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GIS-based Recreation Experience Mapping

Development, Validation and Implementation

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Anton Stahl Olafsson

UNIVERSITY OF COPENHAGEN

FOREST & LANDSCAPE

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KØBENHAVNS UNIVERSITET

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Abstract

This PhD thesis is based on research which was conducted at Forest & Landscape, University of Copenhagen from 2008-2011. Outdoor recreation planning and GIS comprise the focus of the thesis. The starting point for the thesis is a spatial support system concerned with GIS-based Recreation Experience Mapping (REM). In REM, GIS is used to assign indicators to each of the seven recreation experience classes: wilderness, feeling of forest, panoramic views, biodiversity, cultural history, activity and challenge, and service and gathering. The output of the GIS procedure comprises thematic maps and a geo-database which highlights potential for recreation experiences at the landscape level. This spatial information system is new to planning and management and supports outdoor recreation policy making and decision making with easily accessible information on social landscape values which have not been previously systematically available.

The development, validation and implementation of REM are the three focus areas of the thesis. The development of REM is based on a case study of green structure enlargement in greater Copenhagen. The validity issues of REM are investigated through a literature review and a study of spatial accordance between the REM output and spatial data on perceived experience opportunity obtained by visitor participatory mapping. The implementation perspectives of REM are investigated by focusing on collaborative rationality and the use of GIS in recreation trail planning. Empirical data for this part of the study is based on an internship at Ringsted municipality together with an Internet survey with all Danish municipalities on recreation trail planning and GIS.

The thesis concludes that the REM use of the seven experience dimensions is well covered by the literature and has been fairly well validated empirically by visitors. The GIS-basis of REM does not seem to impede planning adoption, but fits a demand and need for more use of GIS among the majority of planners. REM can facilitate collaborative planning by serving as a platform for joint-fact finding and the formation of shared understandings. It is recommended to incorporate participatory mapping into REM in order to improve the integration of local values, and to improve the basis for collaborative planning. It is further recommended to adapt REM to local landscape contexts.

Resumé

Denne ph.d.-afhandling er baseret på forskning udført på Skov & Landskab, Københavns Universitet fra 2008 til 2011. Planlægning for friluftsliv og GIS udgør hovedfokus i afhandlingen. Der tages udgangspunkt i et GIS-baseret planstøttesystem – oplevelsesværdikortlægning - på engelsk Recreation Experience Mapping (REM).

I REM bruges GIS til at tildele indikatorer til hver af de syv rekreative oplevelsesklasser: Urørte naturoplevelser, skovfølelse, udsigt, naturrigdom, kulturhistorie, aktivitet og udfordring, samt service og samvær. Resultatet af GIS-proceduren omfatter tematiske kort og en geodatabase som synliggør rekreative og friluftsoplevelsesmæssige potentialer på landskabsniveau. Dette spatiale informationsgrundlag er nyt for planlægning og forvaltning og understøtter planlægning og forvaltning for friluftsliv med let tilgængelig information om 'bløde' landskabelige værdier, som ikke har været systematisk til rådighed tidligere.

Udvikling, validering og implementering af REM er de tre fokusområde i afhandlingen. Udvikling af REM er baseret på et casestudie af udvidelsen af den grønne struktur i Hovedstadsområdet. Validiteten af REM undersøges ved en litteraturgennemgang og en empirisk undersøgelse af den spatiale overensstemmelse mellem REM og besøgendes oplevelser, kortlagt ved hjælp af feltbaseret participatorisk kortlægning. Implementeringen af REM undersøges med fokus på samarbejdsformer og brugen af GIS i rekreativ stiplanlægning. Det empiriske grundlag for denne del af afhandlingen er baseret på et praktikophold i Ringsted Kommune samt en Internet spørgeskemaundersøgelse i alle danske kommuner om stiplanlægning og GIS.

Afhandlingen konkluderer, at anvendelse af de syv oplevelsesklasser er i overensstemmelse med litteraturen, andre kortlægningsstudier og de besøgendes kortlægning af oplevelsesmuligheder. GIS-forudsætningen i REM synes ikke at hindre implementering i planlægningspraksis, men stemmer overens med efterspørgsel og behov for mere brug af GIS blandt et flertal af planlæggere. REM kan fremme samarbejdsbaseret planlægning ved at fungere som en platform for skabelse af fælles information og viden samt skabe rammen for et fælles forståelsesgrundlag. Det anbefales at indarbejde participatorisk kortlægning i REM med henblik på at forbedre integrationen af lokale værdier og forbedre grundlaget for samarbejdsformer i planlægningen. Det anbefales endvidere at tilpasse REM til den lokale landskabskontekst.

Preface and acknowledgements

The idea behind this thesis developed during my employment in an EU-financed Interreg IIIa project: “The landscape as a resource, scenarios and strategies for a sustainable development in the Sound region”. I was employed in the project during two phases, from 2004 to 2006, and again from 2007 to 2008. The Interreg project was a joint venture project between regional and local planning authorities in Denmark and Sweden, and researchers from the Danish and Swedish agricultural universities. The project opened my eyes to Swedish approaches to mapping social values and social qualities in green spaces (Berggren-Bärring & Grahn 1995, RTK 2001, Ståhle 2000), and provided initial insight into the strengths and weaknesses of research collaboration with planning authorities. Both these experiences have had a profound impact on the research design and outcome of this thesis. The daily leadership of the project was carried out by Ole Hjorth Caspersen, who encouraged me to apply for a PhD scholarship at the faculty, and later became my supervisor.

Many people have contributed to this PhD project. First of all, I would like to thank my two supervisors, Ole Hjorth Caspersen and Frank Søndergaard Jensen, for their support and constructive comments that have been so essential during the whole process of working on this thesis.

A special thanks to the planning unit at Ringsted Municipality for hosting me in an internship which was literally a tremendous eye opener and gave me insights into the practice of municipal policy and decision making. This thesis would not have been the same without this experience. Special thanks to the planners Sol Strømbo Hansen, Elisabeth Skogstad, Frank Nielsen and Emil Husted Erichsen (now Holbæk Municipality) who all participated in our small working group on REM implementation. A special thanks also to Jasper Schipperijn for making my stay at NIPH (National Institute of Public Health, University of Southern Denmark) possible. The stay provided me with the perfect atmosphere for focusing and concentrating during an important phase of my thesis writing. Also thanks to Jasper for his assistance on the development of my research design in Paper II and for co-authoring the final paper.

In an early phase of the thesis, I received valuable input to the development of my methodology from Dr. Jette Hansen Møller and Dr. Dan Williams based on my participation in the PhD course ‘Nature Interpretation’. I also received valuable feedback and critique on the very first draft version of Paper III from Dr. Kine Halvorsen Thorén based on my participation in the NOVA PhD course – ‘Nordic landscape planning’. Further, Dr. Karina Sehested gave me valuable input to develop my initially rather simplistic and naive technocratic approach to planning into an up-to-date understanding of planning based on network-governance, collaboration and participation. And finally, I owe Dr. Lone Søderkvist Kristensen a great deal for co-authoring the final Paper III. Also special thanks to Dr. Hans Skov-Petersen for responding to my plea to arrange and organise the PhD course ‘GIS and spa-

tial planning' and for agreeing to co-author the written outcome from the course into Paper IV.

A special thanks to my PhD study group (Jasper Schipperijn, Glen Nielsen, Peter Bentsen and Sandra Gentin) and my 'green room' office colleagues (the fellow PhD students Jens Peter Vesterager, Julien Grundfelder, Marianne Rosenbak, Sandra Gentin and Peter Stubkjær Andersen) for valuable input, advice, and critique on draft texts, proposed research designs, and the process of conducting a PhD.

Many thanks to Dr. Berit Kaae for her feedback on the design of the Internet survey, and to Peter Bentsen and Mette Fabricius Madsen for encouraging and convincing me of the benefits of conducting an individual telephone call to all possible participants. A special thanks to the excellent field-team of Mette Bindesbøll Nørregård and Judith Sølvkjær for their assistance with the onsite visitor survey data collection and for enduring the long rainy hours.

Lastly, and most importantly, a very special thanks to Mette and Laura for creating a loving, happy and laughing non-work atmosphere for mental restoration.

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1 Introduction

Outdoor recreation is high on today's research and planning agenda. First of all, planning authorities have begun to acknowledge the link between outdoor recreation, active living and public health (e.g. Edwards & Tsouros 2006, Eyler et al. 2008, Herrick 2009, Schasberger et al. 2009). Lifestyle diseases receive a lot of political and public attention and the active role of outdoor recreation in prevention and recuperation regarding stress and obesity is integrated in planning objectives (Kjøller et al. 2007, Ministry of environment 2011, Sehested et al. 2009). Research has shown that Danish forests alone receive more than 75 million visits annually (Jensen 2003), and opportunities for outdoor recreation have become an integrated part of municipal afforestation policy (Forest and Nature Agency & Plan09 2009), municipal landscape planning (Kristensen et al. 2011), national agricultural policy visions (The government 2009), and nature policy (The government 2006). Furthermore, closeness to nature and green spaces with opportunities for outdoor recreation plays a key role in peoples' choice of settlement (e.g. Kaplan & Austin 2004, Præstholm et al. 2002, Tyrväinen & Miettinen 2000, van Dam 2000), and development of outdoor recreation opportunities contribute to rural development by delivering economic benefits to rural societies (Howley et al. 2012, Ilbery & Saxena 2009, Vaughan et al. 2000).

In urbanised and agricultural landscapes[1] (like most of Denmark), recreation accessibility is often limited and restricted due to ownership rights. Similar to many other countries (e.g. the UK, Curry 1994), public recreational access to the countryside has been a key issue since the first Danish Nature Protection Act (NPA) in 1917 (Agger 2001). Today, accessibility is still primarily regulated through the NPA: walkers have legal access to beaches and state forests. Access to private forests is only allowed on roads and trails and can be prohibited if the forest is less than 5 ha in size. In the agricultural countryside, there is legal daytime access to non-fenced uncultivated land, and walking and cycling is allowed on all roads and trails, although the owner of single-owner roads may prevent visitors with the proper signs. Hence, public access to the countryside is very dependent on the local road network and trail system, especially those roads and trails which connect urban areas with nearby recreationally important sites such as small local woodlands and other nature types (Højring 2002).

[1] In this thesis, landscape is used as an integrating term vis-à-vis 'coupled socio-ecological system', 'natural resources', 'human-environment relationship', 'recreation setting', and 'environment'. The broad and inclusive use of landscape in the thesis corresponds to the landscape definition in the European Landscape Convention which addresses the perceptual dimension of landscape, the dynamics of landscapes, and the interaction of cultural and biophysical processes in shaping landscape character: *""Landscape" means an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors"* (Council of Europe 2000:Article 1a).

Outdoor recreation planning is, in general, described as complex, and in need of support tools, models, and frameworks (e.g. Curry 1994, Hall & Page 2006, Leberman & Mason 2002, McCool et al. 2007, Veal 2002, Pigram & Jenkins 2006).

1.1 Research focus

This PhD thesis is founded on a GIS-based planning and decision support system which was developed for landscape and outdoor recreation planning and management. The system focuses on the GIS-mapping of landscape based recreation experience potentials, and is named Recreation Experience Mapping (REM).

The three subject areas; *development, validation, and implementation* of the REM approach form the three central focus areas of the thesis.

The idea and driver behind the development of REM is predominantly based on a planning need to improve the integration of spatial information on social values in landscape and recreation planning. The development of REM is based on GIS elaboration of quantitative and distinctive map indicators to ensure a transparent, viable and flexible mapping approach. A number of assumptions, definitions, and criteria are made in the process of GIS mapping recreation experience opportunities and issues of internal and external validity are important. Validation of REM in relation to visitor perception is another focus of the thesis. During the development of new planning support systems, such as REM, the focus should include the intended end-users of the system, i.e. recreation and landscape planners and managers. Far too many support systems and new tools are developed, but are rarely or never implemented in planning practice. Hence, the implementation perspective of REM in local government planning is also central to the thesis.

1.2 Elaboration of research gaps, shortcomings and research needs

In the following, a description of research developments and trends within the three subject matters of the thesis are outlined with a focus on the challenges in the field, shortcomings, and research needs.

1.2.1 Need for quantification and mapping of recreation values

In current landscape research, the need for mapping and the spatial delineation of recreation values is expressed within different research agendas. In a multifunctional landscape and ecosystem services research perspective, calls have been made for the mapping and quantification of landscape functions (e.g. Vejre et al. 2010, Verburg et al. 2009, Willemen et al. 2008). Specifically, the importance of the quantification of intangible ecosystem services which are linked to human perception, such as aesthetics and recreation values, has been stressed as being a pre-requisite for sustainable development with a balance between ecological, social, and economic values (Bryan et al. 2010, Vejre et al. 2010). Similar calls have been expressed by studies which focus on improving the

integration of perceived landscape qualities in landscape assessments. These studies have suggested different map-based indicators to improve the incorporation of landscape aesthetics and landscape perception, i.e. the visual landscape, into more integrated landscape assessments (e.g. Dramstad et al. 2006, Fry et al. 2009, Ode et al. 2010, Palmer 2004, Tveit et al. 2006). Related to this are studies within natural resource management which focus on informing management with spatial information on social values. For example, studies have obtained information on visitors' or community residents' identification of places which they value in a forest in order to inform fuel management treatments (Gunderson & Watson 2007); forest management plans (McIntyre et al. 2008); and national park planning (Brown & Weber 2011). Finally, the spatial identification of perceptual recreation values has also been carried out in relation to studies which focus on restorative environments within the public mental health and urban green space research agenda (e.g. Björk et al. 2008, Grahn & Stigsdotter 2010, Kim et al. 2011, Lindholst et al. 2011, Schipperijn 2010).

The many different studies mentioned above highlight the planning demand and relevance of mapping recreation values. In addition, the different studies have improved knowledge on the strengths and weaknesses of different methodological and conceptual approaches. However, the need for more research into the field of mapping recreation values remains. A recently published outlook paper on the integration of social and perceptual research into spatial planning information (Ryan 2011) stresses the research need of *"integrating public perceptions and attitudes with the type of information typically found in landscape assessment*" (Ryan 2011:361). Ryan underlines the necessity of describing the social landscape in spatial terms, and states that, in the future, landscape planners will need to know as much about the social landscape as they do about the physical landscape before embarking on planning actions.

From an outdoor recreation sector point of view, inventories, spatial information, and a map output are the main outcomes of many of the existing and successful (in terms of planning implementation) outdoor recreation planning systems, e.g. Recreation Opportunity Spectrum (ROS) and Limits of Acceptable Change (McCool et al. 2007). The mapping outcome of ROS has primarily been generated manually and then digitised. It was only recently recommended to map the recreation opportunity spectrum in ROS by using a variety of data sources and different spatial analyses in GIS (Joyce & Sutton 2009). A GIS-basis creates a more transparent and repeatable mapping process. In general, the development of GIS technology and the availability of geo-information have progressed significantly (Drummond & French 2008), creating new possibilities to add to and further develop existing planning approaches and systems.

The technological development within geo-technologies and the attention within landscape research, which has been devoted to the spatial identification of recreation services in order to inform integrative recreation and landscape planning, have altogether increased the

research need for GIS-based categorisation, mapping, and the spatial delineation of recreation values.

1.2.2 Need for validation of GIS-mapping of experience opportunities

The GIS-mapping of perceptual values of landscapes might seem controversial to some. GIS-mapping approaches entail the clear and distinctive choice of data, definition of indicators, and selection of analytical criteria, which improve the transparency of mapping measures (Joyce & Sutton 2009), but also risk being too simplistic in that they can reduce the individual character of landscape perception into universal mapping objects. The shaping of recreation experiences is a complex individual physical psychological process which is influenced by landscape context and particularly by social and cultural contexts (Driver, 2003). The GIS-based indicator mapping of recreation experience will always be an approximation and postulation in relation to actually perceived experience opportunities. It is therefore relevant and important to validate and calibrate the spatial outcome of GIS-based mapping procedures of recreation opportunities with public perceived experiences. Scenic landscape assessments are often based on expert appraisal without reliability and validity measures (Palmer & Hoffman 2001). However, in other related fields, such as urban green space research and particularly active living research, many studies have focused on spatial validity, agreement levels, and reliability between objective GIS-measures and public perceived measures of, e.g. green neighbourhood qualities (Kim et al. 2011); the distance to a green space (Macintyre et al. 2008); greenness of neighbourhoods (Leslie et al. 2010, Sugiyama et al. 2008); and perceived and GIS measures of the environment in relation to physical activity (e.g. Brownson et al. 2009, Kirtland et al. 2003, Scott et al. 2007). This relatively new research focus on statistical agreement or disagreement between GIS measures and public perceived measures has so far not been investigated in relation to the GIS-mapping of recreation experience opportunities. The need to explore validity is important in order to establish the credibility of the REM approach.

1.2.3 Lack of knowledge of the potential support role of GIS-based REM

In general, GIS-based support systems for planning and management have increased in number, but authors in the field of planning support systems (PSS) research have begun to realise that not many systems are actually applied and implemented as expected by system developers in planning practice (Brail 2008, Geertman & Stillwell 2009a). This recognition has resulted in a whole new research field which focuses on the factors which lead to the use, or otherwise, of planning and decision support systems in practice (Vonk 2006). During the development of new systems, it therefore becomes relevant and important to follow the systems in application and to focus research on potential barriers to implementation (Budic & Godschalk 1994, Gill et al. 1999, Göcmen & Ventura 2010, Johnson & Sieber 2011, Vonk et al. 2007, Vonk & Geertman 2008, Vonk et al. 2005). It is further recommended to collaborate with planners in structured dialogue on the development of new systems in order to put greater focus on the planning context and

demand from planning communities, and less focus on the technological development aspects of more advanced and complex GIS-based support systems (Geertman 2006, Ramsey 2009, te Brömmelstroet & Bertolini 2008, te Brömmelstroet & Schrijnen 2010, Vonk et al. 2007, Vonk & Ligtenberg 2010). In order to carry out such a vision in practice, authors have argued for more case-based research studies (Brömmelstroet 2009, Nedovic-Budic 1999), recognising that the different planning contexts depend on complex relationships between path dependency in planning institutions and local characteristics (Healey, 2007 in Brömmelstroet, 2009).

A similar research gap has been identified within landscape science. More research into "bridging the gaps between science, policy and people" has been recommended by authors to focus on the establishment of a dialogue between science, policy and all stakeholders, and less on the development of new tools (Dramstad & Fjellstad 2011). The need for case studies and the integration of science, planners, and all stakeholders has been addressed in newly developed frameworks for adaptive co-management (Folke et al. 2005, Hahn et al. 2006, Olsson et al. 2004), which, to a large extent, are consistent with the ideas behind collaborative rationality for public policy (Innes & Booher 2010). The communicative power of maps and map-based knowledge has been emphasised (MacEachren 2000, Van Herzele & van Woerkum 2011, Wright et al. 2009), and a growing body of literature attempts to uncover the potential role of GIS maps and GIS-based support systems in a collaborative policy making perspective (Ganapati 2010, Jankowski 2009, Jankowski & Nyerges 2001, MacEachren 2000, MacEachren & Brewer 2004, Vonk & Ligtenberg 2010, Wright et al. 2009). However, many aspects of GIS usage in collaborative policy making remain unexplored in detail.

1.3 Specification of objectives and research questions

The outlined research needs described above are consistent with research into the development of a GIS-based recreation experience mapping system; research into the documentation of validity issues; and research into the implementation of the system in planning practice. This thesis is concerned with the development of a planning support system with a focus on the mapping of outdoor recreation experience values (the REM approach), and the usefulness of the mapping approach (the validity and applicability of REM) in a public and planning perspective. The issue of recreation trail development was chosen as the prime case to explore the applicability and implementation of GIS-based REM in planning practice.

The problem area of the thesis is expressed by the following three main research objectives: (1) The development of the recreation experience mapping approach; (2) Documenting the validity of REM in relation to perceived experiences; and finally, (3) Exploring implementation of GIS-based REM in planning practice. The three objectives are pursued by investigating the following specific research questions:

Development of the REM approach:

- What existing approaches have been developed in the assessment and mapping of recreation experience dimensions?
- What are the strengths and weaknesses of using existing geo-information and GIS to develop a mapping approach for recreation experience potential?

Validity assessment of the REM approach:

- Is the developed mapping approach in conceptual accordance with visitor perceived experiences?
- What is the spatial compliance between visitor and the REM mapping of places involving the same recreation experience opportunities?
- Do visitors agree with the REM output?

REM in planning practice

- Does the GIS-based REM approach fit the demands and needs of recreation planning practice?
- Does the GIS basis of REM impede planning adoption and implementation?
- How can REM be applied in local government recreation trail planning?
- What are the potential advantages and disadvantages of REM support for collaborative trail planning?

These questions are addressed in the following four papers:

Paper I: Recreational mapping and planning for enlargement of the green structure in greater Copenhagen

Paper II: Validation of GIS-based recreation experience mapping

Paper III: Collaborative rationality and GIS-based recreation experience mapping in municipal trail planning practice in Denmark

Paper IV: Use of GIS-based support by local governments for recreation trail planning

Each of the four papers focuses on different research objectives (Figure 1). Before addressing the four papers in detail, the research background of REM is presented and elaborated further followed by an overview of the methodology and materials.

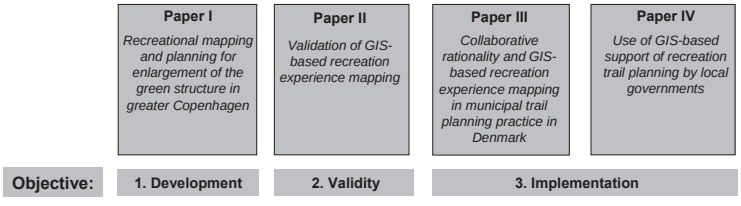


Figure 1. Focus of the four papers in relation to research objectives development, validity and implementation.

2 REM background

As is apparent from the titles of the four papers briefly introduced above, no classic literature review paper is included in this PhD thesis. Hence, the following background section is used to provide an overview of the literature with an emphasis on the conceptual and methodological basis of the REM framework. First, the evolution of the REM approach is described (section 2.1) followed by a report of research findings in relation to the identification of recreation experience dimensions (section 2.2). This is followed by a review of other mapping frameworks with an emphasis on methodology (section 2.3), and a detailed comparison of REM with the identified experience dimensions and other mapping frameworks' use of experience typologies (section 2.4). Finally, the implementation framework of REM is described highlighting the GIS-basis of REM in relation to planning support (section 2.5).

2.1 The Evolution of GIS-based recreation experience mapping (REM)

The idea of REM is to take advantage of the rapidly expanding amount of available geodata and register-based data as an input to a GIS-procedure which assigns multiple mapping indicators to each of the following seven experience dimensions: Wilderness; Feeling of Forest; Panoramic Views; Biodiversity; Cultural History; Activity and Challenge; Service and Gathering. The seven experience classes are illustrated in Figure 2, and described in detail in Table 1. The seven experience classes express a diversity or spectrum of recreation opportunity classes from wilderness to social interaction. The choice of these seven classes is elaborated in the following sections. The mapping procedure and methodology of REM is addressed in section 3.3. The evolution of REM is summarised in Paper I, and is elaborated in a bit more detail in the following.

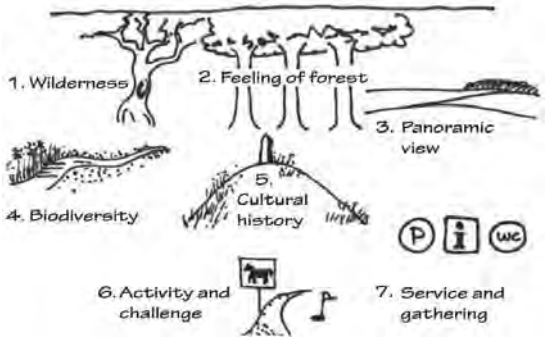


Figure 2. Illustration of the seven experience classes in REM (by Birgitte Strunge, planning unit, Viborg Municipality).

Table 1. Introduction to REM. Description of the seven experience classes and examples of mapping indicators.

Experience class	Description	Examples of mapping indicators
1. Wilderness	In old growth forest, nature forest, and forest swamps, trees are often gnarled, twisted, and old and the probability of encountering dead wood and dying trees is high. Such locations provide ample opportunity to experience a serene, undisturbed and untouched environment	Designated nature forest Forest swamps Old growth forest
2. Feeling of forest	In compact forest areas, it is possible to experience the feeling of isolation, of being "in another world" where one can experience sounds, lights and smells of the forest together with peacefulness and silence. In older forests, branches and leaves form a canopy which enhances the feeling of the forest as a special environment.	Compact and coherent woodlands (min. 5ha) Older broadleaves
3. Panoramic views	Locations with good scenic viewing opportunities facilitate experiences of wide space and freedom. Hilltops, open landscapes, lake and sea shores are examples of such locations.	Hilltops Lake view Open landscape (min. 6ha)
4. Biodiversity	Areas with high biodiversity enhance the chances of encountering flora and fauna, and stimulate feelings of mutual connection, exploration and curiosity.	Aggregated nature preservation designations
5. Cultural history	The landscape consists of multiple traces of cultural historical heritage. An area with tangible heritage (physical historical evidence) in the form of built structures and with intangible heritage (e.g. settings for historical events) promotes feelings of time depth and belonging.	Cultural historical building Barrow Dike Cultural environment
6. Activity and challenge	Specific areas and facilities support possibilities for physical activity in the landscape. Golf courses, trails, tracks and routes are examples of facilities that can enhance opportunities to experience physical challenges with nature, to challenge oneself or others in natural surroundings.	Intensive activity area Trails Marked routes
7. Service and gathering	Feelings of safety, security and confidence in nature are important for some people in order to enjoy a nature experience. Services such as secured parking areas, information through signing or audio-guiding, bonfires, and table and bench sets promote the feeling of safety. The same facilities also generate settings for organising or enhancing social gatherings and recreation with family or friends.	Accessibility facility (parking) Communication facility Security facility Accommodation facilities

The evolution of REM takes its starting point in already developed recreation planning frameworks. Over the years, many recreation planning frameworks have been developed (see e.g. McCool et al. 2007 for an overview of public land recreation planning in an USA context). In a REM context, the Recreation Opportunity Spectrum (ROS) planning system is of particular interest. ROS was developed in the 1970s by USDA Forest Service and Bureau of Land Management (Brown et al. 1978, Clark & Stankey 1978). The key concept in ROS is the need for diversity in outdoor recreation opportunities (Manning 2011). Someone has a recreation opportunity when they can undertake an activity, within a setting, and through this gain an experience – hopefully a preferred experience. Managers manage the setting and to some degree the activities through facilities, services and regulations; recreationists gain the experience; and society gains from the collective

benefits which arise from this behaviour (Joyce & Sutton 2009). The recreation opportunity spectrum is made applicable through the classification or zoning of an area based on different experience opportunities (e.g. experience of isolation, solitude and wilderness to experience of affiliation with individual and groups), which comply to differences in settings, i.e. different physical settings (e.g. level of unmodified natural environments), different manageable settings (e.g. types of roads, trails and facilities), and different social settings (e.g. user density) (Brown et al. 1978, Clark & Stankey 1978). The result is a spectrum or continuum of opportunity classes from primitive to urbanised (or roughly from developed to undeveloped) which are visualised on a map of the planning area. In the 1970s -80s, this map output was a major outcome which displayed the spatial distribution of recreation opportunities, and a distinct advance in resource management enhancing the move away from a reliance on tabular displays of data (McCool et al. 2007).

ROS has inspired many frameworks focused on recreation classification and zoning (Manning 2011), and ROS was part of the inspiration for regional planning authorities in Stockholm, Sweden to develop a GIS-based mapping approach to support green structure planning (RTK 2001, RTK 2004). ROS was used as inspiration together with a system for green space planning for restorative experience dimensions (Berggren-Bärring & Grahn 1995, Grahn 1991), a green space planning approach focused on 'sociotopes' (Ståhle 2000), and finally focus group interviews with visitors. As described in Paper I, the Stockholm approach was further adapted to Danish conditions by a joint-project on green structure planning in greater Copenhagen which involved regional planners at the Greater Copenhagen Authority (GCA) and researchers at Forest and Landscape. The adaptation included calibration by use of available Danish interview and survey data on outdoor recreation behaviour, preferences, and perceptions (Hansen & Nielsen 2005, Hansen-Møller & Oustrup 2004, Jensen 2000, Jensen 2003, Jensen & Koch 2004, Jensen 1998, Jensen 1999, Jensen & Koch 1997, Kaae & Madsen 2003, Koch & Jensen 1988). The outcome of the adaptation process was the recreation experience mapping approach.

The adaptation process is described in more detail in the method and materials section (3.3). The familiarity of REM to ROS is discussed in more detail in section 5.1.3. In the following, the seven experience classes in REM are elaborated by theories and frameworks which focus on the linkage between experience and landscape.

2.2 Outdoor recreation experiences: theories and frameworks

A range of paradigms and scientific approaches are applied in research on outdoor recreation experiences, e.g. formal aesthetic studies, behavioural studies and humanistic studies (Driver 2003, Swanwick 2009). Generally, there is consensus that no clear or consistent message emerges from the plethora of research on why people favour certain landscapes (Swanwick 2009), and many contradictory results and explanations for visitors' perception, preferences, and recreation experiences are present in the current literature

(Dorwart et al. 2010). There is agreement that the shaping of recreational experiences is a complex individual psychological process which is influenced by the landscape, social and cultural contexts. Perceived experience values are embedded in, e.g. differences in ethnicity (e.g. Buis et al., 2009), different lifestyles (e.g. Lupp et al., 2011), recreation activities (e.g. Eiter, 2010), place attachment (e.g. Kyle et al., 2004), the inclusion of emotional bonds based on childhood experiences (e.g. Thompson et al., 2008), and difference in experience use history (e.g. Arnberger & Brandenburg, 2007). In addition, many studies have explored the effect of more classical individual attributes such as age, gender, education, and occupation. In other words, many personal, social and cultural factors contribute to the complexity of shaping outdoor recreational experiences.

Driver and co-authors developed the Recreation Experience Preference (REP) scales which are embedded in motivation theory, human needs, and benefits of leisure (Driver et al. 1991, Driver 1983, Manfredo & Driver 1996). The scales have been tested and validated in many different contexts (Manfredo & Driver 1996), including Danish outdoor recreational contexts (Hansen & Nielsen 2005, Jensen 1998, Kaae & Madsen 2003). In total, the REP scales are divided into 19 domains of recreation experience preferences: Enjoy nature (scenery, general nature experience); physical fitness; reduce tension; escape physical stressors (tranquillity, escape crowds, escape noise); outdoor learning; share similar values (be with friends); independence; family relations; introspection; be with considerate people; achievement; physical rest; teach; risk taking; risk reduction; meet new people; creativity; nostalgia; and agreeable temperatures.

Whilst the social cultural context is important in explaining different landscape experiences, differences in physical landscape context in which the recreational engagement is taking place (i.e. different landscape types and patterns) are just as important. Different landscape types have particular perceptible characteristics that evoke related human perceptions and expectations (Gobster et al. 2007). Conceptual and theoretical frameworks have been produced, which address the linkages between landscape and experiences. Some of the most cited and applied theories include the Theory of Affective Response (Ulrich 1983), and more evolutionary theories like Prospect-Refuge Theory (Appleton 1996), the Information Processing Theory (Kaplan & Kaplan 1989) and the Biophilia Hypothesis (Kellert & Wilson 1993, Wilson 1984). These theories have been combined with empirical data into three different conceptual frameworks for understanding and comprehending the experience dimensions of green spaces and landscapes (Gobster & Westphal 2004, Grahn & Stigsdotter 2010, Tveit et al. 2006) (Table 2). Tveit et al. (2006) based their concepts on a literature review, Gobster & Westphal (2004) used qualitative data (focus group and in-depth interviews) and an on-site survey to identify human dimensions, while Grahn & Stigsdotter (2010) used data from a mailed quantitative questionnaire for the development of their perceived dimensions of green spaces. Hence, the findings from the three studies listed in Table 2 cover many different methodological approaches. Most of the listed

experience dimensions (and concepts) are clearly associated with the theories, and the meanings attached to many of the dimensions are similar among the three frameworks. In the following, a short summary of these similarities is provided.

