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Leveraging Ecosystem Services and Well-Being in Urban Landscape Planning for Nature Conservation: A Case Study of Peri-Urban Dynamics

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Abstract: Within peri-urban landscapes, this research investigated the complexity of the balance between urban development and green infrastructure preservation, with a specific focus on Harku municipality, Estonia. This study aimed to understand the interplay between cultural ecosystem services (CESs) and residents' well-being. Aligned with the EU Nature Restoration Law, this research explored long-term dynamics in peri-urban areas' CES conservation. The methodology included creating scenarios by combining new secondary data with the author's prior studies, which covered landscape belts, CES values, and residents' perceptions of satisfaction with the environment and recreation opportunities collected through a municipal survey. While residents expressed satisfaction in coastal and green spaces, a distinct decline was evident near villages with industrial and agricultural features, highlighting the landscape's impact on well-being. This study identified case-study-specific threats related to rapid urbanisation and put forward constructive policy recommendations. The goal was to develop effective and sustainable strategies for preserving nature through ecosystem service-based frameworks, enhance community well-being, and account for landscape dynamics through scenario planning.

Keywords: peri-urban landscapes; green infrastructure; cultural ecosystem services (CESs); CES conservation; EU Nature Restoration Law; rapid urbanisation; sustainable strategies; policy recommendations; satisfaction survey

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1. Introduction

Peri-urban landscapes are the dynamic transition zones bridging the gap between urban and rural environments. They have garnered increasing attention in the context of rapid urbanisation and their impacts on the crucial role of ecosystem services (ESs) in sustaining human well-being. As global urban populations continue to expand, the boundaries of cities extend outward, encroaching upon previously rural areas. These peri-urban regions represent important spaces where the forces of urbanisation and the intricacies of natural ecosystems intersect, making them critical focal points for research and policy consideration [1–3]. Balancing urban development with the preservation of green infrastructure is an ongoing challenge in peri-urban regions around the world. These dynamic landscapes, situated on the outskirts of urban areas, hold great potential for development and a threat to conservation strategies [4,5]. Navigating this delicate balance effectively requires careful planning, thoughtful policy formation, and broad public support [6].

As societies become more urbanised, the complex web of services that ecosystems provide to enhance human well-being takes on greater significance. ESs, encompassing

provisioning, regulating, cultural, and supporting services, underpin the foundations of human life, livelihoods, and quality of life [7].

Within this broader framework of ESs, cultural ecosystem services (CESs) stand out as a distinct category of the non-material benefits that humans derive from their interaction with the environment. These services encompass the cultural, spiritual, and recreational aspects of humankind's relationship with nature. While provisioning and regulating services have received substantial attention in environmental studies, CESs have gained prominence for their ability to influence human well-being by fostering cultural identity, recreation, and spiritual connection to the natural world. Recent research suggests that CESs can be a valuable way to connect urban residents and planners with nature in cities [8]. CESs, which provide direct and experiential benefits, can help people in urban and peri-urban areas better understand how the environment affects their well-being.

Gaining insights into the dynamics of ESs within peri-urban landscapes is important in the context of the changing urban environment. These transitional landscapes often face challenges related to land use, biodiversity, and ecosystem functioning. Factors such as increasing population, infrastructure development, and changes in land use can significantly influence the provision of ES in peri-urban landscapes. Therefore, studying the dynamics of CES in these evolving city environments is essential for making informed decisions about sustainable development, land-use management, and the conservation of natural resources.

Using the ES approach for decision-making can improve natural resource conservation strategies and the comprehension of the complex relationship between humans and the environment. Although it emphasises the importance of stewardship, it is often criticised for its vague terminology that may cause misunderstandings in different fields [9,10]. This ES approach recognises that the well-being of human populations is intertwined with the health and functionality of the environment [11–13]. Therefore, adopting ecosystem-based approaches to land management aims to ensure that both aspects can coexist in a balanced and sustainable manner, potentially reducing environmental harm and benefiting local communities. Additionally, it can foster greater interdisciplinary collaboration, promoting the exchange of ideas and practices among various disciplines, thus enabling more comprehensive and sustainable decision-making [14–17]. Lastly, investing in research and education to clarify and refine ES terminology and methods is essential for enhancing their effectiveness and expanding their use in both academic and practical contexts [18].

In a global context, the impact of urbanisation on natural resources is evident in northeast India, prompting the need for policy revisions to ensure sustainable ecosystem services [19]. Studies in Sweden, Slovenia and Scotland suggest that peri-urban areas provide important urban ESs attracting many visitors when green spaces are in close proximity [20,21]. Other ES benefits include air pollution control in Italy [22], aesthetic services in Barcelona [23], and community well-being in Pakistan [24]. Moreover, Chinese studies identify critical ecosystem service hotspots in rapidly urbanising areas, contributing to environmental planning efforts [25,26]. While promoting eco-compensation, research suggests a need to refine definitions, understand relationships, and improve valuation methods for effective environmental decision-making [27,28]. Together, these studies highlight the diverse challenges and opportunities of peri-urban landscapes globally, advocating for adaptable planning approaches.

Scenario planning serves as a method for creating various future scenarios, recognising preliminary signs and developing approaches to handle evolving challenges [29]. Its effectiveness lies in involving a diverse array of stakeholders in the development of well-informed regional public policies, examining potential shifts in natural capital, ESs, and human well-being [30–32]. The creation of optimal scenarios centres on crafting relatable and cohesive narratives, subsequently translated and mapped for clarity [31,33]. To adequately convey the futures' unpredictability, the existing literature suggests that scenarios should encompass two to four plausible perspectives [31,34]. For instance, a GIS-based tool like InVEST provides a practical example, aiding the analysis of trade-offs

between development and conservation choices by comparing ESs under different land cover scenarios [35,36]. Additionally, a common method for the non-monetary valuation of CESs involves using ecosystem-based land-use projections [37–40].

This study explores the interplay between long-term dynamics in CESs, specifically focusing on the Harku municipality. This peri-urban area is intricately linked to the well-being of the local population through the accessibility and enjoyment of cultural services provided in the area, thus necessitating a comprehensive examination. The European Union has recently concluded negotiations on the Nature Restoration Law [41], an important step for environmental conservation. This law sets ambitious targets, aiming to restore 20% of European land and sea by 2030 and all ecosystems needing restoration by 2050 [42]. This research on ESs in peri-urban areas is in line with these objectives.

The research gap in the study of peri-urban landscapes lies in the lack of detailed exploration of long-term dynamics related to CESs. The existing literature tends to overlook CESs in peri-urban areas, emphasising provisioning and regulating services. This study aims to address this gap by providing a focused analysis of CES dynamics in the Harku municipality. The objective is to understand how these dynamics impact the well-being of both the local population and the natural environment in peri-urban settings, contributing essential insights to discourse around nature conservation as well as sustainable development. A scenario creation approach was adopted, combining data from previous studies that resulted from the landscape character assessment (LCA) analyses [43,44], mapping exercises, a residents' satisfaction survey conducted by the Harku municipality [45] (hereinafter referred to as the 'municipality survey'), and geospatial data from the Estonian Land Board [46]. LCA is a useful tool for understanding landscapes, evolving from rural to peri-urban contexts [47]. Originally focused on rural landscapes, LCA has expanded to consider physical, ecological, and cultural attributes, aiding decision-making processes [47,48]. Integration with GIS and pattern recognition enhances LCA's precision [49–51].

The following research questions (RQs) were addressed in this study:

1. RQ1: How are the municipality survey data aligned with previous research findings from the area, specifically in terms of residents' satisfaction with the environment and recreation in the municipality (Harku)?
2. RQ2: How do the long-term dynamics of CESs impact the well-being of people and nature in (Harku) peri-urban areas, and what recommendations to mitigate negative impacts could be derived from this analysis?

