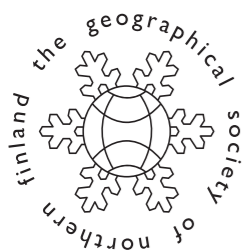


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– the potential of PPGIS in  
increasing interaction

Sini Kantola



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land use planning and decision-  
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increasing interaction**

Sini Kantola

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## Abstract

This doctoral dissertation studies the use of the public participation geographic information system (PPGIS) in land use planning and decision-making in sparsely populated Northern regions. The main research question is: What types of practices and knowledge does PPGIS bring to public participation in land use planning in Northern regions?

Sparsely populated Northern regions pose a specific challenge for planning. In those regions, land ownership by the state or the municipality is general and there are many different interests by locals and non-locals in the same regions. The reconciliation of different land uses is essential because of the many interests (e.g., tourism, nature conservation, mining, forestry, indigenous people, interests of locals and non-locals, recreation and reindeer herding). The different roles of the information, land use and the development of the participation and interaction in land use planning are in focus. The relevant question is who and which interests lead land use planning and decisions.

In this research, the participation in land use planning processes in sparsely populated Northern regions has been examined and participation possibilities have been developed with a mixed method approach. Both qualitative and quantitative methods have been used in the data collection and analysis. The best practices of the use of PPGIS have been studied as well as the novelty of the PPGIS knowledge. The implementation of PPGIS data in decision making, one of the biggest challenges in the field of PPGIS research, has also been examined.

The approach of the research is empirical. The research is a case study and three different sets of data have been collected from Finnish Lapland, sparsely populated regions, from 2015 - 2019. This research used electronic and paper PPGIS, interviews and studying reports and documents. The data is qualitative, quantitative and spatial, and was analyzed with the principles of theory driven content analysis and GIS analyzing methods (theme maps).

The results show that the maintenance and development of the participation possibilities in land use planning are an important part of democratic society. It is essential to maintain discussion, debate, criticism and right of appeal. In the Northern regions with many land use interests, there is no one right way to involve people. The participation is context sensitive; the involvement process and involvement groups need to be estimated in every situation, place and context.

PPGIS has the possibility to improve interaction in sparsely populated regions. The benefits of PPGIS appeared strongly for different data, for example, visually and presenting data on the map in the spatial mode, the possibility to virtually and remotely collect information from a big audience (both locals and non-locals) and the possibility to handle and combine a large amount of digitalized, spatial data. Increasing trust and transparency between different groups were remarkable issues as well. In sparsely populated regions, the fear of stigma is important to take into account when people participate. Thus, PPGIS can encourage people to participate in the land use planning processes due to its characteristics of maintaining anonymity.

It is essential that PPGIS method is used for the real, and even acute, land use needs and thus, motivating respondents to answer is easier and the likelihood of the results being used increases. If the use of the PPGIS method is not strongly linked to the planning process, the results might be of little consequence. Hence, it is recommended that the use of PPGIS is connected with the planning process and in the early phases.

The interest of the organizational managers toward the PPGIS method is essential so that the benefits would be as strong as possible.

The PPGIS method cannot replace other participation methods, but it is good to view as one tool in participation and collecting social spatial data. When the PPGIS method is used, it is important to be critical because the tool is often a commercial product and there is a risk that the needs of the user are not responded to, for example, with the technical characteristics. Making an internet-based PPGIS survey is relatively easy, but it is relevant to use sufficiently deep analysis after gathering the data, for example, with GIS analyzing methods. Systematic storing of PPGIS data in the IT-system of the organization is crucial so that the information is subsequently easy to access.

**Keywords** PPGIS, land use planning, participation, reconciliation of land use interests, sparsely populated Northern areas

## Tiivistelmä

Tämä väitöskirja tutkii osallistavan paikkatiedon (PPGIS) käyttöä maankäytön suunnittelussa ja päätöksenteossa pohjoisilla harvaan asutuilla alueilla. Päättökysymys on: Minkälaisia käytäntöjä ja tietoa osallistava paikkatieto tuo julkiseen osallistamiseen maankäytön suunnittelussa pohjoisilla alueilla?

Pohjoisilla harvaan asutuilla alueilla on erityispiirteitä, jotka tuovat haasteita maankäytön suunnitteluun. Maat ovat yleensä valtion tai kunnan omistuksessa, ja alueisiin kohdistuu monia paikallisten ja ulkopaikkakuntalaisten intressejä. Erilaisten maankäyttömuotojen (esimerkiksi matkailu, luonnonsuojelu, kaivostoiminta, metsätalous, alkuperäiskansat, virkistyskäyttö, paikallisten ja ulkopaikkakuntalaisten näkemykset sekä poronhoito) yhteensovittaminen on välttämätöntä. Keskiössä ovat erilaisen tiedon, maankäytön suunnittelun sekä osallisuuden ja vuorovaikutuksen merkitykset ja roolit. Keskeinen kysymys on, ketkä ja mitkä intressit johtavat maankäytön suunnittelua ja päätöksiä.

Tässä tutkimuksessa tarkastelun kohteena on ollut osallistaminen maankäytön suunnittelun prosesseissa harvaan asutuilla pohjoisilla alueilla. Osallistamismahdollisuuksia on pyritty kehittämään monimenetelmällisen tutkimuksen kautta. Aineiston keräämisessä ja analysoinnissa on käytetty sekä kvalitatiivisia että kvantitatiivisia menetelmiä. Tutkimuksessa on selvitetty osallistavan paikkatiedon parhaita käytäntöjä sekä osallistavan paikkatiedon mahdollista uutuusarvoa. Yhtä alan suurinta tutkimuksellista haastetta eli osallistavan paikkatiedon hyödyntämistä todellisessa maankäytön suunnittelussa on myös tarkasteltu.

Tutkimuksen lähestymistapa on empiirinen. Työ on tapaustutkimus ja siihen kerättiin kolme erilaista aineistoa Suomen Lapista vuosien 2015–2019 aikana. Aineisto saatiin sekä elektronisen että paperisen osallistavan paikkatiedon avulla, ja mukana oli myös haastatteluaineistoa sekä raporttien ja dokumenttien tarkastelua. Aineisto on laadullista, määrällistä ja paikkatietomuotoista ja se analysoitiin teoriasidonnaisen sisällönanalyysin avulla. Paikkatietoaineistoa analysoitiin pääasiassa teemakarttojen avulla.

Tulokset osoittavat, että osallistamismahdollisuuksien ylläpitäminen ja kehittäminen maankäytön suunnittelussa ovat tärkeä osa demokraattista yhteiskuntaa. Olennaista on säilyttää maankäytön suunnitteluun liittyvä keskustelu, väittely, kritiikki ja valitusoikeus myös tulevaisuudessa. Pohjoisilla alueilla monine maankäytön intresseineen ei ole yhtä oikeaa tapaa osallistaa ihmisiä. Osallistamisessa konteksti on tärkeää huomioida; osallisuusprosessi ja osallistettavat ihmiset ja ryhmät on tarpeen arvioida joka tilanteessa ja paikassa aina uudelleen.

Tutkimuksen perusteella voidaan sanoa, että osallistavalla paikkatiedolla on mahdollisuudet kehittää vuorovaikutteisuutta harvaan asutuilla pohjoisilla alueilla. Osallistavan paikkatiedon hyödyt tulevat vahvasti esille erilaisten aineistojen kautta. Näitä ovat esimerkiksi menetelmän tuottama visuaalisuus ja aineistojen esittäminen kartalla paikkatietomuodossa, mahdollisuus elektronisesti ja etäyhteydellä kerätä tietoa suurelta joukolta ihmisiä (sekä paikallisilta että myös muilta) sekä kyky käsitellä ja yhdistää suuria määriä digitaalista, spatiaalista dataa. Menetelmää käytettäessä luottamuksen ja läpinäkyvyyden lisääntyminen erilaisten toimijoiden välillä on huomionarvoista. Harvaan asutuilla alueilla leimaantumisen pelko on tärkeä muistaa osallistettaessa ihmisiä maankäytön suunnitteluun. Erityisesti näissä tilanteissa osallistava paikkatieto voi rohkaista ihmisiä osallistumaan suunnittelun prosesseihin, koska menetelmä mahdollistaa anonyymin osallistumisen.

Tulokset osoittavat, että on olennaista käyttää osallistavan paikkatiedon menetelmää todelliseen ja jopa akuuttiin maankäytön suunnittelun tarpeeseen. Tällöin ihmisten



motivoiminen kyselyyn vastaamiseen on helpompaa, ja todennäköisyys sille, että saatuja tuloksia hyödynnetään käytännössä, kasvaa. Jos osallistavan paikkatietomenetelmän käyttö ei ole vahvasti osa suunnitteluprosessia, siitä saadut hyödyt saattavat jäädä heikoiksi. Näin ollen on suositeltavaa, että menetelmän käyttö sidotaan vahvasti suunnitteluprosessiin ja sitä käytetään prosessin alkuvaiheessa. Hyödynnettäessä osallistavan paikkatiedon menetelmää organisaation johtajien kiinnostus ja sitoutuminen sen käyttöä kohtaan on keskeistä, jotta saadut tulokset olisivat mahdollisimman vaikuttavia.

Osallistava paikkatieto –menetelmä ei yksinään korvaa muita osallistamisen muotoja ja se on hyvä nähdä yhtenä osallistamisen työkaluna ja sosiaalisen paikkatiedon keruumuotona. Kun menetelmää käytetään, on hyvä olla myös kriittinen sitä kohtaan, koska työkalu on usein kaupallinen tuote. On olemassa aina riski, ettei työkalu vastaa tilaajan tarpeita esimerkiksi teknisten ominaisuuksien puolelta. Internet-pohjaisen karttakyselyn luominen on suhteellisen helppoa, mutta olennaista on käyttää riittävästi aikaa ja resursseja analyysiin tulosten keräämisen jälkeen esimerkiksi paikkatietoanalyysien keinoin. Osallistavan paikkatietoaineiston systemaattinen tallentaminen organisaation IT-järjestelmiin on tärkeää, jotta tieto on helposti saatavilla mahdollista myöhempää käyttöä varten.

**Asiasanat** PPGIS eli osallistava paikkatieto, maankäytön suunnittelu, osallisuus / osallistaminen / osallistuminen, maankäytön muotojen yhteensovittaminen, harvaan asutut pohjoiset alueet

## List of original publications

1. Kantola S\*, Uusitalo M, Nivala V & Tuulentie S (2018) Tourism resort users' participation in planning: Testing the public participation geographic information system -method in Levi, Finnish Lapland. *Tourism Management Perspectives* 27: 22–32. <https://doi.org/10.1016/j.tmp.2018.04.001>
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3. Kantola S\* & Tuulentie S (2020) Participation in a large Arctic city – the possibilities of PPGIS for improving interaction. *Polar Geography*. <https://doi.org/10.1080/1088937X.2020.1767709>
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## Author's contributions

\* The author was responsible for collecting and analyzing the data and the author is the main writer. The article was written in collaboration with other writers.

\*\* The data was collected and analyzed and the article was written in equal collaboration with other writers.

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Rovaniemi, November 2021

Sini Kantola

## I Introduction

### I.1 Background and research environment

For a long time, participatory planning has been a part of the discussion on land use planning but has been especially highlighted during the last three decades (Beierle & Cayford 2002; Randolph 2011; Kahila-Tani 2015). The communicative turn of participatory planning happened in the 1970s and 1980s when the importance of interaction and the role of the participants in land use planning as a producer of information became more prominent (Friedmann 1973; Healey 1997; Horelli 2002). The role of the participants in the land use planning process is not simple and changing the existing power structures requires the use of new methods and changing the modes of action (Staffans 2004; Rantanen & Kahila 2009).

In Finland, sparsely populated Northern regions pose specific challenges for planning (Kantola & Tuulentie 2020) and is complex. Contrary to more densely populated areas, in those regions, land ownership by the state or municipality is more common. Different livelihoods and working possibilities are also much more dependent on natural resources and land use than in cities. Because the state owns the land, the reconciliation of different land uses is essential because there is rarely only one way to use a land (Kangas & Naskali 2001). The relationships of locals toward public land vary and people have different views about, for example, everyman's rights, reindeer herding or hunting rights. In many cases, non-locals are interested in following the issues happening in sparsely populated Northern areas because of the many natural resources and national parks located there. On public land, participation is often done by the Finnish Forest and Park Service (Metsähallitus), contrary to regions where the land is privately owned and participation means involving landowners.

The different types of land use interests in sparsely populated Northern regions are tourism, mining, forestry and other primary production, local people's livelihoods and recreational possibilities, and the opportunity for indigenous people to practice their culture, traditions, and livelihoods, for example. Furthermore, there are many military and security needs and uses in the North, as well as major nature conservation interests in the many protected wilderness areas and national parks. The nature is also very ecologically sensitive, and climate change is thought to cause changes in the fauna and flora and human wellbeing. One special characteristic of the Nordic countries are the so-called everyman's rights. These give everyone the basic right to roam freely in the countryside, regardless of who owns or occupies the land (Tuulentie & Rantala 2013). All that makes land use planning in sparsely populated Northern regions a complex issue and calls for the rethinking of planning participation approaches. The importance of getting spatial information is emphasized.

In Finland, the reconciliation of the different land uses has been discussed especially in regarding the use of forests. Forestry has been a significant economic livelihood and an export product since the 1800s (Kangas & Kokko 2001). Bio-based livelihoods (forestry included) are still an important part of Finnish society. One cornerstone of the bio economy is to secure ecosystem services according to the principles of the sustainable development (Valtionneuvoston kanslia 2016). What is essential is the use of natural resources and planning land use in a sustainable way, for example, the discussion on the limits to growth in the tourism sector (Saarinen 2006; 2013) and the development of local communities and sustainable tourism (Saarinen 2019). One part of sustainability is to ensure the possibility for citizens to participate, both on

a national and local level. Participatory planning is one way to improve and achieve social sustainability and prevent conflicts (Hellström 2001; Garcia, Benages-Albert & Vall-Casas 2018; Wolf, Brown & Wohlfart 2018). Measuring the benefits of different land uses is not simple because meanings and values vary according to the person, for example, the recreational use of nature is important for the public health (Kangas & Naskali 2001).

