Utrecht University

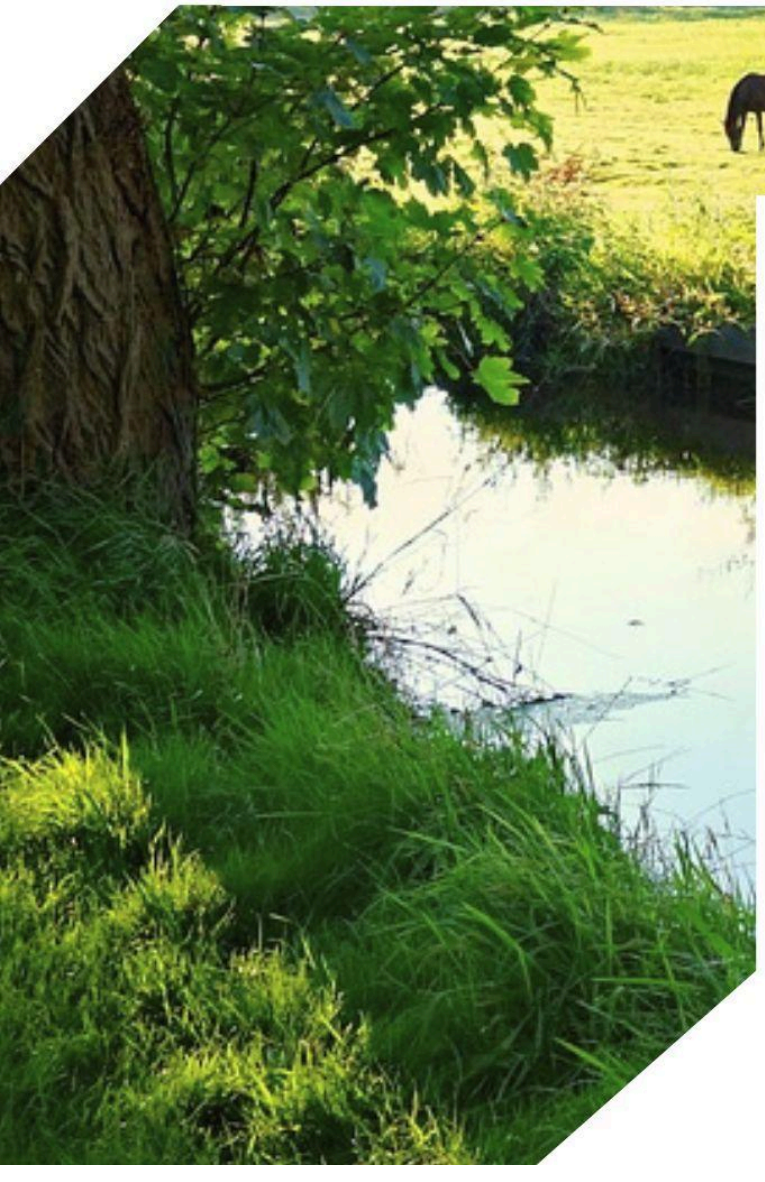
Nationaal Park Utrechtse Heuvelrug

Foundation National Park Utrechtse Heuvelrug

MONA Project

How can a modal shift from car use to more sustainable mobility options be facilitated in the National Park Utrechtse Heuvelrug?

Client Contact: Sterre Sparreboom



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Integrative Executive Summary

This consultancy report has conducted an analysis aimed at providing actionable recommendations to facilitate the shift in car use to sustainable mobility to the National Park Utrechtse Heuvelrug. Foundation National Park Utrechtse Heuvelrug (NPUH) works together with various stakeholders on and around the Utrechtse Heuvelrug to protect and develop nature, landscape and heritage (Nationaal Park Utrechtse Heuvelrug, 2021). NPUH is part of the *"Modal shift, routing and nudging solutions in NAture areas for sustainable tourism"* (MONA) project, which is aimed at enhancing sustainable infrastructure and connectivity to natural parks and has the focus of this project (Interreg North-West Europe, 2023).

The knowledge gap ensues strategies to effectively ensure a shift from car use to increased use of sustainable transportation from and to the park. This research was conducted to propose advice on how to reduce the excessive car usage by inspiring the shift towards sustainable transportation. Answering the question: *How can a modal shift from car use to more sustainable mobility options be facilitated in NPUH?* To answer the question, it was further divided into three sub-chapters each delving into a specific aspect of the journey to the park.

The key findings of the report are two primary pieces of advice. The first piece of advice is to create a green experience or journey to the national park. This can be done by immersing the visitor with a seamless transition from station to park by creating signage and greenery at the stations, creating green paths from stations to the park, and by creating audiobooks or podcasts about the history and park to create a feeling of excitement and commitment to the park.

The second piece of advice is to ensure that the sustainable journey is comfortable for the visitors. The comfortable and enjoyable journey to the park can be facilitated through improving accessibility information to the park by updating the park website with detailed information on public transport routes, providing shortest walking paths and sustainable transport options, and enhancing facilities at the train stations.

Integrative Advice

Integrative Introduction

All over the world national parks have been developed to conserve and protect unique nature and landscapes (Alemu, 2015). In the Netherlands alone there are 21 national parks, of which National Park Utrechtse Heuvelrug (NPUH) holds a special place. The NPUH is a centuries-old area that, due to its location and beauty, is a place where people visit to participate in recreational activities and enjoy nature (Nationaal Park Utrechtse Heuvelrug, 2021). However, alongside the benefits of increased visitation comes the challenge of mitigating environmental impacts, particularly related to transportation. Car use contributes to carbon emissions, air pollution, and habitat fragmentation, posing significant threats to the ecological integrity of nature parks (European Environment Agency, 2024).

The NPUH works together with the owners of nature reserves, the province of Utrecht, municipalities on and around the Utrechtse Heuvelrug, and other organisations and area parties to protect and develop nature, landscape and heritage (Nationaal Park Utrechtse Heuvelrug, 2022). Foundation National Park Utrechtse Heuvelrug oversees numerous projects, including the Sustainable Mobility Project MONA which launched in 2023, aimed at enhancing sustainable infrastructure and connectivity to natural parks (Interreg North-West Europe, 2023). With international cooperation and support from the European Union, MONA seeks to develop innovative solutions to promote eco-friendly mobility within parks and their surrounding areas (Nationaal Park Utrechtse Heuvelrug, 2024).

One significant challenge facing the NPUH is achieving a modal shift from car use to more sustainable mobility options while balancing increased visitor numbers with the preservation of natural heritage (Beunen et al., 2006). Currently, there is a lack of understanding of effective strategies for encouraging behaviour change towards sustainable transportation modes within nature reserves. Additionally, achieving a modal shift from cars to sustainable mobility options requires overcoming deep-rooted habits and preferences of visitors. Achieving a modal shift towards sustainable transportation options is essential for preserving the ecological integrity of the park, reducing carbon emissions, and ensuring its long-term resilience (Laffond et al., 2020). Thus, the question the client seeks advice on is: *How can a*

modal shift from car use to more sustainable mobility options be facilitated in the National Park Utrechtse Heuvelrug?

To answer the question, it was further divided into three sub-chapters each delving into a specific question, researching a different aspect of the issue. Sub-Question 1: "*How can connectivity be improved to facilitate sustainable transport from train stations to the national park?*" focuses on improving connectivity from train stations to the park and ensuring a seamless transition to sustainable transportation options. Sub-Question 2: "*How can train stations be transformed into green entrances?*" delves into transforming train stations into green entrances, imbuing visitors with a sense of environmental consciousness and tranquillity from the onset. Sub-Question 3: "*What measures can be taken to increase awareness among individuals about sustainable transportation options for accessing the National Park?*" explores measures to increase awareness among individuals about sustainable transportation options before their journey to the park and stimulate behavioural changes.

By examining these three sub-questions, the report aims to unravel the complexities surrounding sustainable mobility within the NPUH, paving the way for targeted interventions and informed decision-making to preserve its natural landscape for generations to come.

Advice

There are two primary pieces of advice developed by the consultancy team. This section discusses the results of the report. Sub-chapter 1 and Sub-chapter 2 have all together analysed four train stations. These findings can be extended to other stations in the park in the future. Furthermore, the selection of stations for Sub-chapter 1 and Sub-chapter 2 allowed an overlap of two out of the three stations, facilitating interventions by the Foundation NPUH. The NPUH has higher potential influence over these stations due to their size, enabling exploration of possible modal shift pathways.

Advice 1: Create a green experience

The first primary advice presented by the consultancy team is to create a green experience. The focus of this advice is to create one singular, seamless experience that will make the visitor feel immersed in the national park, even before officially stepping into it. The approach includes elements of nature into the station environment, establishing soft mobility hubs, and creating immersive audio tours. This entails fostering a sense of connection and belonging to the natural environment from the moment of arrival. This will be done by immersing visitors into the sights and sounds of the park, instilling a deep appreciation for the park's nature and inspiring a commitment to sustainable choices.

Argument 1: Implementing specific measures at train stations will create a green experience for the visitor. It consists of the transformation of stations into green entrances to create a gateway to the natural surroundings. One measure would be to implement both native and non-native plants onto the platforms or between the tracks. It should consist of “low, flower-rich, colourful and biodiverse plants” (Appendix 2.C). (Sub-chapter 2, p. 44). In the main hall or squares right outside the station small trees/bushes can have ‘wilder’ and taller nature. (Sub-chapter 2, p. 44). Another specific measure is the instalment of soft-mobility at train stations. Both soft mobility providers, TIER and Baqme, are keen to contribute to the facilitation of a modal shift by continuing to provide their sustainable soft mobility services. (Sub-chapter 1, p. 24). Also, by including soft mobility options into the train station signage it could increasingly induce the use of sustainable transportation (Sub-chapter 2, p. 49). Soft mobility facilities enhance the creation of a green experience because of their increased harmony with the natural environment allowing visitors to immerse themselves in their surroundings while travelling between the park and the train station.

The green entrance creates an immersive experience that instils a sense of connection with nature as soon as arriving into the station. By implementing green elements, through biophilic design, it can influence the behaviour of the visitor to act more responsible in nature. This is because biophilic design "connects human and nature through the built environment by implementing natural elements" (Kellert et al., 2011, p. 3; Sub-chapter 2, p. 43). More can be found on biophilic design under 'Evidence: Feeling of Inclusiveness in Nature'.

Argument 2: Emerging the visitor into the green experience with use of audiobooks creates a connected feeling. Integrating audiobooks or podcasts into the visitor experience offers a powerful tool for immersing individuals in the natural environment even before they arrive at the park. Research suggests that immersive experiences, such as audio tours, can evoke emotional connections to the surroundings, heightening interest and motivation to explore sustainably. According to studies by Magginas et al. (2018) and Karatsoli & Nathanail (2021), online platforms, including audiobooks, play a significant role in shaping travel decisions and influencing behaviour (Sub-chapter 3, p. 63). By providing rich narratives about the park's history, biodiversity, and conservation efforts, audiobooks foster a sense of anticipation and excitement, prompting visitors to adopt sustainable travel practices.

Additionally, the Munich pilot study by Mauro et al. (2022) emphasises the importance of emotional gratification in promoting long-term changes in mobility behaviour (Sub-chapter 3, p. 62). By fostering a connection between visitors and the park they are more likely to act in favour of the park, which is by using sustainable transportation. Therefore, incorporating audiobooks into the MONA project can enhance visitor engagement and encourage environmentally conscious exploration of the park.

Advice 2: Make sure the sustainable journey is comfortable

The second primary advice presented by the consultancy team is to ensure that the sustainable journey is comfortable. This advice focuses on prioritising comfort and convenience to enhance the overall travel experience for the visitor, as it significantly impacts the overall sustainability of their transportation choices. It consists of removing challenges that are currently discouraging visitors from choosing sustainable transport options. Also, it focuses on the seamless transition between transportation modes. By ensuring a comfortable journey, it creates an environment where sustainable travel becomes desirable and enjoyable for all

visitors to the NPUH. It also means that visitors are more likely to opt for sustainable transport options.

Argument 1: Providing easy accessible information about sustainable transport options ensures comfort prior to the journey. Providing visitors with a comfortable sustainable journey improves the key factor, physical opportunity, of behaviour change, according to a study conceptualising behaviour change that was performed by Michie et al. (2011) (Sub-chapter 3, p. 72). Ensuring that information about travel options is disseminated well in advance of visitors' trips, allows them to plan their journey comfortably. By giving information that promotes sustainable transport alternatives over car usage and shows sustainable mobility as the easiest option, visitors may be incentivized to change their behaviour (Sub-chapter 3, p. 62). Moreover, regularly updating and maintaining infrastructure and information channels to ensure ongoing comfort and sustainability in transportation options.

Research highlights the need for easily accessible information about transport options to raise awareness and stimulate behavioural changes. A centralised platform, such as a website, for travel information can significantly impact travel behaviour (Sub-chapter 3, p. 61). Currently, this platform is not well established, information is lacking or not easy to find, Table 3.0 in Sub-chapter 3 provides detailed points of improvement to establish effective websites for the NPUH.

Argument 2: The enhancement of facilities at the train stations will make the journey more comfortable for the visitors of the national park. One measure to be enhanced is water taps, or implemented if not already at the station. Water taps create a reason for advantaging commuters by public transportation over car users. (Sub-chapter 2, p. 47). Another measure to improve on in order to make the journey comfortable for visitors is through signage. Signage is important in creating a well-informed journey for the visitor. As mentioned by Network Rail (2022), directional information is the second most important need in the hierarchy of signage (Sub-chapter 2, p. 48). Signs that are produced using different design styles could be an effective way to make them clearly distinctive than the ones already in stations. This would allow the usage of signs without interference with train information.

Argument 3: Making the sustainable journey comfortable through availability of maps and soft mobility options helps change transport behaviour. Being aware of information on the

most accessible way to enter the park from the station heightens the comfort of the journey. One way this can be done is through identifying the shortest routes, for both walking and biking paths, from train stations to the NPUH (Figure 1.3, Sub-chapter 1, p. 18). Also, informing visitors on the time of travel between the station and the park helps to increase the convenience of the whole journey (Table 1.1, Sub-chapter 1, p. 18). This information can be combined into an interactive map that shows an overview of all soft mobility hubs, paths and stations and can be displayed on the website of the national park. Persuasive technologies like an interactive map can enhance visitor experience and increase awareness by providing information (Sub-chapter 3, p. 62).

Conclusion

To conclude, there are two primary pieces of advice presented by the consultancy team; first to create a green experience and secondly, to make sure that the sustainable journey is comfortable. The integration of these pieces of advice, by the NPHU, will lead to a comfortable and nature centred journey into the park, resulting in less environmental disruption and pressures on nature. It also aims to facilitate the modal shift from car use to sustainable mobility.

Further study of the visitor profile of the NPUH is recommended to locate areas for improvement and to establish local solutions. It would also be recommended to update and engage stakeholders of the NPUH in the implementation of the measures to ensure a collaborative environment to maximise impact.

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How can connectivity be improved to facilitate sustainable transport from train stations to the national park?

