.03.2016	Reussebene	near the bridge in Rottenschwil
Saturday, 02.04.2016	Aarau-Wildegg	in Rupperswil
Sunday, 03.04.2016	Aarau-Wildegg	in Rupperswil

Data analysis: data of the survey was analyzed using descriptive and statistical methods with SPSS (IBM Corp., 2015a, 2015b). Before entering the data into the SPSS data file all the question with their associated answers were coded and described in

the SPSS data file. Every answer retrieved a numerical value to simplify the statistical analyses. The answers from the open questions were classified in several groups (see appendix VII, page xxv). Afterwards, the data was filled in, double checked and analyzed. Descriptive and analytical statistics have been calculated, i.e. bar charts, frequency values like mean and median, Mann-Whitney-U-test, Kendall-correlation and Chi-Square-test.

To statistically compare the measures assessed by the visitors with the implemented ones I needed a concrete number of effective or attractive measures. I decided to threshold the mean visitor ratings of the measures to get binary data. Measures with a median value ≥ 4 were thus classified as effective or attractive. I chose the median because it indicates that at least half of the ratings were equal or higher than 4. I decided to refer to the overall median value of a measure (median value of a measure from all respondents of both areas) because this represents a more robust indication of what measures are assessed as effective or attractive. To simplify the comparison, I pooled the direct effective and direct attractive measures into one group, and did so for the indirect ones, too.

2.4 Comparison of results with theories

After the analysis of the data from the expert interviews and the survey I interpreted those results with regard to the theories describing the relationships between nature and people. As a first step, I tried to connect my results with the concepts of Mace (2014) to gain insight into the people-nature relationship of the visitors and the currently implemented visitor management. I assessed how important different groups of visitor management measures are for the different concepts of conservation according to Mace's (2014) paper. The measure groups are a subsample of direct measures: structural measures and official prohibitions that restrict, and visitor infrastructure that attract visitors. The indirect measures are highly important for all foci of conservation and therefore not included in this analysis. In a second step, I pooled all the measures of the restrictive or attractive measure group that were assessed with an overall median value ≥ 4. Next, I classified the importance of the measure groups according to the sum of the measures, i.e. one or two measures with an overall median value ≥ 4 represent a low importance of this measure group, three or four a medium and five or six a high importance. Additionally, I calculated the importance of the two measure groups in the currently implemented visitor management by

summing up the number of measures in both measure groups and assessing the importance similarly to the survey results.

2.5 Description of the study areas

After some general information about protected areas in the Canton of Aargau the five study areas are described in this section.

The Canton of Aargau has next to Zurich, Bern and Waadt the fourth-largest population of all Swiss cantons (Kanton Aargau, 2016b). 35% of its surface area is covered with forest and, in addition, the rivers Aare, Reuss, Limmat and Rhein flow through the cantonal area (BVU, 2007; Kanton Aargau, 2016c). 375 protected areas cover less than 2% of the cantonal area, including forest reserves, floodplains, bogs, dry or wet habitats, amphibian spawning sites, bird reserves and Landscapes of National Importance (Kanton Aargau, 2016e). Most of the nearby recreation areas are within 20 minutes walking distance for the people living in the Canton of Aargau (BVU, 2007). The protected areas are widely spread out all over the Canton of Aargau and they are used for recreation in a similar level as unprotected areas. All those areas are managed and maintained in different ways, either through the canton, foundations or Pro Natura Aargau. As a consequence, different visitor management are applied in these areas. To provide satisfactorily nearby recreation in the future, one needs to know if the current management are successful and how they might be improved both to provide a sound nature and to satisfy the visitors in the protected areas.

The study areas have been suggested by Erik Olbrecht and Sebastian Meyer from the cantonal agency. They also advised me in selecting topics that are of interest for the Canton of Aargau. The five study areas (see Figure 1) were selected because of their difference in the driving factors such as remoteness, rate of renaturation and supervision service.

All selected areas are water habitats. With the exception of the Hallwilersee the areas are part of the “Auenschutzpark Aargau”. After the cantonal initiative “Auenschutzpark – für eine bedrohte Lebensgemeinschaft” was accepted in 1993 the “Abteilung Landschaft und Gewässer” made a program to protect and reevaluate the remaining floodplains in the Canton of Aargau (Auenschutzpark Aargau, 2003). Its goal is to create and maintain spacious and connected floodplains and river ecosystems for plants, animals and humans (Auenschutzpark Aargau, 2003) in the Canton of Aargau.

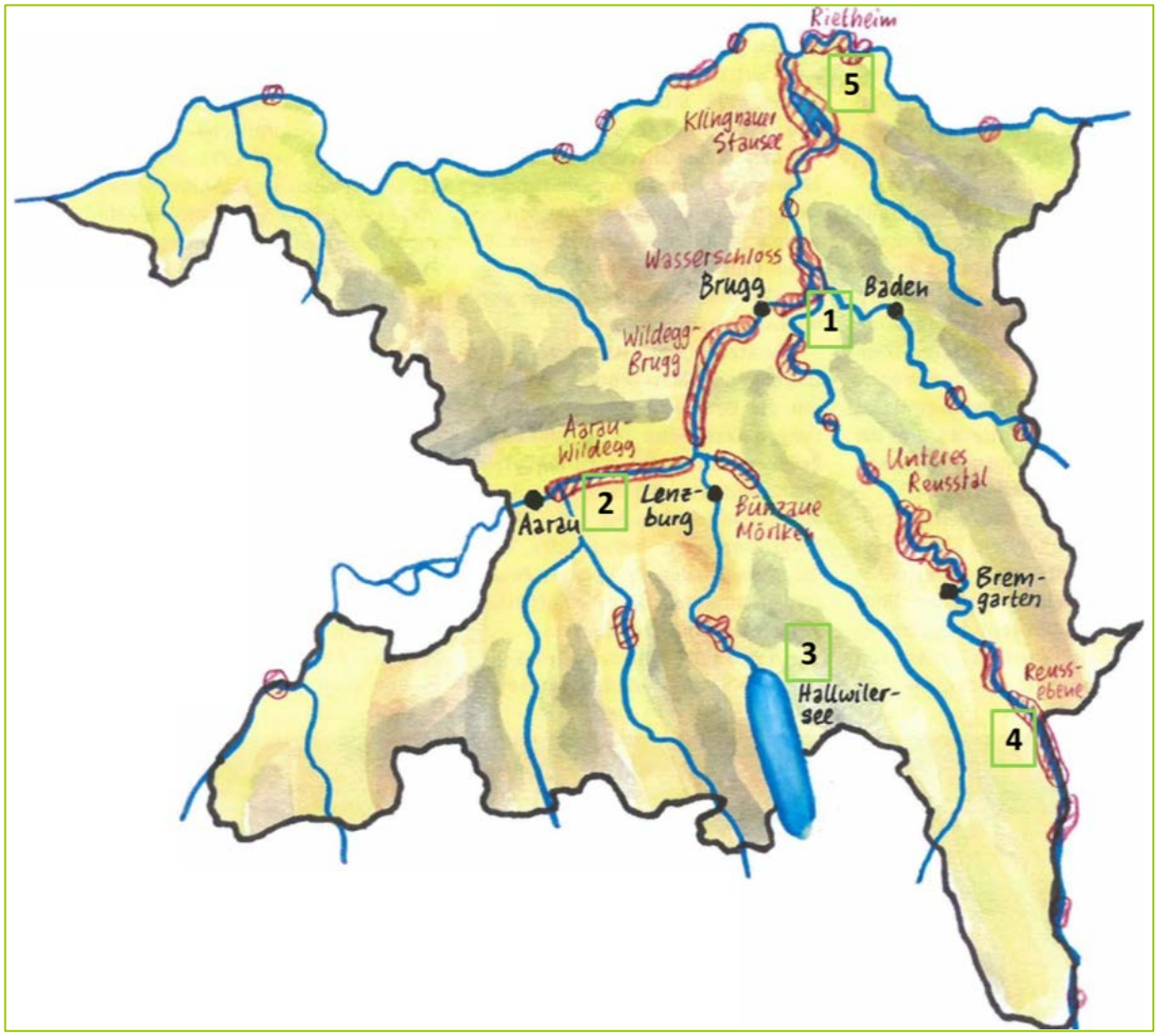

Figure 1: Auenschutzpark and the study areas. 1. Wasserschloss, 2. Aarau-Wildegg, 3. Hallwilersee, 4. Reussebene, 5. Chly Rhy (Rietheim). Source: Schelbert (2015b), edited by Céline Graf.

The wetland areas of Wildegg and Aarau-Wildegg are both located in urban areas whereas the other three study areas Reussebene, Hallwilersee and Chly Rhy are situated in more rural landscapes.

2.5.1 Wasserschloss

The Wasserschloss between Brugg and Baden is the confluence of the rivers Aare, Reuss and Limmat. This area is part of the Federal Inventory of Landscapes and Natural Monuments of National Importance, it contains Amphibian Spawning Sites and Floodplains of National Importance (Swiss Federal Authorities, 2007e). Parts of the floodplains are cantonal Forest Reserves (Swiss Federal Authorities, 2007e). The "Regierungsrat" declared the Wasserschloss a decree area showing that the preservation of the area is of cantonal importance and thus the use and protection of the area are defined in the Richtplan (DüCo GmbH, 2014). CreaNatira GmbH, a subsidi-

ary of Pro Natura Aargau, manages several renaturalized and protected areas, one of those is Geissenschachen near Brugg (Witzig, 2016). On the island "Stroppelinsel" (438ha) the entrance for visitors is prohibited (Pro Natura Aargau, 2016). The floodplains are too small to be efficiently locked for visitors (Olbrecht and Meyer, 2015). Furthermore, conflicts between different visitor groups (walkers, joggers, hikers, people walking their dogs, cyclists, horsemen) occur as all of them use the Wasserschloss as a recreational area (Olbrecht and Meyer, 2015). Men doing civilian service maintain and control the protected areas under the supervision of Pro Natura Aargau (Olbrecht and Meyer, 2015).

2.5.2 Aarau-Wildegg

Spread out between Aarau and Wildegg we find with 317ha the biggest protected floodplain area in the Canton of Aargau (Kanton Aargau, 2016a). Next to Rupperswil the river Aare is entirely renaturalized (Olbrecht and Meyer, 2015). Towards Aarau, the Aare still runs in its river bed and individual renaturation measures were performed (e.g. protected areas for amphibian spawning; Olbrecht and Meyer (2015)). Except of Amphibian Spawning Sites the region is not mentioned in any Inventory of National Importance, however towards the south of Wildegg is a Floodplain of National Importance, towards the north of the Aare is a Landscape of National Importance and in the south are some Forest Reserves (Swiss Federal Authorities, 2007a). The floodplain area between Aarau and Wildegg is the most important local recreation area for the inhabitants of Aarau, therefore many visitor groups are present and conflicts occur (Olbrecht and Meyer, 2015). A current topic is that the visitor groups are not separated from each other and therefore a better organization is asked for (Olbrecht and Meyer, 2015). At the moment there is no control or maintenance staff such as a ranger in charge (Olbrecht and Meyer, 2015).

2.5.3 Hallwilersee

The Hallwilersee is part of the Federal Inventory of Landscapes and Natural Monuments of National Importance (Gemeinde Boniswil, 2016) and several smaller protected areas surround the lake. At the northern end lies the "Boniswiler Ried", including five Nature Preserves of Pro Natura Aarau, a Fen and an Amphibian Spawning Site of National Importance and is an Emerald Site (Swiss Federal Authorities, 2007c). The Hallwilersee is declared as a decree area (DüCo GmbH, 2014). The inhabitants of Boniswil decided to lock the Ried to visitors (Gemeinde Boniswil, 2016). The Hallwilersee is used by different visitor groups and conflicts occur (Rangerdienst Hallwilersee,

2015). “Hallwilersee für Mensch und Natur” is an association founded by the Cantons of Lucerne and Aargau to finance a professional ranger service that maintains and controls the protected areas and performs public information and environmental education (Rangerdienst Hallwilersee, 2015).

2.5.4 Reussebene

Several small protected areas are situated between “Flachsee / Rottenschwiler Moos” and “Rüssspitz” in the Reussebene (Olbrecht and Meyer, 2015). The whole area is part of a Fen and a Floodplain Site of National Importance, the Federal Inventory of Landscapes and Natural Monuments of National Importance and is an Emerald Site too (Swiss Federal Authorities, 2007d). Several Amphibian Spawning Sites of National Importance are situated next to the river Reuss (Swiss Federal Authorities, 2007d). The areas of “Rüssspitz” and “Maschwander Allmend” are Mire Landscape of Particular Beauty and National Significance (Swiss Federal Authorities, 2007d). The areas are part of the Reusstal decree area (DüCo GmbH, 2014). The protected areas are maintained through the cantonal maintenance team for protected areas and supervised by volunteers (Olbrecht and Meyer, 2015).

2.5.5 Chly Rhy

The floodplain Chly Rhy is located at the northern end of the Canton of Aargau at the boundary to Germany. It is a Nature and Forest Preserve of Pro Natura, has an Amphibian Spawning Site of National Importance and is part of a Floodplain of National Importance (Swiss Federal Authorities, 2007b). The floodplain Chly Rhy is part of the Rheinufer protection decree (DüCo GmbH, 2014). CreaNatira GmbH, the subsidiary of Pro Natura Aargau, was in charge for the renaturation and the implementation of a visitor management and is now responsible for the supervision service in this study area (Witzig, 2016).

3 Literature review

The following sections refer to the research questions 1 to 6 and lay out the theoretical background of this thesis. First, some theoretical concepts are explained. The second part of this section focusses on different aspects of visitor management in protected areas.

3.1 Concepts of the relationship between people and nature

Visitor management in protected areas touches upon many ecological, conservational and environmental psychology theories. A few concepts are presented here that seem relevant for this thesis, i.e. the intermediate disturbance hypothesis of Connell (1978), the interaction between human well-being and access to nature and the development of the people-nature relationship through time from Mace (2014).

3.1.1 Intermediate Disturbance Hypothesis IDH

In 1978, Connell described the intermediate disturbance hypothesis (IDH) in his paper (Connell, 1978). The theory is controversially discussed in science (Fox, 2013; Kershaw and Mallik, 2013; Sheil and Burslem, 2013). Nevertheless, it is put into practice (e.g. in the Yellowstone National Park in the USA, Svensson *et al.* (2012)). The IDH describes the relationship between biodiversity and the level of natural or human disturbances in a given habitat (Figure 2). Connell (1978) states that the biodiversity reaches its maximum at a level of intermediate disturbance. With frequent natural or human disturbances only species able to reproduce and mature quickly survive, whereas infrequent natural or human disturbances lead to an overpopulation of the species most capable (Connell, 1978).

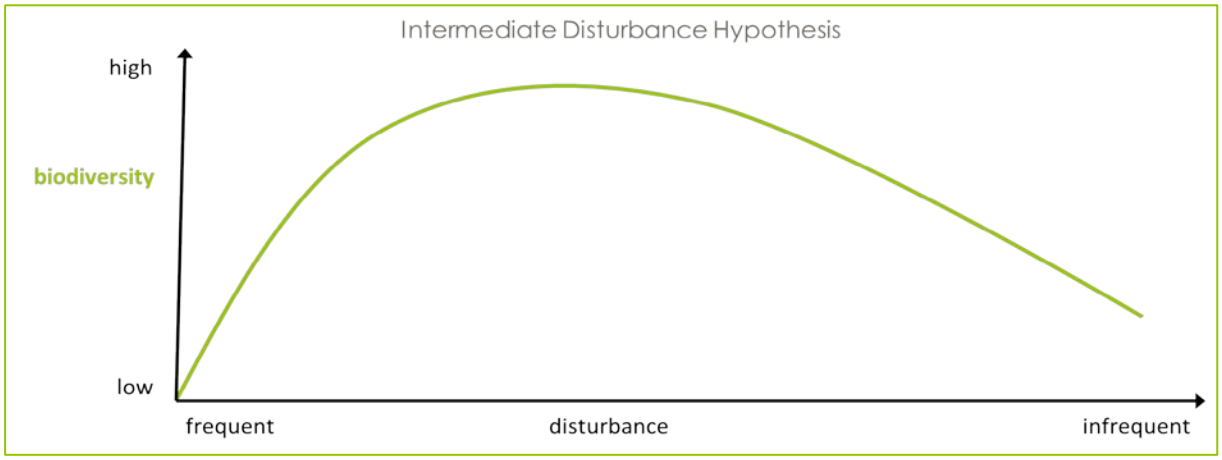

Figure 2: Intermediate disturbance hypothesis according to Connell (1978).

3.1.2 Relation between human well-being and access to nature

Another concept describing a relationship between people and nature is the one of how nature influences the human well-being. Hansmann *et al.* (2007) have been able to show that the human well-being is positively influenced by outdoor recreational activities in a park or forest. The levels of stress and headaches were significantly reduced whereas the general level of feeling well-balanced was increased after the visit of a nature-near or natural area. Similarly, Hunziker and Bauer (2009) found out that activities in nature influenced the amount of people suffering from overweight, depressions or other factors reducing the well-being. Experience of nature is influenced by the access to nature. But, access to nature might be restricted in cities due to little opportunities to visit nature, e.g. little amount of parks, green spaces or many overbuilt areas (Hunziker and Bauer, 2009). Another limitation of access to nature might be the number of restricting measures in visitor management. It defines how much nature one might experience (Needham *et al.*, 2016) through the direct contact with nature. Thus, restricting measures of visitor management influence the access to nature, and therefore the nature experience might eventually lead to a lowered human health (Corvalan *et al.* (2005), Figure 3).

Not only the access to nature but also the quality of the green space influences human well-being. Dallimer *et al.* (2012) and Carrus *et al.* (2015) found out that a higher level of biodiversity and structural diversity positively influence human well-being.

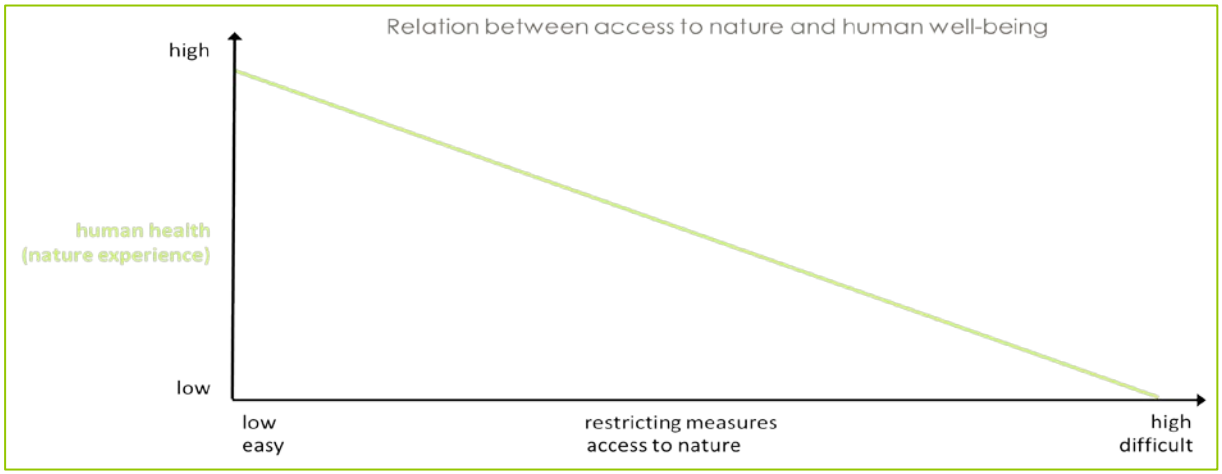

Figure 3: Hypothesized relation between human health and restricting measures of visitor management (respectively access to nature). According to Corvalan *et al.* (2005), Hansmann *et al.* (2007), Hunziker and Bauer (2009) and Needham *et al.* (2016).