Digitalization and internet-based participatory tools make it possible to participate in new ways (Horelli 2002; Afzalan & Muller 2018; Muñoz *et al.* 2019; Staffans, Kahila-Tani & Kytä 2020) and many governments around the world use electronic participation methods to engage their citizens. (Tsai *et al.* 2006; Kingston 2013; Valtioneuvoston kanslia 2016: 73; Oliveira, Oliver & Ramalhinho 2020). The participation of citizens in land use planning and decision-making with new digital tools presents many possibilities. At the same time, there are many issues to take into consideration with the new methods, like equal participation possibilities for citizens. Especially internet and digitalized services open new channels in addition to traditional participation (e.g., public hearings, which are defined by law). Furthermore, the long and expensive complaint processes for land use, for example in municipal decision-making, raise the question of whether it would be possible for citizens to participate in an earlier phase and in an easier way.

The need for participatory planning and public participation geographic information system (PPGIS) was born from the critique that the opinions of local people are not adequately considered in decision-making (National Center for Geographic Information and Analysis 1996). The aim of PPGIS is to engage

“the public in decision-making through its goal to incorporate local knowledge, integrate and contextualize complex spatial information, allow participants to dynamically interact with input, analyse alternatives, and empower individuals and groups” (Sieber 2006: 503).

In this respect, the ideal is that by using the map-based methods, “silent and loud voices” would be heard equally (Brown 2006). Different types of participatory GIS-based tools, like planning support systems (PSS), PPGIS and tools gathering volunteered geographic information (VGI), have been developed for improving participation in land use planning (Kahila-Tani 2015). The basic idea of PPGIS is simple: social values are localized by means of either electronic or paper maps. PPGIS has been used to obtain experiential knowledge about the target area (Rantanen & Kahila 2009; Kahila & Kytä 2010; Brown 2012). This social GIS information can be combined with other GIS data to produce context-dependent maps. Internet-based PPGIS methods offer the possibility to produce information that comes from a larger number of people and is in a digitalized form already.

Despite innovative technological work, challenges remain in adapting these tools to support participatory planning practices on a permanent and profound level (Kahila-Tani 2015). One main challenge in PPGIS research is the question of what happens to the PPGIS information in land use planning and decision-making (Brown & Fagerholm 2015; Raymond, Fagerholm & Kytä 2020). This is a challenge in all types of online participatory technologies (Afzalan & Muller 2018) and there is no empirical evidence of how PPGIS information has been used, applied and adopted in decision-making related to land use. Even though PPGIS can support land use planning, it may not have been fully integrated with the planning process (Kahila-Tani & Kytä 2017).

Many researchers consider the authorities' attitudes as a major problem in realizing interaction and the implementation of information obtained with participation methods such as PPGIS (Rantanen & Kahila 2009; Wood 2010; Hysing 2013; Brown & Kyttä 2014; Brown 2017). While there are different ways to participate, people often feel that they do not have a real possibility to influence the actual decision-making that has impact on their everyday lives (Harrison & Haklay 2002; Tosun 2006; Kahila & Kyttä 2010). In this respect, social and ecological values have often been felt to be less important than economic interests (Irvin & Stansbury 2004; Leskinen 2004; Saarikoski, Tikkanen & Leskinen 2010; Kantola & Tuulentie 2020). According to Boroushaki and Malczewski (2010), however, people are interested in participating in decisions that impact their lives and living environments.

In Finland, the participation in land use planning is guided by international commitments and the land use and building act. The planning system in use recognizes participatory planning and is referred to in the Land Use and Building Act (Finlex 132/1999 English) and the Local Government Act (Finlex 410/2015). These acts emphasize the role of participation, collaboration and transparency in planning practices. They aim to ensure the involvement and interaction of all relevant participants in the preparation of plans (Kahila 2013). Therefore, for the future of democracy, the sense of trust between public administration and citizens is of central importance. In interactive planning, the participants take part in the planning and decision-making because they can impact the real plan (Faehnle 2014). However, the implementation of the acts varies a lot between different places, as Bäcklund and Mäntysalo (2010) show. Even though participation is regulated by law, the role of the information the participants receive is not clear. This makes the interaction frustrating both for planners and citizens (Faehnle 2014). This is a question about power; how authorities, decision-makers and different stakeholders react to the information produced by citizens and what kind of meaning this kind of knowledge is given in relation to other existing information (Faehnle 2014; Faehnle *et al.* 2014; Bryan 2015).

In the Finnish government, improving electronic services and digitalized democracy has been expedited by the program of the Ministry of Finance (SADe program) (Ministry of Finance 2020). One part of the SADe program has been to develop different electronic participation services. For the residency and building sectors, an online-based map survey was developed (Harava). The tool was also presented in a meeting of the council of the United Nations as a good example of improving citizen participation in decision-making. Another example of the growing respect towards online-based maps surveys as a good and serious participatory tool is that the company (Maptionnaire) selling the online map surveys was mentioned in the international research center Nordregion's Key Nordic Sustainable Urban Development Solutions (Nordregio 2020).

## 1.2 Objectives and scope

The scientific framework of this doctoral dissertation is based on human geographical and governance of natural resource discussion, and there are elements of planning geography and the development of PPGIS methodology. The role of PPGIS in participatory land use planning in sparsely populated Northern regions has been examined as well as what types of practices and information PPGIS brings to public participation in land use planning. The participation in land use planning and the

reconciliation of different modes of the land use are the main issues. The emphasis is especially on the development of social sustainability in land use planning. With PPGIS, the idea is to make social and experience knowledge more visible for land use planning and decision-making to improve more sustainable land use.

This research expects that different types of structures of information and power exist in planning and decision-making. The different roles of the information in land use planning and reconciling diverse livelihoods in Northern regions are in focus. The research country and region is the sparsely populated Finnish Lapland: a tourist resort Levi in the municipality of Kittilä, the city of Rovaniemi and organizations who have used PPGIS in Lapland (research areas Levi, the municipality of Muonio and the whole of Lapland). The research focuses on Northern regions and local citizens, entrepreneurs and the visitors of the region.

During my doctoral dissertation process, I have cooperated with the researchers of Natural Resources Institute Finland (Luke) (especially Rovaniemi unit), for example, with data collection and writing articles. The first project was called "Vigorous Forests and Green Roofs", and the case region was the resort, Levi. Another project was called "Building shared knowledge capital to support natural resource governance in the Northern Periphery" (*BuSK*), in which I focused on the city of Rovaniemi.

The main research question of this doctoral thesis is:

What types of practices and knowledge does PPGIS bring to public participation in land use planning in Northern regions? (Articles 1-4)

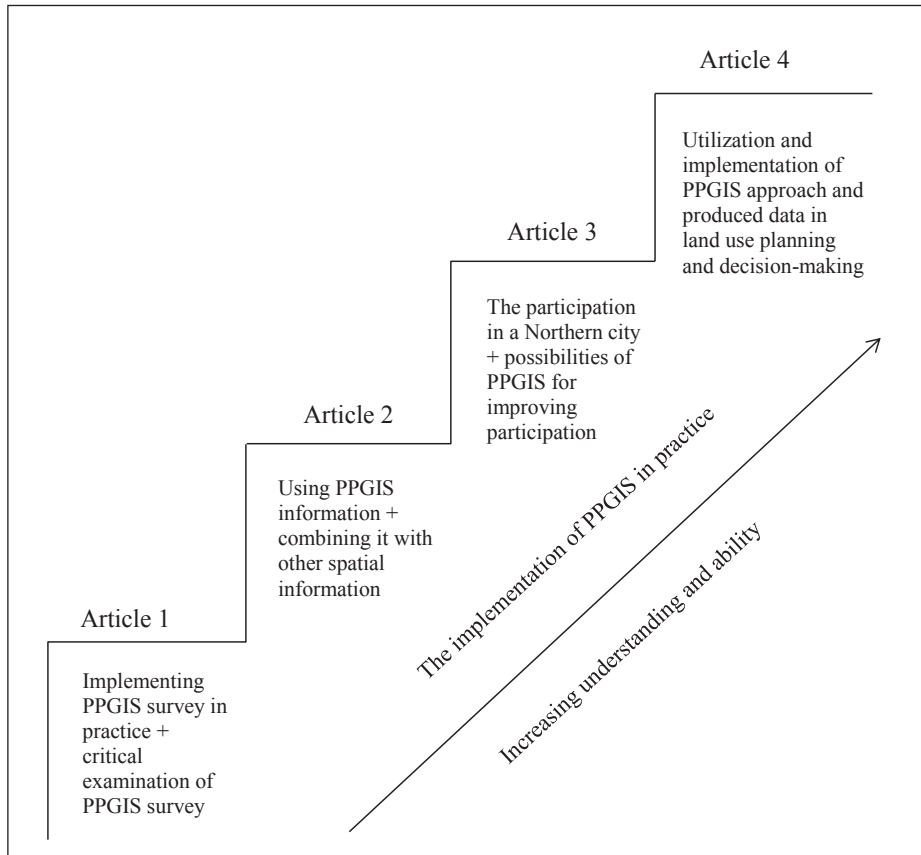
The main questions are divided into the following sub-questions:

- How did the PPGIS survey represent social place experiences in a Northern resort? (Articles 1 & 2)
- If PPGIS is used as a participatory tool in sparsely populated Northern regions, what role does PPGIS have and what are the best practices of its use? (Articles 1 & 4)
- How is participation in land use planning and decision-making realized in a Northern city? (Article 3)
- How has the knowledge collected with PPGIS been used in land use planning and decision-making? (Articles 1-4)

The data of the doctoral dissertation consists of four parts (Figure 1). Firstly, a closer look at PPGIS method in land use planning was taken. The first research article focuses the use of PPGIS in tourism resort planning where it has seldom been used. The main emphasis is on the use of the PPGIS method and its critical evaluation. In the second article, the results of the tourist resort planning project are used in route network planning. The social spatial knowledge given by a PPGIS survey was added to other existing spatial information, like the information of the route network and ecological knowledge. In the third article, where new data was collected, I extensively interviewed the stakeholders, decision-makers and authorities of the city of Rovaniemi regarding the participation and about the possibilities of improving interaction with



PPGIS. With the third set of data, the fourth article focuses on one of the main problems of PPGIS literature, which is the use of PPGIS in practice. I visualized the doctoral dissertation project as stairs where we move from the local use of PPGIS towards broader discussion about participation and the real use of PPGIS information. In addition, my understanding about participation and PPGIS has grown throughout each data and article.



**Figure 1.** Process of the doctoral dissertation.

## 2 Land use planning in the North and PPGIS as a land use planning tool

### 2.1 Land use planning and participation

#### 2.1.1 *The basic principles of the land use planning – Communicative consensus-oriented planning*

Traditional, rationalistic planning is based on the power of the expert and highlighted rationality, quantitative data and careful analysis of the data while making decisions (Horelli 2002; Bäcklund & Mäntysalo 2010). The turn of communicative planning happened in the 1970s when Friedmann (1973) began to highlight the importance of participation at an early stage. Even before that, Lindblom (1959) brought out opinions that information is always incomplete and there is no value-free information. Lindblom highlighted the theory of incrementalism as criticism to the tradition of rational planning (compared to comprehensive-rationalistic planning).

In incrementalism, it is essential to understand the limited possibilities of the planning to predict the development of the future (Bäcklund & Mäntysalo 2010; Kahila-Tani 2015). The importance of achieving a broader base of knowledge and the impossibility of value-free planning are the main questions in the theory. By understanding this, it would be possible to increase the possibilities of a citizen producing information for the needs of planning. According to incrementalism, the knowledge of the planners is always incomplete and they are not value-free either, which means that they prioritize some values more than others. The planning process always includes values (Kahila-Tani & Kytä 2017) and, in addition to statistic information, it is important to understand the need for diverse and varied information.

In transactive planning, Friedmann (1973:171–193) highlighted the dialogue between planners and participants:

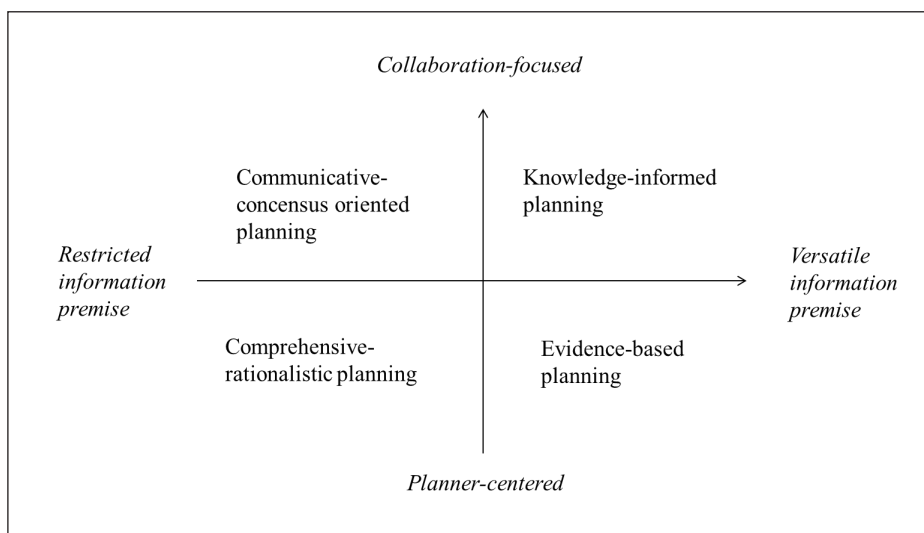
“In mutual learning, planner and client each learn from the other – the planner from the client’s personal knowledge, the client from the planner’s technical expertise.”

Conflicts can be solved through dialogue and they can be seen “as an inevitable part of dialogue and not its termination”. According to Friedmann, the problem has been that messages have been changed between planners and people but not the real meanings of the issues. An attitude favorable to dialogue tends to bring forth an urge to participate in it.

