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A participative approach towards modeling tranquility: A case study in Glarus, Switzerland

GEO 511 Master's Thesis

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Abstract

Tranquility is increasingly recognized as a cultural ecosystem service that contributes to human well-being, yet its meanings and spatial distribution remain underexplored in alpine contexts. This thesis investigates tranquility in the Swiss canton of Glarus. It addresses two central questions: (1) How do residents of Glarus define and perceive tranquility, and what characteristics contribute to tranquil places? (2) How do these perceptions align with a GIS-based tranquility model, comparing potential and experienced tranquility?

While previous research has developed tranquility indices primarily in lowland or urban areas, this study applies a participatory approach to a rural alpine region and integrates qualitative insights into spatial modeling. Methodologically, it combines focus groups and a multi-criteria GIS model informed by the factors influencing tranquility from the groups.

Results of the focus groups show that tranquility is strongly associated with natural features, such as water bodies, forests and mountain views, as well as sensory qualities like silence, fresh air and natural sounds. Anthropogenic features, including settlements, infrastructure and noise, were consistently described as disturbing, though participants also acknowledged tranquil experiences in proximity to human activity if other factors dominated. At the same time, tranquility emerged as a multi-faceted concept shaped not only by sensory impressions but also by emotions, states of mind, and place attachment, underscoring its relational and experiential dimensions.

Findings reveal broad convergence between modeled and experienced tranquility in remote, natural areas, while divergences occur in pockets closer to infrastructure or settlements, where contrast effects allow tranquility to emerge despite disrupting factors. Ethical concerns, particularly the fear of touristification, highlight the need for careful communication and governance in the use of tranquility maps.

By conceptualizing tranquility as a cultural ecosystem service, this thesis underscores both its value and fragility in alpine regions. It contributes methodological innovation by tailoring tranquility factors to the local context through participatory insights and translating them into spatial modeling, thereby providing a basis for more context-sensitive strategies to analyze and understand tranquility.

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Contents

List of Figures

List of Tables

List of Abbreviations

Abbreviation	**Definition**
AHP	Analytic Hierarchy Process
ART	Attention Restoration Theory
CES	Cultural Ecosystem Service
CI	Consistency Index
CR	Consistency Ratio
dB(A)	A-weighted decibels
DEM	Digital Elevation Model
FC	Focus Group
MCDA	Multi-Criteria Decision Analysis
MCE	Multi-Criteria Evaluation
SIL	Sachplan Verkehr, Teil Infrastruktur Luftfahrt
TRAPT	Tranquility Rating Prediction Tool
QOL	Quality of Life

Chapter 1

Introduction

The growing urban population and its constant exposure to noise, movement and overstimulation have increased the demand for spaces of tranquility and unspoiled nature (Purves & Wartmann, 2023). The COVID-19 pandemic accentuated this need: even though regulations forced people to stay at home, they simultaneously sought places of retreat and escape from their daily routines. In Switzerland, the population typically turns to Alpine regions for recreation (Willibald et al., 2019), which has led to frequent overcrowding in specific destinations. Social media exposure often accelerates this process, transforming once quiet landscapes into tourist hotspots within a short time span (Jang & Park, 2020). A prominent example is the Oeschinensee in the Bernese Oberland, where booking systems and ticket limits had to be introduced to mitigate mass tourism (SRF, 2025). Similar dynamics are visible in the canton of Glarus: the Muttenchopf became popular through social media, resulting in problems like wild camping, littering and disturbances to wildlife (SRF, 2024). Such cases show that even in regions that appear rich in quiet landscapes, tranquility is fragile and easily disrupted. This fragility highlights why tranquility is a pressing societal issue: research has shown that access to tranquil environments supports psychological restoration and health, while at the same time such spaces are central to recreation and rural tourism (Kaplan, 1995; WHO, 2018). Ensuring their preservation is therefore not only a matter of individual well-being, but also of sustainable landscape management in regions like the Alps.

Despite this importance, tranquility (mapping) has received limited attention in small-scale alpine research. Existing mapping studies tend to focus on very large areas, such as entire countries, or else on urban environments (Brehme et al., 2018; Hewlett et al., 2017; Jackson et al., 2008; Leeb et al., 2020; Leereveld et al., 2024; Pafi et al., 2020). The specificity of alpine contexts, where remote valleys and steep mountains stand in proximity to settlements and infrastructure, remains largely unexplored. Furthermore, many existing studies rely on factors identified in English-speaking contexts, which may not transfer seamlessly to Switzerland. For example, Leeb et al. (2020) adapted factors first developed by Jackson et al. (2008) for England to the Swiss Plateau. The authors themselves acknowledged that new factors and adapted weightings are required to account for local cultural and environmental conditions. A further limitation lies in the conceptual ambiguity of the term “tranquility.” While most studies use the English expression, in German, the closest equivalent, "Ruhe," narrows the meaning to audible stillness, overlooking visual and psychological aspects. Kirk (2006), for instance, defined “Ruhezonen” as areas of both visible and audible quiet. Still, even this definition omits dimensions frequently highlighted in

the English-language literature, such as emotional responses or place attachment. Finally, many existing models struggle to represent "pockets of tranquility," i.e., places that are not predicted to be tranquil yet are experienced as such by people (Chesnokova et al., 2019; Purves & Wartmann, 2023) like such as a forest clearing next to a busy road. These shortcomings demonstrate that existing approaches are insufficient for capturing tranquility in alpine regions like Glarus.

This thesis addresses these gaps by developing a small-scale case study in the canton of Glarus, a mountainous region where tranquility is assumed to be present in many places and is actively promoted. The canton's Tourism Strategy 2030+ envisions Glarnerland as "easily accessible, with unique nature offering active and relaxing moments of enjoyment" (Kanton Glarus, 2023). Against this background, the central idea of this study is to integrate spatial modeling with participatory methods, thereby capturing both potential and experienced tranquility. On the one hand, participatory focus groups with residents elicit how tranquility is defined, perceived, and located in everyday life. On the other hand, a GIS-based model then uses these insights to inform the selection of environmental proxies (such as forest cover, water bodies, remoteness, and little human presence) and estimate tranquility across the canton. Comparing these two perspectives allows the study to test where the model aligns with local experience and where it diverges, particularly in identifying overlooked "pockets" of tranquility (Chesnokova et al., 2019). This dual approach also provides a culturally situated understanding of tranquility, capturing local meanings and definitions.

This study makes several concrete contributions to both research and practice:

- It provides one of the first small-scale, participatory investigations of tranquility in an alpine canton, addressing a research gap between large-scale national models and urban case studies.
- It adapts and contextualizes tranquility indicators for a German-speaking alpine setting.
- It integrates participatory focus groups with GIS-based modeling, enabling systematic comparison between experienced tranquility and highlighting discrepancies.
- It identifies and emphasizes the importance of "pockets of tranquility", demonstrating that tranquil experiences can occur even in proximity to disturbances such as roads or settlements.
- It offers practical insights for planning and conservation in Glarus, showing how tourism development and the protection of tranquil spaces can be balanced in a region where both recreation and preservation are priorities.

1.1 Background

1.1.1 Theoretical foundations of tranquility: Attention, affect, and restoration

Research on restorative environments and attention theories provides an important foundation for understanding how tranquility contributes to human well-being. According to Kaplan (1995, p. 170), "any prolonged mental effort" leads sooner or later to directed attention fatigue. The concept "directed attention" is based on an earlier work of James (1892). James distinguished

between effortless attention, which is naturally captured by external stimuli and directed attention, which requires deliberate mental effort. In a further development of this theory, Kaplan (1995) postulates the high potential of directed attention fatigue in the modern world, as everyday tasks like focusing on a thesis or pondering over an important decision can use up this resource. To recover from this fatigue, so-called restorative environments have the potential to serve as counteractive locations. They have the following four key qualities: being away (a sense of escape from daily stressors), extent (a feeling of immersion in a coherent environment), fascination (the ability to capture attention effortlessly), and compatibility (alignment with an individual's needs and preferences). These places are typically idyllic, undisturbed areas that allow effortless attention ("soft fascination") (Kaplan, 1995). Alongside Kaplan's attention-based perspective, Ulrich's theory (1983) emphasizes the affective and physiological dimensions of human-environment interaction. He argues that emotional reactions often precede cognition, with rapid "pre-cognitive" responses triggered by broad environmental features. Key predictors of positive affective reactions include water bodies, moderate complexity and perceived depth and openness of the landscape (Ulrich, 1983). Together, these perspectives underline that preferred restorative and tranquil environments are shaped not only by cognitive recovery processes but also by immediate emotional and physiological responses to environmental features, highlighting the essential role of tranquility as a restorative resource for recovering from attention fatigue and sustaining psychological well-being.

1.1.2 Case study region: Canton of Glarus

The canton of Glarus, situated in eastern Switzerland, serves as the study area for this research (Figure 1.1). It is one of the smaller Swiss cantons in terms of area (685 km^2) and population (approximately 42,000 inhabitants), yet it is characterized by a diverse alpine landscape (Kanton Glarus, 2017). The canton is almost entirely enclosed by mountain ranges with only three narrow valley floors along the rivers Linth and Sernf providing space for settlement and transport infrastructure. The elevation ranges from about 400 m a.s.l. in the Linth valley to over 3,600 m at the Tödi, the highest peak in the Glarus Alps (Kanton Glarus, 2017).

Figure 1.1: Location Canton of Glarus (Tschubby, 2025)

The marked topographic relief results in a high part of uninhabited terrain, with more than half of the canton's surface lying above 1,200 m a.s.l. Land use is correspondingly dominated by forest, alpine pastures and bare rock, while built-up areas are concentrated in the valley floors (BFS, 2023). The canton's economy historically relied on textiles and later on hydroelectric power, but nowaday tourism plays an increasing role, drawing visitors to hiking, skiing and lake recreation (Kanton Glarus, 2023).

For the study of tranquility, Glarus presents a particularly interesting case. On the one hand, it offers large tracts of relatively undisturbed natural landscapes, including remote valleys, forests, and high alpine terrain, which are likely to be perceived as tranquil. At the same time, the steep relief and narrow valleys mean that these remote areas lie in proximity to more densely populated valley floors with roads and settlements. This rapid transition between untouched alpine settings and anthropogenic environments, typical of many mountain cantons in Switzerland (Becker et al., 2007; Thomas & Giuliani, 2023), makes Glarus a representative setting for examining how tranquility is perceived and experienced, as well as how it can be spatially modeled.

Chapter 2

Literature Review

This chapter presents existing work on the concept of tranquility, focusing on its conceptualization, mapping approaches and participatory methodologies.

2.1 Perceptions and dimensions of tranquility

Beyond theories of restoration, several empirical studies have investigated how tranquility is perceived and what dimensions contribute to it. Payne and Bruce (2019), for example, examined the relationship between quiet areas in the city and restorative environments, showing that tranquility is not merely an acoustic condition but closely linked to restorative potential. Similarly, as stated in Chapter 1, the concept of tranquility encompasses not only acoustic but also visual dimensions. Herzog and Chernick (2000, p. 1) define tranquility as "the combination of moderate fascination and aesthetic pleasure." In their study, participants were asked to rate 48 pictures depicting either natural settings with fields and forests or urban ones; overall, natural settings were consistently rated as more tranquil. Later work also emphasized the interaction between acoustic and visual factors, either through expert judgment or with the involvement of different stakeholders (Pheasant et al., 2010).

At the same time, tranquility cannot be reduced to external environmental qualities alone. It is also fundamentally linked to subjective experience, inner states and feelings. As several studies have noted, perceptions of tranquility are shaped by emotions, moods and state of mind in general (Christoffersen et al., 2022; Watts & Pheasant, 2015).

Collectively, these studies highlight that tranquility is shaped by the interplay between auditory and visual dimensions as well as by inner states, emotions, and cultural framings, reinforcing the need for multidimensional approaches when operationalizing and mapping the concept.

2.2 Mapping potential tranquility

Modeling and mapping tranquility needs spatially explicit data that can represent factors and criteria associated with the concept. According to Purves and Wartmann (2023), there are basically two ways in which potential tranquility can be mapped. The first includes an object-based approach, in which spatial data is aggregated to predict potential tranquility for specific

locations. The second one combines spatial data to produce a continuous surface and eventually a map, typically by combining raster datasets in a multi-criteria evaluation (MCE) with some sort of weighting. However, by definition, these methods do not take into account individual preferences, notions and states of mind.

Some of the earliest work on mapping tranquility has been carried out in the context of the development of a new transport corridor in the UK (Rendel, 1998). Simon Rendel is seen as one of the pioneers in the field, as his goal was to map "undisturbed countryside" in the face of possible development there, which could weaken or erase landscape qualities (Jackson et al., 2008). Tranquil places in this context were defined as "places which are sufficiently far away from the visual or noise intrusion of development or traffic to be considered unspoilt by urban influences" (Jackson et al., 2008, p. 10). In the study, a buffer of varying size was drawn around disruptive factors, such as noise from roads or the sight of large power stations and then combined through a Boolean overlay to identify undisturbed areas (Jackson et al., 2008; Purves & Wartmann, 2023; Rendel, 1998). However, possible limitations, including the subjectivity of the term and the broad resolution of the map, were acknowledged. Following this pioneering study, Bell (1999) employed a similar approach to map tranquility in Sherwood Forest, Nottinghamshire. Disturbing visible and audible factors, such as traffic noise and built-up areas, were also buffered and classified as non-tranquil. However, Bell (1999) assumed that woodland has a positive effect on tranquility and can diminish the disruptive factors by masking industrial plantations or serving as a barrier to sound. As these two studies illustrate, the selection of factors influencing tranquility up to that point was largely based on expert judgment (Purves & Wartmann, 2023).

Over the past two decades, tranquility has increasingly been modeled and mapped using participatory approaches, where factors were based on perceptions of the population (Hewlett et al., 2017; Jackson et al., 2008). A remarkably comprehensive study was conducted in England, commissioned by the Council for the Protection of Rural England (CPRE) (Jackson et al., 2008). An extensive consultation of the population was undertaken, and the input of over 1,300 persons has been included. Using so-called participatory appraisal consultations, the subjective definitions of tranquility were collected with various methods, such as graffiti walls or mapping exercises. The methodology was tested in Northumberland National Park and the West Durham Coalfield before being scaled to a national level in England. More than 4,000 survey responses were collected, asking participants to identify factors that enhance and that detract from tranquility. The top three positive factors were "seeing natural landscapes", "hearing birdsong" and "seeing the stars at night". In contrast, traffic noise, urban development and large crowds were the most frequently cited detractors from tranquility. To reduce bias in the selection of factors, thresholds for land cover, population density, and urbanization were derived directly from public feedback rather than predefined criteria by experts. For example, the perceived naturalness of different landscapes was assessed through surveys instead of relying solely on expert judgment. These perceptions were then translated into spatial data and implemented in a GIS, where factors such as Digital Elevation Models (DEMs), land cover classes and railway lines were operationalized and weighted according to ratings from the participatory appraisal sessions.

Building on this methodology, Hewlett et al. (2017) developed a similar but more inclusive and comparative approach in the context of the Dorset Area of Outstanding Natural Beauty (AONB) in southern England. Their "Broadly Engaging with Tranquillity" (BET) project broadened the

participatory scope by systematically involving four stakeholder groups, namely institutions, residents, householders and visitors through mixed-method research and GIS-based modeling. The study revealed both shared and contrasting perceptions of tranquility, especially between institutional and non-institutional actors. For example, non-institutional participants included more subjective and sensory elements in their perception and definition of tranquility (e.g., peacefulness, emotional connection), whereas institutions were more likely to focus on measurable or policy-relevant factors, including visual intrusions and noise sources. Nevertheless, tranquil areas were generally associated with remote, natural landscapes. In contrast, factors such as traffic, crowding, and visual traces of human activity (e.g., mobile masts, built-up areas) were seen as non-tranquil. Notably, the study highlighted that expert-derived models may misrepresent local views and that planning decisions should reflect the differing perspectives of various stakeholders.

Adapting the methodological approach from Hewlett et al. (2017), Brehme et al. (2018) used a mixed-methods approach to map tranquility based on the input of 240 participants. The survey consisted of three parts: a sketch mapping exercise, a free-listing task and a demographic section. People were asked to sketch (non-)tranquil areas and describe them accordingly in the free-listing task. Similar to previous studies, elements such as peace and quiet, scenic views, lack of traffic, and absence of people were named as key tranquil features. Conversely, noise, traffic, and visual clutter were repeatedly mentioned as detractors. In this study, the mentioned perceptions and factors were not translated into a spatial dataset but were the base for a heatmap where the sketch maps with the areas marked by hand were digitized and combined to depict the regions colored from red to green. The results emphasized the subjective and sensory nature of tranquility as the researchers were able to identify areas of consensus among participants, but also revealed disagreement in specific locations, reflecting the context-dependence and personal interpretation of tranquility, in line with critiques of earlier national mapping efforts (e.g. Jackson et al. (2008)), Brehme et al. (2018, p. 130) stress the limitations of applying generalized tranquility models across diverse regions and emphasize on "a need to calibrate these models with qualitative data collected from those who reside within, and visit, protected areas".

Leeb et al. (2020) applied a comparable approach, relying on operationalized criteria to develop their tranquility map of the Swiss plateau. The study was triggered by the coronavirus pandemic and the associated increase in inland tourism: local recreation areas in the densely populated Central Plateau were identified to relieve the burden on the alpine regions, which were overwhelmed by the increased number of visitors. Using the same influencing factors as in the study by Jackson et al. (2008), a tranquility raster with a 100×100 m resolution was created. Factors like "seeing/hearing the sea," which are not relevant in the context of Switzerland, were excluded and the weight of the other factors adjusted. The study was able to identify 53 contiguous tranquil sites with an area over 5 km^2. As already recognized in the discussion of the work, the factors that serve as the basis for the modeling would have to be adapted to the local context, i.e., to the perception and definition of tranquility among the Swiss population (Leeb et al., 2020).

Based on factors identified in other studies Pafi et al. (2020), they used what they call a "cost-effective" method to map potential tranquility. They used barriers and tranquility enablers from previous studies, like the one of Jackson et al. (2008) or Votsi et al. (2012), resulting in three main categories: noise disturbance, light pollution and perceptual qualities like naturalness and

ruralness to map potential tranquility in the northeastern part of Greece around a highway. The authors highlight the significance of the interplay between visual and auditory components. To operationalize the factors, freely available data such as the CORINE land cover, produced by the European Environment Agency (EEA), which contains 44 land cover classes, or a digital elevation model derived from NASA data were used. In a MCE, the data were combined, resulting in a final classification of tranquility ranging from low to high. Interestingly, in a second part of their work, to validate their model, 200 randomly selected pictures within the study area were chosen and then shown to participants, who were asked to classify them from high to low tranquility. This validation yielded a Kappa coefficient of 0.70 and 80% overall accuracy, indicating strong alignment between the model and human perception. The study critiques past noise-focused approaches and calls for integrating soundscape, landscape, and lightscape into a more holistic tranquility framework. It is particularly valuable for planning in countries with limited landscape policies, offering a replicable approach using freely available datasets.

Another more object- and perception-based approach was the Tranquility Rating Prediction Tool (TRAPT) developed by Pheasant et al. (2010), which adds a new approach to tranquility mapping. The procedure integrates both acoustic and visual parameters into a predictive model, allowing for the quantification of tranquility in outdoor environments through empirical methods. This tool was designed to predict how tranquil a place feels by combining what people see and hear in a given environment. To develop the tool, participants were shown audio-visual recordings of a wide range of outdoor locations, from busy urban areas to remote countryside spots. Following, they had to rate how tranquil each place felt to them. Based on measurable factors like the presence of natural and scenic features in the picture or the sound level of the background noise, it was found that more greenery and "historic and religious buildings, landmarks, monuments and man-made elements of the landscape that are geographically and aesthetically in keeping with the natural environment" (Pheasant et al., 2010, p. 12) have a positive effect on perceived tranquility and that low noise levels contribute to a higher rating. Importantly, contrasting with other studies, the study also showed that man-made features do not necessarily negatively affect tranquility ratings. "Elements of landscape that are geographically and aesthetically in keeping with the surrounding environment" (Pheasant et al., 2010, p. 6) like historical buildings or monuments may contribute to the natural environment and ultimately to tranquility. Another contribution to the current state of research was that the model matched ratings between tests in the lab and when people actually visited the places.

The developed TRAPT was then applied in subsequent studies (Watts, 2017; Watts & Pheasant, 2013, 2015; Watts et al., 2011) to assess tranquility in different contexts and areas. An illustrative case is the creation of so-called Tranquility Trails (TR) in three cities in the UK. These trails are walking routes through the city that have been designed to offer residents and visitors places where they can recover from stress while enjoying the benefits of exercise. Typically, these are routes in greener, quieter areas of the city. By applying the TRAPT, tranquility was predicted along different sections of these trails based on the local sound environment and visible landscape features. Feedback from users confirmed the expected benefits: people felt more relaxed and less anxious after walking the trails. This application of the TRAPT demonstrates how tranquility models can inform planning decisions, guiding the creation and improvement of urban green infrastructure with well-being in mind.

In summary, it can be said that similar visual and auditory factors were frequently mentioned and ultimately used as a basis for mapping tranquility in the studies carried out to date. Natural phenomena, sounds and landscapes were typically cited as positive factors, while man-made features, such as noise of any kind or built-up areas, were usually named as negative factors. However, as the framing of potential tranquility suggests, the places classified as quiet are not necessarily places where people "consume" and experience tranquility (Purves & Wartmann, 2023; Wartmann et al., 2019, 2021).

2.3 Mapping experienced tranquility

The studies mentioned in the previous chapter use a combination of data to predict potential tranquility in a location. However, it is essential to distinguish between potential tranquility and areas where tranquility is effectively experienced and consumed. These are often specific places, which are either consciously sought out to enjoy peace and quiet or spontaneous moments in which people can experience tranquility. To map or list these places, various methods may be used, including interviews, public participatory GIS (PPGIS) or social media content (Purves & Wartmann, 2023; Wartmann & Mackaness, 2020). There are essentially two main approaches that can be employed to map experienced tranquility. The first approach is more qualitative, relying on in-person methods such as interviews, focus groups, or participatory mapping sessions conducted either on site or in a predefined setting (Purves & Wartmann, 2023; Wartmann & Mackaness, 2020). Similar to procedures used for gathering criteria to map potential tranquility (e.g., Hewlett et al., 2017; Jackson et al., 2008), this approach is time- and resource-intensive. By contrast, more cost- and time-efficient methods increasingly make use of social media content, which offers rich, voluntarily shared experiences from individuals that allows description and mapping of experienced tranquility on a bigger scale. For instance, Wartmann and Mackaness (2020) used a hybrid approach where pictures with tranquility-related tags on the social media platform Flickr served as a base to identify patterns and compare them to the results from interviews. It was found that, while traditional methods provide rich, context-specific insights, social media data can identify spatial patterns of tranquility that align with respondents' on-site ratings, particularly in accessible landscapes adjacent to water bodies. This study emphasized the potential of a multi-method approach, combining data gathered through qualitative methods, such as interviews, with a more scalable method that encompasses the analysis of social media content (Wartmann & Mackaness, 2020). In a previous study, Wartmann et al. (2019) also analyzed geotagged Flickr photographs and their textual tags using automated image processing. Their findings revealed that experienced tranquility is not limited to potentially tranquil places evaluated in previous studies, which are typically remote, less accessible areas. Still, rather than being taken in remote areas entirely free from infrastructure or people, tranquility-related photographs are often uploaded from more accessible landscapes, such as frequently visited inland water bodies, ferry crossings and even urban green spaces. Notably, these findings point out the necessary differentiation between potential and experienced tranquility and also the importance of accessibility of a place. However, photos with tranquility-related tags were also often found in areas featuring water bodies and greenery, and less frequently in areas with crowds of people and buildings, which aligns with tranquility-enhancing factors from previous studies (Hewlett et al., 2017; Jackson et al., 2008; Wartmann et al., 2019).

Another approach to map experienced tranquility was presented by Chesnokova et al. (2019). Their study area was the Lake District National Park in the northwestern part of England, which has been known since the late 18th century for its picturesque landscapes, outdoor recreation (e.g., hiking, swimming), and relative remoteness (Chesnokova et al., 2019). Historical and contemporary literature describing the area was analyzed by applying a combination of close reading and natural language processing. Their study emphasizes that experiences of tranquility, particularly those associated with silence, are culturally and temporally situated, shaped not only by environmental characteristics but also by how individuals choose to describe and interpret these landscapes. Places of experienced tranquility from contemporary literature were then compared with the potential tranquility map of Jackson et al. (2008). It was found that tranquility is frequently associated with specific and accessible “quiet spots", even when located near infrastructural elements like roads, which aligns with the findings of Wartmann et al. (2019).

Taken together, these studies highlight that experienced tranquility often diverges from modeled potential tranquility and cannot be fully captured by environmental proxies alone but often depends on factors that are not operationalizable with spatial data.

2.4 Place attachment, topophilia and the emotional valuation of tranquility

Not only can audible or visible features render an area or place tranquil, but feelings, thoughts and connection with a place may also influence its perception. In the case of consciously frequented places, there is often a particular connection to the place, which can be linked to theories of place attachment and sense of place. According to Jorgensen and Stedman (2001), sense of place is a tripartite attitudinal construct, comprising place attachment (emotional bonds), place identity (cognitive meanings) and place dependence (behavioral use). All three constructs can be linked to places where people can experience tranquility: A person can be deeply emotionally connected to a place and, because of historical connections, identify with it so that they visit it regularly to enjoy peace and quiet, possibly resulting in a dependence because it is one of the places where the individual can recover from everyday life. This concept can also be linked to the concept of topophilia, a neologism coined by the influential human geographer Yi-Fu Tuan (Tuan, 1990). Topophilia can be defined as "the affective bond with one’s environment—a person’s mental, emotional, and cognitive ties to a place" (Heimer, 2005, p. 117). It emphasizes the potential emotional and symbolic bonds between people and place, arguing that "environment may not be the direct cause of topophilia, but environment provides the sensory stimuli, which, as perceived images, lend shape to our joy and ideals" (Tuan, 1990, p. 113). This is inherently connected to the notion of tranquility, as the concept, besides other perceptions, is also based on sensory stimuli, which may lead to attachment to the place itself.