3.1.3 People-nature relationship through time

Mace (2014) described the development of the framing of conservation in the last fifty-five years in the western civilizations in four phases (Table 4). In the first phase "nature for itself", conservation focused on separating wilderness and intact natural habitats (commonly without human access) from intense land use and settlements, implementing protected area management and species conservation. During the second phase called "nature despite people", the focus of conservation moved to the reduction of the negative influence of people on species and habitats. Ideas like sustainable harvesting levels, sustainable use of wildlife and community based management were realized. In the third phase, "nature for people", the pressure on habitats grew persistently and society realized that nature delivers ecosystem goods and services that are vital and irreplaceable. The focus of conservation generally shifted from species to ecosystems with an emphasis on integrated management and the common thinking that people are part of an ecosystem. The last phase "people and nature" shows movement from the utilitarian thinking of ecosystem goods and services to a mutual relationship between people and nature, integrating cultural institutions and structures to develop more sustainable relations between nature and people. As the focus of conservation changed relatively fast along these four phases and not homogeneously in all areas of a region or even the world, a diversity of motives, views and foci exist in today's nature conservation community.

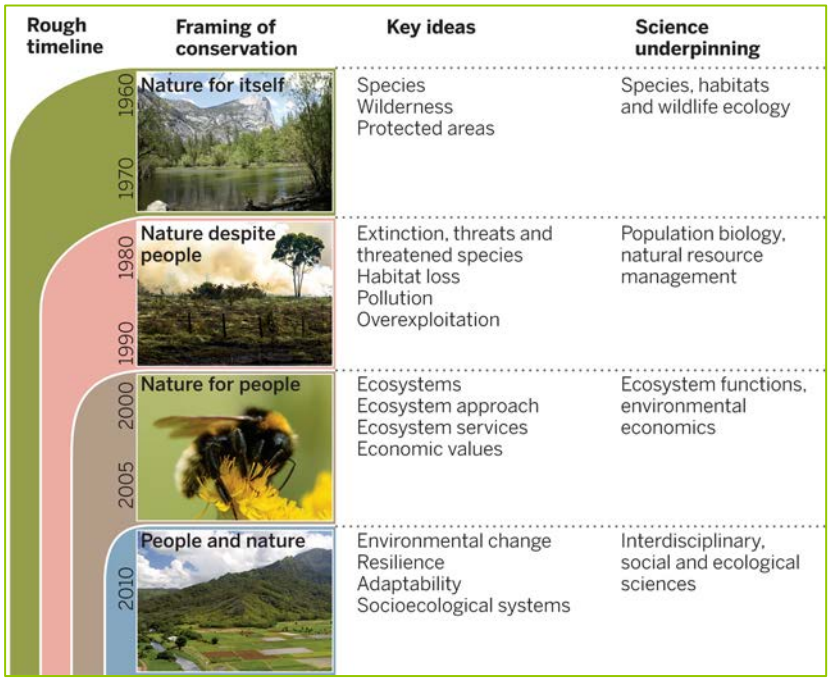

Figure 4: Four phases of how nature and conservation are perceived, according to Mace (2014).

3.2 Visitor management in protected areas

As defined earlier, one purpose of visitor management is to reduce the negative impact of human activities in protected areas. Additionally, it aims at leading visitors to interesting places within the areas (Hall and McArthur, 1996) or to places with attractive outdoor recreational activities (Glauser, 2016). Clivaz *et al.* (2013) provided a list of different objectives of visitor management: ecological, economic, social, psychological and cultural, safety related, cultural heritage protective and politic-administrative objectives. The measures used to achieve an effective visitor management are divided into hard or soft (Mason, 2005), or direct and indirect measures (Clivaz *et al.*, 2013; Manning, 2011; Orams, 1995). Hard or direct measures help to control the behavior of visitors whereas soft or indirect measures aim to change the visitors' behavior (Manning, 2011). Table 5 lists examples of direct and indirect measures mentioned in the literature (Ballantyne *et al.*, 2008; Clivaz *et al.*, 2013).

Table 5: Examples of direct and indirect measures (according to Ballantyne et al., 2008 and Clivaz et al., 2013).

Type	Measures
Direct	prohibitions, sanctions, limiatations of visiting hours or group size for activities, fences, other infrastructre, access and parking fees
Indirect	wayfinding and trail-side signs, interpretive signs, brochures, maps, information about the area, environmental education and interpretation, guided tours, ranger programms, visitor centers, exhibitions, audio-visual materials, attractive activity offers

According to Glauser (2016) and Park *et al.* (2008) a combination of spatially separated areas either prioritizing nature protection or specific nature experience such as outdoor recreation and information for visitors, structural measures and a legal basis is the best strategy for an effective visitor management. Glauser (2016) estimated that 90% of the population keep to the appropriate behavior explained through information about sensitive species and ecosystems, 5% need stronger encouragement (e.g. a fence) and the last 5% only stand by prohibitions and their enforcement. Those last 5% bring the potential to destroy all of the effort by walking into sensitive areas and encourage the other 95% to copy their inappropriate behavior in the protected areas. In her article Glauser (2016) gives a lot of advice how to or not to plan a visitor management and the accompanying measures.

The next paragraphs focus on the indirect visitor management measures supervision service and environmental education. Furthermore, examples showing how visitor management can reduce conflicts between user groups are presented. Finally, needs of visitors are described.

3.2.1 Supervision services

A supervision or ranger service is part of a visitor management. Park guard, forest officer, park warden, forest ranger, game ranger, law enforcement officer, National Park Service Ranger, United State Park Police officer, Vigilante de Natureza, Guardaparque, Parkwächter, Naturwacht – the titles for this particular profession are endless and differ from country to country. Their tasks range from law enforcement, scientific research, data collection, active nature conservation, environmental education to search and rescue activities.

Scientific research on different supervision systems, their tasks and implementation has not been done yet. Most information on those supervision systems are found on websites. The International Ranger Federation (2016) defines the duties of a supervisor as the protection of flora and fauna in marine and terrestrial parks from exploitation, destruction, poaching, theft or vandalism. Supervisors are guardians of natural and cultural resources (International Ranger Federation, 2016). In comparison to this general definition, supervisors in Europe are often seen as mediators between people and nature (Bundesverband Naturwacht, 2016; Swiss Rangers, 2016). Their main duties are the inspection and maintenance of protected areas, and the information of visitors through public information, education and law enforcement activities (Swiss Rangers, 2016). The United States of America have a different view on the tasks of supervisors. According to ParkRangerEDU (2016) the United States Park Police Officers perform the law enforcement and search and rescue duties whereas the National Park Service Rangers are in charge of the interpretation and maintenance activities. The American supervision system is not the only one that differs from the European, also the African and Asian supervision systems differ considerably. The latter both have in common that next to public information, education and maintenance, anti-poaching measures are important to ensure the protection of the parks and reserves (Game Rangers Association of Africa, 2016; Indiaeducation.net, 2016).

A classification of supervision systems in relation to the ecosystems they are embedded has not been done yet. Table 28, in the appendix III, page vii, provides an overview of 44 supervision systems, their main characteristics and duties. The overview is

not comprehensive but contains data of supervision systems with available information on a website. Therefore, the findings only account for this table and may not be generalized. Definitions for the classification of characteristics and duties are found in the appendix IV, page ix.

Supervision systems found in my web search are applied in all ecosystems and on all continents. The ecosystems where supervision systems are implemented differ widely from rain-, boreal or other forests to lakes, wetlands, coasts, rivers, arctic deserts, alpine environments, rocks or bogs. Regarding the duties, there is no link between duty and ecosystem type, hence no prevalence for specific duties was found.

3.2.2 Environmental education and interpretation

As known in literature, both types of measures, indirect and direct, are important for managing visitors in protected areas (Goh and Rosilawati, 2014; Kuo, 2002; Mason, 2005; Poudel and Nyaupane, 2013). Environmental education and interpretation are indirect measures.

The Fachkonferenz Umweltbildung (2014) describes two central aspects of environmental education. First, a "readiness to act" should be developed and supported. Second, the development of competences to handle natural resources in the conflict field of society, ecology and economy should be addressed and established. Interpretation is an instrument to achieve those central aspects in the field of sustainable tourism and in the use of protected areas. But environmental interpretation is not the only popular measure as shown by the lists of Ham (1992), Morales (1992) and Tan and Law (2015): audio equipment / audio visual programs, excursions / guided walks / educational events, interpretive sings / boards, self-guided tours / nature trails, talks, visitor centers and even smartphone applications are used to reach the goals of environmental education.

Some studies examined the effects of environmental education on the knowledge about nature and attitudes towards the environment. Stern *et al.* (2014) conducted a meta-analysis on the impact of environmental education performed with youth. They found evidence in the 86 reviewed studies that environmental education can have a long-term positively influence on knowledge, awareness, skills and enjoyment of youth concerning the environment.

3.2.3 Influence of indirect measures on visitors' behavior

Several studies examined the influence of different visitor management measures on visitors' behavior. For example, Kidd *et al.* (2015) examined the effect of three different treatments to encourage visitors not to leave the marked trails in the summit area of Sargent Mountain in the Acadia National Park in Maine, United States. The study showed that personal contact with a uniformed staff member had a positive effect on visitors' behavior as they stayed mostly on the marked trails. Signpost treatments (with an ecological impact or an amenity sign) only had little positive or even negative impact compared to the control group. This finding is supported by other studies saying that personal contact is the most effective mean to alter visitor behavior (Manning, 2003).

In an early study, Roggenbuck and Berrier (1981) examined the impact of two treatments (brochure and brochure with personal contact) on the camping behavior in the Shining Rock Wilderness Area, North Carolina, United States. Compared to the control group that had no additional information, both treatments altered the behavior of the visitors positively.

Littlefair (2004) showed in a study on guided tours that guides explaining and performing the correct behavior in protected areas significantly influenced the visitors' behavior. Guides reduced the amount of shortcutting of paths to over 90% compared to a control group without any environmental interpretation. Littlefair concluded that environmental interpretation is only effective if directly addressed to the visitors.

Park *et al.* (2008) tested the difference in the impact of direct (fence) or indirect (signs) measures to lower off-trail stays in an environmentally fragile area on Cadillac Mountain in the Acadia National Park in Maine, United States. The treatment with direct measures had the greatest impact on the behavior compared to indirect management practices and a control group (no special treatment). More aggressive and explicit measures had a greater influence than less aggressive ones. However, in the follow-up survey, visitors tended to prefer indirect to direct management practices. Park *et al.* (2008) recommend a mixed strategy with both indirect and direct management strategies to alter visitors' behavior.

From those examples one can conclude that the personal contact with a guide or supervisor who addresses the correct behavior is an effective visitor management measure. Using signs for visitor management seems to be more difficult as the effect

differs widely among different studies and treatments. However, they still have positive effects on visitors' behavior to reduce their negative impacts on nature. And, as Park *et al.* (2008) and Glauser (2016) both mentioned, a combination of direct and indirect measures provides an effective change of visitor behavior.

3.2.4 Successful communication of information

It is not only important that interpretation and environmental education are part of a visitor management, but also how its messages are transmitted to the visitors. Kuo (2002) gave the advice that visitor management need to focus on a "positive development and persuasive interpretation", rather than to mention information about restrictions and penalties. In addition, Hughes *et al.* (2013) and Xu *et al.* (2013) highlighted the importance of a customized interpretation, referring i.e. to specific information on the type of ecosystem to be protected. Tan and Law (2015) concluded that the uniqueness of a site and its conditions, environments and visitor types need to be considered when implementing interpretation or environmental education. The advice of Glauser (2016) confirmed that the information should be adapted to different user groups. She mentioned that information boards at the main entry points with information on the area, regulations and prohibitions written in short, comprehensive and well explained key messages work best.

3.2.5 Impact of visitor management on conflicts between user groups

Another important aspect of visitor management is its potential to reduce conflicts between different user groups. Conflicts among and within different user groups occur when visitors perceive areas as "crowded" (Strasdas *et al.*, 1994) or when motivation and behavior in or between user groups differ (Rupf, 2015). Wagar (1964) introduced the term "carrying capacity" of a protected area to describe a management strategy to hold quality in recreational use high. However, the concept of the carrying capacity is discussed controversially (Rupf, 2015). Cole and Carlson (2010) stated that defining a carrying capacity for a protected area should not be the first priority of a visitor management. Von Janowsky and Becker (2003) gave an overview of different potential conflicts in an urban forest next to Stuttgart (Table 6). The study showed that hikers and walkers have no conflict potential among each other, but the perceived potential of conflicts between hikers / walker and cyclists, mountain bikers and horseback riders vary from slight to heavy conflicts. On the other hand, cyclists, mountain bikers, horseback riders and joggers seem to have intermediate to

high conflicts among the same groups and hikers or walkers with dogs. Conflicts with people without dogs were not perceived.

Table 6: Perceived potential of conflicts between user groups (according to von Janowsky and Becker (2003)). -: no conflicts, +: slight conflicts, ++: intermediate conflicts, +++: heavy conflicts.

		Hiker		Walker		Cyclist	MTB	Horse-back rider	Jogger
		with dog	without dog	with dog	without dog				
Hiker	with dog		-	-	-	+	++	+	-
	without dog	-		-	-	+	++	+	-
Walker	with dog	-	-		-	++	+++	++	-
	without dog	-	-	-		++	+++	++	-
Cyclist		+++	-	+++	-		-	+	-
MTB		+++	-	+++	-	-		+	-
Horseback rider		++	-	++	-	++	+++		+
Jogger		+++	-	+++	-	-	++	+++	

One example of how to reduce the potential and the actual amount of conflicts among different user groups is the Üetliberg, as a report from Hunziker *et al.* (2011) showed. The main conflicts occurred between (down-hill-)bikers and hikers / walkers. The bikers often used the forest paths and rode at higher speed through the forest. Both the bikers and hikers / walkers felt disturbed from the other user group. After a ban to carry up the bike in the train and the opening of two legal down-hill-tracks the perceived conflict potential and the actual conflicts have been reduced. In addition, a large information campaign was launched that also proved to be effective.

Generally, the information that several user groups use the same path reduced the perceived conflict potential (Clivaz *et al.*, 2013). An example of New Zealand showed that hikers knowing that they might encounter mountain bikers perceived less conflicts with bikers than hikers not having this information (Cessford, 2003). If many different user groups use the same paths for outdoor recreation, the need to separate them rises. Schweizer Wanderwege *et al.* (2015) provided guidelines on how bikers and hikers using the same paths should behave and when different paths for the different groups are needed.

If or if not a separation of user groups on a path is necessary may provide a visitor monitoring, showing where and when what visitors use a path. Clivaz *et al.* (2013) suggested a visitor monitoring as an important tool for every visitor management, as it does not only detect conflicts between user groups but also conflicts between visitors and nature and shows, for instance, what paths are commonly used. Glauser (2016) mentioned this too, and provided helpful do's and don'ts in her article.

3.2.6 Visitors' needs

Sections 3.2.1 to 3.2.5 show how the managers of a protected area can use different visitor management measures to reduce conflicts between nature and people and therefore to provide a sound nature in the protected areas. To implement a successful visitor management, the needs of the visitors should be integrated too, as to make sure that the visitors enjoy to stay in the area. Bernet (2010) summarizes needs from visitors in Swiss nearby recreation areas listed by several studies. Ten different needs can be subdivided into needs connected with well-being, landscape planning or infrastructures (Table 7).

Table 7: Needs for nearby recreation. According to Bernet (2010); modified and translated by Céline Graf.

Needs in connection with personal well-being
freedom of disturbances
safety / security
properness
privacy
possibilities for social contacts
Needs in connection with landscape planning
near-nature, aesthetic beautiful landscapes
large, un-dissected recreation areas
Needs in connection with infrastructures
possibilities for sports
information about the area
infrastructure for children, youth, families and elderlies

4 Results

The following sections describe the results of the expert interviews and the survey. More texts, tables and figures describing the data are added in the appendix IV – VIII starting on page ix.

4.1 Expert interviews

4.1.1 Overview of the visitor management in the study areas

A major issue of this thesis was to describe how many and what visitor management measures are implemented in the study areas. This section refers to research question 7.

4.1.1.1 Overview and description of visitor management measures

Twenty-one different visitor management measures were named in the interviews. Nine of them were classified as direct and the other twelve were classified as indirect measures according to the literature (Clivaz *et al.*, 2013). The amount and distribution of measures vary between the areas. In total, Aarau-Wildegg has thirteen, Wasserschloss and Hallwilersee each have fourteen, Chly Rhy has sixteen and the Reussebene nineteen implemented measures. Table 8 lists the implemented measures in each area and Figure 5 shows the distribution of the direct and indirect measures in each study area graphically. The distribution of the measures shows that the areas Reussebene, Wasserschloss und Hallwilersee have more indirect than direct measures whereas the distribution of the measures in the areas Chly Rhy and Aarau-Wildegg is quite equal.

Table 8: List of direct and indirect measures that are implemented in the study areas. The data is retrieved from the interviews. The "x" indicates that the measure is implemented in the study area.

Measure	Wasser-schloss	Aarau-Wildegg	Hall-wilersee	Reuss-ebene	Chly Rhy
Direct					
ban of access	x		x	x	x
barriers / obstacles		x	x		x
bridges	x	x			x
fences / hedges	x	x	x	x	x
hide				x	
observation tower / hill		x		x	x
official prohibition signs	x	x	x	x	x*
playground / picnic site	x	x	x	x	x
relocation or removal of paths		x	x	x	x
Indirect					
excursions / guided tours	x	x	x	x	x
exhibition		x		x	
flyer / brochure	x	x	x	x	x
"Infostand"	x		x	x	
information board: behavior	x	x	x	x	x
information board: area	x	x	x	x	x
information center				x	
nature trail	x			x	
official information board: protected area	x		x	x	x
outline map	x	x	x	x	x
supervision service	x		x	x	x
website				x	x

x*: only in the Rhein, none on land

Figure 5: Distribution of direct and indirect visitor management measures in the study areas.

According to Eagles *et al.* (2002) I subdivided the direct and indirect measures into the subcategories structural measures, visitor infrastructure and official prohibitions (direct), and printed media, information boards, educational offers and supervision service (indirect; Table 9) for facilitating further analyses of the implemented measures.

Table 9: Subcategories of visitor management measures and their corresponding measures. According to Eagles (2002) and modified by Céline Graf.

