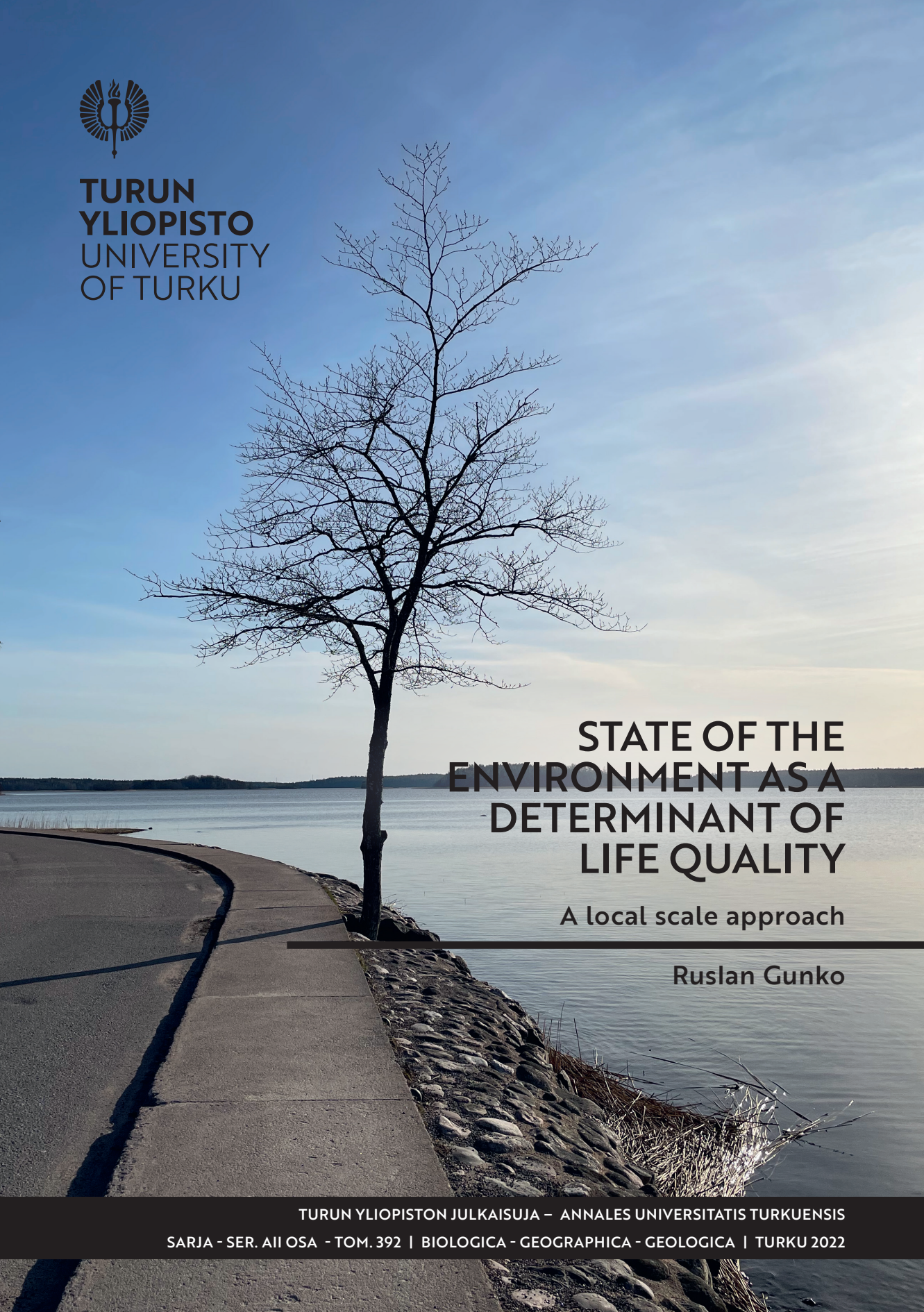

TURUN YLIOPISTO
UNIVERSITY OF TURKU

STATE OF THE ENVIRONMENT AS A DETERMINANT OF LIFE QUALITY

A local scale approach

Ruslan Gunko

TURUN YLIOPISTON JULKAISUJA – ANNALES UNIVERSITATIS TURKUENSIS
SARJA - SER. AII OSA - TOM. 392 | BIOLOGICA - GEOGRAPHICA - GEOLOGICA | TURKU 2022

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To my family, my country, and my people!

Scale down this cliff! Let not the heat, nor the cold
Dare stop us! Withstand the difficulty, and the thirst, and hunger.
For it is designated for you to break down this rock.
Ivan Franko

Лупайте сю скалу! Нехай ні жар, ні холод
Не спинить вас! Зносіть і труд, і спрагу, й голод.
Бо вам призначено скалу сесю розбить.
Іван Франко

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ABSTRACT

Traditionally nature plays a significant role for people worldwide. Thousands of years ago our ancestors made their life-related decisions by accounting for the environmental situation. They relied on natural phenomena, divinized and defied them. Due to the high dependence on the resources provided by the surrounding environment, people were vulnerable, and changes in environmental conditions motivated them towards migration processes and search for ways of communication. In the 21st century this link to the local environment is not so clear for many people and the role of nature for well-being appears to be disappearing in the shadow of traditional socio-economic factors that affect life quality. However, in circumstances of the global environmental crisis caused by climate change, local nature becomes an important indicator of stress with impact on society. At the same time, the role of local nature for the well-being of a community is not well known. In this thesis, I studied the impact of the local environment on people's well-being reflected by the sea surface water quality for inhabitants of a coastal community. These environmental conditions were measured objectively with professional scientific equipment and subjectively by surveying people, who made general assessments of their local environmental conditions. First, I investigated if and how accurately respondents' perception of water quality corresponds with objective measures, and if socio-demographic status can affect people's evaluations. My findings suggest that the accuracy of assessing water quality is high and potentially adequate for considering their use in policymaking. Over 70% of people assessed the state of water quality in the right direction and almost 60% were correct in their estimates. At the same time, socio-demographic status had an effect on perceptions but did not markedly improve their reliability. Next, I tested the effect of the local environmental conditions (objectively measured and perceived) on the well-being of individuals in combination with traditional socio-economic factors. I found that the objectively measured state of the environment has a less pronounced impact on life quality, but that the way people perceive their surrounding environmental (water) quality plays a significant role for well-being (life quality). This finding highlights the psychological effect of how the local environment is perceived. Moreover, the strength of this positive relationship between life quality and water quality is conditional on income level so that people with income issues are more dissatisfied with their life regardless of the quality of surrounding environment. In my third chapter, I found that local nature can buffer the adverse impacts of global stress on

the life quality of individuals. My investigation of the changes in life quality before and during the COVID-19 pandemic indicated that there is a significant role of good environmental conditions for mitigation of the personal impacts of the pandemic. I found that the pandemic had a negative impact on well-being, especially for people who lived in areas with poor coastal water quality. Additionally, I found that the pandemic changed the people-nature relationship toward environmentally-friendly behavior. Lastly, I studied if property prices are influenced by local environmental conditions and whether environmental aspects generate economic benefits through a positive effect on property prices, presented by price perception extracted from real estate listings. My findings indicate that people responsible for the price perception value, property owners and real estate agents, do take into consideration the water quality conditions in their evaluation, and that good water quality corresponds with higher property prices in advertisements. The results of this thesis highlight the significant role of the local environment for life quality of community members. Based on the results, I conclude that local environmental conditions can be a buffer to stress impacts, which is important in light of the negative effects of the climate change crisis that small communities are exposed to. This thesis suggests that local councils should involve residents in decision-making and thereby promote environmental democracy.

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TIIVISTELMÄ

Ihmiset kaikkialla maailmassa ovat perinteisesti pitäneet luontoa merkityksellisenä. Jo vuosituhansia sitten esi-isämme tekivät elämäänsä koskevia valintoja elinympäristönsä tilanteen perusteella. Luonnonilmiöistä oltiin riippuvaisia, niitä jumaloitiin tai uhmattiin. Vahva riippuvuus elinympäristön tarjoamista luonnonvaroista aiheutti haavoittuvuutta, ja elinympäristön olosuhteiden muutoksiin reagoitiin muuttoliikkeillä ja hakemalla uusia kommunikaatioväyliä. 21. vuosisadalla yhteys paikalliseen ympäristöön on monilla ihmisillä hämärtynyt, ja luonnon merkitys elämänlaadulle näyttää olevan katoamassa perinteisten sosioekonomisten tekijöiden varjoon. Ilmastonmuutoksen aiheuttama globaali ympäristökriisi on kuitenkin palauttanut lähiluonnon tärkeäksi ympäristöstressin indikaattoriksi, millä on yhteiskunnallisia seurauksia. Samaan aikaan on kuitenkin käynyt ilmi, että tunnemme huonosti paikallisen luonnon hyvinvointivaikutuksia. Väitöskirjassani tutkin paikallisen ympäristön vaikutusta ihmisten hyvinvointiin selvittämällä rannikkoalueen pintavesien laadun vaikutusta alueen asukkaiden hyvinvointiin. Pintavesien laatua tutkittiin toisaalta objektiivisesti tieteellisillä mittauslaitteilla ja toisaalta subjektiivisesti käyttämällä aineistona ihmisten yleisiä arvioita paikallisen ympäristön tilasta. Aluksi tutkin, miten tarkasti ihmisten käsitykset vesien laadusta sopivat yhteen objektiivisten mittaustulosten kanssa, ja missä määrin esitetyt arviot riippuivat vastaajan sosioekonomisesta tilanteesta. Tulokseni viittaavat siihen, että paikallisten asukkaiden arviot veden laadusta ovat hyvin luotettavia, jopa siinä määrin, että niitä voitaisiin mahdollisesti käyttää poliittisessa päätöksenteossa. Yli 70 % vastaajista arvioi pintavesien laadun oikeansuuntaisesti ja lähes 60 %:lla arviot vastasivat täysin mittaustuloksia. Sosioekonominen status vaikutti arvioihin ympäristön tilasta, mutta ei lisännyt niiden luotettavuutta. Tutkin seuraavaksi paikallisen ympäristön (sekä objektiivisesti mitatun että ihmisten arvioihin perustuvan) vaikutusta koettuun hyvinvointiin yhdessä sosioekonomisten tekijöiden kanssa. Tutkimuksessa ilmeni, että ihmisten koettuun hyvinvointiin ei niinkään vaikuta objektiivisesti mitattu ympäristön tila kuin heidän omat käsityksensä ympäristön laadusta. Tämä tulos korostaa