In the study of Ogunseitan (2005), topophilia is defined as an affective bond between people and place, structured around four domains: ecodiversity, synesthetic tendency, cognitive challenge, and familiarity. The study focused on the relationship between environmental preferences, conceptualized through topophilia and perceived quality of life (QOL). Among the topophilia domains, ecodiversity, particularly preferences for flowers and water bodies, showed the strongest association with QOL (Ogunseitan, 2005). This finding relates to the concept of tranquility, as elements such as natural, biodiverse environments and water bodies have been identified as key

factors that make a place tranquil for people (Jackson et al., 2008; Watts & Pheasant, 2015). The overlap underlines the role of ecodiversity not only in enhancing QOL but also in enabling restorative experiences, which leads back to the Attention Restoration Theory of Kaplan (1995). In this light, tranquil places may be perceived as such not only due to their physical characteristics, but also because of the affective associations, memories, and cultural values embedded in them. This perspective recognizes tranquility as a co-constructed phenomenon, emerging from the interplay between the physical characteristics of landscapes and the social, emotional, and cultural meanings attributed to them by individuals and communities (Purves & Wartmann, 2023).

2.5 Mapping of related concepts

There have also been studies that mapped concepts related to tranquility. For example, Schwick and Spichtig (2012) developed a national-scale map of "Landschaftsqualität" for Switzerland, defined as a composite, quantifiable expression of landscape characteristics that arise from both objective physical features and subjective human perception. The study incorporates factors such as view quality, noise, natural features and anthropogenic features, including high-voltage cables. The factors were weighted based on expert opinion and combined in a multi-criteria evaluation (MCE), resulting in a map with a resolution of 100×100 m. The study incorporates cross-validation with subjective perceptions of residents, which showed a relatively weak correlation between the model and the residents' ratings, considering certain subjective variables such as perceived noise. It underscores the individualized and context-dependent nature of landscape perception. These findings align with mixed-method tranquility mapping studies, where in potentially non-tranquil areas people were still able to experience tranquility, showing the discrepancies between the model and perception (Chesnokova et al., 2019; Wartmann & Mackaness, 2020).

Another related concept is presented in the study by Kienast et al. (2012), who developed a spatial model to assess the suitability of landscapes for nearby recreation in medium-sized towns in Switzerland. The study combines so-called presence data (i.e., residents marking their frequently visited outdoor recreation areas on maps) with objective landscape features such as proximity to settlements, presence of forests, or hiking trails. Generalized linear models were used to identify which landscape variables best predict presence, revealing that people tend to prefer locations with forest cover, scenic views, and proximity to water, while avoiding areas close to major roads. The study systematically compared "objective" landscape properties with "subjective" landscape preferences collected via a questionnaire. This comparison revealed a strong correspondence between what people claim to prefer and where they actually go, particularly regarding access to water, forest, and vantage points, thus reinforcing the relevance of perceptual variables in spatial modeling. This multifaceted approach and comparison revealed that people typically seek landscape characteristics and perceptions, which are often considered in tranquility mapping studies as factors that enhance the potential tranquility at a location, highlighting the connection between recreation areas and tranquility (Jackson et al., 2008; Pafi et al., 2020).

A more conservation-oriented, yet conceptually comparable, approach is the work of Radford et al. (2019), who developed a spatial model to quantify wilderness quality in Switzerland. Wilderness was defined as areas governed by natural processes, largely free from anthropogenic influence,

infrastructure, or visual disturbance. Four indicators, which are based on a MCE themselves, were used to predict wilderness: naturalness, human impact, remoteness and ruggedness. The model produced a national-scale wilderness quality map at a 100×100 m resolution, identifying high-quality wilderness areas mainly in high-altitude regions of the Alps. The authors emphasize the subjective nature of wilderness, similarly to tranquility mapping studies, and advocate for integrating local and expert stakeholder input in future implementations of the model. In a subsequent analysis of Leeb et al. (2020), where the potential tranquility for the Swiss plateau was mapped, several of the four indicators mentioned above were used to operationalize factors that contribute positively to tranquility. For instance, the layer "human impact" was used to map the factor "seeing any signs of human impact" and assigned a weight to merge it with the other factors in the MCE to compute their tranquility index.

2.6 Research gap

Building on the conceptual and contextual background outlined before, this section identifies specific methodological and conceptual gaps in existing tranquility research. Despite increasing scholarly attention on the mapping of tranquility, a few important areas and implications regarding the concept of tranquility in a rural setting in Switzerland remain unexplored.

Few studies have focused on small-scale, rural settings, but rather on either large-scale applications like a whole country or region, or concentrated on urbanized settings (Jackson et al., 2008; Leeb et al., 2020; Marafa et al., 2018). The canton of Glarus, with its relatively small area compared to other cantons and its rapidly changing conditions of built-up regions to more remote, mountainous spaces, can serve as a proxy for other similar regions in the Alps. Additionally, current approaches to mapping and analyzing tranquility often rely heavily on environmental proxies, frequently failing to capture the cultural, emotional, and linguistic factors that shape the perception of tranquil places. Tranquility is increasingly recognized as a cultural ecosystem service (CES). Yet, its meaning and importance are not universal but vary across cultural and linguistic contexts. Purves and Wartmann (2023) emphasize the need for theoretical frameworks that conceptualize tranquility as a co-constructed phenomenon, emerging from the interplay between physical landscapes and subjective meanings. They propose the combination of various methodological approaches, explicitly distinguishing between modeled and experienced tranquility. By identifying discrepancies between modeled and perceived tranquility, this research sheds light on the presence of “pockets of tranquility” that conventional mapping approaches often overlook. This perspective is especially relevant in light of growing demand for tranquil spaces amidst urbanization, environmental pressures and increasing tourism. The study thereby provides a foundation for future research on tranquility in alpine and rural settings, while also offering practical insights for conservation, landscape planning, and sustainable tourism management.

At the same time, such an integrative approach has so far not been implemented in the Swiss context. By systematically comparing modeled potential tranquility with participatory mappings of experienced tranquility in Glarus, this thesis addresses both methodological and conceptual gaps identified in recent literature. In doing so, it not only advances a more nuanced, place-based understanding of tranquility but also responds to the critique of Leeb et al. (2020), who emphasized the need to adapt tranquility factors to local populations rather than transferring them from other contexts such as Jackson et al. (2008). Given the subjective and culturally

situated nature of tranquility, a participatory approach is particularly valuable for capturing locally relevant perspectives and ensuring that the resulting model reflects the lived experiences of residents.

This thesis therefore advances tranquility research by situating the concept within the alpine context of Glarus and by combining participatory perspectives with GIS-based modeling. Rather than treating tranquility as a universal quality, it approaches it as co-constructed through local perceptions and environmental characteristics. In doing so, the study not only highlights alignments and discrepancies between modeled and experienced tranquility, but also underscores the value of locally grounded approaches for informing conservation, tourism and landscape planning in small-scale mountain regions.

2.6.1 Research questions

The research gap and its implications lead to the following two research questions:

- How do residents in the canton of Glarus define and perceive tranquility in their environment, and what specific characteristics contribute to their identification of tranquil places?

- To what extent do the mapped perceptions of tranquility among residents in Glarus align with spatial models constructed using existing environmental data, and what factors contribute to any discrepancies identified?

Chapter 3

Methodology Focus Groups

The following chapter introduces the first method used in this study. Three focus groups were conducted with residents of the canton in a seminar room in Glarus, where participants were asked to share their definitions and perceptions of tranquility.

Focus groups, also known as 'group discussions' or 'group interviews' are a qualitative method, used in various fields like market research, sociology, psychology and political science. Hennink et al. (2020, p. 136) define it as an "interactive discussion between six to eight pre-selected participants, led by a trained moderator and focusing on a specific set of issues. A focus group aims to gain a broad range of views on the research topic over a 60-90 minute period, and to create an environment where participants feel comfortable expressing their views". Focus groups distinguish themselves from other qualitative research methods through multiple characteristics. They typically consist of six to eight preselected participants who have similar backgrounds or share any experience. A focus group centers on a specific topic with a limited number of questions or issues that can be explored in depth. It is led by a moderator, who does not participate in the exchange but instead guides the group to elicit a broad range of views in an informal, pleasant atmosphere free of judgment (Hennink, 2014). As Hennink (2014) also notes, such a comfortable environment and informal discussion can enhance the clarity, depth, and detail of responses, while also facilitating the emergence of unexpected themes. Moreover, because multiple participants contribute within a one to two-hour session, focus groups enable the efficient collection of rich data in a relatively short amount of time (Krueger & Casey, 2015).

Focus groups are particularly suitable for analyzing the concept of tranquility for several reasons. The most critical factor is the inherent subjectivity of the concept itself: people define tranquility differently, and they identify different factors that influence their assessment of a place. Because perceptions are shaped by sensory, emotional, cultural and contextual conditions, group discussions help to explore the deeper meanings and personal backgrounds that underlie individual definitions of tranquility. Other methods, such as surveys, may overlook these nuances or shared meanings. As shown later in this study, participants often describe very specific places and factors, which can be uncovered and examined in greater depth through interactive discussion. The interactive nature of focus groups also encourages participants to build on one another's contributions, serving as memory triggers for particular situations or places where they experienced tranquility; insights that would likely remain hidden in one-on-one interviews (Andersson et al.,

2015; Kitzinger, 1995). Finally, since the goal of this study was to capture as many detailed perspectives as possible, focus groups provided an efficient means of collecting a broad range of viewpoints and are particularly well suited for exploratory research, as the dynamic and open-ended nature of the discussion can reveal new and unexpected dimensions of a topic that may not emerge in more structured methods (Krueger & Casey, 2015).

Despite these strengths, focus groups are not without limitations. A key concern is the potential for group dynamics to distort individual preferences. Dominant participants may steer the conversation and influence the behavior and willingness to share certain thoughts and opinions. This may result in data that reflect power dynamics rather than a balanced range of opinions (Krueger & Casey, 2015; Zenari, 2015). Furthermore, the presence of other people may introduce social desirability bias, as participants may conform to these norms or avoid expressing controversial views (Morgan, 1996). This can compromise the authenticity of the data and distort outcomes.

In addition, the analysis of focus group data can be methodologically challenging as it also strongly depends on how the data is collected. In principle, the discussion should be at least recorded with an audio recorder. But the overlapping dialogue, interruptions, and non-verbal communication inherent in group discussion demand skilled acquisition and interpretation. However, it can also occur that participants do not agree to having the session recorded and other data entry methods such as note-taking or follow-up and entry of data purely from memory must be used, which often leads to missed information (Krueger & Casey, 2015).

The researcher must also consider their own influence on the process, including how their positionality and facilitation style may have shaped the group dynamic (Hennink et al., 2020). Focus groups can be a valuable method for exploratory and inductive research. Though, they are not suitable for generalization due to their typically small and purposively selected samples (Krueger & Casey, 2015). Hence, the method requires detailed justification and transparent reporting of its implementation and limitations. There have been several other studies that used focus groups as a tool to gather perceptions and factors considering tranquility or quiet areas (Hewlett & Brown, 2018; Hewlett et al., 2017; Lavandier & Delaitre, 2015). However, primarily methodological details like sample size, number of sessions, or why this method has been chosen are not reported. This has attracted criticism from other researchers who advocate that more in-depth, detailed reporting is necessary when focus groups are used as a method for analyzing CES (O.Nyumba et al., 2018; Slovák et al., 2023).

An appropriate reporting of the use of focus groups in this thesis is ensured by structuring the subsequent sections according to Hennink's (2014) framework for reporting focus group research. This structure allows for a systematic presentation of the research design, study setting, participant recruitment, reflexivity, data collection and analysis, as well as ethical considerations and limitations.

3.1 Research design

As stated earlier, focus groups do not aim to be representative, but rather to acquire in-depth input from a purposely selected group of individuals (O.Nyumba et al., 2018). Due to time and budget limitations, three focus groups, consisting of six participants in the first two groups and five participants in the last group, were conducted to explore the diversity of experiences and perceptions of tranquility.

3.2 Participant selection and recruitment

Participants for this study were selected through purposive sampling, a non-probability sampling strategy commonly used in qualitative research to identify individuals who are especially suitable for the study. Typically, the group is characterized by homogeneity but with enough inherent variation to allow for contrasting views and discussion (Krueger & Casey, 2015). In this case, the only mandatory criteria were residence in the canton of Glarus and being of legal age. An attempt was made to recruit people with personal familiarity with the local landscape and the ability to reflect on tranquil places or the factors that make a place tranquil for them. To fulfill these criteria, representatives with different backgrounds were recruited. Participants included members of nature conservation NGO's and wildlife associations, outdoor sports clubs, teachers, and individuals with a general interest in nature. The intention was to capture a range of perspectives while maintaining a degree of homogeneity in terms of participants' familiarity with the local landscape and their ability to reflect meaningfully on it. All of them have lived in the canton of Glarus for at least two years, and many have spent their entire lives there. It was ensured to the extent possible that the gender and age groups were equally distributed.

Participants were recruited or attempted to be recruited using a mix of proposed methods from Krueger and Casey (2015), including nominations, snowball sampling, lists and advertisements in public places. The most effective strategies in this study were nominations and lists. In this context, nominations are understood as asking neutral parties if they knew participants who meet the predefined criteria. As a former resident of Glarus, I still have a network there that I could consult to obtain potential participants. In some cases, the contact mediators themselves were also willing to participate. The list method involves consulting existing lists of potential participants. In the present study, this meant consulting a list of nature-oriented clubs and associations in the canton of Glarus. The advantage of this method is reaching a comparatively high number of potential participants with limited effort (Krueger & Casey, 2015). Snowball sampling and advertisements, did not lead to any success. In snowball sampling, potential candidates are asked if they know anyone else, and people who effectively participate are asked after the focus group if they know any other participants. After the first and second focus groups, the next focus group date was communicated, and a flyer was distributed. Additionally, flyers were put up in multiple supermarkets and the Landesbibliothek in Glarus. However, no one has contacted me through the advertisements posted.

During recruitment, three individuals from nature-oriented associations or organizations expressed concerns about the study. They feared that shared areas designated as potential tranquil places could become a tourist hotspot in the future, with the associated problems. This is due to examples such as the Muttenchopf, which, as mentioned in the introduction, has experienced

a rush of visitors triggered by social media, with associated negative consequences such as littering. They worried "that these quiet and familiar magical places become known" (Participant, personal communication, 12 January 2025).

3.3 Data collection

The sessions were led by the author of this study, a 27-year-old male graduate student with little previous interview experience. All three the focus groups were accompanied by a note taker, where in the first two sessions it was a 31-year-old male graduate student, and in the last session it was a 27-year-old female who is working in the health care sector. Both note takers had no or little experience in this task.

3.3.1 Discussion guide

The discussion guide was developed following the structured approach of Krueger and Casey (2015), which emphasizes a logical sequence of questions progressing from general, introductory topics to more specific ones. Its primary aim was to engage all participants in the conversation and foster interaction among them. Content and flow were shaped both by the study's objectives and by established literature on focus group methodology (Hennink, 2014; Krueger & Casey, 2015; O.Nyumba et al., 2018). To this end, the schedule was designed to introduce participants to the study topic, elicit personal and in-depth perceptions and definitions of tranquil places, identify factors that enhance or diminish tranquility, and explore attitudes toward mapping tranquility in the canton of Glarus.

Each focus group session was organized into three main sections: introduction, main discussion, and conclusion. The complete guide is provided in Appendix C.

- Introduction: Every session started with the completion of the consent form, an introduction of the topic and thesis, some basic rules for the following discussion and a simple opening question ("Where are you from and what is your favorite place in the canton?") serving as an early icebreaker to encourage participants to speak up. As people are more likely to actively engage in the discussion when they have already contributed something (Brown & Fagerholm, 2015), every person was personally asked to respond if they did not respond on their own initiative.
- Main discussion: This section was structured around opening and key questions to delve deeper into the topic. I asked participants if they could recall a situation where they felt "particularly calm, relaxed and peaceful" to put them in the right place, figuratively speaking, with their thoughts. To encourage individual reflection, the participants were asked to write down their thoughts on sticky notes before sharing them in an open discussion. Following this, I used the online tool Mentimeter to ask "What makes this place or a place in general tranquil?". Mentimeter is an application that allows participants to scan a QR code on their mobile phone and add terms to a word cloud displayed in real-time on the screen. The same procedure was repeated for the description of non-tranquil situations and places, to enourage persons to describe a situation in which they did not feel calm, relaxed, and peaceful at all and what explicit factors make a place less tranquil. Additionally, I asked the participants if they actively look for tranquil places, if these places change

or have changed over time, and if a map is actually a valuable means of illustrating this concept.

- Conclusion: In the final section participants were asked to identify the factor that influenced the tranquility of a place the most in their opinion, and they had the chance to make additional notes. I summarized the most critical points of the discussion and showed findings from the study of Leeb et al. (2020). At the end of the session, a big thank you was expressed, and a small, symbolic gift was presented.

To complement the group discussions, participants were contacted again approximately three weeks after the focus groups and asked to identify tranquil places in the canton of Glarus explicitly. This was done separately to reduce the tendency for participants to give precise locations that directly matched their earlier descriptions of tranquility. The follow-up step provided additional, spatially explicit information that could later be compared with the outcomes of the tranquility map (see Section 6.4).

3.3.2 Location

The focus groups were conducted on February 24, March 31, and May 14, starting at 7 p.m. The time between sessions was necessary to evaluate the results from the previous groups and gather new participants. As a locality for the meetings, I chose a centrally located seminar room in the city of Glarus, which is the capital of the canton and offers the most balanced accessibility for all participants. The room is equipped with a projector, screen and flipchart, and its large windows create an open and pleasant atmosphere. This is important because it has been proven that the physical environment can influence participants' openness and willingness to express their opinions on a topic (Stans et al., 2017). Consequently, the seating arrangement was in a V-shaped order, allowing participants to look at each other while still being able to see what was displayed on the screen, where the questions and word clouds were shown. The moderator was seated closely to one end of the table, while the note-taker had an inconspicuous, somewhat secluded spot at the back, next to the screen, so as not to influence the discussion. Refreshments and a small aperitif were presented to the participants by the moderator.

To ensure privacy, only invited participants were able to enter the building and room during the event. Each focus group lasted between 90 and 120 minutes, allowing sufficient time for introduction and discussion of all planned topics. The duration depended on the participants' willingness to share their views, where sessions with more "talkers" as described in Krueger and Casey (2015) tended to last longer. All of the discussions were held in the participants' native language, Swiss German, to ensure no lingual barriers hindered the discussion. We captured the sessions using several methods: The entire discussion was audio-recorded using a microphone connected to a computer. The note-taker also focused on the main questions and topics or aspects that emerged from the discussion as particularly important and also served as a possible backup in case the audio recording could not be evaluated afterwards for any reason. Additionally, the sticky notes filled out by the participants were collected at the end of the session, and the answers from the Mentimeter survey were saved for later analysis.

3.4 Reflexivity

3.4.1 Personal reflexivity

Personal reflexivity involves considering the researcher's own background, characteristics, and assumptions that may have influenced the research process, the generated data, and the analysis of it (Hennink, 2014). I am a male researcher in my late twenties from Switzerland with academic training in geography, little experience with interviews and no experience in conducting focus groups. I spent most of my life living in the canton of Glarus and have a long-standing personal connection with the place. My sociocultural background and familiarity with the study area may have shaped how participants perceived me and how questions were framed and interpreted. The fact that I myself was a citizen of the canton may have been beneficial for the atmosphere and participation rate, as the local connection alone created a particular bond. This is particularly important to consider in relation to the recruitment process, as fears and concerns about the study often played a role there. As England (1994) notes, research is a "shared space" shaped by both researchers and participants, with both influencing the process. My own position as a local, at least in terms of origin, has therefore become part of this dynamic, carrying potential advantages as well as disadvantages. Chavez (2015) identifies several of them, many of which I also experienced. These include more immediate legitimacy and acceptance, faster rapport-building and deeper contextual insight into the meanings participants ascribed to places I know myself. However, insider familiarity and closeness to participants can also blur the boundaries between the researcher and the subject, leading to over-identification, selective questioning, or difficulty in recognizing patterns.

To manage these dynamics, I took deliberate steps in preparing the sessions and also during the sessions. I tried to avoid connecting with the participants on a personal basis and create a certain professional distance without putting myself in a high position as a researcher. I regarded myself as a facilitator and moderator rather than an expert on the subject and tried to emphasize that the participants were my experts for the evening, as I relied on their opinions and input. Aligning with the argument of Bourke (2014) that positionality is not inherently a limitation but an ongoing influence, I engaged in reflexive consideration throughout data collection and analysis to recognize and, where possible, mitigate the effects of my insider status.

3.4.2 Interpersonal reflexivity

Interpersonal reflexivity concerns the setting of group discussions and the interpersonal dynamics within the group and between the moderator and participants, which may influence the produced data (Hennink, 2014). These dynamics include the emergence of power hierarchies, interruptions to the discussion and the relationships established between participants and the moderator, as well as the suitability and accessibility of the location. Following Walsh (2003), interpersonal reflexivity also encompasses the ethical questions of how the researcher should relate to participants and the reflective question of what "transpires between researcher and participant in the context of a research project" (Walsh, 2003, p. 56). It requires recognizing the conversational nature of qualitative data collection and how relational and contextual factors may have shaped and influenced the participation and ultimately the data generated.

In the focus groups conducted, these relational dynamics were influenced by my role as a re-

searcher. Shared background and familiarity with the areas surely had a positive effect on the willingness to share information and opinions. However, as the host and moderator of the session, comments were often directed at me rather than at one another, as the participants were mostly unfamiliar with each other personally, which created a certain distance nonetheless. It was striking and hardly surprising that, especially at the beginning of the sessions, discussions were only held between people who already knew each other. Yet, it did not seem to be because of an imbalance in power, but rather personal traits. A few participants proved to be dominant talkers, as described in Krueger and Casey (2015), which then had to be stopped at some point, where others were extremely reserved and had to be encouraged to speak up. It became clear, especially during the evaluation and transcription process, that certain participants contributed much more to the discussion and provided more input than others. Nonetheless, it seemed that all participants felt comfortable expressing their views and that nobody was reluctant to speak up if they felt like doing so.

3.5 Data analysis

The analytic process drew on multiple forms of data generated from the focus groups, including field notes, participant-generated sticky notes, word clouds and most importantly, the audio recording of the session. These materials were the primary data sources for the subsequent analysis, with the goal of gaining insights into the participants' perception of tranquility and, most importantly, what criteria and descriptors were attributed to the concept.

In the first step, verbatim transcripts were generated using the audio recordings and the software MAXQDA 24 (Version 24.9.1). The transcripts were created in standard German, so the Swiss German recordings were "translated" where possible. If terms were used that could not be translated directly into standard German, they were left as they were and placed in quotation marks. After transcription, all transcripts were checked for accuracy by listening to the audio recordings while reading the transcript. This ensured that wording, pauses and other relevant cues were transcribed. In the transcripts, all the names were anonymized, and sounds that support the narrative, such as "mhm" or nodding, were replaced by the symbol "$". The locations mentioned and described were also anonymized so that, on the one hand, no conclusions could be drawn about the individuals involved and, on the other hand, because participants often feared that such locations will become known, especially if they are perceived as tranquil places. The notes on the sticky notes were digitized, and the word clouds from Mentimeter were saved for subsequent analysis. The field notes were also sent to me immediately after each session by the note taker.

3.5.1 Thematic analysis of the transcripts

There are multiple analysis techniques for focus group transcripts. The three most commonly used techniques are qualitative content analysis, thematic analysis and constructionist methods like discourse or conversation analysis (Hennink, 2014). In this study, I used thematic analysis as the overall analytic approach following the six-phase framework outlined by Braun and Clarke (2006). Thematic analysis is a qualitative method for systematically identifying, analyzing, and interpreting patterns of meaning ("themes") across a dataset in relation to a research question. The method was selected for its flexibility in identifying, analyzing and interpreting participants'

perceptions, experiences and meanings regarding a topic. This aligns with the aim of my study to understand how residents conceptualize tranquility. Thematic analysis allows for the search for (repeated) patterns of meaning across multiple transcripts (Clarke & Braun, 2017). Compared to content analysis, which typically emphasizes the explicit, semantic meaning of data, thematic analysis conducted at a latent level allows researchers to move beyond surface meanings and identify underlying ideas, assumptions, and conceptualizations (Braun & Clarke, 2006). While thematic analysis is a flexible method applicable across diverse contexts, its application here was tailored to the goal of translating qualitative insights into spatially operationalizable proxies.

Following the framework of Braun and Clarke (2006), familiarization, coding, and initial categorization were conducted to systematically transform codes into spatial variables. The analysis followed a hybrid strategy: results from previous tranquility studies (Hewlett et al., 2017; Jackson et al., 2008) informed the theoretical starting point and provided some initial ideas about the direction the discussion could take and what results might be expected. The main focus lies on the results from my focus groups, thus the previous literature should not have influenced the analysis of the collected data and an inductive, open coding approach was used without attempting to fit into a pre-existing coding scheme. The opposite approach which would be combining existing results with mine would not have been appropriate in this case, as the focus is precisely on local opinions and assessments without targeting anything specific. Although prior literature gave me a sense of what the focus groups might reveal, I actively worked to safeguard my results from being shaped by these preconceptions.