Table 2. Identification of recreational experience dimensions by three different conceptual frameworks

	Grahn & Stigsdotter (2010)	**Gobster & Westphal (2004)**	**Tveit et al. (2006)**
Concept and context	Eight perceived dimensions of urban green spaces	Six human dimensions of urban greenways	Nine visual concepts for analysing visual landscape character
	Nature	Cleanliness	Stewardship
	Culture	Naturalness	Coherence
	Prospect	Aesthetics	Disturbance
	Social	Safety	Historicity
	Space	Access	Visual scale
	Rich in Species	Appropriate development	Imageability
	Refuge	-	Complexity
	Serene	-	Naturalness
	-	-	Ephemera

'Nature' (Grahn & Stigsdotter 2010) and 'naturalness' (Gobster & Westphal 2004, Tveit et al. 2006) are used to express the same experience dimension. The presence of nature is perhaps the most essential experience dimension (Appelton 1996, Kaplan & Kaplan 1989, Ulrich 1983): the degree to which 'nature' is perceived in contrast to 'non-nature' (Grahn & Stigsdotter 2010). 'Naturalness' was one of the most important experience dimensions among respondents in the Gobster & Westphal (2004) study and 'wild nature' was perceived as being a key resource in the most remote part of the greenway. Hence, the degree of wilderness can be used to express naturalness (Tveit et al. 2006). Some studies have applied a purism scale to wilderness perception, i.e. a spectrum of perceived wilderness divided among non-purist, neutralists, moderate purists, and strong purists' perception (Flanagan & Anderson 2008, Kliskey 1994, Patterson et al. 1998).

The dimensions 'prospect' (Grahn & Stigsdotter 2010), 'aesthetics' and 'access' (to scenic views) (Gobster & Westphal 2004), 'visual scale' and partly 'imageability' (Tveit et al. 2006) are all different terms for a similar experience dimension. This experience dimension is related to aesthetics as the primary aspect of people-landscape interactions (Kaplan & Kaplan 1989), and human preference for open areas with a view (i.e. prospect, scenery, and water). Prospect affords coherence and legibility to the environment which is being perceived (Kaplan & Kaplan 1989), and the high preference for scenery is embedded in our evolutionary history (Appleton 1996).

'Social' and 'refuge' (Grahn & Stigsdotter 2010), 'safety' and partly 'access' (Gobster & Westphal 2004) also cover a similar experience dimension with the emphasis on opportunities for social activities, meeting people, and a feeling of safety in contrast to

feelings of solitude in more remote and isolated settings. The term ‘refuge’ is linked to an inherent preference for an enclosed and safe environment (Appleton 1996).

‘Space’ (Grahn & Stigsdotter 2010) and ‘coherence’ (Tveit et al. 2006) are analogous, and both are used as terms to describe a coherent landscape which provides a sense of order and directs the attention of the observer (Kaplan & Kaplan 1989), gives an experience of spaciousness and connectedness, and an opportunity to enter a ‘whole different world’ (Grahn & Stigsdotter 2010).

‘Rich in Species’ (Grahn & Stigsdotter 2010) and ‘complexity’ (Tveit et al. 2006) are somewhat similar. People have a strong and inherent affiliation for biodiversity which is consistent with the Biophilia hypothesis (Kellert & Wilson 1993, Wilson 1984), and from a perceived landscape approach, complexity is a key concept of visual quality, i.e. the different visual elements in a scene; how intricate the scene is; its richness (Kaplan & Kaplan 1989).

‘Serene’ (Grahn & Stigsdotter 2010) and (un-)’disturbances’ (Tveit et al. 2006) are alike. Both describe the experience qualities associated with an undisturbed environment; the sense of harmony or discord between a man-made feature and its natural background (Ulrich 1983). ‘Serene’ includes experiences of silence (Grahn & Stigsdotter 2010).

Related to disturbances are ‘cleanliness’ (Gobster & Westphal 2004) and ‘stewardship’ (Tveit et al. 2006) which both express preferences for managed and cared for landscapes; a sense of order which contributes to a perceived accordance with an ‘ideal’ situation.

The dimensions ‘culture’ (Grahn & Stigsdotter 2010) and ‘historicity’ (Tveit et al. 2006) are clearly interlinked and are associated with the location of a monument or historical event, and involve the experience of time-depth, and historical processes which are reflected in, e.g. landscape patterns (Tveit et al. 2006).

The last two dimensions ‘ephemera’ (e.g. seasonal change) (Tveit et al. 2006) and ‘appropriate development’ (e.g. experiencing concern regarding urban and recreational development without respect for natural and cultural qualities) (Gobster & Westphal 2004) are not clearly related to the other frameworks.

To summarize, the forming of a recreation experience is a complex perception process which comprises the interaction of social cultural factors, previous experiences, individual motivation (the REP scales), and the character of the landscape setting. Theories have been made which address the linkages between experience and landscape, and studies have identified specific experience dimensions which are interrelated in many ways. Three conceptual frameworks present the following interrelated experiences: Naturalness, serene, space/coherence, prospect/aesthetics, rich in species/complexity, culture/historicity, cleanliness/stewardship, and social/safety. In the following section, mapping frameworks are presented which attempt to spatially identify experience dimensions.

2.3 Mapping social dimensions of landscape

In the following, a summary of studies which map the social dimensions of landscape is provided. The emphasis is on the studies' applied methodology. The summary is used to evaluate and discuss the REM approach versus other similar mapping approaches (section 2.4 and 5.1.2), and in addition, to present different mapping approaches which have inspired the methodological research design used in the validity assessment of REM (section 3.4 and Paper II).

Research interest into mapping the social dimensions of landscape is not new. There is a relatively long research history attached to, e.g. cognitive mapping and spatial behavior (overview in Downs & Stea 1973, Lynch 1960). However, the development within GIS and the increased research interest in integrative, multifunctional, sustainable and holistic landscape planning and management approaches has, during the last decade, led to an increased research focus on the spatial quantification of the social, perceptual and recreational values of landscapes (e.g. Antrop 2005, Council of Europe 2000, Ryan 2011, Selman, 2006). In general, the objective is to achieve a more balanced planning and management basis by integrating spatial information on experiences with other more traditional spatial referenced information, e.g. technical maps and planning and management designations (e.g. Faehnle et al. 2011, Ryan 2011).

Many studies have focused on mapping approaches that can better integrate the experienced landscape in planning. Some studies have termed recreational experience dimensions 'social values' (e.g. Björk et al. 2008, Tyrväinen et al. 2007), others use the term 'place values' (e.g. Hall et al. 2009, McIntyre et al. 2008), and still others use the term 'landscape values' (e.g. Beverly et al. 2008, Brown 2005). These spatial value oriented concepts originated in research projects which had a focus on different planning sectors (e.g. forestry management, urban park management, green structure management), and a basis in different theoretical concepts (e.g. landscape or place). Some have identified and mapped five values (Björk et al. 2008), while others work with 16 values (McIntyre et al. 2004), and some have attempted to map different perceptions of a single value, i.e. perceived wilderness (e.g. Flanagan & Anderson 2008, Kliskey 1994). Common to most of the approaches is the use of a spectrum of recreation values ranging from wild and remote nature experiences to more cultural and/or service oriented recreational experiences. Further, a planning supportive map output is a main outcome of social mapping studies. However, the methods applied in these studies vary a lot, with different conceptual and methodological assumptions, strengths, and shortcomings. Basically, four different approaches in the search for more spatial information on public recreation values can be identified:

*1) Approaches which collect public recreation values as input to expert formulation of mapping criteria (Expert GIS approach).*Information about desirable and undesirable conditions in relation to experience values has been revealed by the use of empirical data from surveys such as structured interviews (e.g. Björk et al. 2008, Gossen & Langers 2000), an on-site survey in a wilderness area (Flanagan & Anderson 2008), or more qualitative and interpretative techniques such as collecting information from focus user group interviews (RTK 2001). The empirical inputs are then used for the formulation and selection of transparent and distinctive spatial GIS indicators, which are mostly based on the analytic use of nationally and regionally available data. The formulation and selection of these GIS indicators are based on assumptions about how they reflect the recreational values in question.

*2) Surveys with attached maps for public designation of expert predefined groups of landscape values or qualities (Paper GIS).*Limiting links between particular qualities which are associated with particular green areas, inspired researcher in Helsinki to develop a thorough postal survey on the local social values of urban woodlands and other green areas (Tyrväinen et al. 2007). The questionnaire included maps with numbered green areas and drawings and descriptions of six positively oriented qualities and three negative characteristics of green areas. The respondents were asked to identify green areas associated with the different qualities; the result was thereby digitised into a GIS. A similar approach can be found in the work of mapping spatial attributes for natural resource management by G. Brown (Brown et al. 2004, Brown 2005, Brown 2006, Raymond & Brown 2007) and ecosystem services (Raymond et al. 2009, Sherrouse et al. 2011). In mail-based surveys, a map is attached and respondents are asked to identify landscape values and/or special places by the use of sticker dots which are fixed to a legend that is labelled with operational definitions of the values. The returned maps are thereby digitised into a GIS for further spatial analysis (e.g. density maps, hot spots analysis). The studies report high response rates and the approach makes it possible to obtain information about recreational values from otherwise silent groups “the silent majority” (Brown 2005). The Paper GIS approach also includes data trade-off problems with the spatial resolution of the obtained data in the form of point mapping without the possibility for more precise and exact polygon mapping (Brown 2005, Kangas et al. 2008). Further, assumptions are made on the map reading and interpretation skills of the respondents, e.g. it can be difficult to interpret the meaning attached to a digitised point in a woodland; is the value attached to a specific location within the wood or to the entire woodland?

*3) Use of public participatory GIS (PPGIS) for mapping of landscape values (Internet GIS).*This approach is, in many ways, similar to the Paper GIS approach, but is based on web technology. Internet PPGIS is seen as a bridge builder in collaborative planning; its goal being social empowerment (Sieber 2006). Internet GIS has been used for the public mapping of predefined groups of landscape values and recreation experience variables in

natural resource management (Beverly et al. 2008, Brown & Weber 2011, Brown & Reed 2009, Carver et al. 2009). The approach has suffered from low response rates, and deviation from the population as a whole. However, it has a promising future due to greater and improved public internet availability and the technological development of Internet GIS web interfaces.

4) Focus group interviews about place values including focus group mapping (Focus Group Mapping). This approach questions whether surveys on their own are the most appropriate way of understanding values (Bryan et al. 2010, Gunderson & Watson 2007, Hall et al. 2009, McIntyre et al. 2004, McIntyre et al. 2008). Authors argue for a place-based approach suggesting that the values of places are better understood through qualitative methods to address context embedded issues including whole relationships to places. In this research process, focus groups are formed and asked to spatially define places and the meanings attached to them by drawing on paper printed maps, which are then digitised into GIS. This type of mapping has also been termed qualitative GIS (Cope & Elwood 2009).

To summarize, the first approach (Expert GIS approach) is concerned with expert definition of mapping indicators based on empirical inputs from respondents, while the other three approaches (Paper GIS, Internet GIS, and Focus Group Mapping) are based on forms of participatory mapping. REM obviously belongs to the group of expert GIS approaches. In the following section, REM is compared to seven of the mapping approaches introduced above, with an emphasis on the applied experience typologies in the different frameworks across conceptual approaches and different mapping techniques.

2.4 Comparison of REM to other experience mapping frameworks

Conceptually speaking, the seven experience classes in REM (wilderness, feeling of forest, panoramic views, biodiversity, cultural history, activity and challenge, and service and gathering) share common characteristics with the theoretically and empirically developed conceptual identification of experience dimensions listed in Table 2 (section 2.2). In addition, REM shares many similarities with other mapping frameworks which focus on the social dimensions of landscapes (section 2.3), of which eight are summarised for detailed comparison in Table 3 (p. 25). These eight frameworks have been chosen in order to present different types of mapping frameworks, mapping techniques and applied experience typologies. Two expert GIS frameworks are summarised (Björk et al. 2008, Kim et al. 2011) and (Gossen and Langers 2000); two Paper GIS frameworks are summarised (Brown 2005, Tyrvainen et al 2007); two Internet GIS frameworks (Brown & Reed 2009, Brown & Weber 2011); one focus group mapping approach (McIntyre et al., 2004); and finally the ROS approach (USDA 1982) (Table 3).

In the following, each of the seven experience classes in REM is described by comparing it to the conceptual findings summarised in Table 2 and the experience typologies in the eight mapping frameworks in Table 3.

Wilderness (class 1)

Nature / naturalness is clearly emphasised as an essential experience dimension and is related to perceived wilderness according to the three different conceptual frameworks listed in Table 2. It is, however, clear that particular experiences of naturalness and wilderness are embedded in cultural differences and individual perceptions of nature and the image of nature (e.g. Buijs 2009, Buijs et al. 2009, de Groot & van den Born 2003, Hull 2001, van den Berg & Koole 2006). Nevertheless, nearly every mapping approach listed in Table 3 includes 'wilderness' or the associated experience opportunity of 'solitude' as an experience class in the mapping approach. Therefore, the REM use of wilderness as an experience class seems to be justified.

Feeling of Forest (class 2)

As listed in Table 3, the REM experience class 'Feeling of forest' corresponds with other mapping approaches' use of a similar experience class. Woodland forms a coherent space and an opportunity to enter a 'whole different world' in accordance with the conceptual dimensions (Table 2). From Table 3, it also becomes clear that 'Woodland,' as an independent experience class, is mostly applied in a European context and is absent in North American and Australian mapping contexts. In a Danish context, the use of 'Feeling of forest' as an independent mapping class seems very appropriate since woodlands are the most preferred recreational environment among Danes (Jensen & Koch 2004).

Panoramic Views (class 3)

The experience of aesthetic, scenic, and beauty is a frequently used class in the different mapping approaches (Table 3), and aesthetic, prospect, visual scale and imageability are all emphasised as primary experience dimensions in the conceptual frameworks (Table 2).

Biodiversity (class 4)

Experiences associated with biological diversity (valuable nature site, lush) and wildlife are also incorporated in nearly all the mapping approaches listed in Table 3, and are highlighted in the conceptual frameworks as 'Rich in Species' and 'Complexity' (Table 2). Experiences of biodiversity, landscape diversity, and wildlife viewing are fairly closely related spatially (but not necessarily), and are, to some extent, associated with the same Biophilia experience opportunity.

Table 3. Comparison of REM with other recreation experience mapping frameworks. The REM typology of experience classes are listed on the left and are compared with eight other experience typologies. In some cases, more than one experience class share similarities with a single REM class, and hence two or more classes are listed, which is indicated by "AND". The table also includes a summary of the applied methodology.

	REM	**Björk et al (2008), Kim et al. (2011)**	**Gossen and Langers, 2000**	**Tyrvainen et al (2007)**	**Brown (2005)**	**Brown & Reed (2009)**	**Brown & Weber (2011)**	**McIntyre et al. (2004)**	**ROS (USDA 1982)**
Mapping method									
Conceptual Approach	*Recreation values*	Restorative environments	Attractiveness model for cycling	Social values	Landscape values	Landscape values	Experience variables	Self-described value/quality themes	Primitive – urban gradient
Mapping approach	*Expert mapping*	Expert mapping	Expert mapping	Public Participation mapping	Public Participation mapping	Public Participation mapping	Public Participation mapping	Public Participation mapping	Expert mapping
Technique	*GIS-based indicators*	GIS-based indicators	GIS-based indicators	Postal survey with attached map	Postal survey with attached map	Internet GIS	Internet GIS	Focus group mapping	Management zones/zoning
Scale of map output	*1:100,000 to 1:10,000*	Regional (Scania, Sweden)	National (Netherlands)	Urban park level (Helsinki, Finland)	1:100,000 to 1:1,000,000 (USA)	National forest level (USA)	National park level (Australia)	1:50,000 (Canada)	Regional to Park level
Classes of experiences									
N of classes	*7*	5	8	8	12	12	9	16	4 to 6
	Wilderness	Wild	-	-	Wilderness	Wilderness	Solitude/ escape	Solitude AND Wilderness	Solitude (Primitive)
	Feeling of forest	Spacious	Woodlands	Forest feeling	-	-	-	-	
	Panoramic views	-	Water AND Scenic routes	Beautiful landscape AND Space and freedom	Aesthetic	Aesthetic	Aesthetic/ scenic	Aesthetics/ beauty	
	Biodiversity	Lush	-	Valuable nature site	Biological Diversity	Biological Diversity	Wildlife viewing	Wildlife	
	Cultural History	Culture	Old rural villages	History and culture	Historic AND Cultural	Historic AND Cultural	-	History	
	Activity and challenge	-	-	Opportunities for activities	Recreation	Recreation	Trail-based activity AND Other physical activity/ adventure	Access AND Exploration/ adventure AND Fishing/ hunting	
	Service and gathering	-	Signpost	-	-	-	Social interaction AND Overnight stay/camping	Intergenerational AND Social	Social interaction (Urban

									developed)
	-	Serene	Tranquillity	Peace and tranquillity	Therapeutic/ health	Therapeutic/ health	-	Therapeutic	-
	-	-	Relief	-	-	-	-	-	-
	-	-	Sand, moor and dune areas	-	-	-	-	-	-
	-	-	Mixed land use	-	-	-	-	-	-
	-	-	-	Favourite place	Special places	Special places	Special places	Belonging	-
	-	-	-	Attractive park	-	-	-	-	-
	-	-	-	-	Learning/ Scientific	Learning/ Scientific	Learning/ discovery	Education/ research	-
	-	-	-	-	Economic	Economic	-	Economic	-
	-	-	-	-	Intrinsic/ Existence	Intrinsic/ Existence	-	-	-
	-	-	-	-	Life sustaining	Life sustaining	-	-	-
	-	-	-	-	Spiritual	Spiritual	-	Spiritual	-
	-	-	-	-	-	-	-	Lakes/water	-
Degrading experiences									
	Traffic noise	-	Traffic noise	Noisiness	-	-	Noise	-	-
	Closeness to urban area	-	Urbanised areas/Industry	-	-	-	-	-	-
	High voltage line	-	-	-	-	-	-	-	-
	-	-	Agriculture	-	-	-	-	-	-
	-	-	-	Unpleasantness	-	-	Track AND camp site condition	-	-
	-	-	-	Scariness	-	-	Rubbish/litter	-	-
	-	-	-	-	-	-	Crowding	-	-
	-	-	-	-	-	-	Dead or sick wildlife and vegetation	-	-

Cultural History (class 5)

Cultural and historical values are also mapped in most of the studies (Table 3), and are highlighted for their conceptual importance in Table 2. However, most have mapped cultural and historical values as independent dimensions, whereas Cultural History (class 5) in REM covers both terms.

Activity and Challenge (class 6)

Opportunities for physical activity, recreation, and adventure have been incorporated in participatory mapping frameworks listed in Table 3, and are clearly reflected as being an important recreational experience dimension in the REP scales and in ROS. However, the conceptual frameworks in Table 2, and the other GIS expert based mapping frameworks in Table 3, have not incorporated opportunities for physical activities as a mapping class.

Service and Gathering (class 7)

The social and safety dimension of outdoor recreational experiences are highlighted in both the REP scales and Table 2, but are only addressed in four out of the eight frameworks listed in Table 3. The four frameworks focus on the mapping of signposts, places for social interaction, overnight stays, and intergenerational interaction.

Mapping of disturbances (tranquillity and therapeutic)

The conceptual studies highlight serene, undisturbed environments and cleanliness as experience dimensions, which is also supported by the REP scale's focus on escape of physical stressors. In REM, this experience dimension is not expressed as an independent experience class, but is incorporated in mapping of, e.g. wilderness. This is in line with ROS, but in contrast to many of the other mapping frameworks which have incorporated serenity, tranquillity, and therapy as a mapping class (Table 3). The REM use of traffic noise and closeness to urban areas for the mapping of degrading experiences or disturbances is similar to other frameworks.

To summarize, the combined analysis of the REM approach in relation to the identified experience dimensions and other mapping frameworks' use of experience typologies shows many similarities, but also differences. From Table 3 it becomes clear that, although the mapping frameworks have used different conceptual approaches and different mapping approaches (expert mapping and public participation mapping), different mapping techniques (GIS-based indicators, postal survey with attached map, Internet GIS, and focus group mapping), and addressed different planning and management issues on different mapping scales, the studies encompass many of the same experience classes. Hence, with the possible exception of Service and Gathering (class 7), the REM classes are among the most widely applied experience opportunity classes in the mapping of recreational values. However, it also becomes clear that REM differs in that it does not incorporate an

independent serenity, tranquillity and therapy experience class. This point will be elaborated further in the discussion (section 5).

2.5 GIS, spatial information and planning support

The review of outdoor recreation experiences (section 2.1), and the review of different studies with a focus on the mapping of recreational experiences to support planning and management measures (section 2.2 and Table 3) clearly demonstrate the interest in planning and management in available spatial information on recreational experience values. In the following, a short review of GIS-based planning support is provided in order to set the scene for an analysis and discussion of REM implementation (carried out in Paper III and Paper IV).

REM can be regarded as a spatially-based planning and decision support system. The precise definition of such systems is, however, disputed in academia and discussions are ongoing on the appropriate definition and differences between systems, e.g. between GIS, PSS (planning support system) and SDSS (spatial decision support system). No final consensus has been reached. Some argue that PSS should be used when developers use the term planning, while others adopt a narrower definition and argue that PSS should involve traditional planning tasks such as scenario making and strategy making, while SDSS should be used for management and decision-making (Geertman & Stillwell 2009b). The SDSS and PSS research fields are developing and are mostly separate in the literature. In this thesis, the term GIS-support system is used as a synonym which covers aspects of applied GIS, PSS and SDSS.

In recent years, many GIS-support systems have been developed, but not all new systems have been implemented, adopted, and used as expected by developers. A new research field has developed which focuses on the gap between the supply of systems and the use of systems in planning practice, or in other words, the non-implementation of GIS-based support systems (Geertman 2006, Klosterman 2001, Nedovic-Budic 1999, Uran & Janssen 2003, Vonk et al. 2007). For example, research by Vonk & Geertman is based on what they term ‘a vicious circle’ of PSS application in practice, which is caused by a mismatch between the demand and supply of PSS, i.e. PSS is not applied, hence lessons are not learned, and PPS is not improved, and therefore not applied (Vonk et al. 2007, Vonk & Geertman 2008, Vonk et al. 2005, Vonk 2006).

Interviews and questionnaires with planners and system developers have revealed the mismatch to be threefold: insufficient instrument quality, insufficient diffusion to and in planning practice, and insufficient acceptance by intended users (Vonk & Geertman 2008). Instrument quality is criticized for being based on a technology push instead of a demand pull. Practice demands simple systems, while many developers provide advanced systems (Vonk 2006). Furthermore, factors such as a poor fit with planning tasks and political

demands, and insufficient empirical proof of PSS values affect the instrument quality (Vonk & Geertman 2008). The insufficient diffusion to planning practice is mainly caused by miscommunication between developers, users and experts of PSS. In planning organisations, factors such as a lack of cooperation between geo-information specialists and planners affect the diffusion of PSS. Problems with acceptance amongst intended users are caused by many different barriers: lack of user friendliness, lack of awareness, lack of experience and lack of intention, and insufficient organizational support. Many of these obstacles and barriers are supported other studies (Croswell 1991, Göcmen & Ventura 2010).

Geertman (2008, 2006, 1999) has developed a conceptual framework in order to comprehend factors that influence the adoption and potential support roles of information, knowledge, and instruments in planning practice (Figure 3). The main idea of the framework is to "*provide an interpretative model with which past and present developments within the field of planning can be confronted with the actual and potential support functions of dedicated information, knowledge, and instruments*" (Geertman 2006:869). In other words, the factors visualised in Figure 3 should be taken into consideration when analysing GIS based planning support in an implementation perspective.

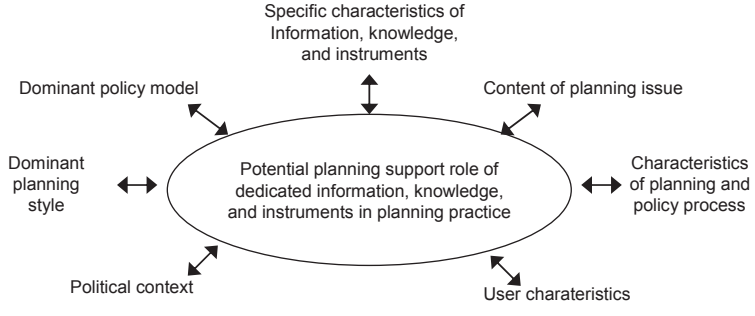


Figure 3. Factors which influence the potential support role of dedicated information, knowledge, and instruments in planning practice, according to Geertman (2006:867).

Among the factors are planning style, policy model, planning and policy processes and the last two decades have been dominated by a focus on governance, deliberation, communication, participation and collaboration (e.g. Healey 1997, Innes & Booher 2010, Innes 1998, Beunen & Opdam 2011). Hence, collaborative and participatory aspects of REM are important to take into account when studying the implementation and usage perspectives of REM in planning practice. In general, geographic information (GI) (i.e. geospatial information, GIS-maps, GIsystems, and other geo-technologies) has been recommended as a platform, portal or mediator that can facilitate collaborative dialogues (e.g. te Brömmelstroet & Schrijnen 2010, MacEachren & Brewer 2004, Ramsey 2009, Vonk & Ligtenberg 2010, Wright et al. 2009). GI which is communicated in maps encodes spatial

relationships into structured formal representation (MacEachren 2000), enabling visually-enabled collaboration (MacEachren & Brewer 2004). When stakeholders are confronted with GI, often literally standing around a map together, something important happens to an adversarial dynamic (Wright et al. 2009). GI provides a space to build stories about the landscape together, or to tell individual stories to each other, and hence, a mutual learning occurs that stimulates receptivity towards new possibilities (Wright et al. 2009). Hence, the use of GI in a joint fact-finding process creates a basis for shared spatial understanding and knowledge that can help facilitate collective environmental and natural resource management (e.g. MacEachren 2000, Ramsey 2009, Wright et al. 2009, Sieber 2006). The facilitator role of GIS in participation and collaboration, however, is not without challenges. Critical GIS researchers have pointed out problematic issues related to GIS in collaboration and participation processes. This critique focuses on the control over information and ownership of GIS data, i.e. an unequal access to GIS and spatial data that excludes or disempowers some stakeholders in the planning process (e.g. Aitken & Michel 1995, Sieber 2006, Wright et al. 2009).

In this context, it is also important to stress the different types of information in planning practice. Spatial information on recreation experiences derived from GIS planning support is needed in normative policy making, strategic area planning, and operative planning and management (Faehnle et al. 2011). As such, REM constitutes a GIS-based system which supports various policies, planning, and management needs regarding the integration of spatial information on nature based recreational values with, e.g. technical, economic, environmental and ecological information (e.g. de Groot et al. 2010, Schipperijn et al. 2005). However, policy making, planning and management practice are very rarely based solely on GIS derived spatial information (Raymond et al. 2010). Many other types of formal information such as written reports and visitor monitoring data are equally important (Kajala et al. 2007, e.g. Leberman & Mason 2002). Furthermore, more informal or personal knowledge is essential (e.g. Gunderson & Watson 2007, McIntyre et al. 2008). This includes the personal experiences of different stakeholders, also termed local, public, lay, or non-expert knowledge; and the planners' own personal experience derived from many years of experience and practice, i.e. expert knowledge (Raymond et al. 2010). Much of this informal knowledge is implicit and tacit, but is essential for successful outdoor recreation planning and management. Hence, the integration of many different types of formal and informal knowledge is a prerequisite for successful planning and decision making, but is in practice generally described as being a challenge (e.g. de Groot et al. 2010, Faehnle et al. 2011, Raymond et al. 2010).

To summarize, REM can be regarded as a GIS-support system. In a REM implementation perspective, it is noticeable that previous research findings highlight various barriers and obstacles to the use of GIS-support systems in practice including: problems associated with the systems poor fit with planning practice; miscommunication between developers

and planners; internal lack of cooperation between GIS specialists and planners in implementation organizations; and lack of user friendliness of systems and lack of experience among planners. Geertman stresses some important factors which influence the support role of GIS-based support systems (Figure 3) (explored in Paper IV), including policy models, policy processes, and planning styles, which are dominated by governance, participation and collaboration. Hence, collaborative aspects of REM are important in an implementation perspective (explored in Paper III). In general, REM produces geographical information which can facilitate collaborative planning processes in many ways (visualisation, joint-fact finding, shared understanding, and ownership feeling). However, many types of information and knowledge are important in policy making and decision making, and knowledge integration is a challenge. Hence, in order to ensure the successful implementation of REM in planning practice, attention needs to be given to collaboration between developers and end-users, and intra-organizational collaboration including knowledge integration.

3 Method and materials

3.1 Overview of methodology

In order to answer the research questions (p. 13), different methods and research techniques were applied. The methods and research techniques comprised a mixture of descriptive and explanatory methods, positivist and interpretive techniques, and self-reported and observed data collection. An overview of the research techniques is presented in Table 4 according to the objectives and Papers I-IV. The development of REM was based on database management and various GIS analyses applied by use of a case study which comprised greater Copenhagen and collaboration with regional planners (Paper I). The validity of REM was examined by collection of visitor data (*n*=159) on perceived experiences in two local recreation landscapes in Ringsted Municipality comprising on-site participatory mapping (Paper II). The implementation perspective of REM was explored by a case study in the municipality of Ringsted including an internship and participant observation (Paper III) and an Internet survey with all municipalities (*n*=89) (Paper III and Paper IV). In the following sections, the study sites, methods, data sampling and analyses are described in more detail.

Table 4. Overview of methodology in relation to research objectives and papers

Objective	1. Development	2. Validation	3. Implementation	
	Paper I	Paper II	Paper III	Paper IV
Method:				
GIS				
Case study				
Internship				
Participant observation				
On-site participatory mapping (*n*=159)				
Web-survey with planners (*n*=89)				

3.2 Study areas

A map-based introduction of the different study areas is presented in Figure 4. An elaborated presentation of each study site is provided in the following.

3.2.1 Regional case study

Paper I focuses on a regional case of green structure planning in greater Copenhagen. The delineation of the regional study (Figure 4) does not correspond with the extent of the capital region, but corresponds with the extent of the enlargement area of the regional green structure (i.e. a new 4th Green Belt and an extension of the existing Green Wedges – see Paper I). This setup was the scene for the development of REM in a Danish context. The study included collaboration on the adaptation of REM with a team of regional green structure planners at the former Greater Copenhagen Authority (GCA).