2. Materials and Methods

2.1. Case Study Area

This case study focuses on Harku municipality, situated to the west of Tallinn, the capital of Estonia (Figure 1). Harku municipality was selected as a representative example of a peri-urban area surrounding Tallinn. It is bordered by the Gulf of Finland to the north, Lake Harku, and Tallinn to the east, and shares its boundaries with neighbouring municipalities including Saue, Keila, and Lääne-Harju (Figure 1). As of March 2023, Harku municipality has a population of 17,606 residents and covers an area of 159.7 km^2 [52]. The central nucleus of the municipality is the town of Tabasalu, which is inhabited by over 3900 residents and accommodates most of the municipality's services and businesses. Tabasalu is positioned 3.5 km from the Tallinn city border and 13 km from the city centre. Approximately 40% of the municipality is covered by forests, primarily concentrated in its central area. Harku municipality also includes four designated nature conservation areas, numerous Natura 2000 sites, and other protected territories [53].

Harku municipality is home to 172 sites listed in the National Cultural Heritage Register, including historical lighthouses in Suurupi, Baltic-German manor complexes in Harku, Muraste, Kumna, and Vääna, and fossil fields in Ilmandu and Muraste [54].

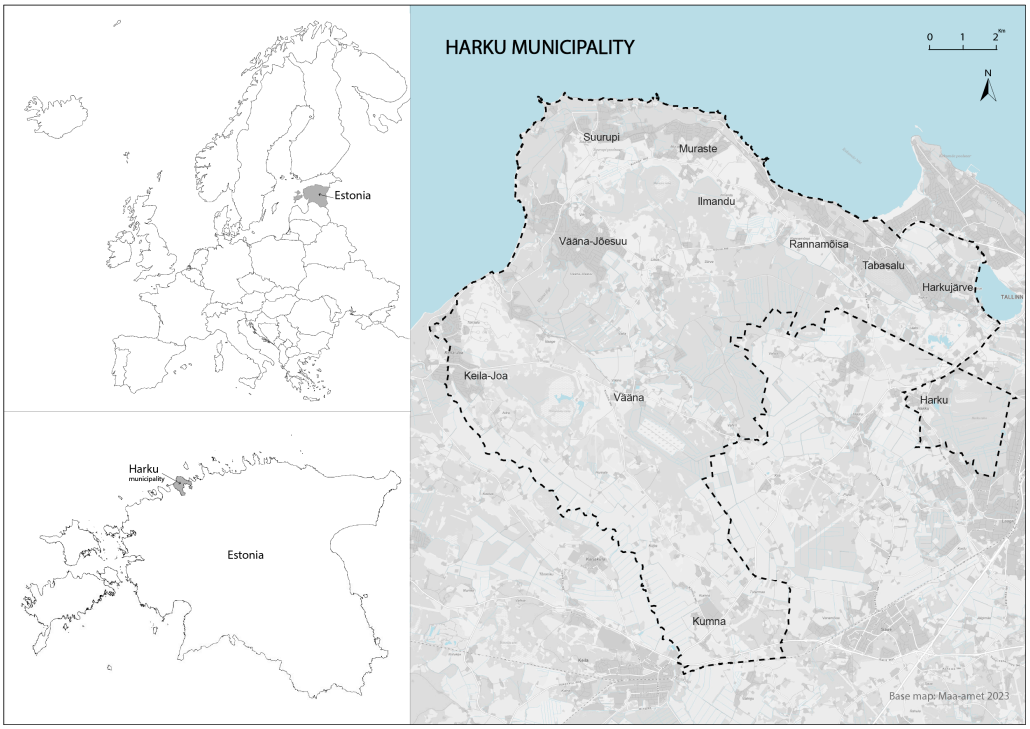

Figure 1. Case study area, Harku municipality, Estonia and the main land use types (accessed 17 July 2023).

The population density in Harku municipality is lower than Tallinn's, but exceeds that of most rural areas in Estonia [55]. The area is considered peri-urban due to its blend of urban features, such as settlements and industrial areas, and rural features, such as wetlands, forests and coastal areas (Figures 1 and 2a–d). In the 1990s, over 20,000 Tallinn residents, mainly of higher social status, moved to peri-urban areas like Harku and Viimsi municipalities [56,57]. However, these areas face challenges from urban and rural development, leading to conflicts over land use and potential environmental degradation, as well as difficulties in securing land for housing and agriculture [58,59].

During the Soviet era (1940–1991), land use underwent significant changes, with significant areas of agricultural land abandoned and leading to increased forested areas. These shifts resulted from land reforms in 1940 and 1949 (related to collectivisation and deportations), as well as, later, the rapid urbanisation and concentration of agricultural production around new village settlements [60]. Since Estonia's independence in 1991, urban expansion has seen a 34% increase in urban land within Harku municipality [61]. Economic and political changes, including land ownership liberalisation and the shift to a market economy, encouraged urbanisation and population movement to the city's outskirts.

2.2. Materials

The illustrated workflow diagram (Figure 3) serves as a visual guide illustrating the steps undertaken to merge materials and methods to assess the landscape character, municipality survey data, and illustration of maps to obtain a deeper understanding of the dynamics within the case study area. The initial materials were taken from a previous study [44], specifically the landscape character assessment (LCA), including value scores and the landscape belts concept. This was integrated with secondary data from the municipality survey [45], and maps were then created to visually convey these two steps and their respective findings. The illustration based on the merged landscape character assessment [44] and municipality survey data aimed to provide a deeper understanding of the dynamics within the case study area.

Figure 2. (**a**–**d**) Aerial views of two different sections of Harku municipality showing the urbanisation of the area in the past 20 years. (**a**,**b**) View 1: Muraste in 2002 and 2022. (**c**,**d**) View 2: Tabasalu in 2002 and 2022. Estonian Land Board (Maa-amet) [44,46] (accessed on 17 August 2023 and 25 September 2023). Although captured in various seasons, these photos effectively depict the rise in urbanisation.

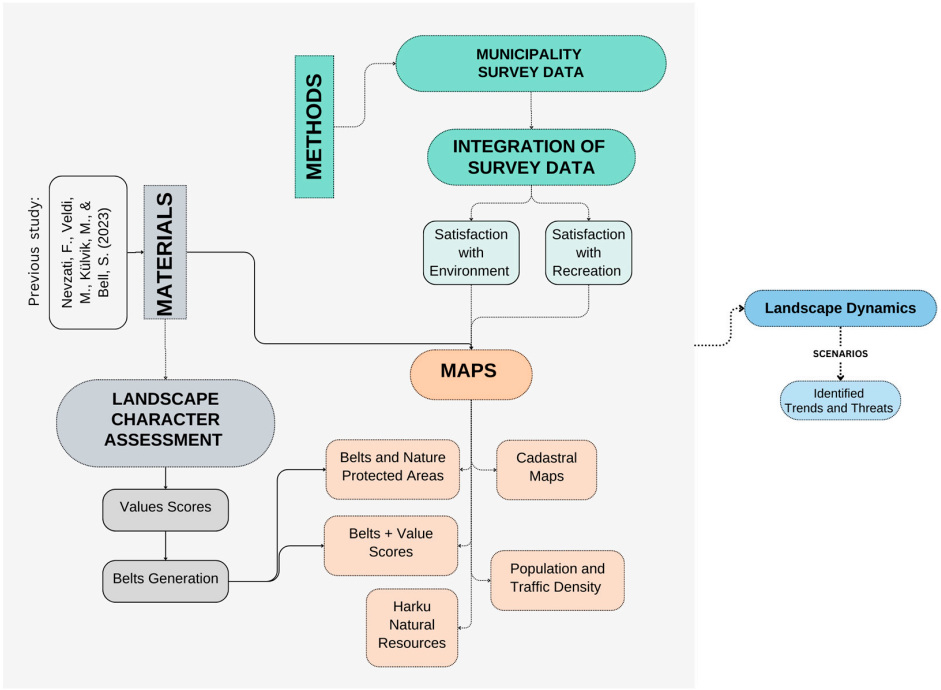

Figure 3. Workflow diagram explaining the study's development to integrate different datasets [44].