The analytic process began with the first step of Braun and Clarke (2006) framework. It consisted of familiarization through repeated reading of the verbatim transcripts and review of additional materials, such as sticky notes and word clouds. Following this, initial codes were generated from the data and assigned to the corresponding lines in the transcript. The next step was to group the codes into themes, which are defined as "rich, multifaceted patterns of shared meaning situated around a central organizing concept" (Terry & Hayfield, 2021, p. 50). Instead of constructing fully elaborated interpretative themes, the coding was primarily aimed at organizing participants' contributions into higher-order categories that could directly inform the spatial modeling of tranquility. All codes were further classified into the following three categories: natural, anthropogenic, and combined natural–anthropogenic. Natural factors referred to features and processes of the physical environment, such as vegetation, wildlife, water bodies, weather phenomena or multisensory impressions like bird song, the smell of rain, or the view of snow-covered landscapes. Anthropogenic factors encompass human-made structures, activities linked to tranquil moments, emotions, and social or technological influences, including experiences of digital availability or stress from work. The combined category was used for situations where natural and human aspects were inseparably intertwined, for instance, engaging in activities like fishing or hiking in remote areas, enjoying the quietness of an urban park, or experiencing silence as the absence of anthropogenic noise in a natural setting. This threefold distinction follows earlier tranquility mapping approaches (Terradillos & Wilkinson, 2015), while being grounded in the specific accounts of participants in Glarus. Codes that did not immediately fit into any category were first left uncategorized and later assigned to an appropriate group, such as the "temporal dimensions of tranquility" (shown in the upper right of Figure 3.1 and discussed in the results chapter).

Within the main three categories, I further identified subthemes such as sensory experiences (e.g., visual or olfactory impressions) and special cases like activities or situational aspects. Last, the codes were distinguished according to whether they referred to positive or negative influences on tranquility. This system allowed for a structured organization of the diverse codes while maintaining sensitivity to both the source of the influence and its perceived direction. All codes were entered directly in MAXQDA, including the terms from the sticky notes and the Mentimeter word clouds. An overview of the classification process with example codes can be found in Figure 3.1. In Table 3.1, examples for specific quotes from the discussion and their classification can be found.

Table 3.1: Example of coded focus group data and assigned categories

Source	**Quote/Note/Term**	**Origin**	**Code**	**Classification**
FC I	"[...] one concrete physical thing for me is that it is not noisy. So no matter what kind of anthropogenic noise."	Quote	Noise	Negative, anthropogenic, auditory
FC II	"But it's enough for me to go out onto the balcony when I read a book."	Quote	Reading	Positive, anthropogenic, activity
FC III	"Or sometimes during a lunch break, where you just run down to the lake for a bit, or something like that, just for a short time, even if it's only 10 minutes."	Quote	Water bodies	Positive, anthropogenic and natural, multisensory

I conducted the coding myself, and to support consistency, codes were reviewed iteratively across transcripts, with earlier coding being revisited in the light of the following, newer data to ensure coherence. Additionally, all the data sources (transcript, sticky notes, Mentimeter) were combined in the coding process, allowing themes to be supported by more than one type of data basis.

Although this procedure diverges from the more interpretative aim of thematic analysis, it offered a transparent way to translate qualitative insights into inputs for the spatial model. After assigning codes to the overarching dimensions and categories described above, they were organized into broader themes that summarized related factors under one heading. The emphasis remained pragmatic, focusing on a coherent grouping of influences rather than developing deeply interpretative narratives. For example, the theme of noise brought together different codes such as construction noise, street noise and public transportation noise. This stage was followed by reviewing and refining the themes to ensure consistency and clarity. The resulting themes provided the basis for linking qualitative findings with spatial proxies, and their outcomes are presented in Chapter 4.

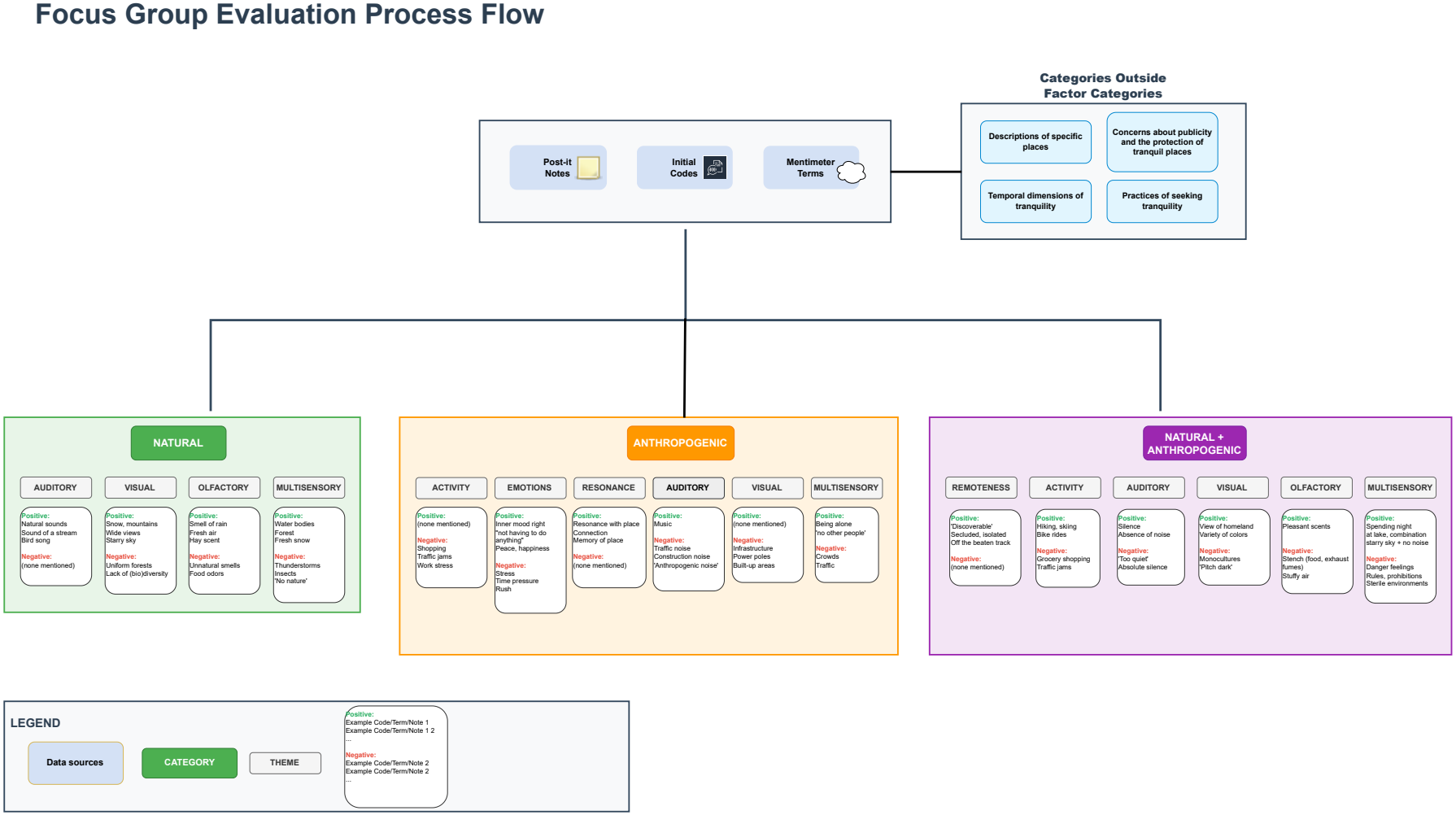

Figure 3.1: Focus Group Evaluation Process Flow

3.6 Ethical issues

All participants were provided with an informed consent sheet outlining the purpose of the study, the (dis)advantages of the study, possible risks and privacy policy. By signing this form, they also approved the audio recording of the session. The consent form was signed twice by every participant and me so that every party could get a signed copy. Participants were informed that their participation was voluntary and that they could withdraw from the study at any time. To protect confidentiality and anonymity, personal identifiers were removed from the transcript and pseudonyms were used in all reporting. Specific location names mentioned by participants were anonymized as well to prevent the identification of sensitive places, particularly those perceived as tranquil by the participants. All data, including audio files, is stored on password-protected devices or clouds. To ensure anonymity, all participants are referred to by pseudonyms (e.g., Participant A2, Participant B1). Gendered pronouns are avoided; instead, the singular 'they' is used throughout.

A small aperitif was provided during and after the session, consisting of snacks and refreshments. At the end of the study, the participants received a small, symbolic gift in the form of traditional pastries from the canton of Glarus. However, this was not announced in advance, and no financial incentives were distributed.

Chapter 4

Results Focus groups

In this chapter, the results of the conducted focus groups are presented. The focus lies on presenting participants' definition of tranquility and what factors add and detract from it. Results from the three conducted groups are presented in a summarized manner, as the focus is not on differences between groups but on the shared and contrasting perceptions of tranquility among residents of the canton of Glarus. The section presents the results in the following manner: First, positive and negative factors and associations with tranquility will be presented, divided into three broad categories: natural, anthropogenic and a combination of both. Although presented as distinct themes, participants' accounts often intersected across these categories, highlighting the fluid and multidimensional character of tranquility. Within these three categories, the broad themes are described separately.

Subsequently, findings that extend beyond individual factors are addressed, including participants' perceptions of specific places, concerns about publicity and the protection of tranquil areas, temporal variations in the experience of tranquility and everyday practices of seeking tranquility. In line with recommendations for reporting focus group data without numerical measures (Hennink, 2014), I refrained from presenting frequencies. Instead, I used descriptive terms such as "often" or "multiple times" to indicate the pervasiveness of specific issues. Participants were anonymized, with identifiers consisting of a letter (A–F) for the participant and a number (1–3) indicating the focus group. Quotes have been translated into English; their originals are listed in Appendix A.

Taken together, these sections aim to provide a coherent narrative that not only highlights dominant perspectives but also captures nuances and ambivalences in participants' accounts, thereby offering a comprehensive picture of how tranquility is understood in the context of the canton of Glarus.

4.1 Positive factors

The following section presents the positive factors that participants associated with experiences of tranquility. As an entry point, Figure 4.1 illustrates a Mentimeter word cloud generated during the second focus group (FC II), which visually highlights the most frequently mentioned positive factors and provides an overview of participants' associations.

Figure 4.1: FC II: Mentimeter word cloud for positive factors.

4.1.1 Natural factors

Natural factors and characteristics in this study refer to environmental features and sensory stimuli that originate primarily from ecosystems and ecological processes rather than from direct human construction. This includes vegetation, water bodies, topography, wildlife and associated multisensory qualities such as natural sounds or smells.

Natural auditory factors

Audible, natural sounds were a striking topic. In this case, the theme primarily emerged through written contributions (sticky notes and Mentimeter) rather than during the oral discussion. Although participants mainly did not elaborate on it verbally, its recurrence across written inputs suggests that it was nevertheless an aspect of tranquility considered relevant by the group. The term "natural sounds" occurred twice on its own. More specifically, the sound of water was frequently mentioned as a factor, caused by various sources such as streams, rivers, or even the sea. One participant also connected it to a personal activity they often do, which involves sitting next to a river and simply listening to the sound of it.

Another regularly mentioned positive factor were animal sounds, especially bird song. Describing a situation in which Participant C1 felt remarkably tranquil, they explained "[...] and in a place like that, um, yes, there's a vibration between you and that place and the landscape, that fir tree with birdsong or whatever [...]".[1] Interestingly, in this description, bird song was connected to a specific situation and even another natural feature (fir tree). Similar to the sound of water, bird song, as a standalone term, was also written down a few times. One participant also highlighted the rustling of leaves as a factor contributing to a sense of tranquility.

Natural visual factors

Seeing natural features emerged repeatedly as a theme, both in the discussion and in the terms noted. Snow and its visual impacts were named as a factor that can render a place more tranquil, as Participant A1 pointed out: "[In snow-covered landscapes,] there are no colored stimuli,

so there is no green, stone, or bushes. Ideally, everything is simply modeled in white, which makes it seem even calmer, quieter and more minimalistic to me."[2] Related to this, participants emphasized the visual influence and presence of mountains and summits: The view of mountains or mountains in general were repeatedly perceived as positive, and one participant specifically described their positive association with the phrase “Erhabenheit der Felswände”, which roughly translates as "sublimity of the cliffs". Another person mentioned the reflection of the mountains in the lake in this context, encompassing two natural features combined that may enhance the tranquility of a place. In addition to purely physical features of nature, participants also highlighted flora and fauna. Colorful meadows and vibrant natural settings were linked to tranquil locations, along with encounters with or observations of animals. More broadly, terms such as (bio)diversity and nature frequently emerged in a positive context, as illustrated by a quote from Participant B1: “[. . .] when you walk through the forest and all the trees look exactly the same, it’s a bit boring, but when each tree is special or has a pretty flower, then you come across an anthill when you lose yourself a little.”[3] Beyond individual plants and animals, participants emphasized the importance of the overall view or panorama of a place. Wide views and open landscapes are generally perceived as positive. What exactly was visible in these views was often not discussed; however, the most crucial factor was the expansive view itself. Participants also mentioned night-specific factors like moonlight and a starry sky as positive factors. In general, the terms "light" and "lighting atmosphere" came up multiple times. Two terms that were noted were “shallow light” and “wide light atmosphere.” Although participants did not specify in detail what constituted the light or lighting atmosphere, their accounts consistently suggested that the “right lighting” positively contributes to a sense of tranquility.

Natural olfactory factors

The sense of smell also plays a role in the participants’ understanding of tranquility. Various natural scents are perceived as positive, including the smell of hay and the smell of rain. Additionally, participants frequently mentioned fresh air as contributing to tranquility. While this is not tied to a specific smell, it was categorized under the olfactory theme, as it reflects the perception of air quality through sensory experience. The term was noted multiple times and also came up in the discussion: "It’s just a little quieter and more pleasant to breathe in the fresh air and sit outside [...]."[4]

Natural multisensory factors

In this study, multisensory refers to environmental features or situations that may influence more than one sense at the same time. For instance, certain situations combine visual, auditory, and olfactory dimensions, such as sitting by a lakeshore where the water and surrounding scenery provide visual impressions, the gentle movement of waves and calls of birds form an acoustic backdrop, and the fresh scent of the lake air contributes to the overall experience. The importance of the interplay is increasingly recognized as essential to how people experience and evaluate places holistically (Chiang, 2023).

As an example, water bodies were mentioned multiple times again, but here without direct reference to associated noises such as rustling or splashing. I assumed that this reference is potentially multisensory, as the experience of water bodies often encompasses not only the visual presence of water but also accompanying sounds and even olfactory impressions, even if these

were not explicitly mentioned by participants. Participant D3 expressed the importance of water in finding tranquility during a break: "Or sometimes during a lunch break, when you just run down to the lake for a bit, or something like that, just for a short time, maybe 10 minutes."[5] Water or bodies of water were also mentioned several times without comment, and I assume that this can influence several senses and contribute to the tranquility of a place in the eyes of the participants, be it auditory, visual, or even olfactory. A similar assumption can be made for the term “forest,” which also appeared repeatedly. People mostly associated being in a forest with tranquility.

Aligning with the multisensory nature of responses, participants sometimes combined sensations or characteristics of a place in their answers. One person noted that a tranquil place or situation is determined by a "combination of silence, animal sounds, nature sounds, feeling nature (grass, wind)".[6] Another participant described the earthy smell and the silence in the forest as very pleasant and enhancing, underscoring the multisensory experience forests may offer. Another recurring factor was snow, especially fresh snow, which can make the atmosphere of a place tranquil but can also have an auditory component in addition to a visual one, which Participant C1 expressed as follows: "I am the first to walk through with snowshoes, and the sound of the snowshoes with fresh powder snow [...]"[7]

Weather and climate phenomena in general were also often a topic of discussion. I assumed that this reference is potentially multisensory, as weather and climate phenomena are typically experienced through multiple senses, including visual impressions, bodily sensations, and auditory cues. It was not only sunny weather that was mentioned as a positive factor, but also rain, almost as often. Often the influence of the weather was context-dependent, as this quote from Participant C3 emphasizes: "[...] Or I mean, if it’s cold or rainy, or you’re in good shape and warm enough, then it can also be very tranquil, no matter what [...]."[8] Similarly, wind and still air were also both positively associated with tranquility. Often, as mentioned before, participants provided no context for their noted-down answers and factors, which does not allow me to determine what a specific named factor needs to be to enhance tranquility. The same is true for the term "the right temperature," which was jotted down on one of the sticky notes. Since there is no generally defined “right temperature”, the exact meaning remains open, yet the statement underscores the strong context dependency of many terms mentioned.

4.1.2 Anthropogenic factors

While tranquility was most frequently associated with natural elements, participants also identified several anthropogenic factors that could foster a sense of calmness and peace. These factors were not described in terms of infrastructure or man-made features alone but rather through a range of emotional, relational and sensory dimensions.

Emotions and inner mood

Emotions and feelings emerged as a central dimension of anthropogenic factors influencing tranquility. Participants not only described external conditions that they experienced with their senses but also emphasized how places and experiences triggered inner states such as happiness, peace, or a sense of balance. These emotional responses demonstrate that for the participants, tranquility is not only a construct influenced by external factors but also a deeply personal and

affective experience.

As stated by Participant E3 on a sticky note and orally, the "inner mood" has to be appropriate: "Somehow, you have to be ready for it."[9] Participant D1 expressed a similar opinion: "[...] and sometimes I find it [tranquility] again, and sometimes I don't, but it's something I approach with a willingness, knowing that the place is ready to give it to me again and again."[10] Several times, the discussion turned to one's own emotional state and how it can strongly influence one's perception of a place and its tranquility. If in that state, such situations may induce peace and feelings of happiness or even trigger physical reactions like goosebumps, according to participants.

The inner mood is often influenced by activities or tasks that have been successfully completed, which can foster such feelings and ultimately lead to an experience of tranquility. For instance, completing a work project or going on a bike ride were described as a positive trigger. Both the inner state required to experience tranquility and the external circumstances that lead participants to feel tranquil or to perceive a place as tranquil were described.

Additionally, time was another crucial factor mentioned in the discussion. Participants stated that the possibility of experiencing tranquility often depends on whether you have enough time and do not have other commitments and obligations coming up that could influence the situation in your mind. Places that are otherwise generally perceived as tranquil may suddenly no longer seem tranquil. As one participant described, when you have a full schedule, it takes up too much of your time to be able to enjoy the situation. However, if they find themselves in a situation where they "do not have to do anything"[11] as Participant A1 wrote it, the situation or place can be tranquil.

Resonance and connection with the place

Participants frequently described resonance with their surroundings as a crucial factor for experiencing tranquility. Resonance was described as a kind of response of a place to the presence of a person, thus establishing a reciprocal relationship between the human and the place, sort of an encounter between the two. Participant D1 expressed this as follows: "It needs the place, but it also needs you to go to that place and be willing to enter into that resonance."[12] Overall, there were several references to the need for a connection to the place being essential for tranquility. Some participants also framed this potential connection as a form of safety and feeling of security given, and spoke of an almost dialogical relationship, where the place seems to respond or offer something back. The memory of a place and the feelings associated with it were also mentioned as a potentially positive factor. This biased attitude could also help participants to more easily return to the "state of resonance" in which tranquility could be experienced.

Anthropogenic auditory factors

Among auditory aspects, music was the only explicitly mentioned positive, anthropogenic factor. A few participants described tranquil moments associated with listening to their preferred music in specific settings, such as sitting outdoors in a calm moment. Music was a way to make a situation or place even more pleasant or to help you wind down. In contrast, the absence of disturbing sounds such as traffic noise, voices, or cowbells was also highlighted as important for tranquility. Since these references relate primarily to disturbances, they are addressed in the section on negative anthropogenic factors.

Anthropogenic multisensory factors

The most frequently mentioned multisensory factor was the possibility of experiencing a place alone. Participants repeatedly emphasized that tranquility was easier to perceive when “no other people” were present, particularly strangers. When asked about the most important characteristic a place needs to have in order to be perceived as tranquil, Participant D2 stated: "[. . .] for me, I think it’s really just a few people. It could even be a city."[13] This shows that even places that are not typically perceived as tranquil can become tranquil through certain factors, such as the absence of people in this case. Some participants even expressed that they actively avoided crowded places or looked for paths off the beaten track.

4.1.3 Combined natural–anthropogenic factors

In addition to factors that were clearly framed as either natural or anthropogenic, participants also described characteristics, experiences, or aspects that emerged from an interaction or combination of both domains. These "mixed" factors reflected situations where human elements were perceived as blending in with, complementing, or even intensifying natural qualities.

Remoteness

One frequently mentioned characteristic that was perceived as positive in terms of tranquility was the remoteness of a place. Participants wrote down terms such as “remoteness,” “isolated,” or “secluded.” In addition, the term “discoverable” was mentioned several times in connection with locations. Participant E3 described a situation where they were hiking with friends as follows: "And none of us knew it [the path], [...] there’s no one there, coming down there. And yes, that somehow made it special [...]. Sometimes it’s good to stray from the beaten path."[14] Unknown, remote, and discoverable places and paths were generally described as tranquil by the participants. At the end of the first focus group, Participant E1 noticed that places which were described as more tranquil during the discussion actually differ significantly in terms of location and “naturalness,” such as a square in a city or a meadow by a lake. Still, they often share the commonality that they are somewhat isolated, they stated. One example contrasted the backyard of a restaurant with a bay or a secluded lakeside area, each embodying remoteness in its own way and thereby positively influencing the tranquility of the location.

Activities and events

Participants frequently emphasized the role of activities in shaping their experiences of tranquility. These activities were consistently described as part of participants’ free time and were not linked to their professional lives. They ranged from everyday hobbies, such as taking a walk or reading a book, to more active outdoor pursuits, including skiing, mountain biking, snowshoeing, kite surfing, or fishing by the river. Certain times of the year, when participants were free from work or study obligations, were described as particularly beneficial for experiencing tranquility, since the absence of everyday stress made it easier to switch off and find peace. For example, Participant B2 recalled a winter season when they worked as a skiing teacher, noting that being removed from regular routines and stress created a particularly tranquil period. Similarly, Participant A3 described his work as an agriculturalist: "So I was a farmer, when I had mowed a field, [...] then that’s how it is, when you say tranquil, then that’s how it is, “poah” now [it is

tranquil for me]."[15]

Participants also mentioned that settings, atmospheric conditions, and fleeting moments could make certain activities feel especially tranquil. Examples included spending the night on a mountain peak and watching the sunrise, playing board games on a rainy evening, experiencing fresh snowfall, or encountering a summer storm. These accounts suggest that tranquility was often linked not only to specific places but also to the circumstances under which activities took place.

Combined auditory factors

Within the mixed human-natural category, participants most often referred to silence or the absence of noise as an essential condition for tranquility. Calmness was described as emerging not only from natural quiet but also from the lack of anthropogenic disturbances, as stated by Participant E2: "So just calm, then I could also stand somewhere at the main station, [...] if the trains didn't make any noise and the people were silent too, I wouldn't really care."[16] This quote emphasizes the importance of silence or the absence of noise for some participants, even in situations or places that would probably be described as not tranquil. In most cases, however, the absence of noise was described merely as a contributing element that can enhance the perception of tranquility, but not as an essential requirement.

Combined visual factors

Participants also described tranquility in relation to visual impressions, which often combined natural scenery with personal interpretation and meaning. The view of the homeland was mentioned as a similar factor to the already described importance of having a nice view. Participants also brought up a variety of colors as a possible positive factor. They did not specify further whether this referred to natural features such as meadows or could also include man-made objects such as colorful architecture, for example.

Combined olfactory factors

Among the mixed human-natural factors, a participant mentioned "Wohlgerüche", which roughly translates as pleasant scents or fragrances. These referred to pleasant smells that could arise in any context and, unlike the natural olfactory factors described earlier, were not limited to natural settings but could also include, for example, the fresh scent of a bakery. While only briefly discussed as a positive influence here, the role of smells was, however, described more often in terms of disturbance, which is examined in greater detail in the sections on negative factors.

Combined multisensory factors

Tranquility was also portrayed as a multisensory experience, with visual, auditory, olfactory and tactile impressions often combined in particular settings. These accounts highlighted the interplay of natural and human elements in a space, creating situations where multiple senses were engaged simultaneously. Some accounts referred to specific moments in particular places, such as spending the night at a lake, watching the starry sky and experiencing the absence of anthropogenic disturbances like traffic noise. These activities could be complemented by the

presence of people whom participants know and have a personal relationship with. Nevertheless, isolation and solitude were again described as tranquility-enhancing factors. Participant A3 even stated that when hiking they avoid normal hiking trails: "[...] and as soon as a path appears, oh, I have to go in the other direction."[17] This quote emphasizes the often-needed and sought-after remoteness and absence of man-made infrastructure or places. Another participant described a situation in which they were in a small clearing shielded from outside influences and emphasized that sharing the moment with a close companion further reinforced the sense of tranquility. Such examples show that tranquility was often not tied to a single sense but emerged from the integration of multiple sensory impressions in which natural and human elements were intertwined.

4.2 Negative factors

The following section addresses the negative factors that participants associated with diminished tranquility. These factors primarily reflect anthropogenic influences, though some natural aspects were also mentioned. As an initial overview, Figure 4.2 presents a Mentimeter word cloud from FC I, which visualizes the most frequently named negative factors and thus highlights participants' immediate associations with sources of disturbance.