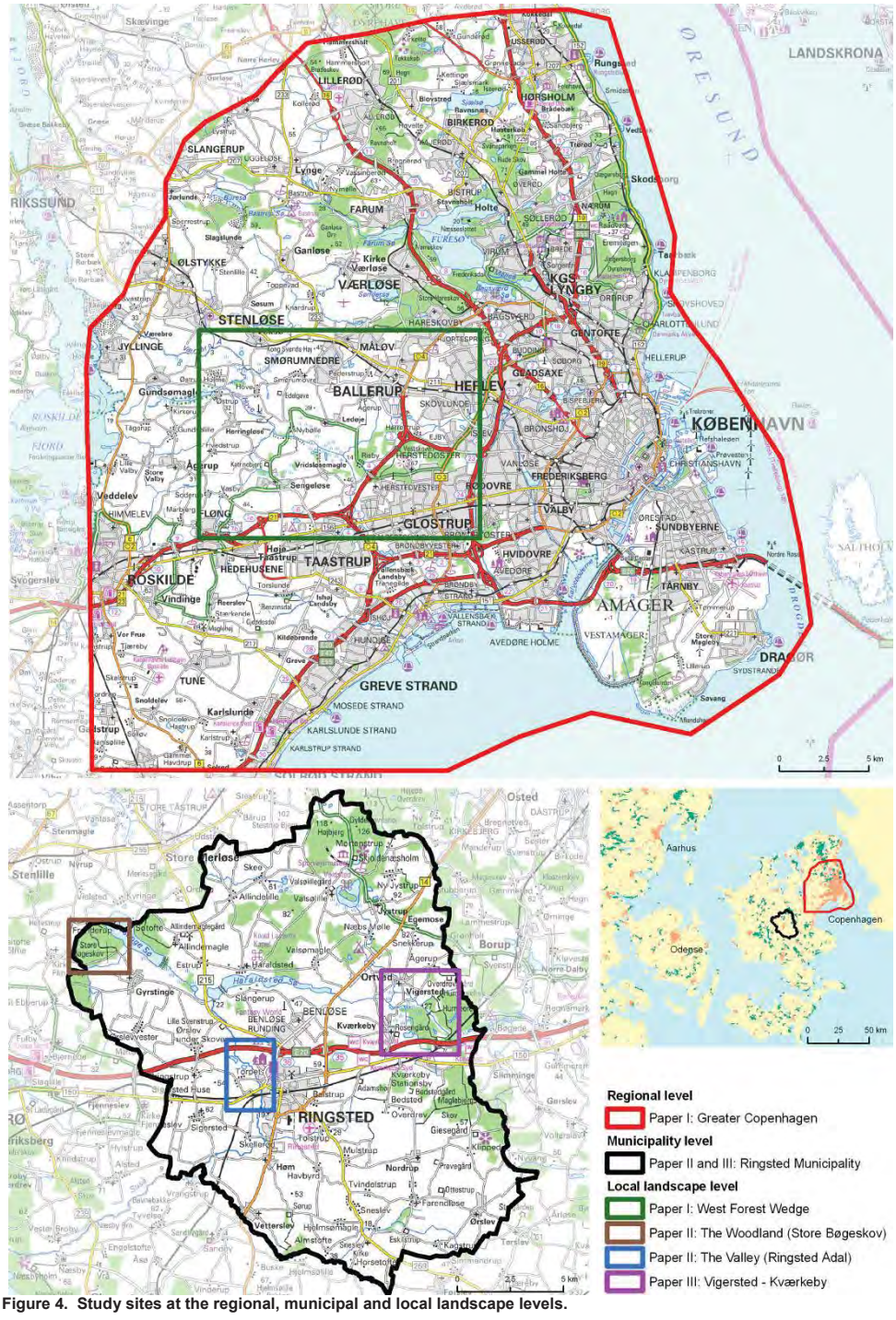


Figure 4. Study sites at the regional, municipal and local landscape levels.

3.2.2 Municipal case study

In paper II and paper III, the municipality of Ringsted serves as the case for studying the validity of REM and the implementation perspectives of REM. The landscape setting in the municipality and the municipal trail planning context are outlined below.

Ringsted Municipality is a rather typical (east) Danish case. Ringsted Municipality is a medium to low size municipality in terms of population and area size, and is situated approximately 70 km south-west of Copenhagen. A large traffic corridor (national highway and railroad) 'cut' the municipality in two; a northern region which is dominated by mixed land use, hills, scattered woodlands and two lakes; while the southern region is dominated by flat and fertile soils with agricultural land use. In terms of population structure, the number of inhabitants is 33,000 of which approximately 65% live in Ringsted city which is located in the centre of the municipality and another 15% live in 12 small urban villages making a total urbanised population count of 80% (a bit less then the national urbanisation count of 87%) (Statistics Denmark, 2011).

Besides the absence of a coastline (90% of all Danish municipalities have a coastline), the overall landscape composition of Ringsted municipality is rather typical. Rural landscape dominates with 69 % agriculture and a forest cover of 13 %, which are both very close to the national land use average for agriculture and forest. Agriculture is rather intensive (cropping and pig farming) and the land ownership structure mainly consists of private farmers, a few larger corporations (estates), and a trust. The most important landscape resources for nature-based recreation are gravel forest roads within scattered mostly deciduous woodlands, two lakes, two small river streams, and a national north-south running trail. All in all, the recreation resources are characterised by a relatively fragmented trail network and a fragmented green infrastructure in an agricultural setting.

Concerning the planning context, the organizational structure in Ringsted Municipality is rather traditional, i.e. hierarchal and sector divided into multiple levels. Trail planning is mainly conducted by the operational Park and Management unit in close collaboration with the formal Planning office, but the offices for Health Management; Culture and Education; Nature and Environmental Management; and the Development Office are also involved. Ringsted Municipality was a first mover regarding adoption of the newly developed landscape planning approach 'Landscape Character Assessment' in municipal planning measures (Hansen et al. 2010). Therefore, the municipality serves as an appropriate case for studying REM implementation in practice.

3.2.3 Study sites at landscape level

West Forest Wedge

In Paper I, the 'West Forest Wedge' was chosen as a sub-case in order to illustrate the mapping outcome of REM. The name 'West Forest Wedge' originates from the so-called 'Finger Plan'. The 'West Forest Wedge' relates to the 1,500 ha urban woodland 'Vestskoven' which has gradually been established since 1967 on land purchased from local farm and horticultural owners by the State and the involved municipalities (Vejre et al. 2007). The study site was also used to illustrate the challenges of private ownership in the proposed enlargement area of the green structure.

Vigersted – Kværkeby area

In Paper III, the landscape setting of two small urban villages (Vigersted and Kværkeby, approximately 500 and 600 inhabitants respectively), which are located in the central-western part of Ringsted Municipality, has been chosen as an area to study REM in planning practice. The landscape is characterized by mixed land use dominated by wetlands (a partly shrub vegetated irregular shaped bog 'Kværkeby mose' approximately 2 km^2 in size) and a more hilly irregularly shaped woodland and esker ('Høed Skov' approximately 1 km^2 in size). This setting was used in a local trail planning initiative launched by the Municipality of Ringsted, in which REM was used to support various planning phases.

The Woodland and the Valley

In paper II, two study sites within Ringsted Municipality are used for the validity tests of REM. One site is a woodland area which is dominated by deciduous forest and is situated beside a lake (Store Bøgeskov "Great Beech Forest", approximately 4.5 km^2 in size); the second site is a peri-urban river valley which is dominated by wetlands and meadows (Ringsted Ådal "Ringsted River Valley", approximately 3.5 km^2 in size), hereafter designated "Woodland" and "Valley", respectively. The Woodland and the Valley were selected as study sites based on three criteria. First, the GIS-mapping approach makes it possible to address the opportunities for outdoor recreational experiences in all landscape types. Woodlands, agricultural landscapes, coastal landscapes, and urban landscapes are included in the mapping procedure. Hence, it was appropriate that the selected study sites reflected this landscape variety. The Woodland and the Valley are two very different landscape types and provide very different settings for outdoor recreational experience opportunities. Secondly, the sites had to be frequently visited in order to collect data on visitors' perceived experiences. According to planners and managers at the municipality of Ringsted and the Foundation Sorø Academy (owner of the Woodland), the two sites are both frequently visited. This point was further supported by Jensen (2003), who found the annual number of visitors to the Woodland to be around 19,000, and by the fact that the

Valley is accessible on foot within approximately ten minutes walking distance of most housing areas in the western part of Ringsted City. Thirdly, in order to test the validity of the REM output among visitors, it was appropriate that possible 'strong' and 'weak' examples of mapped locations which sustain the different recreation experience classes were present at the sites, e.g. the presence of aggregated nature preservation sites of different sizes which may potentially evoke a 'strong' or 'weak' experience of biodiversity amongst visitors according to differences in size.

3.3 REM: indicators, data and analysis

REM is carried out on both a regional level (Paper I) and a municipal level (Paper II and III). This change from a regional focus to a municipal focus reduces the extent of the study area, and thereby increases the scale and the level of detail incorporated in the mapping procedure (Antrop 2000). Further, the availability of geodata differs between planning units and the collaboration with teams of planners results in specific local adaptation which reflects the needs and demands of planning and management practice. Hence, REM in Ringsted Municipality differs from REM in greater Copenhagen.

As described in Paper I, the REM approach is based on mapping indicators, data management, and GIS analyses. However, these three methodological steps are not carried out in a strict order. Available data opportunities, possible GIS analyses, and the development of mapping indicators all affect each other in an iterative mapping process. This process is further characterized by discussions back and forth between planners, managers, and researchers. Nevertheless, these three methodological steps are described separately, followed by an outline of the difference between REM mapping at regional and municipal level. An overview of mapping indicators, data, and GIS criteria is presented in Appendix A for both study areas, while the map output is visualized in Appendix B.

3.3.1 Mapping indicators

The map-based indicators are divided into three different types: visual, audiovisual, and functional services. The first includes indicators which mainly focus on visual perception. Examples are landscape elements and landscape surroundings, which increase the probability of realising the expected recreational experiences. The second type includes audiovisual features which are incorporated through the use of indicators of different levels of noise nuisance which potentially disturb visual nature experiences. Finally, indicators of functional services such as different recreation facilities are incorporated.

The map-based indicators are derived through a normative and iterative developmental process comprising calibration and correlation between six different inputs: (1) Spatial precondition of the experience dimension, (2) Danish data on recreational behavior, preferences, and landscape perception, (3) consultation of experiences from Stockholm, (4) demand and need from planning practice, (5) data availability, and (6) GIS analytical

possibilities. Each of these inputs is presented in Paper I, and is elaborated in more detail in the following.

(1) The map-based indicators are embedded in the spatial preconditions of each of the seven experience dimensions. For example, 'wilderness' (class 1) is associated with naturalness or wild nature. Forest swamp and designated nature forest are used as mapping indicators in this class in order to highlight sites which enhance the opportunity to encounter gnarled, twisted and dying trees, and dead wood which promotes an experience of wilderness. 'Feeling of forest' (class 2) is focused on experiencing space and coherence which is potentially promoted by all woodlands, and specifically in mature stands of forest which form a coherent landscape with a sense of order and an opportunity to enter a 'whole different world'. Hence, a minimum criterion regarding the age and size of the forest is applied as a mapping indicator. Similar spatial preconditions are present for classes 4 to 7 (see Table 1, 2 and 3) and are incorporated in the mapping indicators for each class listed in Appendix A.

(2) Available survey data and qualitative data on Danes' recreation behavior, preferences, and landscape perception was used to calibrate the spatial preconditions of the experience dimensions with Danish research findings (Hansen & Nielsen 2005, Hansen-Møller & Oustrup 2004, Jensen 2000, Jensen 2003, Jensen & Koch 2004, Jensen 1998, Jensen 1999, Jensen & Koch 1997, Kaae & Madsen 2003, Koch & Jensen 1988). For example, Danish studies have used the REP scales (section 2.2) to highlight experiences of nature, peace and quiet, social interaction, and physical activities as prime motives for Danes' visits to nature areas (Hansen & Nielsen 2005, Jensen 1998, Kaae & Madsen 2003), and hence, attention is given to the mapping of indicators regarding, e.g. traffic noise and recreational facilities.

(3) The experience from the Stockholm mapping process (RTK 2001, RTK 2004) was used as input to screen possible mapping indicators for further adaptation to the Danish landscape and planning context.

(4) The adaptation and development of mapping indicators was based on a very important input from regional planners in greater Copenhagen (Paper 1) and local planners and managers in Ringsted Municipality (Paper II and Paper III). Hence, Planners' expert knowledge, and the need and demand for spatial information are included in the development process of mapping indicators.

Finally, (5) data availability, and (6) possible GIS analyses are prerequisites which affect the process of mapping indicator development (inputs 5 and 6 are described separately in sections 3.3.2 and 3.3.3).

3.3.2 Data management

REM is based on many different data sources. The 1:10,000 vector dataset from the National Survey and Cadastre constitutes the main data source. The different data sources included in REM are listed in Appendix A under headings related to ownership and planning levels (state, county, and municipality). However, these should only be considered as a general indication of data copyrights. In fact, many different state data are used, e.g. data from The Danish Road Directorate, Heritage Agency, Nature Agency, Banedanmark (state-owned railroad company), and the National Environmental Research Institute.

The REM data management comprises many different steps including: the screening of available data opportunities (local, municipal, regional and national data); data collection (contacting data owners, geo-referencing, extraction from other databases); digitizing (e.g. of trails, routes and recreational facilities only available from printed maps in leaflets); geo-coding of register-based data (e.g. data on protected buildings); and finally the storage of data in a geo-database which is compatible with the planners' and managers' internal GIS-system.

3.3.3 GIS analyses

The analytical foundation of REM is the utilization of modern digital maps which consist of separate and individual map objects as points, polylines, and polygons, i.e. elements which include topology. This enables the generation of user-defined maps by copying and combining selected separate map elements into user-defined thematic maps within each of the seven classes. This selection includes different criteria such as minimum size, aggregation measures, overlay analyses, distance criteria, merging, and union of features which are subsequently expressed in the mapping indicators (see Appendix A for a full overview). Further, raster analysis is included in the form of a viewshed analysis of lake visibility, i.e. a designation of locations on land with a lake view. Different editing tasks and digitalization were also carried out in the process of using different data sources. For an example of a flowchart see Paper I.

3.3.4 Differences between REM at the regional and municipal levels

The decrease in size of study area from greater Copenhagen to Ringsted Municipality increased the resolution of REM in Ringsted. More mapping indicators are incorporated and more detailed mapping of, e.g. lake view possibilities are integrated (Table 5). Further, the differences between regional and municipal REM comprise differences in data sources, the use of different GIS analyses, different integration of traffic noise and other disturbances, and a changed division of mapping indicators between class 6 (Activity and Challenge) and class 7 (Service and Gathering) (all summarized in Table 5).

Table 5. Examples of differences between REM in greater Copenhagen and REM in Ringsted municipality

	Regional (greater Copenhagen)	Municipal (Ringsted)
Number of data sources	15	20
Integration of degrading disturbances	Possible disturbances such as traffic noise and closeness to urban derived features (housing areas, industrial areas, high-voltage line) are incorporated in mapping class 1-3.	Possible disturbances such as traffic noise and closeness to urban derived features (housing areas, industrial areas, high-voltage line) are united in a separate 'Disturbance map'.
Mapping indicator 'traffic noise'	National low resolution data of traffic noise from larger roads	includes high resolution data on national railway and highway noise
Class 2, mapping indicator 'Older deciduous forest'	Based on minimum age criteria from available state forest 1:10,000 vector dataset	Digitization of older deciduous stands based on high resolution orthophoto interpretation (nearly no state owned forest in Ringsted)
Class 3, mapping indicator 'Lake and sea shore/lake view'	Lake and sea shore (buffer analysis)	Lake view (viewshed analysis based on points at lake surface and the high resolution Digital Surface Model)
Class 4, mapping indicator	Geological hot spot	-
Class 4, mapping indicator	-	Protected streams with 25 meter buffer zones
Class 5, mapping indicator	Well preserved village	-
Class 5, mapping indicator	-	Intangible heritage (archaeological sites by treasure trove)
Class 6, mapping indicator	Footpaths and tracks	Marked routes and trails
Class 6, mapping indicator	Footpaths and tracks	Non-marked routes and trails
Class 6, mapping indicator	Routes and other paths	Cycle routes and lane
Class 6, mapping indicator	-	Forest roads (selection of all type of walkable roads in woodlands)
Composition and division of class 6	Polygon (activity areas), polyline (activity trails) and point information (activity locations)	Polygon (activity areas), polyline (activity trails). Trails divided according to marking and communication, and all point information is united in class 7 (Service and Gathering)

3.4 On-site participatory mapping

The validity of REM was tested by documenting the level of agreement between REM and visitor participatory mapping of perceived recreational experience opportunities (Paper II). The methodological process of visitor participatory mapping is elaborated in the following.

Participatory mapping was carried as part of an on-site interview with visitors. On-site interviews were conducted at two study sites (presented in section 0) during the late summer and early autumn of 2010. The interviews took place on two workdays and six weekend days in each area. The 'waiting method' was applied, such that the interviewers were stationed at specific locations (next to parking areas) waiting for visitors to pass by. The interviews, including participatory mapping, took between 10-20 minutes.

The focus of the interview was on participatory mapping. The participatory mapping approach was similar to the paper-based approaches presented in section 2.3, but was not based on postal mail or handing out invitations, but on in-situ participatory mapping. The respondents were asked to draw sites on a paper map of the study area, which made it

possible to collect different types of spatial data on perceived experience opportunities. An aerial orthophoto (12.5 cm resolution) printed to scale 1:15,000 and overlaid with place names, trail networks, and facilities such as parking areas was used as a background map (Appendix C). As a guideline, the respondents were not assisted during the participatory mapping phase. The interview and participatory mapping procedure was divided into five steps (Table 6).

In order to "warm up" respondents and gather background information on the visitors' recreational behavior in the area, the interview began with relatively straight-forward questions about recreational activities, use history, motives, satisfaction and perceived disturbances (*step 1)* (see Appendix C). This was followed by data on visitor routes which were obtained by respondents' drawing on the paper map of the area (step 2). Step 2 gave the respondents the possibility to match their individual spatial mental maps of the area with the paper map, sustaining re-experience, and forming a basis for spatial orientation. The study sites have multiple access and exit points. Given the prerequisite of this study, it was therefore not practically possible to collect data solely from post trip visitors. Thus, respondents were divided into two groups based on their reply to an earlier question on use frequency of the area. Respondents who made more than five visits per year were asked to map their regular/normal route in the area, while respondents who made five or less visits to the area were asked to map their planned route if they were encountered at the beginning or in the middle of their visit. If they were encountered at the end of their visit, they were asked to map their completed route.

Table 6. Gathering of data on visitors' perceived experience opportunities. A 5-step visitor participation methodology is applied which reveals increasing amount of conceptual and spatial information on the REM approach throughout the interview.

Step	User participation	Aim	Data type
1	Answering questions	Start the interview with easy and smooth questions in order to 'warm up' the respondent	Background information: visitor behavior in the area, visitor groups and visitor characteristics
2	Drawing of route on paper map	Sustain user re-experience and activation of memories; forming a basis for spatial orientation and map reading	Visitor route
3	Designation of self-described experiences on the route map	Obtain information on visitors' own definition, expression and designation of experience opportunities	Spatial data: self-described perceived experience opportunities
4	Designation of the five experience classes on the route map based on a 1-2 minute poster-based presentation of the classes	Obtain spatial information on visitor designation of settings sustaining the five experience classes	Spatial data: perceived data on the five recreational classes
5	Validating 20 proposed experience sites derived from the REM output.	Acquire visitor opinion on the spatial output of REM	Likert scale measure of agreement (agree, don't agree, don't know)

Steps 3 to 5 of the interview were focused on participatory mapping of experience opportunities. The goal was to collect visitor data which was based on a differentiated information level of the REM approach, by gradually revealing more information on the conceptual structure of REM (the five classes) and the spatial output of REM (designated potential experience sites). Graduating the information level made it possible to first obtain spatial data on respondents' individual self-described experience opportunities without any pre-information on the REM concept (step 3). Step 3 was carried out by an open-ended question. The respondents were instructed to map the experience opportunities and the descriptions of the experiences were summarized in-situ by the interviewee. Then the respondents were provided with conceptual information on the REM approach through a 1-2 minute poster-based presentation with an illustration of the experience classes, and were requested to map perceived experience opportunities in relation to the experience classes (step 4). Step 4 was carried out through a simple mapping procedure: the respondents identified the experience classes at specific sites by drawing the number 1-7 corresponding to the class number. Area or stretches along a trail could be identified by the class number (1-7) and a line indicating the length of the stretch. The respondents were instructed to draw the class number (1-7) on a random location on the map with a circle around the number to indicate the experience opportunity to be found in the whole area (see Figure 5).

Finally, respondents were asked about their agreement with the spatial output of the expert REM procedure based on a map presentation of 20 suggested experience sites (step 5). This was carried out with the aid of a poster with small maps of the area. In order not to

confuse the respondents with comprehensive legend reading and to focus the respondents' attention on the spatial location and not on the construction of mapping indicators, a simple red outline was used to point out the experience opportunity site (see Figure 5). This step-by-step approach constructs a good basis for visitor in-situ mapping of perceived experience qualities, giving the respondents gradual possibilities for reflection on previous experiences, spatial orientation of the area, and understanding of the pre-defined experience opportunity classes.

Figure 5. On the left is an example of a respondent's on-site drawn-on paper map (step 2-4). On the right are examples of maps presented to respondents in the final agreement test (step 5). The two maps show sites (outlined with red), which have been suggested as sites for wilderness experiences: a forest swamp in the Valley and a designated nature forest site in the Woodland.

3.5 Internship: Participant observation

An internship was conducted in the planning unit of Ringsted Municipality in order to obtain detailed insights and knowledge on recreational trail policy making and to be able to study and evaluate the implementation and application of REM in planning practice at close quarters (reported in Paper III). Admittance on an internship at the planning unit of Ringsted municipality was achieved by using contacts developed during a landscape planning research project (Kristensen et al. 2011, Præstholm et al. 2008). The internship lasted for 20 full working days over the course of six months from October 2008 to April 2009. A cross-sector working group consisting of the researcher and four planners (two from the planning unit, one from park and management, and one from the development secretary) was established with the aim of conducting and implementing REM. The work on REM included the adaptation of the mapping approach to the conditions in Ringsted (i.e. use of local data opportunities and further development of the method), and the application of the mapping approach and mapping result in plans and daily planning procedures. The internship made it possible to conduct participant observation. Data on the trail planning process and REM implementation was collected through informal talks in the network of the

working group, and during meetings and interviews with different planners and stakeholders. To follow up on the effect of the REM implementation, multiple return visits were carried out during the following two years.

3.6 Internet survey with planners

The implementation perspectives of REM were also investigated at a national level by a survey including all Danish municipalities (Paper III and Paper IV). The survey was conducted with municipal recreation planners in late 2010. Municipal staff with responsibility for planning and the management of recreational trails were contacted in each of Denmark's 98 municipalities. A telephone call was made to all municipalities to identify potential respondents. The telephone call ensured personal contact with all possible respondents thereby increasing the chances of participation. In addition, the telephone conversation made it possible to pose open-ended questions on the status of trail planning in the municipality and usages of GIS. This information was typed up after the telephone conservations. The collected qualitative data formed an information pool from which to identify possible explanations for reply patterns and the formation of hypotheses. One planner from each municipality was approached for the survey, and one reminder mail was sent out. The survey was conducted over the Internet, which is generally recommended when respondents are already known and have Internet access (Ritter & Sue 2007). Data was stored in digital form immediately after receiving responses, thus minimizing any processing errors. In total, 89 out of the 98 Danish municipalities responded to the survey (Figure 6). The ten non-respondents were from very small municipalities with very limited resources (small islands) and from a few large municipalities where no single planners felt comfortable with replying on behalf of the entire unit. In addition, three average sized municipalities did not reply due to limited available time. Hence, the response rate was 90% of all municipalities, making a solid basis for the study.

The survey comprised questions related to recreational planning with an emphasis on trail planning. The questions were focused on three themes: outdoor recreational planning, trail planning, and the use of GIS in outdoor recreational planning (summarized in Table 7). The construction of the survey was primarily based on information obtained during the internship at Ringsted Municipality, but also on different research findings, e.g. previously identified barriers to GIS use in planning (Croswell 1991, Vonk et al. 2005) and a typology of public participation (Arnstein 1969).

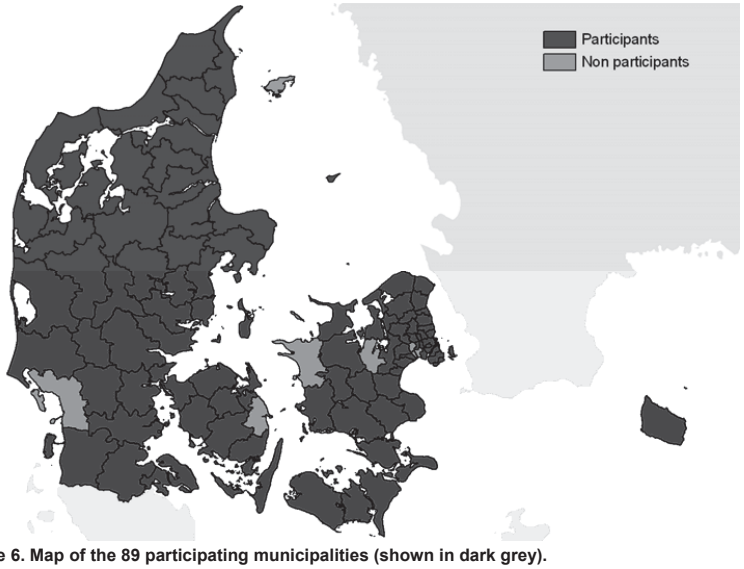


Figure 6. Map of the 89 participating municipalities (shown in dark grey).

Table 7. Headings of questions included in the survey (a full copy of the survey is included in Appendix D).

Question	Answer
Outdoor recreation planning	
Types of policy and strategies	Yes/no
Map-based communication of outdoor recreation experiences	Yes/no
Outdoor recreation projects in relation to crosscutting efforts between municipal sectors	Yes/no
Linkages between outdoor recreation and health	Yes/no
Extent and types of public participation in outdoor recreation planning	Five-level Likert scale, Yes/no
Need for more information on outdoor recreational experiences	Five-level Likert scale
Type of information and knowledge on outdoor recreational planning	Five-level Likert scale
Planners judgement of the weighting of public motives in outdoor recreational planning (the REP scales)	Five-level Likert scale
Outdoor recreational trail planning	
Public interest in recreational trails	Five-level Likert scale
Number of employees engaged in trail planning	Number
Number of man-years in trail planning	Number
Identification of partners engaged in trail planning	Yes/no
Barriers to trail planning	Five-level Likert scale
Number of trails based on volunteer agreements with local land owners	Number/km
Number of trails opened in the last three years	Number/km
Number of planned trails which are expected to be realized in the current planning period	Number/km
Use of GIS in outdoor recreational planning	
Presence of GIS department	Yes/no
The extent of personal GIS usage (including different types of usages)	Yes/no
The extent of municipal GIS usage in outdoor recreational planning (including different types of usages)	Five-level Likert scale, Yes/no
Need for more GIS use in outdoor recreational plannning	Five-level Likert scale
Barriers to more use of GIS	Five-level Likert scale
Planners background information (experience, type of work, education)	-

3.7 Statistical analyses

The survey results described in section 3.6 were used to constitute variables for statistical analyses in Paper III and Paper IV. In Paper III, the variables were presented by frequencies, while more sophisticated statistics were carried out in Paper IV. In Paper IV, the variables which describe different aspects of GIS use in the municipalities and the variables which express the different characteristics of the planning context, in which the use of GIS is embedded, were used in an exploratory factor analysis. The exploratory factor analysis was applied in order to describe the possible effect of different types of planning contexts on GIS use in recreational planning practice. The results of the factor analysis were thereby explored in more detail by comparing variables using various statistical tests (Mann Whitney U test, Willis-Kruskal test and Fisher's Exact test). All statistical analyses were performed with the use of SPSS.

4 Paper introduction and summary of results

In the following, a short introduction is given to the four papers in the thesis. The following introduction sets the scene for the papers in relation to the overall thesis (Figure 7), and provides the opportunity to present a few background details on each paper, which are not incorporated in the single papers. Further, a short summary of results is provided.

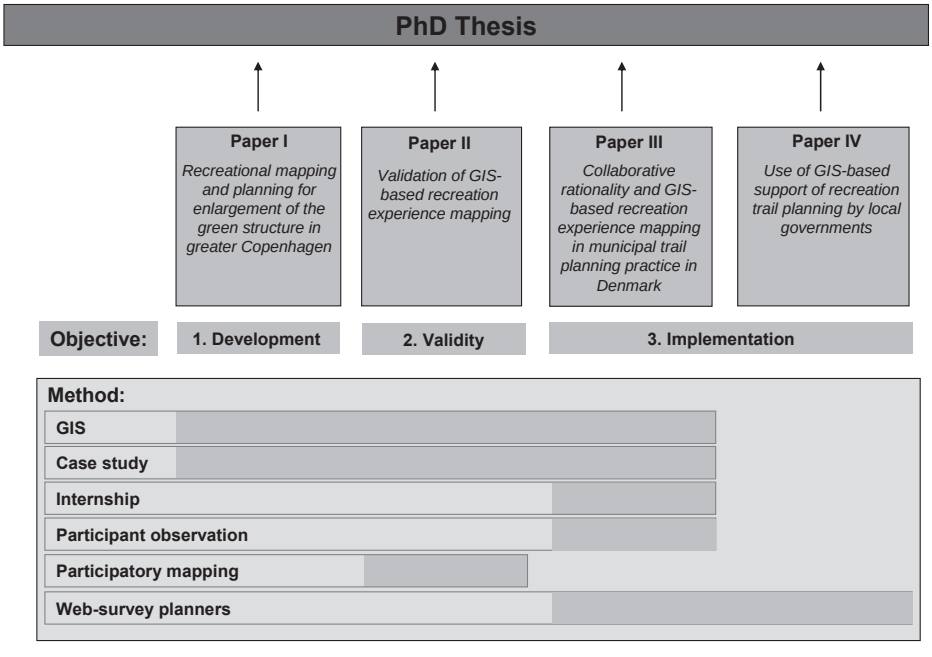


Figure 7. Overview of research design and the four paper outcomes.

4.1 Paper I

Title: Recreational mapping and planning for enlargement of the green structure in greater Copenhagen

Authors: Caspersen, OH & Olafsson, AS

Published in: Urban Forestry & Urban Greening 9 (2010) 101-112

Paper I is concerned with the development of REM. The development of REM and its methodology have already been addressed in section 2.1 (The Evolution of GIS-based recreation experience mapping) and section 3.3 (REM: indicators, data and analysis), and hence, the results of this work have already been reported. The workflow and the outcome of Paper I is summarized in Figure 8. A follow-up to this work is provided in the following.

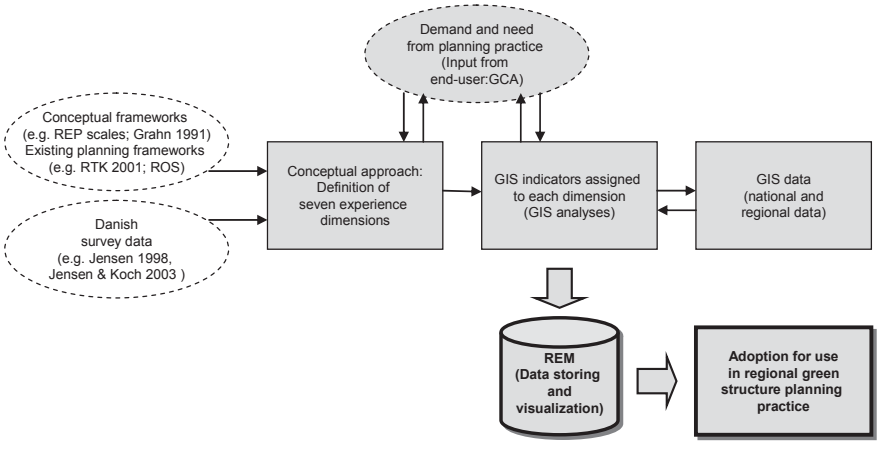


Figure 8. Paper I workflow and outcome (in bold).