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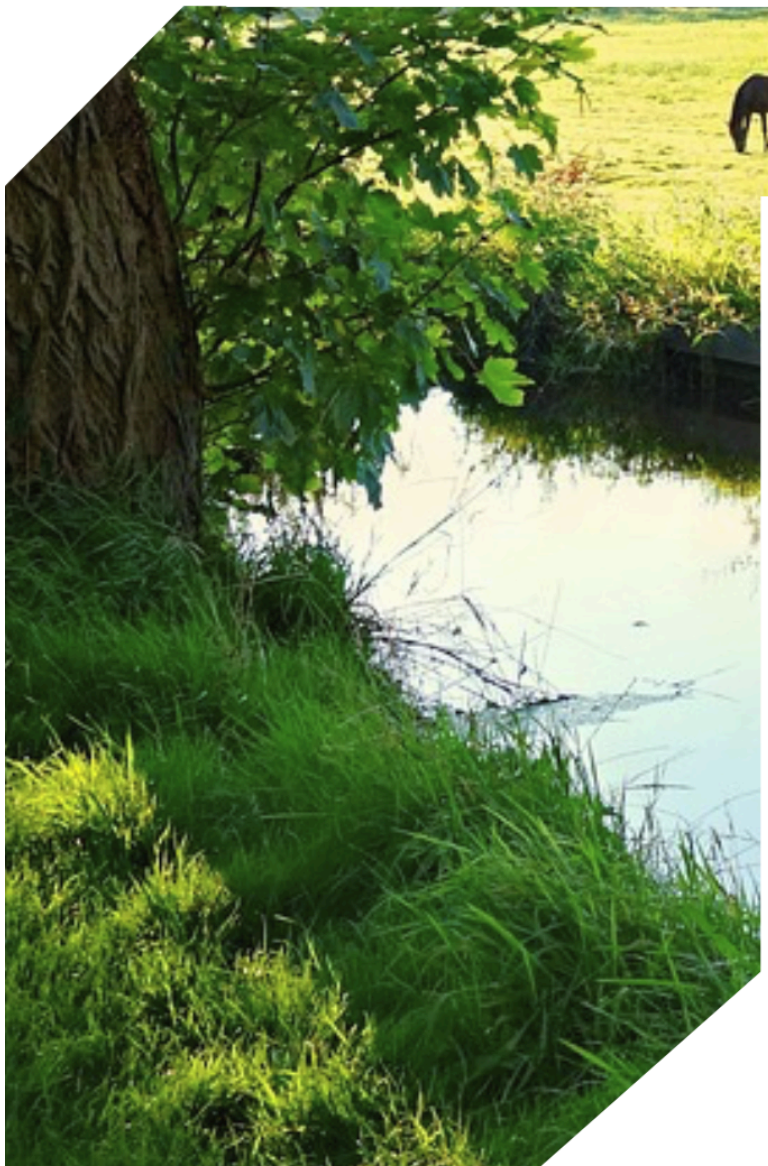

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Consultancy Project GEO3-2423

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Introduction

How can connectivity be improved to facilitate sustainable transport from train stations to the national park?

In this subchapter, the focus lies on improving connectivity between the train station and the National Park Utrechtse Heuvelrug (NPUH). This is crucial due to the challenges the park faces from the extensive car use. These pressures generally include noise pollution, air pollution and the compromised park experience for visitors encountering cars parked along its roads.

The overall objective is to influence the modal split, encouraging more soft and sustainable mobility from the train station to the NPUH. Currently, the park contains 19 train stations situated within or near its boundaries (Figure 1.1). By improving connectivity between these train stations and the park the consultants aim to increase the use of sustainable transport and reduce the pressure created by car use in the park. This objective will be achieved by addressing the following research question: "*How can connectivity be improved to facilitate sustainable transport from train stations to the national park?*"

In this section, soft mobility refers to "*human-powered, non-motorized ways of getting around, such as walking, cycling,* [...] *that have relatively little impact on the environment and require people to be physically active*" (Chapman & Larsson, 2019, p. 2). The concept of soft mobility is expanded upon by the sustainable transportation definition, which refers to transport that emits low or no emissions and has a minimal environmental impact within the park. This expanded definition of soft mobility concept in this sub-chapter includes e-bikes and cargo bikes, which accommodate visitors with limited physical capabilities, those carrying larger items or families with children. Thus, soft mobility refers to walking, cycling, and the use of electric bicycles, while unsustainable transportation in this context refers to private vehicles and taxis.

The consultants looked at the options of green walking paths for shorter distances and biking paths for longer distances to NPUH. Promotion of these connectivity measures could make it more attractive for visitors to utilise the train services in the national park area rather than arriving by car.

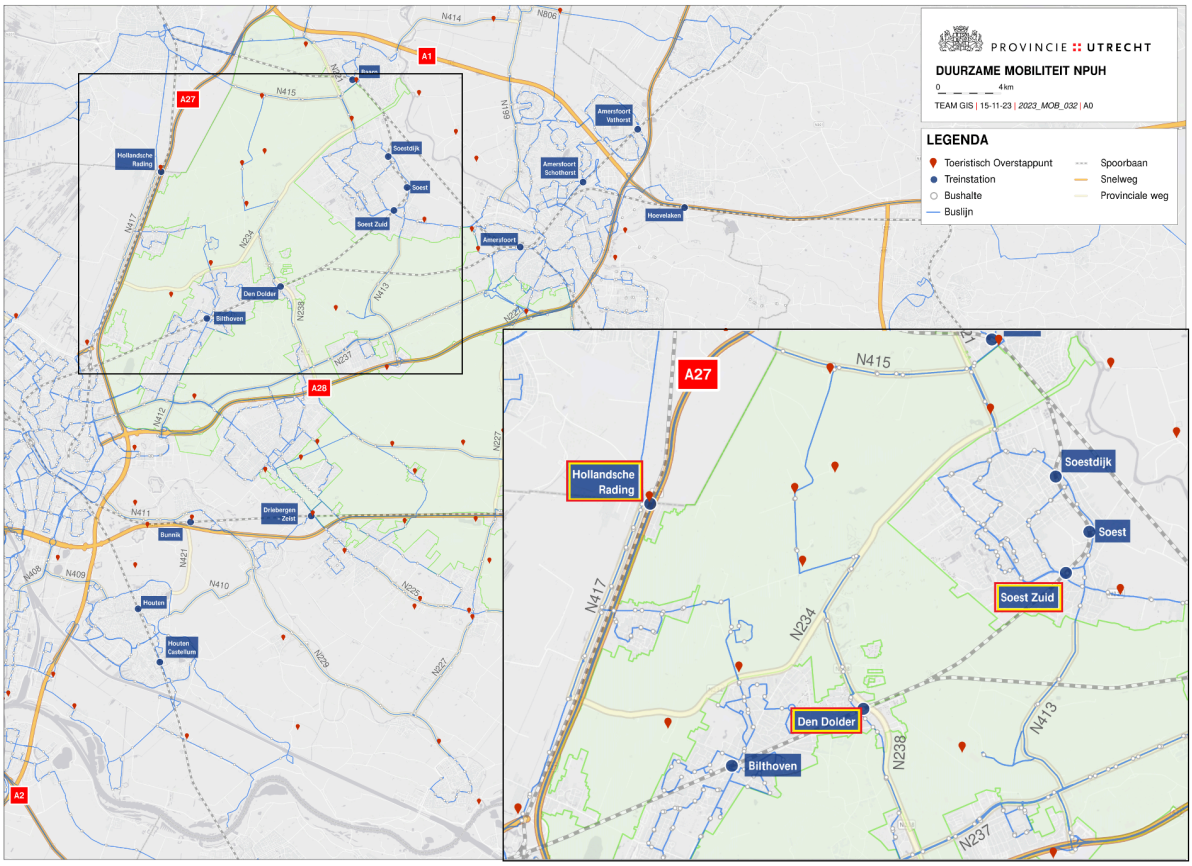


Figure 1.1. Map showing the distribution of stops situated within or nearby NPUH. The three highlighted train stations (in red) are further analysed in this Sub-Chapter. (Figure adapted from the Foundation NPUH, 2024).

Advice

- **Advice 1:** Facilitate and promote green paths for shorter distances such as from Hollandsche Rading train station.
    - **Argument 1.1:** To improve connectivity from the train station Hollandsche Rading to the national park the visitors should be made aware of the walking path between the station and the park. The spatial analysis indicates that there is a sufficient green walking path from train station Hollandsche Rading, taking only six minutes (Table 1.1), thus can be used by visitors as a way of commuting.
        - **Evidence 1.1.1:** Cardozo, Carlos García-Palomares & Gutiérre (2013) brought out a study done by Loutzenheiser (1996) that revealed a significant drop in walking likelihood (a 50% decrease) for every 500m distance increase from a transit station.
    - **Argument 1.2:** It is not necessary to insert a soft mobility hub to station Hollandsche Rading because the distance is short enough to be completed by a walk. Enhancing greenery along the path may be a more efficient way to enhance connectivity at this station.
        - **Evidence 1.2.1:**A study done by Untermann (1984) found that nearly all people were prepared to walk 500 ft (152.4m).

- **Advice 2:** Facilitate the instalment of soft mobility services where distances from the train station to the park are longer such as at Den Dolder and Soest-Zuid.
    - **Argument 2.1:** The spatial analysis indicates that walking takes a significantly longer time to commute to the park than using a bicycle or electric bike from both Den Dolder and Soest-Zuid. Thus, to improve connectivity from Den Dolder and Soest-Zuid train stations to the national park the implementation of a soft mobility hub might be necessary.
        - **Evidence 2.1.1:** This advice is based on findings from a study on Dutch urban transit, which indicated a 20% decrease in willingness to use train stations if they are located more than 500 metres away from residential areas (Keijer & Rietveld, 2000). Furthermore a study done by Untermann (1984) found that 40% of the responders were willing to

walk 1000 ft (304.8m), and just 10% 1.5km. Furthermore, as already mentioned there is a 50% decrease in walking likelihood for every 00m distance increase from a transit station (Cardozo et al., 2013).

- **Argument 2.2**: From the interview analysis, it is clear that the largest obstacles for both interviewed soft mobility providers are demand and finances. These should be addressed to facilitate instalment of soft mobility measures in NPUH. Collaborative efforts should be leveraged as they have emerged as the largest opportunity. Furthermore, Baqme is more open to entering NPUH, thus it could be easier to implement their soft mobility services near the Den Dolder and Soest-Zuid train stations.
  - **Evidence 2.2.1:** Results of the interviews in the result section (Sub-chapter 1, p. 19-25).

- **Advice 3:** More investigation needs to be conducted to reveal specific motivations behind car usage.
  - **Argument 3.1:** Further interviews with visitors and more in depth analysis of visitor profile, expanding on municipality surveys (Kantar Public, 2023a; Kantar Public, 2023b), could aid understanding whether provision of soft mobility services and greening of paths will encourage visitors to switch from a car to soft mobility and which soft mobility providers are more desired at a certain station by the visitor.
    - **Evidence 3.1.1:** Because car users cover a wide demographic. Understanding the specific motivations behind car usage within each target group is crucial for enticing them to opt for public transportation or in this case soft mobility transportation (Göransson & Andersson, 2023).

Results and Evidence

In this section, the results and evidence gathered from geospatial analysis and interviews with Baqme and TIER were analysed to explore sustainable mobility options between selected train stations and National Park Utrechtse Heuvelrug (NPUH). The analysis contrasts walking and biking routes, assesses connectivity and discusses the potential improvements. Insights from the interviews highlight the obstacles and opportunities in enhancing sustainable and soft mobility, focusing on demand, regulations, support, and financing. Through this combination of quantitative and qualitative data, the aim is to provide comprehensive strategies for promoting sustainable transport in the NPUH area.

Results Shortest Path Analysis

In this section, the geospatial results are displayed and discussed. Figure 1.2 shows an overview map with all the walking - and biking routes surrounding National Park Utrechtse Heuvelrug. The three train stations correspond with Figure 1.1 and are the stations that this study focuses on. It can be concluded that all three train stations are well connected to the biking routes. However, it should be noted that the unofficial park's extension reaches more north than the official outline. This is why there is an additional area added to this dataset using the map provided on NPUH's website (Nationaal Park Utrechtse Heuvelrug, 2021).

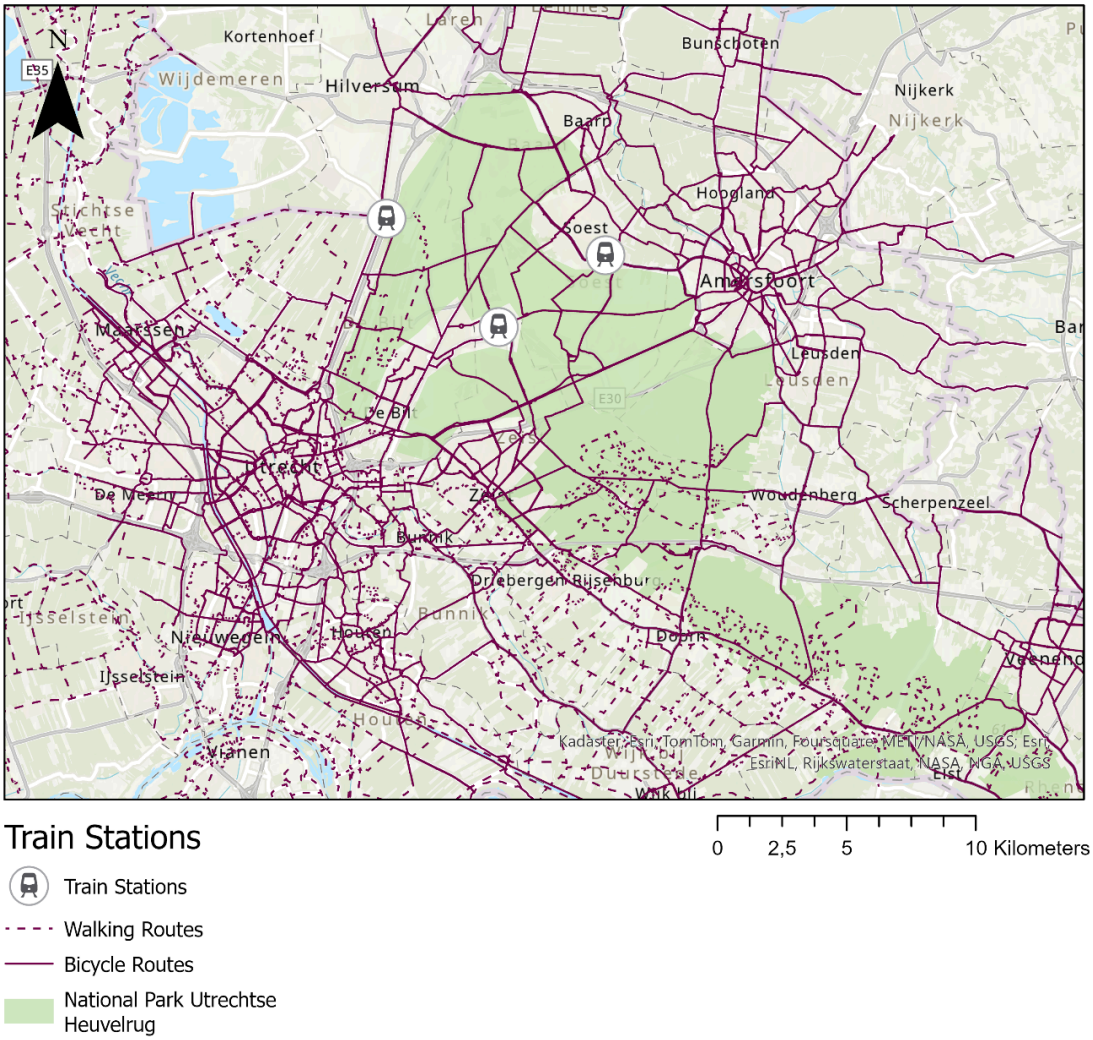


Figure 1.2. Overview map of all datasets used in the ArcGIS Pro analysis. Relation between walking routes, biking routes, train stations and NPUH.