Figure 4.2: FC I: Mentimeter word cloud for negative factors.

4.2.1 Natural factors

It is striking that, in contrast to the numerous positive natural factors mentioned, there were way less negative aspects named. This imbalance itself underscores how strongly natural features were generally associated with calmness and restoration rather than disturbance. In the following sections, only those themes are presented in which natural elements were explicitly described in negative terms. Accordingly, the absence of a theme in this section indicates that no negative associations were coded for that natural factor.

Negative natural visual factors

Only a few visual aspects of the natural environment were described as detracting from tranquility. Some participants mentioned that uniform forests with trees of the same appearance were perceived as less calming, as they lacked the diversity and character that other landscapes offered. Similarly, a lack of openness of the landscape was described as less conducive to tranquility. While not mentioned frequently, these comments show that visual monotony or enclosure in natural settings could occasionally be experienced as negative.

Negative natural multisensory factors

These accounts clustered around weather and atmospheric extremes and disturbance of natural quality through certain animals or sparse vegetation. Participants described thunderstorms, changing weather conditions, and/or extreme heat or wind as possible disturbing factors. In contrast to the positive assessment of contact with animals, insects such as flies and mosquitoes were also mentioned several times as potentially disruptive. Especially Participant D2 felt very disturbed by this, which they also expressed: "Yes, you can lie in the most beautiful place, but then those damn flies, or mosquitoes too, come along. You can lie peacefully in bed, and then the mosquito comes."[18] In addition to these two topics, “no nature” was once again listed as negative without further description.

4.2.2 Anthropogenic factors

A similar trend could be observed here as well: more factors and aspects of purely anthropogenic origin that reduce tranquility were brought up in the discussion and written down.

Affective disturbances

Stress and time pressure were very often mentioned among the emotional factors/reactions and feelings that can prevent one from experiencing tranquility or make a place feel less tranquil. Participant C3 stated that "[...] when I am stressed, [...] then there is no tranquility."[19] These reactions may arise from different everyday life situations. Participants named work, exams, or even being stuck in traffic as potential triggers. A full schedule or deadlines were also explicitly mentioned on multiple occasions. In addition to stress, participants frequently brought up hecticness and uncertainty as factors that make it difficult to perceive a place or situation as tranquil. One participant, for example, wrote down “not knowing where you stand" in relation to their job, expressing insecurities that made them nervous and restless. Related to stress from work, overly high expectations also emerged as a potential disturbance. Stage fright was likewise mentioned as a disrupting feeling. All of the situations described can be linked to two statements that also appeared on sticky notes: “inner mood is not right” and “not ready to let go”. These accounts highlight that, according to participants, one’s emotional state and mood must be appropriate in order to experience tranquility.

In addition, social interactions in anthropogenic settings emerged as negative factors. Impatience, intolerance, and even aggression are terms that were explicitly mentioned. Participant F2 described a situation at the ski lift as follows: "Yes, if the people just can’t stand waiting. There are people who are already annoyed just by going skiing. I don’t understand that. You have a day off, the weather is nice. What does it matter if it takes longer?"[20]

Disruptive activities and events

Tranquility was reported to be negatively affected by a range of situations and events. Among these, road traffic was a recurring theme, with driving in congestion often associated with stress and irritation. Grocery shopping was another everyday activity perceived as disruptive, mainly due to the number of people and their restlessness. This connects closely to the emotional factors discussed earlier, where stress and agitation played a central role. Work and educational contexts, such as jobs, schools, or universities, were also identified as negative influences, although without further specification. In addition, some participants referred to exceptional situations, including attempted robberies or personal accidents, as particularly unsettling. The grazing of alpine pastures was described from two perspectives: one farmer highlighted the stress of moving animals to another pasture, while another participant mentioned deliberately avoiding such situations because they were perceived as non-tranquil.

Digital consumption and the associated constant availability also came up repeatedly, with participants regarding them as particularly disruptive to tranquility.

Negative anthropogenic auditory factors

Noise was by far the most frequently mentioned anthropogenic source of disturbance. Various potential sources of noise were brought up, ranging from traffic and construction work to more specific descriptions like children crying or leaf blowers. However, the most frequently cited sources of noise were motorized vehicles and traffic. Urban soundscapes were generally perceived and described as not tranquil. Participant C1 named anthropogenic noise as one of the most important factors for them for a place to be tranquil: "And specifically now, one concrete physical thing for me [for tranquility] is that it's not noisy. So no matter what kind of anthropogenic noise."[21]

Negative anthropogenic visual factors

Built-up areas dominated by concrete and high-rise buildings were generally perceived as negative, with uniform, grey, and sterile environments described as particularly disturbing. Participant C3 specifically described this as "run-of-the-mill architecture." When asked, they defined it as follows: "Yes, simply unimaginative neighborhoods, industrial architecture, a bit typical, just run-of-the-mill."[22] In general, infrastructure such as power lines, reservoirs, and metal structures were described by several participants as disruptive. Participant E3 expressed this feeling as follows: "I tried to think of any place where there is something made of metal, fences, masts, antennas, I tried to imagine any place where there is something like that, and yet it is quiet, and I can't think of any."[23]. Light of anthropogenic origin was also mentioned several times as a disruptive factor. Especially artificial and/or bright light was noted several times. Additionally, a participant noted that for them, a landscape or place that is too orderly is perceived as not tranquil. They named a strictly regulated parking lot as an example.

Negative anthropogenic olfactory factors

In this category, only one factor was explicitly mentioned, namely the presence of "unnatural smells." Participant A2 described such impressions as potentially disturbing: "Yes, totally, all kinds of smells, it could be food, it could be fumes. Anything that isn't natural and stuff

like that, it quickly starts to smell, like in the city or something."[24] This illustrates that natural scents were almost never framed negatively, whereas anthropogenic odors were readily associated with disturbance. More broadly, the data suggest a consistent pattern: natural qualities were commonly linked with tranquility, while artificial ones tended to be perceived as disruptive.

Negative anthropogenic multisensory factors

Compared to the positive dimensions, a significantly larger number of negative influences were categorized in the anthropogenic, multisensory domain. Participants consistently associated crowded places with a negative influence on the tranquility of a location, encompassing several disruptive factors such as noise, unpleasant smells, or a sense of confinement. This imbalance suggests that tranquility is particularly vulnerable to anthropogenic contexts in which visual, auditory, spatial, and social stressors accumulate simultaneously.

The factor that was by far the most frequently mentioned or written down in this section was "many people." However, many times it was not specified further why or in which situations this is perceived as disturbing. Participants also described that they actively chose times to visit certain places where fewer people are expected to be there. Referring to a popular recreation area, Participant D3 stated: "We all know that you have to time it right so that it's not completely overcrowded."[25] Related to overcrowding of places, (over)tourism was also brought up frequently. People complained about places, some of them in the canton of Glarus, which are very crowded and where these crowds of people are perceived as disruptive. Places associated with tourism and leisure, such as restaurants, resorts, or concerts, were also repeatedly mentioned as diminishing tranquility, either because the activity itself was disruptive or because the location was generally not perceived as tranquil. One participant further noted that the construction of new access roads can alter the character of previously tranquil places by attracting more visitors and tourists, ultimately reducing their sense of calm. The same applies to large cities, as there are already many people living there. Consequential factors arising from the presence of many people in one place were also explicitly mentioned several times. Multiple participants listed waste or litter left in nature as a negative factor. Similarly, lack of personal space was also emphasized. Participants reported that being in crowds of people with individuals who show little awareness of personal distance was stressful and disruptive. The combination of physical closeness, impatience of other persons at the same place was seen as another important way in which tranquility is diminished in anthropogenic contexts.

Another frequently discussed topic was traffic and its consequences, which participants experienced as disruptive in multiple sensory ways, including noise, exhaust fumes, and the constant visibility of cars, motorcycles, or aircraft in the landscape. Participants repeatedly mentioned motorized traffic as disruptive, encompassing a wider range of sources such as cars, motorcycles and air traffic, including airplanes and helicopters. One participant criticized situations with heavy traffic, including leisure-related traffic on weekends and so-called "Sunday drivers", who just drive around for fun, according to the participant. This unnecessary or aimless driving was likewise perceived as a nuisance, reinforcing the sense of busyness and disturbance in otherwise calm surroundings. Public transportation, such as trams or trains, was also mentioned, but less frequently.

The presence of construction sites and military personnel was noted as an occasional multisensory

disturbance. Both can impact a place or situation visually and audibly. For construction sites, one participant described the noise primarily as disturbing, but in further references, including those by the military, the disturbing aspect was not described in detail.

4.2.3 Combined natural–anthropogenic factors

Alongside the purely anthropogenic or natural influences, participants also described disturbances that arise from the interaction of human and natural factors. If no separate section is included for a given combination of factors, this indicates that no relevant influences were coded in that domain.

Negative combined auditory factors

Interestingly, two participants mentioned that they can also find places where nothing can be heard, too quiet. Participant A1 described an expedition to a very remote location where it was impossible to hear anything, and this silence was perceived as too extreme to rate the place positively in terms of tranquility. This stands in contrast to the frequently expressed desire for peace and quiet in tranquil places.

Negative combined visual factors

Another set of negative visual factors emerged at the intersection of human and natural influences, particularly in relation to cultivated areas. Some participants described managed forests and monocultures as visually monotonous and lacking diversity, in contrast to more natural or varied woodland, which was often mentioned as a positive factor.

One person also wrote down the term "pitch dark," which was not further specified, but probably goes in the same direction as the aforementioned absolute silence.

Negative combined olfactory factors

Another essential set of negative factors revolved around smells and air quality. Participants repeatedly mentioned unpleasant odors such as stench or stuffy air. Several times, they did not specify from where these odors emerge, however, if so, anthropogenic causes such as a person's body odor, the smell of food, or even exhaust fumes were mentioned. Since many statements remained unspecific and odors may also originate from natural sources such as animal excrement or decaying matter, this factor was categorized as lying at the interface between human and natural influences.

Negative combined multisensory factors

In addition to concrete sensory disturbances, participants also described factors that were harder to assign to a single domain but which nevertheless shaped the perception of tranquility in a multisensory way. Several participants mentioned referenced to danger and feelings of being uncanny. This reflects situations where visual, auditory and bodily impressions combine to produce an atmosphere of unease.

Participants also referred to places as sterile or not alive, stressing the absence of variety and sensory richness.

Finally, social and normative dimensions emerged in the form of rules and prohibitions, which were perceived as disrupting harmony. While these are not sensory stimuli in a narrow sense, they intersect with the multisensory experience of place by altering how people engage with their surroundings, blending the physical and the social into a combined source of disturbance.

4.3 Descriptions and perceptions of specific places

Although the participants were not asked directly in the focus groups but only afterwards, they nevertheless named some specific places that they considered (not) tranquil. Since there is a great fear, especially for the positively rated locations, that publicity could lead to a rush of visitors, the locations are not explicitly named but only described. However, these are not necessarily locations in the canton of Glarus. In line with the distinction applied in the previous chapter, the explicitly mentioned places can likewise be differentiated according to whether they represent predominantly natural settings or more urbanized environments. However, this does not necessarily align with the distinction between places perceived as tranquil and the ones that are not, as the following sections show. I will distinguish between places that are located in cities and those located in more remote, sparsely populated areas.

4.3.1 Urban locations

Participants described some places in cities as tranquil, even though these often do not exhibit the typical factors mentioned in the discussion. Examples are squares in bigger cities or restaurant backyards. Noticing the frequent comparison of "natural, tranquil" places and "unnatural, urban" places, Participant A1 stated: "Nevertheless, I would like to advocate for a particularly tranquil location, or even two, which are incredibly picturesque, beautiful, tiny, small places in the middle of a large city."[26] The places were described as so-called oases in the big city, where one can still find tranquility despite many disruptive factors due to their relative seclusion and also in combination with the architecture, which can trigger emotions according to participants. In contrast, certain urban locations, such as busy train stations, were perceived as overwhelming because of the constant background noise and numerous signals.

4.3.2 Nature-related tranquil locations

Typically, tranquil places were mentioned that combine characteristics such as location on a body of water, views and seclusion. Contact with animals was also described as a special factor in one location. Interestingly, a popular spot by a lake was described by two different participants as both, tranquil and not tranquil. The temporal component played a particularly important role here, as many more people visit this place in summer, and this is then perceived as disturbing by many. The phenomenon in which a place is perceived as tranquil because of its physical characteristics, such as its location, the presence of water, or a beautiful view, but where this perception is diminished by the inflow of visitors, was also described for three other specific locations and emerged as a recurring theme.

4.4 Concerns about publicity and the protection of tranquil places

As mentioned earlier, participants in the focus group, as well as individuals who were asked to participate, often expressed reservations and fears. The primary concern was that places described as tranquil or marked as such on a map would become known to a broader section of the population and then be visited more frequently. Specific examples were often cited where, according to respondents' own assessments, this phenomenon was already observable. Participant D1 stated: "Yes, exactly, the example of Place-A, which was once on social media, and then you have thousands of people who do everything, so what do you do with a place when you portray it as special, particularly in pictures? What does that do? That was my basic question."[27] Participant A3 expressed similar reservations about social media and its ability to quickly turn a place into a tourist attraction. These accounts show that several participants viewed tranquility as vulnerable to loss when places become more widely known and frequently visited.

4.5 Temporal dimensions of tranquility

When asked about the temporal dimension of tranquility, participants repeatedly emphasized that it is not a static quality but rather subject to temporal variation. These variations may be seasonal, such as during the holiday season or generally during a particular season, or they may occur over longer periods. Participant C2 noted: "But I think at the same time there are also places that are becoming less and less [...] Well, in Location-H2 there's always a lot going on, whether it's winter [...] In summer maybe a little more, um, so I think it depends on the place, what changes over the seasons, the week, the time of day."[28] The seasonal, recurring changes mentioned above mostly concerned the presence of other people, i.e., how many people are in a place at the same time and how this changes the perception of a place. The increase in crowds of people in typical tourist regions was also mentioned, which has risen in recent decades. Additionally, participants named natural causes, such as storms, but also anthropogenic interventions, such as the construction of an access road, as possible factors for changing the perception of tranquility in a place. The impact of the COVID-19 pandemic was also mentioned several times. Participants described the increased urge people felt during this period to go outside into nature and typically seek out tranquil places.

Taken together, these accounts illustrate that tranquility is inherently dynamic and temporal, varying across daily, seasonal and even decadal scales.

4.6 Practices of seeking tranquility

Most of the participants stated that they actively look for tranquil places or situations in their free time. However, participants frequently noted that such moments can be found at home, for instance in the garden, and emphasized that this quality is generally very prevalent in the canton of Glarus. Participant C2 said: "I think that's the beauty of Glarus: you don't have to search long. So you can really, whether it's there now, you can walk up here, and it will probably be rather quiet. [...] That makes it even harder for me to say whether I'm looking for something like that. Because I don't have to search."[29] However, most of the participants spoke of actively searching for it, mostly outdoors. Though some participants also mentioned that places where one goes to enjoy tranquility are not necessarily always tranquil, and that this often depends on

factors such as one's own inner mood, as already mentioned in previous sections. Overall, these accounts show that tranquility is experienced as both something to be actively sought out and as a quality that can be encountered in everyday surroundings, but always in a dynamic interplay with situational conditions and one's own state of mind.

The results presented in this chapter provide a detailed description of how residents of the canton of Glarus perceive tranquility and which factors shape it. These findings highlight the importance of various natural and anthropogenic influences and also reveal additional dimensions such as temporal variation and the search for tranquility. In the following chapter, these qualitative insights will be used to develop a spatial representation of tranquility. Specifically, the themes and factors identified in the focus groups are operationalized with corresponding spatial data and combined to depict the potential tranquility across the canton.

Chapter 5

Methodology GIS model

The GIS model developed in this study aims to translate the qualitative findings of the focus groups into measurable spatial data. While the participants' input provided a rich understanding of what constitutes tranquility for them, these perceptions need to be operationalized to assess and display them across space. This allows for comparison with explicit places where people actually experience tranquility.

A comparable approach has been employed in other tranquility mapping studies, where themes identified through public participation were systematically translated into spatial datasets and subsequently integrated into a composite index (Hewlett et al., 2017; Jackson et al., 2008). Building on this methodological precedent, this study applies a comparable framework, while in contrast to the other Swiss study from Leeb et al. (2020), adapting it to the geographical, cultural, and ecological circumstances of the study area.

In this context, a model is understood as an abstraction that approximates real-world conditions in a simplified form. It integrates various environmental and anthropogenic factors such as noise, visibility, or distance to infrastructure into a single spatial representation in a multicriteria decision analysis (MCDA), which is an often-used approach to evaluate solutions for spatial problems in various fields like ecology, planning, or natural hazard evaluation (Janke, 2010). The resulting tranquility model does not capture the full complexity of lived experience but provides a structured way to visualize and analyze the spatial distribution of tranquility-related conditions.

5.1 Factor selection and operationalization

The results from the focus groups revealed a broad range of factors that participants associated positively or negatively with tranquility. However, not all of these factors were operationalizable. Thus, I filtered them guided by the following criteria (similarly to Terradillos and Wilkinson (2015)):

1. Availability of spatial data: Only factors for which suitable datasets already existed could be included, since collecting new data would have been out of the scope of this thesis.
2. Relevance for the study area: Factors that do not occur in the canton of Glarus were not considered further.

3. Repetition across participants: To ensure that factors reflect more than just an individual opinion, only the ones mentioned more than once in the focus groups or among different participants were included.

Applying these criteria resulted in a subset of factors that could be meaningfully operationalized in GIS. For each of the selected factors, the following subsections describe the operationalization process, including the datasets used, the transformations applied, and the way each factor contributes to the tranquility model (overview in Table 5.1 and Table 5.2).

Table 5.1: Overview of positive factors selected for GIS operationalization

Factor	**Sensory perception**	**Data source**	**Analysis steps**
View	Visual	VisibilityMap© Switzerland (Lienhard & Binna, 2013)	Only rescaled and clipped
Lakes	Multisensory	swissTLMRegio	Visibility analysis, distance weighting
Streams	Multisensory	Flussordnungszahlen (VECTOR25, BAFU)	Visibility analysis, distance weighting
Forest	Multisensory	swissTLM3D	Visibility analysis, distance weighting
Remoteness	Multisensory	LABES Abgeschiedenheit (Kienast & Hunziker, 2022)	Only rescaled and clipped
Bird song	Auditory	Schweizer Brutvogelatlas (Knaus et al., 2018)	Smoothed and capped
Fresh air	Olfactory	Lack of air pollution caused by PM_{10}/$PM_{2.5}$/ozone/NO_2 (BAFU)	Combination to index
Starry sky	Visual	LABES 14 Licht (Kienast & Hunziker, 2022)	Only rescaled and clipped

5.2 GIS-based analysis steps

In the following sections, the main analysis steps used on the data are described. Analyses were conducted using R version 4.5.0 and QGIS version 3.34.11-Prizren. The R Markdown files containing the code are available on GitHub: https://github.com/faeberhard/TIGL.

5.2.1 Viewshed analysis

A viewshed analysis identifies areas that are visible from a given position on the surface of the earth for an observer. The method has been used in various fields such as archaeology and spatial planning (Petrasova et al., 2018). Several tools are available in contemporary GIS software and programming packages to perform viewshed analyses. For this study, I used the Visibility Analysis v1.9.2 plug-in in QGIS developed by Cuckovic (2016), chosen for its reliability, as it allows processes to be executed overnight or across multiple days without interruption.

Table 5.2: Overview of negative factors selected for GIS operationalization

Factor	**Sensory perception**	**Data source**	**Analysis steps**
Many people	Multisensory	Flickr photo locations	Adaptive KDE
Infrastructure and traffic	Visual	swissTLM3D, Arealstatistik	Visibility analysis, distance weighting
Noise	Auditory	Sachplan Infrastruktur Luftfahrt (BAZL), SonBase (BAFU)	Weighted combination of layers
Stench	Olfactory	swissTLM3D, Landwirtschaftliche Nutzung (Kanton GL)	Buffering, distance weighting
Urbanization	Visual	Arealstatistik	Visibility analysis, distance weighting

In contrast to conventional applications, where visibility is modeled from observer locations (e.g., people standing at viewpoints), here the analysis was conducted from the point of view of features themselves to identify the areas in which these features (e.g., infrastructure or land uses) are visible to an observer (inverse viewshed analysis, similar to Senaratne et al. (2013)).

The algorithm takes two main inputs:

- **Digital Elevation Model (DEM)**: A raster dataset representing the land surface elevation. In this case, the swissALTIRegio from swisstopo was used with a resolution of 10 m (swisstopo, 2023).
- **Viewpoints:** A point dataset representing the features from which visibility is calculated (e.g., forest areas). Each viewpoint is parameterized by specific attributes:
  - **Radius:** Defines the extent of the viewshed, i.e., how far visibility is analyzed.
  - **Observer height:** Represents the elevation of the observed feature; in this study, heights of features themselves were used, since visibility was assessed from or towards each raster cell.
  - **Feature height:** Represents the average person's height, here assumed to be 1.72 m.

The observer height (here, the height of the analyzed feature) varied across datasets and will be further described in the respective descriptions of the individual factors. Viewpoint lattices were generated for all lines and polygon data sets. Depending on the size of the features, the distances between the points varied between 50 and 200 m.

5.2.2 Decline of visual influence with distance

A central assumption of this study is that the influence of visible landscape features does not remain constant over space but diminishes with distance. While a lake, a forest or a settlement

may be clearly discernible in close proximity, their perceptual importance decreases with distance. This phenomenon has long been recognized in various fields, such as environmental psychology and landscape research, where visual salience, recognizability, and the perceived contribution of features to overall landscape quality are closely linked to viewing distance (Hull & Buhyoff, 1983; Tenerelli et al., 2017). Therefore, distance influences the human perception of the physical landscape and has to be incorporated as a factor in visibility-based components of the model.

To operationalize this principle, two types of distance decay functions were implemented: a linear and an exponential decline. I applied both approaches exclusively to raster cells identified as locations from which target features such as forests or buildings were visible to an observer. The resulting influence values were standardized to a range between 0 and 100 for comparability, as described below.

Linear decrease

The linear decrease function assumes that visual influence decreases at a constant rate with increasing distance. At the location of the feature (distance = 0 m), the influence is maximum (100) and it decreases proportionally until it reaches zero at a predefined maximum threshold (which varies depending on the factor and is defined by the radius parameter in the Viewshed tool). Beyond this threshold, features were considered irrelevant for perceived tranquility, and their corresponding cell values were set to 0.

Formally, the function can be expressed as:

$$f(d) = \max\left(0, 100 - (d/d_{\max}) \times 100\right)$$

where d is the distance from the feature and $d_{\max}$ is the maximum distance (radius parameter).

Linear functions are practical when the influence decreases evenly and an influence is to be modeled even at greater distances. This is particularly useful for larger, contiguous features that are still visible and recognizable from a greater distance. Another advantage is their simplicity and transparency, since linear functions are easy to parameterize and interpret, which facilitates communication of assumptions and results in applied contexts such as planning or policy.

Exponential decrease

In contrast, the exponential function assumes a steeper reduction in influence at short distances, followed by a more gradual decline at greater distances. This reflects empirical findings that nearby features tend to dominate human perception disproportionately, while more distant objects, though still visible, contribute much less to overall landscape perception (Scott et al., 2005). The function can be written as:

$$f(d) = e^{-\lambda d}$$

where λ is a rate parameter determining the steepness of the decline. At zero distance, influence equals 100 in the model, decreasing rapidly with increasing distance. For this study, various λ based on evidence from existing studies or on reasoned assumptions were used.

Visual perception is also strongly dependent on the size of the object. In the modeling of cultural ecosystem services and landscape aesthetics, distance functions are commonly applied to represent the declining influence of landscape elements with increasing distance. Among various approaches, such as linear or threshold-based functions, exponential decay is also applied (Cimburova & Blumentrath, 2022; Năstase et al., 2019). Table 5.3 shows all the layers where decay functions have been applied. The factors and why each method was chosen is described in the following sections.

All the following raster datasets were resampled to a uniform spatial resolution of 100 × 100 m using bilinear interpolation (unless otherwise stated), clipped to the study area extent and rescaled to 0 to 100 to ensure spatial comparability across analyses.

Table 5.3: Type of distance-decay function applied to layers with visibility analyses

Factor	**Influence**	**Decrease type**
Lakes	Positive	Linear
Streams	Positive	Exponential
Forest	Positive	Linear
Infrastructure / Traffic	Negative	Linear
Urbanization	Negative	Linear

5.3 Operationalization positive factors

5.3.1 View

The factor of view or outlook was mentioned several times in the focus groups. It was identified as a factor that can have a positive effect on the tranquility of a place. Often, no specific details were provided regarding what can be seen in this view. Therefore, I focus here on the fundamental quality of wideness, i.e., having the widest possible field of vision. This aligns with the study of Jackson et al. (2008) where they calculated for every cell the potential number of other cells that can be viewed from there. The higher the value, the greater the openness and, consequently, the perceived width of the field of view. In a Swiss context, in the study of Lienhard and Binna (2013), the visibility of landscape within a radius of 5 km was calculated for the whole country using a time-saving, innovative programming approach. The result was a grid with a resolution of 25 × 25 meters, indicating the percentage of visible area from each grid cell. Following the approach of Leeb et al. (2020), I use this dataset as a proxy for the positive factor "view".

In the modeling, I assume that this landscape quality cannot be experienced from grid cells covered by forest. Therefore, forested cells were assigned a value of 0, contributing no influence to the factor.