The development of REM is embedded in a case study and includes examples of the uses of REM in planning practice. REM was developed and adopted to support green structure planning in greater Copenhagen, and hence, REM reflects the demand and need from planning practice. REM output was used directly for the development of detailed plans for the different sub-parts of the enlarged green structure (e.g. HUR 2006). The plans included map-based information which was based on the REM output. The REM output served as a large information pool which supported field work and collaboration between the regions and the municipalities on the development of the plans, including proposals for a new municipal cross-cutting trail. In 2010, seven municipalities in the south western part of Copenhagen which were co-organized in a Business Development Network, the Copenhagen West ("Vestegnssamarbejdet"), decided to conduct an up-to-date collective process of REM in order to inform a joint planning basis for tourism, recreation and landscape (Vestegnssamarbejdet 2011). Hence, in greater Copenhagen, the REM, which

was originally developed for regional green structure planning, has now been further developed into a municipal GIS-based planning support system implemented for recreational landscape planning and management.

4.2 Paper II

Title: Validation of GIS-based recreation experience mapping

Authors: Olafsson, AS, Shipperijn, J, Caspersen, OH & Jensen, FS

As a consequence of the REM implementation in Danish municipal planning, a need for, and interest in, the further validation of the REM expert method in relation to public perception has become important. Paper II focuses on this validity issue. The focus is on spatial data which describe perceived experience opportunities which stem from on-site visitor participatory mapping compared to the expert-derived REM output. Three different tests were applied which address spatial accordance between REM and visitor participatory mapping. The workflow and the outcome of Paper II is summarized in Figure 9.

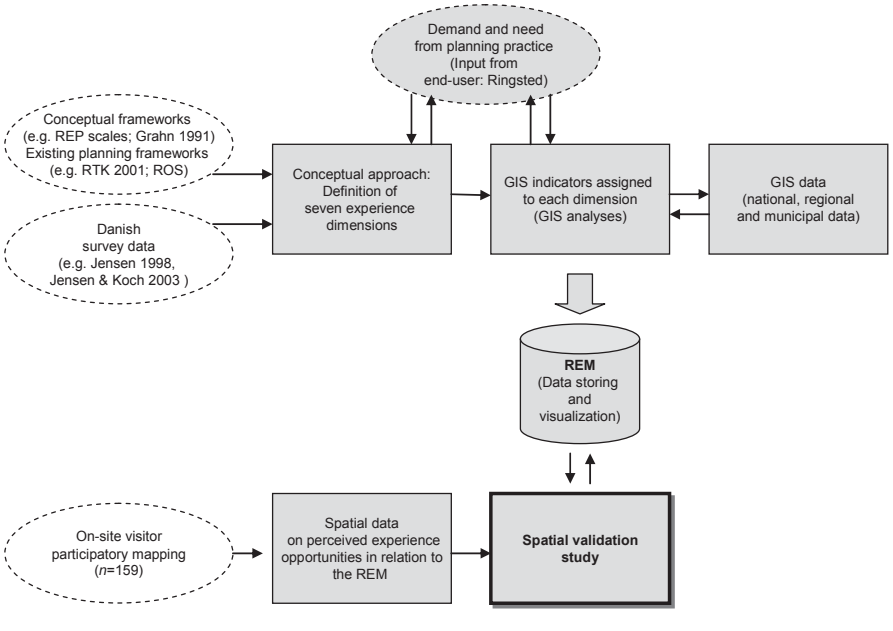


Figure 9. Paper II workflow and outcome (in bold).

The study concludes that REM (class 1-5) is valid in relation to visitor perception of several aspects, but also that there are gaps and shortcomings. Concerning Wilderness (class 1) and Feeling of Forest (class 2), the experience dimensions are expressed by visitors own self-described experience opportunities as non-site specific values (related to remoteness,

peace and quiet, seasonal change, and smell of nature), and REM and visitor mapping is in spatial accordance. Panoramic Views (class 3) and Biodiversity (class 4) are thoroughly incorporated into the resulting place values (i.e. visitor self-described and mapped experience opportunities), and a high level of spatial accordance was found. The greatest number of problems was reported for REM mapping of Cultural History (class 5). Many visitors described cultural historical values, making this class relevant for the mapping approach, but the GIS output was not in spatial accordance with the visitors' own spatial understanding of cultural historical experience opportunities.

The paper concludes with some proposals for the improvement of REM. The results emphasize the importance of landscape context. Hence, it is recommended that the GIS mapping approach includes small fragmented woods if they are situated in a non-woodland context as even small woods (few hectares) can provide a feeling of forest for some visitors in some contexts. Concerning Panoramic Views (class 3), the REM definition and criterion of the inclusion of hilltops and other scenic view sites needs to differ according to the landscape context. In a peri-urban landscape context, the GIS procedure needs to be more inclusive to incorporate more view sites, such as view opportunities at the bottom of a river valley. In a more rural lake landscape context, the GIS mapping approach needs to be more exclusive and strict to focus entirely on scenic view experience opportunities within close proximity to the lake shore. Regarding Biodiversity (class 4), an area size criterion for nature preservation sites needs to be considered as small sites do not provide the experience of biodiversity for most visitors. The problem of Cultural History (class 5) is due to the absence of appropriate data. Perceived cultural historical values are not systematically incorporated into, e.g. registers of preserved monuments, thus complicating the process of making a systematic GIS mapping of the intangible character of cultural history, including places for local storytelling. The mapping of such values requires participatory mapping. In general, however, the results validate and support the REM approach.

4.3 Paper III

Title: Collaborative rationality and GIS-based recreational experience mapping in municipal trail planning practice in Denmark

Authors: Olafsson, AS & Kristensen, LS

At the beginning of my study, my approach to planning practice was rather simplistic and naive. As described by Innes (1998:56), I saw my work on the REM system as: "*the work of a neutral expert who worked outside the organisation apart from the political and bureaucratic process through which policy gets made*". I had had no further thoughts concerning the important process of embedding information in the institutions' or the players' (i.e. planners, stakeholders) understanding. My work with GCA planners (Paper I), and in particular the internship in Ringsted, rapidly changed this rather naive theoretical perception of a linear policy making model where experts support planners with information for input to a plan, which is approved by elected officials and implemented in planning practice (Innes & Booher 2010). I began to focus on newly developed approaches such as network-based collaboration, joint fact finding, communicative policy making, and adaptive co-management.

In adapting and developing REM to a Danish context, none of us who were involved were focusing on the planning issue of recreational trail planning. During my stationing in Ringsted, I presumed that REM would be adopted for landscape planning (add to landscape character assessment), but instead planners quickly adopted REM for use in recreational trail planning. Hence, Paper III focuses on the support role of REM in Ringsted municipality for a collaborative trail planning perspective. Innes and Booher's (2010) theory on collaborative rationality is used as a framework for the study including data from the municipality survey and data based on the internship (see Figure 10).

The study concludes that REM has the potential to facilitate such collaborative processes. In general, REM complies with a planning need for more spatial information on recreational experience opportunities and increased GIS use. Based on the experiences of the implementation process in Ringsted, a joint fact finding process resulted in shared meanings and a feeling of ownership of the mapping approach. REM was thereby embedded in the organization and further applied in trail planning practice. REM proved to enhance the information and knowledge base, and supported different phases of the trail planning process. However, further development of the mapping approach is needed if REM is to be integrated in authentic collaboration. Regarding the ongoing implementation of REM in Danish municipalities, it is recommended that as much in-house collaboration during the adaptation process as possible is conducted, i.e. the integration of all relevant

staff and professions in a joint fact finding process including a conceptual discussion of the approach, mapping indicators, and data input. In order to integrate all key players and affected stakeholders, it is also recommended to focus on flexible collaborative GIS application and the incorporation of public and NGO knowledge regarding recreation experience opportunities through participatory mapping.

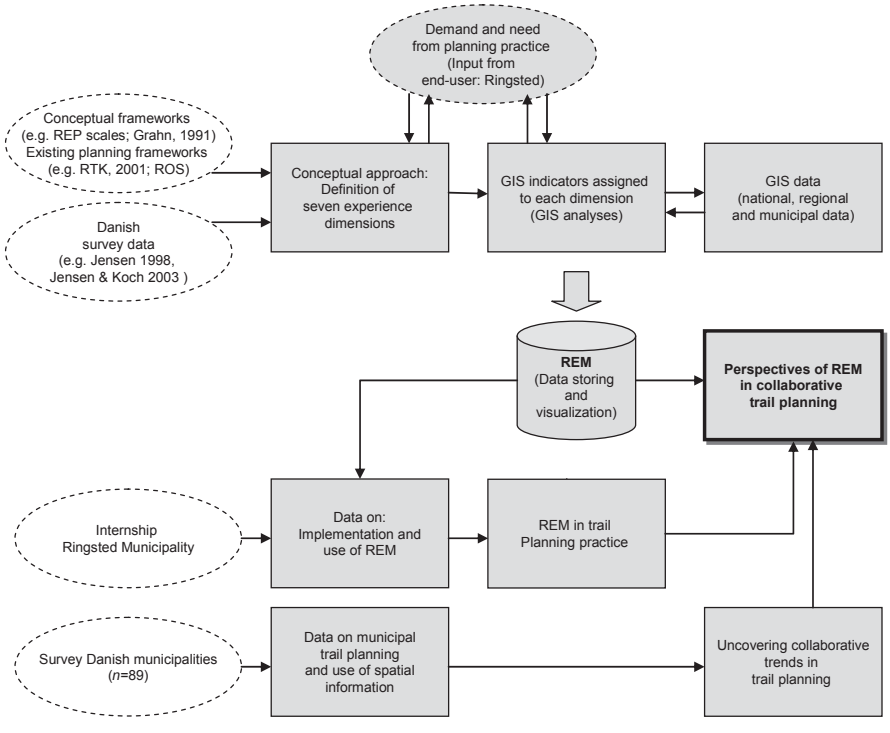


Figure 10. Paper III workflow and outcome (in bold)

4.4 Paper IV

Title: Use of GIS-based support for recreational trail planning by local governments

Authors: Olafsson, AS & Skov-Petersen, H

Submitted to: Applied Spatial Analysis and Policy

The idea for this paper was developed during my internship at Ringsted Municipality. During my internship, I witnessed the planners' GIS expertise in action and the GIS work flow within the organization. This experience made me start to focus on barriers to GIS use, a very relevant factor when studying a GIS-based support system in action. Simple barriers to GIS use would potentially block the adaptation, adoption and implementation of REM, and thereby impede the applied use of REM in planning practice. I realised that my expectations were possibly too high concerning the planners' GIS expertise and the possibilities for use of GIS on a daily basis. In Ringsted, all planners were familiar with and daily users of an in-house Internet-based GIS system (named "NetGIS"), which was used to obtain spatial information relevant for land administration and permit processing. However, nearly all GIS analysis and mapping tasks were carried out by dedicated GIS professionals located in a GIS-department. In practice, very few planners had a desktop GIS client available and so few were able to work analytically with REM. The finding of this sectorally divided GIS use pattern in Ringsted makes it relevant to study GIS use patterns in all municipalities. If the finding from Ringsted can be generalized, i.e. planners do not generally work analytically with GIS; the future of GIS-based planning support such as REM in a planning application may be compromised. Hence, Paper IV aims to uncover GIS-use patterns in all Danish municipalities. The workflow and outcome is sketched in Figure 11.

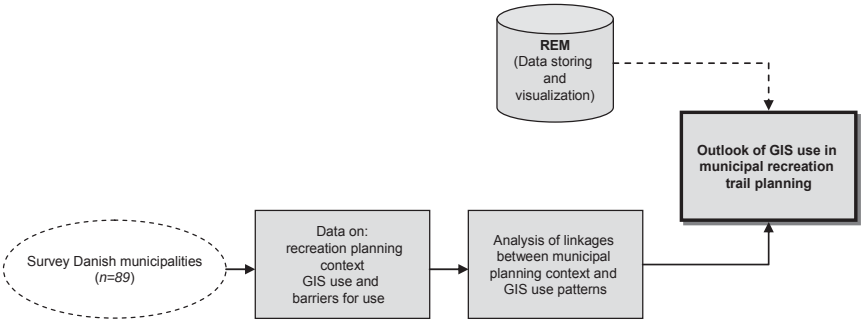


Figure 11. Paper IV workflow

The study concludes that nearly 70% of the respondents report using GIS to a high degree in their daily administration and planning. And for more than 50% of Danish municipalities, this use includes advanced spatial analyses. Recreation trail planning practice is geared to GIS support, and the majority of the surveyed planners expressed a clear need for more GIS use and more spatial information. However, there are considerable differences in the way municipalities assess their need for and use of GIS planning support. These differences were explored in more detail using a factor analysis of planning variables and uses of GIS. Three situations were described: 1) extensive network-based collaborative planning associated with extensive GIS use; 2) experienced and older planners who lag behind in their use of advanced GIS-based planning support; and finally, 3) an envisioned need and demand for more GIS which are mainly realized through a GIS department at the municipality. Hence, the characteristics of the individual planners are important. Planners with long professional experience tend to only use GIS for limited purposes and rely more on their own expert knowledge and field studies than on GIS-based information. Further sector disintegration seems to be a part of the problem, and more cooperation is needed between specialized GIS departments and the planners within the organization in order to increase the use of GIS in recreational trail planning. In general however, the findings stress that GIS use, including more advanced uses (like REM), is more likely to be applied when funding is adequate and when a team of planners work together on collaborative trail planning.

5 Discussion

The specific research questions are addressed and discussed in the four papers. In the following, the three objectives (development, validation, and implementation of REM) are incorporated in a summary discussion which is based on the following four headlines:

- Conceptual design of REM
- REM vs. participatory mapping
- REM and ROS: similarities, differences and lessons
- Application outlook for REM

5.1.1 Conceptual design of REM

The idea behind the conceptual design of REM is thoroughly described in the research review of existing mapping frameworks in Paper 1, and sections 2.2 and 2.3 (Table 3). Based on the review of studies which uncover experience dimensions (Table 2: Gobster & Westphal 2004, Grahn & Stigsdotter 2010, Tveit et al. 2006), and studies which focus on the mapping of these dimensions (listed in Table 3), it can be argued that a form of intersubjectivity is present, that is, an agreement on the identification and use of similar experience dimensions across conceptual frameworks and different mapping frameworks. The REM spectrum of recreational experience classes is in line with the general usage of experience classes, and hence, REM is provided with internal (theoretical) validity. Further, the internal validity has been elaborated by jury inspection of content validity. The increasing examples of REM implementation have involved discussion and acceptance among partners with professional expertise within landscape and recreational planning into the conceptual structure and idea behind the REM approach. Hence, it is fair to assume that REM addresses the most essential recreational experience dimensions.

The validity study (Paper II) provides REM with external (empirical) validity concerning class 1-4 (wilderness; feeling of forest; panoramic views; and biodiversity). The relevance of external validity is less pronounced for Activity and Challenge (class 6) and Service and Gathering (class 7), which focus on the mapping of recreational facilities. Recreational facilities are intentionally provided in order to sustain physical activities (e.g. a trail) and social interaction (e.g. a bench and table set), compared to the more hypothesized linkages between specific landscape attributes and experience opportunities of wilderness, feeling of forest, scenic views, biodiversity and cultural history. However, the GIS-mapping of cultural historical experience opportunities (class 5) needs special attention as visitor perception differs. This discrepancy is due to the availability and quality of data input in REM. The mapping of cultural historical values is mainly based on a national register of preserved heritage values according to national preservation criteria, which do not necessarily reflect local or regional cultural historic experience opportunities related to tangible and intangible heritage values at the landscape level. Reporting this validity issue makes it relevant to

establish the implication of this finding in a planning perspective. According to initial indications, it is clear that REM is compromised by the absence of cultural historical values at the local level, but it is also clear that integration of such information is possible through participatory mapping. Further, the current information on cultural historical values in REM supports planners with valuable information. Information affects perception, and hence, information on cultural historical values on a national level can be incorporated in, e.g. communication of cultural historical experience opportunities based on a local recreation trail ("Rosengårdsstien", described in Paper III), and thereby shape perceived cultural historical experiences.

The external validity findings are embedded in the socio-cultural and landscape context of the validity study sites 'the Woodland' and 'the Valley' (Paper II). Most of the respondents were experienced visitors. Experienced users have a greater knowledge base concerning recreational resources, are more familiar and, therefore, have a richer cognitive, and perhaps affective, basis for evaluating recreation settings (Arnberger & Brandenburg, 2007; Hammitt et al., 2004; Manning, 2011). Hence, it cannot be precluded that participants with different experience use histories would have produced a different outcome of the validity assessment in Paper II.

REM is a normative mapping process. Flexibility and collaboration in the mapping procedure was needed in order to develop a system which would be accepted by end users, i.e. planners and managers. This flexibility included the choice of data input, discussion of mapping indicators and recreation experience classes which all ensured a feeling of ownership and responsibility for implementation. In addition, the outcomes of this thesis recommend further collaboration with affected stakeholders in the mapping procedure and also the adaptation of the mapping approach to local landscape contexts. These high levels of flexibility in the mapping procedure pose a challenge for the scientific basis of the REM concept and methodology. This point is illustrated by the outcome of the collective REM mapping procedure in the seven west Copenhagen municipalities (Vestegnssamarbejdet 2011). The west Copenhagen area has been developed since the period after Second World War on former fertile agricultural land. Hence, besides the coastline, two small streams with riparian areas and a few bogs, not much authentic nature was left close to the new urban developments. In order to adapt REM to the local landscape context, the seven west Copenhagen municipalities in collaboration lowered the criteria for the inclusion of nature-based recreational experiences and traffic noise nuisance, and developed a new recreational experience class named "Urban Nature" (following Cultural History (class 5) in the REM experience spectrum). This class reflects the newer development history of the west Copenhagen area in which residual landscape elements such as artificial hills, noise barriers, coastal protection and rainwater reservoirs were left behind the urban and infrastructural development to create new forms of urban recreational settings with special recreational experience opportunities. The flexibility of the

REM procedure supports such adaptation possibilities, but concerns can be raised due to trade-offs between a high level of flexibility and the scientific basis of REM. The seven experience classes in the original REM are embedded in research findings which are adjusted to planning and management demands, whereas “Urban Nature” is embedded in the local landscape context (the supply of recreational settings) and a local planning demand.

5.1.2 REM versus participatory mapping

When reviewing mapping frameworks with a focus on recreational experience values (section 2.2), it becomes clear that the majority of frameworks are based on participatory mapping. It is therefore of relevance to discuss and highlight the methodological differences between REM and participatory mapping. These differences were briefly addressed at the end of section 2.3, and are elaborated further in the following discussion to provide a critical insight into the strengths and weaknesses of participatory mapping frameworks versus REM as an expert GIS-indicator mapping framework.

The obvious advantage of participatory mapping compared to expert GIS-mapping is the absence of assumptions linked to the use of indicators. Participatory mapping is directly embedded in respondents’ perception and experiences. Hence, in participatory mapping, it is possible to map experience dimensions which might be too elusive or personal to be expressed by GIS-indicators. Examples on this are provided in Table 3 and include: ‘special places’ (sense of belonging, place attachment, locations for childhood memories), spiritual values (sacred, religious, spiritually special areas), and learning, educating and scientific values (related to learning about the environment) (Brown & Weber 2011, Brown 2005, McIntyre et al. 2004, Tyrväinen et al. 2007). Further, degrading experiences or disturbances associated with crowding, rubbish/litter, dead or sick wildlife and vegetation, unpleasantness, and scariness are also too elusive, dynamic and personal to be expressed by an indicator approach, but can be incorporated into participatory mapping.

The strength of participatory mapping is also its weakness. Mapping based on survey data raises concerns related to: representivity, response rate, sampling size, choice of participants (visitors, locals, tourists, stakeholders), design of survey including visual layout, wording and the cognitive complexity of the mapping process (e.g. development of mapping interface and mapping guidelines). Participatory mapping is also less suitable for addressing whole regions or nations, compared to indicator approaches (e.g. Björk et al. 2008, Gossen & Langers 2000, Kim et al. 2011). Although Paper GIS and Internet GIS participatory mapping is directly embedded in the respondents’ perception, assumptions are still made about respondents’ understanding of pre-defined experience classes. Researcher interpretation and the coding of respondents’ self-description of values is also carried out in focus group mapping. Moreover, topics of spatial precision and accuracy are pronounced in participatory mapping. Researchers are left to interpret the exact spatial

extent of, e.g. respondents' point mapping (does a scenic point indicate a specific location such as a hilltop, or a view along a stretch such as an edge, or a scenic characteristic of a larger region?). Additionally, interpretation of precision and accuracy (size of mapping object compared to mapping scale) is an issue of methodological concern in most participatory mapping frameworks (Brown & Pullar 2011, Brown 2005).

GIS-based indicator mapping of recreational experience opportunities will always be an approximation. But the same is true for participatory mapping. Different participatory mapping techniques (e.g. focus group mapping versus Paper GIS mapping) can produce significantly different spatial outputs (Kangas et al. 2008). However, another study found no spatial differences between Paper GIS and Internet GIS participatory mapping (Pocewicz et al. 2011). Participants' perception and mapping of recreational experience opportunities can (intentionally or unintentionally) be formed through the provision of information, as is clearly demonstrated in Paper II, which is in line with findings from other studies (e.g. Brunson & Reiter 1996, Gobster et al. 2007, Jensen 2000, van Marwijk 2008).

A GIS-indicator mapping framework is based on normative assumptions and choices. However, these are expressed as transparent mapping indicators. Based on the use in greater Copenhagen (Paper I) and in Ringsted (Paper III), planners seem to be fully aware of these assumptions. REM information is not regarded as the final "truth" about recreational experience opportunities, but is more regarded as a tool to highlight experience potential in landscapes. In Ringsted (Paper III), REM was used for local trail development. In this process, REM information opened the eyes of experienced planners whom had detailed knowledge of the local landscape based on a long professional career in the municipality. REM focused planners' attention on potential experience opportunities which had not been considered before in the local trail planning process, e.g. the potential of a scenic view from a wooded local small hilltop; the potential view experience of a nearby small lake; a stand of older beech with good opportunities to experience a feeling of forest; and potential noise disturbances from the nearby highway (Paper III).

The discussion related to the advantages and disadvantages of expert frameworks versus participatory frameworks is not necessarily an 'either or' discussion. Participatory and expert mapping can coexist and add to each other in many possible ways. For example, it is possible (and beneficial) to incorporate participatory mapping (e.g. focus group mapping) in the process of REM implementation (recommended in Paper II and Paper III). Such a joint-approach has been applied in Danish municipal landscape character assessment and resulted in the strengthening of identification and mapping of local cultural/historical heritage values (Caspersen 2009). The integration of participatory mapping in REM can improve the basis for a more collaborative REM planning process, and thereby enhance the potential to actually create shared meanings and facilitate collaborative, innovative solutions to the complex planning problem of, e.g. trail development in privately-owned landscapes.

REM and ROS: similarities, differences and lessons

The REM approach is inspired by ROS. The REM use of a spectrum or gradient of experience opportunities based on landscape and facility indicators testifies to this inspiration. However, profound differences also exist between the two frameworks. ROS was developed and designed for implementation in a single jurisdiction area such as a national park or forest reserve, in which classification or zoning is more appropriate compared to a peri-urban region (such as greater Copenhagen), or a Danish municipality (such as Ringsted). In a Danish context, landscapes are in general characterized by mixed land-ownership, multifunctional land use, heterogeneity, dynamics, diverging perceptions, and complex policy and decision making (Busck et al. 2008, Tress & Tress 2001), and ROS inspired recreational experience opportunity zoning would, to put it mildly, be a challenge.

The ROS map output of different management zones was intended as a final planning and management result. However, no such ambitions were intended for the development of REM. REM does not produce a final strategic plan output on which to base the future incorporation of recreational values in planning and management application. REM is intended as an information supply system on landscape recreational experience potential to support various planning and management needs, including: green structure and greenway planning (Paper 1), local trail planning (Paper III), evaluation schemes for recreational values in afforestation (Landskabsværkstedet 2010) and peri-urban landscape character assessment (Viborg Municipality 2009). In other words, REM potentially supports many types of planning and management activities through the conceptualization, measurement and communication of potential recreational experience opportunities. In this perspective, REM is not considered as a traditional planning framework like ROS, or other frameworks for public land recreation planning (McCool et al., 2007).

ROS has become one of the most widely known and successful frameworks in terms of application in planning and management practice worldwide (Driver et al. 1987, Manning 2011, McCool et al. 2007, More & Driver 2005). The success of ROS has, of course, also provoked some criticism. The mapping outcome of ROS is primarily generated manually and then digitized. Only recently was the mapping of the recreational opportunity spectrum in ROS carried out by the use of a variety of data sources and different spatial analyses in GIS (Joyce & Sutton 2009). The ROS map output has been criticised for being on too small a scale to correspond with the scale of other spatial information (Hall et al. 2009, Morse et al. 2009). Further, the renewed interest in place and the increased emphasis on collaborative processes indicate a move away from ‘one-suit-fits-all’ planning models such as ROS (McIntyre et al. 2004). And ROS is simply not site and place specific enough in order to comprehend the diversity and nature of recreational experiences (Kaplan & Kaplan 1989, Patterson et al. 1998).

REM seems to overcome some of these objections. REM is GIS-based and the scale of the map output is flexible (1:100,000 – 1:10,000) and consistent with the scale of other spatial

data. REM is not a 'one-suit-fits-all' planning model, but a flexible information system which potentially can be integrated into collaborative processes. REM is more site-specific than ROS, and a more diverse integration of recreational experiences takes place. However, the GIS-indicator basis of REM is probably still too simplistic to address the hermeneutic criticism levelled by Patterson et al. (1998).

Although the ROS system has been criticised, some of critique represents the very strength of the system in terms of implementation and use in planning practice. ROS is cost-effective, technically possible, and not too complex (e.g. More and Driver 2005), and simplicity is necessary to help ensure implementation (Driver et al 1987). According to McCool et al. (2007):

"A major reason for the broad interest in ROS, we believe, is the collaborative nature of its initial development in the 1970s, involving both scientists (primarily Clark, Stankey, Brown, and Driver) and managers attempting to implement natural resource planning processes mandated by federal-level legislation. By collaborating, managers were able to communicate their needs, scientists were better able to understand these needs, and both were able to design a process that meets these needs" (McCool et al. 2007:58).

In other words, the 'vicious circle' of planning support system application described by Vonk and Geertman (on p. 29) was, in ROS, overcome by close collaboration between developers and users. This is an important lesson, which was taken serious during the collaborative basis for the development of REM.

5.1.3 Application outlook for REM

An application outlook for REM comprises a closer investigation of municipal planning practice including practices related to the use of GIS. The survey findings indicated a surprisingly high level of GIS use in the daily administration and planning of outdoor recreation (70% of municipalities) and also analytical uses of GIS (50% of the municipalities). The need for more GIS use was expressed by the majority of the responding planners. The survey also included a specific question related to the need for more spatial information on recreational experience opportunities:

"I hvilken grad er der behov for øget viden om potentielle oplevelsesmuligheder i kommunens landskaber?" [To what extent is there a need for increased information on potential landscape related experience opportunities?].

Nearly 50% of the planners expressed "a high degree" of need for more information on recreational experience opportunities, 36% "some degree", while below 10% only needed "a small degree" of information or "not at all". Hence, the REM provision of spatial information on experience opportunities seems to be in line with the general request for information from municipal planners. The planners' familiarity with GIS analyses, the need for more GIS use, and the need for more information on experience opportunities, all point

towards rather positive grounds for the future implementation of REM in Danish municipalities.

However, barriers to GIS were also identified. The seniority of planners does not rely on GIS based information, and there seems to be problems associated with cross-collaboration between GIS-specialists and planners, and a perceived need for more GIS training. Parts of these barriers might be related to strategies for GIS application in the municipalities.

The conceptual framework on factors which influence the potentially supportive role of dedicated information, knowledge, and instruments in planning practice (presented in Figure 3) outlines many aspects of the institutional set-up of applied GIS support in planning practice. Most of the highlighted factors, such as the characteristics of policy processes and the specific characteristics of instruments, are related to organizational strategies for GIS application and thereby to the potentially supportive role of REM in planning. There seem to be four organizational strategies for GIS application in the municipalities: (1) to mainly base the use of GIS on intra-departmental expertise, (2) to base the use of GIS on experienced staff in a dedicated GIS-department, (3) to mainly base the use of GIS on an intra web-based GIS service, and finally (4) to outsource GIS services.

The first strategy has the advantage that the relevant, professional expertise (in the present case recreational) – which is required to develop analytical methods – is present in the same office (often the same staff member) where those who have the technical GIS-expertise are located. The disadvantage is that methods often are developed ad hoc, and are therefore rarely standardized or documented. Further, departmentally developed GIS-expertise very often depends on individual staff members, and is therefore vulnerable to staff finding new positions, etc.

The second strategy has the advantage that methods for REM can be developed generically and with respect to in-house standards (software, available data, documentation etc.) when embedded in a municipality GIS department. The disadvantage of organization based on a GIS-department is that specific professional knowledge can be hard to communicate to the dedicated GIS-staff, and issues of cross-collaboration and work procedures between different departments become essential.

The third organizational strategy has the advantage that an intra web-based GIS service is very cost effective, and GIS is easily accessible at every work station in the organization. The disadvantage is that the centralized control of data and the limited editing rights constrain the analytical capabilities and thereby reduce planners' opportunity for firsthand experience with analytical GIS. This lack of analytical experience may hinder the possible future adoption of REM.

The fourth strategy is concerned with the outsourcing of GIS services. Different levels of outsourcing have been implemented, and a few municipalities have outsourced all GIS services to external consultants due to budget cuts. This rather extreme strategy is quite disturbing. Findings in Paper IV clearly show that the planners who request greater use of GIS are employed in municipalities with GIS-departments. Hence, having a GIS-department within the organization affects the planner's awareness of the potential of GIS support (i.e. the opportunity for the planners to experience GIS applied to other planning issues, and thereby to request similar uses of GIS within their own field of expertise).

These strategies do not preclude each other, but rather co-exist in different combinations in most municipalities, which influence the extent of GIS use and the planners' GIS expertise, and the grounds for REM uptake in the municipalities. However, a likely scenario for REM implementation in most municipalities is the use of external consultants who conduct the GIS analyses (to date both COWI and NIRAS consultants have been involved in municipal REM). In order to fully integrate REM as a collaborative planning support system, it is perhaps detrimental to outsource all REM related GIS-analyses to external consultants. The experience from the Ringsted case study (Paper III) clearly demonstrates that a lot of knowledge, information, and discussions among participants are generated during an in-house process of REM. This adaptation process was very important in order to create a shared feeling of ownership of the REM output. Further, close collaboration with GIS-specialists within the municipally can ease the integration of REM in the local Spatial Data Infrastructure (SDI). REM is based on already known data sources which are foremost available from the local planning institution. Hence, the REM output is consistent with other planning and management data with good opportunities for integration of REM data with, e.g. municipal plan data. Data consistency is an important theme in local government SDI, and the development towards spatially enabled e-Governance (e.g. Masser et al. 2008, Nedovic-Budic et al. 2004, Schrøder et al. 2010). SDI integration of REM will improve the integration of spatial information on experience opportunities with other spatial planning information. Many scholars have stated that such knowledge integration is one of the key problems in landscape planning and decision making (e.g. de Groot et al. 2010, Faehnle et al. 2011, Nassauer & Opdam 2008, Raymond et al. 2010, Ryan 2011, Schipperijn et al. 2005). REM integration in a local SDI is, in many ways, the end goal for the application of REM.