psykologisten tekijöiden merkitystä paikallisen ympäristön kokemisessa. Havaitsin myös, että tulotaso vaikuttaa siihen, missä määrin elämänlaatu ja pintavesien tila ovat kytköksissä toisiinsa. Vastaajat, joilla oli taloudellisia ongelmia, olivat elämänlaatuunsa muita tyytymättömämpiä siitä riippumatta, millainen oli pintavesien tila heidän ympäristössään. Työni kolmannessa luvussa havaitsin toisaalta, että lähiluonto lievittää kokemuksia globaalista ympäristöstressistä, ja voi siten parantaa elämänlaatua. Tutkimukseni elämänlaadun eroista ennen ja jälkeen COVID-19 –pandemiaa viittaavat siihen, että hyvä elinympäristön tila voi merkitsevästi lievittää pandemian koettuja henkilökohtaisia haittavaikutuksia. Havaitsin pandemian huonontaneen vastaajien elämänlaatua erityisesti niillä alueilla, joilla rannikkovesien laatu oli huono. Lisäksi havaitsin, että pandemia muutti ihmisten luontosuhdetta luontomyönteisempään suuntaan. Selvitin lopuksi työssäni, vaikuttaako ympäristön laatu kiinteistöjen hintatasoon. Ympäristön positiiviset laatutekijät voisivat periaatteessa tuottaa taloudellista hyötyä nostamalla hintatasoa. Selvitin asiaa kiinteistövälittäjien paikallisten hinnastojen avulla. Tutkimukseni perusteella kiinteistöjen hintatasoon vaikuttavat tahot, toisin sanoen kiinteistöjen omistajat ja kiinteistövälittäjät, ottavat arvioissaan huomioon pintaveden laadun siten, että hyvä veden laatu nostaa markkinoinnissa kiinteistön arvoa. Kaikkiaan työni tulokset osoittavat elinympäristön laadun suuren merkityksen paikallisyhteisöjen asukkaiden hyvinvoinnille. Tulosteni perusteella päättelen, että paikallisesti hyvä ympäristön tila voi puskuroida stressivaikutuksia, millä on suuri merkitys ilmastokriisin altistaessa pieniä paikallisyhteisöjä erilaisille haittavaikutuksille. Työni perusteella voi myös päätellä, että paikallisten päättäjien tulisi nykyistä laajemmin osallistaa paikallisia asukkaita päätöksentekoon, mikä edistäisi ympäristödemokratian toteutumista.

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List of original publications

This thesis is based on the following original publications, referred to in the text by their Roman numerals:

I. Gunko, R., Rapeli, L., Scheinin, M., Vuorisalo, T., & Karell, P. (2022). How accurate is citizen science? Evaluating public assessments of coastal water quality. *Environmental Policy and Governance*, 32(2), 149-157.

II. Gunko, R., Rapeli, L., Vuorisalo, T., Scheinin, M., & Karell, P. (2022). Does water quality matter for life quality? A study of the impact of water quality on well-being in a coastal community. *Environmental Management*, 70, 464-474.

III. Gunko, R., Rapeli, L., & Karell, P. (2022). Striving with Global Stress on a Local Level: Has the COVID-19 Pandemic Changed the Relationship between People and Nature? *Sustainability*, 14(15), 9496.

IV. Gunko, R., Rapeli, L., Scheinin, M., & Karell, P. Does environmental quality play a role in determining housing prices in a coastal community? Manuscript

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Statistical analysis	RG, PK	RG, PK	RG, PK	RG, PK
Writing the first draft	RG, PK, LR	RG, PK, LR	RG, PK, LR	RG, PK, LR
Writing the final draft	RG, PK, LR, MS, TV	RG, PK, LR, MS, TV	RG, PK, LR	RG, PK, LR, MS

RG – Ruslan Gunko, PK – Patrik Karell, LR – Lauri Rapeli, MS – Matias Scheinin, TV – Timo Vuorisalo.

1. Introduction

1.1. Significance of the local environment for well-being

Historically, the relationship between people and nature is a cornerstone for the whole of humanity. For thousands of years, nature has been for people a source of resources for life and development. However, the aesthetic values of the environment have always been crucial, playing a significant role in people's culture, and have often been the main motivators for self-development through a desire to understand processes in nature. Consequently, this process led to the genesis of education and developed our civilization to the extent it exists now.

In recent decades the role of nature has risen significantly due to the climate change crisis, which is considered as one of the biggest threats to our civilization. People experience climate change effects around the globe on a different scale, with both global and local impacts. The consequences of climate change are not well known but the prognoses worsen from year to year. Dealing with climate change requires a comprehensive approach including public actions (IPCC, 2021). The ultimate goal for modern societies is to deal with the consequences (known and potential threats) of the climate change crisis on societal function and try to mitigate them.

In such circumstances, the role of the local environment potentially becomes crucial for small communities. Their sensitivity to climate change is closely linked to the way the climate crisis affects ecosystem services provided by the local environment, which are especially tangible for coastal communities (Daw et al., 2016). Consequently, the deterioration of environmental conditions can have a direct impact on traditional life quality indicators, such as income and health (Tuong et al., 2002; Prüss-Üstün et al., 2008; Remoundou and Koundouri, 2009; Huang, 2022). Through these links local environmental conditions can potentially affect quality of living and drastically change the life of individuals. On top of that, it is not well known if environmental conditions are affecting life quality of individuals directly through their objective state and its consequences (e.g. pollutions cause health issues → deterioration of well-being) or indirectly, by the way how a person perceives the environment (e.g. visually detected changes in environment → changes in well-being). In this study, I made an effort to investigate if the effects on well-being of objective and subjective environmental conditions have a similar pattern and if perceptions are dependent by the socio-demographic status of an individual (Figure 1; II).

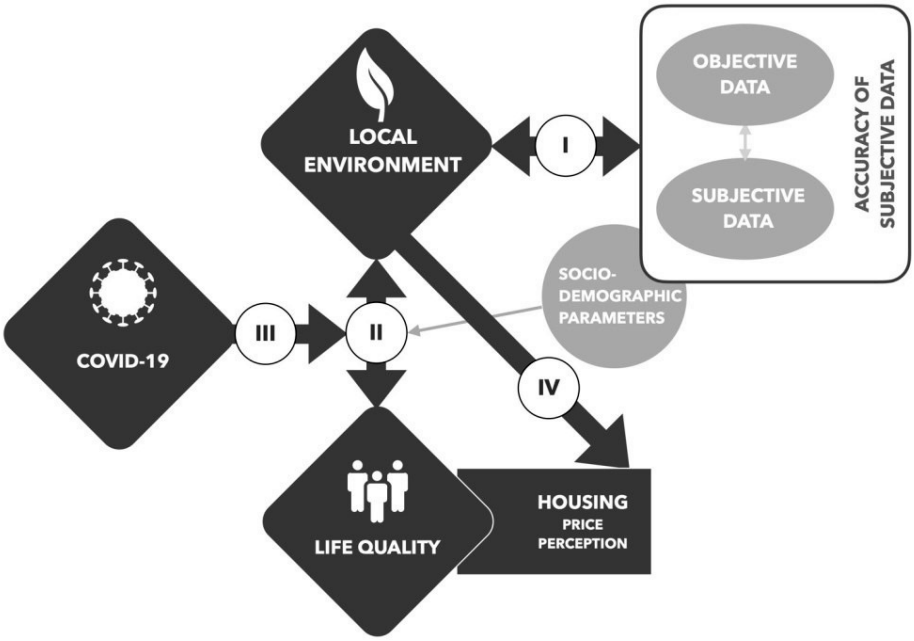


Figure 1. A schematic overview of the study broken down into chapters.

The other side of the coin is to understand if individuals are able to see these links, how they perceive the local environment, and what it means to them. Even when they interact with nature every day, it is not necessarily clear if residents can recognize actual changes in environmental conditions that don't lead to disaster or ecological catastrophe. The potential capability of non-experts to adequately assess local natural conditions through environmental perceptions can shape the relationships between local residents on one side and scientists and policymakers on the other. The involvement of residents in continuous monitoring of the local environment can bring benefits for researchers and local governments alike. In chapter **I** of the thesis, I aim to test the accuracy of lay people environmental perceptions in comparison with the objective state of environmental conditions. The novelty of this test lies in the participation of unprepared and untrained people without any guidance or control (Figure 1; I).

Another aspect discussed in this thesis is the role of the environment during global stress. The role of the environment in relation to people's life quality is tightly bound to the health effect. A number of scholars highlighted the significance of nature in the chain of environmental quality → human health → well-being (Hartig et al., 2003; Mitchell and Popham, 2007; White et al., 2019). Global stress events,

such as the pandemic of COVID-19, often have a sudden characteristic and have an impact on people's health (Lafortezza et al., 2009; Park et al., 2010; Li et al., 2011; Andrusaityte et al., 2016; White et al., 2019). In this study, I investigated an example of COVID-19, if global stress has an impact on people's life quality and if the state of the environment can mitigate the impact (Figure 1; III).