2.2.1. Landscape Character Assessment (LCA)

In a previous paper published by the authors of this study, geospatial datasets from the Estonian Land Board's spatial repository were used [46] to incorporate layers such as elevation, soil, hydrology, land cover and land use, settlement patterns and roads, cultural heritage, and nature-protected areas. Distinct landscape character types in the study area were identified by overlaying and comparing these layers, building upon the prior work [44]. These landscape character types were then assessed using municipality expert ratings [44].

In this paper, the municipality expert ratings were incorporated into 'belts' (as detailed below) to observe the different characteristics of each area to gain a broader perspective. This step might be a useful approach for an initial assessment of the area without requiring deeper knowledge of landscape types that exist.

Landscape Belts

In a previous paper undertaken by the authors [44], an identification of five distinct areas, or "belts", within the study was facilitated by the landscape character assessment (LCA) analysis. These belts, namely the Sea Belt, Settlement Belt, Agricultural Belt, Forest Belt, and Industrial Belt, were generated through a combination of desktop and fieldwork methods, with organisation from north to south offering valuable insights into the peri-urban landscape dynamics, bridging the gap between urban and rural environments (see File S1). These belts were characterised as follows:

1. Sea Belt: Positioned along the northern coast and bounded by the sea, the Sea Belt is characterised by a coastal forest landscape with sparse settlement clusters. Notably, nature protection areas related to the sea, such as beaches, coastal nature parks, and cliffs, contribute to the peri-urban ecosystem's richness.
2. Settlement Belt: Distinguished by densely populated areas, including private houses and blockhouses, the Settlement Belt is primarily concentrated in core zones such as Tabasalu, Harku, and Keila-Joa. Understanding the settlement dynamics is crucial for assessing the peri-urban interface and its implications.
3. Agricultural Belt: Characterised by a blend of cultivated fields, (semi-)natural grasslands, settlement clusters, and individual farms, this belt reflects the ongoing impact of peri-urbanisation, contributing to the reduction in traditional agricultural areas.
4. Forest Belt: Comprising forests, wetlands, and minimal settlement density, this belt underscores the significance of green spaces in peri-urban areas, contributing to biodiversity, recreation, and overall well-being.
5. Industrial Belt: Characterised by concentrated industrial and manufacturing activities, this belt introduces complexity in its connection with cultural ecosystem service (CES) values. Understanding this industrial landscape is important for a comprehensive analysis of CESs in the evolving peri-urban setting due to its unique character compared to other belts.

The organisation of settlements in Harku municipality follows a clear pattern, mostly situated on the outskirts. Southern areas are primarily devoted to agriculture, indicating an emphasis on farming. Central regions display forests, typically preserved for conservation or recreation purposes. The industrial zone's proximity to Tallinn signifies a link to the capital's economy (see File S1).

By leveraging expert ratings derived from a previous study [43,44] and applying them specifically to each of the five identified belts, this approach allowed for a nuanced understanding of how various landscapes relate to CESs, by incorporating individual, interpersonal, and environmental aspects. The exploration of CESs in green and blue spaces, which draws on insights from various sources [7,62,63], revolves around three fundamental values, namely restorative values, social values and cognitive values. Restorative values encompass both physical benefits, such as sports and recreation, and psychological benefits, including stress relief and heightened self-esteem. Social values contribute to community cohesiveness through events and gathering places, and embrace spiritual, historic, and sym-

bolic elements. Cognitive values encompass aesthetic perception and provide support for science and education, spanning areas such as food production and education.

Secondary Municipality Survey Data

The municipality survey data were used to collect information on residents' perceptions of the landscape, their values, and their satisfaction with the environment and recreational opportunities (more details in Section 2.3.1).

2.3. Methods

2.3.1. Data Integration from Resident Municipality Survey

Secondary data were incorporated from the 'Residents of Harku Municipality Satisfaction Survey' (original title: Harku valla elanike rahulolu uuring) conducted in December 2022 [45]. The municipality survey, commissioned by the Harku municipality, aimed to map residents' satisfaction with the way of life in the municipality, as well as their wishes and needs for further development. Conducted online from 2 December to 12 December 2022, the municipality survey received 1804 responses from residents across 9 main regions and 23 villages. This study specifically focused on the responses related to "satisfaction with the environment" and "satisfaction with recreation" in the municipality, and visually represented these village-specific municipality survey data through maps providing a focused and comprehensive understanding of residents' opinions within each village.

Data from the municipality survey were imported into GIS (ArcGIS), and analysed alongside the landscape belts generated from the previous study. This GIS-based integration of spatially distinct datasets enabled a methodological framework for examining landscape dynamics (trends and threats) concerning residents' perceptions of their living environment. By overlaying residents' ratings of the environment and recreation with the landscape belts, we were able to establish a connection made between the residents' opinions and each belt in the study area. The integration of these secondary data aimed to provide a deeper understanding of how residents perceive and engage with the diverse characteristics of each belt within the study area.

2.3.2. Synthesis Methodology: Scenario Creation

To meet the research objectives, a scenario creation approach was used, combining data from the previous landscape character assessment (LCA) [44], mapping exercises, the residents' satisfaction survey performed by the Harku municipality [45], and geospatial data from the Estonian Land Board [46]. This synthesis of diverse datasets forms the basis for constructing scenarios that consider both landscape features and residents' perspectives. Maps were created using Geographic Information System (GIS) tools to visualise changes in landscape elements, values, and their distribution across the study area. This visual representation aids in analysing the implications of each scenario, providing insights into the complex interplay between landscape dynamics, residents' perceptions, and the impacts on CESs.

3. Results

3.1. Residents' Municipality Survey Scores and Belts

The municipality survey [45] comprehensively evaluated overall satisfaction with the area and recreational opportunities where 1804 residents rated their satisfaction with the municipality on a scale of 1 to 5, with 5 indicating the highest satisfaction level. The results revealed an average satisfaction rating for the municipality of 4.2, with a significant majority (63%) expressing high satisfaction. The municipality survey further explored specific aspects such as satisfaction with recreation, working and living conditions, light traffic roads and traffic safety in the Harku municipality area. Notably, the results from the municipality survey [45] showed that the highest levels of satisfaction were with recreational opportunities, with 73% of respondents saying they were very satisfied or rather

satisfied. However, the municipality survey highlighted key challenges faced by residents, including traffic congestion, lack of affordable housing, air pollution, and water pollution.

3.1.1. Satisfaction with Recreational Opportunities in Harku Municipality

The results indicate the level of satisfaction with recreational opportunities in each village, with varying degrees and responsiveness. Vääna-Jõesuu stands out as having the highest satisfaction rate at 82%, indicating a positive sentiment towards recreational opportunities, followed by Suurupi at 77%. On the other hand, Kumna-Tutermaa shows a lower satisfaction rate of 48%, suggesting a less favourable view regarding recreation and a significant percentage of residents expressing uncertainty. In Kumna-Tutermaa, dissatisfaction is notably high at 24%, contributing to the overall lower satisfaction rate. In addition, 28% fall into this category of 'do not know', emphasising the complexity of understanding residents' opinions in this particular village. In summary, while there were variations in satisfaction levels among different villages, the majority of residents across the Harku municipality generally express satisfaction with the recreational opportunities (Figure 4 and Table 1).