Category	Subcategory	Measures
Direct	Structural measures	barriers / obstacles bridges fences / hedges removal / relocation of paths
	Visitor infrastructure	hide observation tower / hill playground / picnic sites
	Official prohibitions	official prohibition signs ban of access
Indirect	Printed media	flyer / brochures website
	Information boards	information board: behavior information board: area official information board: protected areas nature trail outline map
	Educational offers	excursions / guided tours exhibitions information center “Infostand”
	Supervision service	supervision service

Section V, page x of the appendix provides a closer view on the visitor management in each of the five study areas.

4.1.1.2 Data exploration

The data of the interviews have been used to test several hypotheses of how visitor management is influenced by external drivers. Supporting evidence has been found for the following hypotheses:

- First, the more areas with different types of protection (e.g. Landscape or Amphibian Spawning Site of National Importance) exist within a study area, the more indirect measures are implemented in the visitor management (Table 10).
- Second, the age of the visitor management has an influence on the number of different measures: the older the visitor management is, the more educa-

tional offers and the less structural measures are currently implemented (Table 11).

- And third, the belonging of a study area to a decree area of the Canton of Aargau leads to the implementation of a supervision service. Aarau-Wildegg is the only study area that does not belong to a decree area and has no ranger service implemented.

Table 10: Comparison of the number of different types of protection with the number of indirect measures in each area. The data is retrieved from the interviews.

	Wasser-schloss	Aarau-Wildegg	Hallwiler-see	Reuss-ebene	Chly Rhy
# of different types of protection	8	6	8	11	7
# of indirect measures	9	6	9	12	8

Table 11: Comparison of the year of the implementation of the visitor management with the numbers of educational offers and of structural measures in each area. The data is retrieved from the interviews.

	Wasser-schloss	Aarau-Wildegg	Hallwiler-see	Reuss-ebene	Chly Rhy
year of implementation	2001	2012	1990	1980	2015
# of educational offers	2	2	2	4	1
# of structural measures	2	4	3	2	4

Besides those general trends each study area is highly individualistic in the way the visitor management is organized, funded or appreciated by the visitors. This individualistic behavior might explain many differences among the sites. Hypotheses that could not be confirmed are e.g. the distance of the study area to a larger city or the duties and characteristics of the supervision services.

4.1.1.3 Improvements mentioned by the experts

In general, the people in charge of the visitor management were satisfied with their systems. Although, they mentioned a few improvements and some completely new measures that might be implemented in the future. Figure 6 compares the amount of measures planned to be improved or newly implemented to the amount of the currently implemented measures. The area Reussebene would still be the area with the highest number of measures, together with Chly Rhy, followed by Hallwilersee, Wasserschloss and Aarau-Wildegg. The latter is the only area where no new measures are planned.

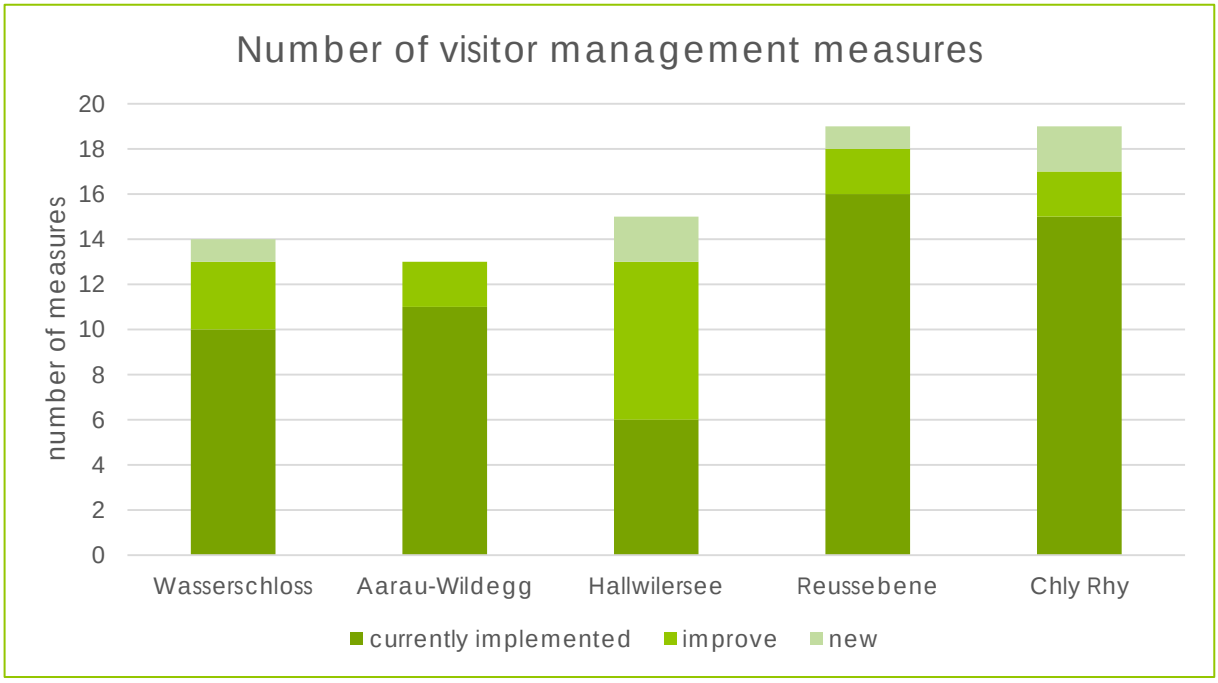

Figure 6: Current number of visitor management measures and expected changes in the future (improvements, new measures). The data is retrieved from the interviews.

The data suggest that it takes roughly 20 to 25 years until a thorough redesign of the visitor management takes place, where old programs are discussed and new programs are launched. This might well be triggered by a changed people-nature relationship, as exemplified in the discussion.

4.1.2 Influence of visitor management on visitor behavior

I asked the experts how the visitors would behave and how the area would change if no visitor management would have been implemented in the area (research question 8). They described the situation without any visitor management or supervision service as “terrible” (Burkard, 2016), “halligalli” (Witzig, 2016) or as “catastrophic” (Fürst, 2016). Only Schelbert (2016) is convinced that there might be no change in the behavior as the visitor management of Aarau-Wildegg mainly consists of structural measures instead of a supervision service or signs. A quantitative value is only given by Bruno Fürst who stated that the violations of prohibitions decreased in the last six years since the implementation of the supervision service “Hallwilersee Ranger” (Fürst, 2016):

> *„Ich bin überzeugt, dass wir heute noch die halben Übertritte haben als vor sechs Jahren, als wir angefangen haben. (...) Die Anzahl der Übertritte geht nicht runter, die stagniert so bei 630 Übertritten. Ich habe in einem alten Bericht gelesen, dass wir schon vor vier Jahren 600 Übertritten hatten, haben*

aber dazumal einen Drittel oder 50% der Stunden gemacht, die wir dieses Jahr machten. (...) Also müsste man sagen, dass wir damals das Doppelte an Übertritten hatten. (I'm convinced that we have half as many violations as we had six years ago when the supervision service started. (...) The amount of violations does not decrease; it stagnates around 630 violations. I read in an old report that we had 600 violations four years ago. But back then we only worked a third or half of the hours we are working this year. (...) Therefore, one can say that we had twice as many violations back then.)"

4.1.3 Environmental education

In research question 11 I wanted to know how environmental education offers are implemented in the visitor management of the study areas. Environmental education is one way of managing visitors (Clivaz *et al.*, 2013). This is done with a number of indirect measures. Table 12 shows what kind of offers are implemented in the study areas. As the offers vary widely in detail and many stakeholders are involved the sum of offers has to be interpreted with caution and is by no means a reliable indicator of how active the public is involved.

The area Reussebene offers the most diverse environmental education program in nine out of ten categories that could be found in literature. It is followed by the areas Wasserschloss, Aarau-Wildegg, Hallwilersee and Chly Rhy. Printed media such as brochures or publications, interpretive sings and boards and educational events / excursions / guided tours were implemented in every area. Other measures are implemented in one or two areas.

Table 12: Environmental education offers implemented in the study areas. The data is retrieved from the interviews.

Environmental Education Category	Wasserschloss	Aarau – Wildegg	Hallwilersee	Reussebene	Chly Rhy
audio equipment / audio visual programs [b)]				CD	
brochures / publications [a), b)]	yes	yes	yes	yes	yes
excursions / guided walks / educational events for schools, private groups, open for public [a), b)]	canton AG / Pro Natura / Naturama	Naturama	Hallwilersee Ranger	Stiftung Reussebene / Naturama	canton AG / Pro Natura / Naturama
exhibits [a)]		Naturama, Container		Zieglerhaus	
interpretive sings / boards [a)]	yes	yes	yes	yes	yes
self-guided tours (nature trails) [a)]	yes			yes	
Smartphone applications [c)]					
talks [a)]	Infomobil		Infostand	Infostand	
visitor center [b)]				yes	
sum of offers	5	4	4	8	3

a) Ham (1992), b) Morales (1992), c) Tan and Law (2015)

4.2 Survey

4.2.1 Demographic description of the respondents

Forty surveys were performed in the two areas Reussebene and Aarau-Wildegg (twenty each). In total, sixteen people (nine women, seven men) visiting the areas alone, and forty-eight in twos (24 couples or friends) answered the survey. The visitors in the average age group were born in 1954, and fifty percent of all respondents were born within the years 1945 and 1966. Seventeen of the respondents reported to live within five kilometer distance (beeline) to the study area and twenty-three reported to live further away. Ten respondents were a member in one or more nature conservation associations. The main activities were walking, hiking, observing nature, walking out the dog, enjoy the nature, biking and one was a fisherman working in the clubhouse. The motivations why the respondents visited the area were nature, sport, local residents / nearby recreation, silence, health, balance to daily work and others. The samples of the respondents differed slightly according to the study areas (Table 13, Table 14 and Table 15).

Table 13: Demographic description of the sample of respondents. nca = member of nature conservation association. Gender was not a significant determinant.

Area	Visiting area ...		Age Group			distance		nca member
	alone	in twos	25%	average	75%	<5km	>5km	
Overall	16	24	1945	1954	1966	17	23	10
Aarau-Wildegg	7	13	1945	1951	1958	9	11	6
Reussebene	9	11	1944	1958	1978	8	12	4

Table 14: Main activity of the respondents in the study areas during the survey.

Area	walking	hiking	observe nature	walking out dog	enjoy nature	biking	working at clubhouse
Overall	21	10	3	2	2	1	1
Aarau-Wildegg	10	6	0	1	1	1	1
Reussebene	11	4	3	1	1	0	0

Table 15: Motivations of the respondents to visit the study area.

Area	nature	sport	local residents	silence	health	balance to daily work	others
Overall	27	10	7	4	1	1	4
Aarau-Wildegg	13	6	4	1	1	1	1
Reussebene	14	4	3	3	0	0	3

4.2.2 Effective and attractive visitor management measures

As a response to the currently implemented measures I asked the visitors to evaluate the effectiveness or attractiveness of visitor management measures (research question 7).

4.2.2.1 Comparison of the statistical values of the measures

Table 16 lists the median values of the measures. They are grouped into direct and indirect measures (see Table 36, page xxii). The visitors assessed the effectiveness of 21 measures that control or change the behavior and the attractiveness of 7 visitor infrastructure measures (see section 2.3 for further information).

Table 16: Median values of the rated direct and indirect measures. Values: 3: neutral, 4: agreement.

Area	median values of the measures					
	effectiveness			attractiveness		
	all	direct	indirect	all	direct	indirect
Overall	3.38	3.40	3.32	3.71	3.67	4.00
Aarau-Wildegg	3.09	3.00	3.26	3.79	3.67	4.00
Reussebene	3.41	3.60	3.39	3.54	3.33	4.00

The analysis of the data showed some trends (see also Figure 7):

- Tendency I: The attractiveness of the measures is rated higher than the effectiveness of the measures in both areas.
- Tendency II: The visitors in Aarau-Wildegg assess the attractiveness of infrastructure measures higher than those in Reussebene. But in contrast, the visitors from Reussebene assess the effectiveness of the other measures higher than those in Aarau-Wildegg.
- Significant difference: The effectiveness of the direct measures is rated significantly lower in Aarau-Wildegg than in Reussebene (Aarau-Wildegg: median=3.00, Reussebene: median=3.60; α=0.05, U=121.50, p=0.033).

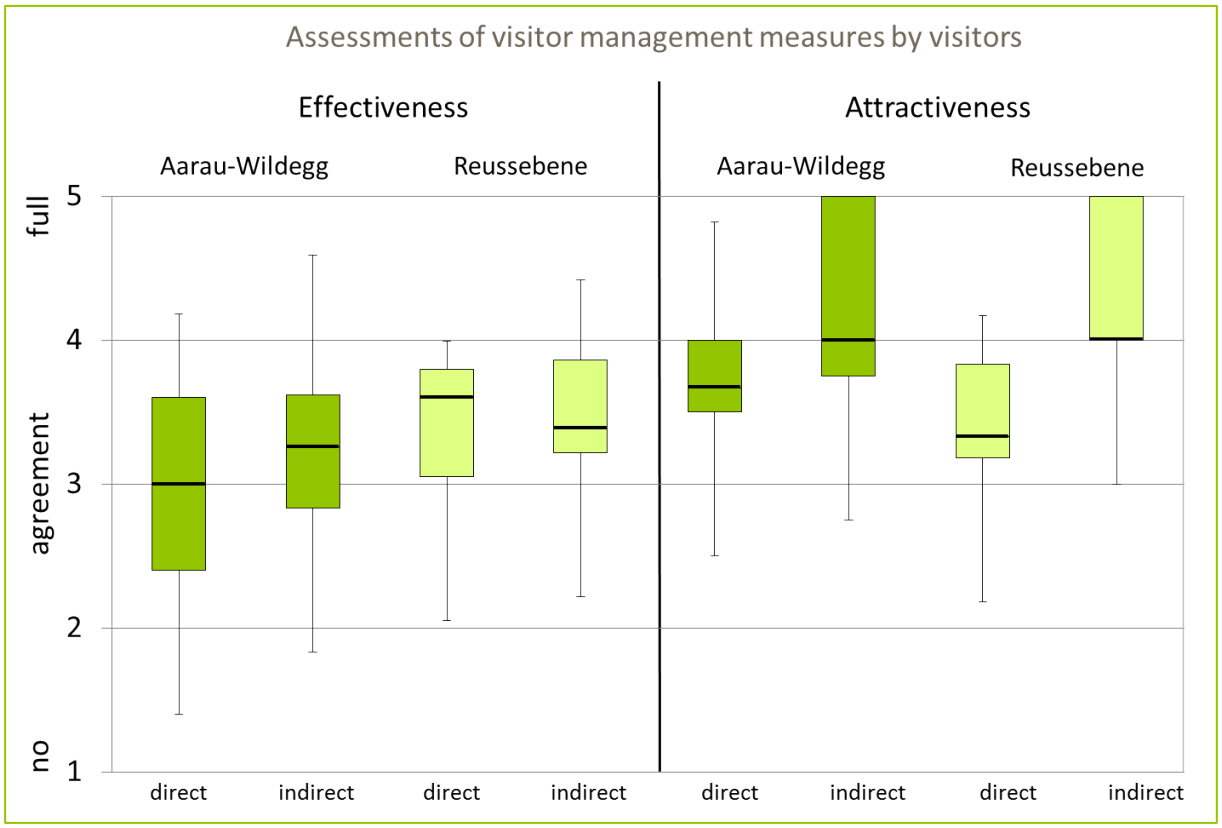

Figure 7: Boxplots showing effectiveness and attractiveness of measures as assessed by respondents. Dark green: Aarau-Wildegg, light green: Reussebene.

A closer look at the statistical values for the single measures reveals that the values differ for each measure in the two areas (Table 36, page xxiii). Significant (α=0.05) differences were found for the measures fence (U=95.0, p=0.004, Aarau-Wildegg AW > Reussebene R), public fire places (U=105.0, p=0.009, AW > R), information cen-

ter (U=114.0, p=0.033, AW < R), bridge (U=108.5, p=0.034, AW < R), information board about the area (U=124.5, p=0.040, AW < R) and hide (U=103.5, p=0.042, AW < R).

4.2.2.2 Comparison with the currently implemented measures

One purpose of the survey was to compare the currently implemented measures in the area (information retrieved from the experts) with those that were assessed as effective or attractive by the respondents (see section 2.3 for further information).

Figure 8 shows the comparison of the number of currently implemented measures (according to the experts, first and third bar) with the number of measures assessed as effective or attractive by the visitors (second and forth bar). The difference between the first and the second bar indicates how many direct measures are assessed as effective or attractive by the respondents but not implemented in the area, i.e. three measures in Wasserschloss. The same applies for the third and fourth bar where the difference indicates the number of indirect measures that are assessed as effective or attractive but are not yet implemented.

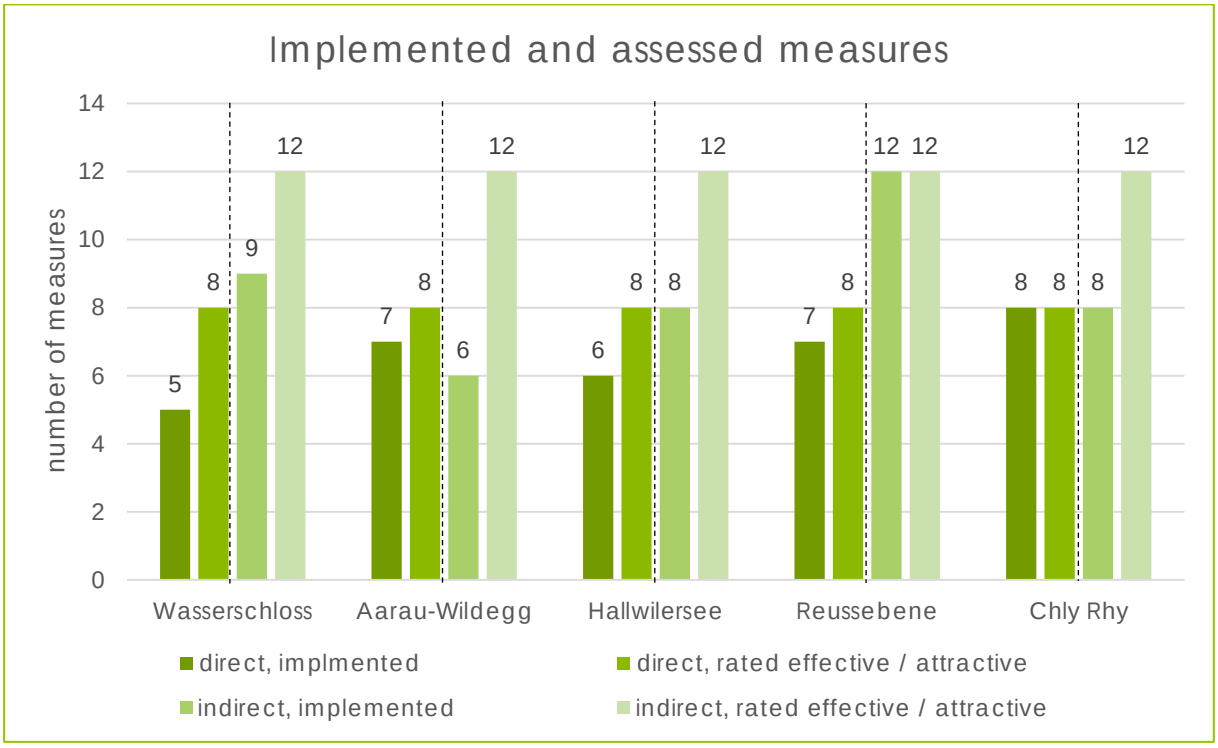

Figure 8: Comparison of the currently implemented measures and those measures rated as effective or attractive by the visitors. Implemented measures: data from the expert interviews. Rated effective or attractive: sum of all measures assessed with an overall median value ≥ 4.