Lastly, the thesis aims to investigate if the adequate state of local environmental conditions has a monetary value through the effect of the environment on property price formation. The property in this study refers to houses and cottages and represents housing conditions. These conditions are a crucial indicator for life quality evaluation (Girouard et al., 2006; Rolfe et al., 2020; OECD, 2020). Adequate housing conditions and improvement in them can lead to change for the better situation with mental health, while in contrast the deterioration of conditions can provoke serious health harm (Krieger and Higgins, 2002; Thompson et al., 2009). It was previously found that the proximity to nature and the state of environmental conditions increase the final fixed selling price (Boyle and Kiel, 2001; Cho et al., 2006). However, there is a lack of information if environmental conditions accounted for during the initial price formation (price perception) and consequently affected the selling price published for the public in the sale advertisement. This thesis aims to shed light on this question.

To summarize, I predict that the state of the local environment plays a significant role in the well-being of the community and has a number of merits, which require further investigation. This study is an attempt to fill the knowledge gaps considering the understanding of the role of the local environment for people's life quality from both societal and an environmental scientific points of view. The results of the thesis can potentially be used by policy-makers as a basis for developing the community with an emphasis on the improvement of local environmental conditions and motivation for delegating decision-making and thereby promoting environmental democracy.

1.2. The state of the environment, society and well-being

Everyday billions of people interact with nature worldwide. However, in most cases, people have constant relationships with the local environment (located in the surroundings of their homes or activity zones), and their environmental concerns depend on the level of their emotional attachment to the place (Gosling and Williams, 2010). The role of local knowledge is often underestimated although it represents different aspects of people's relationship with the area. The "local" refers here to linking the person to the specific place, which encompasses the person's relationship with the area from cultural, historical and ecological perspectives

(Hakkarainen et al., 2022). Typically, people build their experience with nature based on their relationship with the local environment, and they are exposed to direct and indirect climate change effects through changes in the environmental conditions of their surroundings (Nash et al., 2019). Moreover, the local environment and its features help younger generations to develop their sense of place, and of belonging to the local community (Gordon, 2010). On top of that, the aesthetic value of local nature has a high cultural and spiritual importance for individuals (Verschuuren et al., 2021).

The value of nature for individuals is also reflected in the health benefits resulting from easy access to the environment. Access to high quality environmental conditions helps to improve the state of mental health of individuals (de Vries et al., 2003; Fan et al., 2011; Chevalier et al., 2012; White et al., 2019), reduce stress (Björk et al., 2008; Lafortezza et al., 2009), and reduce the mortality rate in urban areas (Villeneuve et al., 2012). Furthermore, good environmental conditions have a positive effect on physical health conditions, as it has been associated with faster recovery after surgery (Ulrich, 1984), reduced blood pressure (Park et al., 2010), reduction in congestive heart failure (Mao et al., 2017), palliative effects on breathing diseases and allergies (Dadvand et al., 2014; Fuertes et al., 2014; Andrusaityte et al., 2016), reduced obesity (Lachowycz and Jones, 2011) and enhanced immune system functioning (Li et al., 2011). Therefore, a direct association between the surrounding environment and life quality of people is expected. Additionally, environmental change can have a broader effect on individuals' life quality over their life span. Bronfenbrenner in his work (1977) discussed the ecological model of human development and interactions between individual, social and physical surroundings during human development. In his later work (Bronfenbrenner, 1986) he additionally singled out the effect of changes in the environment as one of the cores of human development over life. Following the conclusions of Bronfenbrenner (1977; 1986) the environment has a significant effect on human well-being through all stages of life including major life events (e.g. marriage). In this context, it is important to highlight the positive effect of nature on health through exposure to a quality environment, which results in an individual's well-being through building human capacities, promotion of physical activities and public "green areas" (Marselle et al., 2021).

The desire for high life quality (hereafter, LQ) is widespread internationally and assessment of people's well-being has been on the agenda for centuries (Allin and Hand, 2017). The evaluation of LQ became an important tool for measuring the well-being of people worldwide and comparing it on global and local levels. It allows the identification of inequalities and risks in different spheres of life and highlights problems with which governments worldwide should work (OECD, 2020). The approach to LQ measurement has been discussed extensively among scholars and

the theoretical basis of LQ differs among disciplines. For example, scholars in medical science look on LQ through the physical or emotional state of the individual (or patient) (McSweeny et al., 1982; Lewis et al., 2004; Needleman et al., 2004). However, the focus exclusively on health cannot display the full picture of an individual's LQ in environmentally or socially oriented studies (which is not excluding the significant role of health and requires its consideration). The selection of an appropriate approach to LQ measurement is much dependent on the dimension of well-being studied and on the research questions (Linton et al., 2016). Scholars worldwide are measuring different aspects of LQ: physical, economic, social, emotional, psychological, working, and life satisfaction (Frey and Stutzer, 2002; Keyes, 2002; Kahneman et al., 2004; Eid, 2008; Martela and Sheldon, 2019; González et al., 2021). This thesis aims to investigate the link between LQ and the local environment on a personal dimension while accounting for the wider range of aspects including life experience. In the thesis I used a phenomenological approach to assess life satisfaction, which allows taking into account personal experience and perceptions of the respondents (Reid et al., 2005). The use of such a measurement strategy emphasizes personal experience as the perception of reality. However, given that the data used in the study allows for an examination of how accurate such personal experiences are (chapter II), the study is not only dependent on personal experiences as a measure of the state of the environment.

Scholars describe LQ on a personal level as a subjective judgment about life satisfaction, which represents how an individual perceives overall life conditions (Diener et al., 2002; Weber et al., 2015) and evaluates personal quality of life (Diener, 2012; Veenhoven, 2014). Life satisfaction reflects the overall life quality, considering current circumstances in life and personal experience from a long-term perspective (Campbell et al., 1976; Haller and Hadler, 2006; Veenhoven, 2008; Linton et al., 2016). In other words, it reflects subjective LQ. In general, the rationale of this approach is that the ultimate goal in people's life is the achievement of adequate LQ standards (Layard and Layard, 2011), which we expect to be context-dependent.

The assessment of LQ requires that a range of indicators are carefully considered in order to provide a reliable LQ measurement (OECD, 2011). The traditional indicators concern the sociodemographic and economic situation in society, but also the role of the natural environment is receiving increasing attention (Keles, 2012). Negative changes in environmental conditions can lead to a direct negative impact on LQ, both on the individual and community levels (Rogers et al., 2012). Consequences of that can cause health issues, affect the overall living conditions of generations, and potentially be the reason for an armed conflict (Hopwood et al., 2005). At the same time, a good state of the environment (both objective and perceived) can have a strong positive effect on health (Lawton, 1983; Mariani et al.,

2010; Parra et al., 2010) and can affect people's well-being through mental, psychological, physical, or physiological processes (de Hollander et al., 1999; Velarde et al., 2007; Nisbet et al., 2010).

Housing conditions are among the factors affecting the life quality of people the most (Bond et al., 2012). Due to above mentioned positive effects of the environment on people's health, housing located within easy access of a quality environment has a positive effect on well-being. Additionally, access to nature has a positive association with property prices (Luttik, 2000). In particular, access to water has a positive impact on property values (Kaplan and Kaplan, 1989; Cho et al., 2006), whereas an inadequate state of water quality can lead to markdown (Leggett and Bockstael, 2000).

The role of the state of the environment for human health and LQ has been discussed since the ancient era continuously (Burford, 1969; Montford, 2004; Thompson, 2011). Previously, it was assumed that the effects of nature on well-being was based on a visual experience of interacting with it (with a focus on health benefits). Thus, it was assumed that people rather relied on the way how they perceived green areas, water and air than on the objective state of the environment. However, Franco and her colleagues (2017) found that not all effects can be recognized by considering visual perception only. In more recent studies, the state of nature on well-being is considered by its objective and subjective measures, reflecting objectively measured values and perception of the environment respectively (Eurostat, 2015; Tveit et al., 2018; OECD, 2020). However, often the attention of scholars is rather on the consequences of environmental degradation (e.g. air pollution) rather than on the actual state of the environment (Li and Zhou, 2020; Marquart et al., 2021). In this study, I define the state of the environment as the quality of physical environmental conditions.

Objective measurements of the environment reflect the quantitative estimates of the state of the environment and usually require expert knowledge (Perlaviciute and Steg, 2018). For example, the measurement of different types of pollution such as air, noise, and water, and the effect of biodiversity requires professional skills and the use of special equipment (Welsch, 2006; Gidlöf-Gunnarsson and Öhrström, 2007; Keeler et al., 2012; Pecl et al., 2017). However, these objective environmental indicators often represent country-scale trends and by definition lack a subjective reflection of the state of the environment in LQ studies (Streimikiene, 2015).

In contrast, subjectively measured environmental indicators reflect perceptions of environmental conditions in the community or response to the environmental pressure (e.g. air pollution) of community members (Lee, 2008; Petrosillo et al. 2013; Yuan et al., 2018; OECD, 2020). The perceptions are often related to concerns, feelings, and experiences (Bechtel, 1997; Gosling and Williams, 2010; Steinke et al., 2017). However, the way how people perceive nature can be affected by their socio-

economic status (e.g., health, education, income level), and these interactive effects on LQ should be considered (Ibsen and Ballweg, 1969; Canter et al., 1992). In LQ studies subjective environmental data are often collected on a larger scale (e.g. country scale), which makes it impossible to assess its effects on LQ on the level of the individual. For this reason, a number of studies have highlighted the need for localization of the process regardless of the approach used in data collection (Carrus et al., 2015; Welsch, H., & Kühling, 2018; Yuan et al., 2018). In other words, there is a need to study the link between environment and LQ on an individual level and explore the effects of the local environment on the individual scale. This thesis is an attempt to contribute to this question with an emphasis on the test of individual relationships with the environment and the impacts it has on their own perceived LQ. Additionally, there is a limited amount of study done about the accuracy of subjective environmental measurements in comparison to objective (Game et al., 2018; Danielsen et al., 2021).