Healey (1992) created the concept of a communicative turn in planning theory. His thoughts are based on Habermas’ (1981) communicative rationality in which the main idea is to make a decision after different types of debate in society: “In this conception, planning, and its contents, is a way of acting we can choose, after debate” (Healey 1992). Habermas highlighted every person’s equal opportunity to discuss and the meaning of different knowledge while searching for a solution (Healey 1997). Habermas’ premise is that rationality has a social character and is linked to communicative interaction (Kangas 1994). Scientific knowledge is not only rational, but values and emotions are important bases of thinking and functioning. According to Habermas, communicative action is possible if different actors combine their actions based on a commonly accepted definition. What is important is the use of language, which is based

on mutual understanding. According to Healey (1992), “learning and listening and respectful argumentation are not enough.” Everybody affected by a plan should have an equal possibility to participate in the planning process. In communicative planning theory (Healey 1997), the main principles are that all forms of knowledge are socially constructed, people learn about their views in social contexts and through interaction, and they have diverse interests and expectations. Collaborative planning tries to avoid an “I win – you lose” approach. Instead, it asks: “Can we all get on better if we change how we think to accommodate what other people think?” The strength of collaborative planning is valuing diverse information from diverse sources – not only appreciating the knowledge of authorities.

Kahila-Tani (2015: 44) summarizes four planning approaches (Figure 2) which have been used in the second half of the 20<sup>th</sup> century. The previously presented theories of Lindblom (1959), Friedmann (1973), Habermas (1981) and Healey (1992, 1997) provided background for these approaches. Comprehensive-rationalistic planning highlights an expert-driven approach (Bäcklund & Mäntysalo 2010). In this approach, a fact-based way to solve issues is highlighted and an expert is the one who makes decisions. The opinions of the audience / general public are not seen as important in the comprehensive-rationalistic approach, which has been strongly criticized (Kahila-Tani 2015). According to evidence-based planning, there are different types of knowledge, and it is accepted that the producers of the information have different backgrounds. Knowledge-informed planning includes the views of different existing knowledge and also the need for differing knowledge while making decisions. It highlights the fact that information produced by different methods produces different knowledge. Communicative consensus-oriented planning highlights the importance of interaction, communication and participation, which did not exist in evidence-based planning (compare Lindblom 1959). Communicative consensus-oriented planning is based on the concept of communicative planning, which Healey (1992, 1997) has developed. Communicative planning has nowadays been called, for example, participatory planning, and this research is mainly based on the paradigm of this planning approach.



**Figure 2.** Remolding a figure by Kahila-Tani (2015: 44): Framing knowledge-informed planning through a four-fold urban planning approach.

The communicative consensus-oriented planning theory has been critically debated. Critics have most often pointed to the idealistic and utopian character of the theory. However, it defines an important role for citizens as actors contributing to planning argumentation. (Bäcklund & Mäntysalo 2010). Hytönen (2019) argues that applying communicative planning theory in a context-insensitive manner in Finnish legal and administrative culture may lead to increasingly market-oriented planning. Due to the possibility of narrow focus in local circumstances, collective perspectives related to broad environmental concerns, for instance, may be left out. Likewise, the concept of public interest has increasingly taken on individualist and narrow connotations. A narrow focus in local circumstances and local interests is not without problems if it weakens the status of the public planner in relation to particular economic interests.

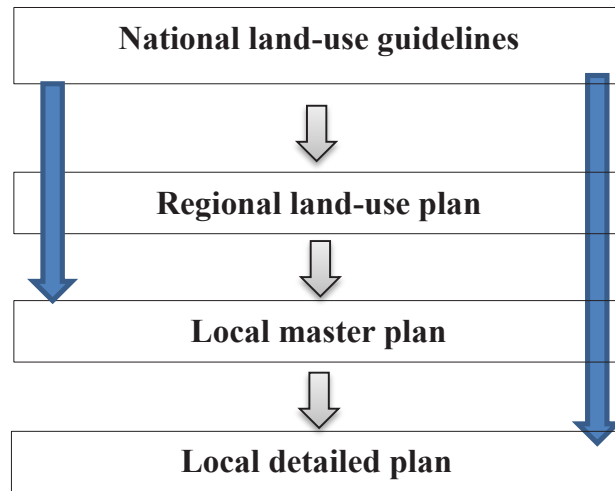
The problems and obstacles met in participation include: a lack of trust towards authorities and politicians, the unwillingness of authorities to enable participation by the public, weak representation of the respondents, a lack of resources in authorities, over-representation of economic interests, defective or faulty information, lack of time, uncommitted participants, stakeholders clinging to their opinions, not enough responsibility given to stakeholders by the decision-makers, hierarchy of authorities, and legal action (Harrison & Haklay 2002; Irvin & Stansbury 2004; Tosun 2006; Randolph 2011). Furthermore, a lack of trust among the parties, the long timespan of the decision and planning processes and planning entities that are too complicated can bring about poor participation results. Randolph (2011) points out that not all people are willing to participate, no matter how much work is put into involving them. Moreover, participation methods that are biased (Anderson, Beazley & Boxall 2009) or too demanding technically may lower motivation to participate (Pettersson-Forsberg 2014).

### 2.1.2 Finnish land use planning system

The four planning approaches summarized by Kahila-Tani (2015) (Figure 2), presented in the previous subchapter, have impacted Finnish land use and land use planning, and have been essential in other western countries. According to Kanninen and Bäcklund (2017), the Finnish and Nordic zoning system is hierarchical and juridical; it is strongly instructive. Municipalities also have a zoning monopoly, which means that they have an exclusive right to zone inside the administrative region for anyone's land.

The guide of the use of the region is under the Ministry of the Environment and it includes steering and controlling. It includes political guiding on a national level, three types of zoning on different levels and other regulations and instructions which have been written in the Land Use and Building Act. The realizers of the land use guidance are the Ministry of the Environment, Centres for Economic Development, Transport and the Environment (ELY centers) and Regional State Administrative Agencies, regions, municipalities and other sectors. From the perspective of participation, it is essential to notice that no single party is responsible for land use planning and development alone (Kanninen & Bäcklund 2017). The goals of regional use are strategical goals and operations models for zoning and guiding land use planning on a national level.

The Finnish three-parts zoning system includes regional land use plans, local master plans and local detailed plans (Figure 3). Creating and accepting regional land use plans is the responsibility of the Regional Council and is the most general of the plans. The plan directs the strategical land use plan of the region and important region reservations and defines protect and development targets. The local master plan is



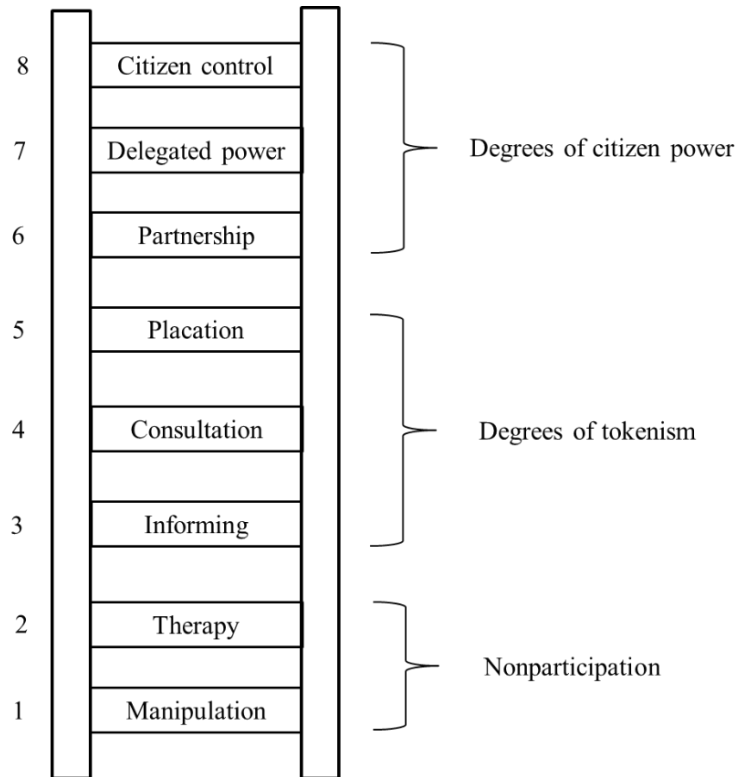
**Figure 3.** Finnish legal land use planning structure of the regions where the higher level guides the lower zoning level (Finlex 132/1999 English. Land Use and Building Act 1999).

created and accepted by the municipality and includes the structure of the municipality. In the local detailed plan, a specific land use and plan of the region and statements of the construction permissions are determined. Municipalities are also responsible for creating local master plans.

### 2.1.3 Participation in the land use planning

Participation is place and context dependent, and the problems and benefits vary with the subject matter (Irvin & Stansbury 2004). It has many benefits, such as mutual learning between the parties, empowerment, prevention of deadlocks and court conflicts, and managing the environment. Building trust between the different parties, such as stakeholders, authorities and politicians, is also an essential benefit (Beierle & Cayford 2002; Irvin & Stansbury 2004). It is not guaranteed that collaboration and use of experiential knowledge automatically leads to better outcomes (Faehnle 2014). By understanding the nature and role of experiential knowledge, it is possible to design processes that are more effective in enhancing municipal democracy.

Arnstein's (1969) seminal work on the ladder of participation (Figure 4) with three levels – non-participation, tokenism and citizen power – has been improved since its presentation, and shortcomings such as ignoring the existence of different relevant forms of knowledge and expertise have been discussed (Tritter & McCallum 2006). In addition, the thought that participation and interaction would automatically improve while moving from a lower step to the next one has been criticized (Reed *et al.* 2009). The top-bottom approach in land use planning has also been criticized a great deal, but Reed *et al.* (2018) think that it could be useful in some situations. This issue needs to be approached differently in each context because there is sometimes a need for authority-based participation.



**Figure 4.** Remolding Arnstein's (1969) eight rungs on a ladder of citizen participation.

Horelli (2002) determines participatory planning as the following:

“Participatory planning is a social, ethical, and political practice in which individuals or groups, assisted by a set of tools, take part in varying degrees at the overlapping phases of the planning and decision-making cycle that may bring forth outcomes congruent with the participants’ needs and interests.”

Participatory planning supports the communicative transactions of participants in the overlapping phases of the planning cycle. Horelli (2002) divided participation into five different levels. The first is that authorities are in charge and there is no participation, which means no community involvement. The second one is information, which means that authorities are still in charge but a one-way flow of information exists. Consultation means that authorities are still in charge, but ask opinions. In partnership, work and decision-making is shared between the authorities and stakeholders (community). In community control, the community decides and the experts are used as resources for knowledge.

In order for participation in land use planning to be as effective as possible, Reed *et al.* (2018) list principles which help make the following recommendations for practice. Firstly, it is good to take time to fully understand the local context to determine the appropriate type of engagement approach and adapt its design to the context. Secondly, it is important to make sure that all affected parties are involved in the dialogue as

soon as possible, to develop shared goals and co-produce outcomes based on the most relevant sources of knowledge. Thirdly, the leader of the process needs to manage power dynamics so that every participant has an equal opportunity to contribute and their contribution is valued. Fourthly, matching the length and frequency of engagement to the goals of the process is important as well as recognizing that changes in deeply held values are likely to take longer than changes in preferences. Lastly, the representation of stakeholder interests and decision-making power should be matched to the spatial scale of the issues being considered.

There are many reasons and motivations to participate. Reed *et al.* (2018) divided motivations into three categories. Motives can be pragmatic, which means better decisions that are more likely to be implemented. Motives can be normative, like the democratic right or expectation that stakeholders and/or the public should participate in major decisions that affect them, or the motives may be to enhance trust in decision-making processes among the public and stakeholders.

There are many ways to involve and engage people: advisory groups, cooperation between different parties, surveys, conflict solution groups, interviews, leaflets, the media, public events, rounds of commentary, and small groups (Beierle & Cayford 2002; Horelli 2002; Anderson *et al.* 2009; Randolph 2011). Physical public events are no longer regarded as a strong enough way of involving the public, but the need to participate electronically has increased (Goodchild 2007; Hanzl 2007; Boroushaki & Malczewski 2010; Kahila & Kytä 2010; Staffans *et al.* 2020). Online techniques offer different, and possibly more effective, ways to support the participatory component of planning processes (Afzalan & Muller 2018). The internet makes it possible for people and groups who agree or disagree with each other to have cross-border, and even global, discussions (Hanzl 2007; Stieglitz & Dang-Xuan 2013; Loader, Vromen & Xenos 2014; Boulianne 2015). At the same time, because the internet makes possible to collect data from a large number of participants, it causes challenges for both analyzers of the data and planners (Staffans *et al.* 2020). The usability and applicability of web-based tools like PPGIS can also be challenging for planners and citizens (Garcia *et al.* 2020).

The role of public participation in planning is place specific and largely determined by the nature of the planning enterprise (Healey 2004; Lane 2005). Reed (2008) speaks about the importance of participation throughout the process, not just using some tools of involvement. Furthermore, the role of delivering information and knowledge is crucial (Bruckmeier & Tovey 2008). However, the obligation and power to make decisions cannot be handed over to the different parties. In a democratic society, it is the politicians and authorities that have the responsibility to make decisions (Aarts & Leeuwis 2010; Kantola & Tuulentie 2020).

The question of who should be involved in land use planning processes continues to be relevant (Forester 1987; Beierle & Cayford 2002; Harrison & Haklay 2002; Schlossberg & Shuford 2005; Sieber 2006; Randolph 2011; Brown 2012). Horelli (2002) raises some critical questions concerning the eligibility of participants: is everybody able to participate in the project, who decides who can participate, and what the criteria of representation for the public are. Attention should be paid to those people and groups in particular that do not look like parties at first, for they can bring surprising new perspectives to the topic (Randolph 2011).