Budget cuts and savings are a reality for almost every municipality. Not many planning units have the resources to carry out visitor monitoring (such as participatory mapping processes). This fact is supported by the survey finding (approximately 80% of the municipalities do not perform any form of visitor/user surveys) and hence information on recreational behavior and participation of user groups is seldom incorporated in recreational planning processes (Leberman & Mason 2002). REM is cost effective, relatively feasible

and is hence an affordable way to improve the integration of information on recreational values in policy-making and decision-making.

5.2 Methodological considerations and limitations

5.2.1 REM procedure

A few assumptions and limitations are important to stress when evaluating the REM approach.

As described in section 5.1.1, REM is data driven. The availability and quality of the data input determines the final REM output. The consequence of this fact is underlined in the validity study. The conclusion of poor to zero accordance between REM and visitor mapping of Cultural History (class 5) is a clear result of a lack of available data, i.e. register based data on heritage values only include preserved sites, monuments, and buildings selected by national preservation criteria which do not necessarily reflect local or regional cultural historical experience opportunities related to artefacts such as ruins, old farmsteads, old industrial buildings in the landscape (e.g. tileworks), estate buildings, old water mills and windmills, or intangible values related to local sites of historical events (such as the fount site in the Woodland which was used for collective baptism), which all promote the experience of historicity in a local context (Alumäe et al. 2003). Hence, the national register is not very suitable for expressing cultural historical values at the landscape level. However, it is the only method available.

REM is a normative mapping process. Flexibility and collaboration in the mapping procedure was needed in order to develop a system which would be accepted by end users. This flexibility included the choice of data input, discussion of mapping indicators and recreational experience classes all of which ensured a feeling of ownership and responsibility for implementation. In addition, the outcomes of this thesis recommend further collaboration with affected stakeholders in the mapping procedure and also the adaptation of the mapping approach to local landscape contexts. These high levels of flexibility in the mapping procedure pose a challenge for the scientific basis of the REM concept and methodology. This point is illustrated by the outcome of the collective REM mapping procedure in the seven west Copenhagen municipalities (Vestegnssamarbejdet 2011), described in section 5.1.1.

5.2.2 Participatory mapping

The participatory mapping approach applied in Paper II combines some of the characteristics of the different participatory approaches which are summarized in section 2.3. Inspired by Paper GIS approaches, respondents drew on printed maps which were then digitized in GIS. However, elements of focus group mapping were also incorporated by the use of an open-ended question which addressed the mapping of self described experience opportunities. In contrast to most participatory mapping approaches in the

literature, the on-site context of the mapping procedure made it possible to collect high resolution data, since the respondents were contacted in the area without a time gap between recent experiences and mapping assistance was provided by interviewers for respondents in need. Moreover, a mapping typology was developed which applied different markers for a small site (a number), for a line (marked by a stretch along a trail), and for a value to be found in the whole area (marked by a circle around a number). In most participatory mapping approaches, participants are detached from the in-situ contact with the study site, and the researcher is left with difficulties in interpreting the extent of the area which is related to a single mapping point (Brown & Pullar 2011). However, some of the same challenges and limitations which are encountered in other participatory mapping approaches were also encountered in the approach in Paper II. In particular, the digitization of the mapping outcome involves uncertainties and interpretation when assigning mapped locations to nearest trails. Further, assumptions are made regarding participant understanding of the pre-defined classes, although the on-site context made it possible to assist individual participants with a more elaborate presentation of the mapping procedure and the conceptual idea behind the experience classes compared to mail-based and Internet GIS-based participatory mapping.

5.2.3 Internship and participation observation

Challenges were present during the internship and the participant observation study in Ringsted Municipality. Challenges emerged such as the tactical and practical problem of gaining admittance to the social setting of interest, and, having gained admittance, the question arose of whether or not to pose in the setting as a 'typical' member or to be admitted as a researcher (Veal 2006). Admittance to Ringsted was overcome by using an existing research contact in the planning unit (from the project of Præstholm et al. 2008). The internship was successful in that I was accepted as a member of the planning team, but it quickly became difficult to switch between being a colleague and being a researcher interviewing members of the same planning team. Further, the classic problem of participant impact on the studied processes was also present during the Ringsted study (Schwartz & Schwartz 1955). One of the aims of the internship was to gain knowledge about the daily practice of GIS use, but the stay itself had an influence on this practice. Planners in the working group began to request access to GIS software and to discuss spatial problems and the use of GIS in the search for different planning answers (e.g. the visual impact of planned windmills, distance analyses, etc.). Hence, the balance between participation and observation was a challenge.

5.2.4 Factor analysis

In paper IV, exploratory factor analysis was used to describe three situations of applied GIS use in planning, although Costello & Osborne (2005) have recommended refraining from drawing substantive conclusions based on exploratory factor analysis. The results of the

factor analysis were, therefore, explored in more detail by comparing variables using various statistical tests (Mann Whitney U test, Willis-Kruskal test and Fisher's Exact test).

6 Recommendations for planning practice

Recommendations for planning practice are highly relevant since municipalities have begun REM implementation. The following section aims to provide recommendations concerning the adaptation of REM to variations in local contexts, including differences in landscape context, social context, and planning context. Adaptation to planning context includes recommendations related to the use of GIS, the REM implementation process and the application of REM in collaborative planning.

6.1 REM adaptation

This study points out a few gaps and the need for improvement in REM, which is summarized below class by class.

Wilderness (class 1)

The data on perceived wilderness validates the GIS mapping procedure, including the use of 'nature forest' and 'forest swamp' as GIS mapping indicators. Hence, in landscape contexts which are similar to the Ringsted Municipality study area, no further adjustments are needed in wilderness mapping. However, the data from the Ringsted study also suggested giving attention to trail design in relation to mapping sites for wilderness experience. It seems as though most people map wilderness experiences in connection with a curved track designed for walking instead of a forest road designed for vehicles. This is in line with other research findings, which indicate a preference for curved and narrow trails which allow close contact with a natural setting (Kaplan et al. 1998). Hence, it is recommended to experiment with a new mapping indicator for wilderness experience in the form of *curved and narrow tracks with natural surfaces*.

Feeling of forest (class 2)

Concerning Feeling of Forest, the results emphasize the importance of the landscape context. Hence, it is recommended that the REM approach includes small fragmented woods if they are situated in a non-woodland context; even small woods (a few hectares) can provide the feeling of forest for some visitors in some non-woodland contexts.

Panoramic views (class 3)

The use of 'lake view' and 'hilltops' as mapping indicators for the mapping of panoramic view experiences are validated. In order to reduce intra-class differences, however, the REM approach needs to place more emphasis on the landscape context. Hence, the REM definition and criterion of inclusion of hilltops and other scenic view sites needs to differ based on the landscape context. In a peri-urban landscape context, the GIS procedure needs to be more inclusive, incorporating more view sites, such as view opportunities at the bottom of a river valley. In a more rural lake landscape context, the GIS mapping approach

needs to be more exclusive and strict, and to focus entirely on scenic view experience opportunities within close proximity of the lake shore.

Biodiversity (class 4)

The REM use of the mapping indicator 'nature preservation site' is spatially validated by the visitors. However, an area size criterion for nature preservation sites needs to be considered. Small sites do not provide the experience of biodiversity for most visitors to the Ringsted area. Hence, aggregation of nature preservation areas into a minimum size of a few hectares will enhance the validity of REM in relation to visitor perception.

Cultural history (class 5)

Local cultural historical values are not systematically incorporated into national registers of preserved monuments, which complicate the process of systematically GIS mapping cultural historical values. Hence, the use of participatory mapping is recommended in order to improve the integration of local cultural historical experience opportunities in REM.

Activity and challenge (class 6) and Service and gathering (class 7)

Mapping classes 6 and 7 is the most demanding and time consuming assignment in REM, since only a limited part of the relevant data is available in digital form. Hence, it demands a significant amount of digitalization work in order to incorporate all the facilities which support the experience of physical activity and social interaction. However, based on the REM studies in greater Copenhagen and Ringsted, this assignment is well worth the effort. Physical activity and social interaction are very important experience dimensions and a complete spatial overview of the facilities which promote these experiences is important to many aspects of planning and management (e.g. health policy making, trail planning, tourism planning, leisure planning, urban development, traffic infrastructure planning, nature restoration, impact assessments). Hence, it is recommended that the necessary resources are invested to conduct a complete digital mapping of the facilities which promote accessibility, communication, security and accommodation and the digital mapping of all marked and unmarked routes and tracks for recreational and commuting bicycling; tracks, routes and paths for hiking and city walking; and more specialized trails for sports such as mountain biking or horseback riding on both private and public land.

Disturbances

In greater Copenhagen, noise nuisance levels and other disturbances were incorporated in classes 1, 2 and 3. However, the planners in Ringsted found it more appropriate and useful to create an independent thematic disturbance map. Hence, a new thematic map was produced which included noise from trains, roads and air traffic, and distance criteria from urban areas and technical installations (high voltages lines, windmills, industrial farms). However, it would also be possible to use these mapping indicators to map a new positive

experience class named “Serenity, peace and tranquillity” (by excluding the disturbance areas). This experience class would be in line with other recreational experience mapping approaches (Björk et al. 2008, Brown & Weber 2011, Brown 2005, Gossen & Langers 2000, Kim et al. 2011, Tyrväinen et al. 2007).

6.2 REM implementation process

Based on the Ringsted case study (Paper III) and the investigation of GIS use in the Danish municipalities (Paper IV), the following recommendations are provided concerning the REM implementation process in municipal planning practice.

The findings in Paper III underline the importance of as much in-house collaboration as possible during the REM implementation process. The establishment of a cross-working implementation group is highly recommended. Landscape and recreational planning is multidisciplinary and it is recommended that all relevant departments and units are invited to participate in the process. Such a cross-working group will provide the possibility of integrating all relevant knowledge and information from staff from across different professions in a joint fact-finding process. This process should include a conceptual discussion of the REM approach, a discussion of the mapping indicators, and a discussion of data input. As a result, a collective learning process will be initiated which will form a spatial information platform that helps to create opportunities for shared understanding and shared meanings among participants. This increases the feeling of joint ownership of REM amongst staff, while innovation can be achieved by planners improving the likelihood of REM success in planning practice.

Furthermore, it is recommended that this cross-working group pays particular attention to the inclusion of a GIS specialist from the local GIS Department. The findings from Paper IV stress that planners’ interest and skills in GIS differ, and in particular, the seniority of planners lags behind the use of GIS-based planning support. Hence, in an optimistic perspective, attaching a GIS specialist to the REM implementation process will assist the digital integration of experienced planners’ expert knowledge in REM. Additionally; the REM implementation process can accommodate other aspects of GIS use in a planning organization. Teamwork between the GIS specialist and planners will provide the opportunity to comply with the need for more GIS training, which has been expressed by those planners who are most positively disposed towards GIS use. And finally, the probability of a seamless integration of the final REM product in the local SDI is increased through close collaboration between a local GIS specialist and planners during the REM implementation process.

6.3 Application of REM in collaborative planning

The findings in Paper IV clearly demonstrate that GIS use, including complex and advanced uses of GIS, is more extensive in outdoor recreational planning when the planning process is complex (many partners involved) and when public participation is carried out. This finding emphasizes the importance of GIS in collaborative and communicative planning, and underlines the potential of collaborative and communicative perspectives of REM in planning practice.

As demonstrated in Paper III, landscape and recreational planning is faced with complex and wicked planning problems determined by a diversity of interests, lack of interdependence among stakeholders, and the challenge of performing joint-fact finding and an authentic dialogue (Innes & Booher 2010). REM has the potential to actually create shared meanings and facilitate collaborative, innovative solutions to complex planning problems. In general, REM complies with a planning need for more spatial information for recreational experience opportunities and more GIS use. However, further development of REM is recommended if it is to be integrated into authentic collaboration between planners and stakeholders. In order to integrate all key players and affected stakeholders, more focus on REM as a flexible collaborative GIS application is recommended by incorporating public and NGO knowledge of recreational experience opportunities through participatory mapping.

7 Future research needs

After completing the PhD project, I am left with some unanswered questions and ideas for future research. In the following, suggestions for future research are outlined. The research needs are concerned with both methodological and implementation issues of the REM mapping approach.

The REM approach

As described in section 3.3.1, the definitions of REM mapping indicators are based on normative criteria and assumptions which emerge from an iterative working process with various inputs from, among others, previous research findings, planners' demands, data opportunities, and GIS analytical possibilities. We anticipated that the validity tests in Ringsted (Paper II) would make it possible to adjust the mapping indicators in more detail. That is, an adjustment of, e.g. the forest age criterion in the mapping of extraordinary feeling of forest sites (class 2), and e.g. an adjustment of the minimum area size criterion for nature protection sites to ensure the experience opportunity of wilderness (class 1) and biodiversity (class 4). The validity research design concerning the three validation tests worked very well. However, in order to be fully able to collect adjustment data on, e.g. forest age classes and area sizes, more study sites and more respondents have to be incorporated in a validity test. Hence, with the exception of class 6 (activity) and class 7 (social interaction), more research is still needed into the construction and validity of each single mapping class, which is described below.

Wilderness (class 1)

By far the most wilderness research is carried out in sparsely or unpopulated areas such as remote mountainous areas, national parks or forest reserves (e.g. Flanagan & Anderson 2008, Kliskey 1994, Kliskey 1998, Patterson et al. 1998). However, the research findings presented here and elsewhere (e.g. Lupp et al. 2011) demonstrate the relevance of a research focus on perceived wilderness in old cultural and urbanized landscapes. The spatial character of a wilderness experience in landscape contexts which are determined by peri-urban land use, agriculture, and coastal environments (very relevant in Denmark) is still unexplored in detail compared to wilderness research in more remote and less populated landscapes.

Feeling of forest (class 2)

Older forest stands are used as indicators in the mapping of a feeling of forest sites. In the validity study (Paper II), respondents were asked in-situ for their spatial identification of sites which stimulate a feeling of forest in a woodland setting. The majority of respondents in the Woodland simply stated that the whole area promoted such an experience opportunity. However, this finding might be biased due to the study design and the choice

of case area. The Woodland is characterized by large trees and an advanced stage of stand development (particularly in the most visited parts), and hence, the study was literally a case of "*can't see the wood for the trees.*" Therefore, the reported accordance between REM and visitor perception may be difficult to generalize. The REM use of "older forest" as mapping indicators is in line with general findings on increase in people's preferences for a forest stand with large trees and an advanced stage of stand development (e.g. Gundersen & Frivold 2008, Jensen 1999), although more research may be needed, i.e. a study with a main focus on exploring possible differences between visitor mapping of 'feeling of forest' in different woodland types embedded in different landscape contexts. Spatial value mapping in an urban and rural woodland setting has previously been carried out by Tyrväinen et al. (2007) and Kangas et al. (2008), respectively, but in a Finnish context.

Panoramic views (class 3)

Adjustment of REM class 3 mapping was suggested in Paper II. This suggestion is based on a reported discrepancy between the visitor mapping of view sites along the river stream and REM neglecting of such view experiences due to mapping criteria related to topography and elevation. This is a consequence of the difference between birds-eye view mapping (GIS) and perceived eye-level view mapping (Dramstad et al. 2006, Ryan 2011). Adjustment of the GIS analyses in REM is needed, e.g. through a more detailed measurement of visible space (Weitkamp et al. 2011) and/or analysis of the scenic and beautiful properties of viewshed (Bishop & Hulse 1994, Dramstad et al. 2006, Germino et al. 2001). In addition, data quality and resolution is constantly improving. Recently, airborne laser scanning (LIDAR) has dramatically improved the resolution of digital elevation models (in Denmark from 10m to 1.5m) and made the use of Digital Surface Models possible (i.e. a model which includes all elevation information, e.g. vegetation, urban buildings, etc.).

Biodiversity (class 4)

Experience of Biodiversity is primarily mapped by indicators of expert designation of protected habitats and protected nature types. However, based on the studies in the Woodland and the Valley, it seems as though wildlife viewing is the central experience opportunity in relation to class 4. In Ringsted, the majority of the visitor mapped wildlife viewing sites was in accordance with the expert designation of biodiversity values, and hence, the REM mapping approach was validated. In general, much research has been carried out on wildlife viewing which addresses larger protection areas (e.g. Knight & Gutzwiller 1995) and spatially, focus has mainly been on the sensitivity of wildlife to spatial patterns of recreationists' behavior (e.g. Fernández-Juricic et al. 2005). Exploring spatial accordance between perceived biodiversity values and expert designated biodiversity values has been directly addressed in an Alaskan bay study (Brown et al. 2004). However, more research is needed with a main focus on the accordance between perceived

biodiversity values, i.e. experienced wildlife viewing, and expert designated small scattered protected biotope sites in an agricultural and urbanized landscape setting. This possible discrepancy has been addressed ethically by “the connoisseurs” versus laymen role in the evaluation of species diversity (Arler 2000).

Cultural history (class 5)

This thesis recommends the use of participatory mapping as an approach to identify local tangible and intangible cultural historical experience values in order to supplement available data on national cultural historical values. Research into spatial identification of cultural historical values by participatory mapping has previously been addressed in the context of landscape character assessments (Caspersen 2009), but is still needed in a REM context.

Perceived disturbances

More knowledge into the spatial and perceptual attributes of perceived traffic noise nuisance is needed. Disturbances, including noise nuisance, were not incorporated in the validation study. However, this aspect is central and needs to be further explored. That is, a study with a main focus on the spatial accordance between traffic noise mapping and perceived noise disturbances in different recreational settings.

Effect of landscape context

There is a need for further research with a detailed focus on the spatial differences in REM perception according to different landscape context. That is, a study which is designed to test the REM experience typology in different recreational settings across, e.g. an urban-rural gradient (urban, peri-urban, rural landscape contexts) would contribute to the literature.

Qualitative interview study

The effect of different socio-cultural attributes on perception and experience in relation to the REM experience typology has not been investigated in detail and needs further research. A qualitative study designed to test the possible differences in perceived REM experiences between visitor groups according to, e.g. place attachment, visitors experience use history and recreational activities is needed. Also, different stakeholder perceptions are of relevance, e.g. differences between the perceptions of local recreationists, tourists, farmers, foresters, planners, and/or managers regarding spatial criteria in relation to REM. A qualitative interview study would be appropriate for with the aim of addressing self-described nature experience opportunities in relation to the REM experience typology.

Methodology

This thesis recommends the engagement of the public (visitors, local residents, tourists) and other stakeholders in the mapping procedure through use of participatory mapping. However, a previous study found significant spatial differences in the outcomes of different types of participatory mapping, i.e. differences between focus group mapping and postal survey mapping (Kangas et al. 2008). However, another study found no spatial differences between Paper GIS and Internet GIS participatory mapping (Pocewicz et al. 2011). More research is needed into the different approaches and types of expert mapping and participatory mapping (paper GIS, Internet GIS and focus group), to explore the outcomes of different mapping approaches in the same study area, and thereby to uncover the strengths and weaknesses of the different mapping approaches.

Evaluation of policy relevance of REM

The policy relevance of REM has, in this thesis, been investigated through case studies with a focus on regional green structural planning and local trail planning. However, the level of generalization and deduction on case studies is debated (Flyvbjerg 2006), and the use of other evaluation techniques could further add to the discussion of the usefulness of REM for policy making. For example, of interest are evaluation designs such as experiments of REM-based collaborative decision making in small inter-organizational groups in a conference room setting (Jankowski & Nyerges 2001), or workshops based on group discussions in a Group Decision Room, 'an electronic meeting room', designed to evaluate spatial outputs (like REM) (Weitkamp et al. 2012). A more focused and structured case study on before-after evaluation of REM in planning practice, would also contribute to the evaluation of the policy relevance of REM.

REM in full scale collaborative planning

This thesis argues that REM has the potential to actually create shared meanings and to facilitate collaborative, innovative solutions to complex planning problems. It is recommended to emphasize REM as a flexible spatial information system and to further develop REM through the integration of public and NGO knowledge regarding recreational experience opportunities through participatory mapping. This argument and these recommendations call for the testing of REM in an authentic collaborative planning situation.

8 Conclusion

The recreational experience mapping approach (REM) addresses the GIS-indicator mapping of seven essential recreational experience dimensions (wilderness, feeling of forest, panoramic views, biodiversity, cultural history, activity and challenge, service and gathering). These seven experience dimensions are reflected in the literature and supported by inter-subjectivity through the use of similar experience typologies in other mapping frameworks.

Much work needs to be done before REM can evolve into a widely accepted information basis for landscape and recreational planning. Reliability and validity in relation to different cultural and landscape settings needs to be explored in more detail. The validity of REM (except class 5) has been reported in a Danish context, but clarification is needed on the validity of REM in relation to other landscape and cultural settings in other regions. However, REM is not intended as a universal mapping approach applicable to all landscape contexts and planning and management situations. It is highly recommended to implement REM on the basis of a collaborative process which integrates planning expertise and local knowledge and values into the adaptation of REM to different local/regional landscape and cultural contexts.

The findings in this thesis clearly show that planners in Denmark request more information on experience opportunities and greater use of GIS in the planning process. Further, compared to other possible information and knowledge sources, GIS is used to a high degree by 80% of the planners. In other words, the GIS-based REM approach seems to fulfil the need for planning support as expressed by recreational trail planners. Through using a simple thematic classification, REM can conceptualize measure and communicate experience dimensions and possible urban-related disturbances in landscapes. The REM approach highlights the recreational experience potential in all landscapes, regardless of whether this recreational potential is accessible to the local population and visitors/tourist or not. Using REM in trail planning can help to maximize recreational experience potential; trails improve recreational access to landscapes, and thereby access to new experience opportunities.

The strength of the presented work is its embedding in planning practice. The development of mapping models in close cooperation with the end-user of the mapping result has ensured the successful implementation of REM in planning institutions. During the ongoing implementation of REM in Danish municipalities, as much in-house collaboration during the adaptation process as possible is recommended. The integration of all relevant staff and professions, particularly a GIS specialist, in a joint fact-finding process, including a conceptual discussion of the approach, mapping indicators, and data input is needed.

In order to integrate all key players and affected stakeholders, a greater focus on flexible collaborative GIS application and the incorporation of public and NGO knowledge of recreational experience opportunities through participatory mapping is also recommend. REM has the potential to actually create shared meanings and to facilitate collaborative, innovative solutions to the complex planning problem of, e.g. trail development in privately-owned landscapes, thereby improving public accessibility, recreational experiences, and active living.

9 References

Agger P. 2001. *Access in the post-productivist landscape: the case of Denmark*. Conference proceeding. Public access to natural, agricultural and forest areas. Clermont-Ferrand, France 24.-26. september 2001.

Aitken SC, Michel SM. 1995. Who contrives the 'real' in GIS? Geographic information, planning and critical theory. *Cartography and Geographic Information Systems* 22(1):17-29

Alumäe H, Printsmann A, Palang H. 2003. Cultural and historical values in landscape planning: Locals' perception. In *Landscape Interfaces. Cultural Heritage in changing Landscapes*, ed. H Palang, G Fry, 8:125-145. Kluwer.

Antrop M. 2000. Background concepts for integrated landscape analysis. *Agriculture, Ecosystems & Environment* 77(1-2):17-28

Antrop M. 2005. From holistic landscape synthesis to transdisciplinary landscape management. In *From Landscape Research to Landscape Planning - Aspects of Integration, Education and Application*, ed. B Tress, G Tress, G Fry, P Opdam, 3:27-50. Springer.

Appleton J. 1996. *The Experience of Landscape,* Chichester: John Wiley & Sons Ltd.

Arler F. 2000. Aspects of landscape or nature quality. *Landscape Ecology* 15(3):291-302

Arnstein SR. 1969. A Ladder Of Citizen Participation. *Journal of the American Institute of Planners* 35(4):216-24

Berggren-Bärring AM, Grahn P. 1995. *Grönstrukturens betydelse för användingen.* Institutionen för landskapsplanering, SLU., Alnarp

Beunen R, Opdam P. 2011. When landscape planning becomes landscape governance, what happens to the science? *Landscape and Urban Planning* 100(4):324-6

Beverly JL, Uto K, Wilkes J, Bothwell P. 2008. Assessing spatial attributes of forest landscape values: an internet-based participatory mapping approach. *Canadian Journal of Forest Research* 38(2):289-303

Bishop ID, Hulse DW. 1994. Prediction of scenic beauty using mapped data and geographic information systems. *Landscape and Urban Planning* 30(1-2):59-70

Björk J, Albin M, Grahn P, Jacobsson H, Ardö J et al. 2008. Recreational values of the natural environment in relation to neighbourhood satisfaction, physical activity, obesity and wellbeing. *Journal of Epidemiology and Community Health* 62(4):e2

Brail RK. 2008. *Planning support systems for cities and regions,* Lincoln Institue of Land Policy.

Brömmelstroet Mt. 2009. The relevance of research in planning support systems: a response to Janssen et al. *Environment and Planning B: Planning and Design* 36(1):4-7

Brown G, Weber D. 2011. Public Participation GIS: A new method for national park planning. *Landscape and Urban Planning* 102(1):1-15

Brown GG, Pullar DV. 2011. An evaluation of the use of points versus polygons in public participation geographic information systems using quasi-experimental design and Monte Carlo simulation. *International Journal of Geographical Information Science*:1-16

Brown G, Reed P. 2009. Public Participation GIS: A new method for use in national forest planning. *Forest Science* 55(2):166-82

Brown G. 2006. Mapping landscape values and development preferences: a method for tourism and residential development planning. *International Journal of Tourism Research* 8(2):101-13

Brown G. 2005. Mapping Spatial Attributes in Survey Research for Natural Resource Management: Methods and Applications. *Society and Natural Resources* 18:17-39

Brown G, Smith C, Alessa L, Kliskey A. 2004. A comparison of perceptions of biological value with scientific assessment of biological importance. *Applied Geography* 24(2):161-80

Brown P, Driver B, McConnell C. 1978. The opportunity spectrum in outdoor recreation supply inventories: Background and application., pp. 73-84. USDA Forest Service General Technical Report RM-55.

Brownson RC, Hoehner CM, Day K, Forsyth A, Sallis JF. 2009. Measuring the Built Environment for Physical Activity: State of the Science. *American Journal of Preventive Medicine* 36(4, Supplement 1):S99-S123

Brunson MW, Reiter DK. 1996. Effects of Ecological Information on Judgments about Scenic Impacts of Timber Harvest. *Journal of Environmental Management* 46(1):31-41

Bryan BA, Raymond CM, Crossman ND, MacDonald DH. 2010. Targeting the management of ecosystem services based on social values: Where, what, and how? *Landscape and Urban Planning* 97(2):111-22

Budic Z, Godschalk D. 1994. Implementation and management effectiveness in adoption of GIS technology in local governments. *Computers, Environment and Urban Systems* 18(5):285-304

Buijs AE. 2009. Lay People's Images of Nature: Comprehensive Frameworks of Values, Beliefs, and Value Orientations. *Society & Natural Resources* 22(5):417-32

Buijs AE, Elands BHM, Langers F. 2009. No wilderness for immigrants: Cultural differences in images of nature and landscape preferences. *Landscape and Urban Planning* 91(3):113-23

Busck AG, Kristensen SP, Præstholm S, Primdahl J. 2008. Porous landscapes - The case of Greater Copenhagen. *Urban Forestry & Urban Greening* 7(3):145-56

Carver S, Watson A, Waters T, Matt R, Gunderson K, Davis B. 2009. Developing Computer-Based Participatory Approaches to Mapping Landscape Values for Landscape and Resource Management. In *Planning Support Systems Best Practice and New Methods*, ed. S Geertman, J Stillwell,431-448.

Caspersen OH. 2009. Public participation in stregthening cultural heritage: The role of landscape character assessment in Denmark. *Danish Journal of Geography* 109(1):33-45

Clark R, Stankey G. 1978. The recreation opportunity spectrum: A framework for planning and management., USDA Forest Service Research Paper PNW-98.

Cope M, Elwood S. 2009. Qualitative GIS. A mixed methods approach, Sage.

Costello A, Osborne J. 2005. Best practices in exploratory factor analysis: four recommendations for getting the most from your analysis. *Practical Assessment Research & Evaluation* 10(7)

Council of Europe. 2000. *The European Landscape Convention,* Strasbourg.

Croswell PL. 1991. Obstacles to GIS implementation and guidelines to increase the opportunities for success. *URISA Journal* 3:43-56

Curry N. 1994. *Countryside recreation, access and land use planning,* London, UK: E & FN SPON, Chapman & Hall.

de Groot RS, Alkemade R, Braat L, Hein L, Willemen L. 2010. Challenges in integrating the concept of ecosystem services and values in landscape planning, management and decision making. *Ecological Complexity* 7(3):260-72

de Groot WT, van den Born RJG. 2003. Visions of nature and landscape type preferences: an exploration in The Netherlands. *Landscape and Urban Planning* 63(3):127-38

Dorwart CE, Moore RL, Leung YF. 2010. Visitors' Perceptions of a Trail Environment and Effects on Experiences: A Model for Nature-Based Recreation Experiences. *Leisure Sciences: An Interdisciplinary Journal* 32(1):33-54

Downs R, Stea D. 1973. Cognitive maps and spatial behavior: process and products. In *Image and environment: Cognitive mapping and spatial behaviour*, ed. R Downs, D Stea, 1:8-26. Chicago: Aldine Press.

Dramstad WE, Tveit MS, Fjellstad WJ, Fry GLA. 2006. Relationships between visual landscape preferences and map-based indicators of landscape structure. *Landscape and Urban Planning* 78(4):465-74

Dramstad WE, Fjellstad WJ. 2011. Landscapes: Bridging the gaps between science, policy and people. *Landscape and Urban Planning* 100(4):330-2

Driver B. 2003. Experiences. In *Encyclopedia of leisure and outdoor recreation*, ed. JM Jenkins, JJ Pigram,168-171. London: Routledge, Taylor & Francis Group.

Driver B, Tinsley H, Manfredo M. 1991. The paragraphs about leisure and recreation experience preference scales: results from two inventories designed to assess the breadth of the perceived psychological benefits of leisure. In *Benefits of leisure*, ed. B Driver, PJ Brown, G Peterson,263-286. State College, PA: Venture.

Driver BL. Master list of items for Recreation Experience Preference scales and domains. USDA Forest Service, fort Collins, CO: Rocky Mountain Forest and Range Experiment Station. 1983.

Ref Type: Internet Communication

Driver BL, Brown PJ, Stankey GH, Gregoire TG. 1987. The ROS Planning System: Evolution, Basic Concepts, and Research Needed. *Leisure Sciences* 9:201-12

Drummond WJ, French SP. 2008. The Future of GIS in Planning: Converging Technologies and Diverging Interests. *Journal of the American Planning Association* 74(2):161-74

Edwards P, Tsouros A. 2006. Promoting physical activity and active living in urban environments. The role of local governments, World Health Organization.

Eyler AA, Brownson RC, Evenson KR, Levinger D, Maddock JE et al. 2008. Policy Influences on Community Trail Development. *Journal of Health Politics Policy and Law* 33(3):407-27

Faehnle M, Bäcklund P, Tyrväinen L. 2011. Looking for the role of nature experiences in planning and decision making: a perspective from the Helsinki metropolitan area. *Sustainability: Science, Practice, & Policy* 7(1):45-55

Fernández-Juricic E, Venier MP, Renison D, Blumstein DT. 2005. Sensitivity of wildlife to spatial patterns of recreationist behavior: A critical assessment of minimum approaching distances and buffer areas for grassland birds. *Biological Conservation* 125(2):225-35

Flanagan TS, Anderson S. 2008. Mapping perceived wilderness to support protected areas management in the San Juan National Forest, Colorado. *Forest Ecology and Management* 256(5):1039-48

Flyvbjerg B. 2006. Five misunderstandings about case-study research. *Qualitative Inquiry* 12(2):219-45

Folke C, Hahn T, Olsson P, Norberg J. 2005. Adaptive governance of social-ecological systems. *Annu. Rev. Environ. Resourc.* 30(1):441-73

Forest and Nature Agency, Plan09. 2009. *Skovrejsning i kommuneplanlægningen,* Skov- & Naturstyrelsen, Miljøministeriet, Plan09, Realdania.