Table 1.1 shows the duration it takes to walk, bike or e-bike from each train station to the outline of the NPUH. It can be concluded from Figure 1.2 that train station Hollandsche Rading is closest to the NPUH with an under 6 minutes walking distance, and a 1 to 2-minute (electrical) biking distance (Table 1.1). Train station Den Dolder is located at a greater distance from the outline of the NPUH with a walking distance of more than 19 minutes, and a 3 to 5-minute (electrical) biking distance (Table 1.1). Train station Soest-Zuid has the furthest distance from the station to the NPUH, where the walking distance is almost 28 minutes, and the (electrical) biking distance is 5 to 7 minutes (Table 1.1). From these results, it is clear that the greater the distance between the train stations and the NPUH, the greater advantage it gives visitors to commute by bicycle instead of walking. Next to that, for these relatively small distances, commuting by an electric bike is not more convenient than

commuting by a regular bike. However, more variables should be considered to make this assumption besides the time it takes to commute.

Table 1.1. *Time calculations from each train station to the closest point of NPUH in minutes. Comparing walking, manual biking and electric biking.*

Shortest route duration	Hollandsche Rading	Den Dolder	Soest-Zuid
Walking	5,93 minutes	19,12 minutes	27,85 minutes
Bicycling (manual)	1,48 minutes	4,78 minutes	6,96 minutes
Bicycling (electric)	1,07 minutes	3,44 minutes	5,01 minutes

Figure 1.3 displays the spatial analysis conducted in ArcGIS Pro, where the highlighted bicycle routes in blue are the shortest routes between the three selected train stations and the NPUH. It should be noted that the shortest bicycle route in Figure 1.3 also represents the shortest walking route. However, the walking route dataset does not extend to the full NPUH and thus aerial photographs in ArcGIS Pro are analysed to make sure there are walking pavements on these roads. Furthermore, it is important to note that the three maps are displayed on different scales to encapture the route in a visually pleasing way.

Figure 1.3. Shortest routes from train stations to the NPUH (highlighted in blue). Train stations from left to right; Hollandsche Rading, Den Dolder, Soest-Zuid.

Interview Analysis

The interviews with representatives from Baqme and TIER were used to gain insight into the possible obstacles and opportunities (code definition Table 1.2) for the facilitation of soft mobility between the three selected train stations and NPUH (Figure 1.4). The analysis mainly revealed obstacles but in parallel, also some opportunities. First, the results present a general overview and explanation of codes. Further, a more in-depth analysis of specific obstacles and opportunities.

Table 1.2. *Brief definitions of the interview analysis codes.*

Codes	**Brief Definitions** (Obtained from Appendix 1.C & Tables A.1.1.-A.1.6)
Demand	Need for the soft mobility option by the consumer.
Regulations	The official allowance/authorisation/rule for installing the soft mobility measure.
Support	Support is needed for the maintenance of the product.
Financing	Financing of the soft mobility measure.
Sustainability Motivations	Driving forces that encourage soft mobility providers to contribute to the modal shift.
Collaborating and Partnership	Collaborations that lead to easier instalment of soft mobility options.

Interview Analysis Overview

Figure 1.4 reveals that collaborations (21%) and finances (22%) are the most frequently mentioned topics throughout the interviews with TIER and Baqme, followed by demand (20%) and regulations (19%). This suggests that focus should be placed on leveraging collaborations as an opportunity. Additionally, attention should be given to overcoming obstacles relating to finances, managing demand, and navigating regulatory challenges when implementing soft mobility solutions such as cargo bikes and e-bikes. Conversely, sustainability motivations (4%) and support (14%) were the least discussed, suggesting that

they may not be the main focus of the client when negotiating for the implementation of these soft mobility measures (Figure 1.4).

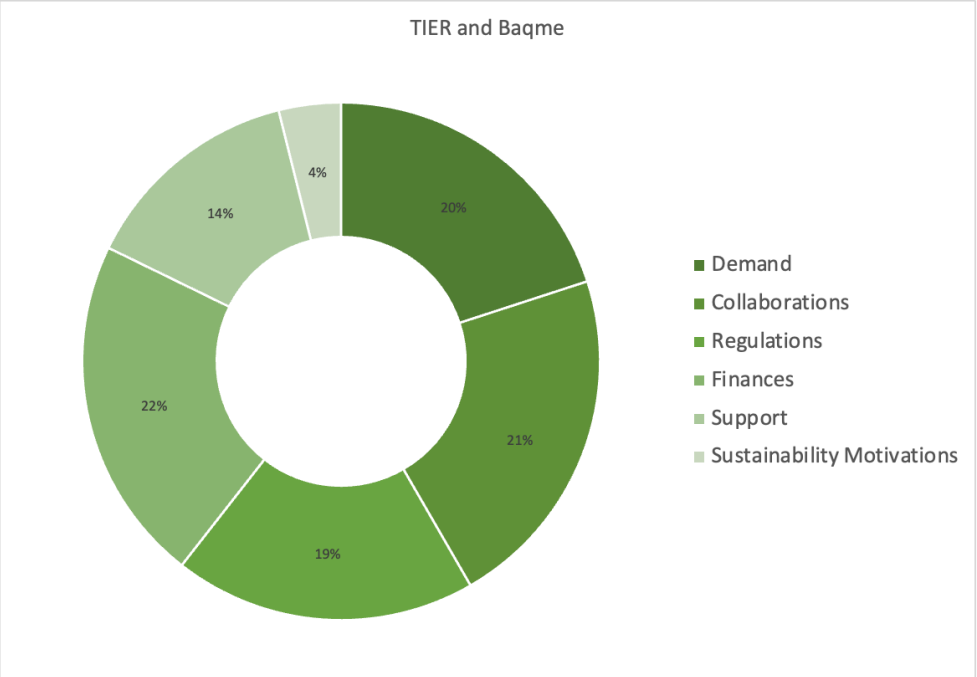


Figure 1.4. Codes from the interviews with Baqme and TIER combined.

Analysis of the interview with TIER shown in Figure 1.5 reveals that demand is the largest obstacle for this soft mobility provider, mentioned a total of 29 times. Therefore, when engaging with TIER, addressing demand issues should be a priority. Additionally, regulations are another major obstacle. To overcome this obstacle, NPUH and other stakeholders could consider negotiating these regulations to facilitate the entrance of soft mobility providers like TIER. Furthermore, because collaborations are a large opportunity it may be useful to leverage this opportunity to mitigate the impact of regulations and ensure easier implementation of this soft mobility measure. Lastly, the sustainability motivations of TIER are rather weak. This may indicate that leveraging this opportunity may not be a priority.

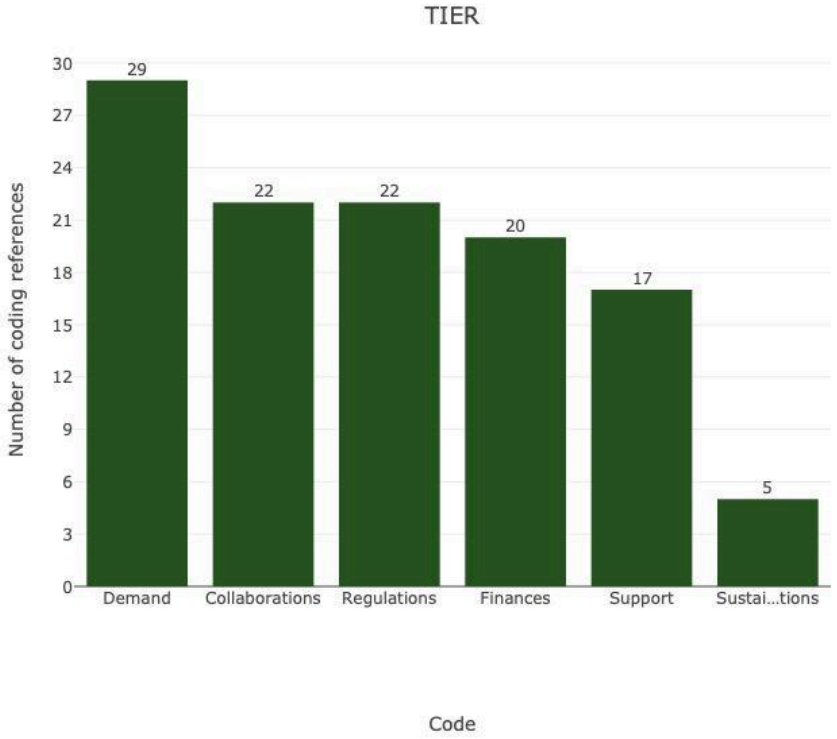


Figure 1.5. Codes from the interview with TIER.

The interview with Baqme shown in Figure 1.6, indicated finances as the most significant obstacle, mentioned 19 times. To address this challenge, financial support in the form of subsidies is necessary from the partners, such as municipalities. These subsidies can ensure a sustainable business model for the company. Collaborations on the other hand emerge as the primary opportunity just like in the case of TIER. This once again highlights the importance of leveraging collaborations to attract soft mobility providers and overcome other obstacles such as regulations, which are a significant obstacle in both cases. Just like in the case of TIER sustainability motivations seem to be a low opportunity and while it should not be disregarded the priority should lie on leveraging collaborative opportunities.

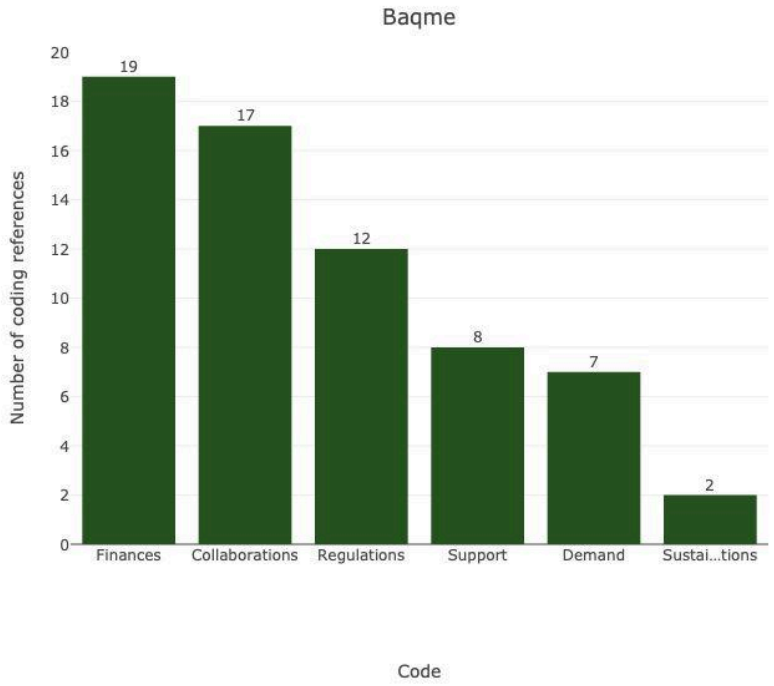


Figure 1.6. Codes from the interview with Baqme.

It is essential to note that the analysis in the figures above is not statistical; rather, it serves as a communication tool. Conducting interviews with more soft mobility providers would be necessary for a comprehensive statistical analysis.

Specific Obstacles and Opportunities

The interviews highlighted a few challenges in providing soft mobility options as well as some opportunities. Figure 1.7 displays a mind map of the two themes and corresponding codes with examples from the interviews.

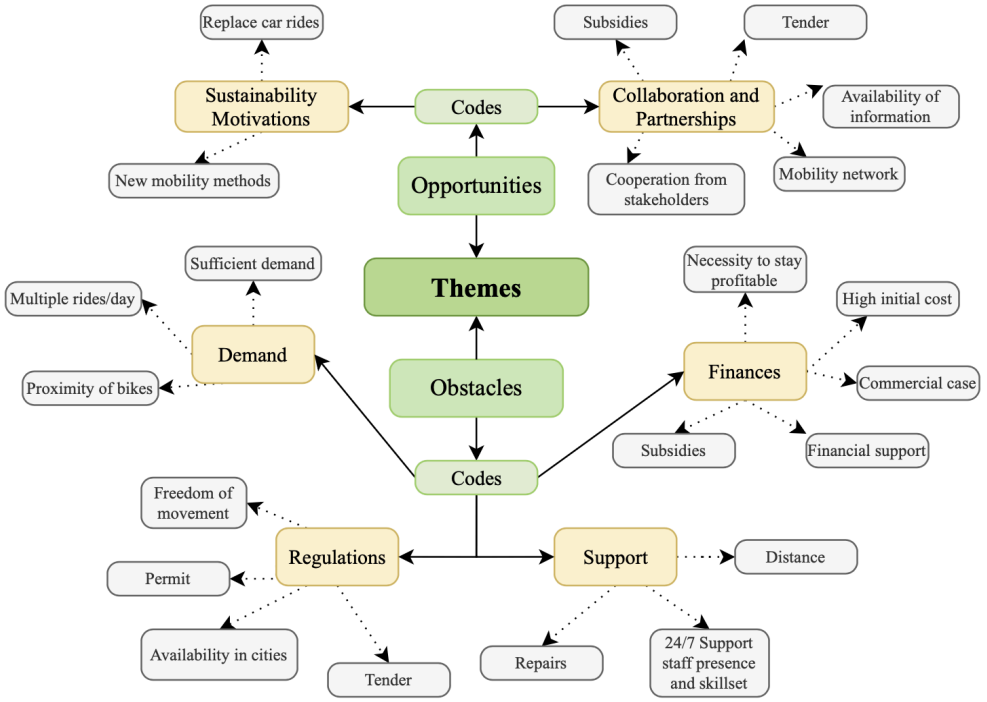


Figure 1.7. Mind map showing the two themes and corresponding codes with examples from the interviews.

Financing is the main obstacle mentioned several times by both soft mobility providers. Both companies rely on profit, thus, due to unsteady demand in the national park, municipalities would be required to subsidise both electrified modes of transport. Baqme representative brought out that "*[...] we would need financial support to get break even, and then we can operate.*" (Appendix 1.A), whereas TIER's representative mentioned that they are self-financing and do not need any additional finances (Appendix 1.B). While Baqme was more open to operating in the NPUH area, TIER immediately expressed that this is not an attractive area for the company at the moment due to irregular visitor density (Appendix 1.B). When the consultants investigated further, the main obstacle for TIER to enter the area was financing. Nevertheless, TIER could be open to entering the area with subsidies, thus, this could be an opportunity to overcome the financing obstacle. This would be particularly relevant for Soest-Zuid and Den Dolder due to the larger distances from these train stations to the park. This will make it more attractive for the visitors to utilise the train services in the NPUH area rather than arriving by car since the distance is at least double compared to Hollandsche Rading (See Table 1.1).