Estimating and measuring the impact of the participation is challenging (Blackstock, Kelly & Horsey 2007). Decision-making is often politics, where decisions do not need to only be based on factual knowledge. Staffans *et al.* (2020) studied how digitalization

supports various communicative actions in public participation in the Helsinki City plan process. They did not find any systematic analysis of the discussion about thousands of comments from citizens obtained with different methods like PPGIS and workshops. According to them, more attention in communication should be put on the link between the knowledge produced in the public participation process and the content and solutions of the plans. More systematic analyses of the feasibility of the various modes of communicative action and digital tools are needed.

Beierle and Cayford (2002) point out that the impact of the information obtained through the participation process can only be properly evaluated after 5-7 years have passed. They have defined “Five stages of Implementation” where the progress, from public participation to implementation, goes through five stages, starting with the output of the public participation process and ending with real changes in the environment. The stages one to five are the following: output of the public participation process (e.g., recommendations or agreements); decision or commitment on the part of the lead agency; changes in laws, regulation, or policy; actions taken on the ground; and changes in the quality of the environment.

#### *2.1.4 Participation in land use planning in Finland and the North*

Participation in land use planning in Finland is based on the Land Use and Building Act and Constitution §2, in which everyone is guaranteed the right to participate in and impact the development of the living environment land use. The ideology of the participation is based on the tradition of communicative consensus-oriented planning. According to the law, the relevant participants are landowners, authorities, societies and everyone who can notably affect the zone by living, working or in another way. The Land Use and Building Act is as follows (Finlex 132/1999 English):

“The objective of this Act is to ensure that the use of land and water areas and building activities on them create preconditions for a favorable living environment and promote ecologically, economically, socially and culturally sustainable development. The Act also aims to ensure that everyone has the right to participate in the preparation process, and that planning is high quality and interactive, that expertise is comprehensive and that there is open provision of information on matters being processed.”

The Land Use and Building Act is under renewal (Ministry of Environment 2020). The main objects of the reform are to achieve a coal-neutral society, the strengthening of natural diversity, the improvement of building quality and the promotion of digitalization.

In Finland, the improvement of participation is visible in a zoning system because the Land Use and Building Act obligates that authorities are responsible for creating a participation and estimation plan and making sure that everybody who considers themselves a participant is able to participate in the zoning process. Participation should be possible in all three levels of the plan. The obligation to make it possible to participate is part of the law, and a principle of public access is also applied to the planning process, that is, an obligation to provide information about planning processes that will be started (Kanninen & Bäcklund 2017). Participation in practice can be, for example, voting in elections, signing petitions, boycotts, striking and demonstration



(Staffans 2004). Furthermore, it can be statements, reminders, complaints, participating in public discussion through different media, personal connections and lobbying. There are possibilities to participate in surveys and public hearings.

In Finland, participating in land use planning has been implemented by active citizens (Kahila-Tani & Kytä 2017). The third sector, for example, resident and village committees have offered good starting points for the participation work of citizens. Influencing on social media through different groups has opened new channels for participation. Still, all these channels do not reach all citizens, and for these reasons, digital participation methods like PPGIS have been developed (Vonk & Geertman 2008; Kahila-Tani & Kytä 2017; Staffans *et al.* 2020).

There has been some research on participation and interaction in sparsely populated regions of the North (Sloan 2004; Armitage *et al.* 2011; Duyck 2011; Brunet, Hickey & Humphries 2014). Brunet, Hickey and Humphries (2014) report that the involvement of local people in Arctic regions has only slightly increased over the last half-century and that it continues to vary systematically according to discipline, organization, and region. Knowledge co-production and social learning are key issues when adapting to the environmental changes in the Arctic (Armitage *et al.* 2011). Duyck (2011) studied how various groups of non-state actors participated in international environmental decision-making in the Arctic. In Arctic fisheries, the participation of women in the decision-making processes of resource management has gone a long way towards broadening the concept of the fishery village in the Arctic (Sloan 2004). In Finland, Tuulentie and Mettinen (2007) have studied local participation in the evolution of ski resorts in Finnish Lapland and found that using the local knowledge of permanent residents could improve the planning process as a whole. Wider hearings would also prevent serious conflicts.

## 2.2 PPGIS method as a land use planning tool

As Longley *et al.* (2001) argued, knowing where something happens is critically important, and almost everything that happens, happens somewhere. Geographic information systems (GIS) enable interactive mapping of the attributes of an area, and this information can be utilized in the planning and decision-making processes (Boyd & Butler 1996: 380; Heywood, Cornelius & Carver 1998) like emergency control systems or large-scale physical infrastructure projects (De Smith, Goodchild & Longley 2018). GIS development originated from an interest in managing the urban environment and balancing competing uses of environmental resources. In other words, GIS includes two main aspects, which are location (i.e., information telling where something is) and attribute information identifying the location (Star, Star & Estes 1990). Maps are an effective way to represent the world and can be used for many types of purposes (Bryan 2015). They revise our way of conceiving the world.

One way to promote participation in land use planning is the method of PPGIS. PPGIS is one part of the geographic information systems (GIS) and is one geo-web method (Haklay, Jankowski & Zwolinski 2018) (Figure 5). The roots of PPGIS are in the aim to develop participation especially among people and groups who have traditionally been ignored in land use planning (National Center for Geographic Information and Analysis 1996; Sieber 2006; Ramasubramanian 2011). PPGIS methods aim to implement a bottom-up approach in land use planning and decision-making. Through the method – as well as generally with GIS – different scenarios of the future,

like visual scenarios on maps, can be produced (Dodge, McDerby & Turner 2008). The decision-making is then based on real and visible region maps and not only on unclear descriptions of regions. PPGIS is based on the idea that not everyone has equal and fair opportunities to participate (Hanzl 2007; Boroushaki & Malczewski 2010; Kahila & Kytä 2010; Brown 2012). Improving the interaction of planning processes is not a new thing, and PPGIS is best seen as a tool for achieving this goal.

Other geo-web methods are volunteered geographic information (VGI) and participation GIS (PGIS) (Brown 2016), of which PGIS has been used mainly in the context of land use planning in developing countries. PPGIS is often applied in cities when information about a larger number of the people is wanted to collect (Brown & Kytä 2014). Indeed, with PGIS, the information is not often shared publicly because the amount of the participants is lower in many cases compared to PPGIS. PGIS is more often linked to the concept of the empowerment of some group (Corbett, Cochrane & Gill 2016) and the challenges of indigenous people are handled with PGIS (Chapin, Lamb & Threlkeld 2005). However, the difference between PPGIS and PGIS is not that clear (Sieber 2006; Brown & Kytä 2014; Sandström, Sandström & Nikula 2020). As a multidisciplinary concept, PPGIS is also between two dominant components of geographic information systems (GIS) and public participation (PP):

“Whereas the former emphasizes spatial technology and information, the latter emphasizes the human and social processes used to engage broader audiences in planning, design and management. This contest between technology and social processes is likely to continue as this multidisciplinary partnership represents an uneasy merger of contrasting knowledge paradigms” (Brown & Kytä 2014).

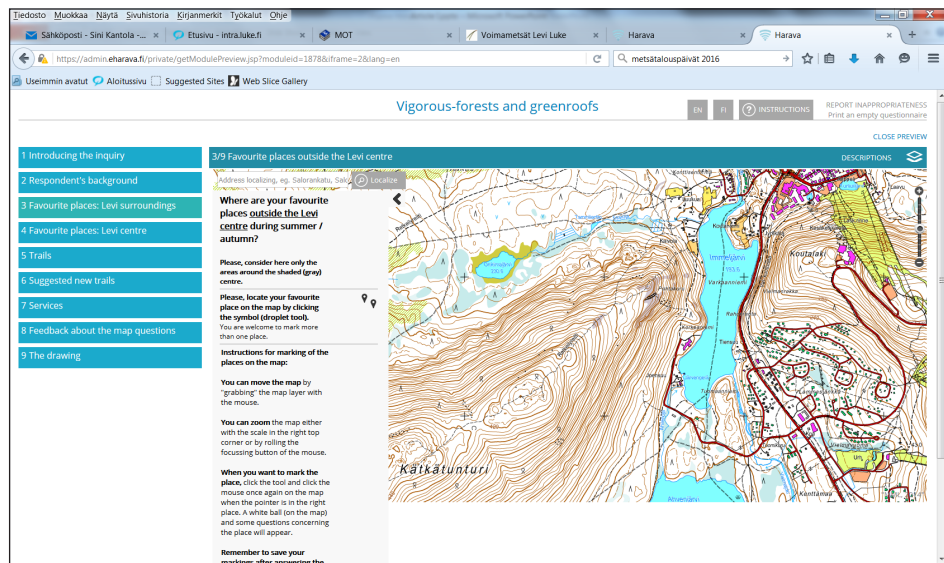


Figure 5. An example of PPGIS survey (Natural Resources Institute Finland 2015).

Finland, Poland and the USA (e.g., Ramasubramanian 2011; Brown & Kytä 2014; Brown 2015 & 2017; Kantola *et al.* 2018; Pietilä 2018; Jankowski *et al.* 2019a, 2019b; Kahila-Tani, Kytä & Geertman 2019; Karimi & Adams 2019; Laatikainen, Haybatollah & Kytä 2019). In addition to researchers, many municipalities, cities and organizations make PPGIS surveys as well (Kahila-Tani, Kytä & Geertman 2019) but these are not reported any specific channel or scientific publications. PPGIS can be applied both in online map surveys and traditional paper map surveys. Internet surveys asking the location-based opinions of local people and residents are more cost-effective compared to their paper map counterparts (Brown & Weber 2013). Online map surveys are developed by various companies or are available from organizations all around the world (International Society for Participatory Mapping 2020). The main concept of online surveys is that respondents are able to answer a PPGIS survey without the need to be in a specific place at a specific time. Questions in PPGIS surveys can be either structured, open-ended or map based. Map responses are marked with a point, line or polygon directly on the map, and, depending on the type of the survey, the respondent may be able to give supplementary information about the location. PPGIS surveys are implemented by cities and municipalities as well as researchers and NGOs. The power of PPGIS is describing places which have some subjective meaning for a respondent without trying to identify physical landscape characters (Brown 2016). Through PPGIS, it is possible, for instance, to locate and show important places in the area (Brown 2004; Alessa, Kliskey & Brown 2008). Consequently, issues which are handled by PPGIS are often also emotionally charged, which is why it is important to protect the anonymity of responses when sensitive topics (e.g., those concerning minorities) are covered (Ball 2002).

Kahila-Tani (2015) has summarized seven planning phases where PPGIS could be used (Table 1). The phases overlap each other partly and show how participation with PPGIS is possible, even from the early phase of the planning process until the end, while giving feedback about the participation process.

Even though the purpose of PPGIS is good, like empowering and increasing bottom-up type planning, participatory mapping has its limits and challenges (Bryan 2015). For example, the question of who makes the PPGIS surveys and what is asked is problematic. Many researchers have listed the challenges of PPGIS (Ball 2002; Kangas & Store 2002; Wood 2005; Sieber 2006; Anderson *et al.* 2009; Kahila & Kytä 2010; Jankowski 2011; Brown 2012; Kingston 2012; Raymond, Fagerholm & Kytä 2020) and those include: the cover and function of the Internet connection, lack of IT skills, map reading skills, generalization, possibilities and willingness to participate, the function of PPGIS methods, scale (on which scale responses are wanted), resources and the lack of GIS experts. The usability and applicability of PPGIS tools, both for users and planners, are in foundation of the method (Garcia *et al.* 2020). The challenges can be divided into technical and response-based challenges (Kantola *et al.* 2018). New methods can create mistrust, and the proper use of the method can be slow (Brown 2012). Fagerholm *et al.* (2021) have developed “explore, explain and predict/model framework” which aims to guide both novice and experienced PPGIS practitioners in using the method.

One essential question with PPGIS is what happens to the information after it has been collected, analyzed, and presented (Raymond, Fagerholm & Kytä 2020). This is why the problem of the implementation information has been put forward as one of the most central questions in PPGIS research (Harrison & Haklay 2002; Anderson *et al.* 2009; Aditya 2010; Kahila & Kytä 2010; Brown 2012; Brown & Kytä 2014; Kahila-Tani 2015; Stewart, Jacobson & Draper 2017; Kahila-Tani *et al.* 2019; Raymond, Fagerholm &

**Table 1.** Different knowledge types produced by residents during each planning phase (Kahila-Tani 2015: 90).

<b>Planning project phases</b>	<b>Knowledge type</b>	<b>Aim</b>	<b>Supported planning approach</b>	<b>Examples of PPGIS tools</b>
<b>Phase 1: Early initiation</b>	From single feedback and suggestions to collective opinion by e.g. interest groups or more systematically collected evaluation knowledge	Promote new topics which participants find relevant in their living environment to affect agenda setting before initiation	Agonistic, deliberative	PPGIS (data validation with sampling and data collection voluntarily) OR Argumentation maps
<b>Phase 2: Initiation</b>	From more thematically structured surveys to value discussions	Supplement the existing background information of the project; test and gain understanding of collective opinion	Evidence based	PPGIS (data validation with random sample and data collection voluntarily)
<b>Phase 3: Formulation of alternatives</b>	From ideas and specific feedback on alternatives to common understanding	Increase the transparency of the process, validate the alternatives, support the understanding of the experts and bring in those residents that are more interested in influencing actual plan making phase	Communicative and deliberative	PPGIS workshops setting and broader data collection voluntarily about plan alternatives
<b>Phase 4: Decision-making</b>	Experts' and lay peoples' statements on the plan proposal	Validate the official decision-making process	Communicative, deliberative and evidence-based	PPGIS with person identification
<b>Phase 5: Implementation</b>	Feedback	Informing the residents about the construction phases	Communicative	PPGIS as a feedback channel for informing
<b>Phase 6: Evaluation</b>	Research-based collection on specific theme during specific time of the process (ex-post/ex-ante) or more continuously	Collect evidence on how the changes have affected the quality of the environment	Evidence based	PPGIS (data validation with random sample and data collection voluntarily)

Kyttä 2020); how to benefit from the PPGIS data and information as much as possible? Fagerholm *et al.* (2021) emphasize the important role of the researchers in ensuring that the PPGIS data and outputs can be readily applied in planning decisions by advancing methods that account for uncertainty. Systematic evaluations of public participation methods have been long called for among researchers (Rowe & Frewer 2000; Brown & Chin 2013; Staffans *et al.* 2020). Another difficulty is how to measure the significance of PPGIS data in land use planning and decision-making, which is a broader challenge related to measuring the importance of participation in general (Blackstock, Kelly & Horsey 2007).