5.3.2 Lakes

Water bodies, specifically lakes, were frequently mentioned as landscape features that positively influenced participants' sense of tranquility. The perceptions were described as multisensory, with both visual and auditory qualities (sight and the sound of water) enhancing the experience. Previous studies have shown similar findings, emphasizing the auditory and visual potential of

water bodies in enhancing restorative effects and tranquility (Herzog & Bosley, 1992; Lai et al., 2024; Qi et al., 2021). In the model, lakes were operationalized through a visibility analysis, with their influence assumed to decline linearly with distance. This reflects the assumption that nearby lakes are experienced more intensely than those further away. As especially relatively large lakes like the Walensee can influence the landscape over long distances, the linear decline was chosen. Although this modeling step primarily captures the visual dimension, the use of distance decay also partially accounts for auditory perception, since closer locations are weighted more strongly.

For the visibility analysis, the lake polygons from the dataset swissTLMregio were used, as this provides a higher level of generalization than the swissTLM3D, which also includes smaller bodies of water in the Alps that even remain dry in summer (swisstopo, 2024a, 2024b). To account for the far-reaching influence of comparatively large lakes, a maximum radius of 15 km was defined for the visibility analysis. This threshold may exceed the perceptual range of smaller lakes but visibility in the highly mountainous study area is in practice often restricted at much shorter distances. Again, cells located within forests were excluded from the analysis and set to a value of 0.

5.3.3 Streams

Both auditory and visual influences were associated with streams, which participants described as having a positive effect on tranquility. The sound of water in particular was highlighted repeatedly in the discussions. To model this factor, I conducted a visibility analysis based on the "Flussordnungszahlen" dataset (BAFU, 2014), which is derived from the VECTOR25 dataset and represents most streams with their corresponding Strahler order for each stream segment. This number indicates the hierarchical position of a stream segment within the drainage network. Headwater channels are assigned order 1, and when two streams of the same order converge, the downstream segment increases by one order (Strahler, 1957). Therefore, higher Strahler numbers correspond to larger streams with greater discharge, which I assume to be associated with stronger auditory and visual influence. Based on this classification, the visibility raster was weighted using an exponential distance-decay function, with each Strahler order assigned a distinct λ value.

Table 5.4: Exponential distance-decay parameters for streams by Strahler order. Half-influence distances are calculated as $d_{1/2} = \frac{\ln(2)}{\lambda} \times 100$, and influence was truncated to zero beyond 6 km.

Strahler order	λ (per 100 m)	**Half influence (m)**	**Zero influence (m)**
1	0.20	347	6000
2	0.16	433	6000
3	0.12	578	6000
4	0.09	770	6000
5	0.05	1386	6000
6	0.035	1980	6000
7	0.02	3470	6000

Here as well, the resulting visibility raster was clipped using forest polygons to reflect the limited visibility within forests. However, cells through which a stream flows were retained, as streams may still exert auditory and/or visual influence even within forested areas.

5.3.4 Forest

Forest was repeatedly described as a positive factor, with participants often explicitly emphasizing the experience of being within a forest and enjoying impressions such as its smell and silence. Numerous other studies have pointed out the psychological and emotional benefits of spending time in forested areas (Haluza et al., 2025; Shin et al., 2010; Wei et al., 2020). Forest was also modeled in the other comparable studies as a positive factor (Jackson et al., 2008; Terradillos & Wilkinson, 2015). To represent this factor, a visibility analysis was performed using forest polygons from the swissTLM3D dataset (tlm_bb_bodenbedeckung, objektart = "Wald") (swisstopo, 2024a). According to statistics, the forest in the canton is composed as follows (Naturzentrum Glarnerland, n.d.):

Table 5.5: Composition of forests in the canton of Glarus

Species	**Proportion (%)**	**Typical Height (m)**	**Source**
Spruce	48	30–60	European Commission, Joint Research Centre (n.d.-b)
Beech	31	30–40	European Commission, Joint Research Centre (n.d.-a)
Maple	7	25–35	Université de Fribourg, Jardin Botanique (2018)
Fir	5	25–60	Fachstelle für Gebirgswaldpflege (2000)

Based on the species-specific heights and their relative proportions (Table 5.5), the weighted mean tree height for the study area was calculated at approximately 36.7 m. This value was used as the observer height in the visibility analysis. Since extensive patterns and features such as forests remain visible and recognizable over longer distances, a radius of 10 km was chosen (Hill et al., 2001). I assumed that, similar to lakes, there is still a relevant visual influence even at greater distances, and thus modeled the decrease with distance linearly.

In addition, all grid cells located within forest polygons were assigned the maximum value. This reflects the repeated emphasis by participants on the experiential qualities of being inside forests and acknowledges that sensory influences, particularly olfactory ones, are strongest in these locations.

5.3.5 Remoteness

Remoteness was frequently highlighted by participants as an important dimension of tranquility, often linked to the absence of people or visible signs of human activity. The concept has previously been modeled as an inverse function of accessibility, i.e., how easy or, above all, how quickly one can get to a place from populated areas (Carver et al., 2012). Radford et al. (2019) calculated remoteness for the whole of Switzerland to include it as a component of a wilderness index. Their approach modeled travel time to each pixel in the study area from cells with more than 15 inhabitants. Natural barriers such as steep slopes, rivers, large lakes and glaciers were taken

into account, and travel speeds were differentiated by land cover and slope. For the detailed parameters and calculation method, see Moos et al. (2022). This approach provides a spatially explicit proxy for remoteness by integrating both natural barriers and infrastructural conditions into travel-time estimates.

In my study, I used the remoteness dataset from the Swiss Landscape Monitoring Program (LABES) (Kienast & Hunziker, 2022). Specifically, the raster "remoteness_labes_2020_distance_mins", which indicates the travel time in minutes from a cell with at least 15 inhabitants to the target cell. The absolute values were normalized to a 0–100 scale, with 100 representing the maximum travel time, reflecting the assumption that greater remoteness corresponds to higher tranquility.

5.3.6 Bird song

Natural sounds, particularly animal calls, were also repeatedly identified by participants as positive factors contributing to tranquility. The chirping of birds was mentioned particularly often. Bird song has also been considered in previous studies, including the English studies by Jackson et al. (2008) and Terradillos and Wilkinson (2015), as well as the Swiss study by Leeb et al. (2020).

To model the potential presence of bird song, previous studies often relied on an indirect approach, assuming that natural sounds are more likely to be audible where anthropogenic noise is low (Jackson et al., 2008; Leeb et al., 2020). In those cases noise indices were primarily based on traffic sources such as road, rail, and air transport.

In contrast, this study employed a direct approach. The Swiss Ornithological Institute in Sempach recently published an atlas of breeding birds (Knaus et al., 2018). In that project, species distribution models were developed that estimate the number of territories per square kilometer for common bird species in Switzerland. Upon request, the Institute kindly provided a dataset that aggregates these modeled densities for all songbird species in the canton of Glarus. The resulting grid represents the estimated number of territories per square kilometer and was used here as a proxy for the likelihood of bird song presence.

To prepare the dataset, several processing steps were applied. First, to reduce the influence of outliers, values were capped at the 95th percentile. The raster was then resampled to a 100 $\times$ 100 m resolution using nearest-neighbor interpolation, which preserves the original distribution of territories. Because bird territories are not confined to discrete cells and bird presence can extend into neighboring areas, the data was subsequently smoothed with a Gaussian kernel of 150 m radius. This procedure is methodologically comparable to the kernel smoothing step described by Hengl et al. (2009), who likewise used Gaussian kernels to transform occurrence-only species records into continuous density surfaces. This smoothing reduced the block-like appearance of the grid and accounted for the spatial spread of bird activity. Finally, to further prevent disproportionate weighting from unusually high values, the 95th-percentile cap was also applied after smoothing.

5.3.7 Fresh air

The quality and smell of the air were mentioned repeatedly in the focus groups. Participants often referred to “fresh air,” though without providing precise definitions. In some cases, they distinguished between natural and unnatural smells, perceiving the natural odors generally as positive and artificial or anthropogenic ones as negative. In both English studies, fresh air was also noted by participants but could not be operationalized due to time constraints or lack of suitable data (Jackson et al., 2008; Terradillos & Wilkinson, 2015).

In this study, aligning with participants' notions, “fresh air” was interpreted as air free from anthropogenic pollutants. Accordingly, the factor was operationalized using Swiss national air quality data provided by the Federal Office for the Environment (FOEN). Available data covers concentrations of nitrogen dioxide (NO_2), particulate matter ($PM_{2.5}$ and PM_{10}), and ozone (O_3).

Initially, I considered applying established thresholds such as the WHO air quality guidelines or the Swiss legal limits ("Luftreinhalteverordnung") to classify pollutant concentrations (Bundesrat, 1986; WHO, 2021). However, when tested on the Glarus dataset, this approach produced an almost binary classification: most areas were either “very favorable” or “very unfavorable.” This resulted from the fact that nearly all $PM_{2.5}$, PM_{10} and NO_2 concentrations fall below the legal thresholds, while ozone values are consistently above them, thus masking local variation.

Since the aim was not to evaluate compliance with health standards but rather to capture relative differences within the canton, I implemented a relative, linear rescaling of the summed absolute pollutant concentrations. This method assumes that lower concentrations correspond to fresher, cleaner air, allowing spatial contrasts to emerge, for example, between remote mountainous regions and locations near highways. Such differentiation better reflects how participants are likely to perceive variations in air quality.

5.3.8 Starry sky

Several participants perceived a visible starry sky as a positive factor. This aspect was also highlighted in two studies involving public consultation (Hewlett et al., 2017; Jackson et al., 2008), and was even incorporated into modeling in studies without direct consultation, such as the one of Pafi et al. (2020). The possibility of observing a starry sky depends strongly on the level of light pollution at a location that would otherwise be dark (Feathers, 2022; Varela Perez, 2023).

For this purpose, I used data from the Swiss Landscape Monitoring Program (LABES). For the indicator “light,” the authors analyzed satellite data to evaluate how much radiance is emitted from the Earth into space at night (Kienast & Hunziker, 2022). Typically, more populated areas emit higher levels of radiance, while remote areas without artificial lighting are less affected.

Following the approach of Leeb et al. (2020), the LABES dataset was rescaled to a 0-100 scale, with 100 representing locations with the lowest light emissions and the highest possibility to see stars, reflecting their positive contribution to the perception of tranquility.

5.4 Negative factors

5.4.1 Human presence

The most frequently mentioned factor that can negatively affect the tranquility of a place was the presence of (many) other people. This aspect was also included in Jackson et al. (2008), where the factor “seeing lots of people” was operationalized using settlement data, road networks, and points of interest (POIs) as proxies for human presence. These datasets were aggregated and reclassified, with higher values assigned to urban areas, longer road segments and greater numbers of POIs to indicate a higher likelihood of encountering people. In the study by Terradillos and Wilkinson (2015), remarks such as "few/many people" from the participatory sessions were summarized under the factor remoteness and modeled using data on open-access areas, roads, and tourist sites. However, the exact workflow was not specified. Similarly, Leeb et al. (2020) used a combination of population density and inverted remoteness rasters representing travel times to reach a destination.

While remoteness may suggest a lower probability of encountering people, this is not always the case. Remote locations that are popular tourist hotspots, for example, may have high human presence despite their relative inaccessibility. For this reason, modeling actual presence using social media data can provide a more nuanced and direct representation of where and when people are present. This approach has been widely applied in research to estimate visitor numbers and behaviors (Domènech et al., 2020; Wood et al., 2013; Yang et al., 2017).

In this study, I used geotagged photos from Flickr, accessed through the Flickr API (https://api.flickr.com/services/rest/) using an API key in R. The database was filtered for photographs located within the canton of Glarus using a specified bounding box. No time restrictions were imposed, the only criterion was that photos had to contain a geotag. Since this is user-generated content, quality control and filtering were necessary (Hollenstein & Purves, 2010). In particular, the goal was to remove bulk uploads by the same person, which could overrepresent specific locations in terms of uploaded photo counts (Wartmann & Mackaness, 2020). To address this, uploads per user were limited to one photo per hour, with additional images removed. After this filtering and clipping to the cantonal boundary with a 5 km buffer to account for edge effects, 1,019 of the original 17,200 photos remained.

To generate a continuous surface of human presence, I implemented an adaptive kernel density estimation (KDE) following the approach of Abramson (1982). The filtered Flickr points were first transformed into a point pattern object within the buffered canton boundary. The pilot bandwidth was selected using Diggle’s cross-validation method via `bw.diggle()` in R, which chooses the bandwidth minimizing a rescaled mean squared error criterion incorporating mean intensity and pair correlation (Diggle, 1985). Based on this pilot intensity, local bandwidths were scaled inversely to the square root of the estimated density, resulting in narrower kernels in dense clusters and broader kernels in sparse areas. This adaptive KDE reduces bias from popular hotspots while still retaining meaningful human presence estimates in less frequented locations. The resulting raster was then capped at the 99th percentile to avoid distortions caused by extreme hotspots.

5.4.2 Infrastructure, traffic (visual)

Participants repeatedly described the influence of traffic and infrastructure as disturbing. The type of impact, however, was not always explicitly clear. For instance, when the terms "traffic" or "cars" were mentioned, it was often ambiguous whether participants referred to visual or auditory disturbances, whereas in the case of power poles, the disruptive impact is most likely visual rather than auditory. Nevertheless, it was assumed that roads and railways are also perceived as visually disruptive, since they represent infrastructure.

For modeling, only those factors explicitly mentioned by participants were included under the category “infrastructure.” An overview of the factors, corresponding swissTLM3D layers, and parameters used in the visibility analyses is provided in Table 5.6.

In line with Jackson et al. (2008), who based their maximum visibility distances on Benson et al. (2002) concerning wind turbine visibility, a radius of 6 km was applied for objects smaller than 25 m, and 15 km for taller features.

The different infrastructure elements were further differentiated by assigning weights $\in [0, 1]$ that reflect their relative visual prominence and the extent to which they were perceived as disturbing in the focus groups. The highest weight (1.0) was assigned to highways and major roads (Autobahn, Autostrasse), as participants repeatedly emphasized traffic as a key source of disturbance, and these features were both visually dominant and associated with movement. Slightly lower weights were given to medium-sized roads (10/8/6 m: 0.7) and narrower roads (4/3 m: 0.4) in order to reflect their comparatively reduced size and traffic volume.

Railways were weighted at 0.7, similar to medium-sized roads, since they were mentioned much less frequently than roads, but still represent a linear infrastructure feature with considerable visibility, especially if there is a train coming through. Power lines were assigned a high weight of 0.9, as pylons and overhead lines can be visually intrusive even at greater distances and were explicitly mentioned multiple times as disturbing in the discussions. Utility buildings, in this case consisting of antennas ("Antenne gross" in the TLM layer), were weighted lower (0.6), since they are comparatively smaller than pylons and less intrusive. Dams, weirs, and traffic areas, such as airfields or parking areas, were assigned a weight of 0.4 to reflect their explicit mentions in the groups, but they are assumed to have less influence due to the lack of horizontal height.

This weighting scheme ensures that the aggregated infrastructure layer reflects both the physical visibility of the features and the relative importance attributed to them in the focus groups, while maintaining comparability across different types of infrastructure.

Table 5.6: Overview of infrastructure-related factors, data sources, parameters for the visibility analysis, and assigned weights used in the tranquility model

Factor	**Layer name (`swissTLM3D`)**	**Parameters (Viewshed)**	**Weight in infrastructure layer**
Roads (Autobahn/Autostrasse)	`tlm_strasse`: filtered for Autobahn, Autostrasse	Viewpoint spacing: 50 m Observer height: 4 m (maximum truck height) Radius: 6000 m	1.0
Roads (10/8/6 m)	`tlm_strasse`: filtered for 10/8/6 m roads	Viewpoint spacing: 50 m Observer height: 4 m Radius: 6000 m	0.7
Roads (4/3 m)	`tlm_strasse`: filtered for 4/3 m roads	Viewpoint spacing: 50 m Observer height: 4 m Radius: 6000 m	0.4
Railways	`tlm_oev_eisenbahn`	Viewpoint spacing: 50 m Observer height: 4.5 m (maximum train height) Radius: 6000 m	0.7
Power lines	`tlm_bauten_leitung`	Viewpoint spacing: 50 m Observer height: 31 m (average pylon height) Radius: 15000 m	0.9
Dams and weirs	`tlm_bauten_staubaute`: filtered for "Staumauer", "Staudamm", "Wehr"	Viewpoint spacing: 50 m (at least one per feature) Observer height: 0 m Radius: 6000 m	0.4

Continued on next page

Table 5.6 — continued

Factor	**Layer name (`swissTLM3D`)**	**Parameters (Viewshed)**	**Weight in infrastructure layer**
Utility buildings (antennas)	`tlm_bauten_versorgungsbaute_pkt`: filtered for "Antenne gross"	Viewpoint spacing: n/a (point features) Observer height: 25 m Radius: 15000 m	0.6
Traffic areas (airfields, parking areas)	`tlm_areale_verkehrsareal`	Viewpoint spacing: 50 m (at least one per feature) Observer height: 0 m Radius: 6000 m	0.4

5.4.3 Noise

Noise from anthropogenic sources was very frequently mentioned as a disruptive factor by participants. Where specified, traffic noise of various kinds (cars, public transport, airplanes) was most often referred to. Participants also referred to other sources of noise, including construction sites as well as specific sounds like shouting or children playing. In existing studies, noise has typically been operationalized by combining data on road, rail, aircraft and military noise (Jackson et al., 2008; Leeb et al., 2020). Terradillos and Wilkinson (2015) additionally incorporated quarries, water sports and fairground noise into their model.

In line with the infrastructure factor, only sources explicitly mentioned by participants were operationalized here. These were road noise, railway noise and aircraft noise. For construction sites, only data for the municipality of Glarus was available so it was not included and the other named factors were not operationalizable. Data on road and railway noise were obtained from the SonBASE project, Switzerland's national noise monitoring program (BAFU, 2025). The raster datasets report noise levels around roads and railways at a height of 4 m in dB(A), a unit of measurement for sound pressure level that reflects perceived loudness by the human ear (BAFU, 2025). Noise registers are also available for Swiss airports, compiled by the Federal Office of Civil Aviation (BAZL). However, as there is no SonBASE register for Mollis Airport available, the "Sachplan Verkehr, Teil Infrastruktur Luftfahrt (SIL)" dataset was used, which delineates a binary noise-affected perimeter without gradation in A-weighted decibels (dB(A)) (BAZL, 2024).

The Federal Office for the Environment (FOEN) defines different dB(A) thresholds depending on sensitivity levels and legal limits. In line with FOEN guidelines, which set an emission limit of 55 dB(A) for ensuring recreational quality during the day, this value was used as a threshold. All cells above 55 dB(A) were assigned the maximum disturbance value (100), while values below were reclassified into graduated intervals to reflect decreasing disturbance with lower noise exposure. Table 5.7 shows the reclassification scheme applied to the railway and road noise rasters.

Table 5.7: Reclassification of sound pressure levels (dB(A)) into the tranquility index, with examples and sources

Noise level dB(A)	**Reclassified value (0–100 scale)**	**Examples**	**Source Examples**
< 25	0 (very tranquil)	Quiet bedroom at night	BAFU (2023)
25–35	0–25 (tranquil)	Quiet rural environment	WHO (2018)
35–45	25–50 (quiet but noticeable)	Library, quiet residential area	WHO (2018)
45–55	50–75 (clearly perceptible)	Normal conversation	BAFU (2023)
> 55	100 (not tranquil)	Traffic, construction work	BAFU (2023)

Both the road and railway noise rasters were reclassified according to this scheme. Following Jackson et al. (2008) and Leeb et al. (2020), the maximum value occurring in a cell was used as the

cell value. Aggregation was avoided, as it is unlikely that all noise sources would simultaneously reach their maximum within the same cell (Leeb et al., 2020). For Mollis Airport, only the binary SIL perimeter was available. This was rasterized and included as an additive factor, with a fixed penalty of 30 on the 0-100 scale. This penalty reflects the relatively frequent mention of aircraft noise in the focus groups, though less often than road traffic. The penalty ensures that areas within the SIL perimeter are clearly distinguished as less tranquil, while still remaining comparable with road and rail noise effects.

The three input layers (road, rail, and aviation noise) were finally combined into a single raster, where higher values indicate stronger noise disturbance and thus lower tranquility.

5.4.4 Stench

Unpleasant odors were repeatedly identified in the focus group discussions as a potential source of disturbance. However, participants did not specify in detail which particular smells they considered disturbing. In the study by Jackson et al. (2008), participants primarily referred to pleasant odors, such as the smell of freshly mown grass or clean air, but also mentioned unpleasant odors, including exhaust fumes or generally "unnatural" smells. Nevertheless, the factor was not operationalized in their model because there was no suitable data available. Terradillos and Wilkinson (2015) likewise reported that people often perceived odors of human origin, such as those from garbage, railways, or meat processing plants, as unpleasant. These were either not converted into a spatial proxy due to a lack of suitable data or time, or were instead subsumed under other factors such as remoteness or railway noise.

In this study, stench was operationalized as a single factor by identifying potential sources of unpleasant odors. Specifically, three types of facilities were included: wastewater treatment plants, farms and waste incineration plants. These facilities were chosen because they are identified in previous research as potential sources of odour and are also subject to spatial regulations owing to their odour-emitting potential (BUWAL, 2005; Farahani et al., 2023; Guo et al., 2017). Their inclusion does not imply that all facilities continuously generate strong odors, but instead acknowledges that such facilities are monitored and regulated precisely because odor emissions can occur under certain conditions.

This approach aligns with findings from other studies emphasizing the importance of mapping “olfactory landscapes” to understand the sensory dimensions of environments. For example, Farahani et al. (2023) used machine learning and GIS to model olfactory perceptions in Tehran, showing that proximity to livestock and poultry farms, garbage volumes and wastewater plants were among the strongest predictors of odor complaints. Similarly, Guo et al. (2017) analyzed emissions from municipal solid waste treatment and disposal facilities in eastern China, demonstrating that incineration plants, transfer stations and landfills all contributed to odor pollution. By analogy, this study focuses on spatially identifiable facilities that have been shown in prior research or regulations to be associated with odor issues.

For operationalization, the locations of wastewater treatment plants, waste incineration plants and agricultural holdings were obtained from cantonal or national datasets (see Table 5.8). Each facility type was buffered to represent its potential odor influence zone. No Swiss regulations specifying buffer distances were found for waste incineration or wastewater treatment plants. The Arkansas Department of Health (2018) recommends a minimum buffer of 300 feet (91 m)

for wastewater treatment plants, though this appears conservative, while Zhou et al. (2022) suggest a minimum distance of 300 m. Therefore, 300 m was applied here.

Buffer distances recommended for waste processing and disposal plants typically range from 100 m to 500 m in national guidelines (Central Pollution Control Board, 2017). For this study, an intermediate value of 300 m was applied for waste processing facilities. For agricultural businesses, Swiss guidelines specify detailed formulas depending on farm size, animal type, ventilation, and other parameters (BUWAL, 2005). Since these details were unavailable in the dataset used, a buffer of 150 m was assumed, corresponding to an example calculation for a farm with 150 pigs and 5,000 chickens in BUWAL (2005).

To represent the decline of odor influence with distance more realistically, an exponential decay function was applied at a finer spatial resolution. This choice reflects evidence from atmospheric dispersion modeling, where odour intensity decreases rapidly close to the source and then tails off with distance. Invernizzi et al. (2020) show that dispersion models incorporate exponential attenuation functions to capture this nonlinear dilution effect, which aligns well with how odours are perceived spatially.

First, the 100 m template raster was disaggregated to 10 m grid cells, and the buffered facilities were rasterized onto this high-resolution grid. Distances from the source cells were then calculated, and the exponential decay function

$$I(d) = e^{-\lambda d}$$

was applied, with half-distances of 75 m for agricultural holdings and 150 m for wastewater treatment and incineration sites. This procedure ensured a smooth and spatially precise representation of influence gradients around odor sources. The resulting high-resolution rasters were subsequently aggregated back to 100 m by averaging the values of the 10 m cells, ensuring alignment with the overall model resolution and maintaining comparability across factors. This approach aligns with earlier GIS-based odor modeling efforts, such as the use of interpolation and kriging methods to represent odor dispersion patterns around waste processing facilities (Sowka et al., 2017), and with studies that combined sensory field measurements with spatial GIS analyses to delineate potential emission sources and gradients through buffer-based modeling (Wojnarowska et al., 2021).

5.4.5 Urbanization (visual)

Participants identified the visibility of urbanization and built-up areas as a negative influence on the tranquility of a place. This factor was also mentioned in the two English studies (Jackson et al., 2008; Terradillos & Wilkinson, 2015), where it was modeled either as the visibility of urban areas or by applying a 1 km buffer around built-up areas to represent zones of reduced tranquility. In these prior studies, a distinction between towns/cities and villages or scattered houses was typically made using population thresholds. For example, Jackson et al. (2008) applied a cut-off of 10,000 inhabitants to delineate towns and cities, an approach also adopted in the Swiss study by Leeb et al. (2020), which used the Arealstatistik classes "Industrie- und Gewerbeareal" and "Gebäudeareal" together with population density data to differentiate villages from cities.