As mentioned above, the lack of demand and its unsteady nature is an obstacle for both soft mobility providers. Baqme's representative mentioned "*The most important thing is to reach the biggest amount of people for that use case.*" (Appendix 1.A), whereas TIER's spokesperson brought out that "*[...] for us to succeed, we need sufficient demand [...]*" (Appendix 1.B). Nevertheless, with increased promotion to use these modes of transport, the demand may grow. Indeed, where the demand is relatively low and there is a connecting green walking path with the NPUH, soft mobility providers do not need to install their services there. Additionally, the consultants have focused predominantly on smaller train stations in the area, thus, it may seem that there is a small number of visitors, whereas, in reality, it may not be the case for all train stations in the NPUH's vicinity.

Moreover, the regulations must make it easy for sustainable transportation providers to offer their services in the NPUH area. TIER representative brought out that *"[...] the main thing that is [...] slowing us down are city regulations.*" (Appendix 1.B). One of the opportunities to ease this process is the participation of municipalities that are responsible for mobility permits in the municipality. Thus, making it more attractive for sustainable transportation providers to enter the national park area and provide their services.

Nevertheless, opportunities such as collaboration and partnership are present and can be leveraged to overcome identified obstacles. Both interviewees seemed keen on fostering collaborations and regarded it as an opportunity for installing their services. Encouraging such collaborations will be important for improving connectivity and facilitating sustainable transport from train stations to the national park. Nils Verkennis from TIER mentioned the following: '*I do not consider us as a standalone product nor a standalone solution. [...] You want to be part of the whole mobility network within the city, and that requires you also to connect your services to other platforms in the mobility sector.*' (Appendix 1.B). Moreover, Sven Velthuis from Baqme stated that "*[...] cooperation with the stakeholders is very important for us [...]*" (Appendix 1.A). Therefore, the improvement of the collaboration between soft mobility providers, other stakeholders, such as municipalities, and the NPUH, could lead to enhanced connectivity opportunities.

Additionally, both soft mobility providers have a goal which aligns with a sustainable outlook and they are keen to contribute to the facilitation of a modal shift by continuing to provide their sustainable soft mobility services. Thus, increasing the proportion of sustainable

transportation options. A representative from TIER stated, "*[...] almost half of our trips are taken in combination with a different mode of transport, often it is public transport.*" (Appendix 1.B). Baqme's spokesperson brought out that "*[...] mainly what we are trying to do with Baqme is to replace short car rides in urban areas.*" (Appendix 1.A). Although a sustainable outlook offers comparatively lower opportunities, it can still aid the facilitation of soft mobility measures due to the aligned goals of the soft mobility providers and NPUH stakeholders

Lastly, there are several connections present between the obstacles and opportunities. Certain interview elements can be interpreted as both an opportunity and an obstacle. For instance, collaborations and finances share intersecting codes such as subsidies, which can be seen as both a financial obstacle but also an opportunity for collaboration (Figure 1.7). TIER's spokesperson mentioned that "*a subsidy for low-performing areas* [i.e., NPUH] *does make it a lot more attractive to a larger service there*". Moreover, regulations were often mentioned alongside possible collaborations, which would aid the implementation of the soft mobility measure. For example, TIER's representative brought out that "*to become operational, you need to have a permit*" (Appendix 1.B) and to get the permit the provider, according to Baqme's representative has to go through a "*competitive tender where the city invited shared mobility operators to submit a proposal to offer shared bikes in the city*" (Appendix 1.A). Therefore, it can be said that collaboration is closely intertwined with various obstacles.

Methodology

Sustainable connectivity options from train stations to the NPUH were explored through a qualitative research approach and advanced Geographical Information Systems (GIS) methodologies to provide a comprehensive understanding of the current situation and the potential for sustainable mobility measures.

Interviews were chosen over surveys as surveys were not considered a feasible method for this project due to the complexity and depth of understanding required as well as due to time constraints. The interviews were conducted in a semi-structured manner to allow for flexibility and a conversation-like discussion (Jamshed, 2014). The interview questions were designed to gain an understanding of the current situation and allow the identification of obstacles and opportunities for the implementation of soft mobility measures connecting train stations to the NPUH. The chosen methodological combination of interviews and GIS analysis allows for an extensive collection of data and insights necessary for this analysis.

GIS techniques were integrated by looking at the routes from the three focus train stations to the NPUH by utilising Dijkstra's algorithm to calculate the shortest walking and biking routes (Table 1.3). This algorithm evaluates the possible pathways to determine the one with the lowest aspect (i.e., distance), thereby, ensuring that the most efficient route is identified for both walking and biking scenarios (*Dijkstra's Algorithm*, 2021). ArcGIS Pro was used to create detailed walking and biking network analyses based on datasets and topology rules provided by Esri, facilitating a precise calculation of the optimal paths to the national park.

This project focuses on small to medium-sized stations, which are defined as having ≤1000 travellers for small stations and 1000-2000 travellers per day for medium stations. The focus is on three out of the 19 train stations situated within the NPUH area (Table 1.3), which are chosen in collaboration with the Foundation NPUH and Sub-group 2. This selection of stations allowed an overlap of two out of three stations, for greater integration. The smaller size of the stations facilitates interventions by allowing the Foundation NPUH to potentially have more influence on the stations, enabling a comprehensive exploration of the ways modal shifts can be encouraged. Moreover, this sample allowed the consultants to obtain a broader understanding of how modal shifts can be facilitated starting with smaller stations which could serve as a pilot project and then move on to the larger ones. The same methodology

could be applied to gain insights into enhancing sustainable connectivity throughout the whole NPUH area.

Table 1.3. *Showing the three selected stations chosen to be investigated, as well as the number of visitors per day, and the mode of transport taken after the arrival at the station (NS, 2022).*

Station	Nr of visitors per day	Sustainable Transport after transport (%)	Unsustainable Transport after transport (%)
Den Dolder	1547	89	11
Hollandsche Rading	745	73	27
Soest Zuid	1444	83	17

Research Framework

GIS Research Framework

Dijkstra's algorithm is used to calculate the shortest walking- and biking route from the three train stations to the national park (*Dijkstra's Algorithm*, 2021) This algorithm calculates the shortest path from one point to another, where each possible direction from the first point has a certain value (Yang, 2017). The algorithm considers all possibilities, and will eventually decide on the pathway that has the lowest value. This either means the lowest distance (metres), expenses (euros), or steepness (degrees). It makes sense to use this framework because the analysis aims to find the shortest walking and biking routes for NPUH visitors. Figure 3 shows an example graph of this algorithm, where the green circles represent different points (0-6) and each line in between these points gets a value assigned.

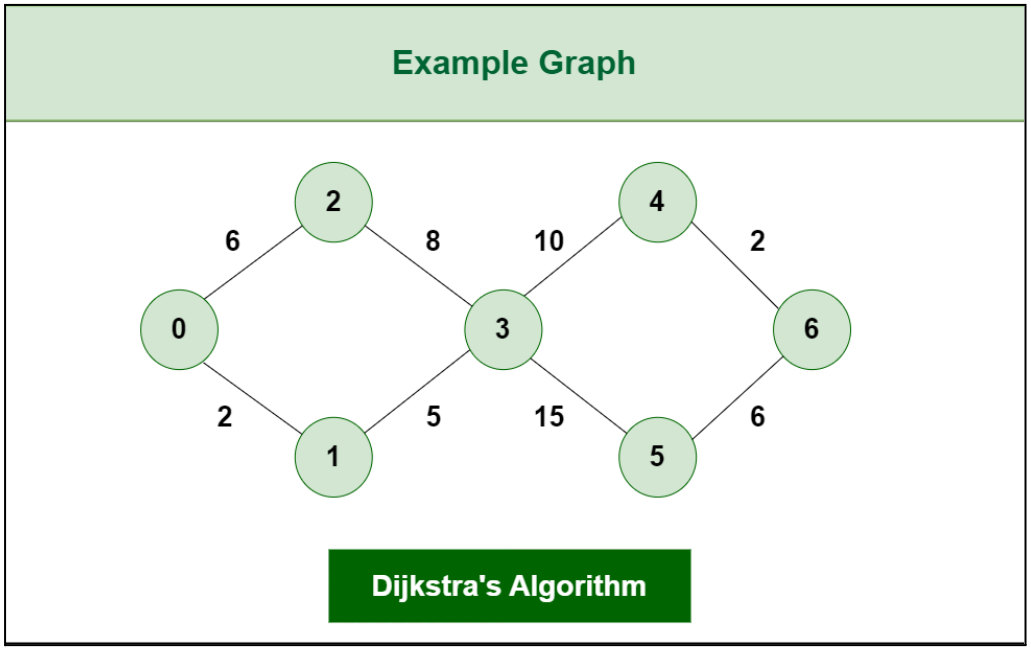


Figure 1.8. Dijkstra's Algorithm (GfG, 2024)

There are numerous Geographical Information System-programmes in which Dijkstra's algorithm could be calculated, where for this project the application ArcGIS Pro was used. To calculate these pathways for this analysis specifically, there are two networks created; a walking network, and a biking network. These networks are created using the different datasets and topology rules, which are provided by Esri. Once these datasets are geometrically connected, the shortest route is calculated with the "Network Analysis" extension toolkit in ArcGIS Pro.

Interview Research Framework

A Qualitative Content Analysis (QCA) framework from Kuckartz (2019) was used for the interview analysis. The QCA uses categories (codes), which form the category system (coding frame). The categories are established using either "*Concept-driven ('deductive') development*", "*Data-driven ('inductive') development*", or "*Mixing a concept-driven and data-driven development*" (Kuckartz, 2019, p. 184-185). Qualitative Content Analysis allows reliable and transparent analysis of the interviews. In QCA the data is completely coded, meaning that all relevant passages for answering the question are included (Kuckartz, 2019). Kuckartz's (2019) framework emphasises the central role of the research question; this is done to "*externalize the researcher's subjective standpoint in the investigation*" (Selvi, 2019, p. 444). Additionally, it shows the circular nature of the analysis phases such as building the

coding frame (Kuckartz, 2019). The framework in Figure 1.9 is further explained in the analysis section.

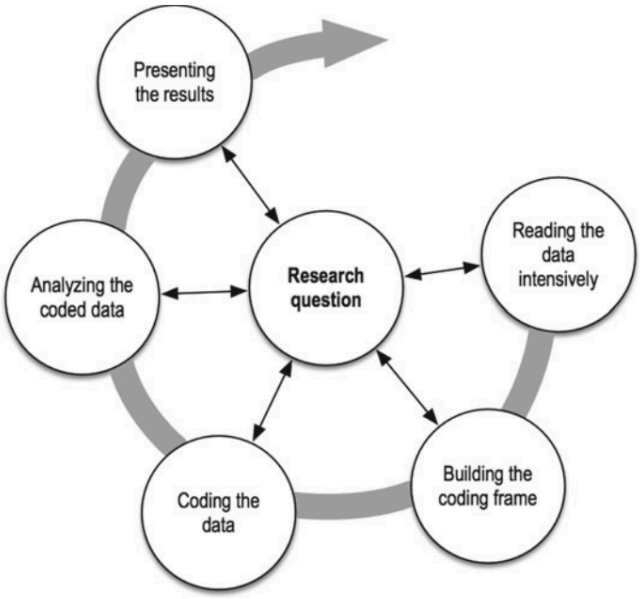


Figure 1.9. "*The five phases of qualitative content analysis*" (Kuckartz, 2019, p. 186).

Data collection

Multiple methods were used to collect information about the connectivity to the NPUH and to look into what the future possibilities would be to facilitate sustainable transport from train stations to the national park.

Spatial data collection

The walking- and biking route datasets used for the spatial analysis are gathered from the Nationaal GeoRegister (*Nationaal Georegister*, n.d.), which are then downloaded as a shapefile to view in ArcGIS Pro. The dataset of the train stations is gathered from the Living Atlas in ArcGIS Pro. The following datasets are used:

- Nationaal Park Utrechtse Heuvelrug
- Wandelroutenetwerk - Routes
- Regionaal Fietsnetwerk 2024
- Stations_NS

Interview data collection

To understand the motives and barriers of the stakeholders in implementing sustainable mobility options at or near the train stations, semi-structured interviews with soft mobility and sustainable transportation providers were conducted (see Appendix 1.A & Appendix 1.B). The semi-structured interviews allowed the sub-group to identify opportunities and obstacles in the change towards sustainable transportation (Jamshed, 2014).

Data Analysis

Spatial data analysis

The data visualisation is conducted in ArcGIS Pro, where for each train station there is a shortest route for the walking paths and the biking paths. Figure 1.10 displays the "Modelbuilder" diagram from ArcGIS Pro, where each step of the analysis is explained.

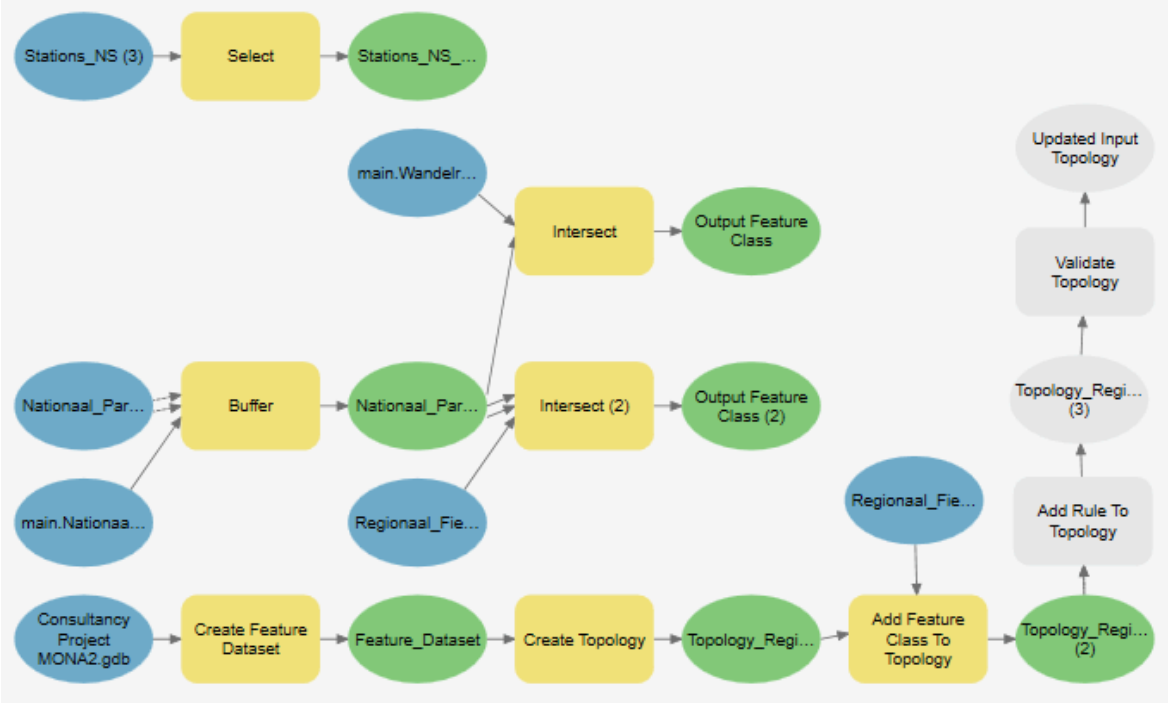


Figure 1.10. Modelbuilder retrieved from ArcGIS Pro.