The effectiveness of PPGIS methods has been evaluated from the perspective of respondents by assessing the representativeness of participants and stakeholders, the level of their involvement and the ability of different groups to access the process (Jankowski *et al.* 2019a, 2019b). Evaluation has often been performed in relation to the process criteria (the effectiveness of the process and the used methods) or the outcomes criteria (the evaluation or attainment of the outcomes and aims) (Rowe & Frewer 2000; Brown & Chin 2013; Kahila-Tani *et al.* 2016; Jankowski 2019a). The lack of agreement concerning evaluation criteria has been one of the reasons behind the sparse number of evaluation studies (Brown & Chin 2013; Staffans *et al.* 2020).

The choice of criteria can be influenced by the evaluation perspective, potentially involving planners, participants and researchers (Brown & Chin 2013). For example, the planner's perspective centers on the quality of data obtained from participation (i.e., participation outcomes) in terms of its information content and value for a planning procedure. Ramasubramanian (2011) used a meta-evaluation framework for studying the implementation of PPGIS in land use planning in the USA: the process, outcomes and impacts. In addition, they outlined three impact categories: process design, short-term outcomes and long-term impacts. Kahila-Tani *et al.* (2019) highlight the effectiveness of PPGIS tools in enhancing effective arrangements of public participation, reaching a broad spectrum of people and producing high-quality and versatile knowledge.

Brown (2012) studied 17 PPGIS surveys concerning land use planning cases over ten years, and the implementation of PPGIS information was underwhelming. The reasons for this were technological challenges, a lack of trust towards PPGIS information and the unwillingness of various parties involved to use PPGIS information. Kahila-Tani *et al.* (2019) examined the implementation of about 200 PPGIS cases all over the world, and they found that the use of a PPGIS survey in an early phase of the process reduced the need for its use later in the planning process. However, the use of PPGIS survey results has been extremely context bound and the use of those results has varied accordingly. Jankowski *et al.* (2019a) found that Geoweb applications (PPGIS methods) scale public participation more effectively than public meetings. The possibility of having a large number of diverse participants taking part in the process was one positive factor in the evaluation of the participation results. Staffans *et al.* (2020) studied how digitalization supports various communicative actions in public participation in the Helsinki City plan process. Admirably, 22 000 locations were received via PPGIS survey but the analyses of them were found to be weak and not systematic and many important political choices were already made before public participation even started.

Reed *et al.* (2018) propose a theory to explain the variation in outcomes from different types of engagement: (1) a number of socioeconomic, cultural, and institutional contextual factors influence the outcomes of engagement; (2) there are a number of process design factors that can increase the likelihood that engagement leads to desired outcomes across a wide range of sociocultural, political, economic, and

biophysical contexts; (3) the effectiveness of engagement is significantly influenced by power dynamics, the values of participants, and their epistemologies, that is, the way they construct knowledge and which types of knowledge they consider valid; and (4) engagement processes work differently and can lead to different outcomes when they operate over different spatial and temporal scales.

Faehnle and Tyrväinen (2013) and Faehnle (2014) have developed a framework for evaluating and designing collaborative processes of land use and nature area planning. The evaluation perspectives are knowledge integration, meaningful involvement, functioning governance and sustainable use of the area. The first three perspectives focus on the participation process and the last one on the evaluation of the implemented plan.

In this research, the examination is focused on Northern and sparsely populated cases. Brown (2012) and Brown and Kyttä (2014) have listed and explained examples of using PPGIS/PGIS in 40 different contexts in regional and environmental and urban-based PPGIS studies. In sparsely populated areas, PPGIS has been applied, for instance, in national forest planning, outdoor recreation planning and conservation planning. In cities, PPGIS has been used, for example, in community development, everyday mobility or neighborhood safety. In urban areas, the amount of the respondents in a PPGIS survey is often much larger than in sparsely populated areas and there is a lower risk of being recognized based on responses in more densely populated areas. Additionally, the variety of opinions can be larger because of the bigger population.

To give some examples of using PPGIS in sparsely populated areas, Eisner *et al.* (2012) developed a user-friendly platform for indigenous people to increase interactivity in Alaska. Fagerholm *et al.* (2016) assessed the links between ecosystem services, land use and well-being in an agroforestry landscape in Spain with PPGIS. Stewart, Jacobson and Draper (2017) used PPGIS in Arctic Canada and emphasized the importance of developing trust between parties and incorporating indigenous knowledge appropriately. Wolf, Brown and Wohlfart (2018) applied PPGIS in informing and managing visitor conflicts along multi-use trails in national parks in Australia. Muñoz *et al.* (2019) identified spatial overlap in the values of locals and tourists in protected areas in two national parks in Norway. Engen *et al.* (2020) applied PPGIS to assess local acceptance of protected area management in Norway. They found that use-based framing of conservation is more likely to resonate with these communities than narratives tied to the preservation of pristine nature and emerging conservation ideas of the rewilding of nature.

In Finland, PPGIS has been used mainly in urban planning (Brown & Kyttä 2014; Kahila-Tani 2015; Kahila-Tani, Kyttä & Geertman 2019; Staffans *et al.* 2020) but has been implemented in sparsely populated areas as well. Kantola *et al.* (2018) and Uusitalo *et al.* (2018) have done research testing the possibilities of using PPGIS in tourism resort planning. Visitors' assessments of the impacts of tourism have been mapped and used in Finnish national parks (Pietilä & Kangas 2015; Pietilä & Fagerholm 2016; Pietilä 2018). Kantola and Tuulentie (2020) have surveyed the possibilities of PPGIS in Arctic city planning. By using PPGIS, Tolvanen *et al.* (2020) investigated how people's recreational activities, values, and land use preferences are related to the protection level, biodiversity and cultural heritage values of nature-based tourism areas in Kainuu, northern Finland. The Finnish Forest and Park Service has used PPGIS surveys in regional plans in Lapland (Heikkonen 2013; Puustinen & Karvonen 2019). Brown *et al.* (2017) identified potential environmental and natural resource management conflicts by using PPGIS in Northern Finland. PPGIS was also used to map landscape values,

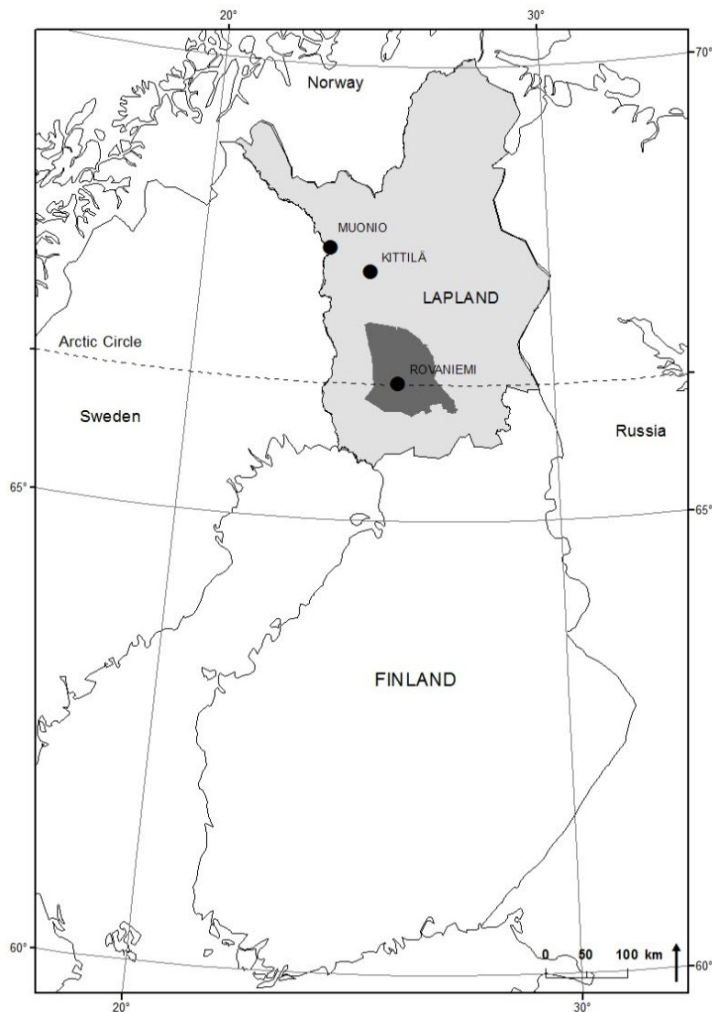
knowledge needs and future perspectives in post-mining environments in Northern Finland (Kivinen, Vartiainen & Kumpla 2018). Their results show that post-mining sites were generally considered unpleasant places. Identifying and mapping stakeholder values, opinions, and knowledge needs could significantly improve post-mining land use planning and mitigate the loss of multifunctional landscapes. The experiences of applying Akwé: Kon Guidelines into land use planning, based on PPGIS and interviews have been researched in Enontekiö, Finnish Lapland (Markkula *et al.* 2020; Nikula *et al.* 2020).

### 3 Research design and methods

#### 3.1 Case study areas

The research data focus on sparsely populated Northern regions where the special characteristics include broad public land ownership, many types of and often overlapping land use interests and broad, protected nature areas. The research areas (Figure 6) are examples of the development possibilities of sparsely populated regions.

In the first and second articles, the research area was the resort Levi, which consists of the village Sirkka and a newer resort region. Levi is located in the municipality of Kittilä in Western Lapland and is one of the biggest winter resorts in Finland and Northern Europe. There are many fells in the region, such as Levi fell and Kätkä fell. The biggest not-harnessed river inside Finland, Ounasjoki, runs next to the Levi center. Both nature attractions and different service and activity opportunities make Levi an appealing nature resort.



**Figure 6.** Research areas the city of Rovaniemi, municipalities of Muonio and Kittilä and the region of Lapland (Sini Kantola / Luke 2020).



In the third article, the studied region was the city of Rovaniemi in Finnish Lapland, in the Arctic Circle. The study focused on the area within the limits of the city of Rovaniemi. With its 62 000 inhabitants, Rovaniemi is the biggest city in Lapland (801 675 square meters) and the state owns 52% of the land in the region. The main livelihoods in Rovaniemi are in the service sector, tourism, and forestry, but reindeer herding, agriculture, other primary production, and mining are also well represented. The Finnish Defense Forces have a base in the city.

The cases in the fourth article represent different levels of planning: the first was a broad survey of the whole Lapland region (Finnish Forest and Park Service's Regional ecological planning in Lapland), the second used a PPGIS survey at the local level (Ylimuonio's land use plan) and the third one was a project based PPGIS survey (Project Vigorous Forests and Green Roofs). The last case is the same as the study in Levi in which the implementation of a PPGIS survey was studied. The cases focus on the theme of reconciling tourism, forestry and recreation with each other, and the case areas are mainly located on public land.

### 3.2 Data and methods

This doctoral dissertation is empirical, which means the materials collected from the research areas are used in the search for answers to the research questions as Niiniluoto (1980) explains. The method is descriptive and idiographic, which means that it focuses on individual cases. The research is a case study in which the target of the research is to study a process or phenomenon (Laine, Bamberg & Jokinen 2007) and different data and methods can be used.

This research represents a mixed method approach where both qualitative and quantitative methods of data collection and analysis can be used (Creswell 1999). This type of a research enables a researcher to understand complex phenomena qualitatively as well as to explain the phenomena through numbers, charts, basic statistical analyses, and descriptive analyses. The history of the mixed method is in the great clash between qualitative and quantitative methods (Rossman & Wilson 1985). With the approach, it appeared that both methods can be used in the same research project and produce a more constructive result. The benefit of the mixed method approach is that the research can present both quantitative data and narratives for decision making (Creswell 1999). The mixed method approach is often presented when the PPGIS method is used (Brown *et al.* 2017; Garcia, Benages-Albert & Vall-Casas 2018; Fagerholm *et al.* 2021).

The mixed method approach in this research was chosen because focus was not only desired on analyzing the online PPGIS survey and the quantitative points received but also on understanding the participation and implementation elements. That is why the qualitative approach was needed as well. With the quantitative approach, it was possible to get theme maps where the spatial information was visually summarized and statistical analyses had been made. The methods used were online and paper PPGIS, semi-structured theme interviews and observation of the reports and other documents. With these methods, quantitative, qualitative and spatial data were collected (Table 2).

In the first article, it was decided to use an online PPGIS survey to test how the tool works in tourism resort planning. The emphasis was on a quantitative approach by analyzing the points, but a qualitative approach was needed to understand the characteristics of the survey. The spatial information was analyzed with GIS analyses, like examining the exact locations of given places and making theme maps. The enquiry

included qualitative elements by having open questions which gave more specific information about single interesting spots or problems in the functionality of the survey. In the second article, the emphasis was on both quantitative and qualitative approaches, and the quantitative results and theme maps of the first article were utilized. For that information, more spatial information was added and new types of GIS analyses made. Qualitative elements were collected by theme interviews with local people and, in this way, their perspectives were more prominent. The third article had a qualitative approach by having semi-structured theme interviews. In addition, the interview data and spatial information was collected by asking people to mark points directly to the paper map. With the fourth article, the approach was also qualitative by having semi-structured theme interviews. In addition, reports and documents were examined.

All interviews were semi-structured theme interviews when the researcher has certain themes to cover in mind but the sequence of questions can vary (Hirsjärvi & Hurme 2015). The interviewer can also ask more specific questions concerning the theme at hand. The interview data has been analyzed through theory-driven content analysis. The programs ESRI ArcGIS, SPSS and NVivo have been used for the analysis work.