Further analyses showed that not all implemented measures are rated as effective or attractive (Table 39 in the appendix) and thus, Table 17 indicates that the potentials to improve the visitor management are actually higher than the bars in the figure above suggest. The column "potential" indicates the number of measures that might be implemented to provide a visitor management consisting of all measures rated as effective or attractive by the visitors. For instance, the area Wasserschloss could implement five direct and four indirect measures that are rated as effective and attractive and that are not yet implemented in the visitor management.

Table 17: Comparison of the implemented measures and those rated as effective or attractive by the respondents. *: The total number of measures rated effective or attractive indicates the number of measures assessed with an overall median value ≥ 4 from the respondents of both areas Aarau-Wildegg and Reussebene independent whether the measures can be found in the areas.

	Number of measures	Wasser-schloss	Aarau-Wildegg	Hallwiler-see	Reuss-ebene	Chly Rhy
Direct	A. total implemented direct measures	5	7	6	7	8
	B. implemented, rated effective / attractive	3	4	3	5	5
	C. implemented, not rated effective / attractive	2	3	3	2	3
	D. total number of measures rated effective / attractive by the respondents*	8	8	8	8	8
	Potential (D-B)	**5**	**4**	**5**	**3**	**3**
Indirect	E. total implemented indirect measures	9	6	8	12	8
	F. implemented, rated effective / attractive	8	5	7	10	7
	G. implemented, not rated effective / attractive	1	1	1	2	1
	H. total number of measures rated effective / attractive by the respondents*	12	12	12	12	12
	Potential (H-F)	**4**	**7**	**5**	**2**	**5**

Some of the measures rated as effective and attractive have been mentioned by the experts as measures that might be newly implemented in the future (like public fire places, public toilets, information boards with news on plants / animals / events in the area or a Junior Ranger Program). On the contrary, measures like fence / hedges, flyer / brochure or playground / picnic site are implemented in at least some of the study areas but are not rated as effective or attractive by the visitors.

4.2.3 Change of the areas without any visitor management measures

I asked the respondents of the surveys to tell me how the study area would change in their opinion if no visitor management measures would have been implemented (research question 8). Table 18 lists the grouped statements. In total, eleven groups of statements were mentioned (see appendix VII, page xxv). The biggest differences among the two study areas were found for the statements "disturbance of plants, animals, habitats" (Aarau-Wildegg: 3 times mentioned, Reussebene: 9), "inappropri-

ate behavior of people" (Aarau-Wildegg: 5, Reussebene: 1) and "slight or no change" (Aarau-Wildegg: 6, Reussebene: 2). A Chi-Square-test indicated that the differences among the sites are not significant (α=0.05, χ^2=14.156, p=0.224). The statements with highest frequencies in the two areas differ considerably and show slightly different concerns of the visitors:

- Aarau-Wildegg: slight or no change (6), inappropriate behavior of people (5), dogs not on the leash (4), more people (4), more waste (4);
- Reussebene: disturbance of plants, animal and/or their habitats (9), more people (6), more waste (4).

Table 18: Statements of the visitors how the area would develop if there were no visitor management measures. The numbers indicate how many respondents named each statement.

Statement	Overall	Aarau-Wildegg	Reussebene
disturbance of plants, animals and/or their habitats	12	3	9
more people	10	4	6
more waste	8	4	4
slight or no change	8	6	2
inappropriate behavior of people	6	5	1
dogs not on the leash	6	4	2
more fire places	5	2	3
nature develops without humans	4	2	2
illegal trails	3	1	2
less people	1	1	0
others	4	3	1
total number of statements	67	35	32

4.2.4 Need of a supervision service

Another question was if the visitors perceive the need of a supervision service in the study area. Table 19 shows the mean values of the answers (1: no supervision service needed at all, 5: supervision fully needed). The means are quite similar between the two groups of respondents. Their mean values of 2.80 (sd=1.473, Aarau-Wildegg) and 2.89 (sd=1.329, Reussebene) indicate a slight disagreement whether a supervision service is needed. This disagreement is also expressed with the medians of 2.5 (Aarau-Wildegg) and 2 (Reussebene).

Table 19: Respondents assessment of the necessity of a supervision service. Significance: significance from the U-test according to Mann and Whitney. Values: 1: no agreement at all, 2: no agreement, 3: neutral, 4: agreement, 5: total agreement.

Area	mean	standard deviation	median	quartiles	U, significance
Overall	2.85	1.387	2	2, 4	U=179.5, p=0.771
Aarau-Wildegg	2.80	1.473	2.5	1.25, 4	
Reussebene	2.89	1.329	2	2, 4	

The analysis of the data showed a correlation between the stated need of a supervision service and the rated effectiveness of a supervision service (Table 20). The correlation "the higher one rates the effectiveness of a supervision service the higher one rates the need of a supervision service in the area" is significant (α=0.05) for the overall situation and in the area Reussebene but not significant for the area Aarau-Wildegg. No other correlation between the different questions or with demographic data was found during the analysis of the data.

Table 20: Correlation between the need of a supervision service in the area and the rated effectiveness of a supervision service to protect the nature. The * indicates a significant correlation (α=0.05).

Value	Overall	Aarau-Wildegg	Reussebene
Kendell's τ_b	0.350	0.225	0.473
N	39	20	19
p	0.011 *	0.250	0.019 *

4.2.5 Environmental education from the visitors' point of view

During the analysis of the data I was interested on how environmental education offers were assessed by the visitors (research question 11) to compare them with the currently implemented environmental education offers. Therefore, the measures described in this section are a subsample of all assessed measures. Table 21 compares the measures that are currently implemented in the areas with those that were assessed as effective or attractive. The only measures rated as effective or attractive *and* that are implemented in all study areas are excursions and information boards. Potential to improve the environmental education offers in the areas is in implementing exhibits, self-guided tours or talks. The measures brochures / publications, Smartphone applications and visitor center were not rated as effective or attractive.

Table 21: Comparison of the currently implemented environmental education measures and those rated as effective or attractive in the study areas. The column "visitors' view" represents those measures assessed with an overall median value ≥ 4. The "x" in the other columns indicates that the measure is currently implemented in the area.

Environmental Education Category	Visitors' view	Wasser-schloss	Aarau – Wildegg	Hallwiler-see	Reuss-ebene	Chly Rhy
excursions / guided walks / educational events for schools, private groups, open for public [a), b)]	x	x	x	x	x	x
interpretive sings / boards [a)]	x	x	x	x	x	x
exhibits [a)]	x		x		x	
self-guided tours (nature trails) [a)]	x	x			x	
talks (Infostand) [a)]	x	x		x	x	
audio equipment / audio visual programs [b)]	n.r.*				x	
brochures / publications [a), b)]		x	x	x	x	x
Smartphone applications [c)]						
visitor center [b)]					x	

a) Ham (1992), b) Morales (1992), c) Tan and Law (2015). *: n.r.= not rated by the respondents

4.2.6 Most liked landscape elements

During the survey, I asked the visitors to indicate what elements they like most in the area to learn what their needs and demands are. Ten different groups of landscape elements were mentioned; they can be compared to needs (Table 22). There are no big differences except for the element water (mentioned 16 times in Aarau-Wildegg and 10 times in Reussebene). A Chi-Square-test showed that the differences are not significant (α=0.05, χ^2=14.084, p=0.228).

Table 22: Statements of the visitors what they like best in the area. The numbers indicate how many respondents named each landscape element.

Landscape element	Overall	Aarau-Wildegg	Reussebene
water	26	16	10
infrastructure	17	9	8
fauna and flora	12	4	8
landscape	12	6	6
nature / beauty	12	8	4
silence / recreation	12	5	7
small structures (e.g. pond)	4	1	3
forest	3	3	0
proximity	3	1	2
others	3	1	2
total number of statements	104	54	50

4.2.7 Assessment of the visitor management in general

Also, the people assessed the current visitor management in the area (research question 8). They indicated how satisfied they are with the current system (1: not at all satisfied, 5: totally satisfied). The comparison of the mean values indicated a slight dissatisfaction with the current visitor management (see Table 23). The dissatisfaction was slightly stronger in the area Aarau-Wildegg (mean=2.65, sd=0.606) than in the area Reussebene (mean=2.90, sd=0.308). However, this difference is not statistically significant (α=0.05, U=136.0, p=0.311).

Table 23: Statistical values of how the visitors are satisfied with the current visitor management system in the areas.

Area	mean	standard deviation	median	quartiles	U, significance
Overall	2.78	0.479	3	3, 3	U=136.0, p=0.311
Aarau-Wildegg	2.65	0.606	3	2, 3	
Reussebene	2.90	0.308	3	3, 3	

4.2.8 Level of information

I asked the respondents to state how well informed they feel in the area (research question 12). Overall, the visitors seem to be well informed as the overall mean value of 4.18 indicates (sd=0.997, see Table 24). However, the comparison of the two areas showed that the visitors in Aarau-Wildegg feel not as well informed (mean=3.68, sd=1.157) as those in Reussebene (mean=4.65, sd=0.489). The Mann-Whitney-U-test indicated that those two mean values differ significantly from each other (α=0.05, U=98.5, p=0.009).

Table 24: Statistical values of the statement of how well informed the respondents feel in the areas.

Area	mean	standard deviation	median	quartiles	U, significance
Overall	4.18	0.997	4	4, 5	U=98.500, p=0.009 *
Aarau-Wildegg	3.68	1.157	4	3, 5	
Reussebene	4.65	0.489	5	4, 5	

4.2.9 Suggestions for improvements

One purpose of the survey was to learn suggestions for improvements from the visitors. The research questions 7, 8, and 10 touch, among other topics, upon this request. Table 25 lists the grouped statements, Table 37 in the appendix VII, page xxv, gives an overview of the statements and their allocated group of statement. Eleven people said that they are satisfied with the status quo and need nothing more to fulfil their needs. The statements with highest frequencies differ among the two study areas:

- Aarau-Wildegg: projects for schools (8), waste removal (6) and infrastructure (5);
- Reussebene: nothing (7), benches (6) and infrastructure (5).

Table 25: Respondents suggestions for improvement for the study areas. The numbers indicate how many respondents named each measure.

Measures to fulfil the visitors' needs	Overall	Aarau-Wildegg	Reussebene
nothing	11	4	7
infrastructure (e.g. café, paths)	10	5	5
benches	9	3	6
projects for schools	9	8	1
waste removal	8	6	2
offer / events	6	4	2
prohibitions and regulations	6	4	2
nature	4	3	1
separation of user groups	3	2	1
transport	2	0	2
others	5	1	4
total number of statements	73	40	33

Additionally, the visitors could state what improvements they wish for the visitor information. Half of the respondents answered that they are currently satisfied and need nothing to fulfill their needs, six of them in Aarau-Wildegg and fourteen in Reussebene (Table 26). This distribution complies with the question on how well informed the visitors feel (Table 24). Hence, the statements do not differ significantly in the two areas (α=0.05, χ^2=4.818, p=0.682). The only big difference was that in the area Aarau-Wildegg seven respondents stated an improvement for the "information boards on the behavior" whereas in the area Reussebene two respondents did so.

Table 26: Respondents suggestions for improvements for the information measures in the study areas. The numbers indicate how many respondents named each measure.

Improvements for information	Overall	Aarau-Wildegg	Reussebene
nothing	20	6	14
information board on the correct behavior*	9	7	2
information board on the area (plants, animals)*	6	4	2
information board on news in the area*	3	2	1
nature trail*	2	2	0
flyer/brochures	1	1	0
outline map*	1	0	1
others	2	1	1
total number of statements	44	23	21

*: rated as effective by the visitors

5 Discussion

5.1 Methodological discussion

One of the biggest sources of uncertainty in the current thesis are the open questions in both the expert interviews and the survey. As far as the surveys are concerned I had no possibility to confirm with the respondents if I had interpreted their answers correctly. Concerning the expert interviews, there was no time to hand over my transcribed interviews to the experts for proof reading. Therefore, the interpretations of the open questions from both the expert interviews and the surveys are my own interpretations. They have been discussed with scholars in the field but are not completely free of personal judgements.

Furthermore, the number of respondents in the survey is not high enough to allow general representative conclusions. The sample does not cover the true distribution of user groups as it primarily represents the contemplative users. The sample is small and thus overstrained by the statistical analyses and interpretations. An enlarged sample of respondents would have been more robust. With surveys in all study areas the measures rated as effective or attractive could have been compared with the in-situ implemented measures in the corresponding area and thus, provide a more detailed analysis.

Also, a better order of the questions in the survey could have resulted in a more distinct outcome concerning the question about the general appreciation of the current visitor management in the study areas. It seemed to me that the visitors tended to indicate a neutral answer because they could not really imagine what visitor management means despite the short explanation of the term. The visitors might have been able to indicate a more distinct assessment of the current visitor management after rating all the possible visitor management measures. Another difficulty concerning the assessment of the visitor measures was that effectiveness and attractiveness might have been mixed up by the respondents. As a consequence, I pooled the two assessments whenever it was not necessary to strictly separate them.

Finally, one handicap of surveys is the so-called “social desirability bias” (Fisher, 1993) where people tend to avoid social embarrassment by not reporting their true feelings or opinions. Fisher (1993) found out that indirect questioning allows the respondents to project their opinion on other subjects and, thus, reduces this bias. Therefore, we tried to ask indirect, projective questions. As a rule, this was satisfactory for most ques-

tions except for the topic of supervision / ranger systems. The visitors rated rangers as an effective visitor management measure (mean=3.90), but they did not express a necessity for a ranger in their respective study area (mean=2.85). Since I could show a positive correlation between the perceived effectiveness and the general need of a supervision service, I can assume that the visitors see the need of a ranger but they rather represent a society that is capable of keeping to the rules in a protected area.

5.2 Discussion of the expert interviews

One central purpose of this Master thesis was to describe the visitor management in the five study areas and to find reasons that might explain the differences in those systems. Unfortunately, I was not able to define different types of visitor management systems nor did I find such a classification in the reviewed literature.

The hypotheses explaining those differences claim that the age of the visitor management, the number of different types of protected areas, the experience of a manager, the belonging to a decree area and the management, financing and implementation in general influence the orientation of a visitor management. The Bachelor thesis of Eggenberger (in preparation) confirms that the age and also the management and financing of a visitor management influence the combination of visitor management measures in two regional nature parks both in Switzerland and France.

Another goal of the expert interviews was to gain information on how the experts estimate the effectiveness of visitor management. They expressed that the development of the study areas without a visitor management would rather be negative; e.g. people would not keep to rules, just walk into the area and destroy sensitive sites or species. Those statements are in agreement with the literature (Kidd *et al.*, 2015; Littlefair, 2004; Manning, 2003) saying that visitor management in general and supervision services in particular are important to change and control visitors behavior in order to protect sensitive sites and nature reserves.

A further aspect discussed in the interviews was the conducting of a visitor monitoring. Clivaz *et al.* (2013) and Glauser (2016) both recommend a visitor monitoring as a valuable instrument to control the effectiveness of a management and to detect conflicts among user groups or conflicts between nature and visitors. Another advantage of a visitor monitoring is that one gains an overview of how the visitors use the area e.g. where or when they are present. Eggenberger (in preparation) shows

that visitor monitoring is a review instrument used in regional nature parks to evaluate and improve the existing visitor management. Except in the area Hallwilersee, no visitor monitoring was performed yet in my study areas. Reasons are missing needs or missing financial resources.

5.3 Discussion of the survey

This part of the discussion focusses on the surveys performed in the two areas Aarau-Wildegg and Reussebene and thus on the assessment of the effectiveness or attractiveness of visitor management measures. The next paragraphs compare the results of the survey with findings from literature. Afterwards, I try to identify factors explaining why the respondents in Aarau-Wildegg and Reussebene assessed the measures differently.

First, the analysis of the assessed measures shows that both direct and indirect measures are perceived as effective in reducing the negative impact of recreational activities on nature. This combination of accepted measures represents the advices of Park *et al.* (2008) and Glauser (2016) saying that a combination of direct and indirect measures is most effective to protect nature.

Second, I had a look at the measures that transmit information to the visitors. The analysis showed that different measures transmitting information were assessed as effective by the respondents. This outcome describes the different requirements visitors have to gain knowledge on the protected areas and their natural objects. Xu *et al.* (2013), Hughes *et al.* (2013) and Glauser (2016) all recommend to install customized information for different user groups. In this thesis, the statistical analysis of the sample did not show any variances between different user or demographic groups. However, this might be due to the small size of the sample. Additionally, the survey reveals that being informed is a need of the visitors as the suggestions for improvements showed. In the area Aarau-Wildegg less information boards and environmental education offers are implemented as in the area Reussebene. Likewise, the respondents in Aarau-Wildegg stated that they feel less well informed than those in Reussebene and they mentioned more suggestions for improvements.

Third, the visitors assessed a ranger or supervision service as an effective measure to reduce the negative impact of recreational activities on nature. This result is in accordance with the literature (Kidd *et al.*, 2015; Littlefair, 2004; Manning, 2003) and with the opinion of the area managers. In spite of the discussed disagreement of the

visitors for a supervison service it seems to be worth carrying out a supervison service in any form as it is already done in all study areas except Aarau-Wildegg.

Forth, the open questions revealed the requirement of a better spatial separation of bikers and hikers / walkers especially in the area Aarau-Wildegg. The perception of conflicts between the two user groups is in agreement with the described conflict potential by Von Janowsky and Becker (2003). In the area Aarau-Wildegg a user group separation by means of better signal control, controlling of the existing driving ban and a new driving ban along the “Umgehungsgewässer” in Rupperswil might be worth an improvement of the existing visitor management.

Fifth, the measure assessed as the most effective one was in both areas a Junior Ranger Program. Literature has shown that environmental education can positively influence the knowledge and awareness of youth towards environment (Stern *et al.*, 2014). Additionally, the interviews with the managers revealed that at least in the areas Hallwilersee and Reussebene the idea to offer regularly activities for children and youth exists (e.g. a Junior Ranger Program).

Sixth, I wanted to hear from the visitors how the area would develop in their opinion if no visitor management would have been implemented. The visitors were mostly concerned about the disturbance of plants, animals or their habitats due to inappropriate behavior of (other) visitors. These answers are comparable with those of the experts and with literature saying that one purpose of visitor management is to reduce the negative impact from people on nature (Glauser, 2016; Mason, 2005).

Last, the needs of visitors concerning the landscape and the recreational area represent the common needs of Swiss people seeking for recreation (Bernet, 2010). However, the respondents did not mention the complete spectrum of needs compiled by Bernet (2010) but rather needs in connection with landscape planning.

Further, the analysis of the data showed that the respondents of the two study areas gave slightly different answers for the assessments of the effectiveness and attractiveness of the measures and also for their suggestions for improvements. Several possible reasons for that trend are discussed in the following paragraphs.