Fry G, Tveit MS, Ode +, Velarde MD. 2009. The ecology of visual landscapes: Exploring the conceptual common ground of visual and ecological landscape indicators. *Ecological Indicators* 9(5):933-47

Ganapati S. 2010. Public Participation Geographic Information Systems: A Literature Survey. In *Comparative E-Government*, ed. CG Reddick,449-466. Springer New York.

Geertman S, Stillwell J. 2009a. Planning Support Systems: Best practice and new methods, GeoJournal, Springer.

Geertman S, Stillwell J. 2009b. Planning Support Systems: Content, Issues and Trends. In *Planning Support Systems. Best Practice and New Methods*, ed. S Geertman, J Stillwell, 1:1-26

Geertman S. 2008. Planning support systems. A planners perspective. In *Planning support systems for cities and regions*, ed. RK Brail, 10:213-274. Lincoln Institute of Land Policy.

Geertman S. 2006. Potentials for planning support: a planning-conceptual approach. *Environment and Planning B: Planning and Design* 33(6):863-80

Geertman S. 1999. Geographical information technology and strategic physical planning. In *Geographical information and planning*, ed. J Stillwell, S Geertman, S Openshaw, 4:69-86. Springer.

Germino MJ, Reiners WA, Blasko BJ, McLeod D, Bastian CT. 2001. Estimating visual properties of Rocky Mountain landscapes using GIS. *Landscape and Urban Planning* 53(1-4):71-83

Gill S, Higgs G, Nevitt P. 1999. GIS in planning departments: Preliminary results from a survey of local planning authorities in Wales. *Planning Practice and Research* 14(3):341-61

Gobster P, Nassauer J, Daniel T, Fry G. 2007. The shared landscape: what does aesthetics have to do with ecology? *Landscape Ecology* 22(7):959-72

Gobster PH, Westphal LM. 2004. The human dimensions of urban greenways: planning for recreation and related experiences. *Landscape and Urban Planning* 68(2-3):147-65

Gossen M, Langers F. 2000. Assessing quality of rural areas in the Netherlands: finding the most important indicators for recreation. *Landscape and Urban Planning* 46:241-51

Grahn P. 1991. Landscapes in our minds: people's choice of recreation places in towns. *Landscape Research* 16:11-9

Grahn P, Stigsdotter UK. 2010. The relation between perceived sensory dimensions of urban green space and stress restoration. *Landscape and Urban Planning* 94(3-4):264-75

Gundersen VS, Frivold LH. 2008. Public preferences for forest structures: A review of quantitative surveys from Finland, Norway and Sweden. *Urban Forestry & Urban Greening* 7(4):241-58

Gunderson K, Watson A. 2007. Understanding Place Meanings on the Bitterroot National Forest, Montana. *Society & Natural Resources: An International Journal* 20(8):705-21

Göcmen ZA, Ventura SJ. 2010. Barriers to GIS Use in Planning. *Journal of the American Planning Association* 76(2):172-83

Hahn T, Olsson P, Folke C, Johansson K. 2006. Trust-building, Knowledge Generation and Organizational Innovations: The Role of a Bridging Organization for Adaptive Comanagement of a Wetland Landscape around Kristianstad, Sweden. *Human Ecology* 34(4):573-92

Hall TE, Farnum JO, Slider TC, Ludlow K. 2009. New approaches to forest planning: Inventorying and mapping place values in the Pacific Northwest Region. *USDA, Research Note* PNW-RN-562

Hall CM, Page SJ. 2006. The geography of tourism & recreation. Environment, place and space, London: Routledge.

Hansen KB, Nielsen TS. 2005. *Natur og grønne områder forebygger stress,* Skov & Landskab, KVL.

Hansen SS, Olafsson AS, Caspersen OH. 2010. *Ladskabskarakterkortlægning i praksis. Eksempler fra Ringsted Kommune (2),* Videnblade By og land, 9.4-20. Skov & Landskab.

Hansen-Møller J, Oustrup L. 2004. Emotional, Physical/Functional and Symbolic Aspects of an Urban Forest in Denmark to Nearby Residents. *Scandinavian Journal of Forest Research* 19(4 supp 4):56-64

Healey P. 1997. Collaborative planning. Shaping places in fragmented societies, MacMillan Press LTD.

Herrick C. 2009. Designing the fit city: public health, active lives, and the (re)instrumentalization of urban space. *Environment and Planning A* 41(10):2437-54

Højring K. 2002. The right to roam the countryside - law and reality concerning public access to the landscape in Denmark. *Landscape and Urban Planning* 59(1):29-41

Howley P, Doherty E, Buckley C, Hynes S, van Rensburg T, Green S. 2012. Exploring preferences towards the provision of farmland walking trails: A supply and demand perspective. *Land Use Policy* 29(1):111-8

Hull RB. 2001. Public Understandings of Nature: A Case Study of Local Knowledge About "Natural" Forest Conditions. *Society & Natural Resources* 14(4):325-40

HUR. 2006. Vestskovkilens forlængelse - Kileplan (West Forest wedge enlargement - wedge plan) (In Danish), Valby: HUR plan.

Ilbery B, Saxena G. 2009. Evaluating 'best practice' in integrated rural tourism. Case examples from the England - Wales border region. *Environment and Planning A* 41:2248-66

Innes JE. 1998. Information in communicative planning. *Journal of the American Planning Association* 64(1):52-63

Innes JE, Booher DE. 2010. Planning with complexity. An introduction to collaborative rationality for public policy, London and New York: Routledge, Taylor & Francis Group.

Jankowski P. 2009. Towards participatory geographic information systems for community-based environmental decision making. *Journal of Environmental Management* 90(6):1966-71

Jankowski P, Nyerges T. 2001. GIS-Supported Collaborative Decision Making: Results of an Experiment. *Annals of the Association of American Geographers* 91(1):48-70

Jensen FS. 2003. *Friluftsliv i 592 skove og andre naturområder,* Skovbrugsserien nr 32, Skov & Landskab, Miljøministeriet.

Jensen FS. 2000. The effects of information on Danish forest visitors' acceptance of various management actions. *Forestry* 73(2):165-72

Jensen FSn, Koch NE. 2004. Twenty-five Years of Forest Recreation Research in Denmark and its Influence on Forest Policy. *Scandinavian Journal of Forest Research* 19(4 supp 4):93-102

Jensen FS. 1998. *Friluftsliv i det åbne land 1994/95*. *Rep. 25*, Forskningscenteret for Skov & Landskab, Miljø- og Energiministeriet, Hørsholm

Jensen FS. 1999. *Forest recreation in Denmark from the 1970s to the 1990s,* Hørsholm: Forskningscentret for Skov & Landskab, Miljø- og Energiministeriet.

Jensen FS, Koch NE. 1997. *Friluftsliv i skovene 1976/77-1993/94*. *Rep. 20*, Forskningscenteret for Skov & Landskab, Hørsholm

Johnson PA, Sieber RE. 2011. Negotiating constraints to the adoption of agent-based modeling in tourism planning. *Environment and Planning B: Planning and Design* 38(2):307-21

Joyce K, Sutton S. 2009. A method for automatic generation of the Recreation Opportunity Spectrum in New Zealand. *Applied Geography* 29(3):409-18

Kaae B, Madsen LM. 2003. *Holdninger og ønsker til Danmarks natur.* Forskningscentret for Skov & Landskab, Miljøministeriet.,

Kajala L, Almik A, Dahl R, Diksaité L, Erkkonen J et al. 2007. *Visitor monitoring in nature areas. A manual based on experiences from the Nordic and Baltic countries,* Swedish environmental Protection Agency, Nordic Council of Ministers.

Kangas A, Haapakoski R, Tyrväinen L. 2008. Integrating place-specific social values into forest planning: case of UPM-Kymmene forests in Hyrynsalmi, Finland. *Silva Fennica* 42(5):773-90

Kaplan R, Austin M. 2004. Out in the country: sprawl and the quest for nature nearby. *Landscape and Urban Planning* 69:235-43

Kaplan R, Kaplan S, Ryan RL. 1998. *With People in Mind. Design and management of everyday nature,* Washington, D.C.: Island Press.

Kaplan R, Kaplan S. 1989. *The Experience of Nature,* New York: Cambridge University Press.

Kellert S, Wilson E. 1993. *The Biophilia Hypothesis,* Washington, DC: Islands Press.

Kim dJ, Albin M, Skärbäck E, Grahn P, Wadbro J et al. 2011. Area-aggregated assessments of perceived environmental attributes may overcome singlesource bias in studies of green environments and health: results from a cross-sectional survey in southern Sweden. *Environmental Health: A Global Access Science Source* 10(1):1-11

Kirtland KA, Porter DE, Addy CL, Neet MJ, Williams JE et al. 2003. Environmental measures of physical activity supports: Perception versus reality. *American Journal of Preventive Medicine* 24(4):323-31

Kjøller M, Juel K, Kamper-Jørgensen F. 2007. *The public health report Denmark 2007,* National Institute for Public Health, University of Southern Denmark.

Kliskey AD. 1998. Linking the Wilderness Perception Mapping Concept to the Recreation Opportunity Spectrum. *Environmental Management* 22(1):79-88

Kliskey AD. 1994. A Comparative Analysis of Approaches to Wilderness Perception Mapping. *Journal of Environmental Management* 41(3):199-236

Klosterman RE. 2001. Planning support systems: a new perspective on computer-aided planning. In *Planning support systems: integrating geographic information systems, models and visualisation tools*, ed. RK Brail, RE Klosterman, 1:1-23. New York: ESRI.

Knight RL, Gutzwiller KJ. 1995. Wildlife and recreationists: coexistence through management and research, Island Press.

Koch NE, Jensen FS. 1988. *Skovenes friluftsfunktion i Danmark. IV. Del Befolkningens ønsker til skovenes og det åbne lands udformning.,* København: Særtryk af Det forstlige Forsøgsvæsen i Danmark, beretning nr. 351, bd. XLI, h.3.

Kristensen SPB, Busck AG, Præstholm S. 2011. *Landskab og planlægning - analyse af landskabets rolle i kommuneplanlægningen indtil kommunalreformen i 2007,* Institut for Geografi og Geologi, Københavns Universitet. Center for strategisk Byforskning - Working Paper 22.

Landskabsværkstedet. 2010. Skovrejsninger fra 1990'erne – et eftersyn [Afforestations in the 1990'ties: An examination], Landskabsværkstedet.

Leberman SI, Mason P. 2002. Planning for recreation and tourism at the local level: Applied research in the Manawatu region of New Zealand. *Tourism Geographies: An International Journal of Tourism Space, Place and Environment* 4(1):3-21

Leslie E, Sugiyama T, Ierodiaconou D, Kremer P. 2010. Perceived and objectively measured greenness of neighbourhoods: Are they measuring the same thing? *Landscape and Urban Planning* 95(1-2):28-33

Lindholst AC, Dempsey N, Burton M. 2011. Introducing a method for mapping recreational experience. *Manuscript in review for Urban Design and Planning*

Lupp G, Höchtl F, Wende W. 2011. "Wilderness" - A designation for Central European landscapes? *Land Use Policy* 28(3):594-603

Lynch K. 1960. *The image of the city,* Cambridge, Massachusetts: The MIT Press.

MacEachren AM. 2000. Cartography and GIS: facilitating collaboration. *Progress in Human Geography* 24(3):445-56

MacEachren AM, Brewer I. 2004. Developing a conceptual framework for visually-enabled geocollaboration. *International Journal of Geographical Information Science* 18(1):1-34

Macintyre S, Macdonald L, Ellaway A. 2008. Lack of agreement between measured and self-reported distance from public green parks in Glasgow, Scotland. *International Journal of Behavioral Nutrition and Physical Activity* 26(5)

Manfredo MJ, Driver BL. 1996. Measuring leisure motivation: A meta-analysis of the recreation experience preference scales. *Journal of Leisure Research* 28(3):188

Manning RE. 2011. Studies in outdoor recreation. Search and research for satisfaction., Oregan State University Press.

Masser I, Rajabifard A, Williamson I. 2008. Spatially enabling governments through SDI implementation. *International Journal of Geographical Information Science* 22(1):5-20

McCool SF, Clark RN, Stankey GH. 2007. *An assessment of frameworks useful for public land recreation planning,* General Technical Report, PNW-GTR-705. USDA, Forest Service, Pacific Northwest Research Station.

McIntyre N, Moore J, Yuan M. 2008. A Place-Based, Values-Centered Approach to Managing Recreation on Canadian Crown Lands. *Society & Natural Resources: An International Journal* 21(8):657-70

McIntyre N, Yuan M, Payne R, Moore J. 2004. Development of a value-based approach to managing recreation on Canadian Crown Lands. In *Proceedings of the Second International Conference on Monitoring and Management of Visitor Flows in Recreation and Protected Areas. June 16-20, 2004. Rovaniemi, Finland*, ed. T Sievenen, J Errkonen, J Saarinen, S Tuulentie, E Virtanen,291-299. Finnish Forest Research Institute.

Ministry of environment. 2011. *Oversigt over statslige interesser i kommuneplanlægningen 2013,* Naturstyrelsen, Miljøministeriet.

More RL, Driver BL. 2005. Introduction to outdoor recreation. Providing and managing natural resource based opportunities, Pennsylvania, USA: Venture.

Morse W, Hall T, Kruger L. 2009. Improving the Integration of Recreation Management with Management of Other Natural Resources by Applying Concepts of Scale from Ecology. *Environmental Management* 43(3):369-80

Nassauer J, Opdam P. 2008. Design in science: extending the landscape ecology paradigm. *Landscape Ecology* 23(6):633-44

Nedovic-Budic Z. 1999. Evaluating the Effects of GIS Technology: Review of Methods. *Journal of Planning Literature* 13(3):284-95

Nedovic-Budic Z, Feeney ME, Rajabifard A, Williamson I. 2004. Are SDIs serving the needs of local planning? Case study of Victoria, Australia and Illinois, USA. *Computers, Environment and Urban Systems* 28(4):329-51

Ode Å, Hagerhall CM, Sang N. 2010. Analysing Visual Landscape Complexity: Theory and Application. *Landscape Research* 35(1):111-31

Olsson P, Folke C, Berkes F. 2004. Adaptive Comanagement for Building Resilience in SocialÎ¯ÇôEcological Systems. *Environmental Management* 34(1):75-90

Palmer JF. 2004. Using spatial metrics to predict scenic perception in a changing landscape: Dennis, Massachusetts. *Landscape and Urban Planning* 69(2-3):201-18

Palmer JF, Hoffman RE. 2001. Rating reliability and representation validity in scenic landscape assessments. *Landscape and Urban Planning* 54(1-4):149-61

Patterson ME, Watson A, Williams DR, Roggenbuck JR. 1998. An hermeneutic approach to studying the nature of wilderness experiences. *Journal of Leisure Research* 30(4):423-52

Pigram JJ, Jenkins JM. 2006. *Outdoor recreation management,* London: Routlegde, Taylor & Francis Group.

Pocewicz A, Nielsen-Pincus M, Brown G, Schnitzer R. 2011. An evaluation of internet versus paper-based methods for public participation geographic information systems (PPGIS). *Transactions in GIS* Accepted for publication

Præstholm S, Busck AG, Kristensen SP. 2008. Landskab og planlægning. Analyse af kommuneplanlægningen og samspil mellem planaktører i Ringsted kommune, Center for Strategisk Byforskning.

Præstholm S, Jensen FS, Hasler B, Damgaard C, Erichsen E. 2002. Forests improve qualities and values of local areas in Denmark. *Urban Forestry & Urban Greening* 1(2):97-106

Ramsey K. 2009. GIS, modeling, and politics: On the tensions of collaborative decision support. *Journal of Environmental Management* 90(6):1972-80

Raymond C, Brown G. 2007. A Spatial Method for Assessing Resident and Visitor Attitudes Towards Tourism Growth and Development. *Journal of Sustainable Tourism* 15(5):520-40

Raymond CM, Bryan BA, MacDonald DH, Cast A, Strathearn S et al. 2009. Mapping community values for natural capital and ecosystem services. *Ecological Economics* 68(5):1301-15

Raymond CM, Fazey I, Reed MS, Stringer LC, Robinson GM, Evely AC. 2010. Integrating local and scientific knowledge for environmental management. *Journal of Environmental Management* 91(8):1766-77

Ritter LA, Sue VM. 2007. Introduction to using online surveys. *New Directions for Evaluation* 2007(115):5-14

RTK. 2001. Upplevelsevärden. Sociala kvaliteter i den regionala grönstrukturen. Rep. 4, Regionplane- och trafikkontoret, Stockholm

RTK. 2004. *Upplevelsevärden i Stockholmsregionens gröna kilar*. *Rep. 1-10*, Regionplane- och trafikkontoret, Stockholm

Ryan RL. 2011. The social landscape of planning: Integrating social and perceptual research with spatial planning information. *Landscape and Urban Planning* 100(4):361-3

Schasberger MG, Hussa CS, Polgar MF, McMonagle JA, Burke SJ, Gegaris Jr AJ. 2009. Promoting and Developing a Trail Network Across Suburban, Rural, and Urban Communities. *American Journal of Preventive Medicine* 37(6, Supplement 2):S336-S344

Schipperijn J. 2010. *Use of urban green space*. Faculty of LIFE Sciences, University of Copenhagen.

Schipperijn J, Pillmann W, Tyrväinen L, Mäkinen K, O'Sullivan R. 2005. Information for urban forest planning and management. In *Urban forest and trees*, ed. CC Konijnendijk, K Nilsson, T Randrup, J Schipperijn, 14:398-417. The Netherlands: Springer.

Schrøder L, Hvingel L, Hansen H. 2010. E-Government and Geographical Information Based Collaboration Patterns. In *Electronic Government and the Information Systems Perspective*, ed. K Andersen, E Francesconi, Å Grönlund, T van Engers,204-218. Springer Berlin / Heidelberg.

Schwartz MS, Schwartz CG. 1955. Problems in Participant Observation. *American Journal of Sociology* 60(4):343-53

Scott M, Evenson K, Cohen D, Cox C. 2007. Comparing Perceived and Objectively Measured Access to Recreational Facilities as Predictors of Physical Activity in Adolescent Girls. *Journal of Urban Health* 84(3):346-59

Sehested K, Groth NB, Caspersen OH. 2009. Evaluering af kommuneplanstrategier. Notat 3: Case-beskrivelser - Tværgående analyse - Konklusion., Arbejdsrapport Skov & Landsskab nr 63-2009.

Selman P. 2006. *Planning at the landscape scale,* Routledge, Taylor & Francis Group.

Sherrouse BC, Clement JM, Semmens DJ. 2011. A GIS application for assessing, mapping, and quantifying the social values of ecosystem services. *Applied Geography* 31(2):748-60

Sieber R. 2006. Public Participation Geographic Information Systems: A Literature Review and Framework. *Annals of the Association of American Geographers* 96(3):491-507

Ståhle A. 2000. Sociotop som redskap i grönområdesplanering., Stadsbyggnads kontoret.

Sugiyama T, Leslie E, Giles-Corti B, Owen N. 2008. Associations of neighbourhood greenness with physical and mental health: do walking, social coherence and local social interaction explain the relationships? *Journal of Epidemiology and Community Health* 62(5):e9

Swanwick C. 2009. Society's attitudes to and preferences for land and landscape. *Land Use Policy* 26(Supplement 1):S62-S75

te Brömmelstroet M, Bertolini L. 2008. Developing land use and transport PSS: Meaningful information through a dialogue between modelers and planners. *Transport Policy* 15(4):251-9

te Brömmelstroet M, Schrijnen PM. 2010. From planning support systems to mediated planning support: a structured dialogue to overcome the implementation gap. *Environment and Planning B: Planning and Design* 37(1):3-20

The government. 2006. Regeringens naturpolitiske redegørelse 2006 [The government's nature policy statement], Miljøministeriet.

The government. 2009. *Grøn vækst,* Økonomi- og Erhvervsministeriet.

Tress B, Tress G. 2001. Capitalising on multiplicity: a transdisciplinary systems approach to landscape research. *Landscape and Urban Planning* 57(3-4):143-57

Tveit M, Ode Å, Fry G. 2006. Key Concepts in a Framework for Analysing Visual Landscape Character. *Landscape Research* 31(3):229-55

Tyrväinen L, Mäkinen K, Schipperijn J. 2007. Tools for mapping social values of urban woodlands and other green areas. *Landscape and Urban Planning* 79(1):5-19

Tyrväinen L, Miettinen A. 2000. Property Prices and Urban Forest Amenities. *Journal of Environmental Economics and Management* 39(2):205-23

Ulrich RS. 1983. Aesthetic and affective response to natural environment. In *Human behaviour and the environment*, ed. I Altman, JF Wohlwill,85-125. New York: Plenum.

Uran O, Janssen R. 2003. Why are spatial decision support systems not used? Some experiences from the Netherlands. *Computers, Environment and Urban Systems* 27(5):511-26

van Dam F. 2000. Revealed and stated preferences for rural living. Evidence from the Netherlands. In *Claiming Rural Identities. Dynamics, contexts, policies.*, ed. T Haartsen, P Groote, PPP Huigen, 8:80-91.

van den Berg AE, Koole SL. 2006. New wilderness in the Netherlands: An investigation of visual preferences for nature development landscapes. *Landscape and Urban Planning* 78(4):362-72

Van Herzele A, van Woerkum C. 2011. On the argumentative work of map-based visualisation. *Landscape and Urban Planning* 100(4):396-9

van Marwijk R. 2008. Walkers' perspectives on nature management strategies: Nature restoration in a national park. In *Landscape, Leisure and Tourism*, ed. H de Haan, R van der Duim, 8:113-126. Delft: Eburon.

Vaughan DR, Farr H, Slee DRW. 2000. Estimating and interpreting the local economic benefits of visitor spending: an explanation. *Leisure Studies* 19(2):95-118

Veal AJ. 2006. Research methods for leisure and tourism. A practical guide, FT Prentice Hall.

Veal AJ. 2002. Leisure and tourism policy and planning, UK: CABI Publishing.

Vejre H, Jensen FSn, Thorsen BJ. 2010. Demonstrating the importance of intangible ecosystem services from peri-urban landscapes. *Ecological Complexity* 7(3):338-48

Vejre H, Primdahl J, Brandt J. 2007. The Copenhagen Finger Plan. In *Europe's living landscapes. Essays exploring our identity in the countryside*, ed. B Pedroli, A van Doorn, G de Blust, ML Paracchini, D Wascher, F Bunce, 19:310-328. Wageningen: KNNV.

Verburg PH, van de Steeg J, Veldkamp A, Willemen L. 2009. From land cover change to land function dynamics: A major challenge to improve land characterization. *Journal of Environmental Management* 90(3):1327-35

Vestegnssamarbejdet. 2011. Oplevelsesværdier – kortlægning og afrapportering af oplevelsesværdier på Vestegnen [Outdoor recreation experiences – mapping and summarize of findings on Vestegnen]., Åbent land gruppen Vestegnssamarbejdet og Niras.

Viborg Municipality. 2009. *Kommuneplan 2009-2020*. Bilag 2: Kortlægning af oplevelsesværdier [Municipal plan 2009-2020: Appendix 2: Recreation experience mapping], Viborg Kommune.

Vonk G, Geertman S. 2008. Improving the adoption and use of planning support systems in practice. *Applied Spatial Analysis* 1:153-73

Vonk G, Geertman S, Schot P. 2007. A SWOT analysis of planning support systems. *Environment and Planning A* 39(7):1699-714

Vonk G, Geertman S, Schot P. 2007. New technologies stuck in old hierarchies: The diffusion of geo-information technologies in Dutch public organizations. *Public Administration Review* 67(4):745-56

Vonk GA, Geertman SCM, Schot PP. 2005. Bottlenecks blocking widespread usage of planning support systems. *Environment and Planning A* 37(5):909-24

Vonk G, Ligtenberg A. 2010. Socio-technical PSS development to improve functionality and usability--Sketch planning using a Maptable. *Landscape and Urban Planning* 94(3-4):166-74

Vonk GA. 2006. *Improving Planning Support*. PhD thesis, Faculty of Geosciences, Utrecht University.

Weitkamp G, Bregt A, Van Lammeren R. 2011. Measuring Visible Space to Assess Landscape Openness. *Landscape Research* 36(2):127-50

Weitkamp G, van den Berg AE, Bregt AK, Van Lammeren RJA. 2012. Evaluation by policy makers of a procedure to describe perceived landscape openness. *Journal of Environmental Management* 95(1):17-28

Willemen L, Verburg PH, Hein L, van Mensvoort MEF. 2008. Spatial characterization of landscape functions. *Landscape and Urban Planning* 88(1):34-43

Wilson E. 1984. *Biophilia,* Cambridge: Harvard University Press.

Wright DJ, Duncan SL, Lach D. 2009. Social Power and GIS Technology: A Review and Assessment of Approaches for Natural Resource Management. *Annals of the Association of American Geographers* 99(2):254-72

LIST OF PAPERS

Paper I:
Caspersen, O.H. & Olafsson, A.S. 2010. Recreational mapping and planning for enlargement of the green structure in greater Copenhagen, Urban Forestry & Urban Greening 9, 101-112.

Paper II:
Olafsson, A.S., Shipperijn, J., Caspersen, O.H. & Jensen, F.S. Validation of GIS-based recreation experience mapping. Submitted to Landscape Research. Not published jet.

Paper III:
Olafsson, A.S & Kristensen, L.S. Collaborative rationality and GIS-based recreational experience mapping in municipal trail planning practice in Denmark. Submitted to Land Use Policy. Not published jet.

Paper IV:
Olafsson, A.S. & Skov-Peteren, H. The use of GIS-based support of recreational trail planning by local governments. Applied Spatial Analysis and Policy (In review).

The four papers are not included in this version of the thesis due to copyright.

Appendix

A. REM mapping indicators and data sources

B. REM map output

C. Interview manual for on-site survey (in Danish)

D. Survey with municipal recreation planners (in Danish)

A. REM mapping indicators and data sources

REM overview of mapping indicators, data sources, and GIS analyses in the greater Copenhagen study (Paper I).

Experience class	Map based indicator	Elaboration, GIS criteria (data source a)
1. Wilderness	Nature forest	National designation (SA)
	Forest swamp	Overlay tree cover and wet areas (GA)
	Old growth deciduous forest	Minimum 200 years (GA)
	Old growth coniferous forest	Minimum 100 years (GA)
	Silent area	Maximum 45 dB(A) traffic noise from road, rail, air (SA, CD)
	Minimum distance to urban land use	250 meter (GA)
	Minimum distance to high voltage line	75 meter (GA)
2. Feeling of forest	Compact forest	Minimum 5 ha, 50 meters inside buffer (GA)
	Deciduous forest	Minimum 40 years (GA)
	Coniferous forest	Minimum 50 years (GA)
	Silent area	Maximum 55 dB(A) traffic noise from road, rail, air (SA, CD)
	Minimum distance to high voltage line	75 meter (GA)
3. Panoramic views, water and scenery	Hill top with viewing potential	Analysis based on digital terrain model and more (GA)
	Lake- and sea shore	Buffer analysis (GA)
	Lake and sea surface	Minimum 6 ha (GA)
	Coherent open landscape	Minimum 6 ha (GA)
	Silent area	Maximum 55 dB(A) traffic noise from road, rail, air (SA,CD)
4. Biodiversity and land form	Wood edge and lake shore	25 meter (GA)
	National nature protection area	Bog, marsh, moor and meadow, all minimum 0.25 ha Ponds min. 0.1 ha and most streams (CD)
	International nature protection area	Natura 2000 designation (SA)
	Distinctive geomorphologic feature	Esker, moraine, hummocky, tunnel valley, and more (SA)
	Geological hot spot	Gravel pit, coast slops, boulder and more (SA, CD)
5. Cultural history	Cultural historical building	Church, manor, windmill, watermill, protected farms and more (SA)
	Church surroundings	Designation (CD)
	Well preserved village	Regional assessment and designation

		(CD)
	Barrow	Burial mound, cairn (CD)
	Dike	Stone dike and earth walls (CD)
	Historical path	Closed railway line, road with historical significance (CD)
	Cultural environment	Designation on county level (CD)
	Cultural historical land use type	Meadow, pasture, grazing forest (SA, CD)
6. Activity and challenge	Intensive activity area	Golf court, urban green areas, football field and more (SA, CD)
	Intensive activity location	Outdoor swimming, nature playground, camp site (SA, CD)
	Footpaths and tracks	Walking paths in urban, open and forested areas (SA, CD)
	Routes and other paths	Route and paths for biking and horseback riding (CD, SA)
	Waterways, lakes and sea	Kayaking, canoeing, sailing allowed (SA, CD)
7. Service and gathering	Accessibility facility	Parking area, bus and train stop (CD)
	Communication facility	Information sign, tourist office, nature exhibition, visitors farm, nature school (SA, CD)
	Security facility	Camp fire, bird tower, beach, lifeguard, toilet, tea garden, table and bench set (SA, CD)
	Accommodation facility	Camp site, camping ground, B&B, hostel, hotel (SA)

[a] County Designation (CD), State Agencies (SA), GIS Analysis (GA)

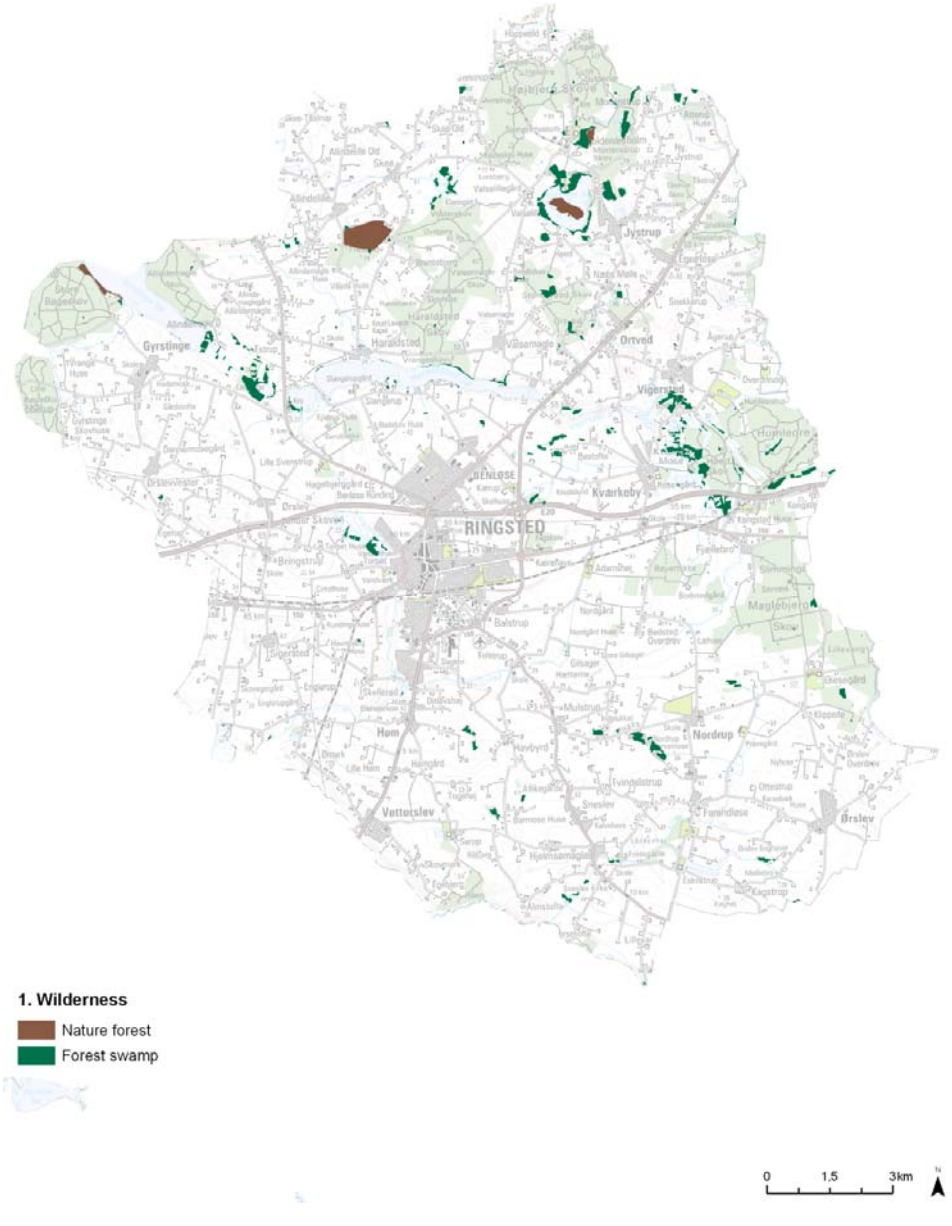
REM overview of mapping indicators, data sources, and GIS analyses in the Ringsted Municipality study (Paper II and III).