**Table 2.** Articles with research questions, research methods and data

Article	Research questions	Research method and year	Type of data	Data
I	How does PPGIS succeed in: 1. reflecting users' favorite places and 2. collecting users' knowledge on a nature-based tourism resort?	PPGIS survey for public: 2015	Quantitative, Spatial	309 point marks and 75 route marks (by 235 respondents)
II	1. How would the experiences of tourists and locals about the current trail network and places appear better? 2. How could the trails guide people better for the places, "vigorous forests" which offer memorable and wellbeing nature experiences, and which have seldom been used?	PPGIS survey for public and interviews: 2015	Quantitative, Spatial, Qualitative	309 point marks and 75 route marks (235 respondents), 9 interviews (local residents and entrepreneurs)
III	1. How has participation in land use planning and decision-making been implemented in the context of a sparsely populated Arctic city in past and present times? 2. How do the interviewees see the potential of the use of PPGIS?	Interviews and PPGIS on paper map: 2017	Qualitative, Spatial	27 expert interviews conducted with the presenters of stakeholder groups, authorities and politicians
IV	1. How has PPGIS data been used in actual decision-making? 2. What are the best practices for using PPGIS approaches and produced data in actual decision-making? 3. Do PPGIS approaches change the process of participation?	Interviews and observation documents and reports: 2019	Qualitative	6 expert interviews of the organizations and reports and documents

### 3.2.1 PPGIS survey and interviews in Levi (Articles I and II)

Behind articles 1 and 2 was the project "Vigorous Forests and Green roofs", which focused on developing summer and autumn tourism to Finnish Lapland, Levi resort as a pilot region (Kantola *et al.* 2018; Uusitalo *et al.* 2018). In order to learn about places with tourism and recreational values, ecological and physical spatial data was gathered first from existing data sources. The collected data included, for example, the hiking routes of the area, habitat network utilized by wildlife and other areas with high ecological value. Second, information about tourists' and local people's favorite places in the Levi area were acquired using the internet based PPGIS map questionnaire software. For the map questionnaire, the Harava software tool was used, and the survey included open, structured and map questions. The survey was open from July to September 2015. Background questions were age, gender, traveling company, method of traveling, the duration of the trip, permanent living environment and summer and autumn activities in the Levi region. In addition, respondents were asked how they found the survey. The respondents were requested to mark their favorite places on the map and explain why the places are special, what they do there, and how the places should be developed. There were questions about the use of the routes, too, and hopes for new routes. The favorite places were taken into consideration as social spatial information while creating the vigorous forest network in Levi.

It was possible to respond to the survey in both Finnish and English. The survey was advertised in different channels like sharing leaflets in different events in Levi, local shops and companies, local newspapers and on the internet page of the municipality of Kittilä. The most effective way to reach respondents seemed to be Facebook, where most of the respondents found the survey.

There were 235 people who responded to the PPGIS survey. The amount of map marks varied from one to 15 per respondent. The average age of the respondents was 43 years, and three quarters were women. Of the respondents, 13 percent were local entrepreneurs, seasonal workers or local inhabitants and the rest were travelers. Because the number of locals was so small, the data was supplemented with nine interviews with locals. With the interviews, more information about the development possibilities of the summer tourism and routes from the perspective of the locals was desired. In the second article, both the data from the PPGIS survey and interviews were used.

In the interviews, the locals were asked, among other things, about the possibilities of summer and wellbeing tourism in Levi. In addition, GIS information was collected by asking interviewees to mark attractive places and routes on the map. The map marks were digitalized for GIS analysis after the interviews. Thus, they were taken into consideration as social spatial GIS information while creating the network of the vigorous forests. Interviewees were asked to give development suggestions about new tourism services and routes from the perspective of different summer activities and summer tourists.

GIS information gathered by the PPGIS survey and interviews have been used in map presentations, and a GIS analysis of the PPGIS has been conducted with the ArcGIS program. That information was combined with ecological GIS information of the Levi region. Theme maps were created based on the ecological and PPGIS information and hot spots were made from the tourists' favorite places. Spatial information of the interview data of attractive places and hardly, or not at all, used places and regions was added to the same maps. The aim was to find hot spots where the places which

are attractive for tourists would be valuable from the perspective of nature experience or wellbeing at the same time. Hot spots are experienced as enjoyable places that have lovely views and are rich in berries, fungi or wild herbs as well as being good living environments with an especially wide range of species. With the SPSS program, analyses were conducted about the attitudes of the PPGIS survey respondents towards the survey itself.

### 3.2.2 Interviews in Rovaniemi and interviews of the representatives of the organizations (Articles III & IV)

In the BuSK project (“Building shared knowledge capital to support natural resource governance in the Northern Periphery”), representatives of the stakeholders were interviewed whose work/livelihood was somehow linked to land use. The interviewees comprised of nine representatives of authorities, three policy makers, and 15 stakeholders representing different fields such as entrepreneurship, tourism, reindeer herding, local inhabitants, forestry, the Finnish Defense Forces, regional boards, nature conservation, and a hunting club. In four cases, the stakeholder representative was also a policy maker. The issues covered hinged on the current situation, the problems and successes in land use planning, and the decision making in Rovaniemi. In addition, the current use and potential future uses of PPGIS was discussed. In this study, the participation in land use planning was examined on many levels, such as the federal, regional, and city level, according to each interviewee’s perceptions and experiences of the participation.

The main research data of the fourth article consists of six interviews (two people for each specific case) with the parties who conducted the PPGIS surveys. The interviewees were creators of the PPGIS surveys and the end-users of the survey results. In the study, the organizations’ point of view was used and the focus was mainly on outcomes, but the processes were evaluated as well. The interview questions were composed to reflect the ten chosen criteria from Blackstock *et al.* (2007). The questions were divided by following the Blackstock *et al.* (2007) criteria context, process and outcomes and were complemented with background information and facts concerning the realization of the PPGIS survey. In addition, reports were obtained from the organizations that were mainly used to provide background information concerning the PPGIS surveys.

When trying to find research cases for the fourth article where the PPGIS survey was used, it became apparent that reports, maps and other survey documents had remained unused in planning even though several PPGIS surveys had been carried out in Lapland. This is a result that Brown (2012) has found to be true for several other PPGIS surveys as well. Current employees were unaware of previous surveys and, therefore, could not be used as interviewees. Thus, finding research cases and interviewees was not easy.

With the interview data, the principles of theory-driven content analysis were used which means that theory helps in making analyses (Tuomi & Sarajärvi 2002). Then, the meaning of produced information is not to test the theory but to gain newer ideas and thoughts. The interview data was carefully scrutinized so that all responses containing essential information relevant to the research questions were noted and recorded. The analysis has included, among other things, categorizing the data into themes and types and some quantifying. Categorizing into themes means that data is first broken down and then divided into different themes. In the Rovaniemi case, in addition to data in text form, there was also GIS data comprising 111 comments. This information was

presented verbally in the research. While researching the real significance of PPGIS in decision-making, interview data was transcribed and deeply analyzed with the help of the NVivo program.

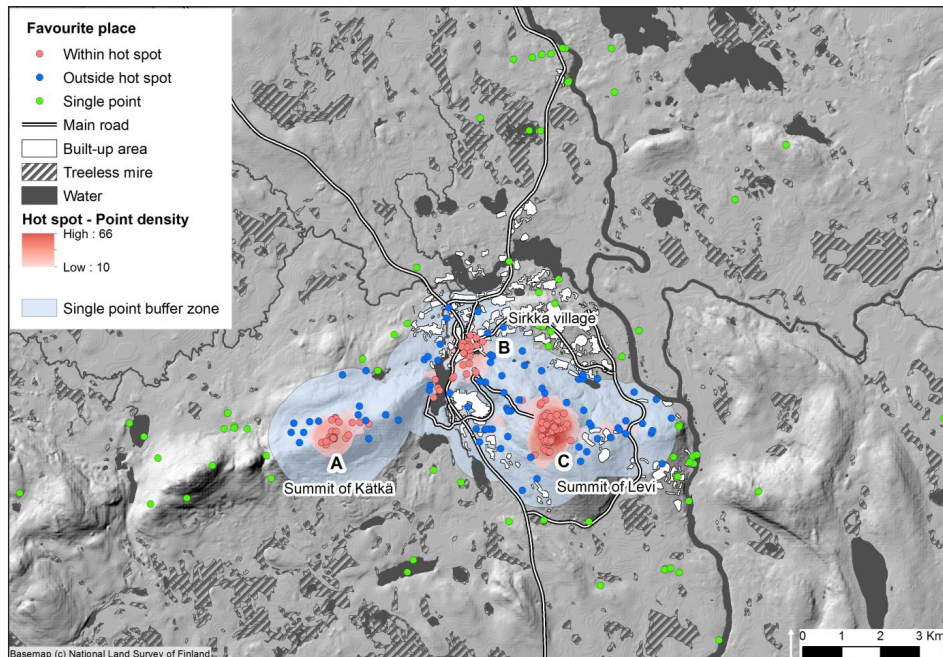
## 4 Results

### 4.1 The place experiences of tourists and locals in the Northern resort in the PPGIS survey and interviews (AI and AII)

Through the hot spots of favorite places, the PPGIS indicated that visitors of a nature-based tourism resort can be quite unanimous in their preferences. The hot spots were located close to natural sites which are the key assets in a nature-based tourism resort (Figure 7). In addition, the method revealed interesting single points detached from the hot spots. Their existence revealed that peoples' needs may differ. The single points, mainly located close to water, further showed that the present trail network does not necessarily reach all types of natural areas. For example, the river Ounasjoki is situated nearby the Levi city center, but there are no bridges and the eastern side of the river inaccessible. These kinds of comments give new insights into resort planning.

Instead of collecting tourists' general opinions about resort development, with PPGIS, it is possible to pinpoint where the improvements are essential. The users' suggestions involved mainly adding signposts, improving accessibility and repairing areas damaged by trampling. They concentrated on the fell Kätäkunturi, which is in a more natural state compared to the Levi fell hot spot. This knowledge underlines the importance of the accessibility of natural sites and maintaining their natural and wilderness qualities.

In other words, knowledge about social values highlights how important closeness to nature is to tourists. It stresses well-marked paths (i.e., how easily one can reach their favorite places) as an important issue in the promotion of wellbeing. Only four recommendations for new routes were, however, made by the respondents. The findings



**Figure 7.** Favorite places, social hot spots and single points in Levi resort. (Vesa Nivala/Luke 2016).

imply that a sufficient number of summer and autumn routes and tracks already exist at the Levi resort. Alternatively, the marking of new trails and marking the points were hindered by technical difficulties with the PPGIS internet application. The latter explanation was supported by the respondents' feedback on the technical functionality of the software when making map marks.

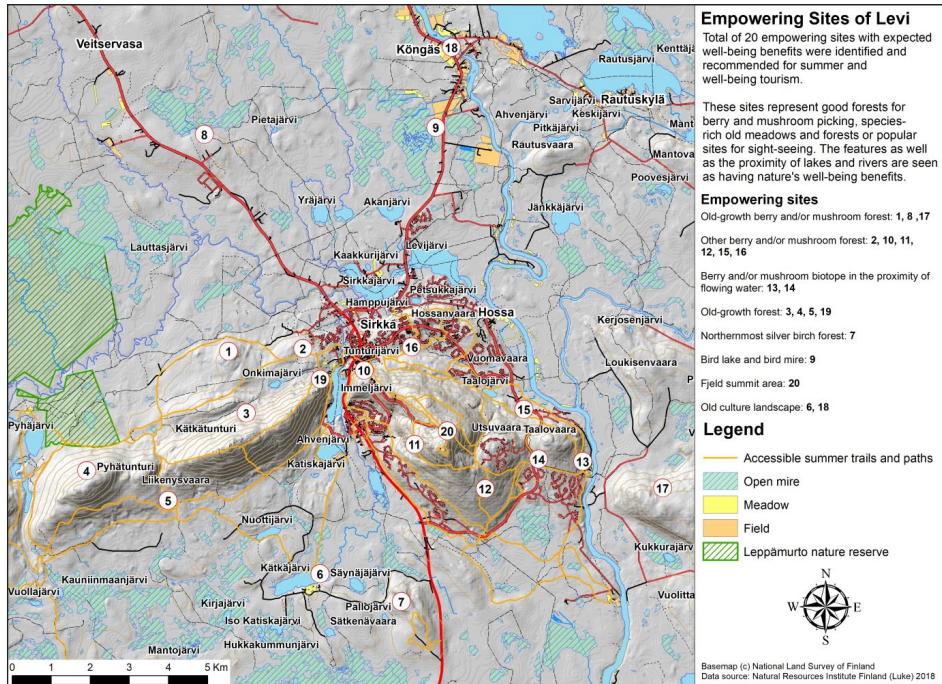
Indeed, the usability of the PPGIS survey needs to be watertight and easy so that full use can be made of the properties of the method in resort planning. When meeting technical challenges, people, and especially tourists who are enjoying their holidays, may easily lose interest in expressing opinions. Moreover, the representation of respondents needs to be considered. This can be improved through well planned promotion. Social media (especially Facebook) was found to be an effective way to promote the survey. The digital questionnaires could also be supplemented with a printed version for the sake of tourists, such as elderly people, who may not be seasoned users of IT applications. It is recommended to compare different software solutions, since their purposes and technologies may vary, and to control the length of the survey. One needs to remember that map tasks are quite time-consuming. Based on this study case, a survey that takes 15–20 minutes to answer seems too laborious.

The data was utilized more in the second article by studying how the experiences of the tourists and locals about the current route network and places of the resort could be better brought out. In addition, the experiences of the respondents were combined with ecological information to find valuable concentrations, hot spots. With their help, it was considered how the routes could better include places that offer memorable nature experiences and wellbeing benefits but are not currently often visited, such as vigorous forests. The social spatial information was included in the network of the vigorous forests, which was created as a planning tool for the land use, routes and service products of the tourist resort. From that, summer and wellbeing tourism in Levi can be developed considering the needs of the clients.