First, the conservation history of the area might influence the perception of the visitor management. Visitors and local residents got used to the long established visitor management in Reussebene and, therefore, its measures were assessed as effective or attractive. Burkard (2016) confirmed this hypothesis in the expert interview and

stated that most of the implemented measures are accepted by the visitors. On the other hand, the visitor management in Aarau-Wildegg is relatively new and the people might still have in mind their freedom of behaving as they could prior to the implementation of the visitor management.

A second hypothesis explaining the difference would be that different user groups were present in the two areas. Hence, the analysis of the data has shown that this was not the case.

Furthermore, not only the measures were assessed differently but also different suggestion for improvements were mentioned by the visitors of the two study areas. The different order of the statements with the highest frequencies might indicate that the respondents in the area Aarau-Wildegg are more concerned about people that are disturbed by inappropriate behavior of visitors whereas in Reussebene the respondents show more concern with nature. This might represent two different concepts of nature conservation as discussed in the next section.

To conclude, the survey revealed many comments on the current visitor management and also needs and suggestions for improvements. This suggests that a survey is a valuable method to gain information on what worries are concerning the visitors and local resident in the area. Including their comments and ideas might help to provide satisfying outdoor recreational activities in protected and recreational areas.

5.4 Interpretation of the results regarding the theories

In this section I interpret the results from the expert interviews and the survey with regard to the theories describing nature-people-relationships. As a first step, I checked how important experts and visitors rate restrictive measures that inhibit visitors' presence and attractive measures that further visitors' presence (see section 2.4). To do so I interpreted the survey data and the expert interviews in a generalized form. I then compared these preferences to two conservation concepts of Mace (2014), i.e. the "nature for itself" and the "nature for people" concept.

Table 27: Importance of measure groups. The row "Mace" represents the importance of the two measure groups for two concepts according to her paper (2014). The row "Survey" represents the assessed importance of the respondents of the survey (number of measures assessed with an overall median values ≥ 4). The row "Experts" represents the importance of the measure groups in the currently implemented visitor management. Low importance: 1-2 measures, medium: 3-4, high: 5-6.

Source	Concept / Area	Importance of measure group	
		restrictive	attractive
Mace	nature for itself	high	medium
	nature for people	low	high
Survey	Aarau-Wildegg	low	high
	Reussebene	medium	medium
Experts	Wasserschloss	medium	low
	Aarau-Wildegg	medium	medium
	Hallwilersee	high	low
	Reussebene	medium	medium
	Chly Rhy	high	medium

It is evident from Table 27 that the assessment of the respondents in Aarau-Wildegg represents a "nature for people" concept of conservation whereas the assessment of the respondents in Reussebene represents a less restrictive "nature for itself" concept than Mace (2014) described. Table 27 also reveals that the experts generally prefer a "nature for itself" strategy to a "nature for people" concept for their visitor management. Reasons for the current orientation of the visitor management are diverse and discussed earlier.

It is more difficult to explain the discrepancy between the two assessments of the visitors and the experts and to explain why the visitors in the areas represent two different nature conceptions. One possible reason might be that people in urban areas prefer to use green spaces for their own outdoor recreational activities instead of sparing areas to nature conservation as the assessment from the visitors in the area Aarau-Wildegg (urban) suggests. Additionally, the visitors in Aarau-Wildegg seem to perceive the well-being of people as more important than nature whereas the respondents in Reussebene (rural) were more concerned about nature than people. In rural areas, there is enough space available to provide both spatially separated areas for outdoor recreation and for nature conservation (without human access.

As a last step, I analyzed what might happen to the human well-being and to the level of biodiversity if one changes a visitor management from a "nature for itself" to a "nature for people" concept. Thus, I had a look at the theories describing the relationships between people and nature that I found in the literature review and integrated the intermediate disturbance hypothesis (Connell, 1978) with the hypothesized relationship of access to nature and human well-being (Figure 9). Next, I tried to

allocate Mace's (2014) concepts to the different positions of restrictive measures on the x-axis. The "nature for itself" concepts with many restrictive measures allows only little access to nature and thus results in infrequent human disturbances, a medium level of biodiversity and a medium level of human well-being. On the other hand, the "nature for people" concept with fewer restrictive measures allows a higher level of access to nature and thus leads to frequent human disturbances, a medium level of biodiversity and a high level of human well-being.

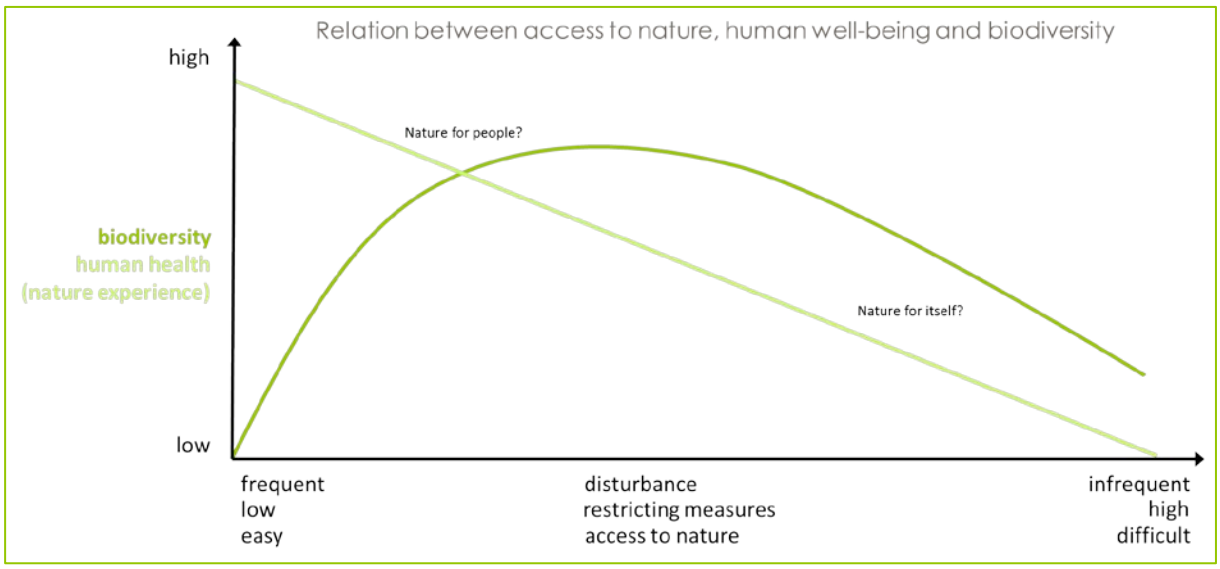

Figure 9: People-nature relationship. Merge of the intermediate disturbance hypothesis of (dark green curve) of Connell (1978) with the relationship of access to nature and human well-being (light green line). The positions of the two concepts "nature for people" and "nature for itself" from Mace (2014) are estimated by their number of restricting measures.

A shift from a "nature for itself" to a "nature for people" concept might first increase the level of biodiversity as the amount of (human) disturbances raises. But, at a given number of restrictive measures respectively a given level of access to nature, the level of biodiversity starts to decline again. On the other hand, the human well-being might increase with a higher access to nature and thus more "nature experiences". The challenge is to find a number of restrictive measures to guide the access to nature and the amount of disturbances in a way that balances out the level of biodiversity and human well-being.

One weakness of Figure 9 is that it ignores the connection between biodiversity and human well-being. Dallimer *et al.* (2012) and Carrus *et al.* (2015) found out that the level of (perceived) biodiversity influences human well-being positively. Thus, the light green line should rather be a curve similar to the dark green one of biodiversity. One option to avoid this misbalancing of biodiversity and nature experience at the left

side of the x-axis in Figure 9 would be to create “nature illusions” or an enhanced level of (perceived) biodiversity. This means one could implement measures that result in an illusion of more biodiversity or nature around a site, e.g. implementing a protected area or install small structures like a pond or hedge. This would not lead to an immediate rise of the level of biodiversity but the visitors would perceive more nature around them and thus the nature experience and human well-being increase. Hence, in the long term, a nature reserve or small structures will, if correctly maintained, lead to an augmented biodiversity.

6 Conclusions

6.1 Explaining trends

Some general trends might explain the current situations in the study areas. All protected wetland areas are close to (highly) populated sites. Still, Aarau-Wildegg and Wasserschloss might experience more pressure from visitors and local residents as they are situated in urban landscapes, whereas the other three study areas are situated in more rural landscapes. On one hand, every study site protects sensitive sites or species. On the other hand, all areas are used for outdoor recreational activities and thus, all study areas face conflicts between nature and recreation. Glauser (2016) advised for Switzerland to follow a "nature for itself" concept. I agree with this for the rural areas where space for large areas prioritizing nature that exclude any human access is available. In urban landscapes space is rarer and thus a "nature for people" concept might be easier to implement.

6.2 Conclusions for the practice

The following conclusions should help to improve the visitor management in the study areas in a way that visitors experience satisfying outdoor recreation and that nature does not suffer from negative human impact.

Generally, the managers should perform a review of the visitor management to examine if it fulfils the goals of their management concepts. One method is to compare the implemented measures with the concepts. Another proven instrument is a visitor monitoring that also detects conflicts between different user groups and between nature and people. And as this thesis showed, a survey can reveal needs and worries from visitors and local residents. As long as their suggestions for improvements fit to the goals of the concept they could be included in the visitor management. A further method to improve the visitor management would be to compare the currently implemented measures with those measures rated as effective or attractive by the visitors and within literature.

Some general advices that are valid for all study areas to improve visitor management can be deduced from the discussion. First, many visitors asked for more events for children or classes and the Junior Ranger Program was assessed as the most effective measure. This is in agreement with literature. Thus, the implementation of a Junior Ranger Program or other regular activities for children would be highly supported by visitors and local residents.

Another specific hint valid for all areas is that information needs to be communicated clearly and in different ways. The survey revealed that different information boards with different topics are important for the visitors (e.g. appropriate behavior, explanation of need for rules, sensitive species and sites in the areas, events and news). It might be worth a try for the managers to examine and revise their information concepts. Other indirect measures like nature trails, excursions or a "Infostand" should also be included in the visitor management to provide information with other media than written language.

In short, I suggest for the managers of the areas to review their visitor management with regard to the information concept and the indirect measures. A survey can reveal specific needs and suggestion for improvements by the visitors for each area and a visitor monitoring detects conflicts between user groups or nature and people. Last but not least, implementing activities for children might be a sustainable investment for the future.

7 Acknowledgement

First of all, a kind “thank you” to Felix Kienast for being my supervisor at WSL. With your scientific knowledge, your different ideas on how to develop the topic and with the encouraging discussions you helped me to find my way through this process of writing a scientific thesis. Thanks for all the time you spend with proof reading, advising and simply supporting me and that the door of your office was, literally, always open for me.

A special “thank you” also goes to Janine Bolliger from the WSL. Thanks for your input and support as my co-supervisor. I also would like to thank the rest of the Landscape ecology research group at WSL for your comments and inputs, they are much appreciated. I enjoyed the time as a member of your group and felt very welcomed.

Many thanks also go to Matthias Buchecker from the WSL. His scientific input and corrections improved my expert interviews and the questionnaire of the survey a lot and helped to avoid common mistakes in social science research.

This thesis was launched by Sebastian Meyer and Erik Olbrecht from the cantonal agency “Abteilung Landschaft und Gewässer”. Thanks for the interesting discussion in April 2015, it gave me an exclusive insight of how science and practice interact. Sebastian, thank you for your input on what is interesting to know for the cantonal agency.

I like to express my gratitude to the six experts that participated in the expert interviews: Thomas Burkard, Ambros Ehrensperger, Bruno Fürst, Bruno Schelbert, Philipp Schuppli, and Ulysses Witzig. Thank you for the open conversations about visitor management, its success and challenges.

I’d like to thank all the sixty-four participants of my survey. Thank you very much for your frankness, honesty and suggestion for improvements. You revealed that a survey is an important instrument to learn what is of concern for local residents and visitors of a protected or recreational area.

Finally, I thank my cousin Madeleine Geissmann for proof reading my English writing and for her cheerful inputs. Last but not least, a huge thank you goes to my family and to my friends. The discussions and talks with you were pure motivation for me. You gave me the opportunity to spend great times with you, to escape my thesis and enjoy social life.

June 2016

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amphibien,ch.bafu.bundesinventare-auen,ch.bafu.bundesinventare-flachmoore,ch.pronatura.naturschutzgebiete,ch.bafu.bundesinventare-amphibien_anhoerung,ch.swisstopo.swisstlm3d-wanderwege&X=234140.00&Y=670500.00&zoom=5&layers_opacity=1,1,1,0.65,1,1,1,0.65,1,0.75,1&catalogNodes=532,653.

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9 Declaration of originality

ETH

Eidgenössische Technische Hochschule Zürich
Swiss Federal Institute of Technology Zurich

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The signed declaration of originality is a component of every semester paper, Bachelor's thesis, Master's thesis and any other degree paper undertaken during the course of studies, including the respective electronic versions.

Lecturers may also require a declaration of originality for other written papers compiled for their courses.

I hereby confirm that I am the sole author of the written work here enclosed and that I have compiled it in my own words. Parts excepted are corrections of form and content by the supervisor.

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Authored by (in block letters):

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Name(s):	First name(s):
Graf	Céline

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Place, date	Signature(s)
Birmensdorf, 27.06.2016	C. Graf

10 Appendix

I. Questions of expert interviews

Block Besucherlenkung

1a) Welche Besucherlenkungsmassnahmen werden in diesem Naturschutz-/Auen-/BLN-Gebiet erfolgreich umgesetzt?

1b) Welche Besucherlenkungsmassnahmen werden nicht erfolgreich umgesetzt?

1c) Welche Besucherlenkungsmassnahmen existieren sonst noch im Naturschutzgebiet?

2a) Welche Regeln werden von den Besuchenden eingehalten?

2b) Welche Regeln werden nicht eingehalten?

3a) In welchem Kontext werden Regeln und Besucherlenkungsmassnahmen nicht eingehalten/akzeptiert? Von welchen Besuchergruppen werden die Regeln / Besucherlenkungsmassnahmen nicht eingehalten? Gibt es Unterschiede zwischen einheimischen und auswärtigen Besuchern?

3b) Wie wird damit umgegangen, wenn Regeln und Besucherlenkungsmassnahmen nicht eingehalten werden?

4) Gibt es Hotspots im Gebiet, wo die Besucherlenkung nicht funktioniert? (zB Trampelpfade, die die Besucher trotz Weggebot brauchen?)

5a) Was wäre, wenn es im Gebiet keine Besucherlenkung gäbe?

5b) Was sind die Gründe für eine Besucherlenkung in diesem Gebiet?

6a) Wer legt/e die Besucherlenkungsmassnahmen fest?

6b) Wer ist für die Umsetzung und den Unterhalt der festgelegten Besucherlenkungsmassnahmen verantwortlich?

6c) Wie werden Freiwillige an der Umsetzung der Besucherlenkung beteiligt?

6d) Wer bezahlt die Kosten für die Besucherlenkungsmassnahmen?

7a) Wird der Erfolg der Besucherlenkung überwacht / kontrolliert? Wenn ja, wie?

7b) Haben Sie schon einmal ein Besuchermonitoring durchgeführt?

8a) Wie zufrieden sind Sie mit der aktuellen Besucherlenkung?

8b) Wie sieht die Besucherlenkung in diesem Gebiet in Zukunft aus? Gibt es Pläne / Diskussionen dazu?

Block Aufsichtsdienst / Ranger

1) Wie ist Ihre Beziehung als Aufsichtsperson zu den Besuchern?

2) Warum kommen die Menschen in dieses (Naturschutz)gebiet? Was sind die Motive der auswärtigen und einheimischen Bevölkerung für einen Besuch von diesem Gebiet?

3a) Welche Aufgaben hat der Aufsichtsdienst in diesem (Naturschutz)gebiet?

3b) Was ist Ihre Rolle als Aufsichtsperson?

4a) Wer ist für die Umsetzung des Aufsichtsdienstes im (Naturschutz)gebiet verantwortlich?

4b) Arbeiten Freiwillige mit?

4c) Wer kommt für die Kosten des Aufsichtsdienstes auf?

5) Welche Rückmeldungen erhalten Sie aus der einheimischen und auswärtigen Bevölkerung / von Besuchern zum Aufsichtsdienst?

6a) Welche Aufgaben des Aufsichtsdiensts sind anspruchsvoll?

6b) Wie wird damit umgegangen?

7a) Wieso braucht es einen Aufsichtsdienst in diesem Gebiet? Was ist sein Einfluss auf das Verhalten der einheimischen und auswärtigen Besucher?

7b) Sind Sie befugt, Sanktionen auszusprechen? Werden diese von den Besuchern akzeptiert?

9) Wird der Erfolg des Aufsichtsdienstes überwacht / kontrolliert? Wenn ja, wie?

10a) Wie zufrieden sind Sie mit dem aktuellen Aufsichtsdienst?

10b) Wie sieht der Aufsichtsdienst in diesem Gebiet in Zukunft aus? Gibt es Pläne / Diskussionen dazu?

Block Umweltbildung

1a) Wie wird Umweltbildung in Besucherlenkung einbezogen?

1b) Welche Inhalte / Themen werden konkret angesprochen?

2) Wie wird Umweltbildung durch Aufsichtsdienst ausgeführt?

3) Wer ist verantwortlich für die Umweltbildung im (Naturschutz)gebiet?

4a) Stellen Sie Defizite im Bereich der Umweltbildung in diesem (Naturschutz)gebiet fest?

4b) Wie wird damit umgegangen?

5a) Wie zufrieden sind Sie mit der aktuellen Umweltbildung?

5b) Wie sieht die Umweltbildung in diesem Gebiet in Zukunft aus? Gibt es Pläne / Diskussionen dazu?

II. Questionnaire of the survey

Umfrage zur Besucherlenkung in Naturschutzgebieten

Ich schreibe meine Masterarbeit an der ETH zu Naturschutzgebieten im Aargau. Es geht darum, herauszufinden, wie zufrieden die Besucher sind und wie sie gewisse Massnahmen, die durch die Verantwortlichen der Gebiete umgesetzt werden, einschätzen. Sie haben zudem die Möglichkeit, Anliegen und Verbesserungsvorschläge zu äussern.

1) Was ist Ihre Motivation, dieses Gebiet zu besuchen?
☐ alleine sein, ☐ Ausgleich zum Alltag/zur Arbeit, ☐ Erholung, ☐ Geselligkeit, ☐ Gesundheit/frische Luft, ☐ Natur erleben/beobachten/geniessen, ☐ Ruhe, ☐ Sport/Bewegung, ☐ andere, nämlich:

2) Können Sie mir sagen, was Ihrer Meinung nach in diesem Gebiet geschützt wird?

In den folgenden 4 Fragen geht es um die Besucherlenkung.
Eine Besucherlenkung dient dazu, die Menschen zu besonderen Orten im Gebiet zu führen oder aus Zonen, innerhalb welcher die Natur geschützt werden soll, heraus zu halten. Um diese Ziele zu erreichen, werden unterschiedliche Massnahmen umgesetzt. Beispielsweise werden Zäune entlang von geschützten Zonen errichtet, Verbotsschilder oder Infotafeln aufgestellt, öffentliche Führungen angeboten oder es gibt im Gebiet einen Aufsichts- und Informationsdienst.