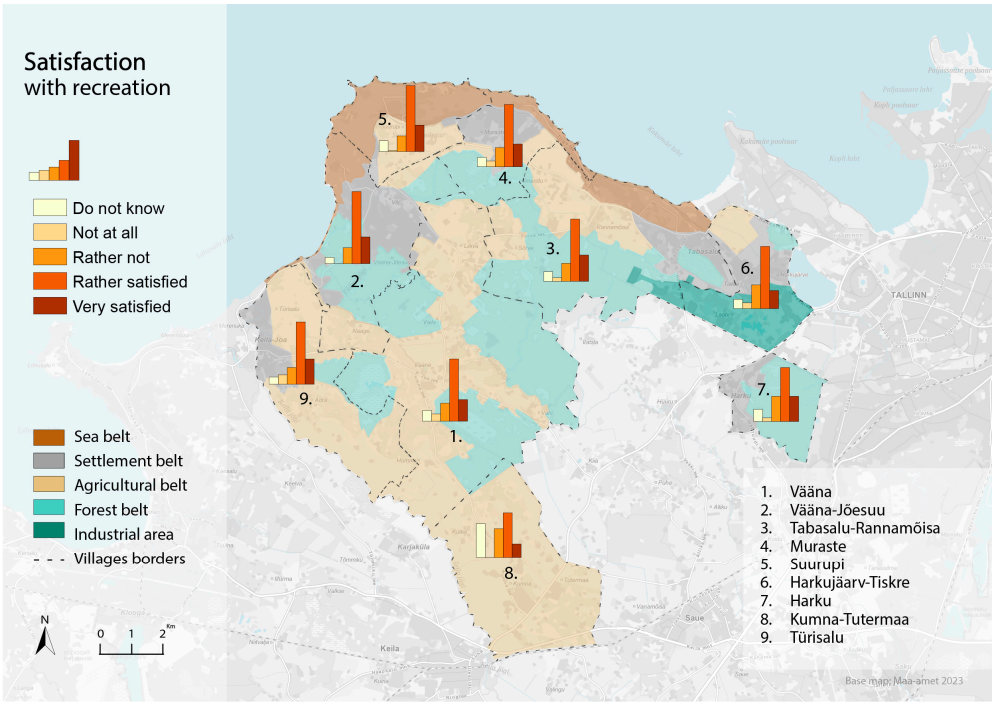

Figure 4. Residents' satisfaction with the recreational opportunities in the area.

In Vääna-Jõesuu, distinguished as the highest-rated village for recreational opportunities, the prevailing landscape features encompass coastal, settlement, and forest belts. This pattern persisted across nearly all of the villages identified as having the highest recreation ratings (including Suurupi, Tabsalu-Rannamõisa and Türisalu), where the presence of the coast within the village borders is a common characteristic. Additionally, they comprise agricultural and forest areas, with a lower density of settlement areas and non-industrial features.

Conversely, the villages with the lowest-rated satisfaction for recreation (Kumna-Tutermaa, Harkujärv-Tiskre and Harku) predominantly reside within the agricultural belts, exhibiting little or no presence of sea or forest belts. Additionally, these areas were either notably covered by or were adjacent to industrial belts. This juxtaposition highlights a clear correlation between lower satisfaction ratings and a predominantly agricultural and industrial landscape.

Table 1. Percentage of the residents' satisfaction with the recreational opportunities by village [45].

Village	Very Satisfied or Rather Satisfied	Rather Not or Not at All	Do Not Know
1. Vääna	70%	21%	9%
2. Vääna-Jõesuu	82%	13%	5%
3. Tabasalu-Rannamõisa	74%	18%	8%
4. Muraste	71%	21%	8%
5. Suurupi	77%	14%	9%
6. Harkujärv-Tiskre	67%	25%	8%
7. Harku	66%	24%	10%
8. Kumna-Tutermaa	48%	24%	28%
9. Türisalu	73%	22%	5%

3.1.2. Satisfaction with the Environment in Harku Municipality

Table 2 provides a comprehensive overview of residents' satisfaction with the environment across various villages in the study area. Notably, Suurupi and Tabasalu-Rannamõisa stand out, with a substantial majority of residents (92%) expressing high satisfaction, while a smaller percentage (7–8%) reported lower satisfaction. Vääna-Jõesuu residents also showed a commendable satisfaction rate of 87%, with only 13% of the residents expressing lower satisfaction.

Table 2. Percentage of the residents' satisfaction with the environment by village [45].

Village	Very Satisfied or Rather Satisfied	Rather Not or Not at All	Do Not Know
1. Vääna	82%	15,5%	2,5%
2. Vääna-Jõesuu	87%	13%	0%
3. Tabasalu-Rannamõisa	92%	7%	1%
4. Muraste	89%	11%	0%
5. Suurupi	92%	8%	0%
6. Harkujärv-Tiskre	79%	20%	1%
7. Harku	79%	20%	1%
8. Kumna-Tutermaa	73%	21%	6%
9. Türisalu	71%	28%	1%

In contrast, villages like Türisalu, Kumna-Tutermaa, Harku, and Harkujärv-Tiskre demonstrated a slightly lower satisfaction percentage (the highest being 79%), with a relatively higher proportion expressing dissatisfaction. The "do not know" category, though generally low, highlights some uncertainty among residents, with Kumna-Tutermaa and Vääna having the highest percentages at 6% and 2.5%, respectively.

The highest-rated areas for satisfaction predominantly fall within the coastal belt, characterised by a mix of settlement zones and agricultural activities. Notably, the industrial belt has a minimal incursion into the forest belt within these high-rated satisfaction zones. The villages with the highest-rated satisfaction, Suurupi and Tabasalu-Rannamõisa, were aligned mostly with the coastal or forest belts, complemented by a presence of agricultural belts and small settlement belts.

Consistent with the findings on recreational satisfaction, villages with lower environmental satisfaction levels lacked significant or only had a minimal presence of coastal and forest belts within their boundaries. Instead, they tended to be situated in agricultural and industrial belts or adjacent to them, often accompanied by settlement areas (Figure 5).

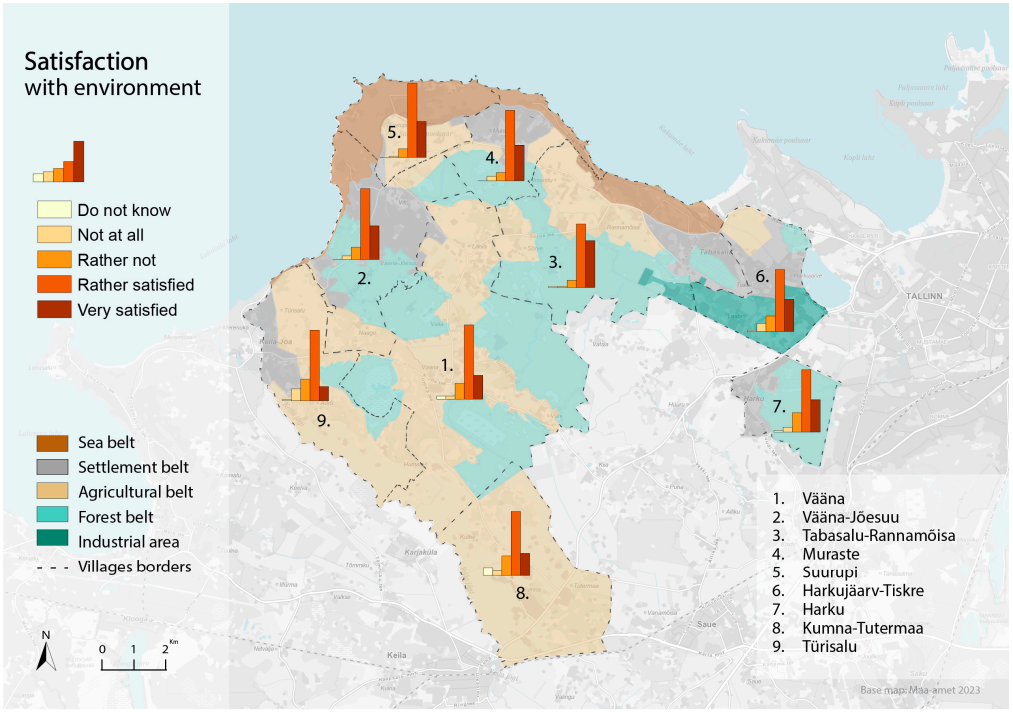

Figure 5. Residents' satisfaction with the environment in the area.