By combining social and ecological data, 20 hot spots were created (Figure 8). Those were grouped and as a result, eight different types of regions were formed which form the vigorous forests of Levi. Utilizing them is recommended to increase summer and wellbeing tourism. The places are located mainly in the fell environment, which is nearby the Levi center, and where most of the hot spots were, but vigorous forests were found further from fells as well. The locations of the endangered species and land ownership conditions were taken into consideration when choosing the regions.

With the PPGIS method, it is possible to reach a large number of respondents and find new perspectives. With the use of social media (in this case Facebook), the marketed survey found people who have strong spatial knowledge and experiences of the region, but who were not in Levi while making the survey. Otherwise, it would have been difficult or even impossible to find them, for example, using a survey via mail. With the PPGIS method, participants who do not want to share their opinions can be encouraged to do so while others are listening. On the other hand, it can be hard to evaluate how well the respondents represented the users of the region.

A map where the information is presented in an analyzed and spatial form is a good way to visually transmit and summarize information. The PPGIS method makes social information visible. Implementing the surveys demands time and money. In addition, it is important to consider how to react to the information and how it is seen in political decision-making, which is what land use planning mostly is (Faehnle *et al.* 2014). Usually in planning, the role of the municipalities, tourism companies and landowners are



**Figure 8.** 20 hot spots were found from Levi region which are suitable for summer and wellbeing tourism. (Vesa Nivala / Luke 2020).

highlighted. The PPGIS survey and interviews showed that locals and tourists have many important views and information about what kind of network is good.

The creating the network of the Vigorous forests revealed that the outdoor routes of Levi can still be developed with summer and wellbeing tourists in mind, even though tourists and locals were mainly happy with the existing routes. On the routes, it is easy to be in touch with nature even nearby the Levi center. Both tourists and locals appreciated that the places and views, which seem natural and a part of the wilderness, are easily accessible through the existing route network. Summer tourists hoped for more variety in the length of the routes and route environments in Levi and especially for more routes for one-day hikes, marshland routes and routes nearby water systems.

Tourists did not want changes in the nature environment and this desire was made especially with the fell Kätäkätunturi in mind. It is good to remember these wishes while planning a tourist resort. It would be good to develop the existing routes in Levi primarily by theming existing routes and concentrating new routes and infrastructure on the current side of Levi fell, where many favorite tourist places are located. When making new routes, it would be important to take advantage of the paths which are as short as possible and utilize the unofficial path network because new paths can affect erosion or disturb animals. Tourists pay attention to the erosion of the paths and more investment in environmental care was required. It appears tourists miss being close to nature and in the summer, they long for even better environmental quality because the snow does not cover problematic places.

The main parts of the favorite places of tourists were added to Levi's vigorous forest network. In addition, many suggested "new" spots already existed in the network and



for those places, development was started to create summer activities and wellbeing products in the workshops of the project. These kinds of products are always based on the functioning ecosystem's services. Thus, vigorous forests are not only disconnected nature attractions, but the vigorous forest network formed by the network of the nature region is part of the landscaping of the resort, where vigorous forests can be connected with each other. This kind of holistic observation of the land use, to which the development work of the route network is bound, supports the view of the locals that summer tourism should not only be limited to the resort region.

It came up in the interviews that, in the Levi region, there is interest and acceptance for developing summer routes and productization, both for independent tourists and packaged holiday tourists. Locals have many ideas about productization which follow the needs and hopes of the tourists. Local interviewees pointed out, for example, possible landing places on the river and thought about necessary infrastructure like signs and campfire places, suggested circle routes and bike renting and services for theme tourism like guided berry, mushroom, flora and fauna and bird hikes. New routes on the river and marshland and developing the network nearby the resort center with themes and stories would diversify the offerings of summer and autumn tourist seasons.

#### **4.2 Perceived possibilities and limitations of PPGIS for developing a sparsely populated Northern city by authorities, politicians and representatives of the stakeholders (AIII)**

In the third article, the potential of PPGIS was examined in the Nordic city, Rovaniemi. The views of the current situation and future needs in regard to participation varied considerably among the authorities and local policy makers. Some thought that participation had been sufficiently implemented already, while some saw a lot lacking in the level of current involvement. The values of the economy and business life were considered to have fared better in the decision-making than nature conservation values, for example.

There was also a great deal of variation in the views on whether public participation should be mostly initiated by participants or by authorities or politicians. Some respondents believed that interested parties would be capable and vigilant enough to act by themselves. That is an untenable notion, as not all people have the reserve energy, knowledge and time for continuous alertness on what is going on in land use planning. Thus, the essential thing is to build a trust that land use planning issues will be brought to public awareness early enough and that the public will be informed on participation possibilities widely and through different channels. In the end, the responsibility for participation was seen to lie with local politicians, as Aarts and Leeuwis (2010) also suggest. Local politicians have the power to return issues to the authorities for revision if they see that public participation in the preparation has been insufficient.

The lack of trust and the importance of building trust between different parties was one of the main issues in this study. One good way to build trust could be to introduce a real-time interactive and technically sound GIS-based discussion application. The best one can do to improve participation and build trust is tell the stories of positive examples of effective participation. In trust building, the significance of open, continuous and sufficient distribution of information was highlighted as a central issue. It is important to be able to trust that the authorities will provide information about upcoming issues

openly and early enough that people do not feel pressured to be constantly aware of what is going on.

According to the interviews, the risk issues in democratic decision-making are largely value questions, and the outcome depends on whose perspectives guide the decisions. Hence, it is unthinkable that all decisions could be made on the basis of comprehensive surveys; authority information is needed, especially when piecing together the big picture. Furthermore, values which do not have advocates are exemplified by values of nature and the perspectives of people in a weak position in society. The interviewees felt that the parties who represent business livelihoods, such as entrepreneurship, forestry, tourism, and mining, have been able to participate more intensively than the parties who represent nature values or local people. Nature values and the perspectives of local people have been perceived as a threat to economic livelihoods. If non-economic values were also given a price tag, it would be an effective way to perceive the importance of ecosystem services, for example.

In a relatively small city such as Rovaniemi, the importance of personal relationships is even more significant. Good personal relations with decision-makers may help to promote the aims of some groups. On the other hand, with PPGIS, people should be able to have an impact on the planning process without the support of a group or being a member of such a group.

The question of who should be counted as a concerned party has been amply discussed in the literature on participation and the same problematic issue came up in this data. Electronic survey methods, such as PPGIS, open the possibility to involve larger numbers of people. Especially the Arctic, where the land is mainly publicly owned, seems to be owned by all citizens of the country and particularly by the indigenous people of the area. Therefore, the need to participate varies from case to case. All interested parties should be guaranteed an opportunity to participate on a realistic timetable, and Randolph (2011) recommends paying attention to parties and people who have first been regarded as non-participants; those parties may have surprising new perspectives on the topic.

The fear of stigma from expressing one's opinion surfaced many times in different interviews. At the individual level, and especially in a relatively small city such as Rovaniemi, using one's freedom of speech can sometimes turn into loss of face. Hence, personal relationships and direct exertion of influence can be both an advantage and a disadvantage. Because of this, general supervision by the authorities is of the essence, and it is important that the state and city authorities be sufficiently funded. On the other hand, with current electronic methods such as PPGIS, people can now express their opinions, be heard, and be able to exert influence without fear of their comments being regarded as an unconnected statement from a stigmatized person.

Even though the interviewees stated that there had not been significant problematic land use planning issues in Rovaniemi, the city received critical feedback on 84 points on the map the city had published for inspection. Hence, presenting a map can be seen to concretize the discussion and comments when presented. Most of the comments concerned the city center, which indicates that people's notions tend to largely focus on what they see when they move about. If an electronic PPGIS survey is planned to be launched in a Nordic city and a large number of responses is desired, it would be wise to conduct it where most of the population live, i.e., in the city center. The most critical comments were directed to the public construction or demolishing of new buildings and protecting nature spots near the city center.

### 4.3 The use of PPGIS information in land use planning and decision making (AIV)

The representatives of the organizations had a positive attitude toward using PPGIS surveys. The potential and possibilities of PPGIS surveys, such as the ability to reach large amounts of people and improve participation, were noticed. According to the results, the strength of a PPGIS survey is that it can bring out various perspectives of participation: political, social, cultural, historical and ecological.

According to the results, the PPGIS survey data has been implemented especially well in organizational decision-making if there was an acute need for particular spatial information in land use planning. The results show that a need-driven starting point is essential, both in a successful PPGIS survey process and in the implementation of PPGIS data. In these cases, the survey has not been done in the spirit of “nice to know”. PPGIS surveys do not work in every situation, and if they are used, it is important that the respondents feel their answers have significance. For instance, in the Muonio case, where land use planning became conflicted and a PPGIS survey was used to solve that conflict, the results were positive. It was vital to implement the surveys in a manner that made them essential to the planning and decision-making process as well as ensure they were carried out in an early phase of the process. It was also important to involve people as openly as possible and to communicate the existence of the survey via various channels. All this increased trust among stakeholders and planners.

The Kittilä case demonstrated the issue of a project-based PPGIS survey: the creator of the survey (Luke) and the end-user of the results (the municipality of Kittilä) were two different organizations. If there is no acute need or motivation to gather new information, for example, by the municipality to use in a zoning process, the information can easily remain unused. The organization responsible for the survey (e.g., an external research organization) may not even know how and where the results are being utilized. Following the utilization of the results after the project ends should be important but can also be challenging if there is no more funding. Much of the produced information may remain unused when things are forgotten or the information is produced at the “wrong time”. Information produced by the project easily stays at the pilot stage. The passage of time and changes in organization personnel create problems as well and recalling information produced years earlier by the project becomes more difficult. The issue is also problematic in that it can erode the trust between decision-makers and citizens as well as the value of the surveys.

PPGIS surveys, as all types of surveys, require time and effort. Thus, it is important to evaluate whether using the PPGIS method to produce unspecific knowledge is worth it. However, during the Kittilä case, it was said that the information collected may be useful later, for example, while planning new hiking routes for the region. Because of the possibility of the data being used later, it is important that organizations make note of how to store the data so that it will be easy to find and use in the future. As a result, IT and data storage systems which make it possible for organizations to easily use the stored data in the future are required and in need of development.

The results show that the practices of the organization (i.e., the interest and positive attitude of the leadership toward the process) are vital both in the implementation of the PPGIS survey and in the utilization of the information it produces. Using a new method may demand open-mindedness inside an organization. In addition to learning a new method, there may be skepticism and pessimism towards the usefulness of the method. The best advocates for the use of the method are positive examples

of the functionality of PPGIS surveys and the data and information produced. The best experiences regarding the use of PPGIS surveys have been produced when the approach has been implemented in an early phase, as Kahila-Tani *et al.* (2019) have found. However, Kahila-Tani and Kytä (2017) also recognized that it is possible to use PPGIS methods in other phases in the planning process as well, but organizations may not see all the possibilities in utilizing collected information yet. The most positive examples of the use of the PPGIS survey came from the Finnish Forest and Park Service's Regional ecological planning in Lapland, in which the survey produced many new locations that are now part of the regional ecological network.

PPGIS surveys can change the participation process by supplementing, or even replacing, existing participation models. However, from the perspective of the planning process, it is alarming if PPGIS surveys become the only way to participate and replace other participation mechanisms. Thus, it is important that PPGIS surveys remain one way of participation, and public events, for example, are still kept in the toolbox of participation.

An essential issue in the use of PPGIS surveys from the perspective of the organizations is daring to allow different groups to express opinions and ideas. According to Brown (2012), the attitude and willingness of the leadership is of essential importance regarding this. There are various options for participation, such as PPGIS, if there is enough ambition to use them. The interviewees pointed out that strong misconceptions about participation not being needed still exist in our society. At the same time, the possibility to participate is regulated by law and, for example, public discussion forces organizations to participate, as Kahila-Tani (2015) mentions. Thus, citizens and stakeholders are not regarded as just opposing authorities/organizations, but the organization recognizes the potential and possibility for varying opinions to rise up. At best, PPGIS offers the possibility of equitable and open participation and includes the organizations as a community in the learning process. The important role of researchers is to critically analyze the methods and significance of the information that is produced.

## 5 Discussion

### 5.1 The maintenance and development of the participation possibilities in land use planning are an important part of democratic society

Land use planning is an ongoing process which will never be ready, as Horelli (2002) and Kahila-Tani and Kyttä (2017) have explained. Because of this, there is a continuous need to be aware of what is going on in land use planning. Those people, organizations and authorities who have the power in land use planning and decision-making must accept that their actions can be examined critically (Kantola & Tuulentie 2020). Criticism and the possibility for criticism is an important part of the land use planning and decision-making because it reminds us that we do not live in a dictatorship. It is then important to maintain discussion and debate, criticism and a right of appeal. The decision-makers should not see the criticism, challenges and disagreements as threat but as a natural part of the land use planning processes, as Friedmann (1973) writes.

When a new land use planning situation appears, the need for participation needs to be examined every time. According to Healey (2004), Irvin and Stansbury (2004) and Lane (2005), the need for participation is very place and context dependent and as Reed *et al.* (2018) note, engagement processes work differently and can lead to different outcomes. Hence, there is not only one way to involve people. In addition, participation is context sensitive; the involvement process and involvement groups need to be estimated in every situation, place and context individually.

It is possible to learn about good involvement practices, but success in land use planning in one situation does not guarantee success in another situation, even if the participation process is implemented by the same organization (Kantola & Tuulentie 2020; Kantola, Fagerholm & Nikula 2021). It demands bravery and openness to face every planning situation as a new case. The danger is that one gets stuck in the same participation methods and cannot criticize one's own work, even though there are several ways to involve people, as many researchers have pointed out (Beierle & Cayford 2002; Horelli 2002; Anderson *et al.* 2009; Randolph 2011).