3) Wenn Sie an die Besucherlenkungsmassnahmen in diesem Gebiet denken, wie zufrieden sind Sie damit im Allgemeinen? Finden Sie, dass die Massnahmen in diesem Gebiet…
☐ 5 zu streng ☐ 4 eher streng ☐ 3 gerade richtig ☐ 2 eher mild ☐ 1 zu mild sind?

4) Nachfolgend lese ich Ihnen 21 Behauptungen vor. Ich möchte wissen, wie Sie die Wirkung von Lenkungsmassnahmen einschätzen. Bitte geben Sie Ihre persönliche Zustimmung auf der folgenden Skala an.

5: stimme voll zu, 4: stimme zu, 3: weder noch, 2: stimme nicht zu, 1: stimme gar nicht zu

	Ein / Eine ... erbringt für die Natur den besten Schutz vor den störenden Einfluss des Menschen.	5	4	3	2	1
1	Zaun / Hecke					
2	Hindernis / Barriere, zB Baumstamm quer über dem Weg					
3	Umlegung oder Auflösung von Wegen					
4	Infotafeln, die auf das korrekte Verhalten hinweisen					
5	Infotafeln, die über das Gebiet informieren					
6	Infotafel, die über Aktuelles im Gebiet informiert, zB Aktivitäten des Bibers					
7	offiziellen Naturschutzgebiets-Tafeln (Bild)					
8	offizielle Verbotsschilder, zB Fahrverbot, Leinenpflicht					
9	Betretungsverbote					
10	Übersichtkarte über das Gebiet, wo ist Naturschutzgebiet, wo nicht					
11	Exkursion / Führung					
12	„Infomobil“/“Infostand“: Fachleute / Zivis informieren Besucher zu bestimmtem Thema					
13	Informationszentrum					
14	Ausstellung zu einem bestimmten Thema, zB Biber oder Auen					
15	Flyer / Broschüren mit Infos zum Gebiet und übers erwünschte Verhalten					
16	Webseite über das Gebiet: Infos Gebiet und Verhalten					
17	Auftritt in sozialen Medien wie Facebook, Twitter, Instagram					
18	Smartphone App, mit Infos zum Gebiet und übers erwünschte Verhalten					
19	Aufsichts- und Informationsdienst: Leute, die tagsüber im Gebiet unterwegs sind und schauen, dass die Regeln eingehalten werden und die Fragen beantworten					
20	Polizei: Regeln einhalten, Bussen verteilen					
21	Junior Ranger Programm: Regelmässige Anlässe für Kinder aus der Region. Sie machen Exkursionen und Arbeitseinsätze für die Natur					

5) Nachfolgend lese ich Ihnen nochmals 7 Behauptungen vor. Dieses Mal geht es darum, ob eine Massnahme das Gebiet für die Naherholung attraktiver macht. Bitte antworten Sie wieder mit derselben Skala.

5: stimme voll zu, 4: stimme zu, 3: weder noch, 2: stimme nicht zu, 1: stimme überhaupt nicht zu

	Ein / Eine … macht das Gebiet attraktiver für die Naherholung.	5	4	3	2	1
1	Picknick- und Spielplatz					
2	öffentliche Feuerstellen					
3	öffentliche Toiletten					
4	Brücken auf eine Insel oder über einen Fluss					
5	Beobachtungsturm,- hügel damit man eine grössere Übersicht übers Gebiet erhält					
6	Hide (Bild), damit kommt man ganz nah an die Tiere ran ohne dass diese einen bemerken					
7	Naturlehrpfad zu bestimmtem Thema					

6) Kommen Ihnen spontan noch weitere Massnahmen in den Sinn, welche Sie wichtig finden und welche Sie gerne hier in diesem Gebiet umgesetzt sehen?

In den zwei nächsten Fragen geht es um die Information der BesucherInnen durch die Verantwortlichen des Gebiets.

7a) Wenn Sie an die Informationen über das Gebiet an sich oder über das erwünschte Verhalten denken, finden Sie dass Sie genügend und ansprechend informiert sind?

☐ 5 ja ☐ 4 eher ja ☐ 3 weder noch ☐ 2 eher nein ☐ 1 nein

7b) Was würden Sie an der Information für Besucher/innen ändern?

Nun möchte ich noch etwas über Ihre Ansprüche an dieses Gebiet erfahren.

8a) Bitte nennen Sie mir drei Dinge (aus der Landschaft), die Ihnen in diesem Gebiet am besten gefallen.

8b) Was müsste sich ändern, damit Ihre Ansprüche an das Naherholungsgebiet und an die Besucherlenkung erfüllt wären?

9) Zum Abschluss bitte ich Sie, sich vorzustellen, dass es keine Besucherlenkungsmassnahmen in diesem Gebiet gäbe. Wie würde sich das Gebiet Ihrer Meinung nach verändern?

10) Finden Sie, dass es in diesem Gebiet einen Aufsichts- und Informationsdienst braucht? Bitte antworten Sie mit der folgenden Skala:
☐ 5 ja ☐ 4 eher ja ☐ 3 weder noch ☐ 2 eher nein ☐ 1 nein

Zum Schluss benötige ich noch einige Angaben zu Ihrer Person.

Geschlecht: ☐ weiblich, ☐ männlich, ☐ Paar

Jahrgang: ……

PLZ Ihres Wohnorts: ……..

Aktivität im Naturschutzgebiet:
☐ Hund ausführen, ☐ Joggen, ☐ Sein, ☐ Spazieren, ☐ Velofahren / Biken, ☐ Wandern, ☐ andere, nämlich:

Mitglied in Naturschutzverein: ☐ nein, ☐ ja, bei ……

Naturschutzgebiet: ☐ Wasserschloss, ☐ Aarau-Wildegg, ☐ Hallwilersee, ☐ Reussebene, ☐ Chly Rhy

Haben Sie noch Anregungen oder Verbesserungsvorschläge, die Sie bis jetzt nicht äussern konnten?

Vielen Dank für Ihre Zeit und Ihre Mithilfe. Sie helfen mir damit, einen Beitrag zum Naturschutz im Kanton Aargau zu leisten.

III. Overview of different ranger and supervision systems worldwide

Table 28: Description of ranger and supervision services worldwide.

Park / organization	Country	Ecosystems	Main duties (see next table for details)													Source
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Honorary Rangers (Volunteers)	South Africa		x		x		x			x					x	SANParks Honoryry Rangers, 2016
South African National Parks	South Africa		x	x	x		x	x	x	x		x			x	South African National Parks, 2015
Tunduru District	Tanzania	woodland, virgin forest			x				x							PAWA, 2016
Namtumbo District	Tanzania	woodland, virgin forest			x		x		x	x	x					PAWA, 2016
PAMS Foundation	Tanzania				x						x					PAWA, 2016
Game Ranger Assiciation of Africa	several		x		x	x			x	x	x				x	Game Ranger Association of Africa, 2016
India Education Information	India			x			x	x		x					x	Indiaeducation.net, 2016
Rhino Protection Unit / Ujung Kulon National Park, Java	Indonesia	lowland forest	x		x			x							x	Safe the Rhino International, 2016
Nationalpark Bayrischer Wald	Germany	forest	x		x			x								Nationalparkverwaltung Bayrischer Wald, 2013
Nationalpark Schwarzwald	Germany	forest	x	x	x	x	x	x	x							Nationalpark Schwarzwald, 2015
Kellerwald-Eersee Nationalpark	Germany	forest, lake	x		x		x	x	x							Nationalparkamt Kellerwald-Edersee, 2013
Bundesverband Naturwacht	Germany		x		x		x	x	x							Bundesverband Naturwacht, 2016
Natur- und Landschaftspfleger	Germany		x	x	x		x									Bundesamt für Naturschutz, 2016
Vatnajökull National Park	Iceland	glacier		x	x		x									International Ranger Federation, 2016
Vatnsfjördur Nature Reserve	Iceland	rough vegetation, heaths	x	x			x				x					International Ranger Federation, 2016
Jotunheimen National Park	Norway	alpine ecosystem					x	x	x		x					International Ranger Federation, 2016
Reinheimen National Park	Norway	alpine ecosystem	x		x		x		x	x						PAWA, 2016
Nature Reserve of the Tagus Estuary	Portugal	wetland							x	x						International Ranger Federation, 2016
Pro Natura Zentrum Aletsch	Switzerland	alpine forest	x	x	x			x	x							Pro Natura Zentrum Aletsch, 2015
Schweizerischer Nationalpark	Switzerland	alpine forest, plains	x	x	x		x	x	x	x						Schweizerischer Nationalpark, 2015
Zivis Pro Natura Kt. Aargau	Switzerland	floodplain	x	x	x		x			x						Pro Natura Aargau, 2016
Wildnispark Silhwald	Switzerland	forest	x	x	x		x	x								Wildnispark Zürich, 2015
Hallwilersee	Switzerland	lake	x	x	x		x		x							Rangerdienst Hallwilersee, 2015
Greifensee	Switzerland	lake	x	x	x		x		x							Greifensee-Stiftung, 2014
Swiss Rangers	Switzerland		x	x	x	x	x	x	x	x						Swiss Rangers, 2016
Naturschutzgebietspfleger	Switzerland		x				x			x						Volkswirtschaftsdirektion Kanton Bern, 2016
Jasper National Park	Canada	alpine ecosystem, lakes, glacier		x	x		x	x	x	x		x		x		Jasper National Park of Canada, 2015; International Ranger Federation, 2016

Park / organization	Country	Ecosystems	Main duties (see next table for details)													Source
			1	2	3	4	5	6	7	8	9	10	11	12	13	
Eco Canada	Canada								x	x			x	x		ECO Canada, 2016
Gates of the Arctic National Park and Preserve	USA	arctic desert, boreal forest	x		x		x		x					x		Gates of the Arctic National Park and Preserve, 2012
Grand Canyon National Park	USA	rock	x	x	x				x			x	x	x		Grand Canyon National Park, 2015
United States Park Police	USA								x				x	x		United States Park Police, 2014; ParkRangerEDU, 2016
National Park Service Ranger	USA		x		x		x	x								ParkRangerEDU, 2016
Nitmiluk National Park	Australia	river, rock, forest	x	x			x		x	x			x	x		International Ranger Federation, 2016
Kosciuskp National Park	Australia	alpine heaths, bogs		x			x			x		x	x	x		PAWA, 2016
Garical & Ku-ring-gai Chase National Park	Australia	costal, cultural	x	x			x		x	x		x	x	x		PAWA, 2016
Ngambaa Nature Reserve	Australia	forest			x		x	x	x	x	x	x	x			PAWA, 2016
Macquarie Island Nature Reserve	Australia	island								x						PAWA, 2016
NSW National Parks and Wildlife Service	Australia									x		x	x			PAWA, 2016
Office of Environment and Heritage NSW	Australia											x				PAWA, 2016
Department of Environmental and Natural Resources Kangaroo Island	Australia										x					PAWA, 2016
Department of Environment, Climate Change and Water	Australia											x				PAWA, 2016
Quebrada del Condorito National Park	Argentina	Sierra Pampeana	x		x		x				x					PAWA, 2016
Parque Ondigena Do Tumucumaque	Brazil	rainforest			x											PAWA, 2016
Atlantic Forest / Rangers in Action	Brazil				x											PAWA, 2016

IV. Overview of main duties carried out by rangers

Table 29: Description of main duties of ranger and supervision services.

Duty		Tasks performed within this category
1	education / interpretation	plan an do excursions, guided tours, visitor centers, education in schools, events
2	visitor management	plan, implement and maintain measures such as fences, stairs, trails, signs
3	public information	provide information to visitors, park neighbors, give presentations and meet with park neighbors
4	tourism marketing	plan, implement and maintain tourism and recreation activities
5	maintenance and reparation	maintain and repair park infrastructure, plan and implement conservation measures
6	scientific and social research	study, monitor, record and report on natural occurrences and phenomenon, field collection of data and samples, study acceptance of protected areas in the society
7	law enforcement	Actively combat potential or actual threats to the area of management, work together with authorities, enforce different laws
8	sustainable resource utilization	Promote the value of and prevent the degradation/destruction of natural resources, wildlife and flora management
9	staff and park management	budgeting, guide the staff, manage the park
10	cultural heritage management	strengthen contact with aboriginal communities, restore cultural heritage such as buildings/sites, research on aboriginal culture
11	fire management	locate and combat fire
12	search and rescue	search and rescue injured or missing people
13	anti-poaching	anti-poaching patrols, measures against poaching

V. Overview of the visitor management in the study areas

If not indicated otherwise, the information is retrieved from the meeting with Olbrecht and Meyer (2015) and the expert interviews (Burkard, 2016; Ehrensperger, 2016; Fürst, 2016; Schelbert, 2016; Schuppli, 2016; Witzig, 2016).

Wasserschloss

Measures

The area Wasserschloss has thirteen measures in total, four direct and nine indirect. From the four direct measures two are structural measures (bridges, fences / hedges). The playground and picnic sites count to the visitor infrastructure and there are official prohibition signs along the paths. Five out of nine indirect measures are information boards and a nature trail. There is no website but flyers and brochures (printed media) and there is the "Infomobil" and excursions / guided tours throughout the area. Since 2001, two men doing civilian service during the week and the weekends provide a supervision and information service. Compared to the other areas the Wasserschloss has little structural measures and visitor infrastructure but has many different information boards.

Managing visitor management measures

The area Wasserschloss is managed through Pro Natura Aarau and its subsidiary creaNatira. They work on behalf of the canton Aargau and the projects are financed through contracts by the canton. The Naturama, the nature museum in Aarau, the canton Aargau and Pro Natura are the three stakeholders providing excursions and guided tours in those two areas.

Protected Areas

With the acceptation of the initiative for the Auenschutzpark the renaturations around the Wasserschloss started. Pro Natura Aargau purchased the areas "Limmatspitz" and "Stroppelinsel" in the year 1998. Afterwards, they renaturalized the areas and turned them into preserved areas. Other renaturations took place near Vogelsang and Geissenschachen.

The area Wasserschloss has areas with eight different levels of protection. It is, as mentioned above, part of the cantonal Auenschutzpark and is a decree area since 1989. The whole area from Brugg to Stilli is in the Federal Inventory of Landscapes and Nature Monuments of National Importance. Parts of the area are Amphibian Spawning Sites or Alluvial Zones of National Importance and others are cantonal, communal or Pro Natura protected areas.

General characteristics of the area

The area is around 170 ha big and its distance is approximately 25 km to Aarau and 40 km to Zurich.

Common problems

Ulysses Witzig reported violations of the following rules and regulations: keep dogs on a leash, ban of access, stay on paths, ban of littering, ban of fire making and ban of camping.

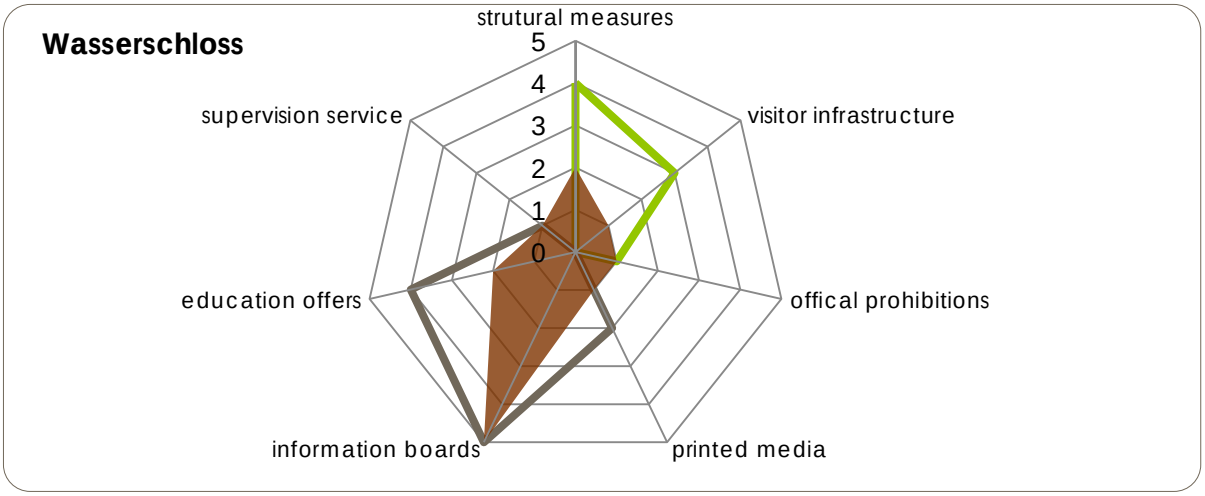

Figure 10: Distribution of visitor management measures in the subcategories in the area Wasserschloss. The green respectively brown line indicates the highest amount of direct respectively indirect measures reached by other areas.

Aarau-Wildegg

Measures

In the area Aarau-Wildegg thirteen measures are implemented in total. Four of the seven direct measures are structural measures (barriers / obstacles, bridges, fences / hedges, removal / relocation of paths). There are two visitor infrastructure measures (playground / picnic sites and observation hills) and official prohibition signs. Three of the six indirect measures are information boards (information boards on behaviour in the area, the area itself and outline maps), there are two educational offers from the Naturama (exhibition and excursions) and flyer / brochure (printed media). Compared to the other study areas the area Aarau-Wildegg is the only one without any supervision or information service and has little different information boards but many structural measures.

Managing visitor management

The area is totally managed and financed through the canton Aargau, respectively through the canton agency “Abteilung für Landschaft und Gewässer” under the surveillance of Bruno Schelbert. Local companies or farmers through contracts with the

cantonal agency implement the measures. The Naturama provides excursions and guided tours in the area.

Protected Areas

In 1993 the initiative for the Auenschutzpark was accepted by the population of the canton Aargau. During the years 2003 to 2012 the cantona agency "Abteilung für Landschaft und Gewässer" renaturalized the Aare between Aarau and Wildegg and finished some major projects like the "Umgehungsgewässer" in Rupperswil or the "dynamische Flussaue".

Including the Auenschutzpark, the area between Aarau and Wildegg has areas with six different types of protection. Some areas are Amphibian Spawning Sites of National Importance and it was proposed in the year 2015 to become an Alluvial Zone of National Importance. It has cantonal, communal and one Pro Natura nature preserve. At its northern extent the area borders to a Landscape and Nature Monument of National Importance.

General characteristics of the area

The area is around 370 ha big (Schelbert, 2015a) and is the closest study area to Aarau (0-13km). To Zurich the distance is between 35-45km (Google, 2016).

Common problems

Major violations occur for the following rules and regulations: keep dogs on a leash, stay on paths, ban of littering. Currently, no bans of access exist in the area.

Personal opinion

Bruno Schelbert clearly stated that he prefers structural measures (direct) to information boards (indirect):

> *"Das Wichtigste ist die entsprechende Gestaltung, ein Wassergraben ist beispielsweise eine gute Besucherlenkung. Das ist zehnmal besser als ein Stacheldraht oder schöne Verbotstafeln, von denen halte ich nämlich nichts.* (*The most important issue is the design, for example a ditch is a good visitor management. It is ten times better than any barbed wire or beautiful prohibition signs.* (Schelbert, 2016))."