The first step of the analysis is "Data handling", where the rough datasets are converted to more specific and smaller datasets. This ensures faster and more convenient data calculations, as it removes any excess data.

The second step of the analysis is “Creating topology”, ensuring the datasets are connected. This step also allows you to correct any mistakes in the topology. For example, where two lines are not connected properly.

The last step is the “Shorter route analysis”, using the designated tool. The two points that are used for this analysis are the station points and the NPUH.

Due to technical difficulties when dealing with the topology, and also missing data on the walking routes, the shortest route is calculated manually using the “measure” tool in ArcGIS Pro. Aerial photographs were analysed to ensure that the paths were both walkable and bikeable. After measuring the route in kilometres, the average walking or biking time is calculated and the actual time the route takes is shown in the results table. The time consumption is calculated using the average speed of walking and biking according to (Altijd in Beweging, n.d.) and (Welhof, 2022).

Interview data analysis

The interviews were recorded, transcribed and then analysed based on Qualitative Content Analysis (QCA) (Kuckartz, 2019). The analysis was done using the steps in Table 1.4. These will be further expanded on below. NVivo tool was used to organise and effectively interpret the data obtained during the interviews.

Table 1.4. *Steps in QCA (Table adapted from Selvi, 2019).*

Phase	*Step*
Preparation	1. Decide on a research question
Organisation	2. Select material 3. Build a coding frame 4. Trial coding 5. Evaluation and modification of the coding frame
Results	6. Main analysis 7. Presentation and interpretation of the findings

The interview analysis was conducted using the steps below taken from Kuckartz (2019) and Selvi (2019). Some modifications to the steps were made by the consultancy team to better accommodate the research. For example, the segmentation mentioned in Selvi (2019) was

removed as it was incorporated into the coding frame step. Furthermore, Kuckartz's (2019) text was used to revise the steps and expand on them.

Interview Analysis Steps:

1. **Transcription of the Interview Recording**: Transcription was done using the HappyScribe.com website.

2. **Development of a Coding Frame:** Developing a coding frame helped conduct a systematic analysis (Selvi, 2019). These codes were organised hierarchically to understand connections between different aspects of the data. In this way, the data can be transformed "*into meaningful, manageable, specific, and smaller units of information*" (Selvi, 2019, p. 444). This manageable data is also known as codes. These codes aid in avoiding subjectivity and biases (Selvi, 2019). Developing such a frame also allows "*selecting the right amount of data reflecting the full diversity of materials, while minimising time and energy spent on irrelevant data*" (Selvi, 2019, p. 446). The coding frame can be seen in Figure 1.11. The coding frame was developed using a data-driven approach.

    a. **Forming Main Themes**: The main themes corresponded with the research question for the interview part of this section. These themes are: obstacles and opportunities as interviews were conducted to analyse the obstacles and opportunities of mobility providers towards sustainable connectivity options.

    b. **Developing Codes:** Codes were developed by selecting materials that fit under the main themes. Then this material was structured and sub-categories for the main themes were generated (Kuckartz, 2019). This process is also referred to as retrieval (Kuckartz, 2019). These categories were revised and expanded upon at the beginning of the analysis.

    c. **Defining the Categories:** The code definitions were developed. They include the name of the code, brief definition, full definition, when to use the code, when not to use the code, and an example. Definitions of the codes can be found in Appendix 1.C.

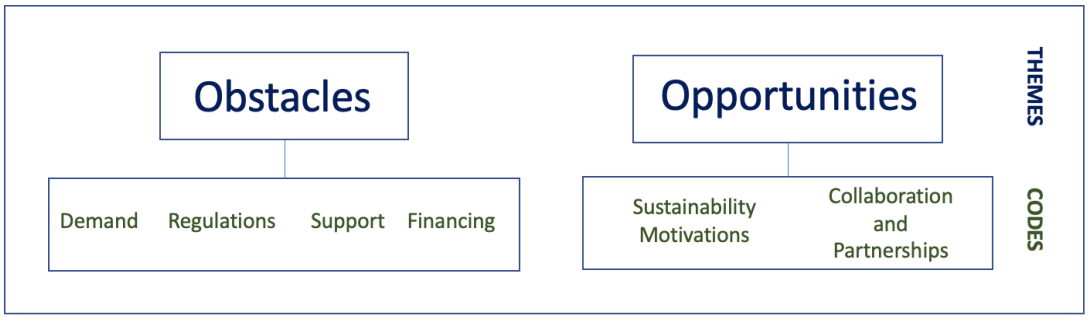


Figure 1.11. Coding frame for the interview analysis.

3. **Trial coding:** In this step, researchers used categories from the coding frame to analyse the material in two rounds of coding, while complying with the same procedure that was used during the initial coding phase (Selvi, 2019). Here the two coders worked independently. The coding was done using NVivo.

    a. Any challenges or inconsistencies that arose at this stage were addressed within the research team to allow modifications and finalisation of the coding frame before proceeding with the main analysis process (Selvi, 2019). This stage helped minimise subjectivity and biases and achieve "*intersubjective agreement*" (Kuckartz, 2019, p. 196).

4. **Category-based Analysis**: In this step, the actual coding was done (Selvi, 2019). The coding frame was finalised and could no longer be modified (Selvi, 2019). The data was summarised, compared and contrasted (Kuckartz, 2019).

    a. **Identifying Relationship between Themes:** Here the consultants looked into the interaction between the two themes to see any relationships.

5. **Presenting the Findings:** The findings were presented in a mind map. Additionally, visualisation of the data helped the consultants to detect the most frequent codes and draw conclusions.

Utrecht University

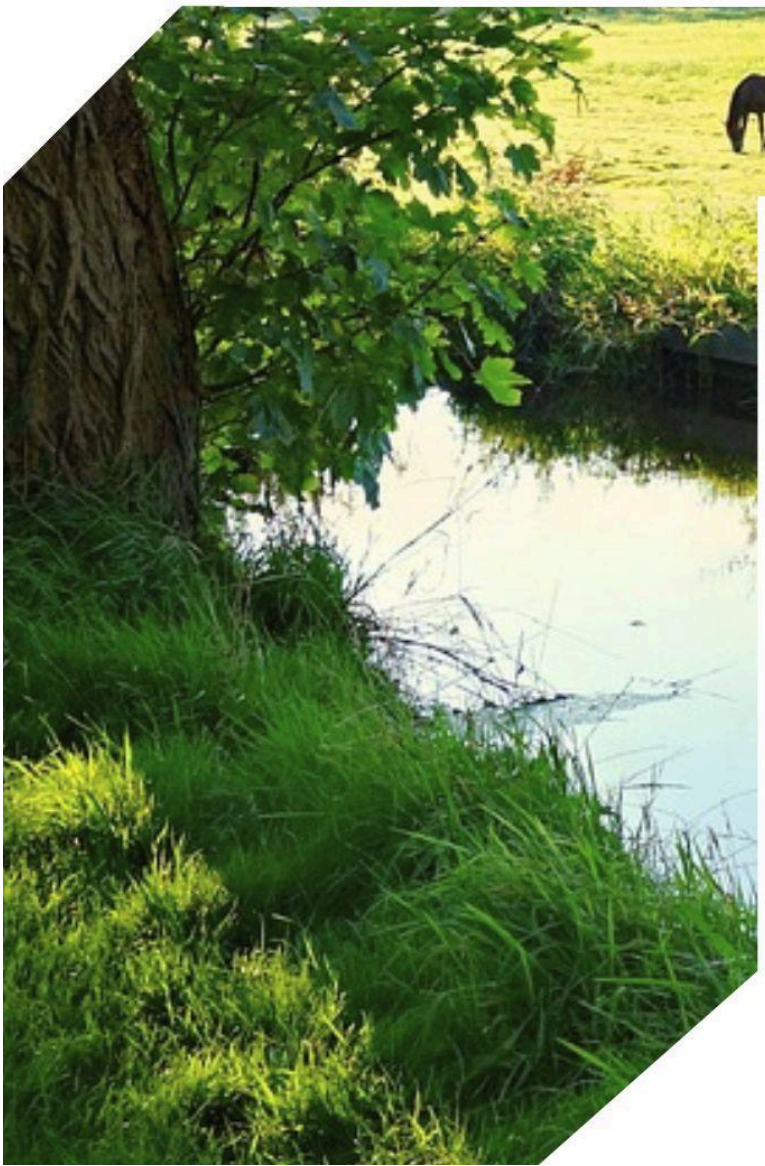
Nationaal Park Utrechtse Heuvelrug

Foundation National Park Utrechtse Heuvelrug

MONA Project

How can train stations be transformed into green entrances?

Client Contact: Sterre Sparreboom



Sub-group 2

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Word Count:

5052

Supervisor: Amy Newsom

Consultancy Project GEO3-2423

2024

Introduction

How can train stations be transformed into green entrances?

In this subchapter, the consultancy team will advise the NPUH on how to transform train stations into green entrances. The ambition to establish green entrances aligns closely with the core objectives of the MONA project for the NPUH. The concept of green entrances can be defined as a place that is welcoming, facilitating, and a nature-inclusive entrance and transition into the National Park. The aim is to create a gateway into nature that starts from the train station, which makes the visitor feel a natural experience even before entering the park. By creating a green entrance, the aim is to shift car use to more sustainable mobility, through influencing people's behaviour and their feeling of inclusiveness in nature.

Train stations are of crucial importance because they play a *"critical role in reshaping our cities in a sustainable manner by facilitating intermodality, green and active modes of transport and logistics, and by gathering proximity services.*" (Lunardon et al., 2023). They are especially important for the NPUH because of the numerous stations that are in its boundaries. This creates an opportunity to ensure that the stations are used to their full potential.

Addressing the sub-question: How can train stations be transformed into green entrances?, comprises a comprehensive approach that integrates design elements with the environment. A research framework was used to structure the factors involved in the transition to a green entrance and framework indicators were used to assess the measures and infrastructure already in place at three train stations. Through those observations and a literature review, areas for improvement were identified.

Advice

- **Advice 1:** To transform train stations in the National Park Utrechtse Heuvelrug into green entrances, the integration of vegetation in and around the train station should be prioritised.
    - **Argument 1.1:** Incorporating flora in the design and appearance of train stations creates a more pleasant journey for commuters and enhances the direct experience of nature.
        - **Evidence 1.1.1:** The indicator analysis of the sample of train stations showed room for improvement in accessibility to nature. (Subsection 'Results and Evidence'/ 'Indicator analysis'/ 'Table 2.1')
        - **Evidence 1.1.2:** Green roofs provide environmental and health benefits. (Subsection 'Measures'/ 'Direct Experience of Nature'/ 'Flora')
        - **Evidence 1.1.3:** Displaying plants on platforms, in main halls and on squares improves journey experience for travellers. (Subsection 'Measures'/ 'Direct Experience of Nature'/ 'Flora')
        - **Evidence 1.1.4:** Considerate selection of species can help counter the menace of butterflies and help birds with nesting places. In return they bring multisensory immersion in the experience of nature for commuters. (Subsection 'Measures'/ 'Direct Experience of Nature'/ 'Fauna')

- **Advice 2:** To transform train stations in the National Park Utrechtse Heuvelrug into green entrances, more water amenities for visitors should be implemented.
    - **Argument 2.1:** Good amenities stimulate visitors of the National Park Utrechtse Heuvelrug to use sustainable transportation instead of the car for their visit.
        - **Evidence 2.1.1:** The indicator analysis of the sample of train stations showed room for improvement in 'Water amenities'. (Subsection 'Results and Evidence'/ 'Indicator analysis'/ 'Table 2.1')

        - **Evidence 2.1.2:** People need motivation to change their behaviour. Having a benefit at the end of a behavioural/ habit change can make this transition easier. (Subsection ‘Evidence: Influencing Sustainable Transport Decisions’)
        - **Evidence 2.1.3:** Water taps create an advantageous facility for commuters by public transportation over car users. And water amenities stimulate the use of reusable bottles, reducing the consumption of plastic bottles. (Subsection ‘Measures’/ ‘Direct Experience of Nature’/ ‘Visitor amenities’)

- **Advice 3:** To transform train stations in the National Park Utrechtse Heuvelrug into green entrances, waste separation should be facilitated.
    - **Argument 3.1:** Facilitating waste separation facilities in train stations enhances visitors' sustainable journey experience.
        - **Evidence 3.1.1:** The indicator analysis of the sample of train stations showed room for improvement in ‘Waste management practices’. (Subsection ‘Results and Evidence’/ ‘Indicator analysis’/ ‘Table 2.1’)
        - **Evidence 3.1.2:** Providing information and accessibility of waste separation bins can incentify commuters recycling behaviour. (Subsection ‘Measures’/ ‘Indirect Experience of Nature’/ ‘Waste separation’)

- **Advice 4:** To transform train stations in the National Park Utrechtse Heuvelrug into green entrances, proper signage (wayfinding and information) should be enhanced.
    - **Argument 4.1:** Creating an informed and sustainable wayfinding system improves the visitors’ journey from the train platforms to the national park.
        - **Evidence 4.1.1:** The indicator analysis of the sample of train stations recognized ‘Wayfinding & signage’ and ‘Integration with surroundings’ as areas for improvement. (Subsection ‘Results and Evidence’/ ‘Indicator analysis’/ ‘Table 2.1’)

- **Evidence 4.1.2:** Implementing clear and easy to follow wayfinding signs increases the use of sustainable transportation modes for the onward journey. (Subsection ‘Measures’/ ‘Experience of Space and Place’/ ‘Signage and Wayfinding’)
- **Evidence 4.1.3:** Risk of interference with train information signage is avoided through graphic design choices. (Subsection ‘Measures’/ ‘Experience of Space and Place’/ ‘Signage and Wayfinding’)
- **Evidence 4.1.4:** Recycled or natural materials can be used for the sustainable wayfinding signs, promoting the indirect experience of nature. (Subsection ‘Measures’/ ‘Indirect experience of nature’)

Results and Evidence

Indicator analysis

The analysis of the selected train stations' greenness was conducted based on the adapted Biophilic Design Framework, focusing on three overarching themes: Direct Experience of Nature, Indirect Experience of Nature, and Experience of Space and Place (see subsection Methodology, Framework). This involved assessing key indicators within each theme to determine the stations' alignment with the biophilic design principles (Wijesooriya et al., 2023).