### 5.2 Sparsely populated Northern regions have special characteristics in participation

Especially in urban planning, PPGIS surveys have usually been used for reaching large numbers of people (Brown & Kyttä 2014), which is not possible, or even worth it, in sparsely populated Northern regions. In these regions, a large number of responses can be received if the right to participate is not only limited to locals (Kantola *et al.* 2018; Uusitalo *et al.* 2018). When involving people in sparsely populated Northern regions with PPGIS, it is important to consider whether the aim is actually to reach a large number of people. In some cases, it is relevant to use paper maps and ask people to mark their opinions concerning the spatial issues directly onto the map (Kantola & Tuulentie 2020). When publishing the results, and especially exact GIS information, it is important to consider possible anonymity or at least inform the respondents carefully what their responses will be used for and where the data will be kept afterwards.

In the Northern regions, the quantitative volume and especially variety of opinions can be small and narrow. While surveying participating groups, it would be essential always to make sure that all essential groups have been taken into account. One interviewee

in the research of Kantola and Tuulentie (2020) mentioned that attention should be especially on the groups who do not seem to be relevant participants at first glance, as Healey (1992) and Randolph (2011) mention and which is also discussed in PPGIS literature (National Center for Geographic Information and Analysis 1996; Sieber 2006; Ramasubramanian 2011). Because sparsely populated Northern regions are largely public land areas, both locals and non-locals are interested in the issues happening there. The interests of locals also vary significantly inside the region. Guaranteeing participation possibilities to the inhabitants of the region and other stakeholders and parties is essential, but at the same time, it should not be limited only to the inhabitants of the region. For example, the decisions affecting national parks are important to many others and not only people living nearby them. When other people are also allowed to participate in addition to locals, it guarantees more diverse opinions.

Especially in small places, issues are easily personified and there is a risk that particular people or groups are stigmatized as perpetual complainers (Kantola & Tuulentie 2020). Thus, the value of their opinions can decrease in the eyes of the authorities and decision-makers. Genuine interaction after broken trust can be difficult. One charismatic or influential person can overshadow another too much, in which case, the possibility of bringing other opinions up can be low. The social pressure and fear of stigma in sparsely populated regions can silence different opinions. When, for example, the owners of holiday apartments are able to participate to land use planning (Kantola *et al.* 2018; Uusitalo *et al.* 2018), the variety of opinions is increased compared to only locals. A special characteristic of the Northern region is that many educated and young people move away from the region. Without dismissing local knowledge, education broadens civilization and ways of looking at the world. Because of this, it is also important that not only locals have the possibility to participate, especially regarding big projects such as mining. That is why the approach to the question about who the relevant participant is in the land use planning process (Forester 1987; Beierle & Cayford 2002; Harrison & Haklay 2002; Schlossberg & Shuford 2005; Sieber 2006; Randolph 2011; Brown 2012) needs to be open-minded, objective and brave.

### 5.3 PPGIS brings many benefits to participation

In this research, the benefits of PPGIS mentioned in previous literature (e.g. Brown 2004; 2006 & 2012; Sieber 2006; Alessa, Kliskey & Brown 2008; Rantanen & Kahila 2009; Kahila & Kytä 2010; Brown & Kytä 2014) are raised as well, such as presenting issues in spatial mode, getting the information directly in digital form when using online PPGIS, and the possibility to respond remotely and ask for opinions from a large number of people (Kantola *et al.* 2018; Uusitalo *et al.* 2018; Kantola & Tuulentie 2020; Kantola, Fagerholm & Nikula 2021). With this, the possibility to express one's opinion reaches a larger group of people, which is a good way of increasing democratic participation.

The ability of PPGIS to increase trust between different parties is one remarkable benefit of the method (Kantola & Tuulentie 2020; Kantola, Fagerholm & Nikula 2021). Trust is an especially important part of a functioning and successful land use planning process. It is important inside and between the groups and especially important between different groups, authorities and politics. Achieving complete trust is perhaps impossible, but every way to preserve and increase trust should be used. Trust and

the ability to talk about difficult issues is especially important in small places where everybody knows each other.

Summarized, PPGIS brings many benefits to participation (Kantola *et al.* 2018; Uusitalo *et al.* 2018; Kantola & Tuulentie 2020; Kantola, Fagerholm & Nikula 2021). The most important are anonymity, reaching a large number of people, increasing trust and transparency between different groups, getting exact spatial knowledge, participation possibility remotely, and the possibility to handle and combine large amounts of digitalized, spatial data.

#### **5.4 PPGIS surveys are only good to use for real land use planning needs by being a part of the planning process**

The fourth article (Kantola, Fagerholm & Nikula 2021) was based on especially the research question: “How is the information collected with PPGIS used in land use planning and decision-making?” As is written in the theory, PPGIS literature is more urgently looking an answer to this topic (Harrison & Haklay 2002; Anderson *et al.* 2009; Aditya 2010; Kahila & Kytta 2010; Brown 2012; Brown & Kytta 2014; Kahila-Tani 2015; Stewart, Jacobson & Draper 2017; Kahila-Tani *et al.* 2019; Staffans *et al.* 2020). This topic has mainly been studied by examining large numbers of map surveys (Brown 2012; Kahila-Tani *et al.* 2019) and in this research, the question aimed to be answered by conducting an analysis of three map surveys with the deep analysis method. It is essential to note that all cases where a PPGIS survey has been used are case specific, so it is impossible to generalize or say how the use of PPGIS information is currently carried out. It is worth mentioning that acquiring data for the last study was extremely challenging. The reason was not a lack of PPGIS surveys in Finnish Lapland, but the implementation of the data, which was non-existent. The three cases where the results of PPGIS survey had been used even a little were the only options from over ten surveys.

To use PPGIS information effectively, it is sensible to implement the PPGIS survey in the early phase of the planning process for a real and acute land use planning need (Kantola, Fagerholm & Nikula 2021). It is essential that the leaders of the organizations are interested and motivated in the implementation of the PPGIS survey. When making PPGIS surveys, attitude toward the PPGIS method and data should be serious as otherwise it is a waste of time and resources. Further, making the survey does not guarantee that participation would work well; in addition to making the survey, just as much time and resources should be put into the implementation of the information. Special attention should be paid to the fact that the information acquired using PPGIS should be stored systematically, as Staffans *et al.* (2020) mention, as with all types of participatory data so that it can be easily accessed in the future (Kantola, Fagerholm & Nikula 2021).

#### **5.5 Questions to ask when considering the use of PPGIS**

PPGIS makes it possible to emphasize other values and amounts than economic in land use planning (Kantola & Tuulentie 2020). It is a step towards achieving social sustainability (Hellström 2001) and more democratic land use planning. With PPGIS, it is possible to get closer to solving one challenge that land use planning has, namely that

locals often feel that they cannot influence matters, or, at its worst, they are completely ignored (Sieber 2006; Ramasubramanian 2011). In land use planning, different methods should be used to give the different groups a possibility to participate; one way to do this could be PPGIS.

PPGIS cannot, however, be the only way to participate and cannot be seen as a perfect tool (Kantola *et al.* 2018; Kantola, Fagerholm & Nikula 2021) which solves all land use planning problems. It is important to keep developing the method, as Garcia *et al.* (2020) summarize. On the other hand, PPGIS should not be left unused because of its faults, and the list that Kahila-Tani and Kyttä (2017) have compiled of the seven phases where PPGIS could be used sheds light on this matter. The users and researchers of the tool can be involved the development work too (López-Aparici *et al.* 2017; Kahila-Tani, Kyttä & Geertman 2019). When considering the use of PPGIS, it is essential to think about the following questions:

- Is the question spatial?
- Does PPGIS genuinely bring new information which does not exist already?
- Who and with whose resources will the survey be implemented and who will analyze the information?
- Who is motivated to get the PPGIS information?
- How can the PPGIS information be used?
- How will the information be relayed to the respondents?
- How will PPGIS information be saved to the organization's IT-systems?

## 5.6 The suggestions of the successful use of PPGIS

PPGIS can improve participation in land use planning and decision-making when specific limitations and preconditions are taken into account. Because one essential problem has been the weak use of PPGIS information (Harrison & Haklay 2002; Anderson *et al.* 2009; Aditya 2010; Kahila & Kyttä 2010; Brown 2012; Brown & Kyttä 2014; Kahila-Tani 2015; Stewart, Jacobson & Draper 2017; Kahila-Tani *et al.* 2019), the following pre-conditions are introduced, which are based on this research results and can improve the use and implementation of PPGIS information:

- The leaders/top people of the organization understand the possibilities of the PPGIS and, most importantly, have the motivation to involve citizens/different groups through PPGIS.
- The use of PPGIS for real and even acute land use planning needs which interest locals. Interest in the particular issue guarantees that there will be many responses and hence, the credibility of the PPGIS data increases.



- It is sensible to use a PPGIS survey as a part of planning and zoning process, not as a separate project. Hence, the results can be part of the process.
- It is important to allocate enough time, resources and abilities for analysis of the data. If necessary, it is reasonable to use, for example, an external GIS expert for GIS analyses.
- Systematic storing of PPGIS data in the IT-system of the organization is crucial so that the information can easily be found later.
- In addition to informing people about the survey, it is essential to present the results of the survey as transparently as possible. It is important to be able to show the respondents how, where and when the responses were used. This is important for maintaining the credibility of PPGIS surveys, all types of surveys and the sense of the participation.

It could be impossible to develop a quantitative impressiveness and elucidating scale which is clear and fit for every situation for measuring the effectiveness of the PPGIS, even though this kind of criteria is called for (Rowe & Frewer 2000; Brown & Chin 2013). All situations and contexts of implementing the PPGIS survey and data are different. When the PPGIS method is used, it is important to be critical because the method is a commercial product and there is a risk that it does not respond to the needs of the user, for example, with its technical characteristics. The success of the use of the method cannot be hindered by technical problems.

## 5.7 Limitations of the research and recommendations for further research

The strength of geography is that it aims to examine the world from different perspectives. This is where a geographer aims too; to be in the middle of different types of knowledge by examining them. This PhD research aimed to be objective research, but at the same time it is good to be aware of the fact that we all have adherences. For example, I did interviews with my own face and research questions, which means that I, as a researcher, have been a participant element in the research.

I recommend that PPGIS should be used broadly in different land use planning situations in the sparsely populated Northern regions, as well as elsewhere. Based on this research, it can be said that the method has its place and position in the broader field of participation, and interaction and participation can be improved with it. The method is especially effective for collecting “invisible”, non-quantitative and social knowledge. For guaranteeing the effective use of the method, it is encouraged to take into account the preconditions of the method (listed in the Discussion 5.6).

I see still that in the future, the duty of researchers is to continue evaluating the PPGIS method critically because PPGIS surveys are sold mainly by commercial companies. The companies may not mention possible shortcomings to the clients, even though there could be problems. The success of the use of the method cannot be hindered by technical problems. PPGIS is frequently, and even more so in the future,

used as a participation method in different kinds of research and planning. Therefore, it is important that the professionals of participation are involved in planning projects to avoid the common pitfalls of PPGIS and participation.

## 6 Conclusion

This PhD work increases understanding about land use planning, participation and the possibilities of PPGIS in developing interaction in sparsely populated Northern regions in Finland, and what types of practices and information PPGIS brings to public participation in land use planning. In addition to the sparsely populated Northern region, the research results can also be used in land use planning in relation to PPGIS without the use of the method. In reference to my study, the main arguments are as follows:

- The maintenance and development of the participation possibilities in land use planning are an important part of democratic society; it is important to maintain discussion, debate, criticism and right of appeal.
- In the Northern regions with many land use interests, there is no one right way to involve people. Participation is a context sensitive issue; the involvement process and involvement groups need to be estimated in every situation, place and context.
- PPGIS is one important and functional tool for participation and brings many benefits to participation. The most important benefits are anonymity, reaching a large number of people, increasing trust and transparency between different groups, getting exact spatial knowledge, participation possibilities remotely, and the possibility to handle and combine a large amount of digitalized, spatial data.
- In the Northern regions with sparse populations, PPGIS can encourage people to participate in the land use planning processes because the method reduces the risk of stigma.
- In public Northern regions, both locals and non-locals have diverse interests toward the same land areas. Because of its virtual features, participation is possible with PPGIS for non-locals too.
- It is sensible to conduct a PPGIS survey only for real land use planning needs so that the leaders of the organization are committed and motivated, and that the survey is conducted as a part of the planning process, preferably in the early phases of the process. In land use planning, different methods should be used to give different groups the possibility to participate; one way to do this could be PPGIS.
- PPGIS can improve participation in land use planning and decision-making when specific limitations and pre-conditions are taken into account. Systematic storing of PPGIS data in the IT-system of the organization is crucial so that finding the information later will be easy.
- When the PPGIS method is used, it is important to be critical because the tool is often commercially produced and there is a risk that it does not respond to the needs of the user.

**Footnote: Data management**

The data of the research does not include any types of health or ethnical information. The data is used only for the original purpose as initially promised. The data of the first three articles is owned by Natural Resources Institute Finland (Luke), which functions within the guidelines of the National Archives of Finland when it comes to saving the data. Luke moves the original data to long-term storage. The data of the first and second articles are part of the project “Vigorous forest and green roofs” and the leader of the project is responsible for data management and data protection issues. The author of the PhD has removed all information which was collected for the lottery (names, phone numbers and email address) of the survey from the files. The third article and its data are added to Luke’s BuSK-project. In the article, no other data of the BuSK project was used. The article which was written about the data was done anonymously so that the interviewees are unrecognizable.

The owner of the data of the fourth article is the University of Oulu. The data consists of six interviews, and before the interviews, the interviewees were told that because of the small amount of the interviewees it is possible to recognize them relatively easily if somebody is willing to. Hence, the interviewees have been able to take this into account while giving responses. In practice, the possible risk of recognition has meant it that even though the names of the interviews have not been mentioned, if the particular project has been mentioned and it has been said that the leader of the project was the one interviewed, it is easy to find the person. The transcribed text has been sent to each interviewee for checking before analyzing and they were asked to give comments about possible changes they would like in the text. The topics of the interviews did not include sensitive themes.

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