Table 5.8: Overview of odor-related factors and applied buffer distances

Factor	**Data source**	**Buffer distance**	**Buffer source**
Agriculture (farms)	Landwirtschaftliche Nutzung (Layer: pub_ch_lw_nutzung) (Kanton Glarus, Abteilung Landwirtschaft (DVI), 2021)	150 m	BUWAL (2005)
Wastewater treatment plants	swissTLM3D, layer: tlm_areale_nutzungsareal filtered for "Abwasserreinigungsareal" (swisstopo, 2024a)	300 m	No legal Swiss regulation; Arkansas Department of Health (2018) and Zhou et al. (2022)
Waste incineration plants	swissTLM3D, layer: tlm_areale_nutzungsareal filtered for "Kehrichtverbrennungsareal" (swisstopo, 2024a)	300 m	No legal Swiss regulation; Central Pollution Control Board (2017)

However, settlements are much smaller in the case of Glarus, with a maximum of around 6,000 inhabitants per village when considered individually rather than aggregated across the three municipalities (Gemeinde Glarus, 2025). Therefore, a more context-sensitive approach was adopted: urbanization and built-up areas were defined directly from land-use data rather than applying population thresholds. This reflects the predominantly rural character of the canton, with only small urban centers, while still capturing the visual disturbance associated with settlement structures of any size.

For operationalization, the Arealstatistik (BFS, 2023) was filtered for the classes "Industrie- und Gewerbeareal" and "Gebäudeareal" (categories 1 and 2 in the AS_17 classification). These were used as proxies for built-up areas. Following the approach of Leeb et al. (2020), only cells with at least two neighboring points belonging to the same categories were retained. These were transformed into viewpoints with an observer height of 7 m, corresponding to the average building height in the canton (Fachstelle Geoinformation Kanton Glarus, 2021). A radius of 10 km was applied, following Scott et al. (2005), who found that clusters of buildings remain visually discernible up to this distance. The decline in influence was modeled linearly, as built-up areas, particularly clusters of larger settlements, can still affect the landscape from considerable distances, for example, when visible from mountain peaks.

5.5 Weighting and combination of the factors

To describe the importance of the factors in relation to each other and to weight them accordingly, an Analytical Hierarchy Process (AHP) was carried out based on the results of a survey of residents. The survey was implemented online using LimeSurvey and distributed via personal contacts, social media and flyers in public places, resulting in 40 responses in total. The purpose was not to achieve demographic representativeness but rather to elicit relative weights for the tranquility factors that had been identified in the focus groups. The only conditions for participation were being of legal age and residing in the canton of Glarus.

5.5.1 Analytical Hierarchy Process (AHP)

The Analytic Hierarchy Process (AHP) is a widely applied multi-criteria decision-making method particularly suited to situations where both qualitative and quantitative information must be integrated into a structured evaluation (Saaty, 1977, 2008; Zahedi, 1986). Its strength lies in deriving weights for multiple, potentially heterogeneous criteria, especially when there is no apparent relationship between them (Ara et al., 2025). AHP is based on pairwise comparisons of criteria, which improves reliability compared to direct weight assignments as participants only need to assess the relative importance between two criteria at a time (Torfi et al., 2010).

The AHP procedure generally follows four steps. First, a decision hierarchy is defined with the overarching goal at the top level (in this study, the tranquility index) and criteria or sub-criteria at lower levels (the positive and negative factors) (Saaty, 1977, 2008; Zahedi, 1986). Second, pairwise comparisons of these criteria are carried out to assess their relative importance. In this study, this was done through a survey with residents of the canton of Glarus. Third, the resulting comparison matrices are processed to derive relative weights. Finally, these weights are aggregated to obtain a consistent set of factor weights that can be applied to a spatial model (Zahedi, 1986).

Pairwise comparison survey design

The factors were divided into positive and negative. Participants were asked to evaluate the factors by comparing them pairwise following the AHP (example question in Figure 5.1). In each case, two criteria were presented side by side and respondents indicated which one they considered more important and to what extent.

Figure 5.1: Sample question, comparison of forests and water bodies

Evaluation of the survey and calculation of weights

The evaluation was performed using a modified version of the R script from the study by Kunz et al. (2025). The analysis is based on the R package `ahpsurvey` (Cho, 2019).

For each participant, the pairwise comparison data were transformed into reciprocal pairwise

comparison matrices (PCMs). In the matrices, each of the seven positive factors was compared with every other positive factor, resulting in an $n \times n$ matrix where n is the number of criteria. The same was done for the four negative factors. The diagonal elements were set to 1, and reciprocal values were assigned so that if factor P_i was judged as more important than P_j, the matrix entry a_{ij} took a value from 1 to 9, while the opposite comparison was recorded as the reciprocal $a_{ji} = 1/a_{ij}$. This structure ensures internal consistency and allows for the derivation of relative importance values across all factors.

The responses were processed using the eigenvalue method, which yielded individual weight vectors and enabled the computation of consistency ratios. To obtain the final group weights for the spatial model, I applied the Aggregation of Individual Priorities (AIP) approach, which is more appropriate when individual heterogeneity matters (e.g., participatory settings) (Escobar & Moreno-Jiménez, 2007). In this procedure, individual preference weights are first calculated for each participant and then aggregated across respondents using the geometric mean. The geometric mean preserves reciprocity, fairness, and consistency across individuals, reflecting the setting of a participatory study where each respondent's input should be treated equally. It also reduces the influence of outliers or inconsistencies and is mathematically consistent with the reciprocal property of pairwise comparisons (Forman & Peniwati, 1998).

AIP was chosen over the alternative Aggregation of Individual Judgments (AIJ) because it ensures that each respondent's preferences contribute equally to the final group weights, which is again suitable in a participatory, survey-based setting with non-experts such as this (Saaty & Vargas, 2012). In contrast, AIJ aggregates the pairwise judgments of all respondents into a single group comparison matrix, which is then treated as if it represented the view of a single "collective" decision maker (Forman & Peniwati, 1998). While this approach is often used in expert panels where consensus is expected or strived for, it can distort the diversity of individual perspectives in broader participatory contexts.

Consistency analysis

An important aspect of the AHP is the evaluation of the consistency of participants' pairwise comparison matrices (PCMs). Since AHP relies on human and, in my case, non-expert judgments, inconsistencies are common and can undermine the reliability of the resulting weights if left unchecked (Saaty, 1987). The consistency Ratio (CR) is used to assess whether judgments are acceptably coherent by comparing the observed consistency index (CI) with a value derived from random matrices (Saaty & Vargas, 2012). Values of CR below or equal to 0.1 are generally considered acceptable in expert applications (Aguarón & Moreno-Jiménez, 2003). However, it has been recognized in other studies that this is just a guiding value and other, higher values, up to 0.26, have also been used in other participatory studies (Nilsson et al., 2016; Schmidt et al., 2016). In this study, I will use a loose value of 0.3. This decision reflects the exploratory and participatory character of the research, where the aim is not to produce exact decision-support weights but to capture relative preferences among tranquility factors.

While all CR values were computed and reported for transparency reasons, no corrective measures (e.g., exclusion of inconsistent responses or transformation of inconsistent PCM's) were applied in the subsequent aggregation of weights. This choice was made to respect time constraints and to retain the full diversity of participants' input.

5.6 Indicator aggregation

After operationalization of the individual indicators of perceived tranquility and conversion into raster form, the next step was their aggregation into a composite index. Spatial raster overlay using weighted linear combination is a typical method to combine various layers of data and was also used in the studies of Jackson et al. (2008) and Leeb et al. (2020). The goal of this step was to consistently integrate the diverse spatial factors so that the criteria defined in the focus groups could be translated into a spatially continuous model of potential tranquility.

In a first step, all positive factors were aggregated into a composite positive tranquility index. Similarly, all negative indicators were combined into a composite negative tranquility index by inverting their values to reflect their opposite effect on tranquility. In both groups, individual raster layers were weighted according to their AHP-derived importance, and the weights were normalized within each group to ensure comparability.

In a second step, the two sub-indices were combined with equal weight to generate the final tranquility index, resulting in a spatially continuous representation of tranquility across the canton of Glarus. This decision is based on the assumption that positive and negative influences contribute equally to the overall outcome. In addition, both sub-indices were saved separately to be able to view and compare the two resulting indices of positive and negative drivers of tranquility.

The final index is computed using the following formula:

$$TI = \sum_{i=1}^{n} w_i^+ \cdot x_i^+ \; + \; \sum_{j=1}^{m} w_j^- \cdot x_j^- \tag{5.1}$$

where

- TI = final tranquility index
- x_i^+ = standardized raster values of positive indicators
- x_j^- = standardized raster values of negative indicators (inverted to reflect their opposite effect)
- w_i^+ = AHP-derived weights of positive indicators, normalized within the positive group ($\sum_{i=1}^{n} w_i^+ = 1$)
- w_j^- = AHP-derived weights of negative indicators, normalized within the negative group ($\sum_{j=1}^{m} w_j^- = 1$)
- n = number of positive indicators
- m = number of negative indicators

Chapter 6

Results GIS model

This chapter presents the results of the GIS-based tranquility model, developed through operationalization of the factors identified in the focus groups into spatially measurable indicators. The following sections first report the weights assigned to each factor through the AHP. Then, the final map for the canton of Glarus resulting from the aggregated factors is presented. To contextualize and validate the model qualitatively, the results are subsequently compared with explicit locations identified by focus group participants.

6.1 Results of the AHP weighting

Table 6.1: AHP-derived weights for positive and negative tranquility indicators

Positive indicators	**Weight**
View	0.116
Lakes	0.131
Streams	0.131
Forest	0.135
Remoteness	0.17
Bird song	0.131
Fresh Air	0.145
Starry Sky	0.172
Negative indicators	**Weight**
Human presence	0.192
Infrastructure/traffic (visual)	0.245
Noise	0.282
Stench	0.165
Urbanization (visual)	0.116

The AHP weighting process resulted in distinct importance values for each factor in their respective category (Table 6.1). Among the positive indicators, starry sky (0.172) and remoteness

emerged as the most influential. Fresh air (0.145) and forest (0.135) were moderately important, while lakes, streams, view and bird song received similar but slightly lower weights (0.117-0.131).

Within the negative indicators, noise was identified as the most dominant disturbance factor (0.282), followed by infrastructure and traffic (0.245) and human presence (0.192). Stench and urbanization were weighted slightly lower (0.116).

6.1.1 Consistency analysis

Positive criteria

For the positive tranquility indicators, 9 out of 40 participants (22.5%) produced consistent responses (CR ≤ 0.3). The remaining 31 participants (77.5%) exceeded the threshold, with CR values often between 0.5 and 1 and in some cases exceeding 1. Only two participants achieved CR values close to the stricter 0.10 benchmark.

Negative criteria

For the negative tranquility indicators, 11 out of 40 participants (27.5%) achieved consistency (CR ≤ 0.3). The majority (72.5%) provided inconsistent responses, with CR values ranging from 0.5 to 1.6.

6.2 Final tranquility index and map

6.2.1 Value range and classification

The final tranquility index, consisting of the layers specified in the methods section, has a range of values between -34.76 and 69.78. The distribution of the tranquility index values (Figure 6.1) shows a right-skewed pattern, with a majority of raster cells falling into the positive range. As both positive and negative factors were combined into a single indicator before adding them together (with the negative ones as negative values and vice versa, see Eq. (5.1)), the value of 0 represents a turning point between non-tranquil and tranquil areas in my model. Based on the breaks visible in the histogram, the values were grouped into six classes for the symbolization on the map (Figure 6.2) and further analysis. Very low tranquility (≤ -17) and low tranquility (-16 to 0) occur only rarely and represent strongly disturbed areas. Moderate tranquility (1–24) and intermediate tranquility (25–40) cover a larger share of the landscape but remain less dominant except for the southeastern area of the canton, where intermediate values occur frequently. The highest concentration of values lies between 41 and 55, classified as high tranquility, which represents the most extensive class in the study area. To highlight particularly undisturbed locations, an additional threshold was defined for values above 55, designated as very high tranquility.

The decision to include this sixth class can be justified on three grounds. First, values above 55 correspond to the upper tail of the distribution, meaning that only a small proportion of cells reach such high scores, and highlighting them helps to identify extreme cases. Second, from a cartographic and communication perspective, the additional class improves interpretability by separating "exceptional tranquility" from the already broad category of high tranquility. Third, given that no absolute standard for tranquility indices exists, the classification remains relative

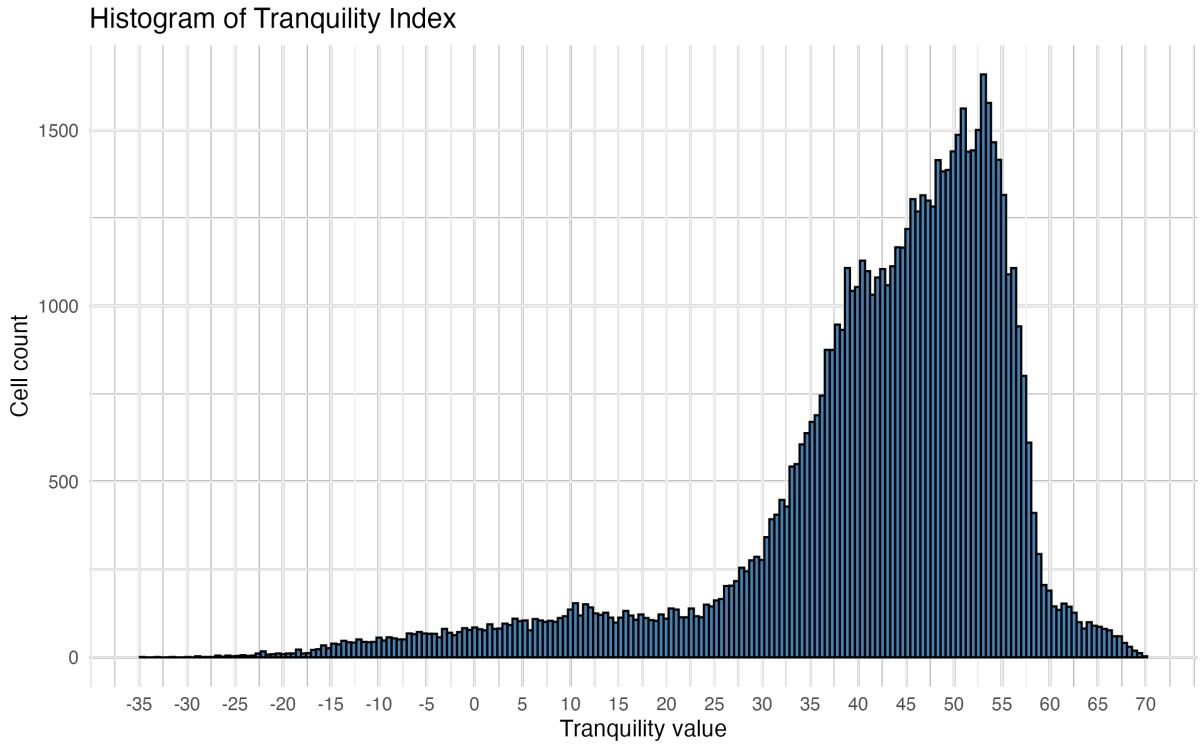

Figure 6.1: Histogram of cell values of the tranquility index

to the study area. The >55 threshold thus marks the extreme positive end of my index for the canton of Glarus and helps to visualize locations that are outstanding in this context.

The class of very low tranquility ($-34--17$) captures the extreme negative end of the index, where the combined influence of disturbances such as infrastructure, noise and other anthropogenic pressures strongly outweighs positive factors. Although relatively few cells fall into this range, mapping them separately makes it possible to highlight the most heavily impacted locations within the canton. This distinction is important for interpretation, as it clearly identifies areas where tranquility is severely compromised and thus provides a useful contrast to zones of moderate or higher tranquility.

6.3 Map description

The map in Figure 6.2 shows the three valleys, which are home to the majority of the population, as areas with a low potential for tranquility. Areas around larger settlements and infrastructure, such as roads or the airport, in particular, show lower values. Tranquil areas tend to be concentrated in higher-altitude regions, which are generally located in areas with low population density. The influence of bodies of water is also evident in some locations, which have high potential tranquility due to the visibility of a lake or stream, among other factors.

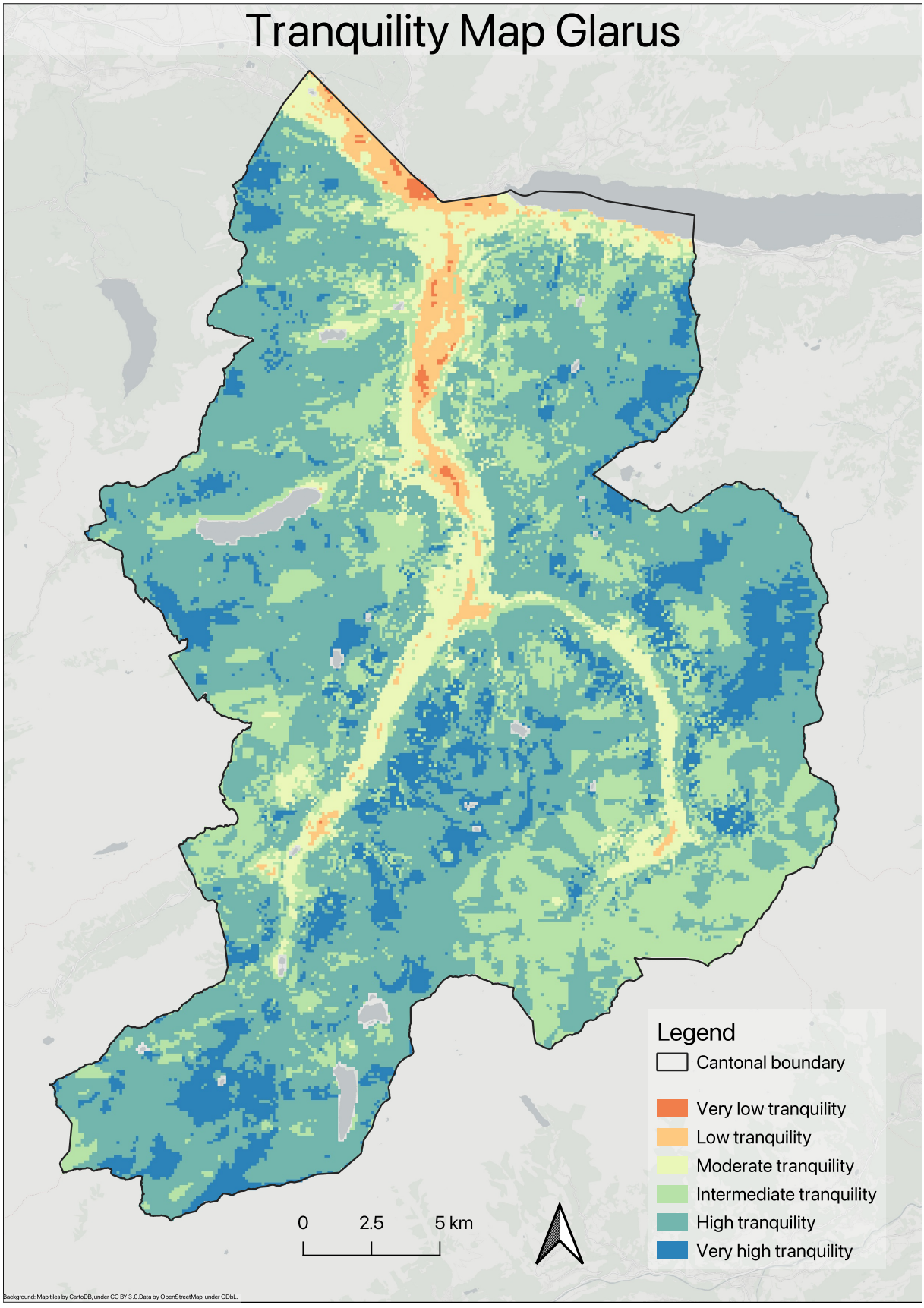

Figure 6.2: Tranquility Map Glarus

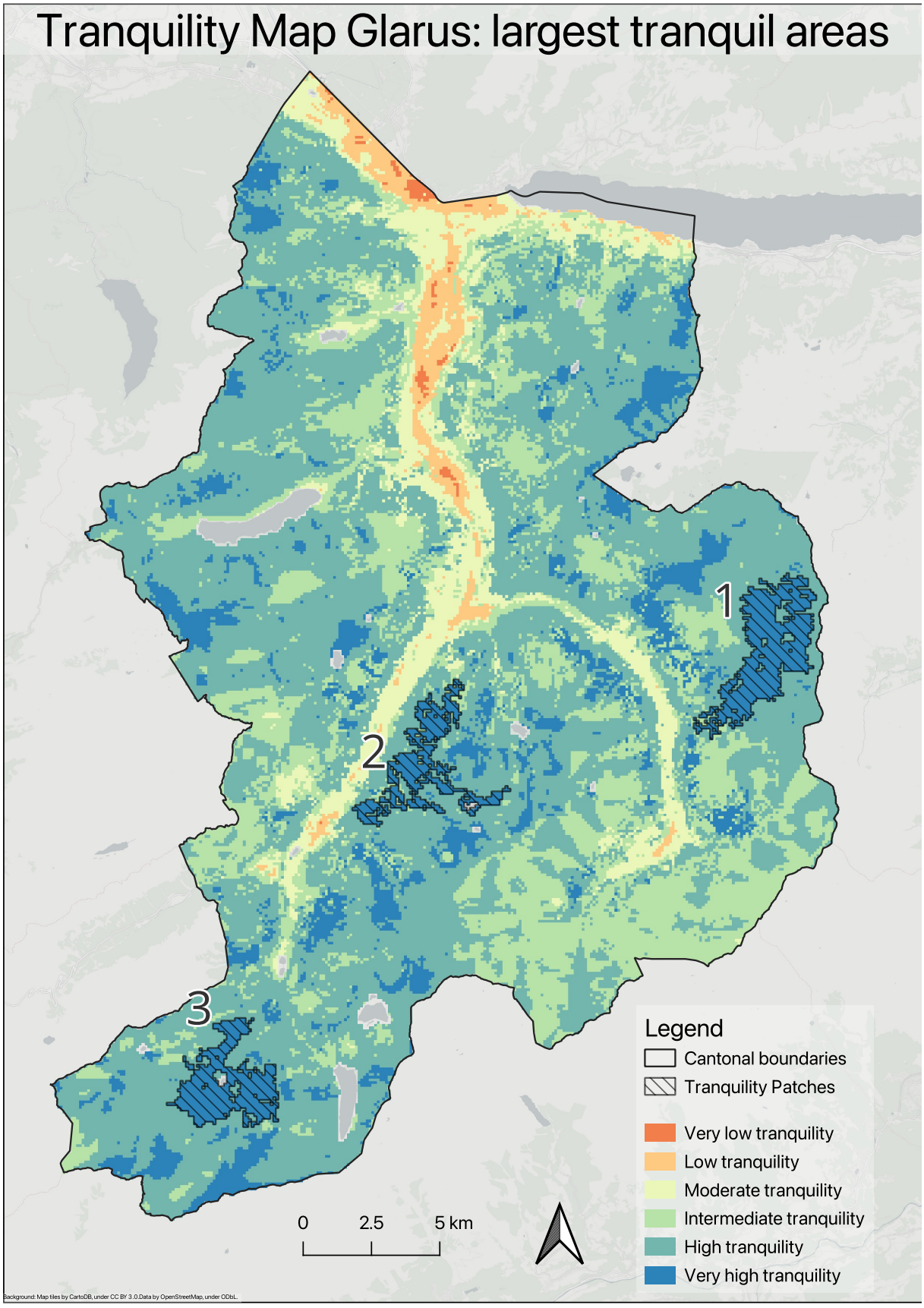

Figure 6.3: Tranquility Map with the three largest tranquility patches (Tranquility Index >55)

6.3.1 Most tranquil areas

Similar to Leeb et al. (2020) where contiguous areas over 5 km^2 with high potential tranquility were identified, the three largest contiguous tranquility areas are marked in Figure 6.3 (score > 55). The mean elevation of the three largest tranquility patches is summarized in Table 6.2, while their land cover composition is shown in Figure 6.4.

Patch 1 with a mean elevation of 1,623 m a.s.l., is characterized by a mixed composition of agricultural land and stocked areas. Within the agricultural component, alpine pastures, natural meadows and home pastures together account for a substantial share. The stocked areas are dominated by forest and a smaller share of shrub forest and wooded areas. In addition, unproductive vegetation and vegetation-free surfaces cover a smaller part of the patch. Cells classified as waters occur rarely, while settlement and traffic areas are also marginally represented.

Patch 2, located at a mean elevation of 1,428 m a.s.l., is strongly dominated by stocked areas, forest in particular, which alone accounts for more than sixty percent of all cells. Smaller shares of shrub forest and wooded areas complete the category. Agricultural land is represented primarily by alpine pastures and minor areas of natural meadows and home pastures. Furthermore, the patch contains limited amounts of unproductive vegetation, vegetation-free surfaces, and flowing waters. Settlement and traffic areas are scarcely represented.

Patch 3, at a mean elevation 1,933 m a.s.l., shows a different composition. It is dominated by unproductive land, above all, vegetation-free surfaces, making up more than half of all cells. Wooded areas and smaller amounts of forest and shrub forest also occur. Agricultural land plays only a minor role, while standing waters and unproductive vegetation occur locally. As in the other patches, settlement and traffic areas are negligible.

Taken together, the three patches show alignments as well as differences. Across all patches, settlement areas occur only negligibly. Most are dominated by grasslands or meadows, with the exception of Patch 3, where vegetation-free surfaces at higher altitudes prevail. All patches show mean altitudes over 1,400 m a.s.l. as they are located in less densely populated areas of the canton, which are generally situated in mountainous terrain, since the majority of the population lives in the canton's three valleys.

Beyond these similarities, the patches reveal distinct ecological and land-use properties that reflect the altitudinal gradients characteristic of the Glarus landscape. Patches 1 and 2 are both located at comparatively lower elevations and display a stronger presence of agricultural and forested land. Patch 3, in contrast, reflects the harsher environmental conditions of higher elevations, where extensive unproductive and vegetation-free surfaces dominate.