The original survey results, along with demographic details about the respondents, are documented in Files S2 and S3 for reference.

3.2. Scenarios

This section builds on the landscape belt dynamics and examines the landscape dynamics, encompassed by identified trends and threats to CESs in potential future scenarios. This study also pinpoints three key aspects influencing the study area's future.

Landscape Belt Dynamics: Recognised Trends and Threats to CESs

Utilising insights from prior research [44], three cultural values were focussed on—restorative, social, and cognitive. These trends and threats are crucial aspects of how landscapes change over time, showing the various ways in which landscape belts contribute to CESs and impact residents' well-being.

The analysis showed the prevalence of "restorative" values in all landscape belts. The highest restorative value is observed in Belt A (Sea) with a rating of 2.56, indicating high physical and psychological benefits such as sports, recreation, stress relief, and enhanced self-esteem. Belt D (Forest) also demonstrated a relatively high restorative value of 2.52. Belt B (Settlement) followed, with a restorative rating of 2.29, while Belt C (Agricultural) scored the lowest in this category, with a rating of 2.00. Belt E (Industrial) was rated at 2.06 for restorative value, indicating a moderate perception of physical and psychological well-being benefits in this industrial area (Figure 6, Table 3). This suggests that the coastal and forested landscapes provide restorative benefits to residents.

Belt A (Sea) provided social value with a rating of 2.99, followed by Belt B (Settlement) with 2.25, Belt C (Agricultural) with 2.25, and Belt D (Forest) with 1.99, which also indicated social values. Belt E (Industrial) had the lowest score in this category, with a rating of 1.88 (Figure 7, Table 3). The Sea Belt therefore contributed the most significantly to community and cohesion, potentially through events and as a place to gather.

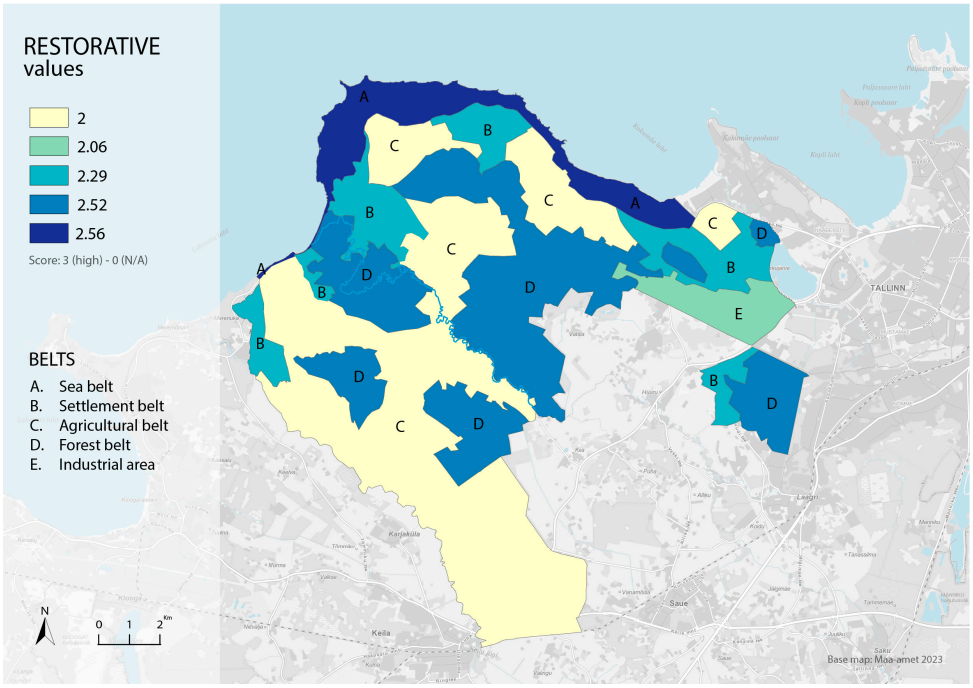

Figure 6. The spatial distribution and the ratings of 'restorative' values throughout the belts.

Table 3. Belts' results.

Belt Type	Restorative Value	Social Value	Cognitive Value
A. Sea	2.56	2.29	2.17
B. Settlement	2.29	2.25	2.04
C. Agricultural	2	2.01	2.18
D. Forest	2.52	1.99	2.24
E. Industrial	2.06	1.88	1.67

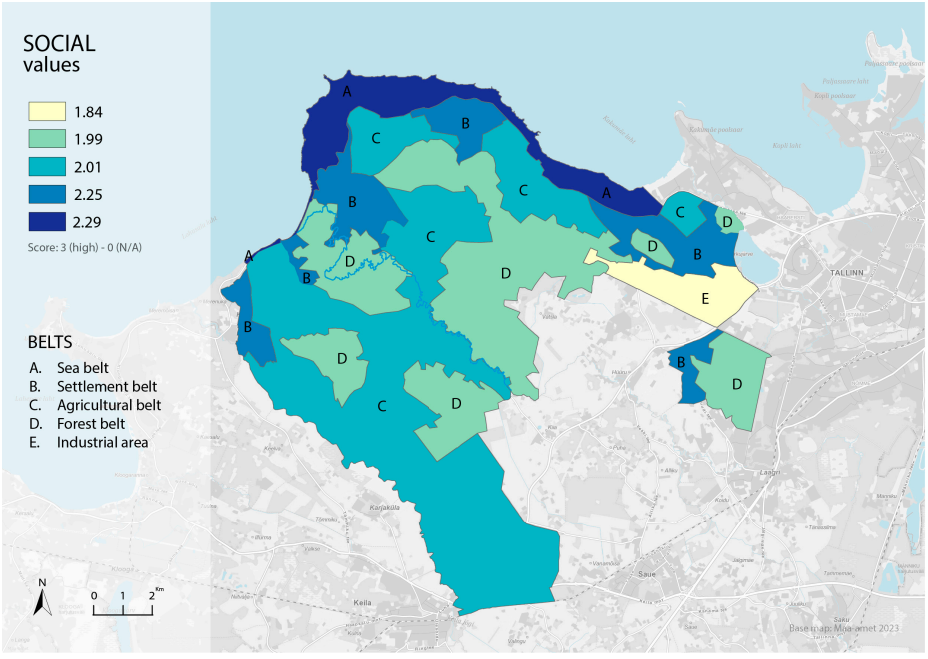

Figure 7. The spatial distribution and the ratings of 'social' values throughout the belts.

Belt D (Forest) showed the highest cognitive value with a rating of 2.24, indicating that this belt was perceived as having aesthetic and educational significance, potentially supporting science and education.

Belt A (Sea) and Belt C (Agricultural) also had relatively high cognitive values, with ratings of 2.17 and 2.18, respectively.

Belt B (Settlement) had a slightly lower cognitive value of 2.04.

Belt E (Industrial) scored the lowest in the cognitive category, with a rating of 1.67, suggesting a perception of limited aesthetic and educational contributions in this industrial belt (Figure 8, Table 3), as expected.