The fundamental aim of this study is to contribute to the broader research agenda, which seeks to understand the relationship between people and nature. In the thesis, I investigate the role of environmental conditions for LQ of people in two dimensions, by using both objectively and subjectively measured environmental data. I use sea water quality data as a representative environmental indicator in the coastal community I have investigated, since the study area is located in the archipelago, and the ecosystem services provided by sea are particularly important for coastal communities (Barbier et al., 2011; Blythe et al., 2020). Thus, I predict that water quality (hereafter referred to as WQ) may have both psychological, physiological, and physical impacts on LQ of community members, and potentially plays a more important role than other reflections of the state of the environment.

1.3. How accurate are people in their assessments of the local environment?

Subjective assessments of environmental conditions made by people usually include both an evaluation of the environmental state, but also self-perceptions of the conditions based on current feelings, knowledge and experience (Heer et al., 2003; Xu et al., 2006, Petrosillo et al., 2007). The collection of subjectively measured environmental data requires interaction with people by actively involving them in the actual research, which is commonly known as a citizen science approach (Irwin, 2018). The motivation of people's participation in environmental science projects varies a lot and can include motives such as general environmental concern, learning of new skills, the possibility to spend more time with family or friends, the wish to support a specific region or the possibility to spend more time outside (Geoghegan et al., 2016).

From a scholar's point of view, citizen science provides an exciting opportunity to collect larger amounts of data from larger areas using standardized methods (Havens et al., 2012; Lukyanenko et al., 2014). In particular, citizen science increases researchers' ability to collect detailed data on local scales (Newman et al., 2017), and can be very cost-effective (NACEPT, 2016; Pocock et al., 2014). The collaboration between scientists and local residents enables both parties to interact and exchange information that they deem important (Bonney et al., 2015; Carolan, 2006; Trumbull et al., 2000). The citizen science approach is widely used in biodiversity studies (Danielsen et al., 2008; Pocock et al., 2017), where a large number of amateurs or laypeople contribute to a project by reporting verifiable observations. In some projects, such as water monitoring programs, there is a requirement for volunteer training before data collection (Capdevila et al., 2020; Zhang et al., 2017) with the aim of ensuring data reliability (Toivanen et al., 2013). However, this is not always the case and citizen science data can be collected without any prior instructions to participants.

The accuracy of subjective environmental assessments is a matter of debate and the accuracy of subjective measures requires verification. Participants may have sufficient knowledge and experience to give a qualitative estimate of the environment in question, but have no prior training, represent different backgrounds and education levels, and have no access to professional scientific equipment. Currently, it is not well known how accurate such participants are in their subjective measures and there is a lack of direct objective-subjective data tests. The contradistinction of the data collected by professional scientists and laypeople can potentially give a “window of opportunity” for involving ordinary people in research projects. The involvement of a broader representative sample of society in data collection may facilitate speeding up conservation and management actions (Danielsen et al., 2007, 2010). However, it is possible that the evaluation of environmental conditions based on subjective perceptions might be affected by the participants' socioeconomic status and experience of the environment (Steinke et al., 2017). Additionally, the reliability of perceptions can be affected by psychological (e.g. mental health), ecological (e.g. exposure to pollution), social (e.g. income level), and political (e.g. political orientation) factors. These issues are normally addressed by increasing sample size (Dickinson et al., 2010) or effective training (Kosmala et al., 2016). The involvement of people in environmental processes and data collection has the potential to promoting environmental democracy (Alarcon Ferrari et al., 2021). Environmental democracy inherently means the participation of citizens in decision-making and free access of society to environmental data (Worker and Ratté, 2014). On top of that, it enhances the capacity of citizens to monitor and control governmental decisions and potential human rights violations related to climate change (Gellers and Jeffords, 2018).

In this thesis, I investigate the accuracy of environmental perceptions and factors that potentially have an effect on its quality. For that, I compare the respondents' subjective evaluation of WQ conditions (perceptions) with simultaneously measured objective WQ data in the corresponding locations.

1.4. The role of global stress (COVID-19) for people-nature relationships

The effects of global stressors such as the COVID-19 pandemic are tangible on a global scale and can have particularly strong impact on small communities, which are sensitive to new abrupt conditions (Piccininni et al., 2020; Mueller et al., 2021). The pandemic has provoked rapid negative changes in almost all spheres of human life (Higgins-Desbiolles, 2020; Marinoni et al., 2020; Ozili and Arun, 2020; Zhang et l., 2020; Mofijur et al., 2021). Besides the evident consequences, such as increased mortality rate or economic crisis, it has a strong effect on society through changes in peoples' relationships and human behavior, which has been found to lead to significant shifts in mental health, social and moral norms (Bavel et al., 2020). Additionally, there is evidence of increased vulnerability in less-protected social groups such as elderly people or individuals with low socioeconomic status (Usher et al., 2020). The overall psychological well-being of the general public has been found to have undergone serious negative psychosocial changes during the COVID-19 pandemic (Ivbijaro et al., 2020; Vindegaard and Benros, 2020).

Among sectors that suffered markedly during the active stages of the pandemic is the tourist sphere (Škare et al., 2020). The restrictions related to quarantine measures affected the freedom of movement between countries and, in some cases, even between localities (Liu et al., 2020; Jeon et al., 2021). At the same time, the role of nature for the tourism industry increased and access to nature became crucial for tourists (Spalding et al., 2021). Access to nature was often limited to the local region due to the restrictions. Moreover, the restrictions increased the stress level of people and had a negative effect on their mental health (Mækelæ et al., 2020). Numerous scholars have highlighted the important role of nature in reducing stress through interaction with nature, therapeutic effect on psychological state and received positive emotions (Morita et al., 2007; Berto, 2014; Razani et al., 2016). The role of nature rose during the COVID-19 pandemic through interaction with nature by foraging, gardening, hiking, jogging, photographing, relaxing alone, walking, and watching wildlife (Morse et al., 2020). The reported positive effect of access to nature, either by being outside or bringing plants indoors, demonstrated the increased demand for green spaces during the pandemic (Naomi, 2020; Soga et al., 2021; Egerer et al., 2022). The restrictions during the pandemic made outdoor activities the only option to be out and connect people and nature. Under such

circumstances, the opportunity to experience the local environment may become increasingly important. Thereby living in a neighbourhood with poor environmental quality might affect mental health negatively and increase impacts of the pandemic on life quality of individuals. In the thesis, I expect to find mitigation characteristics of good environmental (water) conditions, which potentially can buffer against adverse stress impacts.

1.5. Aim of the study

The main goal of the thesis is to investigate the role of the local environment for well-being of individual inhabitants in the society and how environmental status may influence the impacts of global stressors on people-nature relationships. As an indicator of the state of local environment I used surface water quality due to its significant importance in coastal communities (see Information box 1). In chapter **I** I focused on the quality of environmental perceptions of citizens and if they are able to recognize the state of local environment. More specifically, my aim was to understand if people's perceptions of WQ are accurate enough in comparison to the objectively measured WQ, and if the socio-demographic status of citizens can affect their environmental perceptions. In chapter **II** my aim was to investigate the role of the state of local environment, both objectively measured and perceived, for the life quality of residents. I wanted to compare whether oWQ or sWQ is a better predictor of LQ when corrected for traditional socio-demographic indicators. In chapter **III** my focus was on the impact of a global stressor, the COVID-19 pandemic, on people-nature relationships and life quality, and whether perceived environmental quality (sWQ) influenced the impacts of the pandemic on life quality (sLQ). Based on responses about the personal impacts of the pandemic, my aim was to understand if the pandemic caused behavioural changes promoting local nature among citizens. On top of that, I aimed to understand if the perceived local environment can play a buffer role for LQ in mitigating the negative impacts of global stressors on a psychological level. In chapter IV I aimed to find out if real estate price perceptions (houses and cottages) are determined based on the state of the environment (sWQ and oWQ) in the area. Hence, I focused on the potential added economic value of a higher quality of the environment.

2. Methods

2.1. Study area

The research in the thesis was conducted in the municipality of Raseborg, which is located along the southwest coast of Finland in Ekenäs archipelago (Figure 1). The municipality has a population of almost 28,000 inhabitants (OSF, 2020). The population size increases significantly during the vacation period in summer (up to 50%). The municipality of Raseborg was created in 2009 by merging several smaller municipalities. As a result, it has three distinct urban areas with bigger administrative centers (Ekenäs, Karis and, Pojo), and rural areas where people live mostly in small villages and houses far apart from each other. Raseborg is located relatively close to the capital region (withing 90 km) and, thus, is becoming a popular place to live in among people working in Helsinki and its surroundings and for leisure housing.

Raseborg is a coastal community consisting of a large archipelago, and the state of the coastal waters has a significant importance for tourism, which is socio-economically important for the municipality and its citizens. The municipality is important for recreation and remains one of the most popular municipalities by the number of summer cottages (OSF, 2019). However, according to Finnish Environmental Agency SYKE (2019), most waters in the Ekenäs archipelago have a "poor" ecological status. This is mainly due to eutrophication issues in the Baltic Sea (HELCOM, 2018). Eutrophication and a degradation of the state of the coastal waters could potentially affect tourism and the life quality of inhabitants.