The results indicate variations in the implementation of green infrastructure, accessibility to nature, biophilic design elements, and waste management practices across the selected stations. Stations were scored based on the presence and effectiveness of these indicators, providing insights into their overall greenness and potential as green entrances. The specific details and observations for each indicator at the different train stations can be found in Appendix 2.A.

The following section presents the results of the assessment conducted to evaluate the greenness of train stations based on biophilic design indicators. Table 2.1 provides an overview of the overall assessment scores for each train station, indicating the degree of adherence to biophilic design principles on a scale of 1 to 10. Additionally, Figure 2.1 illustrates the assessment of greenness per indicator for each train station, while Figure 2.2 displays the average assessment of greenness per indicator across the three stations: Den Dolder, Baarn, and Hollandsche Rading. Finally, Table 2.1 presents the average assessment of greenness based on biophilic design indicators for each station, providing further insights into which station has the most priority for green measures to be implemented.

Table 2.1: *Assessment of train station greenness based on biophilic design indicators.*

		Scores (1-10)		
Framework Indicators		**Den Dolder**	**Baarn**	**Hollandsche Rading**
1a	Presence of green infrastructure	4	2	3
1b	Accessibility to nature	3	3	5

1c	Water amenities	2	1	7
2a	Sustainable materials	3	3	7
2b	Biophilic design elements	5	4	2
2c	Waste management practices	5	6	6
3a	Accessibility and mobility	9	9	8
3b	Wayfinding and signage	1	1	1
3c	Integration with surroundings	5	4	5

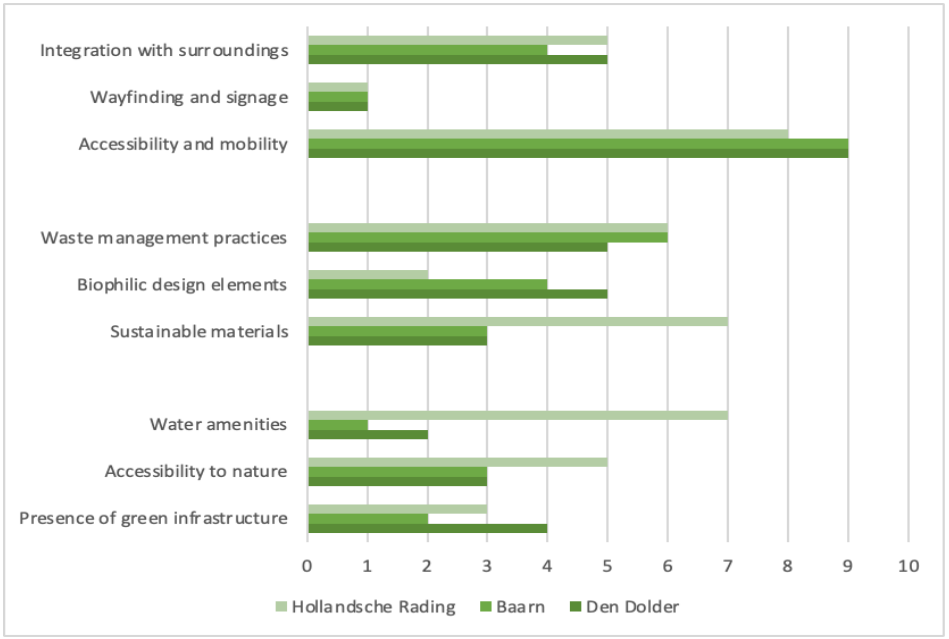


Figure 2.1: Assessment of greenness per indicator per train station (scores: 1-10).

The following results, deducted from Table 2.1 and Figure 2.1, highlight the varying strengths and weaknesses of Den Dolder, Baarn, and Hollandsche Rading train stations in terms of their greenness and alignment with biophilic design principles.

Den Dolder station demonstrated strengths in accessibility and mobility (3a), with sufficient seating, indoor facilities, and proximity to the city centre, earning a high score of 9. However, it showed weaknesses in waste management practices (2c) and wayfinding signage (3b), scoring only 1 in both categories. Additionally, the station lacked proper green infrastructure and water amenities, contributing to its overall lower score in the assessment.

Baarn station performed moderate across most indicators, with notable strengths in accessibility to nature (1b) and sustainable materials (2a). However, it also lacked points in waste management practices (2c) and integration with surroundings (3c), resulting in a mixed assessment of its greenness.

Hollandsche Rading station stood out for its provision of water amenities (1c) and waste management practices (2c), because of the presence of a functioning water tap and the sufficient number of bins. However, it lacked biophilic design elements (2b) and signage directing to nearby parks or nature areas (3b). Despite being well-integrated into the surrounding area, the station needed more awareness initiatives for proper behaviour in the nearby natural area.

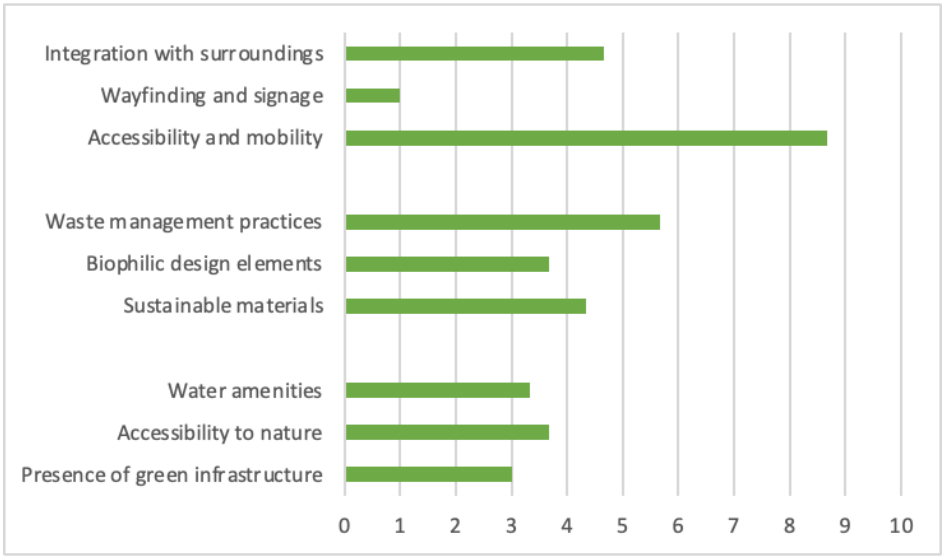


Figure 2.2: Average assessment of greenness per indicator based on the three train stations (Den Dolder, Baarn and Hollandsche Rading) (scores: 1-10).

The average results per indicator offer an overview of the train stations performance within the biophilic design framework. Across the three themes (Direct Experience of Nature, Indirect Experience of Nature, and Experience of Space and Place) the stations demonstrate moderate scores, with mean values ranging from 3 to 6. Particularly remarkable is the strength observed in the Experience of Space and Place category, especially in accessibility and mobility (3a), where the mean score is almost 9.

However, several indicators show areas for improvement. For example, wayfinding signage (3b) scores relatively low, with an average score of 1 across all stations. Besides, the indicator for waste management practices (2c), within the Indirect Experience of Nature category, has a

mean score of 6, which suggests improvement as well. Finally, within the Direct Experience of Nature category, the provision of water amenities (1c) also emerges as a key point for improvement, with an average score of 3.

Table 2.2 *Average assessment of greenness based on biophilic design indicators per station (scores: 1-10).*

Stations	Score
Den Dolder	4.11
Baarn	3.67
Hollandsche Rading	4.89

Table 2.2 presents the average assessment of greenness for each station based on biophilic design indicators. Den Dolder and Hollandsche Rading have relatively higher average scores of 4.11 and 4.89 respectively, indicating stronger alignment with biophilic design principles compared to Baarn, which scores slightly lower at 3.67.

Evidence: Influencing Sustainable Transport Decisions

To better understand how to encourage and promote sustainable mobility, it is important to understand why people make certain transportation decisions and how these can be altered to a more sustainable decision pattern. Another goal of this section is to understand what motivates responsible behaviour towards nature and how this can be increased. This was done to tackle the identified gap of unsustainable transport to the National Park by means such as a car.

To begin with, pro-environmental behaviour has been defined as "*behaviour that is enacted by an individual or collective of companion species that diminishes harm and contributes to the ecological health of the Earth*" (Siegel et al., 2018, p. 195-196). This comprehensive definition highlights the shared necessity to reduce environmental impact and states that actions of varying importance are a sign of pro-environmental behaviour. Pro-environmental behaviour can be categorised into three dimensions; holding actions, structural transformation and consciousness shifting that interact with each other (Macy and Brown, 2014). These include both individual and collective efforts, and strongly emphasises the interconnectedness

of both the dimensions themselves and people's actions. Understanding pro-environmental behaviour is needed to formulate effective strategies to change behaviour to promote increased sustainable actions.

However, changing behaviour as a whole is often difficult and it is necessary to understand where the resistance to change is coming from. Popescu (2019, p. 122), states that "*Acting pro-environmentally is largely considered to be the right thing to do, but often it proves to be more time-consuming, less profitable, less enjoyable or more effort* [...]". This explains the hurdles that are encountered when considering making more sustainable choices. It correlates to another reason why behavioural change is not occurring, which is habits. As described by Scheiner (2018, p. 47), habits are a "*mechanism to make life easier*" and are a result of repeated daily actions. It is clear to understand why habits are such a big part of daily life; uncertainty and complexity are widely reduced when carrying out a habit. This reason also explains why habits are hard to break.

For both travel and environmental behaviour, a big challenge is that of agency. Agency is the belief in the ability of oneself to carry out an action to achieve a desired result (Bandura (1997). Scholars agree that there is "*little individual suffering in travel behaviour*" and that there is a "*lack of internal incentives*" (Scheiner, 2018, p. 53) (Kollmuss and Agyeman, 2002, p. 257). As usual travelling behaviour is habitual, it becomes difficult for the individual to make a change. Unless otherwise restricted or encouraged, an individual will not change their behaviour, especially their transport behaviour, on their own.

As indicated by this literature review, behaviour change is an important tool in the transition towards sustainable mobility. As stated by Webb (2012, p. 133), one way is through "*positively promoting*" the desired change by encouraging pro-environmental choices, while at the same time discouraging alternatives through "*penalties*". For example, this can be done through promoting the benefits of sustainable actions such as health benefits, reduced costs and less environmental impact. Nudging is another way of influencing people's decision making about sustainable transportation, and green entrances can play a big role in doing this. Nudging is defined as "*ways of influencing choice without limiting the choice set or making alternatives appreciably more costly in terms of time, trouble, social sanctions, and so forth*" (Hansen and Jespersen, 2013, p. 7). Nudging is a proven way to influence behaviour because of its subtle nature making people increasingly incentivised to change. In the context of

sustainable transportation, nudging involves designing the environment or providing information in a way that, in the end, the best option is also the most sustainable one.

Evidence: Feeling of inclusiveness in nature

The green transformation of train stations should induce the feeling of inclusiveness in nature with the visitors of the stations and the national park. Another goal for the green stations is to induce nature responsible behaviour for visitors in the national park. This section will explore how the biophilic design concept can help attain these goals.

One of the objectives of biophilic design is creating a connection with nature, through incorporating natural elements and designing to induce people to spend more time outside. For this project this is relevant because the measures implemented in train stations should stimulate the visitors to responsibly recreate in the national park (Gaekwad et al., 2022).

The concept of biophilia concerns the connection between human and nature. Connection is beneficial for all humans, in both physiological as well as psychological effects. Biophilic design is based on this concept and aims to connect human and nature through the built environment through an addition of natural elements. It is an emerging construct that is solely focussed on the emotional effects of human nature interaction. "*The deliberate attempt to translate an understanding of the inherent human affinity with natural systems and processes - known as biophilia - into the design of the built environment*" (Kellert et al., 2011, p.3). Biophilic design contrasts the current infrastructural custom approach which isolates humans from the natural environment. The theory comprises de-stressing and attention span effects of nature on humans. The metaanalysis of Gaekwad et al (2022) confirmed that exposure to natural environments rather than urban environments increase positive emotion and decrease negative emotion. Translated to the biophilic design theory for the transformation of a public space, it can be interpreted that increasing natural environmental elements in urban environments can induce positive emotion and decrease negative emotion with visitors. Furthermore, it was observed that an important aspect of biophilic design is the multisensory immersion in the natural environment (Franco et al., 2017). Measures that can be implemented in alignment with the biophilic design principles are discussed in the next section.

There are more benefits to the implementation of this design method in public spaces. The

paper of Zylstra et al. (2014) points towards the positive influence ‘connectedness with nature’ (CWN) has on ‘environmentally responsible behaviour’ (ERB). Connectedness with nature evolves around the information about nature and the experience in nature for realising transformational outcomes. A mutually positive relationship exists between CWN and ERB. Environmentally responsible behaviour can be induced by connectedness with nature through the incorporation of natural elements in the built up environment.

This is relevant evidence of the green entrance transformation project, since it attains the goal of visitor’s environmentally responsible behaviour in the National Park Utrechtse Heuvelrug. So, through biophilic design and connectedness with nature, visitors' experience in train stations and behaviour in the national park can be positively influenced.

Measures

This section will explore the different measures that have been found in the literature review or proposed by the expert interviewed and will explain how and why they can help to transform a train station into a green entrance. This section has been influenced by the scoring of the train station done in the above sections, meaning that proposed measures in the advice have been expressed due to their involvement at the train stations scored.

Direct Experience of Nature

The first type of measures that will be explored are those that deal with the direct experience of nature. Nature based solutions is a strategy designed to address environmental challenges (Joshi & Teller, 2021).

Nature based solutions

The EU policy agenda for nature based solutions (NBS) describes them as “*actions inspired by, supported by or copied from nature; both using and enhancing existing solutions to challenges*" (Bauduceau et al., 2015, p. 24). NBS can be seen as an overarching concept for measures that deal with the direct experience of nature. To enhance the direct experience of nature, more nature can be integrated in the train stations.

Flora - green roofs and displaying plants

Green roofs are a relatively easy way to incorporate more plants in train stations; they have

shown to provide environmental and health benefits to its observers. This measure facilitates better water management, by soaking up the rainwater that would otherwise become runoff (US EPA, 2023). Permeable pavements also have a lot of potential for (rain)water management (Boogaard & Lucke, 2019). Other natural elements that can be implemented are plants on the platforms or between the tracks. Daimy Jansen, Green Advisor for NS, explained that from their research it showed that displaying plants on the platforms improved the journey of their commuters. However, due to safety concerns for all commuters and machinists it is not possible to have big plants on the platforms. The nature on the platforms should consist of low, flower-rich, colourful and biodiverse plants. Furthermore, it can be wise to choose non-native plants, since they function better in an urban/indoor environment (D. Jansen, personal communication, March 12, 2024). An example is shown in Figure 2.3.c. Also, in the station main hall, more 'wilder' greenery can be encountered according to the Green Advisor of NS. Additionally, Den Dolder is a great example for incorporating trees in the infrastructure of the train station, by having a line of big trees between tracks (full interview transcript is presented in Appendix 2.C).