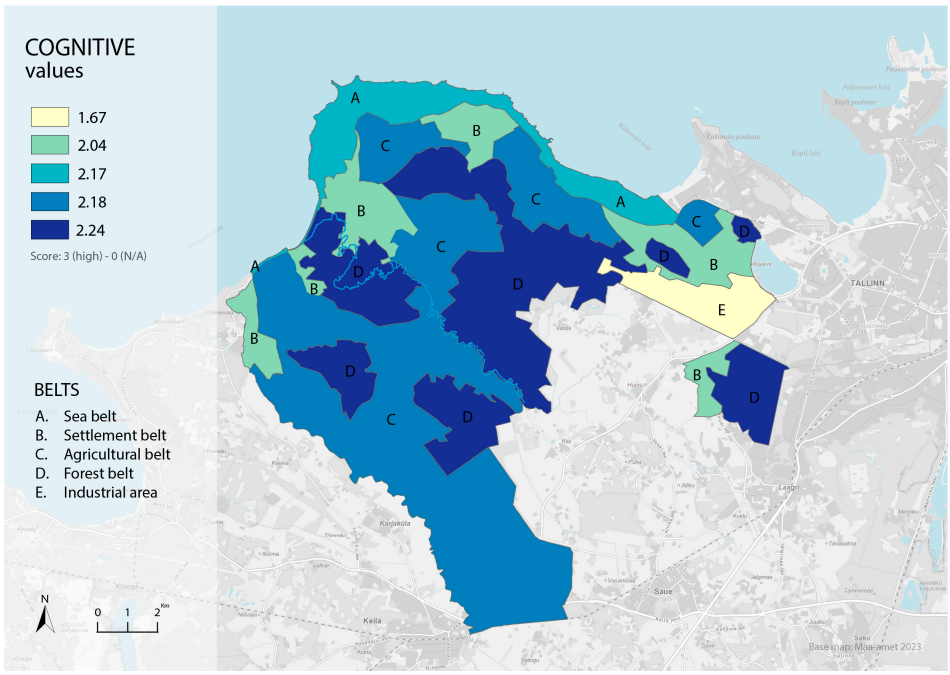

Figure 8. The spatial distribution and the ratings of 'cognitive' values throughout the belts.

The identified trends and threats significantly impact the environment and human interactions in the region, each with distinct implications for future strategies in mitigation and sustainable development. A more detailed exploration aimed to contribute to a more nuanced understanding of landscape dynamics and their direct relevance to CESs and human well-being. The current discussion builds on a prior study [44], employing landscape character assessment and an ES-based framework, reflecting a careful and collaborative effort to enhance the understanding of these dynamics. In this case, particular examples were examined for their significance in the context of this study area:

1. Peri-Urbanisation: This phenomenon is driven by factors like population growth, urbanisation, and economic development. As cities grow, they naturally extend into previously rural or less densely populated regions. The proliferation of new houses on these maps is indicative of increased urban development in the Harku municipality's peri-urban areas. This signifies that more people were moving to these transitional zones and that urban infrastructure, services, and housing were extending into what were previously rural or agricultural spaces. As urban areas expand, land use in peri-urban zones can shift from traditional agricultural or natural land to residential, commercial, or industrial uses. This transformation has far-reaching implications for the environment, as well as for the people living in these areas. Cadastral maps offer valuable insights into the dynamic landscape by displaying property boundaries and land ownership details. An analysis of these maps allowed us to monitor the potential emergence of new structures and the evolving patterns of land use (Figure 9).

Figure 9. Cadastral maps: Land showing increasingly divided plots showing the potential to be converted to housing (yellow lines mark ownership boundaries).

2. Potential Threats to Nature Conservation: Resource extraction is the second threat and pertains to the activity of removing or mining natural materials within this study area (Figure 10). In this context, there was a potential threat from the extraction of limestone and sand, serving various purposes in construction, manufacturing, and other industries [64,65]. However, it is important to note that poorly managed resource extraction can have environmental and social consequences. It can lead to habitat disruption, water pollution, and land degradation. Furthermore, the figure reveals potential urban expansion in agricultural zones, some under the ownership of development companies already fixed in cadastral units. These areas share similar social and recreational conditions with existing settlements, yet lack nature-protected land within their boundaries. This deficiency makes them more vulnerable to future urban development and transformation into settlement belts.

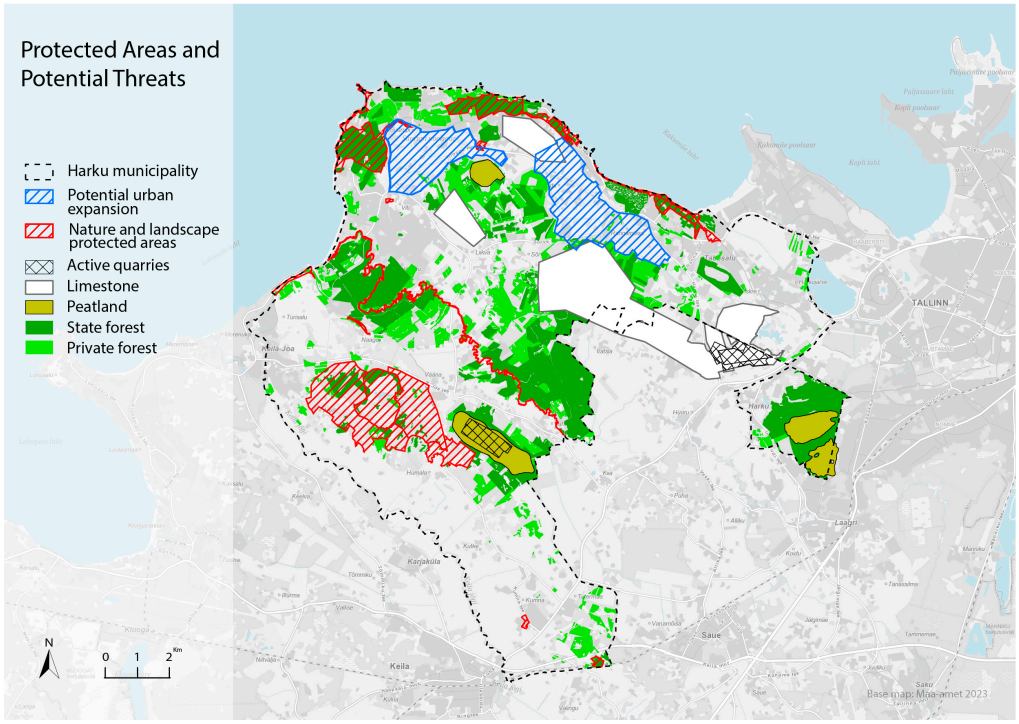

Figure 10. Protected areas and potential threats: land use conflicts involving quarries, peatlands, forests, and areas prone to urban expansion.

3. Recreational Stress on the Environment: This threat highlights the growing environmental strain resulting from the increasing trend towards outdoor recreational activities in Estonian society. This phenomenon is closely interconnected with several

other factors, including peri-urbanisation, the reduction in green and blue spaces, and the expected increase in population density due to migration away from the city. In the Harku municipality area, recreational activities encompass a wide range of outdoor and leisure pursuits, such as hiking, camping, boating, and picnicking. As urbanisation expands into peri-urban areas, the demand for such recreational activities often intensifies, particularly close to habitations, contributing to an increased stress on the environment. A key part of this trend is the decrease in natural areas like parks, forests, and water bodies that people use for leisure. As urban areas expand into peri-urban zones, these natural spaces can shrink, meaning there are fewer places for people to relax and have fun. Furthermore, the trend of recreational stress on the environment is connected to an expected increase in population density. Data from a population density map for 2023 reinforce these projections. In particular, areas like Tabasalu, Muraste, the Vääna River mouth, and Viti are expected to experience a substantial increase in population, leading to further environmental impacts (Figure 11).