2.2. Survey data collection

To test my predictions in the thesis about the role of local nature for society and people's LQ, two types of environmental data were collected (Information box 1): objectively measured (by using professional equipment) and subjectively measured (perceptions of inhabitants). Subjective environmental data was collected by surveying people in Raseborg. The data were collected in three rounds, the first in October-December 2018, the second in July-September 2019, and the third in May-August 2021. The data for the first two rounds were merged and used for the investigation of the accuracy of people's environmental perceptions and for the study of the role of the local environment in people's well-being (**I**, **II**, **III**). The third round of surveying people aimed to collect data for research about the pandemic's impact on the people-nature relationship, changes in well-being in relation to the local environment and the role of environment for the property price formation (**III**, **IV**). Surveys were available for respondents in three languages: the official languages Swedish and Finnish, and also in English. The respondents had an opportunity to fill

Information box 1

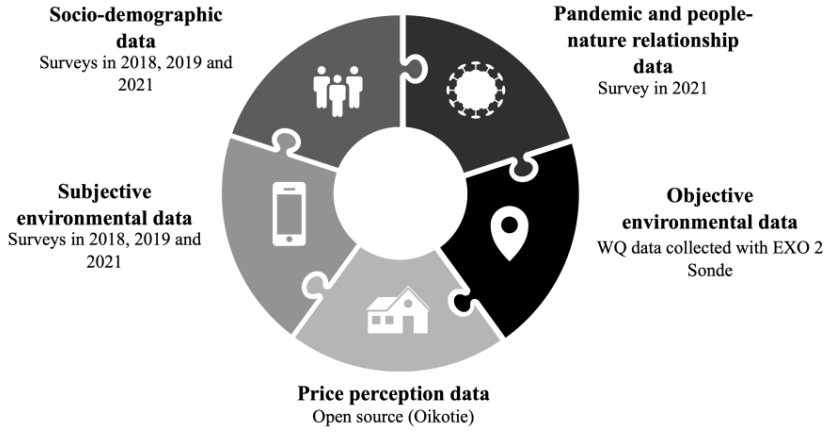
In the thesis I used questionnaires and biomonitoring tools to collect various types of data to assess local surface water quality (measured objectively and subjectively), to assess well-being of inhabitants and their socio-demographic status, and to assess property price perception data. Due to the complexity and versatility of the data I refer to established abbreviations of the data types throughout the thesis. Their explanation, compact details and potential differences are presented below.

oWQ – objectively measured sea water quality. oWQ was collected by sampling water quality variables in coastal waters of the study area with EXO2 multiparameter sonde and an associated Handheld Unit (Xylem Inc., United States). In chapter **I** represented by fluorescent, dissolved organic matter (fDOM) and in chapters **II** and **IV** represented by residuals between fDOM and surface water salinity. In this thesis oWQ is used as an environmental indicator because coastal waters provide the most important ecosystem services for coastal communities (Barbier et al., 2011; Blythe et al., 2020).

sWQ – subjectively measured sea water quality. sWQ represents people's perceptions of the state of the local coastal water. Data were collected by surveying people who were asked to assess the water quality next to their home on a 0-10 scale, where 0 means poor water conditions and 10 means good water conditions. In chapters **I**, **II**, **III** used as a direct measurement and in chapter **IV** as a mean value calculated from the responses surrounding the property in question.

LQ – subjective self-evaluation of individuals' life quality. In the questionnaire inhabitants responded to the question on a 0-10 scale, where 0 means dissatisfied with life and 10 means satisfied with life. It is assumed, that the question about life satisfaction reflects the personal evaluation of life quality (Weber et al., 2015). Abbreviation sLQ is used in chapter **II**.

PP – property price perception data. PP was collected from real estate listings for houses and cottages in the study area which were published on the nationwide open-source property trade platform Oikotie. PP is used in chapter **IV**.



in a survey during recreational events in the municipality (only for the first round) and online (for all three rounds). The online questionnaires were advertised via mass media (local newspaper), and an invitation to participate in the survey was delivered to available post-boxes across the municipality. Additionally, I used Facebook advertising during the data collection periods aimed to reach people from Raseborg aged 16 years and older. To increase the response rate and motivation, participants could simultaneously join a lottery for three 50-euro gift cards to a local supermarket.

The first and second rounds of the survey had 16 questions, including items asking people to assess the local water quality close to their property or home. This sWQ estimate was used as a local environmental indicator because ecosystem services provided by sea have been found to be the most important in coastal communities (Barbier et al., 2011; Blythe et al., 2020). Additionally, 97% of coastal waters in the Baltic Sea are suffering from eutrophication and WQ was found to be a major concern for the environment of the study area (HELCOM, 2018). People were also asked to evaluate how emotionally attached they felt to their house or property. The answers were given on a scale ranging between 0 and 10, where 0 means bad/not important and 10 means good/very important. Simultaneously, I collected data on socio-demographic parameters, such as age, gender, education level, level of income, health situation, how long they had lived in/owned the property, type of property and what type of relationship they had with it (owning or renting), and emotional attachment to the place[1]. The selection of socio-demographic parameters for survey collection and later for the analysis based on OECD framework of study well-being (see OECD, 2020). Additionally, each respondent was asked to provide the address of the house/property they bear in mind (reference point) for the location which he/she referred to in the survey during WQ assessment water quality. The full questionnaire used in 2018-2019 is available in Appendices to chapters **I** and **II**. All answers were sorted and unclear responses (e.g., incomplete surveys, missing address data, age of respondent under 16, etc.) were excluded. Thus, during the first and second rounds, 779 answers available for analysis were collected.

In May-July 2021 I conducted a third round of the survey. The questionnaire had 21 questions related to the effects of the pandemic on a personal level: 1) how the pandemic affected the respondent's own relationship with nature, 2) how the pandemic affected people-nature relationships in general, 3) respondent's thoughts whether human exploitation of nature has caused the pandemic, 4) an evaluation of the importance of natural benefits for the respondent, and 5) each respondent's life

[1] For traditional measurement of place attachment variable see Raymond et al., 2010. In the thesis, deviation from the traditional methodology is explained by the practical reasons for maximizing the response rate.

satisfaction assessment. It is assumed that the question about life satisfaction reflected the personal evaluation of life quality (Weber et al., 2015). The respondents had the opportunity to give answers on a scale ranging between 0 and 10, where 0 means not affected/no relationship between nature treatment and pandemic and 10 means strongly affected/significant relationship for the group of questions for which people evaluated the personal pandemic impact and to what extent they believe that the pandemic has been caused by the impact people have had on nature. The respondents also answered to a group of questions (with predefined statements) related to the changes in perceptions of people-nature relationships, their concerns about the environment, their relationship with nature, their consumer behavior concerning environmentally-friendly products, as well as changes in their time spent in nature (full questionnaire available in Appendix to chapter **III**). In addition, respondents evaluated the water quality of the coastal water in the vicinity of their locations (similarly, to the questionnaire used in **I** and **II**), as well as the socio-demographic parameters of respondents were collected: age, gender, education, health, and income situation as covariates in the assessment of LQ changes related to the pandemic. All answers in the survey were referred to the specific local areas in Raseborg pointed out by the respondents. All collected responses were sorted and unclear or unsuitable responses (e.g., incomplete surveys, those with missing address data or respondents under the age of 16, etc.) were excluded, resulting in 769 complete responses. The georgraphical distribution of answers to three rounds of surveys is presented in Figure 2.

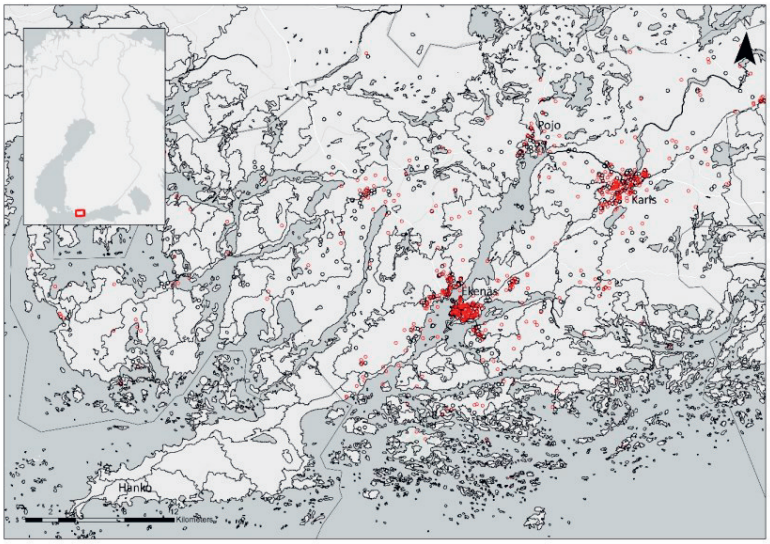


Figure 2. Survey answers' distribution in the study area divided on watersheds (see 2.5 for definition of watershed). Black circles refer to the first and second round (2018-2019) and red dots to the third round (2021).

The responses were corrected for age and gender in order to improve demographic representativeness (de Leeuw et al., 2008). I applied a post-survey weight based on the population age structure in Raseborg corresponding to the year of the data collection (OSF, 2020; OSF, 2021) using the formula

$$\omega_i = \frac{NK_i}{n_i},$$

where N is the number of respondents, K_i is desired distribution in the age group and n_i is the number of respondents from the following age-gender group.

2.3. Objective environmental data

oWQ was collected by sampling observable water quality variables, such as water turbidity and concentrations of fluorescent, dissolved organic matter (hereafter referred to as fDOM), and chlorophyll-*a*, along with variables depicting the physical environment, such as temperature and salinity. In this study, the fDOM concentration was used as a proxy for the level of organic loading, in accordance with Nixon (1995). The fDOM measurements were carried out using an automated underway measurement system equipped with optical sensors, along a coastal transect of approximately 300 nautical miles (550 km), covering the Raseborg archipelago. The oWQ variables were collected during mid-October 2019 and April-September 2021. Based on corresponding data that cover seasonal variation in WQ, October is the most representative time to reflect the overall status of the waters within the study area (used in **I** and **II**). From the second-round data the mean value of 2021 was calculated (used in **IV**). The water quality data were constantly recorded, together with geospatial referencing information, at 5-second (s) intervals by an EXO2 multiparameter sonde and an associated Handheld Unit (Xylem Inc., United States). Data collection, calibration and handling are described in detail in Scheinin and Asmala (2020). Additionally, each variable was corrected for the statistical analysis using salinity as a way to link observations to the physical characteristics of the environment (details about oWQ data collection presented in **I**).