The absence of a supervision and information service is partly due to the fact that the area is no decree area where the canton is in charge to finance a supervision service and not the municipalities; and that there are not yet any bans of access

being the basis for a good working supervision service. Bruno Schelbert stated it as follows:

> *"Wenn man einen Rangerdienst will und aufzieht, dann braucht es klipp und klare Regelungen, sonst nützt er nichts.* (*If one wants to have a supervision service one needs to have clear rules, otherwise it does not help anyone.* (Schelbert, 2016))."

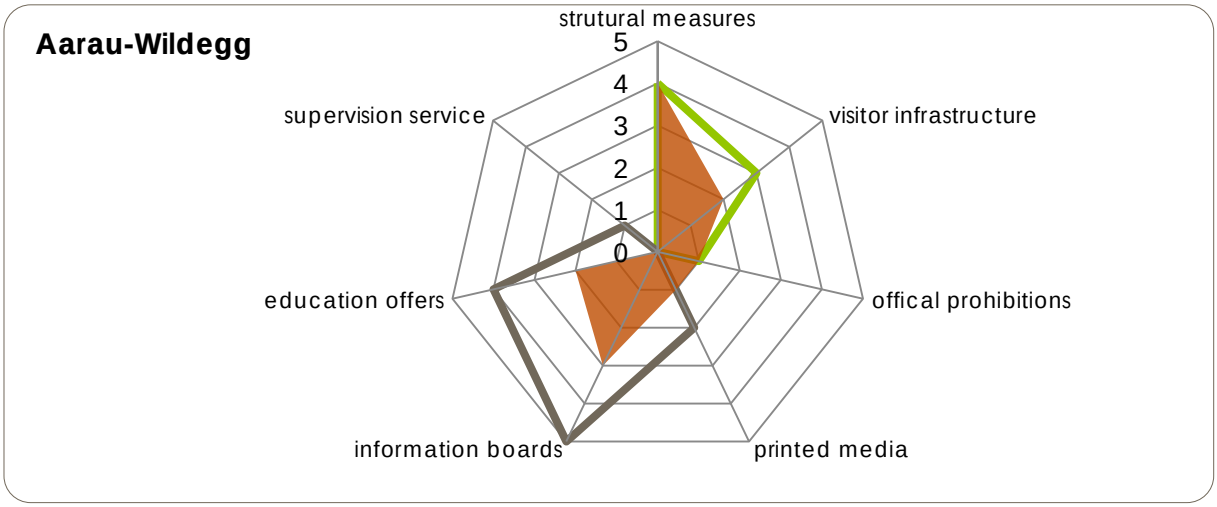

Figure 11: Distribution of visitor management measures in the subcategories in the area Aarau-Wildegg. The green respectively brown line indicates the highest amount of direct respectively indirect measures reached by other areas.

Hallwilersee

Measures

In total, the area Hallwilersee has thirteen different visitor management measures. Three are structural measures (barriers / obstacles, fences / hedges and removal / relocation of paths), one is a visitor infrastructure measure (playground / picnic sites) and it has official prohibition signs. As indirect measures it has four information boards (all except a nature trail), two education offers (excursions / guided tours and the "infostand"), flyers and brochures (print media) and the Hallwilersee Rangers work as a supervision service. They are four trained Ranger from the Bildungszentrum Wald in Lyss (BZWL), one biologist and an environmental pedagogue who are present during the week (one person) and the weekends (two people) around the lake. Compared to the other areas the Hallwilersee only has little visitor infrastructure, otherwise its values represent the average of the others.

Managing visitor management measures

In the area Hallwilersee the situation is quite complicated. The Hallwilersee Rangers plan the measures together with the concerned municipalities around the lake. The

building authorities of those municipalities implement and maintain the measures in general. The maintenance team is responsible for the cantonal protected areas. The Rangers are in charge of the supervision and information service and for the educational offers. The cantons Aargau and Lucerne and the concerned municipalities finance the Rangers through the "Verein Hallwilersee für Mensch und Natur" by a contract with the Rangers.

Protected Areas

1920 the area where the Boniswiler Ried next to the Hallwilersee lies was put under strict protection. In the year 1986 the decree of the Hallwilersee came into charge and regulated the use and protection of the different preserved areas around the Hallwilersee. In the year 2009 the "Verein Hallwilersee für Mensch und Natur" made the Hallwilersee Ranger responsible for the supervision service around the lake.

The Hallwilersee is the only area that is not part of the Auenschutzpark. Including the decree it has areas with eight different types of protection. The whole area is part of the Federal Inventory for Landscapes and Nature Monuments of National Importance and is declared an Emerald Site. Parts of the area are Amphibian Spawning Sites or Fenlands of National Importance. It has cantonal, communal and nine Pro Natura Nature Preserves.

General characteristics of the area

The protected areas lay around the Hallwilersee (10km^2). Its northern end is 20 km away from Aarau and 40 km away from Zurich (Google, 2016).

Common problems

Bruno Fürst stated that they have many violations of rules and regulations: keep dogs on a leash, ban of access, stay on paths, ban of littering, ban of fire making, driving ban for bikes, ban of camping and ban of dropping the anchor near the reed belts.

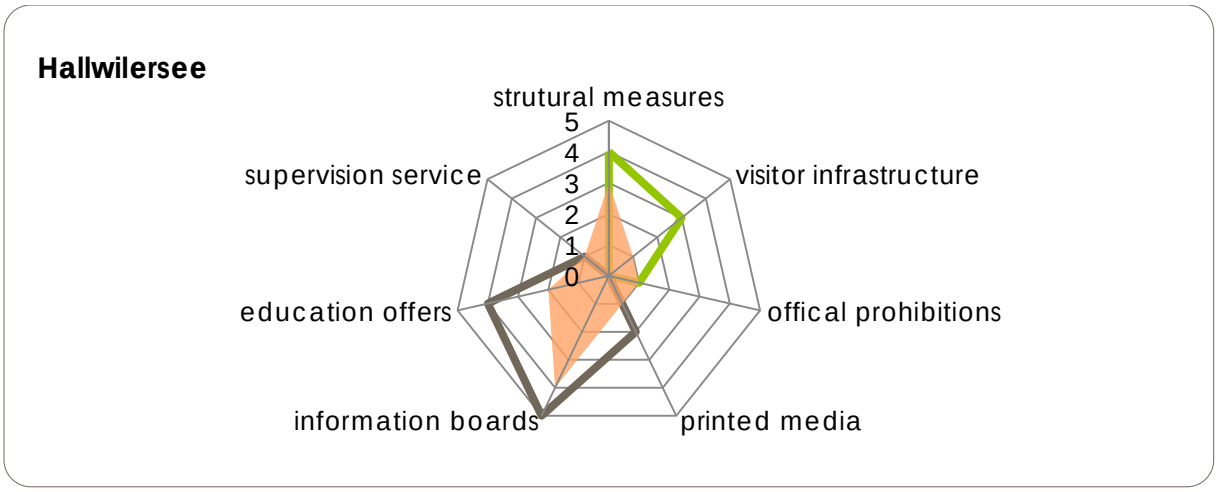

Figure 12: Distribution of visitor management measures in the subcategories in the area Hallwilersee. The green respectively brown line indicates the highest amount of direct respectively indirect measures reached by other areas.

Reussebene

Measures

The area Reussebene has the most visitor management measures, eighteen in total. Only in the subcategory structural measures they do not have as many as others. They have two structural measures (fences / hedges, removal / relocation of paths), three visitor infrastructure (hides, observation hills and playgrounds / picnic sites) and official prohibition signs. The area has all indirect measures in each subcategory printed media, information boards, education offers and supervision service. The "Aufsichts- und Informationsdienst Reussebene" consists of ten people with local reference being pensioners, students or part-time workers. Every day, one of them is present at hotspots throughout the area. Compared to the others, due to the high amount of different visitor management measures, the area has many information boards, education offers and visitor infrastructure but only little structural measures.

Managing visitor management measures

In the area Reussebene the cantona agency plans the visitor management measures through a concept. The Stiftung Reussebene can plan minor measures such as prohibition signs but has to request for them by the canton Aargau or Zurich depending on the site for the measure. The measures are implemented through the cantonal maintenance team for protected areas and financed through the canton. The "Aufsichts- und Informationsdienst Reusstal" is in charge for the supervision service and both the Naturama and the Stiftung Reussebene provide educational offers. The Stiftung Reussebene is financed through contracts by the cantons Aargau and Zurich.

Protected Areas

With the Flachsee that was constructed in the year 1974 the need for visitor management measures became aware. Since the year 1980 there exists a visitor management concept designed from the canton of Aargau that puts the Stiftung Reusstal in charge of the visitor management measures and the supervision service that was implemented in the same year.

The Reussebene has areas with eleven different types of protection. It is part of the Auenschutzpark and is a decree area since 1982. The whole area is part of the Federal Inventory of Landscapes and Nature Monuments of National Importance and is an Emerald Site. Parts of the area are Amphibian Spawning Sites, Alluvial Zones, Fenlands of National Importance. The southern end is a Mire Landscape of Particular Beauty and National Significance and the Flachsee is declared a Reserve for Waterbirds and Migratory Birds of International and National Importance. There are cantonal and communal but no Pro Natura Nature Preserves.

General characteristics of the area

The protected areas lay along both sides of the Reuss and cover 320 ha (Schelbert, 2015a). The distance to Aarau is around 40km and to Zurich 25km (Google, 2016).

Common problems

Most violations of rules and regulations occur by the following ones: keep dogs on a leash, ban of access, stay on paths, ban of littering, ban of fire making, driving ban for bikes, driving and parking ban for cars.

Personal opinion

The visitor management system of the Reussebene seems to work quite well and the measures seem mostly to be accepted. According to Thomas Burkhard, the reason for this might be the huge experience they won over the years:

> *"Da kann man über die Jahre hinweg sehr viel Erfahrung sammeln.* (*One can gain many experiences during those years.* (Burkard, 2016))"

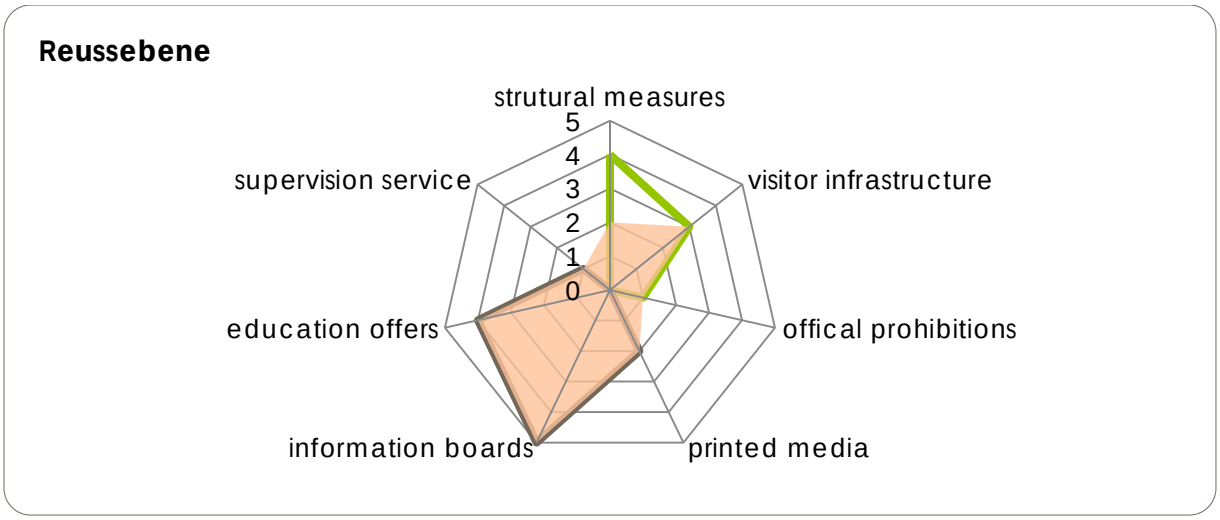

Figure 13: Distribution of visitor management measures in the subcategories in the area Reussebene. The green respectively brown line indicates the highest amount of direct respectively indirect measures reached by other areas.

Chly Rhy

Measures

In total, the area Chly Rhy has fifteen visitor management measure. Four are structural measures (barriers / obstacles, bridges, fences / hedges, removal / relocation of paths), two visitor infrastructure (observation towers and playgrounds / picnic sites). The prohibition signs are a special case in the area Chly Rhy as they are only in the Rhein for the water sports enthusiasts but there are none on the land area. There are two printed media measures (flyer / brochures and a website), four information boards (all except a nature trail), one education offer (excursions / guided tours) and a supervision service as indirect measures. Ambros Ehrensperger, a teacher who knows the area well is in charge for the supervision and information service at the weekends. Compared to the other areas the Chly Rhy has no prohibition sites on land, only little education offers and many structural measures.

Managing visitor management measures

The area Chly Rhy is managed similar to the area Wasserschloss as for both Pro Natura Aargau and its subsidiary creaNatira are responsible. They work on behalf of the canton Aargau and the projects are financed through contracts by the canton as well. The Naturama, the canton Aargau and Pro Natura are the three stakeholders providing excursions and guided tours in those two areas. The only difference is the supervision service, which is done half-professional by a teacher in the area Chly Rhy since 2015.

Protected Areas

Since 1992 the floodplain Chly Rhy is designated an Alluvial Zone of National Importance. In the years 20014/2015 Pro Natura Aargau and the canton Aargau renaturalized the floodplain and implemented a visitor management system including a supervision service.

There are areas of seven different types of protection. The whole area is part of the Auenschutzpark and is a decree since 1948. In addition to Alluvial Zones it also has Amphibian Spawning Sites of National Importance. There are cantonal, communal and Pro Natura Nature and Forest Preserves.

General characteristics of the area

The area Chly Rhy is a small floodplain in approximately 40km distance to Aarau and 45km distance to Zurich (Google, 2016).

Common problems

Common violations of the following rules and regulations occur: keep dogs on a leash, ban of access, stay on paths and ban of swimming/entering the waters.

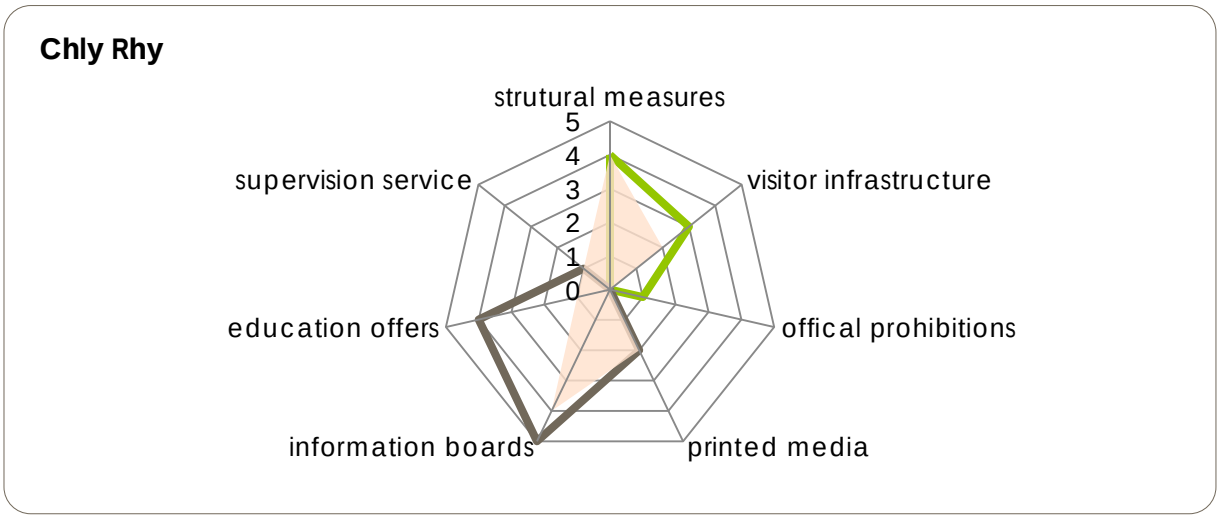

Figure 14: Distribution of visitor management measures in the subcategories in the area Chly Rhy. The green respectively brown line indicates the highest amount of direct respectively indirect measures reached by other areas.

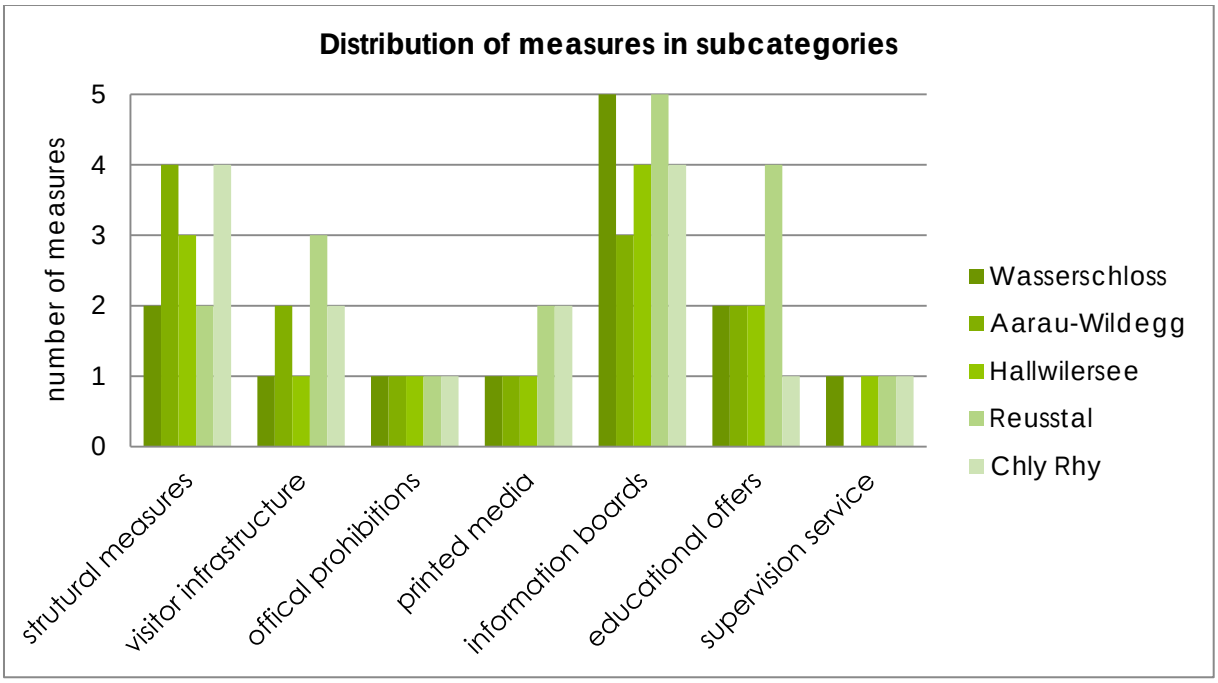

Figure 15: Overview of the visitor management measures in the subcategories.

Table 30: Overview of the different visitor management systems. The data is retrieved from the interviews.