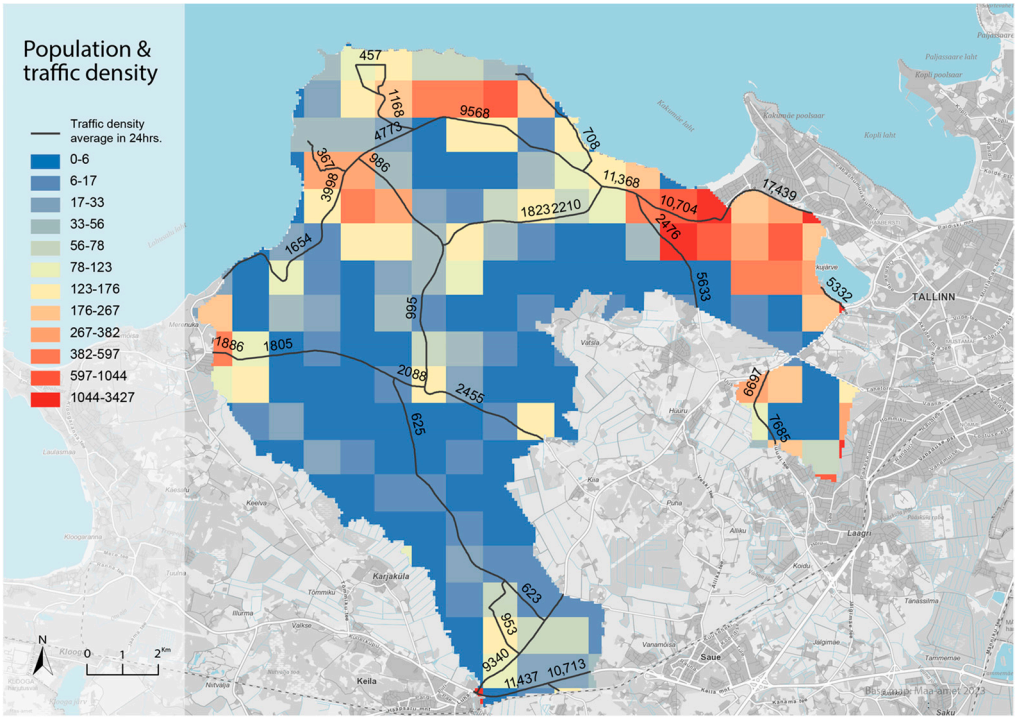

Figure 11. Harku population density and traffic density map.

4. Discussion

Answering research question 1: How are the municipality survey data aligned with each of the five belts, specifically in terms of resident's satisfaction with the environment and recreation in the municipality (Harku municipality)?

This study aligns municipality survey data with the landscape belts in Harku municipality to understand their impact on resident's satisfaction with the environment and recreation. Analysing both recreation and environmental satisfaction in various villages reveals distinct correlations with specific landscape features.

For recreational satisfaction, villages with high satisfaction, such as Vääna-Jõesuu, demonstrate a predominant presence of coastal, then settlement, and forest belts. Conversely, areas with lower satisfaction, exemplified by Kumna-Tutermaa, are mainly situated in the agricultural belt and Harkujärv-Tiskre is mostly in the industrial belt.

In examining environmental satisfaction, villages that reported high satisfaction, like Suurupi and Tabasalu-Rannamõisa, exhibited a combination of coastal, agricultural, and for-

est belts with a moderate presence of settlement areas as well. In contrast, villages with lower satisfaction were often situated in agricultural and industrial belts and lacked significant coastal and forest features. This pattern underscored the influence of specific landscape elements on residents' environmental satisfaction.

The findings, addressing RQ1, indicate that firstly coastal belts, then forest belts and agricultural belts with a moderate presence of settlement areas, positively influence residents' satisfaction with recreation and the environment. This underscores the importance of preserving these landscape elements in local planning to enhance overall satisfaction. The observed associations provide a foundation for future studies to delve into causal factors and engage with the community for a deeper understanding of the dynamics influencing satisfaction levels. This correlation suggests a tangible link between landscape composition and residents' recreational contentment.

This study aligns with existing research highlighting the critical role of coastal ecosystems in supporting human well-being, emphasising the need for preservation measures [66]. Additionally, it resonates with findings emphasising the importance of high-quality ecological sites near urban areas for delivering CESs [67]. The integration of remote sensing and landscape ecology is deemed crucial for identifying processes affecting coastal ecosystems, particularly regarding forest degradation and recovery [68]. The study also aligns with research advocating for tailored strategies to effectively promote CESs in European forests [69]. Furthermore, it complements studies that quantify the scientific value of coastal ecosystems and underscores the importance of natural and nature-based solutions for coastal protection [70,71]. This corresponds with prior investigations into CESs within the green and blue spaces of Harku municipality undertaken by the authors of this study. The assessment, conducted through expert ratings and focusing on three dimensions—restorative, cognitive, and social—revealed that coastal areas with semi-dense settlements and mixed forests garnered favourable ratings. In contrast, industrial and agricultural landscapes consistently received the lowest ratings across all evaluated values [44]. Together, these findings emphasise the multifaceted value of ecosystems and advocate for holistic preservation and management approaches.

In conclusion, the research effectively answers RQ1 by establishing clear connections between resident satisfaction and the distinct belts in Harku municipality. The implications of these findings guide recommendations for local planning and environmental management, emphasising the role of specific landscape features in fostering satisfaction among Harku municipality's residents. It is essential to recognise that the identified association does not necessarily indicate a causal relationship. Although specific landscape elements align with higher satisfaction levels, various other factors, including infrastructure, community programmes, and cultural aspects, could also contribute to resident's experiences. To gain a more comprehensive understanding of the intricate connection between landscape composition and resident's satisfaction with recreational opportunities, additional studies and community engagement are advised.

Answering research question 2: How do long-term dynamics in CESs impact the well-being of people and nature in (Harku municipality) peri-urban areas, and what recommendations to mitigate negative impacts could be derived from this analysis?

To explore the second research question, the landscape dynamics were examined—namely three discernible trends and threats—by evaluating social, restorative, and cognitive values in potential future scenarios. This analysis offers insights into the well-being of peri-urban areas in Harku municipality. By concentrating on three fundamental cultural values—restorative, social, and cognitive—distinct patterns across various landscape belts were identified, providing a basis for informed decision-making. The assessment demonstrated a prevalence of high "restorative" values across all landscape belts, with coastal (Belt A) and forest (Belt D) areas scoring notably high. Coastal and forested landscapes emerged as primary contributors to residents' physical and psychological well-being, aligning with previous studies [43,44]. This emphasises the significance of preserving and enhancing these specific landscape elements for the community's overall satisfaction. The Sea Belt

(Belt A) demonstrated the highest "social" value, followed by the Settlement Belt (Belt B), indicating its significant role in fostering community and cohesion. This aligns with the idea of coastal areas serving as gathering spaces and contributing to social interactions. Conversely, the Industrial Belt (Belt E) exhibited the lowest social value, emphasising the need for nuanced planning in industrial areas to enhance their social contributions. Forested areas (Belt D) stood out as having the highest "cognitive" value, indicating perceived aesthetic and educational significance. Coastal (Belt A) and agricultural (Belt C) areas demonstrated relatively high cognitive values. In contrast, the Industrial Belt (Belt E) scored the lowest in this category, suggesting limited aesthetic and educational contributions. The impact of climate change and human activities has exerted notable effects on coastal development, introducing challenges that threaten coastal conservation [72]. The effective management of coastal and marine ecosystems holds the potential to enhance human well-being; however, it involves intricate trade-offs between economic benefits and environmental impacts [73,74]. For a comprehensive coastal management model, it becomes crucial to consider a holistic approach encompassing both physical processes and socio-economic activities. This model should address key aspects such as biodiversity, land–sea interaction, and cultural heritage, while also incorporating strategies to tackle the pressing issues of climate change and sea-level rise [75].