Overall, these three largest patches classified as very tranquil illustrate that in this case tranquility is more likely to occur in areas at higher altitudes but across different land-cover types. While mid-elevation landscapes combine agricultural and forested components, higher-lying terrain is characterized by extensive unproductive surfaces with little vegetation. Taken together, the patterns highlight that tranquil areas in Glarus are not tied to a single landscape type but emerge across a spectrum of environments shaped by altitude, land use, and natural conditions, underlining the importance of considering both ecological and topographic context when interpreting the spatial distribution of tranquility.

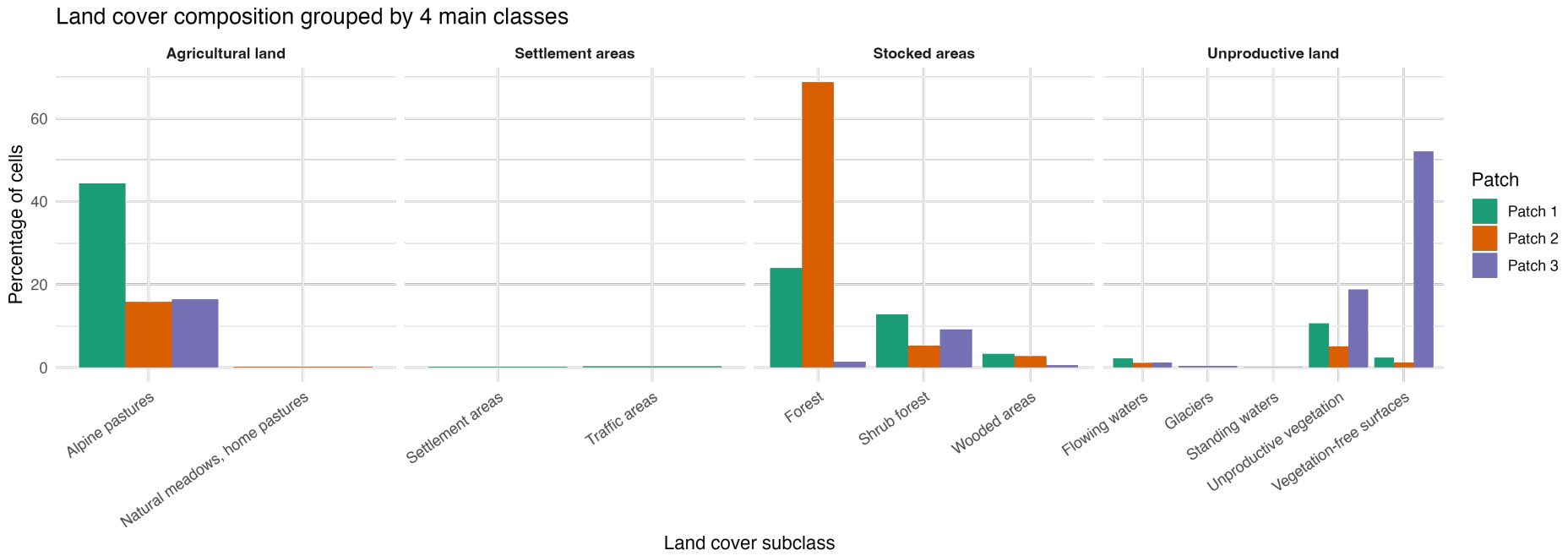

Figure 6.4: Land cover composition of the three largest tranquility patches grouped by main land cover classes

Table 6.2: Mean elevation above sea level for the three largest tranquility patches and their combined extent

Patch	**Mean elevation (m a.s.l.)**
Patch 1	1,623
Patch 2	1,428
Patch 3	1,933
All patches combined	1,661

6.4 Comparison with named tranquil places

The following section will deliver a comparison between the explicit tranquil places named by participants and the model or map created (see Table 6.3). To respect the concerns of participants regarding the disclosure of such locations, the locations are not named but are described instead. The descriptions of the participants themselves were also included, translated from German to English (original wording can be found in Appendix B).

Table 6.3: Participant locations with tranquility values and descriptions

ID	Tranquility value	Description participant	Description place
1	60.7	Silence, hardly any people, wild nature/mountain surroundings/animal sounds make you feel calm (despite the noticeable effects of climate change on the disappearance of the glacier).[1]	Mountain peak with views, including glaciers
2	58.3	New, as yet unnamed large lake north of 1: absolute silence, sounds of water and ice blocks, pioneer vegetation (surroundings).[2]	Glacial lake surrounded by rugged mountain peaks
3	56.3	[Location name]: Particularly in the upper part, a very wild and unspoiled forest (the opposite of a plantation), silence, the cycle of nature, animal sounds/birds.[3]	In a forest, a few kilometers away from the nearest settlement
4	56.4	Silence (even in the popular [location name], especially in winter), nature/mountain surroundings high above [location name] make you feel small and quiet, many birds, including eagles, circle above you.[4]	Mountain peak with a view of other mountains and a lake

Continued on next page

Place ID	Tranquility value	Description participant	Own description of the place
5	41.6	A very peaceful place with one of the most beautiful views in [location name], but also in the Glarus Hinterland.[5]	Mountain peak with a view of the valley and other mountains
6	53.8	The view is not particularly special, but it is very peaceful, with woods and streams. There are also animals to see.[6]	Place surrounded by forest in a side valley
7	19.1	I generally find [location name] very nice, but it's a bit touristy and therefore not so "tranquil" for me now.[7]	Mountain village
8	44.7	Water, mountains are so impressive there, nature, floodplain forest, fresh air.[8]	Place by a lake surrounded by forest and with a view of the mountains
9	47.1	Forest, fresh air, few walkers[9]	Fire pit near spring, surrounded by forest
10	34.5	Beautiful flower meadows, views, many natural structures such as dry stone walls, warm slopes when the sun shines.[10]	Place in a valley with meadow and forest and dry stone walls
11	41.8	[Location name] in winter, few people, mountains, nature, tranquility[11]	Mountain valley with meadows, forests
12	40.7	Although I've only been there once, it applies to most of the mountains in Glarus – it's a mega view, I saw the sunrise, the air was incredibly fresh, it was quiet because no one else was there except me so early in the morning, nature was super beautiful, even on the way up.[12]	Mountain peak with a view of the lake and valley

Continued on next page

Place ID	Tranquility value	Description participant	Own description of the place
13	41.5	[Location names]: Both are definitely very beautiful to look at and linger over, depending on the weather, but very soothing to the eye, especially in fall or winter when there are fewer people around. Always a very beautiful view, but also very peaceful, perfect for running in nature.[13]	Place in a valley with view of lake and mountains
14	4.7	Along the [location name], I just love the sound of the water, the view isn't that great, but it's really calming when you can't hear much else except the sound of the water.[14]	By a river in the valley, in a settlement
15	40.4	Great view, quiet, nice for skiing downhill[15]	Mountain peak with a view of the lake
16	9.0	Cozy, great for swimming and surfing, sunny[16]	Beach on a lake with swimming facilities
17	48.7	Quiet, nature, alone, beautiful view[17]	Place in the mountains with a view of the lake and other mountains
18	11.6	Water, views, tranquility, no people, vacation feeling[18]	Location by a lake lake with a view of mountains
19	-0.0	No people, sound of the stream, forest[19]	Location at the edge of the forest with a view of the village and mountains

Continued on next page

Place ID	Tranquility value	Description participant	Own description of the place
20	32.4	Running water, rustling leaves, unpaved ground. I find gravel paths or nature trails more tranquil than paved surfaces.[20]	By a river within a forest
21	58.3	Further up, if you continue along the [stream name], it's also very beautiful! Very few people there. Again, water nearby, surrounded by trees (rustling leaves).[21]	In a side valley by a stream at the edge of the forest
22	32.4	Surrounded by trees (separated from everything and everyone else)[22]	Barbecue area surrounded by trees
23	26.5	Beautiful view of the entire Glarus region from the summit, giving you a sense of home. I also like it because it is quiet and not crowded, and you are "rewarded" for the strenuous climb.[23]	Mountain peak with views of valleys, lakes, and other mountains
24	50.5	no description given by participants, just location name	Location in the mountains with a view of the valley and other mountains
25	14.5	no description given by participants, just location name	Location near a meadow surrounded by forest and with a view of mountains
26	51.9	no description given by participants, just location name	By a lake surrounded by forest and with a view of the mountains

Table 6.4: Participant locations grouped by tranquility classification categories

Category	**Description**	**Location IDs**
Very low (–34 to –17)	Very low tranquility	–
Low negative (–14 to 0)	Low tranquility	19
Low positive (1–24)	Moderate tranquil	7, 10, 14, 16, 18, 20, 22, 23, 25
Medium (25–40)	Intermediate tranquility	5, 11, 12, 13, 15
High (41–55)	High tranquility	6, 8, 9, 24, 26
Very high (56–70)	Very high tranquility	1, 2, 3, 4, 17, 21

The comparison between the modeled tranquility and the specific locations indicated by participants shows that there tends to be more agreement than divergence between the two, as all except one of the locations mentioned have a positive tranquility index value. However, the range of values is relatively large, and some divergences can be identified.

Several of the places identified as tranquil by participants correspond to high values in the model, particularly remote mountain areas, forested sites and locations near lakes or streams. Mountain peaks were mentioned repeatedly, with views highlighted as a key factor. Overall, sites embedded in natural features aligned closely with the model outcomes, where tranquility scores frequently exceeded 50 (e.g., Places 1–4, 17, 21, and 26), indicating that the modeled indicators reflect the conditions participants associated with tranquility.

However, several locations identified as tranquil by the participants received only moderate or low tranquility values in the model. The tranquility scores at these sites extended down to values below 20 (e.g., Places 7, 14, 16, 18, 19 and 25), despite being described as places where tranquility can be experienced, Place 19 was the only site with a slightly negative value, even though it was portrayed positively in terms of natural sounds and the absence of people. In several cases, again, participants described natural features such as rivers, lakes, or mountain surroundings (e.g., Place 14 by a river, Place 16 at a beach, Place 18 by a lake) as contributing to tranquility. Still, these were not reflected in high model scores. Interestingly, Place 7 was explicitly described as not tranquil because of tourism, which is also reflected in the model by a low value resulting from the presence of a cluster of Flickr photographs in and around this area.

Overall, the scores of tranquility at participant-indicated locations covered a wide range from near-zero to very high values above 60. Most locations fell into the medium to very high categories of the classification system, while only one was situated at the margin of the negative classes. This shows that nearly all places identified by participants corresponded with at least some degree of modeled tranquility, but the level of agreement varied considerably.

Chapter 7

Discussion

This chapter critically reflects on the study's findings and situates them within the broader literature on tranquility as a cultural ecosystem service. The discussion is organized into four main parts. First, I revisit the research questions. Second, I examine the multi-faceted nature of tranquility, highlighting its natural, sensory, emotional, and relational dimensions and considering how these resonate with or diverge from existing studies. Third, I compare experienced tranquility with potential tranquility as represented in the GIS model, drawing attention to both alignments and divergences between participants' accounts and my index. Fourth, I address the limitations of both the focus group approach and the GIS-based model, before outlining directions for future research.

My research questions guide the discussion:

1. How do residents in the canton of Glarus define and perceive tranquility, and what specific characteristics contribute to their identification of tranquil places?
2. To what extent do the mapped perceptions of tranquility among residents in Glarus align with spatial models constructed using existing environmental data, and what factors contribute to any discrepancies identified?

7.1 Tranquility as a multi-faceted concept

In alignment with the study of Purves and Wartmann (2023), my results from the focus groups indicate that tranquility is a multi-dimensional concept, combining natural, sensory, social and emotional aspects. These findings reinforce the notion that CES, like tranquility, need to be understood and analyzed as a relational interaction between affective and natural factors (Daniel et al., 2012; Fish et al., 2016). In my study, this became evident when participants described how even the normally most tranquil place did not feel like it if they were under time pressure or stressed in general. Such accounts highlight that tranquility is co-produced through the interplay of environmental features and the individual's emotional state and availability of time.

Natural features such as mountains, forests, lakes, rivers and wildlife were repeatedly described as central factors that contribute to the tranquility of a place. Participants most often associated tranquility with such natural features through multisensory experiences including sight, sound and smell. These elements have also been highlighted in previous studies as primary contributors

to perceptions of tranquility (Hewlett et al., 2017; Jackson et al., 2008). However, there were also new natural factors that emerged in my study: glaciers and mountains were mentioned particularly often in comparison with other studies, which is probably due to the study area being located in the Alps, as residents are more frequently confronted with them. This supports the critique of earlier work, such as Leeb et al. (2020), which emphasized the need to adapt the criteria to assess tranquility for mapping to the local context.

Auditory qualities play an equally important role. Anthropogenic noise emerging from traffic or other sources were repeatedly mentioned as disturbing factors, while natural sounds (such as birdsong, rustling leaves, and water flow) were described as positively reinforcing tranquility. This aligns with the TRAPT framework of Pheasant et al. (2010), which integrates acoustic and visual dimensions.

Place-based meaning and connection, or even communication with places, were evident in several accounts. This highlights the role of sense of place or landscape attachment in the perception of tranquility as a CES (Agnew et al., 2003; Ryfield et al., 2019) and reflects the topophilia theory by Tuan (1990), which emphasizes a person's mental, emotional, and cognitive ties to a place. For some participants, such ties enhanced the tranquility of a location and motivated them to return repeatedly.

In addition, the absence of people or crowds was often described as a prerequisite for tranquility and solitude or being "alone in nature" was valued positively, comparable to the findings of Naor and Mayseless (2020) and Petersen et al. (2021), who likewise emphasize the role of solitude in natural settings for fostering calm and well-being. Participants also underlined internal and relational dimensions: tranquility was said to depend on inner mood, emotional readiness, and the availability of time, echoing studies that link mindfulness and concentration with enhanced inner peace and reduced psychological distress (Chan et al., 2023; Liu et al., 2015). Feelings of calmness and even physical reactions, such as goose bumps, were associated with these experiences. The notion of resonance and reciprocal connection with place thus links back to sense of place theories, where attachment can strongly shape perceptions of tranquility (Ardoin et al., 2019).

Participants further emphasized the temporal dimension, for example, experiencing tranquility in winter when a popular location is empty. At the same time, some also described finding tranquility in urban contexts, such as a café or backyard. This aligns with Purves and Wartmann (2023) and Chesnokova et al. (2019), who show that people may experience tranquility even in places generally perceived as non-tranquil or categorized as such in models ("pockets"). Such accounts soften the contrast often drawn between natural and man-made environments, which in both this and previous studies were frequently associated with either tranquility or disturbance (Hewlett et al., 2017; Jackson et al., 2008).

Emotional and inner feelings were evident in several accounts, similarly to Jackson et al. (2008), where this was listed under the broad category "tranquility of mind". Purves and Wartmann (2023) also stated that earlier definitions from the Romantic period emphasized that tranquility is not only determined by the right combination of natural features, but also by the state of mind. This was evident in my study when participants explained that they could not experience tranquility without being in the right state of mind, for example when under time pressure or when lacking a sense of resonance with the location, regardless of its external conditions or features.

Finally, doubts and fears were expressed when asked to participate in the study as well as during the sessions themselves. The primary concern related to the publicity of tranquil places was its potential to attract more tourism, thereby diminishing the perceived tranquility of these locations. This highlights that disturbances were predominantly attributed to anthropogenic influences such as noise, traffic, and crowding, but that social concerns about touristification and the loss of tranquil places due to publicity were equally present. This reflects the inherent political dimension of CES and the potential risks of their commodification (Kull et al., 2015; Martin-Ortega et al., 2023). It also compares to the study of Hewlett et al. (2017), where non-institutional participants described tranquility as fragile and easily disrupted by human presence and associated activities.

Taken together, the focus groups demonstrate that tranquility is perceived as a multisensory, relational and place-based experience, deeply embedded in natural features, inner feelings, emotions, moods and place-specific attachment. These findings also illustrate that tranquility is not understood as an abstract concept detached from place, but is closely tied to concrete landscapes and settings, with its characteristics only becoming meaningful in relation to the specific environments in which they are experienced.

Overall, these insights show that residents of Glarus define tranquility as a relational and context-dependent quality shaped by natural features, sensory experiences, inner states, and place-based connections.

7.2 Potential and experienced tranquility

This section addresses Research Question 2, which asks to what extent the mapped perceptions of tranquility among residents align with the GIS-based model and what factors explain divergences. A central point of this study lies in the comparison between modeled and experienced tranquility, derived from spatial indicators and specific locations that are perceived as tranquil, as described by participants. As Table 6.4 shows, the general alignment between the two perspectives is high, suggesting that the selected indicators provide a robust baseline for representing tranquil landscapes at the regional scale. The model captured many of the classic features consistently associated with tranquil environments in the literature, such as remoteness, forest cover, water bodies and the absence of anthropogenic disturbance. These features also emerged as highly valued in participants' accounts. For instance, mountain peaks and remote valleys were identified by both the model and participants as remarkably tranquil, also echoing previous findings that naturalness and distance from development are central to tranquil experiences (Jackson et al., 2008; Leeb et al., 2020).

Yet, exceptions and internal differences between similar places demonstrate the limitations of the model. While it was most successful in remote areas such as mountain peaks, a relatively high variance appeared even between sites with similar environmental characteristics. For example, comparing Place 1 and Place 23 revealed that both are mountain peaks with similar descriptions in terms of view, yet their tranquility values differ by more than 34 points. In the model, this discrepancy is primarily explained by the factors of infrastructure and visibility of urbanization, which are present at Place 23 but absent at Place 1. Although such factors had to be incorporated into the spatial model according to the results of the focus groups, the participants' descriptions

underline that tranquility can still be experienced even when infrastructure or buildings are visible, particularly when other qualities, such as a beautiful view, are foregrounded. This may also indicate that the model reaches its limitations when distance weightings are applied, and, as shown by Jackson et al. (2008), sensitivity studies such as spatial threshold analyses, in which participants rated sequences of images (e.g. roads, pylons, urban areas) at progressively greater distances, are necessary to better capture and understand how the visibility of different features disrupts perceptions of tranquility.

Besides the alignments and internal differences, divergences were evident as well. Participants named places that were assigned with comparatively low or even slightly negative scores. Place 19 was the only location with a minimally negative score. Multiple negative factors had a high negative influence, as the location is close to settlements and especially right next to a road which was which led to noise being the strongest influencing factor in this location. Nonetheless, the participant described only positive factors for this specific location, and in terms of noise, only the stream was mentioned, which is attributed as positive. This is consistent with the findings of Wartmann et al. (2019) and Chesnokova et al. (2019), who show that people may still experience tranquility even in locations exposed to potential noise from roads. The same applies to locations in cities, such as restaurant backyards or specific places that were mentioned directly in the focus group. Although these places were not directly compared with the model because they are located outside the canton, it can be assumed that the values for potential tranquility in these locations would be low to negative due to factors such as noise, visibility of settlements, or lack of remoteness. These examples also underscore the thesis that tranquility can often be experienced in smaller pockets despite low potential. Location 14 also stands out, as it is a place by a river in a village. Here as well, the potential tranquility is comparatively low, but the person perceives the location as tranquil because of the stream and its sound, even though there is no special view or other positively contributing factors from the model. This is an example of tranquility by contrast (here a stream in a relatively densely populated area), which has also been described in other studies (Purves & Wartmann, 2023; Wartmann et al., 2021).

The comparison with the GIS-based model thus showed general alignment, particularly in mountainous and remote areas rated highly tranquil by both participants and the model. At the same time, divergences appeared more frequently in popular touristic places or areas closer to settlements. While many of these dimensions overlap with findings from previous studies in the UK, the emphasis on the Alpine landscape—with the relatively high number of mentions of mountains or mountain peaks—and the explicit concerns about touristification point to the importance of geographical and cultural context in shaping how tranquility is understood. This supports the argument made in other studies (Brehme et al., 2018; Leeb et al., 2020) that tranquility models need to be adapted to the local context through participatory approaches, as the term remains highly subjective and may vary with the geographical context.

The divergences illustrate the limits of relying solely on modeled indices for planning or policy: while spatial models are effective in identifying broad patterns and regional hotspots, they risk overlooking the fine-grained experiences of tranquility that residents described, such as seasonal emptiness, meaningful views, or pockets of calm within otherwise disturbed settings. However, in my study area, where the supply of potentially tranquil places is relatively abundant, the

opposite question arises, namely, protecting such places rather than searching for more. Becoming well-known and touristification are fears repeatedly mentioned by participants, which could potentially harm tranquil places. This aligns with other studies suggesting that increased tourism can alter perceptions of places, whether due to increased noise or loss of identity (Olgun et al., 2024; Sánchez-Fuarros et al., 2023). At the same time, modeling tranquility is not only a methodological task but also an inherently political act, in which decisions about representation and disclosure carry material consequences for both landscapes and communities.

In summary, these findings suggest that potential tranquility, as modeled through environmental proxies, basically captures the conditions that generally support experienced tranquility, yet it cannot fully account for all dimensions, especially when tranquility is experienced in smaller areas within potentially non-tranquil locations. Apart from that, emotions, feelings, and place attachment also have a significant influence, as shown in the focus groups. The latter may be difficult to capture in planning and modeling; in contrast, pockets such as urban green spaces represent relatively easy ways to offer potentially tranquil places to a broader population, and they can also be incorporated into models by treating them as tranquil areas even when embedded within the urban fabric (Nordh & Østby, 2013; Purves & Wartmann, 2023).

7.3 Limitations of the focus groups

Several methodological limitations of this study need to be acknowledged. Importantly, the focus here is on the particular circumstances of my research rather than on generic drawbacks associated with qualitative approaches, such as focus groups, as suggested by Hennink (2014). By reflecting on study-specific constraints in the design, recruitment, moderation and data collection processes, the boundaries within the findings should become clearer.

First, the recruitment process introduced certain limitations. Although participants were purposively sampled to capture diversity across gender and age, the individual groups themselves were unevenly composed. The first focus group was skewed towards men, where the participants were either under the age of 30 or over 60 in total. Focus group II comprised mostly women and included one older participant alongside predominantly late twenties to mid-thirties participants. Focus group III was smaller and dominated by women in middle to older age brackets. These imbalances, particularly the overrepresentation of women in general and the underrepresentation of younger men, may have shaped the range of perspectives expressed, including potential generational and gendered differences in how tranquility is defined and perceived. A further limitation arises from the recruitment strategy itself: participants were primarily recruited from nature conservation associations, outdoor sports groups, and other individuals with a strong interest in nature. As a result, the perspectives of residents less engaged with outdoor activities or less connected to nature were underrepresented. This may have introduced a bias toward more nature-oriented understandings of tranquility, while alternative perspectives remain less visible in the data.

The discussion was conducted solely with residents of the canton of Glarus, and the findings should therefore be understood as situated within this particular cultural and geographical context, especially for the concept of tranquility, which is influenced strongly by such factors. Rather than offering broad statistical generalizability, which is not the aim of focus group research and

cannot be achieved with small, purposively recruited groups (Hennink, 2014), the study points towards transferability to comparable mountainous areas or cantons in Switzerland. Transferability in qualitative research refers to the extent to which concepts identified in one context can inform understanding in others, emphasizing the conceptual transferability of the concepts generated rather than statistical representativeness (Green & Thorogood, 2006). In this study, while the specific answers and results are rooted in Glarus, broader themes such as the value of nature, the importance of multisensory experiences and concerns about touristification may hold relevance for other similar areas or cantons in Switzerland.

Group dynamics and moderation posed additional challenges. Overall, the discussion remained rather "frontal," with participants addressing me more than engaging in dialogue with each other. As a result, the potential for debate, contradiction, and collective meaning-making was reduced (Morgan, 2010). A different seating arrangement, where participants were positioned more opposite each other instead of facing both the screen and me, might have improved the situation.

Additionally, some participants held extended monologues while others contributed only minimally. In hindsight, I should have intervened and interrupted more to balance contributions and encourage quieter participants to speak up. This would have mitigated the risk of dominant voices shaping the overall discussion (Krueger & Casey, 2015). These dynamics may have led to a partial overrepresentation of particular viewpoints.

My own role as an inexperienced moderator should also be considered. In situations such as the example above, more guidance would have been beneficial. At the same time, my position as a student researcher and non-authority figure may have facilitated a relaxed atmosphere, which in turn encouraged openness and active participation.

In sum, while these limitations shaped the dynamics and scope of the data, they also reflect the realities of participatory qualitative research. Acknowledging them enhances transparency and provides guidance for future applications of focus groups in similar contexts.

7.4 Limitations of the GIS model

While the GIS-based tranquility model developed in this study provides a structured and replicable framework to represent potential tranquility at a regional scale, several methodological and conceptual limitations must be acknowledged. These relate to data accuracy, factor selection, model assumptions and how tranquility is represented cartographically.

7.4.1 Data availability and spatial resolution

The model integrates spatial datasets from various sources and years. Although all layers were harmonized to a 100 m grid, the input data vary in their original resolution and accuracy. Fine-scale aspects of tranquility, such as the presence of a small forest clearing close to a road or small streams, cannot be adequately represented at this resolution. The hectare grid represents the assumption that tranquility does not change abruptly within several meters, where in reality, this may be the case.