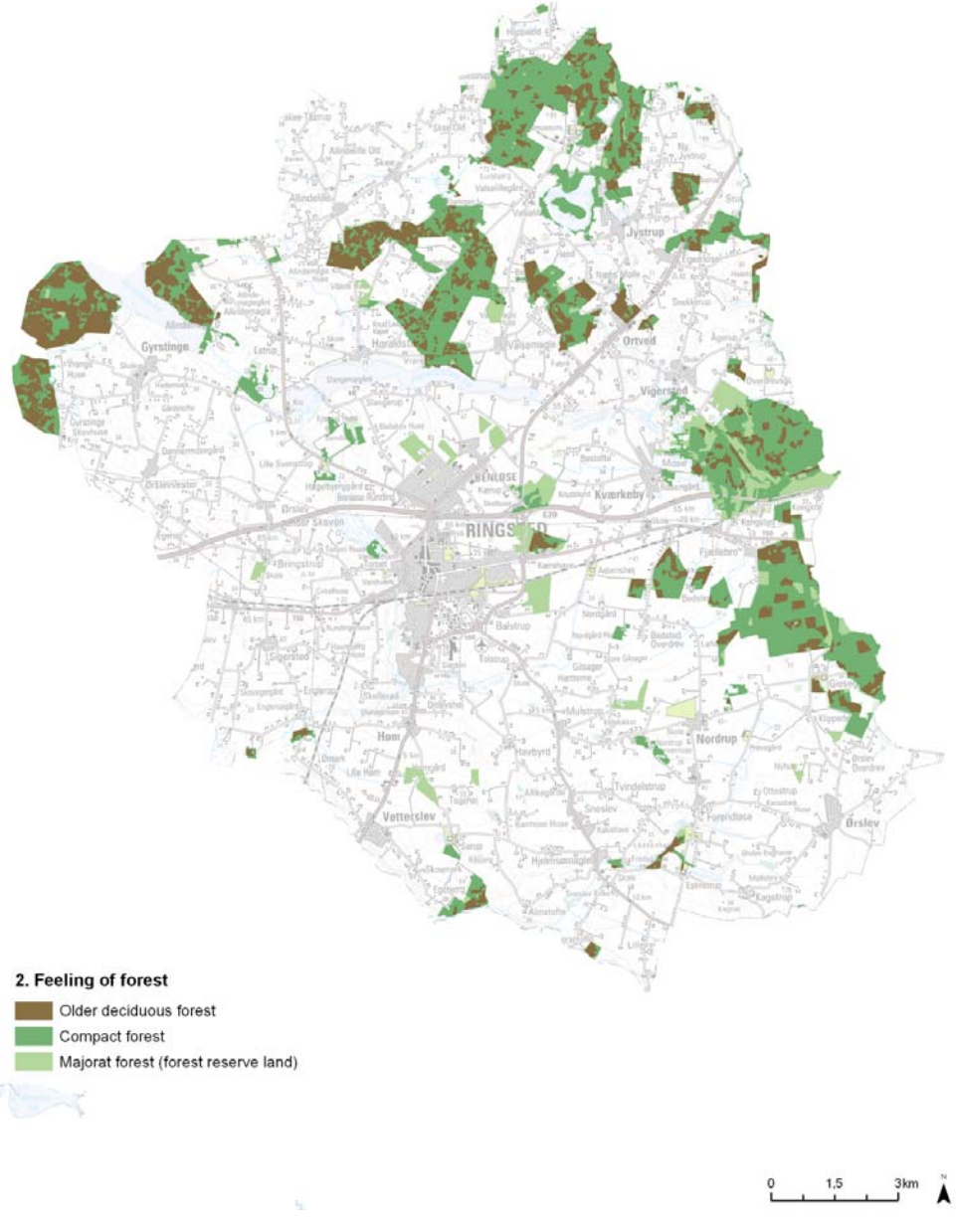
Experience class	Map based indicator	Elaboration, GIS criteria (data source a)
1. Wilderness	Nature forest	Digitisation of a paper-map designation in non-state owned forest (SA)
	Forest swamp	Overlay of tree cover and wet areas (GA)
2. Feeling of forest	Older deciduous forest	Digitisation of older deciduous stands based on orthophoto interpretation (app. minimum 80 years) (GA)
	Compact forest	Minimum 5 ha (GA)
	Majorat forest (forest reserve land)	Areas from Cadastral Register (MD)
3. Panoramic views	Hill top with viewing potential	Analysis based on digital terrain model and more (GA)
	Lake view	Viewshed analysis based on points at lake surface and the Digital Surface Model (GA)
	Lake and sea surface	Minimum 6 ha (GA)
	Coherent open landscape	Minimum 6 ha (GA)
4. Biodiversity	International nature protection area	Natura 2000 designation (SA)
	National nature protection area	Bog, marsh, moor and meadow, all minimum 0.25 ha Ponds min. 0.1 ha and most streams (MD)
	Stream and riparian areas	Protected streams with 25 meter buffer zone (MD, GA)
	Wood edge and lake shore	25 meter buffer zone (GA)
	Distinctive geomorphologic feature	Esker, moraine, hummocky, tunnel valley, and more (CD)
5. Cultural history	Cultural historical building and ruins	Church, manor, windmill, watermill, protected farms (MD, SA) and digitalisation of ruins (MD)
	Church surroundings	Designation (MD)
	Protected monuments	Barrow, burial mound, cairn (MD)
	Dike	Stone dike and earth walls (MD)
	Historical route of transport	Closed railway line, road with historical significance (MD)
	Cultural environment	Designation (MD)
	Cultural historical land use type	Meadow and pasture (MD)
	Intangible heritage	Archaeological sites by treasure trove (SA)
6. Activity and challenge	Intensive activity area	Golf court, urban green areas, football field and more (SA,MD)

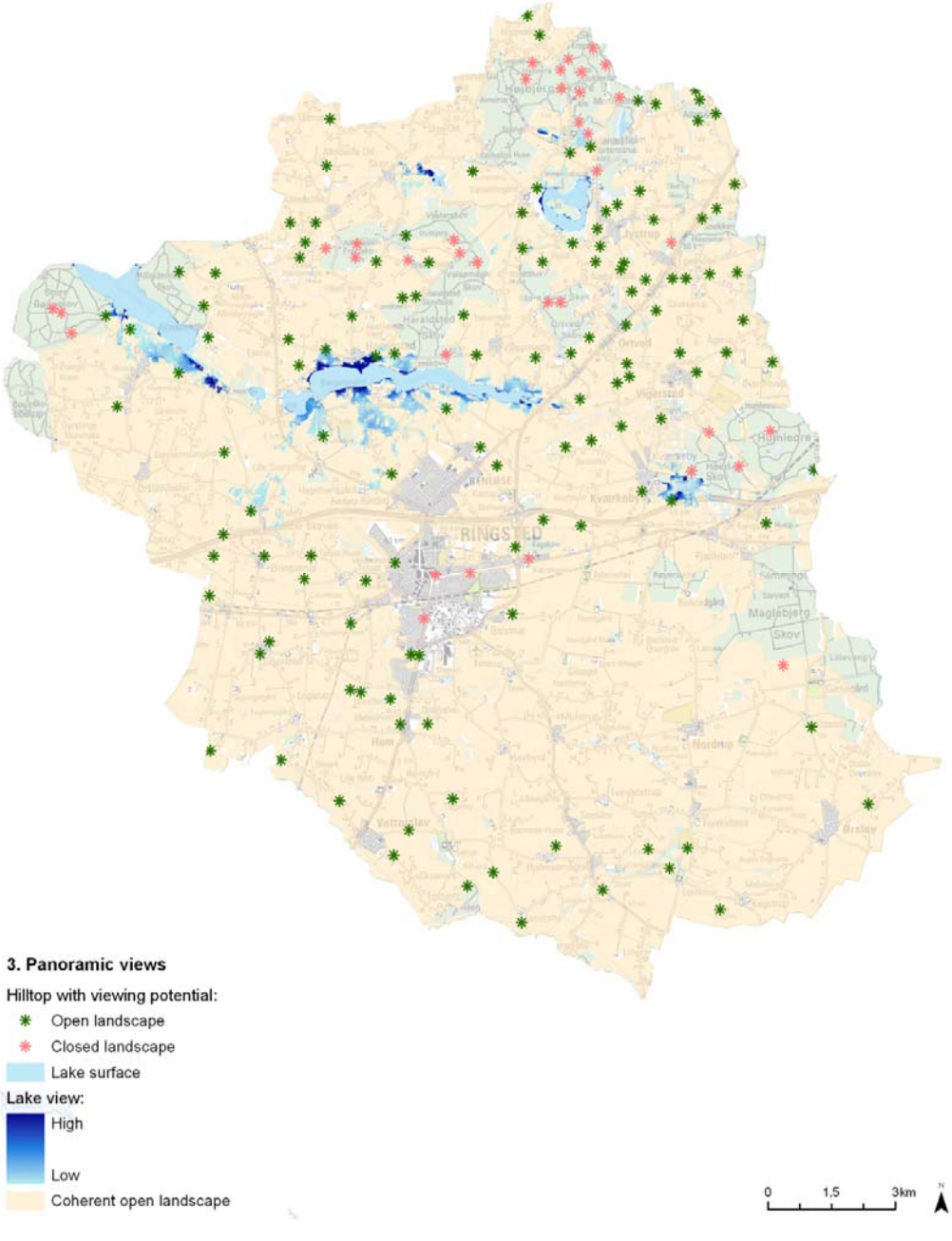
	Marked routes and trails	Route and trails for hiking and/or horse-back riding (MD, SA, other)
	Non-marked footpaths and tracks	Walking paths in urban, open and forested areas (SA, MD, other)
	Cycle routes and lane	Cycle route (marked) and cycle lane
	Forest roads	Overlay of roads and forest (GA)
	Waterways and lakes	Kayaking, canoeing, sailing allowed (SA, CD, MD)
7. Service and gathering	Accessibility facility	Parking area (MD)
	Communication facility	Information sign, tourist office, visitors farm, nature school (SA, MD)
	Security facility	Camp fire, bird tower, beach, lifeguard, toilet, tea garden, table and bench set (SA, CD, MD)
	Accommodation facility	Camp site, camping ground, B&B, hostel, hotel (SA, MD)
Disturbances	Traffic noise highway and national rail road	Five zones, 55-75 dB(A) (MD,SA)
	Traffic noise nuisance	45 and 55 dB(A) traffic noise zones from road and rail (SA)
	Minimum distance to urban land use	250 meter (GA)
	Minimum distance to high voltage line	75 meter (GA)

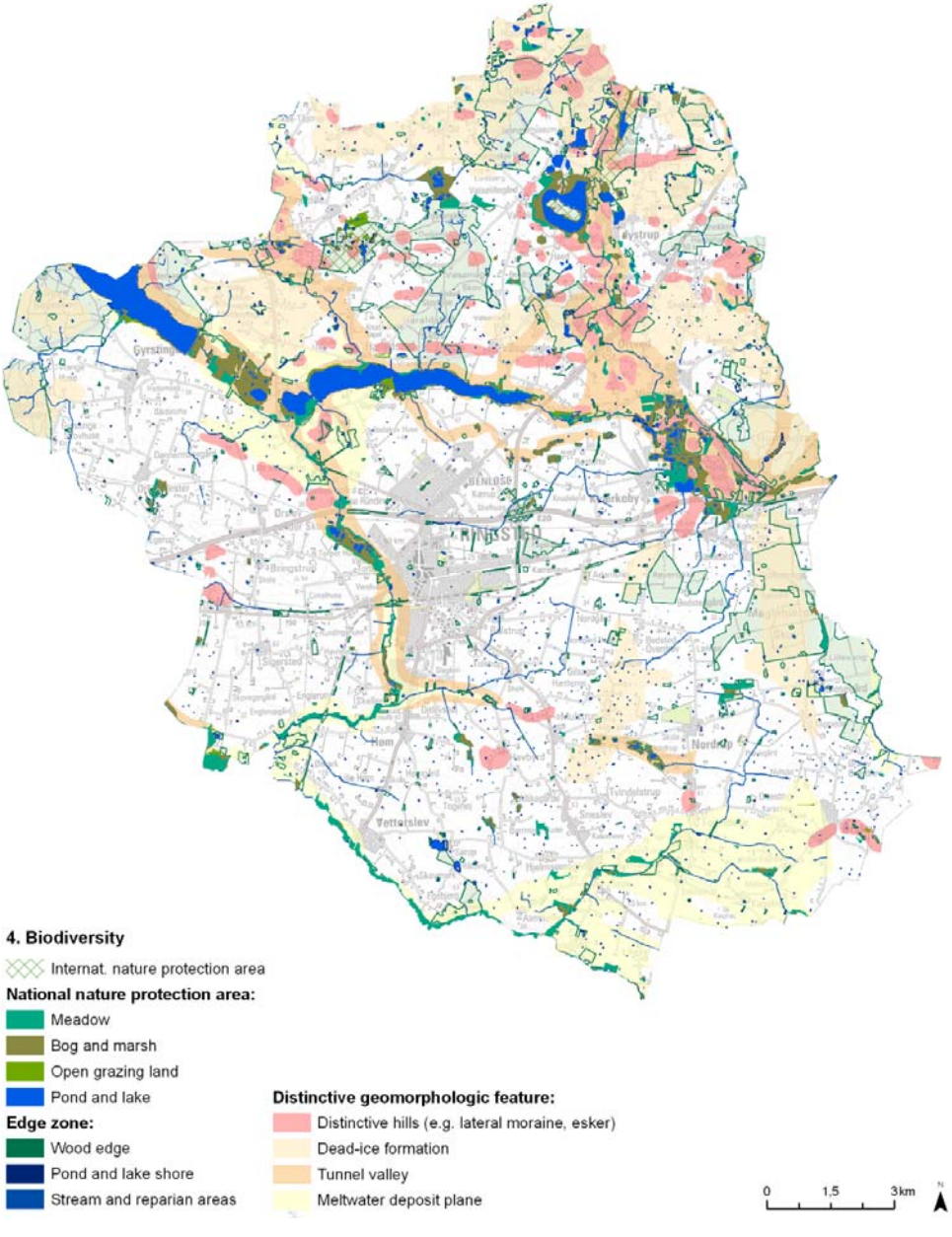
[a] Municipal Designation (MD), County Designation (CD), State Agencies (SA), GIS Analysis (GA)

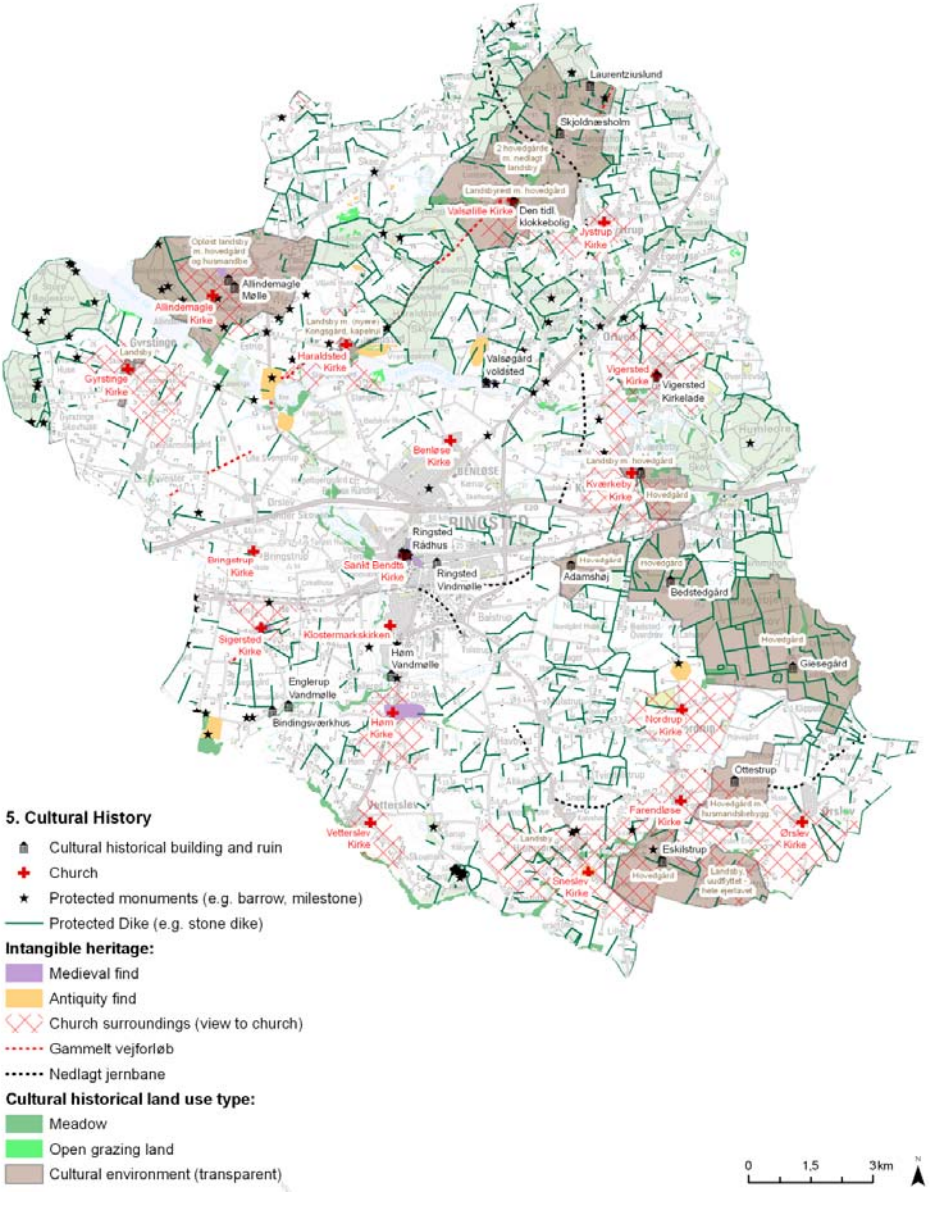
B. REM map output

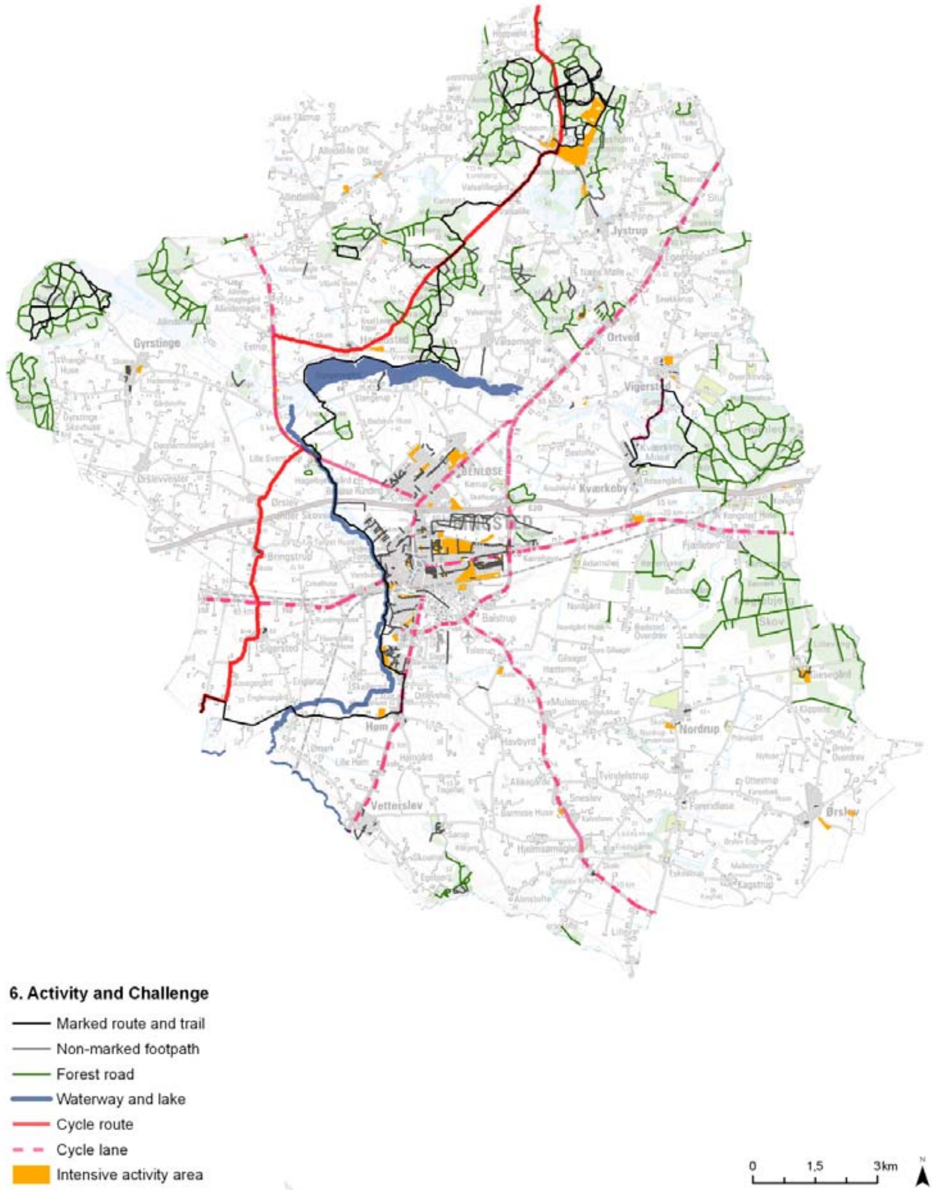



Gyrstinge
Jyderup
Ortved
Vigersted
Kværkeby
RINGSTED
Balstrup
Hvidebæk
Nordrup
Hvidebæk
Vetterslev
Ørslev
2. Feeling of forest
Older deciduous forest
Compact forest
Majorat forest (forest reserve land)
0
1.5
3km
N

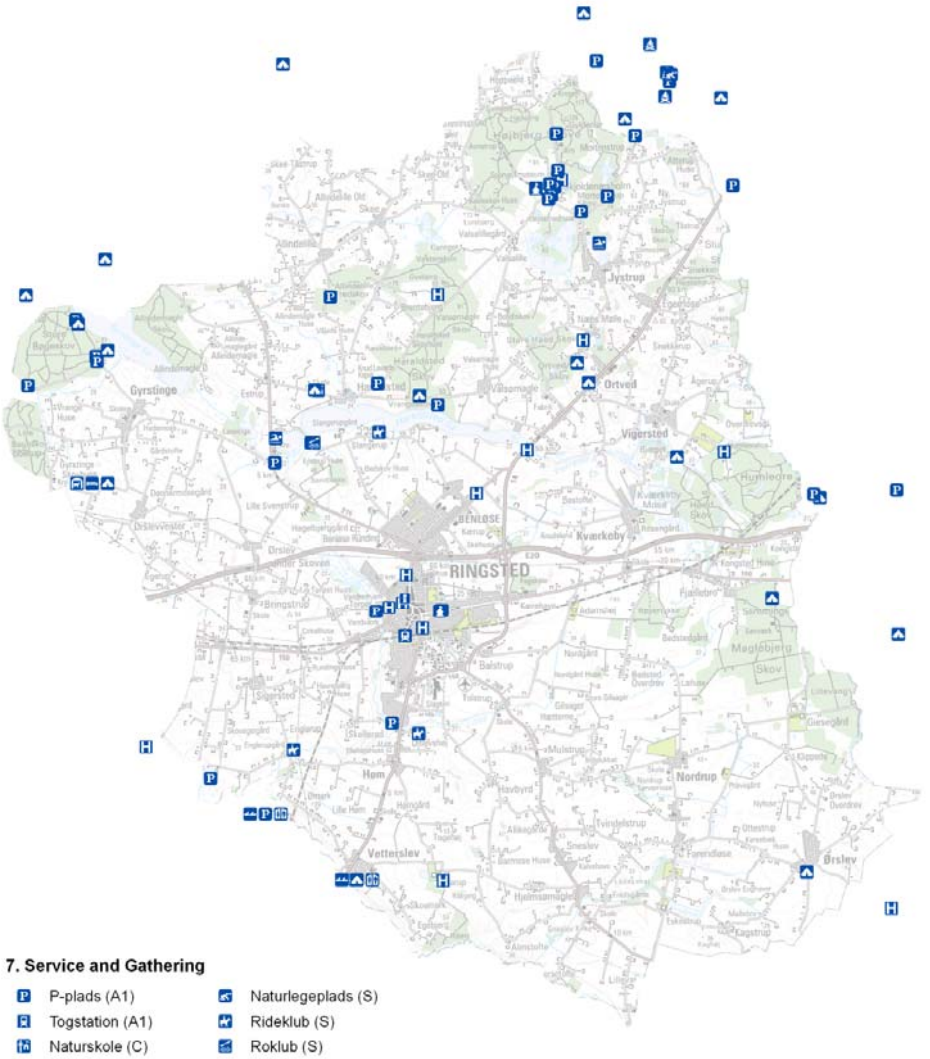

RINGSTED
3. Panoramic views
Hilltop with viewing potential:
Open landscape
Closed landscape
Lake surface
Lake view:
High
Low
Coherent open landscape
0
1,5
3km
N


4. Biodiversity
Internat. nature protection area
National nature protection area:
Meadow
Bog and marsh
Open grazing land
Pond and lake
Edge zone:
Wood edge
Pond and lake shore
Stream and reparian areas
Distinctive geomorphologic feature:
Distinctive hills (e.g. lateral moraine, esker)
Dead-ice formation
Tunnel valley
Meltwater deposit plane
0
1,5
3km
N


5. Cultural History
Cultural historical building and ruin
Church
Protected monuments (e.g. barrow, milestone)
Protected Dike (e.g. stone dike)
Intangible heritage:
Medieval find
Antiquity find
Church surroundings (view to church)
Gammelt vejforløb
Nedlagt jernbane
Cultural historical land use type:
Meadow
Open grazing land
Cultural environment (transparent)
0
1,5
3km
N
Laurentziuslund
Skjoldnæsholm
Valsølille Kirke
Den tidl. klokkebolig
Jystrup Kirke
Allindemagle Kirke
Allindemagle Mølle
Gyrstinge Kirke
Haraldsted Kirke
Valsegård voldsted
Vigersted Kirke
Vigersted Kirkelade
Benløse Kirke
Kværkeby Kirke
Ringsted Rådhus
Ringsted Vindmølle
Sankt Bendts Kirke
Adamshøj
Bedstedgård
Giesegård
Sigersted Kirke
Klostermarkskirken
Hørn Vandmølle
Englerup Vandmølle
Bindingsværkhus
Hørn Kirke
Nordrup Kirke
Ottestrup
Vetterslev Kirke
Farendløse Kirke
Ørslev Kirke
Eskilstrup
Sneslev Kirke



6. Activity and Challenge

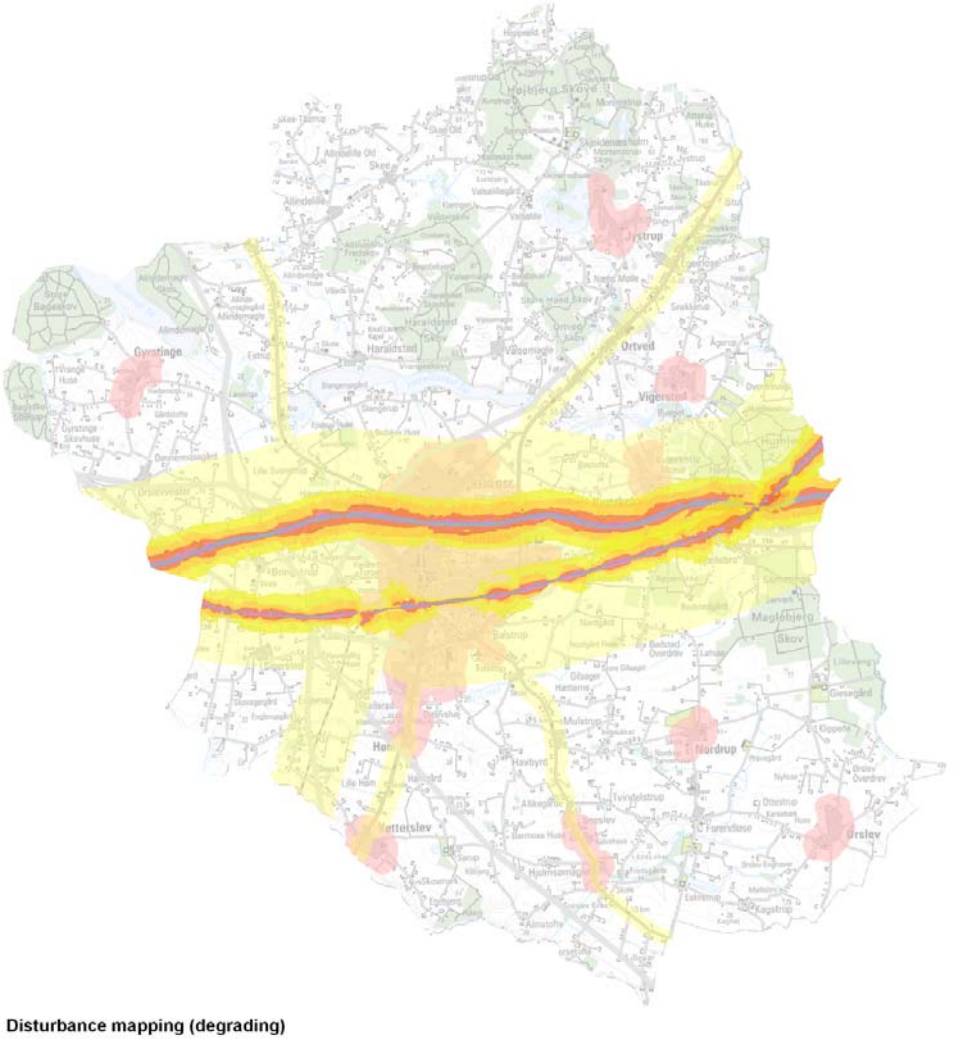


7. Service and Gathering

- P-plads (A1)
- Togstation (A1)
- Naturskole (C)
- Besøgsbondegård (C)
- Museum (C)
- Turistbureau (C)
- Badevand (S)
- Bålplads (S)
- Toilet (S)
- Isætningsplads (S)
- Naturlegeplads (S)
- Rideklub (S)
- Roklub (S)
- Shelter & teltplads (A2)
- Teltplads (A2)
- Camping (A2)
- B & B (A2)
- Vandrerhjem (A2)
- Hotel (A2)