In essence, the identified landscape dynamics suggest that residents derive significant well-being benefits from coastal and forested landscapes, and the social and cognitive values associated with these areas contribute positively to community satisfaction. Understanding these landscape dynamics—trends and threats—is crucial for informed decision-making in urban planning and sustainable development.

In investigating the landscape dynamics, three significant environmental trends and threats emerged, each requiring careful consideration for sustainable development.

Peri-Urbanisation:

The phenomenon of peri-urbanisation, driven by population growth and urbanisation, poses a substantial threat. As urban areas expand into peri-urban zones, traditional landscapes shift to residential, commercial, or industrial uses. Cadastral maps illustrate this transformation, highlighting increased urban development and the potential conversion of green spaces to housing.

Resource Extraction:

Resource extraction, particularly the extraction of limestone and sand for various purposes, presents a second threat. The map of Harku municipality's natural resources outlines potential conflicts among various land uses, emphasising the importance of sustainable resource management to mitigate environmental and social consequences.

Recreational Stress on the Environment:

The growing environmental strain resulting from increased outdoor recreational activities forms the third threat. Connected to peri-urbanisation, this trend puts pressure on green and blue spaces, affecting the availability of areas for leisure activities. Population density and traffic density maps further underscore the expected increase in recreational stress on the environment, especially in areas like Tabasalu, Muraste, the Vääna River mouth, and Viti.

This study paves the way for future research by highlighting the importance of understanding long-term dynamics in peri-urban areas. Longitudinal studies, in-depth community engagement, and policy impact assessments are recommended to further explore the dynamic relationship between landscape composition, CESs, and residents' well-being.

In summary, the findings from this study offer insights into the complex interplay between landscape dynamics and CESs, providing a foundation for informed decision-making and sustainable development in peri-urban areas.

4.1. Recommendations

4.1.1. Proactive Measures

- Conservation: Conservation efforts play a crucial role in maintaining the availability of ESs, particularly in the context of coastal forests and wetlands. These ecosystems offer a wide range of benefits, from flood mitigation and water purification to habitat for biodiversity and recreational spaces for the community. Prioritising the conservation of critical ecosystems is essential to maintaining the provision of CESs [71,76]. Protecting these natural areas can safeguard their ability to offer restorative and recreational benefits to the community. The maps (Figures 9–11) reveal vulnerable areas, emphasising where CESs and conservation priorities face the greatest risk [65]. Furthermore, the global depletion of forests and wetlands, together with increased values in cropland and urban coverage, resulted in a net annual financial loss of 1.21 trillion US dollars during the period of 1995–2015 [77]. Analysing these types of data is crucial for clarifying insights from the maps, guiding strategic local planning, and pinpointing the most vulnerable areas [78].
- Sustainable Urban Planning: Responsible urban expansion practices that consider the preservation of green and blue spaces and the integration of natural elements into urban design can help mitigate the loss of CESs [8,79]. In addition, it is important for urban planning to emphasise the creation of spaces that support the well-being of the community [80,81]. Well-designed urban environments can contribute to improved mental and physical health, social interactions, and an overall higher quality of life for residents. This is not only beneficial for the people who live in these areas but also for the long-term sustainability and desirability of the city itself. Sustainable urban planning that values the preservation of natural elements, such as green and blue spaces, and actively integrates them into urban design is a fundamental step in mitigating the loss of CESs [82–84] and the authors argue will relieve the stress on protected areas.
- Ecosystem-Based Land Management: Adopting ecosystem-based approaches to land management can help to balance human development with the preservation of ESs [16,85]. One of the key strengths of ecosystem-based land management is that it acknowledges the interconnectedness of all life forms and natural processes in a given area. By doing so, it actively seeks to preserve not just individual species or specific ecosystems but the intricate web of relationships and services that ecosystems provide [62,64]. Ecosystem-based approaches emphasise long-term thinking because they understand that the short-term benefits of unsustainable land management can harm the future. They aim to ensure that the land continues to provide vital ESs for both current and future generations [86–88].

4.1.2. Interdisciplinary Collaboration

For sustainable development, addressing challenges such as land fragmentation and ESs decline relies on the practice of interdisciplinary collaboration [9,89,90]. By actively involving stakeholders [91,92] in collaboration with researchers and practitioners, there is a need to ensure that planning and conservation efforts are not isolated actions but are instead enriched by a wide array of perspectives. This enrichment substantially improves their chances of achieving success and ensuring long-term sustainability [10,93]. Moreover, such collaboration has the potential to create innovative design solutions that benefit both the environment and local well-being [79,94]. Maps are important for showing areas at risk of land fragmentation and ecosystem service loss. They help to identify places where natural landscapes are being divided, often due to human activities like urbanisation. These maps use visuals to highlight vulnerable spots, making it easier for people to understand the problem. The maps also serve as a tool to start discussions with local communities. They provide a clear picture of the challenges in their area, making it easier for everyone to talk about potential impacts and solutions. This collaborative approach ensures that

strategies to address the issues consider the needs and perspectives of the people directly affected [95,96].

4.2. Limitations and Future Study Recommendations

This methodological approach comprised the identification of landscape belts, mapping techniques, and the integration of residents' data in alignment with the study objectives. The categorisation of landscapes into belts facilitates the assessment of long-term CES dynamics, namely trends and threats. However, it is crucial to acknowledge the potential oversimplification of complex areas within each belt. The utilisation of mapping techniques is integral for visualising spatial data, aiding in the identification of dynamic patterns of change. While maps provide a clear representation, the potential to oversimplify the dynamic changes over time requires a longitudinal perspective to capture temporal changes and strengthen the sustainability of the recommendations. The incorporation of residents' data, specifically satisfaction with the environment and recreational opportunities, enhances the human-centric perspective in understanding CESs' impact on well-being. However, the subjective nature of responses and potential individual biases in municipality survey data should also be acknowledged. Future research could explore ways to mitigate these limitations and further enhance the depth and accuracy of CES assessments in peri-urban areas. Engaging with the local population, however, can offer valuable insights for developing effective strategies to address these challenges.

5. Conclusions

This study underscores the challenges related to balancing urban development and green infrastructure preservation in peri-urban landscapes critical for human well-being. Emphasising the role of CESs, this research work advocates for ES-based decision-making, interdisciplinary collaboration, and nature conservation, aligning with the EU Nature Restoration Law in the Harku municipality region. This study revealed several key insights that deepen our understanding of the peri-urban landscapes in the Harku municipality. Firstly, our research identified specific vulnerable areas that were at risk due to urban development, emphasising the necessity for targeted conservation measures to protect CESs and resident well-being. Secondly, employing a mixed-methods approach, this study unveiled the temporal dynamics of resident satisfaction with CESs. This understanding of how satisfaction levels changed over time provided valuable insights into the resilience of these services and the effectiveness of conservation and urban development interventions. Lastly, our research highlighted a positive correlation between coastal belts and resident well-being, emphasising the significance of preserving and enhancing coastal areas for CESs and overall community satisfaction. These insights not only contributed to our knowledge of the Harku peri-urban landscape, but also offered practical implications for future nature conservation efforts and urban development strategies in similar contexts.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/conservation4010001/s1, File S1: The Landscape Belts; File S2: Municipality Survey—Supplementary Contextual Information for the Harku Municipality Satisfaction Survey (demographic information); File S3: Municipality Survey—Supplementary Contextual Information for the Harku Municipality Satisfaction Survey (summary of the findings). Ref. [97] is cited in Supplementary Materials.

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