7.4.2 Indicator selection and simplification

The chosen proxies reflect notions from both the literature and participants, but inevitably cannot capture the full multidimensionality of tranquility. Especially, rather abstract, subjective factors like stench, fresh air or human presence are only approximated and may not capture the full range of participants' ideas. For instance, the modeling of stench applied a simplified spatial proxy based on proximity to known odor sources. Unlike Farahani et al. (2023), who integrated meteorological variables (wind direction, humidity) and survey-based perception into their model or Guo et al. (2017), who combined chemical and olfactometric analysis to quantify odor intensities, my approach was static and not based on the various other variables that could have an influence. Similarly, the modeling of "human presence" relied on geotagged photographs. Geolocated social media data offer valuable insights into visitation. Still, they suffer from representativeness biases due to uneven user penetration, platform-specific usage patterns, and unreliable or incomplete photo uploads (Domènech et al., 2020).

The modeling of aircraft noise was likewise constrained by data availability. Although helicopter and airplane noise are perceptible beyond the SIL perimeter, no spatially explicit data on flight routes or noise contours were available, so the analysis was limited to the SIL perimeter as the officially recognized zone of influence of the airfield.

While the operationalization of "fresh air" through pollutant concentrations aligns with participants' emphasis on anthropogenic impacts, this approach also raises several methodological concerns. First, the pollutants were summed into a single indicator, implicitly assuming that their effects are additive and comparable. Yet, air pollutants differ in their chemical behavior, health impacts, and spatial distribution (Vienneau et al., 2010). By aggregating these pollutants into a single score, important distinctions between types of "freshness" may have been overlooked. Additionally, the linear rescaling of pollutant concentrations assumes that perceptions of "fresh air" correspond directly to measured pollutant loads, yet human sensory experience is shaped more by odors, humidity and noticeable emissions than invisible pollutants (Steinemann, 2018).

7.4.3 Model assumptions and parameterization

The model is underpinned by several critical assumptions that significantly influence its outcomes. For the visibility analyses, choices such as whether to apply a linear or exponential distance decay or which radius threshold to use affect how strongly visual disturbances are weighted. No empirical calibration, as in the study by Jackson et al. (2008), was carried out, which means these decisions rest on informed but ultimately also subjective judgment.

Another core assumption is the additive construction of the tranquility, where first all positive and negative factors were combined and then both indicators were summed. Therefore, the model assumes that benefits and disturbances compensate each other symmetrically. However, research shows that in many evaluative settings, negative aspects tend to outweigh positive ones, making simple additive compensation problematic (Greco et al., 2019). Moreover, the construction of a model with one fixed value per cell and fixed weights from the AHP procedure implies that the influence and importance of the factors are constant over time. In practice, preferences are often context-dependent and may shift over seasons and time of the day or week, as shown in the results from the focus groups. Especially the shift between different seasons on perception of landscape or green spaces has also been investigated in other studies (Duan et al.,

2024; Półrolniczak & Kolendowicz, 2023). Works like Benítez et al. (2012) and Chen and Huang (2023) acknowledge the static nature of AHP weights and propose dynamic frameworks in which weights are updated over time or with context. Thus, while one aggregated, static tranquility index provides transparency and comparability between locations, it inevitably simplifies the complexity and variability of human definitions and perceptions of the concept.

7.4.4 Weighting and validation constraints

The AHP process in this study was conducted with lay participants rather than experts, which probably contributed to high inconsistency ratios. Only a minority of participants achieved the loose CR ≤ 0.3 benchmark for layman studies, while the majority provided inconsistent responses, in some cases with a CR value even greater than 1. Such results are not unusual in participatory AHP settings, where respondents are asked to evaluate many pairwise comparisons without prior experience (Pascoe, 2022). Inconsistencies may arise from various cognitive limitations such as lack of cross-checking, concentration lapses, mood or attention shifts and the constraints of the discrete 1–9 scale, which cannot capture fractional trade-offs. They can also be results from overuse of extreme or the same values, data entry errors or other random variations in judgment, making consistency difficult to achieve (Olschewski et al., 2018; Pascoe, 2022). Specifically, in my study, inconsistencies likely arose because participants struggled to compare abstract and qualitatively different criteria such as "forest," "fresh air," "noise," or "human presence" against one another. Without a shared conceptual basis, such judgments become cognitively demanding, increasing the likelihood of inconsistent responses. The design of the survey, where participants could not go back to revise their answers and correct them, may also have aggravated the inconsistencies, as this would be a way to reduce them (Ishizaka & Labib, 2011).

Further evaluation or correction of inconsistencies, for instance through Harker's method (Harker, 1987), would have been possible to improve overall CR values, as done by Kunz et al. (2025) in their study, although it was not applied here. Instead, the analysis proceeded with the raw participants' weights, which retain the full diversity of judgments but also reflect the difficulty of determining internally consistent preferences in complex multi-criteria settings with lay participants. Moreover, only 40 persons completed the survey, and the sample was skewed towards younger residents, limiting representativeness. The derived weights should therefore be regarded as indicative rather than statistically representative of the broader population.

7.4.5 Cartographic representation

The way in which I classified and symbolized my tranquility index in the map has a significant influence on interpretation, especially if the map is judged by color or classes without the absolute values. Class boundaries and the choice of color schemes shape how areas are perceived as either less or more tranquil. Various studies have shown that map design and classification schemes strongly affect perception of spatial patterns (Crameri et al., 2020; Sibrel et al., 2020). Although a six-class scheme was adopted to capture variation, alternative approaches such as quantile classification could have highlighted different contrasts. Research has shown that the choice of break method (e.g., equal interval, quantiles, natural breaks, equal area) can lead to markedly different impressions of the same data (Abboud et al., 2020). This introduces a layer of

subjectivity in addition to the model calculations and parameters, underscoring the importance of transparent cartographic choices. This aligns with general cartographic principles that color schemes and class design should match the data structure to avoid misinterpretation (Zimnicki et al., 2023).

7.4.6 Comparison with Leeb et al. (2020)

Many of the methodological challenges identified by Leeb et al. (2020) for their tranquility map of the Swiss Plateau also apply here, although several have been at least partially addressed:

- **Influence factors and weighting:** Whereas Leeb et al. (2020) adopted weights and factors from the study of Jackson et al. (2008), my study derived them directly from focus groups and a survey with people from Glarus. This addresses the critique that English preferences (e.g., the sea) do not reflect the Swiss context.
- **Visibility analyses:** Leeb et al. (2020) did not include topographically explicit visibility modeling due to computational constraints. In contrast, this study incorporated viewshed analyses, including visibility constraints due to topography. However, simplifications and assumptions (linear vs. exponential decay, radius selection) were still necessary, and results remain sensitive to parameter choices.
- **Relativity of tranquility values:** As identified by Leeb et al. (2020), the tranquility areas identified in this study do not necessarily represent areas with a very high level of tranquility, but rather contiguous areas that have a higher level of tranquility relative to the rest of the study area. This limitation remains, as no further distinction and comparison were made.
- **Additive logic of factor combination:** The problem noted by Leeb et al. (2020) that the opposite influence can mask strong disturbances or positive factors persists. Despite differentiated weighting, the additive structure remains problematic.
- **Validation:** Leeb et al. (2020) called for external validation, for example via expert judgment. In my study, validation was partially addresses through participants' descriptions of explicit places. Yet the approach remains qualitative and not systematic.
- **Data coverage:** In contrast to the study by Leeb et al. (2020), data from neighboring areas can also be used due to the canton's location, thereby limiting border effects.
- **Sensitivity analysis:** Like Leeb et al. (2020), this study did not conduct a systematic sensitivity analysis, leaving uncertainty about how parameter choices (e.g., maximum perception distances) affect results.

In summary, this study builds on and improves several aspects highlighted in the previous Swiss study, particularly in terms of incorporating local views, visibility analyses and partial validation. However, some limitations remain, most notably the additive combination of factors and the lack of systematic sensitivity testing.

7.5 Further research

The findings of this thesis provide a first systematic exploration of tranquility in a German-speaking alpine context, yet they also leave several points open for further investigation.

First, participation could be broadened beyond the resident population of the canton of Glarus to include domestic and foreign tourists. Such an expansion would enable the comparison between locally embedded and external perspectives, helping to identify potential differences or commonalities in how tranquility is perceived and which places are specifically sought out for enjoyment of tranquility. This could also help manage visitor flows, as is already being done with the "Gästelenkung" platform, which shows which popular areas still have capacity for visitors available at very popular times (Glarnerland, 2024).

Second, the GIS-based tranquility model could be refined and extended by incorporating more diverse data sources and time-sensitive data. Although the present model relied on static proxies, it could be enhanced by incorporating dynamic layers such as real-time noise monitoring or data from the "Gästelenkung" platform. These additions would allow the factor "human presence" to be represented in real time, thereby capturing the temporal dimension of potential tranquility more accurately. To further address the inherent subjectiveness of the concept, one participant of the focus groups suggested that future studies might experiment with individualized mapping, where respondents can create their own tranquility maps by choosing and weighting factors by themselves, resulting in a personalized map of potential tranquility.

Third, the question of transferability remains central. While this study presents a case study in the cultural and geographical context of Glarus, comparative research across different alpine cantons or even across linguistic regions in Switzerland would help clarify to what extent the identified criteria and divergences between modeled and perceived tranquility are place-specific or more generalizable.

Finally, future work should engage directly with the ethical and political dimensions of tranquility mapping. Concerns voiced by participants about touristification highlight the need for careful reflection on how spatial representations of the concept are communicated and used. Further interdisciplinary research, combining geography, environmental psychology, tourism and political ecology, could help develop guidelines for how to responsibly display, protect, and govern tranquil areas as cultural ecosystem services.

Chapter 8

Conclusion

This thesis has provided a first systematic exploration of tranquility in the German-speaking, alpine context of the canton of Glarus, combining participatory methods with GIS-based modeling. The integration of focus groups with spatial proxies demonstrates that tranquility constitutes a multidimensional cultural ecosystem service, shaped not only by environmental features but also by emotions, feelings, and personal connections to the environment.

A central finding is the strong value that participants placed on natural features, such as mountains, forests, lakes, streams, and wildlife, as primary sources of tranquility. These elements were repeatedly described as enhancing sensory experiences, from fresh air and natural sounds to the feeling of remoteness. By contrast, anthropogenic features such as infrastructure, settlements and noise were consistently associated with disturbance and a reduction of the tranquility of place. Yet, participants also highlighted nuances and contrasts in their experiences of tranquility: they reported being able to find it even near human activity, where disturbances might be expected to dominate, with feelings, attachments, emotions, or other positive associations shaping whether a place was perceived as tranquil.

The insights on environmental variables closely align with the spatial model in many remote, natural areas, but they also highlight its limitations. While the model captures many "classic" tranquil environments, divergences occurred in places where factors that did not dominate at this place in the model shaped the participants' experiences. This underlines the need to view tranquility not only as the absence of disturbance or presence of enhancing factors but as a relational and contextual quality that emerges from the interplay of inner feelings, emotions and the natural or anthropogenic elements.

Methodologically, the study demonstrates how qualitative data can be operationalized into spatial indicators but also acknowledges the challenges of finding suitable data, factor weighting and the local specificity of results. The ethical concerns voiced by participants, especially the fear of overexposure and touristification, reinforce the importance of careful governance and communication when mapping potential tranquility. At the same time, spatial variability in how tranquility is perceived remains insufficiently captured in the model, which represents an important limitation.

In sum, this thesis shows that tranquility is multidimensional, valuable, but also potentially fragile. By investigating tranquility in a qualitative way and with local contribution, the study

contributes to a deeper understanding of its definition and role in a rural, alpine region in Switzerland. It provides a foundation for further research and exploration in this context, to incorporate this rather precious cultural ecosystem service meaningfully into future planning and preservation in Switzerland and beyond.

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Appendix A

Original quotations in German

1 Participant C1: [...] und an einem solchen Ort ähm ja da entsteht eine Schwingung, zwischen dir und diesem Ort und der Landschaft, dieser Tanne mit Vogelgeräuschen oder weiss nicht was [...]

2 Participant A1: Also es hängt vielleicht auch mit dem visuellen Eindruck zusammen, das das ähm, es gibt keine farbigen Reize, also es gibt nicht grün und Stein und Gebüsch sondern es ist im Idealfall einfach alles weiss modelliert und dann wirkt es auf mich noch ruhiger, noch stiller, noch minimaler.

3 Participant A3: [...] wenn du durch den Wald läufst und alle Bäume sehen genau gleich aus ist etwas langweilig aber wenn jeder Baum etwas spezielles ist oder wenn es ein schönes Blümchen hat, dann kommt ein Ameisenhügel, wenn du dich so ein wenig verlieren kannst.

4 Participant E2: Es ist einfach schon ein bisschen ruhiger und angenehmer, die frische Luft reinzuschnaufen und draussen zu sitzen, und [...]

5 Participant D3: Oder manchmal in einer Mittagspause, wo man nur kurz irgendwie den See runterläuft, oder so, nur kurz, wenn es 10 Minuten sind.

6 Participant A2: Kombination aus Stille, Tiergeräuschen, Naturgeräuschen, Fühlen von Natur (Gras, Wind)

7 Participant C1: Ich laufe als erster mit den Schneeschuhen durch und das Geräusch der Schneeschuhe mit frischem Pulverschnee [...]

8 Participant C3: [...] oder ich meine wenn es kalt ist dann kann ein, oder regnerisch, oder man ist in guter Verfassung, man hat genug warm, dann kann es auch sehr tranquil sein, egal [...]

9 Participant E3: Ja, das gehört für mich auch so zu, irgendwie die innere Stimmung muss auch dazu passen, irgendwie kannst du es [...]

10 Participant D3: Aber diese Orte, es gibt schon Orte, welche ich aktiv suche von denen ich weiss, an denen habe ich immer wieder die Resonanz gefunden und manchmal finde ich sie wieder und manchmal nicht aber es ist etwas wo ich auch darauf zugehe in einer Bereitschaft und dann weiss, dass der Ort bereit ist, mir das immer wieder zu geben.

11 Participant A1: Nichts müssen.

12 Participant D1: Es braucht den Ort aber es braucht auch dich, der in diesen Ort geht und Bereitschaft, in diese Resonanz zu gehen.

15 Participant A3: Also ich war Bauer, wenn ich ein "Bord" gemäht hatte, wenn ich etwas gemäht hatte und ich fertig war, dann ist das so, das mit dem, wenn du sagst "tranquil", dann ist das so "poah" jetzt.[1]

13 Participant D2: Also für mich ist es glaube ich wirklich wenig Menschen. Es kann vielleicht auch eine Stadt zu einem Ort werden sogar.

14 Participant E3: Ja, es war auch so, dass eigentlich niemand von uns den Weg gekannt hat. [...] Dort ist eigentlich, dort ist kein Mensch, der dort herabkommt. [...] Manchmal irgendwie wieder mal einen gewohnten Weg zu verlassen.

16 Participant E2: Für mich wäre es die Ruhe aber das kommt also beides Hand in Hand. Also einfach ruhig, dann könnte ich auch wie sie sagt irgendwo am HB stehen, wenn die Züge keine Geräusche machen würde und die Menschen auch stumm wären, wäre mir das irgendwie einfach egal.

17 Participant A3: Und sobald ein Weg kommt, oh, ich muss in die andere Richtung.

24 Participant C3: Ja, voll, also jenste Gerüche, es kann Essen sein, es können Ausdünstungen sein. Alles, was nicht so Natur ist und so, das riecht dann schnell mal, so in der Stadt oder so.

18 Participant D2: Ja, du kannst am schönsten Ort liegen oder und diese scheiss Fliegen, oder Mücken auch, genau du kannst schön ruhig im Bett liegen und dann kommt die Mücke.

19 Participant C3: Das ist, wenn ich gestresst bin, kann ich nicht, habe ich nicht, dann gibt es keine "Tranquility".

20 Participant F2: Ja, wenn man einfach nicht warten mag. Nachher sind so Leute, die sind schon genervt nur schon wenn sie Ski fahren gehen. Das verstehe ich nicht. Man hat ja einen freien Tag, es ist schönes Wetter. Was soll es, wenn es länger dauert?

21 Participant C1: Und konkret jetzt, eine konkrete physische Sache ist bei mir, dass es nicht lärmig ist. Also egal, welche Sorte von anthropogenem Lärm.

22 Participant C1: Ja einfach fantasielose Quartiere, Industriearchitektur, so ein wenig die übliche, eben 0815.

23 Participant E1: Ich habe versucht, mir irgend einen Ort auszudenken wo irgendetwas aus Metall steht, Gitter, Masten, Antennen, ich habe mir irgendeinen versucht vorzustellen, wo so etwas steht und trotzdem ruhig ist und mir kommt keiner in den Sinn.

25 Participant D3: Man muss es, wissen wir alle hier drin, das man es gerade gut erwischen muss, dass es nicht komplett überlaufen ist.

26 Participant A1: Ich breche jetzt trotzdem noch eine Lanze für einen speziell "tranquilen" Ort, oder zwei sogar, und zwar sind es unglaublich pitoreske, schöne, winzige, kleine Plätze

[1] "Bord" bedeutet in diesem Kontext ein Wiesenstück mit Gefälle.

mitten in einer Grosssstadt.

27 Participant A3: Ja eben, das Beispiel Ort-A, welches einmal in den sozialen Medien ist und nachher hast du tausende Leute, die alles, also quasi was machst du mit einem Ort, wenn du ihn als besonders, besonders bildlich darstellt, was macht das, das war ja meine Grundfrage.

28 Participant C2: Aber ich glaube, gleichzeitig gibt es auch Ortschaften, die immer weniger [...] Also etz im Ort-H ist immer viel los, ob es jetzt im Winter ist [. . .] Im Sommer vielleicht mehr ein wenig, ähm also ich glaube, es kommt wie auf den Ort an, was sich verändert über die Jahreszeit, die Woche, die Tageszeit.

29 Participant C2: Ich glaube, das ist ja das Schöne im Glarnerland, man muss nicht lange suchen. Also man kann wirklich, ob es jetzt auch da ist, man kann hier hochlaufen, und es wird wahrscheinlich eher ruhig sein. [...] Dadurch finde ich es eigentlich noch schwer, selbst für mich zu sagen, ob ich so etwas suche. Weil ich ja nicht suchen muss.

Appendix B

Original wording of place descriptions

1 Stille, kaum Menschen, wilde Natur/Bergumgebung/Tiergeräusche lässt einem selber still werden (trotz spürbarer Folgen des Klimawandels am Schwund des Gletscher-A).

2 Neuer, noch namenloser grosser See nördlich von 1: absolute Stille, Wasser-Eisblock-Geräusche, Pioniervegetation (Umgebung)

3 Vor allem im oberen Teil sehr wilder und ursprünglicher Wald (Gegenteil von Forst), Stille, Naturkreislauf, Tiergeräusche/Vögel

4 Stille (auch im vielbegangenen Ort-D, v.a. Winter), Natur/Bergumgebung hoch über Ort-D lässt einen still und klein werden, viele Vögel, auch Adler drehen vor einem ihre Runden

5 Sehr ruhiger Ort mit einer der schönsten Aussichten Richtung Ort-E, aber auch in ins Glarner Hinterland.

6 Dort ist die Aussicht weniger speziell, aber megaa ruhig, Wald und kleine Bäche. Allenfalls gibt es auch Tiere zu sehen.

7 Ort-F finde ich allgemein auch sehr schön, aber ist jetzt schon eher ein wenig touristisch und darum für mich jetzt nicht so "tranquil".

8 Wasser, Berge sind so imposant da, Natur, Auenwald, frische Luft.

9 Wald, frische Luft, wenig Spaziergänger

10 Schöne Blumenwiesen, Aussicht, viele natürliche Strukturen wie Trockenmauern, warmer Hang wenn die Sonne scheint.

11 Ort-I im Winter, wenig Leute, Berge, Natur, Ruhe

12 War zwar nur einmal dort aber es gilt eigentlich für fast alle Berge in Glarus - es ist eine mega Aussicht, ich habe den Sonnenaufgang gesehen, unglaublich frische Luft, ruhig weil niemand dort oben war ausser wir so früh, die Natur war super schön, schon auf dem Weg nach oben.

13 Ort-D oder Ort-J die Aussicht - beides auf alle Fälle sehr schon anzuschauen und um zu verweilen, laut je nach dem, aber für die Augen sehr beruhigend, vor allem auch im Herbst

oder Winter zum Beispiel wenn es weniger Leute hat, immer noch sehr schöne aussicht aber auch sehr schön ruhig, um in der Natur zu spazieren sehr schön.

14 Ort-K, hier liebe ich einfach das Wasserrauschen, sonst keine mega Aussicht, aber es beruhigt stark wenn man sonst nicht viel hört nur das Wasserrauschen.

15 Tolle Aussicht, ruhig, schön um mit den Ski runter zu fahren.

16 Gemütlich, toll zum Baden und Surfen, ruhig

17 Ruhig, Natur, alleine, schöne Aussicht

18 Wasser, Aussicht, Ruhe – keine Menschen, Feriefeeling

19 Keine Menschen, Bachklänge, Wald

20 Fliessendes Wasser, Blätter rascheln, unbefestigter Boden. Kieswege oder Naturpfade empfinde ich als tranquiler als asphaltierte Böden

21 Auch weiter oben, also wenn man dem Bach-A weiter folgt, sehr schön! Sehr wenig Menschen dort. Auch hier wieder: Wasser in der Nähe, von Bäumen umgeben (Blätter rascheln)

22 Umgeben von Bäumen (abgegrenzt von allem und allen anderen)

23 Schöne Aussicht aufs ganze Glarnerland auf dem Gipfel und es gibt einem Heimatgefühl. Es gefällt mir auch weil es ruhig ist und wenig Leute hat und man wird «belohnt» für den strengen Anstieg

Appendix C

Focus group guide

Ablauf Focus Group (nach Krueger 2014) — Zeit

Einstieg

1. *Begrüssung der Teilnehmenden* — **5**
    a. Einverständniserklärung (auf Papier auszufüllen)

2. *Überblick über meine Masterarbeit / das heutige Thema* — **5**
    a. MA am GIUZ mit Thema «Tranquility in Glarus»
    b. Übersetzung / Definition Begriff «Tranquility»

3. *Informationen zu Beginn* — **5**
    a. «ground rules»:
        - Es gibt keine falschen Antworten
        - Diskussion bleibt anonym
        - Nicht formell
        - Man darf diskutieren
        - Ich bin nur Moderator, nicht Experte
    b. Info zur Selektion: Personen sind eingeladen als Einheimische mit verschiedenen Hintergründen, bewusst unterschiedliche Inputs

4. *Simple Eröffnungsfrage* — **5**
    a. Woher kommen Sie und was ist Ihr Lieblingsort im Kanton?

Hauptteil

5. *Einstiegsfrage* — **10**
   Können Sie sich an eine bestimmte Situation erinnern, in der Sie sich besonders ruhig, entspannt und friedlich gefühlt haben?
    a. Was hat diesen Moment so besonders gemacht?

➔ Zuerst sollen die Teilnehmenden selbst überlegen und dann werden Gedanken zusammentragen und auf Post-its notiert, welche auf Flipchart geklebt werden

6. *Schlüsselfrage* — **15**
   Was macht diesen/einen Ort "tranquil"?
    a. Auditiv: Was hören Sie?

b. Visuell: Was sehen Sie?
c. Sonstige Eindrücke?

➔ Hier Begriffe in word cloud sammeln mit mentimeter (Hinweis in Einladung, dass Smartphone mitgenommen werden soll. Falls nicht möglich auch wieder post-its ausfüllen)

7. *Schlüsselfrage* **10**
   a. Suchen Sie aktiv solche Orte?
   b. Falls nein, «erleben» Sie trotzdem «Tranquility» in gewissen Situationen?

8. *Einstiegsfrage* **10**
   Können Sie sich an eine bestimmte Situation erinnern, in der Sie das Gegenteil gefühlt haben, also überhaupt nicht ruhig, entspannt und friedlich gefühlt haben? Was hat diesen Moment ausgemacht?

➔ Zuerst sollen die Teilnehmenden selbst überlegen und dann werden Gedanken zusammentragen und auf Post-its notiert, welche auf Flipchart geklebt werden.

9. *Schlüsselfrage* **15**
   Was macht diesen/einen Ort weniger "tranquil"?
   a. Auditiv: Was hören Sie?
   b. Visuell: Was sehen Sie?
   c. Sonstige Eindrücke?

➔ Zuerst kurz selber überlegen und dann zusammentragen und Gedanken auf Post-its notieren, welche auf Flipchart geklebt werden

10. *Schlüsselfrage* **10**
    Soll man überhaupt eine Karte machen?
    a. Was wären Alternativen, um das Konzept abzubilden?

11. *Falls noch Zeit: Schlüsselfrage* **5**
    Wie verändert sich Tranquility über die Zeit?
    a. Wird ein Ort zu bestimmten Tageszeiten, Wochen oder Jahreszeiten mehr oder weniger "tranquil"?
    b. Gibt es Orte, die sich verändelook n über die Zeit?

Ende

12. *Schlussfragen* **15**
    a. «All things considered question»*:* Wenn Sie eine Eigenschaft auswählen müssten für einen tranquil place, welche wäre dies?
    b. Mündliche Zusammenfassung: Wichtigste Punkte nochmals repetieren und fragen, ob etwas Wichtiges fehlt (mit Hilfe der Person, die Notizen macht)
    c. Falls Zeit: Auch typische Resultate aus anderen Studien aufbringen, die fehlten, und Meinung von Teilnehmenden dazu fragen.
    d. Letzte Frage: Haben wir etwas Wichtiges vergessen?

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Personal declaration: I hereby declare that the submitted thesis results from my own independent work. All external sources are explicitly acknowledged in the thesis.

Disclaimer: The tools Deepl Translator and ChatGPT 5 were used for translation and rewording in some circumstances. ChatGPT was used as support in certain coding problems.

Zurich, September 30, 2025

Fabio Eberhard