A1: Accessibility facility
C: Communication facility
S: Security facility
A2: Accommodation facility

0 1,5 3km


Disturbance mapping (degrading)
Traffic noise zones:
45 - 55 dB
55 - 60 dB
60 - 65 dB
65 - 70 dB
70 - 75 dB
over 75 dB
High voltage line zone
Urban land use zone
0
1,5
3km
N

C. Interview manual for on-site survey (in Danish)

Interview skema

Løbenummer_____

Lokalitetsnummer		Initialer
Dato	Tidspunkt	Vejr
1= Sol; 2= Let overskyet; 3=Overskyet; 4= Regn		

1.1 HVAD HAR DU BESKÆFTIGET DIG MED I FORBINDELSE MED BESØGET HER I DAG?

*(**vis planche A** – der må gerne svares mere end én aktivitet)*

- Oplevet naturen
- Studeret naturen
- Set på dyr
- Set på fugle
- Fodret fugle og andre vilde dyr
- Siddet stille
- Spist medbragt mad
- Stavgang
- Løbet en tur
- Luftet hund
- Gået en tur
- Cyklet på mountain-bike
- Cyklet en tur
- Leget
- Samlet bær, svampe, blomster og lign.
- Fotograferet
- Overnattet i naturen (i telt, i det fri)
- Været på tur med naturvejleder
- Været ude at fiske
- Været på jagt
- Været på arbejde
- Været ude at ride
- Andre aktiviteter, *skriv hvilke*:……

1.2 **HVOR LÆNGE VAREDE DIT BESØG HER I DAG?**

(sæt ét kryds)

□ mindre end 5 minutter
□ et kvarters tid
□ ½ times tid
□ 1 times tid
□ 1 til 2 timer
□ 2 til 3 timer
□ 3 til 4 timer
□ 4 til 8 timer
□ mere end 8 timer

1.3 HVORNÅR OPHOLDT DU DIG SIDSTE GANG I DETTE OMRÅDE?

(sæt ét kryds)

□ Har aldrig besøgt det før
□ I går
□ For 2 til 6 dage siden
□ For 1 til 2 uger siden
□ For 2 til 4 uger siden
□ For 1 til 2 måneder siden
□ For 2 til 4 måneder siden
□ For 4 til 12 måneder siden
□ For mere end 1 år siden
□ Husker ikke/ved ikke

1.3.1 HVOR MANGE GANGE HAR DU VÆRET I DETTE OMRÅDE I LØBET AF DET SIDSTE ÅR?

…….
*(skriv antal gange i **det sidste år**)*

1.4 HVOR MANGE GANGE HAR DU VÆRET I SKOVEN/NATUREN I LØBET AF DET SIDSTE ÅR?

(samtlige ture til alle skov-/naturområder skal medregnes; også mindre køreture eller f.eks. ganske korte spadsereture regnes for en 'tur i skoven/naturen', hvis de er foregået helt eller delvist med det formål at komme i skoven/naturen)

…….
(s*kriv antal gange i **det sidste år**)*

1.5 HVAD VAR ÅRSAGEN TIL AT DU TOG UD I NATUREN I DAG?

*(**vis planche B** – sæt kryds for vigtigheden af hver enkelt årsag!)*

	Særdeles vigtig	Vigtig	Hverken/ eller	Ikke vigtig	Absolut ikke vigtig
A. "At opleve naturen/landskabet" (f.eks. at nyde landskabet, være i kontakt med naturen, opleve naturens farver, lugte, mystik mm.)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
B. "At opleve dyrelivet" (f.eks. se "vilde" dyr/fugle, høre fuglesang, se spor efter dyr mm.)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
C. "At få fred og ro" (f.eks. at komme væk fra larm og tætbefolkede områder, frigøre sig fra at være "hængt op" mm.)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
D. "At motionere" (f.eks. at forbedre sin fysiske form/kondition, udvikle sine færdigheder mm.)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
E. "Knytte familiebånd" (f.eks. at tilbringe tid sammen, gøre noget sammen i familien)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
F. "Møde andre mennesker" (f.eks. en chance for at møde andre mennesker, tale med nye og forskellige mennesker, være sammen med venner)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑

1.5.1 HVILKE AF DE SEKS ÅRSAGER VAR DEN VIGTIGSTE FOR DIG?

(skriv bogstavet for den vigtigste årsag)……

1.6 ALT I ALT, HVOR TILFREDS VAR DU MED TUREN?

(sæt ét kryds)

Meget tilfreds	Tilfreds	Hverken/eller	Utilfreds	Meget utilfreds
❑	❑	❑	❑	❑

1.7 HAR DU OPLEVET NOGEN FORSTYRRELSER AF DIN OPLEVELSE HER I OMRÅDET?

(sæt ét kryds)

Nej	Knallert	Cyklist	Person(er)	Affald	Hund	Støj
❑	❑	❑	❑	❑	❑	❑

Andet……

1.8 VIL DU VENLIGST PÅ DETTE KORT TEGNE DEN RUTE DU *FULGTE*/*NORMAL FØLGER* GENNEM OMRÅDET VED DETTE BESØG?

(Hvis området besøges sjældent (< 5 gange om året) → DU FULGTE ❑)
(Hvis området besøges ofte (> 5 gange om året) → NORMAL FØLGER ❑)

*(**vis RUTEkort på skriveplade** - sæt ét kryds)*
□ Ja
□ Nej
(Lad respondent tegne ruteforløbet med angivelse af retning med en pil. Brug en sort sprittusch. Hjælp gerne respondent med at orientere sig på kortet).

1.9 MARKER VENLIGST MED ET KRYDS PÅ KORTET HVILKE ATTRAKTIONER ELLER SÆRLIGE OPLEVELSER DU "ER GÅET EFTER". HVOR PÅ RUTEN HAR DU HAFT EN SÆRLIG OPLEVELSE?

BESKRIV VENLIGST OPLEVELSEN KORT?
Bed respondent om kort at beskrive deres særlige oplevelse: hvis flere forskellige identificer kryds med bogstaver (A, B, C osv) eller få respondenten til at skrive ved kryds på kort (for eksempel "frøer", "fugl", "udsigt", "bænk" osv.). Brug den sorte sprittusch.

A .....

.....

B .....

.....

C .....

.....

D .....

.....

2

KOMMUNEN HAR GENNEMFØRT EN REGISTRERING AF EN RÆKKE OPLEVELSESMULIGHEDER I NATUR OG LANDSKAB.
*(**vis planche C.** Forklar meget kort hver oplevelsesklasse ved at pege på planchen og beskrive hver oplevelsesværdi (se tabel under tegning). For eksempel: "urørt og eventyrlig skovmiljø, dvs. lokaliteter som byder på vilde og urørte naturoplevelser, fx væltede træer, knudrede gamle træer, skovsump og lignende".*

MED UDGANGSPUNKT I DISSE VIL JEG BEDE DIG VURDERE DIN TUR I DAG.

2.1 HVOR PÅ DIN RUTE HAR DU HAFT OPLEVELSER SOM STEMMER OVERENS MED TEMAERNE FRA PLANCHE C?

2.1.1 SÆT ET ELLER FLERE TAL FOR TYPE AF OPLEVELSERNE (1-7) LANGS DIN RUTE?

Anvend den røde sprittusch.

HVIS OPLEVELSEN ER GENEREL FOR HELE RUTEFORLØBET INDTEGN DA TALLET I EN CIRKEL

Anvend den røde sprittusch.

HVIS OPLEVELSEN ER GENEREL FOR DELSTRÆKNING(ER) AF RUTEFORLØBET, INDTEGN DA TALLET OG EN STREG PARALLELT MED RUTEN SOM INDIKERER PÅGÆLDENDE DELSTRÆKNING

Anvend den røde sprittusch.

3

3.1 HER SER DU SÅ RESULTATET AF KOMMUNENS KORTLÆGNING. HVOR ENIG, UENIG ER DU?

***(vis planche D – vurderingskortet** – sæt kryds ved hvert enkelt delkort. Forklar respondent at den røde cirkel er en kortlagt lokalitet for denne oplevelsesmulighed. Gennemgå kort for kort med respondenten. Hvis der er behov for det, skriv evt. kommentarer til de enkelte delkort under kortene. Fx "Udsigt kan man opleve i hele området")*

4

4.1 SÅ MANGLER VI BLOT KØN, ALDER OG UDDANNELSE:

KØN
□ Mand
□ Kvinde

ALDER?: …….år *(skriv alder)*

UDDANNELSE?..... *(skriv den højeste gennemførte uddannelse)*

UDFYLDES uden at spørge:

A. Vurdering af respondents færdighed i kortlæsning

Har det nemt	**Har det svært**
□ Skal ikke have meget hjælp	□ Skal have meget hjælp
□ Kan/vil godt tegne på RUTEkortet	□ Kan ikke/vil ikke tegne på RUTEkortet
□ Har nemt ved at stedslokalisere	□ Har svært ved at stedslokalisere (fx peger i diffus retning mod en lokalitet)

B. Antal personer i gruppen: **Børn** (0-ca. 15 år): ……..

Voksne (inkl. interviewpersonen) ……

I alt: ……

C. Antal hunde[1] → **I snor:** …… **Uden snor:**……
Hvis interviewpersonen ingen hund(e) har med, skrives der 0 (nul) her (begge steder).

D. Observeret kategori[2] → ……
[2]Interviewpersonen henføres til en af flg. Kategorier:
1:Gående; 2:Person med hund(e); 3:Person m. barnevogn; 4:Stavgænger; 5:Motionsløber; 6:Cyklist; 7:Mountainbiker; 8:Rytter; 9: Andre: skriv her hvilken:……

Eventuelle bemærkninger eller forslag fra den interviewede gæst (brug evt. også bagsiden)

……..

……..

……..

……..

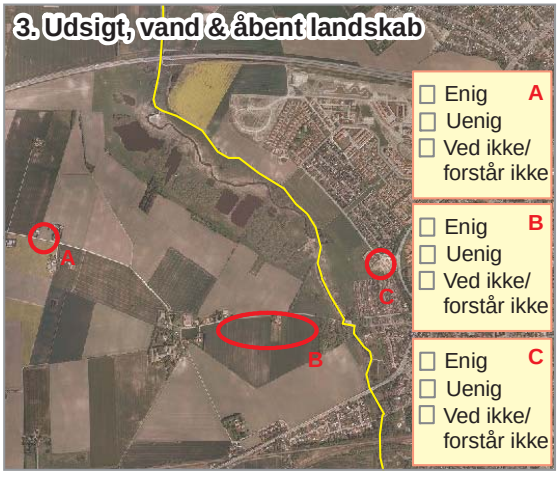
LØBENUMMER_____

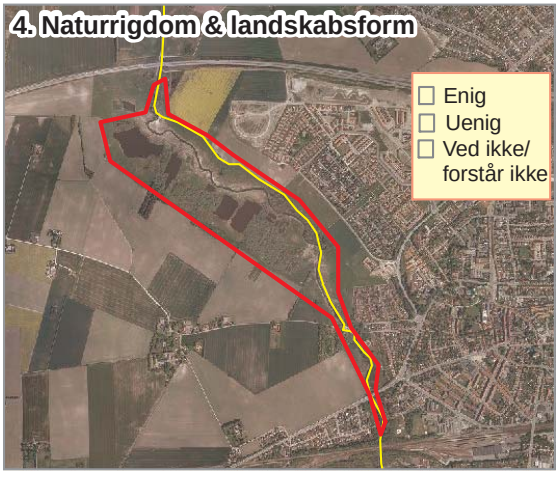
0 250 500 Meter

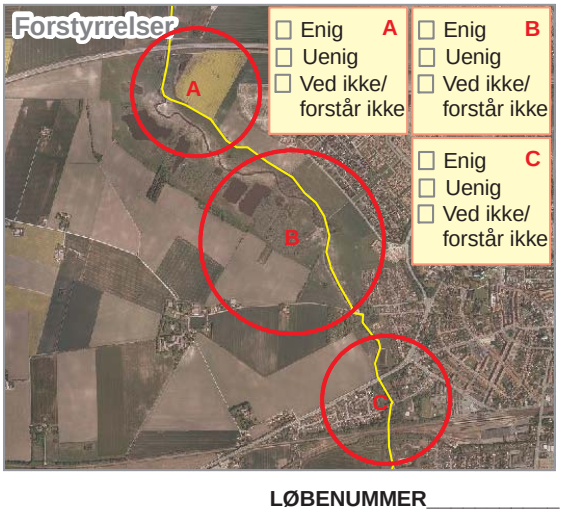
N


Nyrupvej
Frenderupvej
Frenderupvej
SØVEJ
Kilden
GYRSTINGE SØ
Møllemosevej
Gl. Kildevej
Risdalgvej
Nyrupvej
Hanemose
Smedevej
Linievej
Dyssevej
PROCESVEJEN
Søvej
Lysevej
Egebækvej
Fars sti
Marinevej
Pagtermosevej
Flinterupvej
Skyttevej
Fredskovsminde
ST. BØGESKOVVEJ
Flinterupvej
Store Bøgeskovvej
LØBENUMMER
0
250
500 Meter
N

Kommunens kortlægning af oplevelsesmuligheder

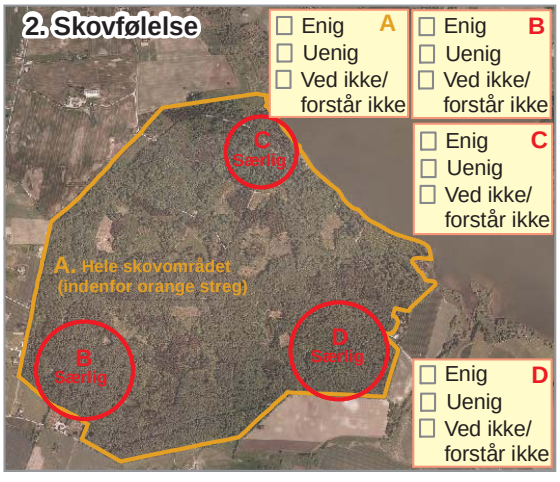


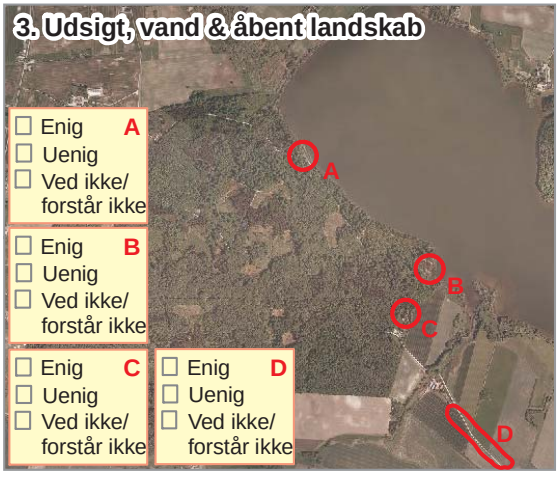


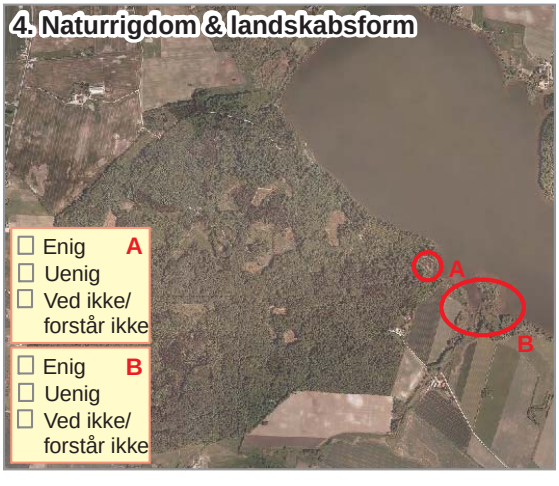


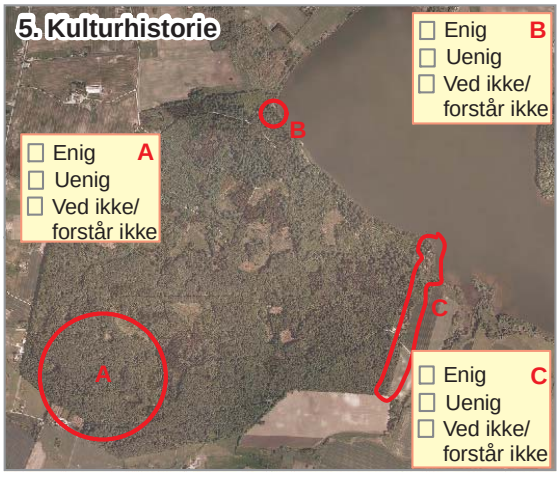
LØBENUMMER_____

Kommunens kortlægning af oplevelsesmuligheder









LØBENUMMER_____

D. Survey with municipal recreation planners (in Danish)

Velkommen til undersøgelsen af friluftsliv i kommuneplanlægningen 2010

Det tager ca. 20-30 min. at svare på undersøgelsen.
Du kan bevæge dig frem og tilbage mellem de forskellige spørgsmål ved hjælp af pilene.
Skemaet afleveres først, når der klikkes på krydset på sidste side.
Hvis du ønsker at besvare spørgeskemaet af flere omgange kan det godt lade sig gøre.
Svarene bliver automatisk gemt til næste gang du åbner undersøgelsen.

Hvilken kommune arbejder du i?

_____

Hvilken afdeling arbejder du i? ***(skriv navn på din afdeling)***

_____

Hvor længe har du arbejdet med rekreativ planlægning?

_____

Hvor meget af din arbejdstid på et år bruger du ca. på følgende arbejdsområder?
Angiv et procental (i alt 100 %)

Strategisk planlægning (politik, strategi, analyse og plan og lign.) _____

Enkeltsagsbehandling (borgerhenvendelser, miljøgodkendelser og lign.) _____

Anlægsopgaver og drift (design, nyanlæg, renovering og lign.) _____

Andet _____

De følgende spørgsmål omhandler kommunens rekreative planlægning generelt

Er der foruden planstrategi og kommuneplan udarbejdet en politik, strategi, analyse eller plan for friluftsliv og naturoplevelser i kommunen?

(1) ❑ Ja, hvilke?

_____

(2) ❑ Nej, men har planer om det
(3) ❑ Nej
(4) ❑ Ved ikke

Har kommunen eget friluftskort med oversigt over rekreative stier, faciliteter mv.?

(1) ❑ Ja
(2) ❑ Nej
(3) ❑ Ved ikke

Hvilken form for friluftskort har I? *(sæt gerne flere krydser)*

(1) ❑ Et trykt papirkort (f.eks. en folder)
(2) ❑ Et digitalt zoombart friluftskort på kommunens hjemmeside
(3) ❑ Egen GIS-database (f.eks. med information om stier, faciliteter, naturoplevelser mv.)
(4) ❑ Andet (skriv)

_____

(5) ❑ Ved ikke

Nej, vi har ikke eget friluftskort, men vi:
(sæt gerne flere krydser)

(1) ❑ Har planer om at lave et
(2) ❑ Henviser til Skov- & Naturstyrelsens friluftskort på vores hjemmeside
(3) ❑ Andet (skriv)

_____

Er der i kommunen eksempler på projekter, hvor friluftsliv indgår i tværgående indsatser mellem de kommunale opgaveområder (f.eks. uddannelse, sundhed, natur, kultur osv.)?

(1) ❑ Ja (hvilke?)

_____

(3) ❑ Nej, men har planer om det
(4) ❑ Nej
(5) ❑ Ved ikke

Der har i den sidste tid været meget fokus på koblingen mellem friluftsliv og sundhed. Har I inden for de sidste tre år arbejdet med et eller flere af følgende konkrete projekter? *(sæt gerne flere krydser)*

(1) ❑ Motionsruter (f.eks. løberuter, sundstier, stierne i bevægelse, 30 min. om dagen stier)
(2) ❑ Gang i Danmark
(3) ❑ Hjertestier
(4) ❑ Motionspladser (f.eks. træningspavilloner, naturfitness, sund fitness)
(5) ❑ Motionsparker
(6) ❑ BKO (Bevægelses Klare Områder)
(7) ❑ Andet (skriv)

_____

(8) ❑ Nej, men vi har planer om det
(9) ❑ Nej
(10) ❑ Ved ikke

Hvilken af følgende former for borgerinddragelse er blevet anvendt i den rekreative planlægning? *(sæt gerne flere krydser)*

(1) ❑ **Selvbestemmelse** (uddelegering til f.eks. lokalråd)
(2) ❑ **Medbestemmelse** (deltagelse i f.eks. fælles arbejdsgrupper)
(3) ❑ **Dialog** (debat på f.eks. borgermøder eller via internet)
(4) ❑ **Information** (husstandsomdelte foldere, orientering på hjemmesider mv.)
(5) ❑ **Ingen inddragelse**
(6) ❑ Ved ikke
(7) ❑ Andet (skriv)

_____

Hvis borgerinddragelse er blevet anvendt i den rekreative planlægning, har det da fremmet processen?

(1) ❑ Meget høj grad
(2) ❑ Høj grad
(3) ❑ Nogen grad
(4) ❑ Lille grad
(5) ❑ Slet ikke
(6) ❑ Ingen inddragelse

Uddyb gerne:

_____

Gennemfører kommunen brugertællinger eller brugerundersøgelser af friluftsliv?

(1) ❑ Ja
(2) ❑ Nej
(3) ❑ Ved ikke

I hvilken grad er der behov for øget viden om potentielle oplevelsesmuligheder i kommunens landskaber?

(1) ❑ Meget høj grad
(2) ❑ Høj grad
(3) ❑ Nogen grad
(4) ❑ Lille grad
(5) ❑ Slet ikke
(6) ❑ Ved ikke

Når der indhentes information, data og viden til brug i det rekreative planarbejde, i hvor høj grad anvendes da følgende kilder? ***(sæt gerne flere krydser)***

	Meget høj grad	**Høj grad**	**Nogen grad**	**Lille grad**	**Slet ikke**
Lokal viden (eget kendskab til lokalområder)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
Feltarbejde (besøg og udflugter til et lokalområde)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
Kortbladsanalyser (topografiske kort)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
Kommunale GIS data (planudpegninger og tekniske kort)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
Kommunale rapporter (strategier, planer eller analyser)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
Amtsrapporter (regionale analyserapporter udarbejdet i forbindelse med frednings- og regionplanlægningen)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
Brugerundersøgelser (spørgeskema, interview eller tællestationer)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
Borgerinddragelse	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑

Andre kilder til indhentning af information, data og viden til støtte for rekreativ planlægning?

_____

Nedenfor er nævnt seks forskellige årsager til at tage ud i naturen/landskabet.

I hvilken grad vurderer du som planlægger, at hver af de seks nævnte årsager bliver *prioriteret* i forbindelse med kommunens planlægning for friluftsliv?
(sæt et kryds ved hver af de 6 årsager)

	Særdeles vigtig	Vigtig	Hverken/eller	Ikke vigtig	Absolut ikke vigtig
A. "At opleve naturen/landskabet" (f.eks. at nyde landskabet, være i kontakt med naturen, opleve naturens farver, lugte, mystik mm.)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
B. "At opleve dyrelivet" (f.eks. se "vilde" dyr/fugle, høre fuglesang, se spor efter dyr mm.)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
C. "At få fred og ro" (f.eks. at komme væk fra larm og tætbefolkede områder, frigøre sig fra at være "hængt op" mm.)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
D. "At motionere" (f.eks. at forbedre sin fysiske form/kondition, udvikle sine færdigheder mm.)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
E. "Knytte familiebånd" (f.eks. at tilbringe tid sammen, gøre noget sammen i familien)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑
F. "Møde andre mennesker" (f.eks. en chance for at møde andre mennesker, tale med nye og forskellige mennesker, være sammen med venner)	(5) ❑	(4) ❑	(3) ❑	(2) ❑	(1) ❑

Hvilke af de seks årsager ovenfor, vil du vurdere bliver prioriteret højest i planlægningen?

	A	B	C	D	E	F
Vælg bogstavet for den vigtigste årsag	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

De følgende spørgsmål omhandler kommunens rekreative stiplanlægning generelt

Hvordan oplever du interessen for rekreativ stier blandt kommunens borgere?

(1) ❑ Meget stor
(2) ❑ Stor
(3) ❑ Lille
(4) ❑ Meget lille
(5) ❑ Ved ikke

Hvor mange medarbejdere i kommunen arbejder med rekreativ stiplanlægning?

_____

Hvor mange årsværk vil du skønne, at der anvendes til rekreativ stiplanlægning i kommunen?

_____

Hvilke af følgende partnere samarbejdes der med i konkrete stiprojekter? ***(sæt gerne flere krydser)***

(1) ❑ A. Anden forvaltning i kommunen
(2) ❑ B. Nabokommune
(3) ❑ C. Agenda 21
(4) ❑ D. Grønt råd
(5) ❑ E. Vækstforum
(6) ❑ F. Lokalt erhvervsliv
(7) ❑ G. Lokale stigrupper
(26) ❑ H. Lokal råd
(8) ❑ I. LAG (lokale aktionsgrupper)
(9) ❑ J. Regionen
(10) ❑ K. Skov- & Naturstyrelsen centralt
(11) ❑ L. Skov- & Naturstyrelsen lokalt
(12) ❑ M. Privat skovdistrikt
(13) ❑ N. Lodsejere (skovbrug)

(14) ❑ O. Lodsejere (landbrug)
(15) ❑ P. Private aktører (borgere)
(16) ❑ Q. Fond
(17) ❑ R. EU programmer (f.eks. Interreg)
(18) ❑ S. Visit Danmark
(19) ❑ T. Anden turistorganisation
(20) ❑ U. Lodsejerorganisation (f.eks. Dansk Skovforening, Landboforening)
(21) ❑ V. Friluftsrådet
(22) ❑ X. Organiseret friluftsliv (f.eks. spejdere)
(23) ❑ Y. Naturorganisation (f.eks. DN, DOF)
(24) ❑ Z. Anden (skriv)

_____

Hvilke partnere er de vigtigste?
(skriv bogstaverne for de vigtigste partnere)

_____

I hvor høj grad virker følgende faktorer som en barriere for realiseringen af planlagte stier? ***(sæt gerne flere krydser)***

	Meget høj grad	**Høj grad**	**Nogen grad**	**Lille grad**	**Slet ikke**	**Ved ikke**
Samarbejdsvanskeligheder mellem forskellige aktører, partnere og interessenter	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Manglende velvilje fra lodsejere	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Mangel på offentligt ejerskab til jord	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Mangel på kommunal egenfinansiering	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Mangel på eksterne finansieringsmuligheder	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Mangel på lokal borger efterspørgsel	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Beskyttelsesinteresser	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Eventuelt andre barrierer for realiseringen af planlagte stier?

_____

Hvor mange af kommunens *anlagte* rekreative stier og ruter er baseret på frivillige aftaler med lodsejere? *(Giv et skøn)*

Procentdel af de anlagte stier _____

Evt. antal stier _____

Evt. antal km _____

Hvor mange rekreative stier og ruter er blevet *indviet* i din kommune i de sidste tre år (siden kommunalreformen)?

Antal stier _____

Antal km _____

Hvor stor en del af de *planlagte* rekreative stier i kommuneplanen forventes realiserede i den nuværende planperiode (2009-2013)? *(Giv et skøn)*

Procentdel af planlagte stier _____

Antal km _____

De næste spørgsmål omhandler brugen af GIS og kort i den rekreative friluftsplanlægning

Findes der en GIS-afdeling i kommunen?

(1) ❑ Ja
(2) ❑ Nej
(3) ❑ Ved ikke

I hvilket omfang bruger du GIS? ***(sæt gerne flere kryds)***

(7) ❑ Jeg bruger ikke GIS
(1) ❑ Jeg arbejder med GIS-kort, som andre har fremstillet
(6) ❑ Jeg redigerer i eksisterende GIS-kort
(3) ❑ Jeg skaber selv data til brug i GIS
(5) ❑ Jeg laver rumlige analyser i GIS

I hvor høj grad anvendes GIS i den daglige administration og planlægning for friluftsliv?

(1) ❑ Meget høj grad
(2) ❑ Høj grad
(3) ❑ Nogen grad
(4) ❑ Lille grad
(5) ❑ Slet ikke
(6) ❑ Ved ikke

Hvordan bliver GIS brugt i den rekreative planlægning i din kommune? ***(sæt gerne flere krydser)***

(1) ❑ Fremstilling af plankort til kommuneplan
(2) ❑ Fremstilling af turkort til foldere
(3) ❑ Skabe oversigt over stier og ruter
(4) ❑ Håndtering af data over frilufts- og turismefaciliteter
(5) ❑ Internetformidling via kortindgang
(6) ❑ Analytisk brug (f.eks. bufferzoner eller afstandsberegninger)
(7) ❑ Ved ikke
(8) ❑ Andet (skriv)

_____

Mener du, at mere brug af GIS vil kunne forbedre grundlaget for den rekreative planlægning?

(1) ❑ Meget høj grad
(2) ❑ Høj grad
(3) ❑ Nogen grad
(4) ❑ Lille grad
(5) ❑ Slet ikke
(6) ❑ Ved ikke

I hvor høj grad vurderer du, at følgende barrierer blokerer for mere brug af GIS?

	Meget høj grad	Høj grad	Nogen grad	Lille grad	Slet ikke	Ved ikke
Utilstrækkeligt kendskab til GIS blandt medarbejderne på friluftsområdet	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Utilstrækkelige GIS færdigheder blandt medarbejderne på friluftsområdet	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Utilstrækkeligt kendskab til GIS på lederniveau	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Utilstrækkelig erfaring med GIS i forvaltningen	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Manglende samarbejde med GIS kyndige	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Utilstrækkelig GIS support	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Knappe ressourcer til køb af ekstern ekspertise	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Utilstrækkelig viden om potentialet i GIS	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Utilstrækkelig brugervenlighed	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
GIS er for ufleksibelt	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Datakvalitet ikke god nok	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Utilstrækkelig adgang til data	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑
Mere brug af GIS hæmmes af ledelsens attitude/indstilling	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

	Meget høj grad	Høj grad	Nogen grad	Lille grad	Slet ikke	Ved ikke
Mere brug af GIS stemmer ikke overens med planlægningspraksis	(1) ❑	(2) ❑	(3) ❑	(4) ❑	(5) ❑	(6) ❑

Andre barrierer der blokerer for mere brug af GIS?

_____

Skriv venligst dit navn, så jeg evt. senere kan kontakte dig for uddybende spørgsmål

_____

Hvad er din uddannelse?

_____

Hvilke årstal blev du uddannet?

_____

Før kommunalreformen, var du da sidst ansat i:

(1) ❑ Nuværende kommune
(2) ❑ Anden kommune
(3) ❑ Amt
(4) ❑ Stat
(5) ❑ Privat
(6) ❑ Studerende
(7) ❑ Andet (skriv)

_____

Vil du modtage resultat af undersøgelsen?

(1) ❑ Ja

Øvrige bemærkninger og kommentarer til undersøgelsen og/eller rekreativ planlægning?

_____
_____
_____
_____
_____

Klik på krydset for at aflevere skemaet!

Tusind tak for din medvirken.

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