... the visitor management measures	**Wasser-schloss**	**Aarau-Wildegg**	**Hallwilersee**	**Reussebene**	**Chly Rhy**
Plan ...					
	Pro Natura Aargau on behalf of the canton Aargau	canton agency	Ranger together with the municipalities	canton agency, canton Zürich; Stiftung Reusstal via request	Pro Natura on behalf of the canton Aargau
Implement & maintain ...					
In general	Pro Natura Aargau on behalf of the canton Aargau	Local companies and farmers on behalf of the cantonal agency	Building authorities of the municipalities	Cantonal maintenance team for protected areas	Pro Natura Aargau on behalf of the canton Aargau
Supervision service	Men doing civilian service	-	Hallwilersee Ranger	Aufsicht- und Informationsdienst Reusstal	Ambros Ehrensperger
Educational offers	canton Aargau, Pro Natura Aargau, Naturama	Naturama	Hallwilersee Ranger	Stiftung Reusstal, Naturama	canton Aargau, Pro Natura Aargau, Naturama
Finance ...					
	Canton of Aargau through contracts with Pro Natura Aargau	cantonal agency	40% Cantons Aargau and Lucerne, 60% municipalities	Cantons Aargau and Zurich through contracts with Stiftung Reusstal	Canton of Aargau through contracts with Pro Natura Aargau

Table 31: Overview of areas with different types of protection. The data is retrieved from the interviews and the online maps of Kanton Aargau (2016d).

types of protection	Wasser-schloss	Aarau-Wildegg	Hallwiler-see	Reuss-ebene	Chly Rhy
Amphibian Spawning Sites of National Importance	x	x	x	x	x
Auenschutzpark	x	x		x	x
Cantonal protected areas	x	x	x	x	x
Communal protected areas	x	x	x	x	x
Decree [a)]	1989		1986	1982	1948
Emerald Site			x	x	
Landscape and Natural Monument of National Importance	x	x	x	x	
Reserve for Waterbirds and Migratory Birds of International and National Importance				x	
Fenland of National Importance			x	x	
Alluvial Zone of National Importance	x	proposed 2015		x	x
Mire Landscapes of Particular Beauty and National Significance				x	
Nature and Forest Preserves of Pro Natura Aarau [b)]	3	1	9	0	2
IN TOTAL [c)]	8	6	8	11	7

a) The number indicates the year of the coming into force of the decree if existing. No number means that there exists no decree for the area. b) The number indicates the amount of existing Pro Natura Preserves in the area. c) The number indicates the total amount of types of different protection.

Table 32: Different characteristics of the study areas. The data is retrieved from the interviews and the directions service from Google (2016).

	Wasser-schloss	Aarau-Wildegg	Hallwiler-see	Reuss-ebene	Chly Rhy
Total amount of measures	13	13	13	18	15
Distance to Aarau	25km	<15km	20km	40km	40km
Distance to Zurich	40km	40km	40km	25km	45km
Measures since	1998	2003	1986	1975	2015
Supervision service since	2001	-	2009	1980	2015

Table 33: Rules and regulations that are often violated in the study areas. The data is retrieved from the interviews.

Rules / regulations	Wasser-schloss	Aarau-Wildegg	Hallwiler-see	Reuss-ebene	Chly Rhy
Dogs on a leash [a)]	x	x	x	x	x
Ban of access [a)]	x	not existing	x	x	x
Stay on paths [a)]	x	x	x	x	x
Ban on Littering [a)]	x	x	x	x	
Fire ban [a)]	x		x	x	
Driving ban for bikes			x	x	
Driving and parking ban for cars				x	
Ban on camping	x		x		
Ban of dropping anchor			x		
Total	6	3	8	7	3

Table 34: Number of visitor management measures that are improved or planned in each area. They are classified according the subcategories of visitor management measures. The data is retrieved from the interviews.

	Wasser-schloss	Aarau – Wildegg	Hallwilersee	Reussebene	Chly Rhy
Structural measures		1	2		1
Visitor infrastructure			3		
Official prohibitions	1	2	1	1	1
Printed media					
Information boards	1		1		1
Educational offers	1		2	1	1
Supervision service	1			1	1
TOTAL	4	3	9	3	5

VI. Statistical values of the assessed visitor management measures

Table 35: Statistical values for the different visitor management measure groups. Area: A-W: Aarau-Wildegg, Re: Reussebene. Significance: exact significance from the U-test according to Mann and Whitney.

	area	mean	standard deviation	median	quartiles	U, significance
rated effective or attractive, all measures	overall	3.42	0.386	3.41	3.10, 3.66	U=130.5, p=0.060
	A-W	3.33	0.453	3.15	3.04, 3.62	
	Re	3.52	0.286	3.42	3.33, 3.73	
rated effective or attractive, direct measures	overall	3.42	0.392	3.45	3.18, 3.64	U=176.0, p=0.529
	A-W	3.38	0.483	3.33	3.09, 3.70	
	Re	3.46	0.282	3.45	3.20, 3.64	
rated effective or attractive, indirect measures	overall	3.43	0.488	3.36	3.18, 3.76	U=132.0, p=0.068
	A-W	3.29	0.549	3.29	2.93, 3.65	
	Re	3.57	0.384	3.42	3.25, 3.85	
effectiveness, all measures	overall	3.35	0.476	3.38	3.05, 3.58	U=121.5, p=0.033 *
	A-W	3.19	0.536	3.09	2.82, 3.57	
	Re	3.50	0.357	3.41	3.21, 3.84	
effectiveness, direct measures	overall	3.22	0.583	3.40	2.76, 3.75	U=121.5, p=0.033 *
	A-W	3.03	0.624	3.00	2.40, 3.60	
	Re	3.42	0.476	3.60	3.05, 3.80	
effectiveness, indirect measures	overall	3.39	0.498	3.32	3.13, 3.73	U=134.0, p=0.076
	A-W	3.25	0.560	3.26	2.83, 3.62	
	Re	3.53	0.394	3.39	3.22, 3.86	
attractiveness, all measures	overall	3.67	0.470	3.71	3.43, 4.00	U=152.0, p=0.201
	A-W	3.75	0.535	3.79	3.57, 4.00	
	Re	3.58	0.391	3.54	3.29, 3.96	
attractiveness, direct measures	overall	3.60	0.519	3.67	3.33, 4.00	U=142.5, p=0.121
	A-W	3.72	0.585	3.67	3.50, 4.00	
	Re	3.49	0.428	3.33	3.18, 3.83	
attractiveness, indirect measures	overall	4.08	0.784	4.00	4.00, 5.00	U=165.0, p=0.675
	A-W	4.00	0.840	4.00	3.75, 5.00	
	Re	4.15	0.745	4.00	4.00, 5.00	

Table 36: Statistical values for the different visitor management measures. Area: A-W: Aarau-Wildegg, Re: Reussebene. Significance: exact significance from the U-test according to Mann and Whitney. Values: 1: no agreement at all, 2: no agreement, 3: neither, 4: agreement, 5: full agreement. A): Measures assessed of effectiveness, b): measures assessed of attractiveness. In bold: overall median ≥ 4.

Measure	area	mean	standard deviation	median	quartiles	U, significance
Direct						
ban of access a)	overall	3.56	0.940	4	3, 4	U=138.0, p=0.149
	A-W	3.32	0.946	4	2, 4	
	Re	3.80	0.894	4	3, 4	
barriers / obstacles a)	overall	2.63	1.079	2	2, 4	U=177.5, p=0.547
	A-W	2.75	1.164	2	2, 4	
	Re	2.50	1.000	2	2, 3.75	
bridges b)	overall	3.66	1.097	4	3, 4	U=108.5, p=0.034 *
	A-W	4.05	0.911	4	4, 5	
	Re	3.26	1.147	4	2, 4	
fences / hedges a)	overall	2.95	1.260	3	2, 4	U=95, p=0.004 **
	A-W	2.35	1.226	2	1, 4	
	Re	3.55	0.999	4	3, 4	
hide b)	overall	4.05	0.941	4	4, 5	U=103.5, p=0.042 *
	A-W	3.71	0.985	4	3, 4	
	Re	4.35	0.813	4.5	4, 5	
observation tower / hill b)	overall	4.21	0.923	4	4, 5	U=168.5, p=0.550
	A-W	4.05	1.079	4	4, 5	
	Re	4.35	0.745	4	4, 5	
official prohibition signs a)	overall	3.53	0.987	4	3, 4	U=141.5, p=0.114
	A-W	3.25	1.209	3	2, 4	
	Re	3.80	0.616	4	4, 4	
playground / picnic site b)	overall	2.9	1.328	3	2, 4	U=161.0, p=0.301
	A-W	3.15	1.137	4	2, 4	
	Re	2.70	1.490	3	1, 4	
public fire places b)	overall	3.50	0.961	4	3, 4	U=105.0, p=0.009 **
	A-W	3.90	0.852	4	4, 4	
	Re	3.10	0.912	3	2, 4	
public toilets b)	overall	3.30	1.224	4	2, 4	U=170.5, p=0.429
	A-W	3.45	1.234	4	2.25, 4	
	Re	3.15	1.226	3.5	2, 4	
relocation or removal of paths a)	overall	3.48	0.877	4	3, 4	U=192.5, p=0.841
	A-W	3.50	0.889	4	3, 4	
	Re	3.45	0.887	3.5	3, 4	
Indirect						
excursions / guided tours a)	overall	3.41	1.040	4	3, 4	U=165.0, p=0.892
	A-W	3.40	1.095	4	2.25, 4	
	Re	3.41	1.004	3	3, 4	
exhibition a)	overall	3.49	0.804	4	3, 4	U=147.5, p=0.497
	A-W	3.35	0.862	4	2.5, 4	
	Re	3.60	0.754	4	3, 4	
flyer / brochure a)	overall	2.77	1.063	3	2, 4	U=144.5, p=0.204
	A-W	2.53	1.172	2	2, 4	
	Re	3.00	0.918	3	2, 4	
"Infostand" a)	overall	3.59	1.044	4	3, 4	U=188.5, p=0.967
	A-W	3.63	0.831	4	3, 4	
	Re	3.55	1.234	4	2.25, 4.75	
information board: area a)	overall	3.65	0.975	4	3, 4	U=124.5, p=0.040 *
	A-W	3.30	1.031	4	2.25, 4	
	Re	4	0.795	4	4, 4.75	

Measure	area	mean	standard deviation	median	quartiles	U, significance
information board: behavior a)	overall	3.43	1.174	4	2, 4	U=153.5, p=0.211
	A-W	3.15	1.307	3.5	2, 4	
	Re	3.70	0.979	4	3, 4	
information board: currently in the area a)	overall	3.83	0.903	4	3, 4	U=141.0, p=0.114
	A-W	3.55	1.050	4	3, 4	
	Re	4.10	0.641	4	4, 4.75	
information center a)	overall	3.08	1.036	3	2, 4	U=114.0, p=0.033 *
	A-W	2.68	1.003	3	2, 4	
	Re	3.45	0.945	4	3, 4	
Junior Ranger program a)	overall	4.44	0.552	4	4, 5	U=180.5, p=0.792
	A-W	4.42	0.507	4	4, 5	
	Re	4.45	0.605	4.5	4, 5	
nature trail b)	overall	4.08	0.784	4	4, 5	U=165.0, p=0.675
	A-W	4.00	0.840	4	3.75, 5	
	Re	4.15	0.745	4	4, 5	
official information board: protected area a)	overall	3.33	1.177	4	2, 4	U=121.5, p=0.054
	A-W	2.95	1.276	3	2, 4	
	Re	3.74	0.933	4	3, 4	
outline map a)	overall	3.50	0.923	4	3, 4	U=168.0, p=0.729
	A-W	3.53	1.073	4	2, 4	
	Re	3.47	0.772	4	3, 4	
police a)	overall	2.10	1.172	2	1, 2	U=184.0, p=0.678
	A-W	2.20	1.240	2	1, 3	
	Re	2.00	1.124	2	1, 2	
presence on social media networks a)	overall	3.07	1.035	3	2, 4	U=87.0, p=0.925
	A-W	3.08	0.793	3	2.25, 4	
	Re	3.07	1.223	3	2, 4	
smartphone application a)	overall	3.30	0.988	3	2, 4	U=88.0, p=0.334
	A-W	3.50	1.019	4	2.75, 4	
	Re	3.13	0.957	3	2, 4	
supervision service a)	overall	3.90	0.955	4	3.25, 5	U=188.0, p=0.758
	A-W	4	0.795	4	4, 4.75	
	Re	3.80	1.105	4	3, 5	
website a)	overall	3.46	1.016	4	3, 4	U=140.5, p=0.358
	A-W	3.22	1.166	4	2, 4	
	Re	3.68	0.822	4	3, 4	

VII. Classification of the answers to the open questions

Table 37: Grouped statements of the visitors of how the area would develop without any visitor management measures.

Group	Statements
illegal trails	Trampelpfade
more people	Leute überall im Gebiet, mehr Leute, Leute irgendwo, mehr Biker, mehr Autos, mehr Fischer, mehr Boote
disturbance of plants, animals and/or their habitats	das Wild wird gestört, Tiere würden Freiraum verlieren, Lebensraum der Tiere beeinträchtigt, Schutz der Tiere nicht mehr gewährleistet, schädlich für Natur, weniger Vogelarten/Wintergäste
bad behaviour	vergammeln, jeder macht was er will, Camping/Partys, verschmutzen, unerlaubtes Fischen, Chaos, Menschen machen was sie wollen
no changes	kurzfristig keine Änderung, nicht gross, wenig Veränderung, keine Veränderung, nicht gross
more waste	mehr Abfall, Abfall liegen lassen
more fire places	Feuerstellen
dogs not on the leash	freie Hunde, freie Hunde schränken Tiere ein, Tiere gestört durch freilaufende Hunde
less people	weniger Leute
nature develops without humans	natürliche Entwicklung der Landschaft, keine Pflege der Natur mehr, Natur würde nicht bewirtschaftet
others	keine Informationen, kommt auf Gesellschaft an, es braucht die Information, Sicherheit reduziert

Table 38: Grouped statements of the visitors for new or improved measures, measures to fulfil their needs and information.

Group	Statement
new / improvement of visitor management measures	
separation of user groups	Trennung Velofahrer und Fussgänger, Trennung Velo/Fussgänger Dammweg Umgehungsgewässer, Fahrverbot beim Dammweg Umgehungsgewässer, bessere Trennung Velo/Fussgänger,
prohibitions and regulations	Boot-Fahrverbot auf Reuss, Einhalten der Leinenpflicht für Hunde, Kontrolle Fahrverbote, Fahrverbot anpassen, Fahrverbot Velo besser durchsetzen, Umgehungsgewässer als Naturschutzgebiet ausweisen
change of paths	direkter Weg an Fluss, schmalere Wege, Fahrverbot Dammweg Umgehungsgewässer, Wege Kinderwagen- und Rollstuhlfreundlich, Weg vom Ufer weg verlegen
infrastructure	Turm für Birder am linken Flachseeufer
offers / events	kostengünstige / gratis Angebote (Führungen), Fest/Veranstaltung auf Gelände, mehr Angebote für Kinder / Jugendliche, nächste Generation / Familien abholen, öffentliche Führungen, Wettbewerb / Foxtrail, Umfragen
projects for schools	Schulprojekte
measures to fulfil needs	
nature	renaturierte Flächen vergrössern, Lücken in Hecken damit man im Sommer die Aare vom Weg aus sieht, grosse Bäume vor Biber schützen, Rehzucht
infrastructure	Hide öffnen, öffentliche Toiletten, Restaurant / Café, Voliere, Attraktionen warten (Glasscheibe bei Fischtreppe)
transport	besserer öV, mehr Parkplätze an Sonntagen
waste	Kontrolle Abfall, mehr Abfalleimer/-kontrolle, natürlich gestaltete Abfalleimer, mehr Abfalleimer entlang der Wege. Mehr Robbidog-Eimer
benches / places to sit	mehr Bänkli / Sitzgelegenheiten, mehr Bänkli
others	weniger Leute, weniger Velofahrer, Unterrichtsmaterial für Lehrpersonen bereitstellen, Fütterungsverbot aufheben
information	
information boards: currently in the area	aktuelle Tiere im Gebiet-Tafel, Tafel mit „aktuellem“ Tiere/Events, Information was grad läuft (Holzschlag), bessere Information was läuft (warum geholzt wurde)
information boards: behaviour	mehr und klarere Verbotstafeln / Kontrolle Regeln, erwünschtes Verhalten grösser, Piktogramme korrektes Verhalten grösser / deutlicher, Verhaltenshinweise grösser / mehrsprachig, Fahrverbot Velo deutlicher machen / kontrollieren, Tafel wann man wo baden darf, Hundehalter besser aufklären
information board: user groups	auf Rücksichtnahme appellieren, an Rücksichtnahme appellieren, Velofahrer rücksichtsvoller fahren
information board: area	Hinweis zum Zieglerhaus deutlicher, Informationen zum Biber, Infotafeln zu Pflanzen, interaktive Tafeln, , mehr Informationen zum Leben der Fische, mehr Tafeln, Leute bereits ab öV Stationen über Gebiet informieren, interaktive Tafeln
nature trail	Lehrpfad, Naturlehrpfad
flyer / brochures	Flyer in Haushalte schicken
outline map	Angabe Wanderzeiten auf Übersichtskarte
others	Eintrag der Naturschutzgebiete in Google Maps, nicht zu viel Werbung fürs Gebiet

VIII. Comparison of the currently implemented measures and those rated as effective or attractive

Table 39: List of the currently implemented measures and those rated as effective or attractively the visitors in the study areas. The column "visitors' view" represents those measures assessed with an overall median value ≥ 4, indicating that at least 50% of the respondents from both areas (Aarau-Wildegg and Reussebene) rated those measure with an "x" as effective or attractive. With this summarization of both visitors' view it becomes more robust. The "x" in the other columns indicates that the measure is currently implemented in the area. The green "p" marks a potential to implement measures that are assessed as effective or attractive by the visitors.

Measure	Visitors' view	Wasser-schloss	Aarau-Wildegg	Hall-wilersee	Reuss-ebene	Chly Rhy
Direct						
ban of access*	x	x	p	x	x	x
bridges	x	x	x	p	p	x
hide	x	p	p	p	x	p
observation tower / hill	x	p	x	p	x	x
official prohibition signs	x	x	x	x	x	x**
public fire places*	x	p	p	p	p	p
public toilets*	x	p	p	p	p	p
relocation or removal of paths	x	p	x	x	x	x
barriers / obstacles			x	x		x
fences / hedges		x	x	x	x	x
playground / picnic site		x	x	x	x	x
Indirect						
excursions / guided tours	x	x	x	x	x	x
exhibition	x	p	x	p	x	p
information board: area	x	x	x	x	x	x
information board: behavior	x	x	x	x	x	x
information board: currently in the area*	x	p	p	p	p	p
"Infomobil" / "Infostand"	x	x	p	x	x	p
Junior Ranger program*	x	p	p	p	p	p
nature trail	x	x	p	p	x	p
official information board: protected area	x	x	p	x	x	x
outline map	x	x	x	x	x	x
supervision service	x	x	p	x	x	x
website	x	p	p	p	x	x
flyer / brochure		x	x	x	x	x
information center					x	
police*						
presence on social media networks*						
smartphone application*						

*: ideas for implementation mentioned from the experts during the interviews; x**: only in the Rhein, none on land