2.4. Property price data

I collected freely available data on property prices from real estate sale advertisements in the study area to investigate the role of environmental state on the formation of property prices (**IV**). I obtained data by monitoring the advertisements about houses and cottages on market in Raseborg from the Finnish real-estate web-platform Oikotie (https://www.oikotie.fi/) during May-September 2021. The period

of data collection is characterized as the high peak season when selling prices tend to rise in comparison to other seasons (Cho et al., 2006). I collected the selling prices of all houses and cottages, i.e. the prices that were determined by the real estate agents and owners prior to the actual sales (price perception value, hereafter PP). In addition, I collected data on the properties for variables which are important for price formation, and which were available in the advertisement, such as size (area) of the house/cottage and size of the whole property, construction year, condition of the house/cottage, distance to sea water, boat requirement for transportation and distance to the metropolitan area (Helsinki). I used data on properties which were located at a maximum distance to the sea of 2000 m. In total, data from 75 houses and 78 cottages that were published for sale were collected (see Figure 3). This number represents 64% of all houses and cottages available on market in Raseborg in May-September 2021.

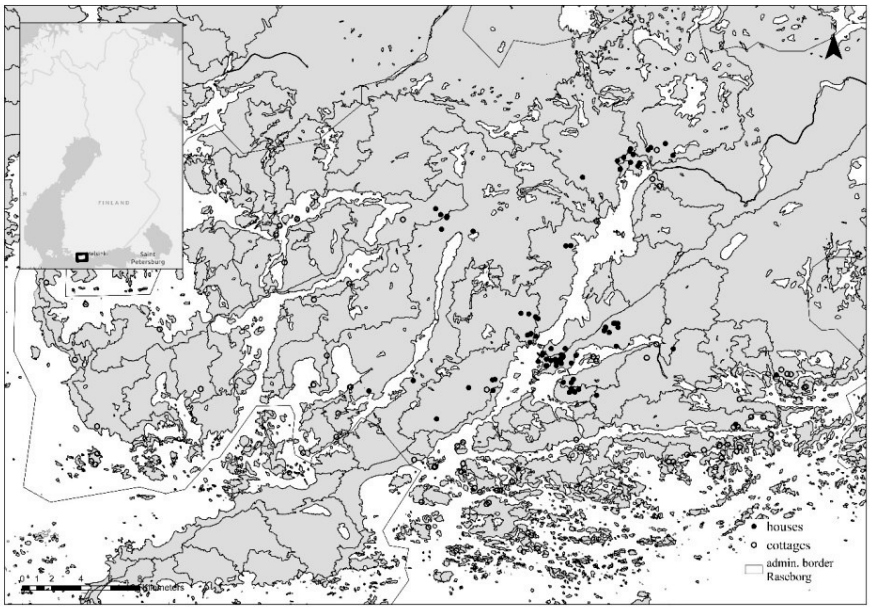


Figure 3. Price perception data distribution. The map represents the positions of the houses and cottages for sale used in chapter **IV**

2.5. Data preparation and statistical analysis

The collected data (water quality data, questionnaire data and property data) were transformed and prepared for the analysis by using geospatial software ArcGIS 10.5 (ESRI, 2017) and ArcGIS Pro 2.8 (ESRI, 2021). First, the study area was split into watersheds using a 10 m Digital Elevation Model (NLS, 2016). Watershed is commonly known as an area from which all water through streams and rivers flows

to a common outlet. Watershed division connects anthropogenic impact (land-use activities of people) in the area with the state of the water, which is affected by nutrients transported by flow in watersheds. The split of the area into watersheds allows the connection of each individual to coastal waters (Figure 3). Next, I converted the oWQ data using the interpolation, buffer and mean calculation tools for allocating oWQ for each watershed (details explained in **I**). For chapter **I**, the values of fDOM, Chl-*a* and turbidity were used. In **II** and **IV**, oWQ for the analysis was represented by residuals between fDOM and salinity. The questionnaire data were georeferenced by reference points (addresses or coordinates) provided by respondents, and the property data were georeferenced by addresses provided in advertisements. Thus, each watershed (see Figure 4) used in the analysis had oWQ, sWQ and sociodemographic parameters data (for **I**); oWQ, sWQ, sLQ and sociodemographic parameters data (for **II**); sWQ, sLQ, pandemic data and sociodemographic parameters (for **III**) and oWQ, sWQ and property data (for **IV**).

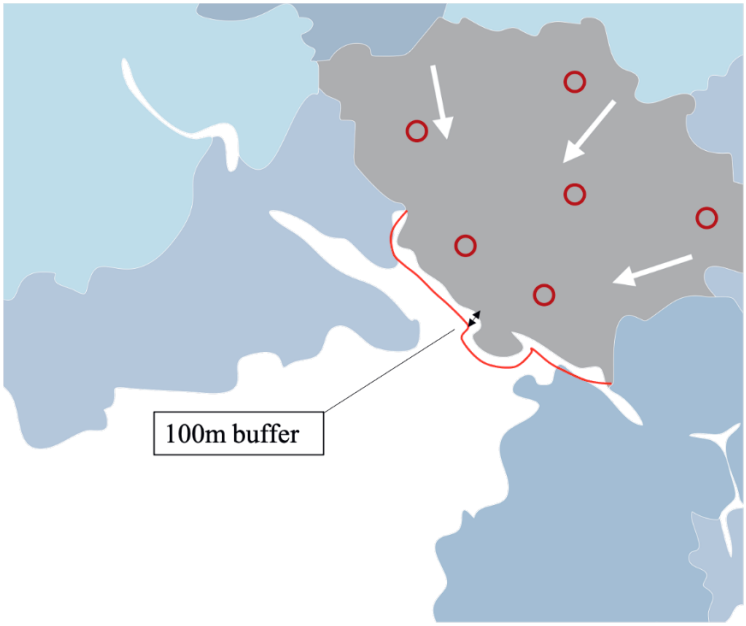


Figure 4. An example of a watershed and data transformation. Red dots correspond to the georeferenced respondents' locations, white arrows demonstrate the flow direction in the watershed, and a 100m buffer is used for the calculation of the mean oWQ value for each watershed

For the analysis in the thesis, I used linear mixed models. In models where

several data points from the survey shared the same data on watershed (i.e. non-independent data points) I used watershed ID as a random effect to correct for pseudoreplication (chapters **I** and **II)**. In chapter **I** the response variable was sWQ and oWQ along with socio-demographic parameters of respondents were used as explanatory variables. In chapter **I** I also applied a stepwise model selection approach. In chapter **II** explanatory variables were traditional LQ socio-demographic indicators and indicators reflecting the state of local environment (oWQ and sWQ); sLQ was the response variable in this case. In chapter **III** I similarly used traditional LQ indicators, sWQ and factors of the presence/absence of the pandemic (for comparison of data collected during the pandemic and in pre-pandemic) to explain changes in sWQ of respondents, the response variable. Additionally, I used Spearman rank correlations to analyse relationships between the pandemic impact and people-nature relationships. In chapter **IV** I used standardized PP as response variable with oWQ together with traditional price affecting indicators as explanatory variables.

All models and statistical analyses were run in R statistical software v.3.6.1. (R Core Team, 2014).

3. Results and discussion

3.1. Accuracy of environmental perceptions

In chapter **I**, I tested the accuracy of the subjectively assessed environmental conditions represented by WQ (peoples' perceptions) in comparison to objectively assessed WQ values (fDOM). The simple comparison of oWQ and sWQ demonstrate a reasonably high level of accuracy of people's environmental perceptions (calculated by proportion of answers): 72.4% of respondents were correct in the direction of their assessment and 59.1% were correct within a two-point deviation in either direction in their estimates. Moreover, the test of the direct associations between oWQ and sWQ demonstrated a strong relationship between the measurements (Figure 5a). This suggests that people are able to visually catch the differences in the state of WQ.

Further, I tested if additional parameters, such as level of education of respondents, their gender and level of their emotional attachment to the place, can improve the predictions (Figure 5b). The results demonstrated that respondents with higher education level underestimate WQ. However, there was no interaction between education and oWQ, which suggests that the accuracy (slope of the association between sWQ and oWQ) is not dependent on the level of education. I found a strong effect of emotional attachment to the property on people's perceptions of WQ; the more a person was attached to the property, the higher the sWQ score. However, emotional attachment did not have a different effect depending on oWQ. I found that males evaluated WQ higher than females but there was no interaction between gender and oWQ, which indicates no gender difference in accuracy of environmental perceptions, despite perceiving WQ differently. Lastly, I found an effect of emotional attachment on males' perceptions; the more emotionally attached they were, the more they underestimated water quality.