Fauna - birds and butterflies

More than half of the total butterfly population in the Netherlands has disappeared since 1990 due to habitat loss/ degradation (Warren et al., 2021). The MONA project can make a positive impact in helping the butterfly population by creating rain gardens/green roofs/platform plants that function as a shelter and by installing additional birdhouses and insect hotels around the stations. This would improve connectivity between sites and by making unoccupied (built-up) areas suitable for colonisation.

Visitor amenities

Another opportunity for the direct experience of nature is improving visitor amenities. Water taps can help stimulate the use of reusable bottles, reducing the plastic bottle consumption (Jevdokimov, 2024) and creates an advantageous facility for visitors commuting via the train station into the National Park.

a. Green roofs **b. Permeable pavements** **c. Plants on platforms** **d. Birds and butterflies** **e. Water amenities**

Figure 2.3: Examples of measures to be implemented for the direct experience of nature.

Indirect Experience of Nature

The next measures that will be explored are those that deal with the indirect experience of nature. According to the biophilic design principles discussed in 'Evidence: feeling of inclusiveness in nature'

Biophilic design elements

Downton et al. (2017) recommends using materials as natural analogues. This entails the use of biomorphic forms and patterns, complexity and order of nature and to create a material connection with nature through materials that reflect nature. *"The use of natural materials and textures has proven biophilic effects"* (Downton et al., 2017, p. 190). In order to achieve these effects, materials used should contrast the hard, shiny surfaces and textures that currently exist in the transportation sector. Since the train stations will not be fully redesigned but only transformed, the measures applicable for this project should be focussed on smaller adaptations. To guarantee responsible transformations resources and materials should be sourced from the region (Downton et al. 2017). Examples for relatively easy implementation are platform or main halls that can be transformed according to the biophilic design principles. In Figure 2.4.a there is an example of benches from treated wood in natural round shapes. Another measure to merge measures for the direct experience of nature with these principles is through adding green walls as artworks in the main halls of the stations (example in Figure 2.4.b). Using the principle of complexity of nature and creating a biomorphic design is well depicted in Figure 2.4.c. In Figure 2.4.d the wooden material for the potted plants is used to contrast the textures in the industrial building.

Eco-friendly materials

Recycling materials is a circular way to reduce the waste of the transformation of train stations into green entrances. Station Hollandsche Rading is a primary example, during the rebuilding of the station, recycled platform pavement was installed (ProRail, 2021). Necessary rebuilding of stations can be used as a momentum for the transformation according to the biophilic design principles. Other examples of using eco-friendly building materials can be found in the first station made of wooden modules of the Deutsche Bahn (ANA, 2023) or refurbished future high-line stations in the UK (ARUP, n.d.).

Waste separation

The last element of the indirect experience of nature is the improvement of waste separation facilities. Sheau-Ting et al. (2016) showed that information and accessibility of recycling bins are key attributes of waste separation behaviour. Replacing regular bins with waste separation bins (as shown in Figure 2.4.e) can help incentivise commuters to separate their waste.

a. Biophilic bench **b. Green walls artwork** **c. Natural complexity/ order design** **d. Wooden plant pot** **e. Waste separation bins**

Figure 2.4: Examples of measures to be implemented for the indirect experience of nature

All above mentioned design elements are a selection of eco-friendly materials and measures and biophilic design principles for integrating indirect experience of nature in green entrances.

Experience of Space and Place

Finally, the last measures that will be explored are those that deal with space and place. Since the analysed train stations all scored high on the accessibility & mobility, this research was not focussed on measures to provide these services. However, on the indicators of wayfinding & signage and integration with surroundings the explored train stations scored significantly

lower, thus leaving space for improvement.

Signage and wayfinding design

"*Wayfinding refers to the design field devoted to planning and designing coherent systems which incorporate maps, signs, directional markers and the insertion of small clues throughout the built environment that enable orientation*" (Network Rail, 2022, p. 13). An important measure for creating a feeling of space and place is to create a well-informed journey for the commuter. From the train onto the platform, all the way through the main hall and into the exit and the onward journey. Directional information, which includes onward journey information, is the second most important need in the hierarchy according to Network Rail (2022). Even though the NPUH is not looking to attract more visitors, it lays within their goals to create a well informed and comfortable journey for their visitors.

A barrier in the implementation of wayfinding design for the onward journey is the interference with essential train travel information. Daimy Jansen, Green Advisor for NS, mentioned this interference problem in the interview that was conducted (D. Jansen, personal communication, March 12, 2024). However, Network Rail (2022) identified the onward transportation information as an opportunity for encouraging sustainable transportation forms instead of cars. Signage should be clear and easy to follow, from train and platform to onward transportation measures (i.e. the shared bike facilities as suggested in Subchapter 1) or the National Park. To minimise the risks of interference with train information, a new graphic design style can be used, showcasing a different font, colour and size compared to the train information signage and recycled materials can be used for circularity. A suggested example can be found in Figure 2.5.a.

Nudging

Nudging (Subsection 'Evidence: Influencing Sustainable Transport Decisions') is a proven method for steering choices and behaviour (Pihlajamaa et al., 2019). A visible example of how the concept of nudging is applied is through the placing of footsteps to waste bins (Figure 2.5.b).

Surroundings consciousness - informational signs

The integration of walking or biking maps directly onto the stations could induce the use of sustainable transportation (Network Rail, 2022). Visitors can plan their journey and choose a

mode of onward transportation. Landmarks, public art and urban landscaping can be used in information sources. For the improvement of the experience of place and space, local plants, animals or other landscape characteristics could be integrated into the signage to inform visitors about their upcoming journey in the National Park (see Figure 2.5.c). This could also induce their environmentally responsible behaviour (ERB) during their visit to the national park.

a. Sustainable onwards journey wayfinding design

b. Nudging footsteps

c. Surroundings informational signs

Figure 2.5: Examples of measures to be implemented for the experience of space and place

Wayfinding design and information, together with nudging can be implemented in the train stations in the National Park Utrechtse Heuvelrug to enhance the experience of space and place.

Methodology

Framework

The adapted Biophilic Design Framework provided a structured approach for evaluating the greenness of train stations (see Figure 2.6). By categorising indicators under three themes, it facilitated the assessment of each station's environmental features and their impact on visitors' experience.

The framework enabled the differentiation between stations and identified areas for improvement to prioritise for intervention. This systematic approach ensured that efforts to transform train stations into green entrances were aligned with biophilic design principles and tailored to the specific needs of each location.

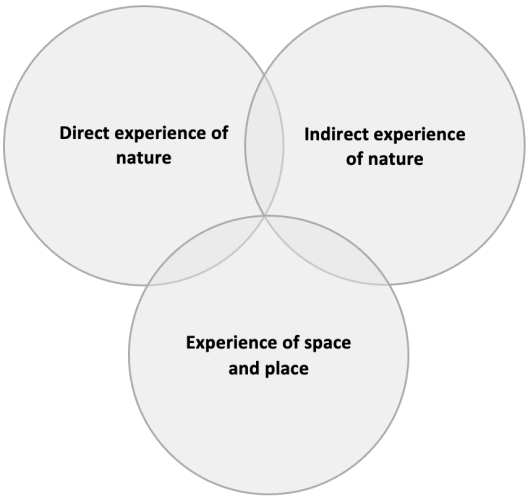


Figure 2.6: An adapted version of the Biophilic Design Framework

Indicator analysis

Onsite observations were conducted to gather data on the existing infrastructure of the selected train stations, focusing on the indicators outlined in Appendix 2.A. This involved visually assessing the relevant features. In order to effectively carry out the observations a maximum number of three stations were chosen due to time constraints and specificity needed to write the report. As mentioned in the integrative introduction, since the NPUH aims to transform the whole area, the measures in the results can be applied to the other train stations as well. The three train stations selected to use as model stations for the assessment

are Den Dolder, Baarn and Hollandsche Rading. These stations were selected because of their difference size, construction and surroundings, but are all in the same, most visited area of the National Park. The score range from 1 to 10 reflects varying degrees of alignment with the biophilic design principles. Higher scores indicate greater integration of green and sustainable elements within the train stations. Photographs were taken during the onsite observations, capturing both close-up details and panoramic views of the environment of the stations (see Appendix 2.B). This approach ensured thorough documentation of the existing infrastructure and supported a detailed analysis of the station's greenness.

To illustrate the scoring scale visually, Figure 2.7 displays three examples of photos representing different levels of greenness and biophilic design integration observed. Together with the observations at the train stations, as listed in Appendix 2.A, the scores were assigned. For example, the photo for the accessibility and mobility indicator (3a) at Baarn station reflects a score of 9 due to its extensive accessibility features such as elevators, stairs, benches, and a bike park, which ensures easy movement for all passengers. In contrast, the photo illustrating waste management strategies (2c) at Den Dolder station demonstrates a score of 5, reflecting the limited amount of waste bins and no presence of waste separation. Finally, the image for water amenities (1c) at Hollandsche Rading station portrays a score of 7, showing the presence of a properly functioning water tap.

3a. Accessibility and mobility (Baarn)

2c. Waste management strategies(Den Dolder)

1c. Water amenities (Hollandsche Rading)

Figure 2.7: Scoring examples of three different indicators per station.

The figure was created using Excel to analyse and visualise the collected data. This allowed for a quantitative comparison of the station's performance across different indicators, highlighting areas of strength and areas requiring improvement.

Literature Review

To conduct the literature review, the consulted search engines were Google Scholar and JSTOR. When searching for articles on behaviour change in regards to transportation, terms such as ‘behaviour change and transportation’, ‘behaviour change towards sustainable mobility’, and 'behaviour change to achieve sustainable changes’ were used. Other terms such as ‘responsible behaviour in nature’, ‘pro-environmental behaviour’, and ‘environmental knowledge’ were used to collect further research related behaviour change. Keywords such as ‘sustainability’ were often replaced by terms like ‘green’ or ‘energy-efficient’. ‘Transportation’ was replaced by ‘mobility’, ‘movement’ or ‘vehicle’ and ‘behaviour’ was replaced by ‘conduct’ or ‘habit’. When searching for articles on the feeling of inclusiveness in nature, searchterms like ‘biophilic design’, ‘inclusiveness in nature’, ‘nature experience’, ‘visitor experience’, ‘human nature connection’ and ‘environmentally responsible behaviour’ were used. For selecting literature a publication year of 2000 or higher was chosen in combination with the judgement on relevance to provide evidence for the arguments supporting the advice. The title, the abstract and the full article were consecutively consulted to judge for relevance on the topic.

Interview and Transcribing

An interview with Daimy Jansen, who is a Biodiversity and Green Conservation advisor for NS, was conducted to gather insight into the feasibility of the proposed project. It was also to gain expert knowledge about specific measures that can be used to transform train stations into a green entrance. The full interview transcription can be found in Appendix 2.C and quotes from the interview have been mentioned in the results section of this subchapter. To carry out the interview, the client first contacted the interviewee in order to explain the project to her and to see if she would be willing to participate. Once Daimy agreed, the sub-group sent her an advance of the questions that would be asked during the interview so that she could prepare. The interview was held online via Microsoft Teams and the meeting was recorded in order to later be transcribed. The transcription was done using both the automatic transcription from Microsoft and the website Otter.ai.

Utrecht University

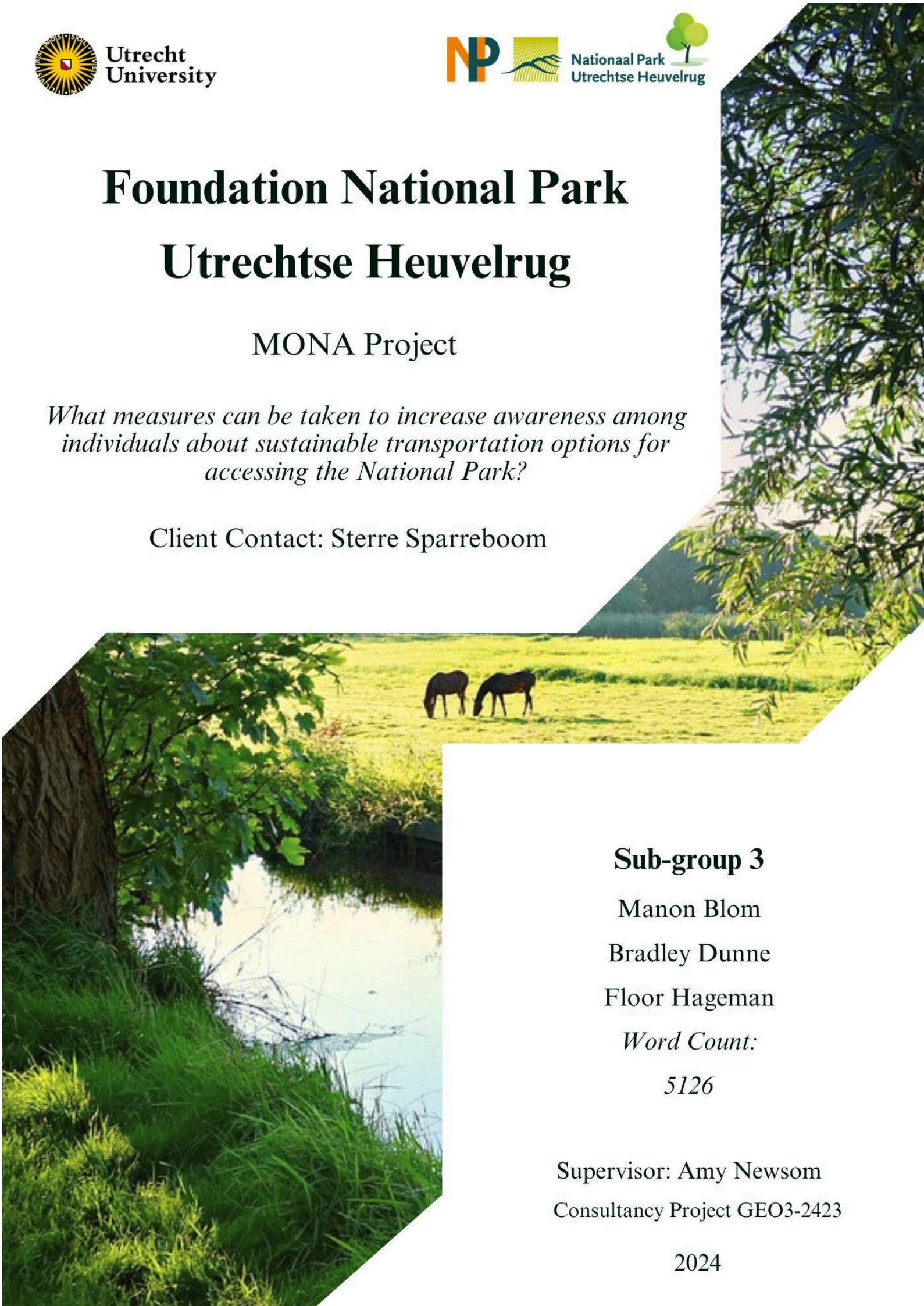
Nationaal Park Utrechtse Heuvelrug

Foundation National Park Utrechtse Heuvelrug

MONA Project

What measures can be taken to increase awareness among individuals about sustainable transportation options for accessing the National Park?