The main focus in **I** was to investigate if the data collected by non-experts has a scientific value and how aware people are about the state of the local environment. The results in this chapter suggest that people's environmental perceptions are accurate enough, and that accuracy is dependent on the socio-demographic profile of the respondent. Nevertheless, I found that people with higher educational levels tends to underestimate WQ. It can be explained by the general higher environmental knowledge of highly educated people, which can provoke criticism in their evaluation approach to the local environment (Branchini et al., 2015). The opposite trend was demonstrated in the emotional attachment effect, which suggests that people show a desire to see their local environment in better condition if it is dear to them. The attachment to the place, also, increased environmental concern and motivation to adapt to existing circumstances, in other words, continue to live

regardless of changes happening in the local environment (Vaske and Kobrin, 2001; Amundsen, 2013). Lastly, results suggest that involving citizens in scientific projects can be source of useful and valuable environmental data. These data can be beneficial not only for researchers, but also for local policymakers. Through the citizens' involvement community members have a chance of "being heard" by scientists and local councils and become active participants of the processes related to the local environment. Thus, the collaboration with community members can promote the development of environmental democracy (Conrad & Hilchey, 2011; Strasser & Haklay, 2018).

a) b)

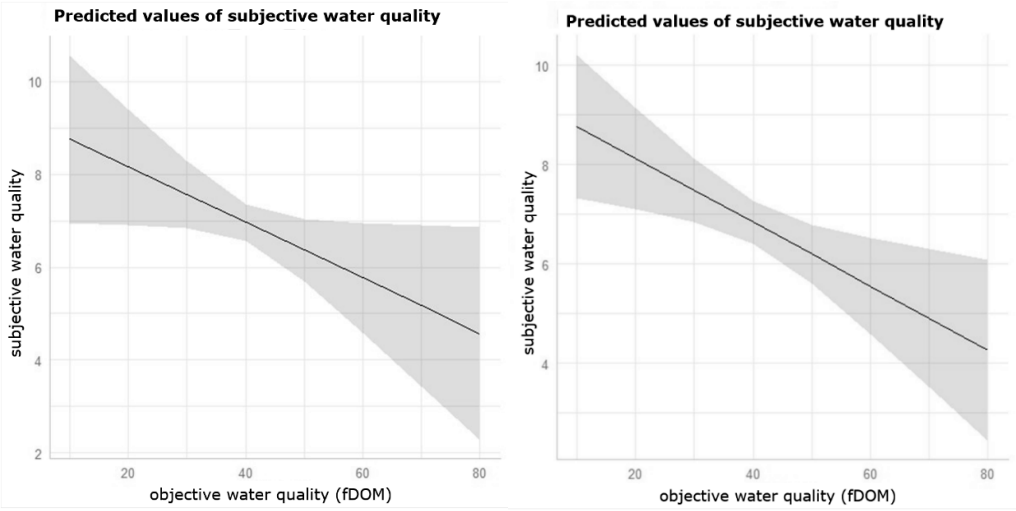


Figure 5. The relationship between respondents' WQ perceptions and objectively assessed water quality (corrected for salinity). The slopes are derived from linear mixed models. In (a) the model includes no covariates relating to the respondents and in (b) the model takes into account emotional attachment, gender and education of the respondents.

3.2. The effect of the local environment on people's life quality

In chapter **II**, I investigated the role of the local environment for LQ of people. For the analysis I used WQ as an indicator of the state of the local environment represented by the objectively measured WQ (residuals between fDOM and salinity) and subjectively evaluated WQ by the respondents (perceived WQ), traditional sociodemographic parameters affecting LQ, and life satisfaction (sLQ) reported by the respondents.

I found that objectively measured WQ did not have any significant effect on

people's LQ. On the contrary, the perceived WQ (sWQ) had a significant impact on sLQ. However, my results suggest that the effect of the environmental state (sWQ) on life quality (sLQ) is dependent on income level, where the effect was absent among those who reported a very low income level and increasingly stronger the higher the income level (Figure 6; for statistics see Appendix 2 in **II**). These findings highlight the role of environmental perceptions for LQ, but that socio-demographic status of the respondent has an impact on environmental effects on well-being.

I interpret these findings in **II** as a demonstration of the psychological effect of the local environment on LQ. The absence of an impact of objectively measured WQ does not reduce the importance of the objective state of environment for LQ, but rather highlights the necessity to also consider a subjective reflection of the environment. The perception of the local environmental conditions together with traditional socio-demographic LQ indicators explain better the variation in well-being. At the same time, an extreme negative socio-economic situation (in this study, income) can level out the psychological role of the local environment on LQ. This characterizes the need to prioritize socio-economic status worldwide to improve LQ (Ferreira and Moro, 2013; Scopelliti et al., 2016; Strieder Philippssen et al., 2017). The prevailing importance of the materialistic factors over the environment in achieving higher life quality can mislead local councils in their programs, especially in light of climate change adaptation measures. My results support the notion that governments should concentrate their efforts not only on achieving high LQ standards through economic growth, but that they should also consider improving local environmental conditions to increase LQ and to mitigate the effects of climate change on society. This requires balancing between traditional community demands (e.g., increasing income level) and long-term goals (such as climate change mitigation). Lastly, the results in **II** demonstrate that policymakers should not concentrate their efforts on achieving only short-term materialistic improvements, but should also consider improvement in the local environment (long-term strategy). Findings in **I** and **II** suggest that people are able adequately evaluate the state of the local environment but at the same time the way people perceive natural conditions plays an important role in their LQ. This combination of results highlights the value of subjective evaluations made by community members and sends a signal to local councils to delegate a part of their power regarding environmental agenda to society by the active involvement of community members in decision making.

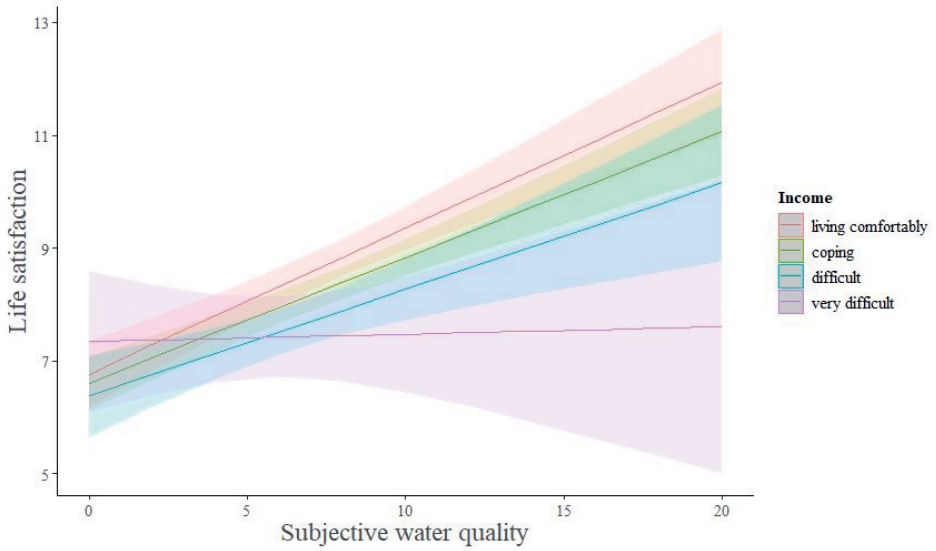


Figure 6. The interaction between reported income level and perceived water quality (sWQ), and its effect on life satisfaction.

3.3. The impact of large-scale societal stress events on people's relationship with nature and life quality

In chapter **III**, I investigated the effects of a global stressor event (the COVID-19 pandemic) on people-nature relationship and LQ. I used survey data collected before and during the pandemic to analyse changes in LQ in relation to the state of the local environment (represented by sWQ). From the 2021 questionnaire I obtained respondents' self-evaluations of the extent to which the pandemic had affected them and their relationship with nature. First, I investigated if the pandemic caused changes in LQ in relation to the state of the local environment, represented by respondents' perceptions. For that, I used a linear model approach and compared the data collected before and during the pandemic (surveys 2018-2019 and 2021). I found that the pandemic had a significant negative effect on LQ, but it was stronger for respondents who perceived the water quality conditions in their surroundings as poor (Figure 7). Hence, the effect of the pandemic on LQ was smaller for those living in areas with better (perceived) water quality. This finding demonstrates the potential of the surrounding nature to serve as a buffer against large-scale stressors. Furthermore, I found a link between the personal impact of the pandemic and changes in the respondents' relationship with nature, such that people who felt they

were heavily impacted by the pandemic developed a stronger relationship to their local environment (Figure 8). This indicates a raised concern about nature and the important role of nature for well-being during the pandemic.

The drop in the level of LQ during the pandemic underlines the adverse impact of global stressors on communities. The experience of the pandemic demonstrated that citizens worldwide are vulnerable to changes caused by stressors, such as social inequalities, economic issues, disruptions in the routine (Lau et al., 2021; Perry et al., 2021; Yang et al., 2021). Thus, attention to the factors that may mitigate stressors is important for the well-being of community members. Due to this "buffer effect" of the local environment on LQ (**III**), the role of local governments in supporting local environmental initiatives to "greenify" the area and monitoring the quality of nature can be of great importance. Moreover, the changes found in peoples' relationship with nature caused by the pandemic showed the internal initiative of people in focusing on the environment and connecting with nature on a personal level. This is a signal for policymakers worldwide and an important lesson from global stressors, highlighting a raised awareness and interest in nature on a local level.

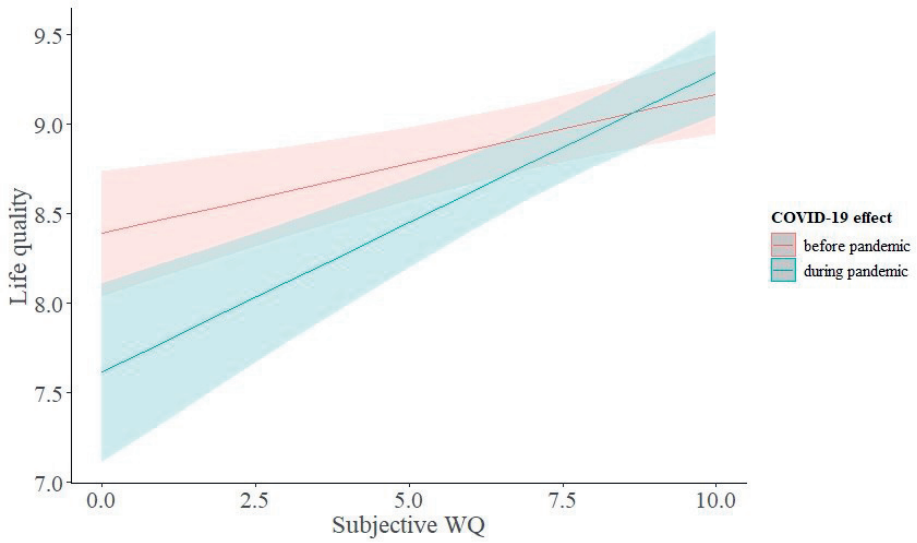


Figure 7. The interactive effect of the pandemic and perceived coastal water quality on LQ

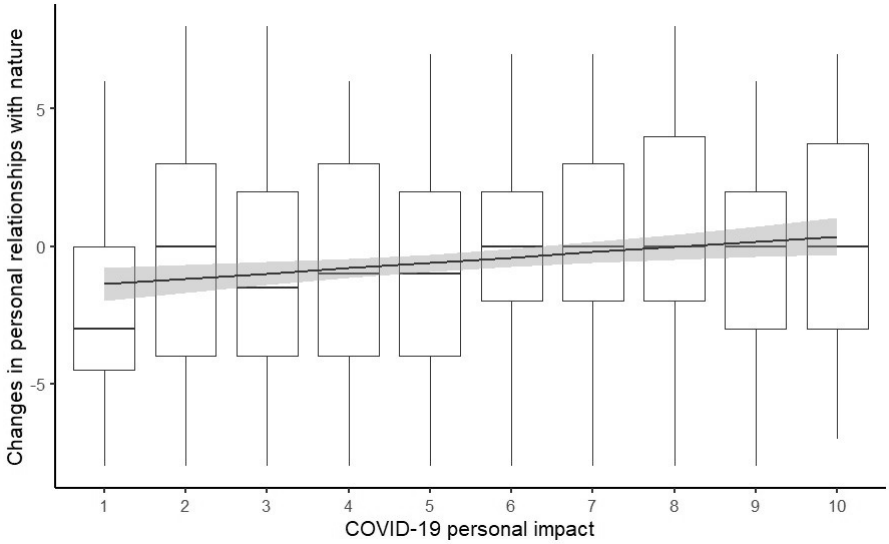


Figure 8. The relationship between the personal impact of the pandemic and changes in people–nature relationship on a personal level.

3.4. The monetary effect of environmental quality

In chapter **IV** I studied the effect of the local environment on property price perceptions. I used water quality data (oWQ) collected in 2021 as an indicator of environmental conditions and standardized price data collected from the house/cottage for sale advertisements (PP data). In a model corrected for typical sales characteristics of houses (size, age, condition, etc.) I found a clear positive effect of oWQ on the property price (better oWQ predicts higher selling price; Figure 9). This finding demonstrates that the people responsible for the property price formation (owners and real estate agents) consider the local environmental conditions in their perceptions of the house/cottage monetary value.

These results suggest that the quality of the local environment is important for people when they evaluate the property price. I assume that the people responsible for the price formation (owner and real-estate agent) during the economic evaluation are able to recognize the overall visually accessible state of the local environment. Additionally, owners and real-estate agents can place monetary value on natural conditions and include them among the factors affecting the price the most.

Another aspect is that individuals can benefit economically from a high-quality environment. Often, scholars discuss this benefit in the tourism sector by demonstrating an increasing economic benefit in a community through attracting more tourists, but also negative impacts of such actions are sometimes inevitable

(Hakim et al., 2011; Duffy, 2015; Ghoddousi et al., 2018). My results in **IV**, provide a new insight in how community members can extract economic benefits without serious pressure on the local environment. Moreover, the economic benefit of adequate environmental conditions in a locality can promote pro-environmental initiatives, such as environmental protection, among community members. These types of monetary benefits of environmental quality can potentially drive local councils to pay more attention to environmental questions, and it can activate economic instruments for supporting local environmental initiatives and decentralizing climate change actions (bottom-top approach).

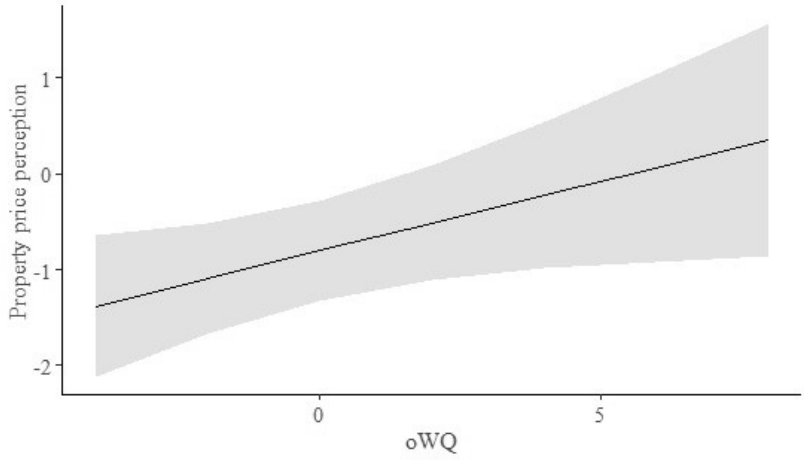


Figure 9. The relationship between oWQ and price perception gradients for houses and cottages

4. Conclusions

In this thesis, I discuss the role of the local environment in the quality of life of members of a small community. My focus is on demonstrating the significance of representative natural conditions (in this thesis WQ) in different dimensions (objective and subjective). This was possible thanks to the possibility to collect detailed oWQ data and to obtain subjective data by surveying people in the study area. In a step-by-step approach, I evaluated the accuracy of people's environmental perceptions (**I**), the role of the local environment for LQ (**II**), the impact of global stressors (COVID-19) on the people-nature relationship, and on LQ (in relation to environmental quality) (**III**), and investigated if environmental conditions are given an economical value in real estate sales (**IV**). Therefore, I believe that the findings point out that environmental quality plays an important role for well-being in society, especially in stressful circumstances and that environmental quality is important also from an economic point-of-view.

In particular, my findings suggest that peoples' focus on nature has a local dimension. The respondents of the surveys used in the thesis demonstrated awareness of environmental issues related to WQ and a clear understanding of the current state of the environment by providing an adequate evaluation of WQ conditions. The accuracy of their environmental perceptions was high, and this is a signal to scientists and local governments to actively involve community members in local environmental actions. The results in **I** suggest that the role of community members could be changed from observers to actors, which would strengthen the environmental democracy on a local level. Moreover, the high accuracy of people's perceptions opens up the "opportunity window" for scholars to collect large amounts of local scale scientific data using cost-efficient methods.

The role of adequate environmental conditions highlighted in **II** should mobilize the local councils for more effective actions toward the environment. The LQ measure in a small community showed that people consider environmental conditions as important along with other traditional socio-economic factors. My interpretation of the strong effect of environmental perceptions (sWQ) on LQ is that community members place a high demand to live in a community where environmental issues are not ignored. The less pronounced effect of sWQ for respondents with income issues underlines the balance in LQ that local councils should aim for.

At the same time, the impact of the pandemic demonstrated an increased role for the local environment as a buffer against adverse effects of global stressors. The impacts of the pandemic have been tangible worldwide and people are vulnerable to disruptive changes caused by the pandemic (Campbell et al., 2021; Lau et al., 2021; Perry et al., 2021; Yang et al., 2021). Thus, the mitigation opportunity plays a

significant role. Moreover, the ability of community members to recognize the actual state of the local environment (found in **I**) in combination with the high importance of the environmental perceptions (found in **II**) and the impact of good environmental conditions in mitigating negative impacts of the pandemic (**III**) highlights the significance of a high quality state of the local environment, especially in the event of extreme circumstances. This can be interpreted in such a way that local governments should concentrate their efforts on satisfying the "green needs" of the population. It aligns with previous findings of Korpilo and colleagues (2021), who found significant importance of access to nearby urban green areas during the pandemic and highlighted these areas as the critical infrastructure for inhabitants. In parallel with the results of this thesis, their work emphasizes the role of the local environment for urban planners and policy-makers. The changes in the people-nature relationship towards environmentally friendly decisions and increased concern for the environment caused by the pandemic (**III**) strengthen the conclusions about people's increased demand to live in communities where the environment is given a high priority. Additionally, it is important to mention that findings in the thesis benefit scholars through emphasizing the ability of residents adequately assess local environmental conditions (**I)**, which shows the reliability of subjective data. It gives the opportunity to researchers significantly increase their datasets in a way to identify "hot spots" (places that require attention) in the study areas. On top of that, the significant role of environmental perceptions for LQ (**II**) demonstrates the importance of accounting for such measurements together with the objective assessments and the role of subjective environmental data during the evaluation of extreme events impacts on LQ (**III**).

The positive effect of adequate WQ for PP (**IV)** complements the findings in previous chapters about the role of the local environment for society members. The potential economic benefit of nature that can be extracted by property owners can be a stimulus for additional attention given to the quality of the environment (both by people and local governments). It is supported by previous findings from Kaiser and colleagues (2020) who found financial rewards to be efficient to promote environmental protection. However, they noted that the effect disappeared when the rewarding activities were cancelled. This is not the case here due to the long-term characteristic of the potential economic benefit related to the potential higher property prices for community members. Additionally, the potential economic benefit can be a motivator for people to move into the community.

The findings in the thesis are important in light of the ongoing climate change crisis and highlight the significance of localization of climate change actions. The acknowledgment of local values, experience, and knowledge can help to see the people-nature relationships and the world itself through "local people's eyes". Moreover, localization allows communities to build their own approach to protecting

nature by taking into account the interest of local community members (accounting for people-nature interdependence). The involvement of locals in policymaking is often a matter of improvements in life quality of the community (IPBES, 2022). The bottom-up approach and the use of environmental democracy instruments can potentially be the solution to reduce the vulnerability of small communities facing the effects of climate change.

People have a strong connection to nature surrounding their homes or activity zone. The sufficiently high quality of local natural conditions is the core of people's well-being in different circumstances. Yet, community members have the ability to reliably evaluate the current state of the environmental conditions. On top of that, improved environmental quality is associated with economic benefits. Thus, the combination of these factors makes society an important pressure lever on local policymakers during the climate change crisis.

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Ruslan Gunko

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