Client Contact: Sterre Sparreboom



Sub-group 3

Manon Blom

Bradley Dunne

Floor Hageman

Word Count:

5126

Supervisor: Amy Newsom

Consultancy Project GEO3-2423

2024

Introduction

In this subchapter, the consultancy team will advise the NPUH on how to increase awareness on sustainable transportation options to the National Park among individuals. Amidst promising development of establishing more sustainable ways of travel to the national park lies a notable complication of awareness (Gemeente Utrechtse Heuvelrug, 2010). For the National Park, the complication lies with a pervasive lack of awareness regarding these sustainable modes of travel among visitors which leads to high levels of car use. Especially in peak seasons the use of cars can cause dangers, is environmentally disadvantageous and worsens the experience (RTV Utrecht, 2022). Thus initiatives to increase awareness and stimulate behavioural change are needed for a shift in car use to more sustainable transportation.

This prompts the question: "What measures can be taken to increase awareness among individuals about sustainable transportation options for accessing the National Park?". This question serves as the focal point, prompting the consultants to delve into the complexities of communication, accessibility, and behavioural change within the context of sustainable transportation. To answer the question, the team will look at the underlying factors contributing to the awareness gap and devise effective strategies towards successful environmentally friendly transportation practices.

This chapter will consist of three distinct reviews. Firstly, a literature review of existing literature on awareness-raising and behaviour-changing measures in the context of sustainable transportation was conducted. By synthesising insights from various sources, the aim is to identify key factors influencing individual awareness and decision-making processes, as well as best practices for implementing successful awareness campaigns and behaviour change initiatives.

Secondly, the NPUH website was reviewed as a primary information source for visitors seeking travel options to the park. Through a systematic assessment of the website's content, design, and accessibility, we aim to determine its effectiveness in disseminating information about sustainable transportation alternatives. By examining the clarity, comprehensiveness, and user-friendliness of the website, potential areas for improvement to enhance visitor awareness of eco-friendly travel options and facilitate informed decision-making were identified.

Thirdly, the existing survey was reviewed. The survey's design, questions, and data collection methods to identify strengths and weaknesses were assessed and opportunities for improvement were identified. Based on this review, adaptations to the survey aimed at obtaining better insights into visitor perceptions, behaviours, and preferences regarding sustainable transportation options are proposed. By refining the survey, the aim is to gather data that can inform targeted interventions and strategies to encourage mode shift from car travel to alternatives.

This multifaceted approach underscores the commitment to addressing the pressing need for increased awareness and adoption of sustainable transportation practices within the NPUH visitor community.

Advice

- **Advice 1:** Provide clear online information about sustainable transportation options
    - **Argument 1.1:** Providing the information is a necessary factor to raise awareness and can be the initial step to behavioural changes (Adaji & Adisa, 2022; Anagnostopoulou et al., 2018; Karatsoli & Nathanail, 2021; Kaspar et al., 2021; Magginas et al., 2018; Marconi et al., 2019; Mauro et al., 2022; Mitran et al., 2021; Zhao & Baird, 2014).
    - **Argument 1.2:** Online content is a promising way to reach a large number of people and spread awareness and transport-related information to them, to educate and inform. In today's world, most people look online for travel information, so an easy way to influence behaviour is to promote the wanted use of transportation in this format.
    - **Argument 1.3:** The current websites provide minimal information regarding sustainable transport, or the information is difficult to find, table 3.1. Table 3.0 provides structured points of improvement with explanation for each of the analysed websites based on the review done in the section Website Evaluation.

Table 3.0 *Advice per website.*

Website	**Advice**
National Park Utrechtse Heuvelrug	**Point of improvement 1.1** *Increase the amount of information on sustainable transport:* The evaluation has shown that the website of NPUH provides minimal information regarding sustainable transport. This could be improved by mentioning which train stations near the park have ov-bikes or other efficient types of shared mobility. **Point of improvement 1.2** *Promote sustainable transport over car usage:* According to Mauro et al (2022), nudges can be implemented as one of the most effective strategies in promotion of long-term changes in mobility behaviour. Therefore, a recommendation of utilising a nudge that aims at exploiting the attraction of default options is advised. This entails first mentioning the sustainable options on the website and then stating the less sustainable ones.

Military museum	**Point of improvement 2.1** *Promote sustainable transport over car usage:* The main point of improvement that was deduced from the evaluation is implementing the nudge that was also advised to NPUH. The website of the military museum is advised to mention the sustainable methods of transport before car usage to give the user a nudge in the desired behaviour.
Pyramid of Austerlitz	**Point of improvement 3.1** *Increase the amount of information on sustainable transport:* In order to improve the awareness of sustainable methods of transport to the pyramid of austerlitz the website would be advised to mention these methods.
Ouwehands Dierenpark	**Point of improvement 4.1** *Promote sustainable transport over car usage* The evaluation of the website of the zoo resulted in the advice of using nudges that allow the prospective visitors to see the sustainable option as the default.
Henschotermeer	**Point of improvement 5.1** *Increase the amount of information on sustainable transport:* The website of the recreational lake called Henschotermeer is deemed to be insufficient regarding the provision of sustainable commuting methods as the site does not offer any information on the matter. The website is advised to provide information on sustainable transport towards the lake so that visitors can be aware of this option.
Opdeheuvelrug.nl	**Point of improvement 6.1** *Increase the amount of information on sustainable transport:* The website provides an overview of many possible activities available in the Utrechtse Heuvelrug. However, the website lacks a clear provision of information on sustainable transport towards the mentioned locations. **Point of improvement 6.2** *Promote sustainable transport over car use:* The website provides a direction towards Google Maps, which then shows the possible ways of getting to the mentioned locations. This does not promote the utilisation of sustainable transport, another method of showing website visitors the different ways of commuting which do promote sustainable transport is recommended.

- **Advice 2:** Make the overall experience to the park via sustainable transport easier and more enjoyable.
    - **Argument 2.1:** The creation of an app or audio book can make the experience to the park more immersive, this can make visitors feel connected to the park even before arriving, thereby increasing interest and motivation to explore sustainably.
    - **Argument 2.2:** Combining nudges with applications can create a positive value towards the national park and create a feel good feeling. Nudges can also include the highlighting of personal benefits for using public transportation, which have been shown to exert great influence on behaviour (Göransson and Andersson 2023; Kim et al. 2013; Villanen et al. 2023).

- **Advice 3**: Conduct a survey structured according to the COM-B model in the target areas.
    - **Argument 3.1:** Surveys are a valuable tool for gathering data about the local context. Every environment and part of the park is different; local data is needed to apply the measures to the local needs and context. Research consistently highlights the need for context-specific interventions to address unique challenges and leverage opportunities effectively (Banerjee, 2003; Bridger & Luloff, 1999; Goddard, 2005; Muthuri et al., 2008; Valente, 2012).
    - **Argument 3.2:** Conducting a survey based on the COM-B model enhances capability, opportunity, and motivation assessment, providing comprehensive insights into visitors' behaviours and transportation choices (Michie et al. 2011). Table 3.3 Provides an overview of proposed questions.
        - **Evidence 3.2.1:** Assessing visitors' physical and psychological capabilities regarding sustainable transportation is essential for identifying potential barriers and tailoring interventions accordingly and effectively. By targeting these areas distinct issues or shortcomings can be presented clearly.
        - **Evidence 3.2.2:** A comprehensive understanding of environmental and social opportunities is crucial for promoting sustainable transportation. The availability of infrastructure, e.g. bike lanes, bus stops, and rental

bikes, may influence individuals' transportation choices. Moreover, social norms and peer influence play a significant role in shaping behaviour, emphasising the importance of assessing social opportunities.

        - **Evidence 3.2.3:** Exploring motivations provides insights into visitors' attitudes, beliefs, and preferences toward sustainable transportation. Motivation can start to change during the survey, as reflective motivation is triggered when the participant has to think about their mobility patterns. Motivation can be stimulated by showing the benefits of using sustainable transportation for the environment and the individual's own health.
    - **Argument 3.3:** Conducting surveys and interacting with visitors and stakeholders increases the likelihood of positive action. Involving local communities and visitors in the survey processes fosters ownership and cooperation, increasing the likelihood of successful intervention implementation. Stakeholders are more likely to agree and interact with interventions when they have been able to influence and participate in the formation of the measures (Barr et al., 2011).

- **Advice 4**: Conduct surveys on a timely basis.
    - **Argument 4.1:** Strategic survey distribution and timely data collection enable a comprehensive understanding and evaluation of visitor perceptions and behaviours, facilitating informed decision-making and continuous improvement.
    - **Argument 4.2:** Regular assessment of survey data allows for the monitoring of implemented measures and adaptation of strategies over time (Gideon, 2012).

Results and evidence

This section will present the results and evidence for the advice. The section consists of three parts: literature review, website review, and survey review.

Literature review

The following section provides a literature review that focuses on strategies that have been found successful to raise awareness and change behaviour.

How can mobility behaviour effectively be changed?

First of all, almost all analysed studies indicate that providing the information is a necessary factor to raise awareness and can be the initial step to behavioural changes (Adaji & Adisa, 2022; Anagnostopoulou et al., 2018; Karatsoli & Nathanail, 2021; Kaspar et al., 2021; Magginas et al., 2018; Marconi et al., 2019; Mauro et al., 2022; Mitran et al., 2021; Zhao & Baird, 2014). Especially in the technological age of the current day, online content is a promising way to reach a large number of people and spread awareness and transport-related information to them, to educate and inform.

Online content is considered to have a significant impact on decision-making and seeking advice. One online platform to promote sustainable mobility and a more active lifestyle is social media. With their rapid expansion as vital sources of information, the content shared on social media platforms can prompt individuals to visit a particular place, switch transportation methods or destinations, or even cancel previously made plans (Karatsoli & Nathanail, 2021; Magginas et al., 2018). Study shows that people are more likely to change their plans after seeing information online, as a result, social media and online platforms are useful for sharing transportation information and raising awareness among a wide audience (Karatsoli & Nathanail, 2021).

Moreover, persuasive technologies are found to be effective (Adaji & Adisa, 2022; Anagnostopoulou et al., 2018; Zhao & Baird, 2014). Persuasive technologies are interactive systems that are designed to influence people to change their attitudes or behaviours. Studies showed significant positive outcomes in behaviour change, such as increased awareness of the environmental impact of diets and improved sustainability awareness in schools (Adaji & Adisa, 2022). Informative websites, public transportation information, and mobile apps with

audio tours are examples of persuasive technologies. These can enhance the visitor experience and promote sustainable travel practices. Features like audio tours can provide immersive experiences, making visitors feel connected to the park even before arriving, thereby increasing interest and motivation to explore sustainably. A national park in Scotland, ‘lochlomond-trossachs’, is conducting a trial with an app for the national park, including audiobooks (Loch Lomond & The Trossachs National Park, 2023b). Progress on this trial can be followed and implemented in a similar manner if found successful.

Furthermore, nudge strategies, categorised into various types targeting different cognitive systems, have been identified as effective means to influence behaviour (Göransson & Andersson, 2023; De Las Heras-Rosas & Herrera, 2019; Mauro et al. 2022; Zhao & Baird, 2014). These strategies include exploiting default options, simplifying tasks, leveraging social norms, capturing attention, providing guidance and reminders, and tapping into an aversion to inconsistency (Göransson & Andersson, 2023). Again, communication plays a vital role in raising awareness about sustainability and driving acceptance of transport policies (De Las Heras-Rosas & Herrera, 2019).

Based on this, an effective way to influence user behaviour is by communicating sustainable options in a meaningful manner, taking into account psychological, sociological, and technical factors. Communication, when timed appropriately and tailored to the target audience, can raise awareness about sustainability. Knowing about a service is just the first step; understanding its features and benefits is crucial. Good communication has been proven to drive acceptance of transport policies. However, we cannot assume that increasing awareness would automatically change travel behaviour, since environmental awareness and pro-environmental behaviours do not necessarily lead to increased usage of sustainable transport (De Las Heras-Rosas & Herrera, 2019). Therefore it is also necessary to change the perception of sustainable transport.

In order to effectively change the perception of sustainable transport, understanding individuals' motivations and preferences is crucial. While people care about the environment, it doesn't always mean they act in ways that help the environment (De Las Heras-Rosas & Herrera, 2019). Case studies by Villanen et al. (2023), Göransson and Andersson (2023), and Kim et al. (2013) shows that personal reasons were more important for the participants than environmental issues when choosing a certain type of transportation. Thoughts and feelings affect how people choose to travel. Existing public transportation users are likely to care

about the environment, but that is not the only influencing factor. The personal reasons, such as ease to navigate, health and wellbeing, were found as priorities for them. Existing potential public transportation users prioritise reliability and flexibility in their current travel modes. Maintaining or improving these aspects is vital for retaining current users and attracting new ones. Car users vary in their preferences, so understanding their motivations is key to enticing them to use public transportation (Göransson & Andersson, 2023). The researchers state that programs to encourage people to use public transportation could work better if they focus on what each group cares about. Therefore, tailoring messaging to focus on what each group values, whether environmental benefits or personal advantages like cost savings or convenience, can enhance the effectiveness of programs promoting sustainable travel (Kim et al., 2013; Villianen et al., 2023).

Combining the nudge approach with the findings from these studies about personal motivation and preferences can provide key messages that can communicated to individuals:

- Highlight the variable costs of owning a car in real-time, including fuel consumption and maintenance expenses.
- Emphasise the cost of parking and time wasted in traffic.
- Encourage the use of trip organising apps that default to sustainable modes of travel.
- Share emotionally rewarding stories of positive experiences with public transport to inspire imagination.
- Stress the health benefits of physical activity through sustainable modes of travel.
- Make waiting times at public transport stops more bearable by providing timely updates on location and availability of seats.

Serving as type two nudges the above stated points can simplify decision-making by providing relevant information in an uncomplicated manner. They can also capture users' attention, acting as type four nudges that engage their rational thinking. Additionally, communication can function as type five nudges, offering reminders and guidance to prevent users from overlooking opportunities for sustainable mobility. (Mauro et al., 2022) The addition of theory-based targeted messaging, with reinforcing photographs can enhance the effectiveness of the travel awareness materials (Carreno et al., 2011b).

Website Evaluation

This section will display tables that resulted from evaluating websites that are relevant for increasing awareness among visitors of National Park Utrechtse Heuvelrug. The definition of the quality levels can be found in Table 3.4.

Table 3.1 *Criteria table assigning scores to different aspects of websites of interest.*

	Websites					
Criteria	*NPUH*	*Military Museum*	*Pyramide van Austerlitz*	*Ouwehands Dierenpark*	*Henschotermeer*	*Opdeheuvelrug.nl*
Availability of sustainable transportation information	1	3	1	3	1	1
Promotion of sustainable transport relative to car use	1	2	1	1	1	1
Navigation	3	2	1	3	2	3
Graphical representation	1	2	1	3	2	3
Simplicity	2	2	1	2	2	2
Total points	8	11	5	12	8	10

Table 3.2 *Visualisation of assigned Quality level per evaluated websites.*

Websites	**Quality Level**
NPUH	**2**
Military Museum	**3**
Pyramid of Austerlitz	**1**
Ouwehands Dierenpark	**3**
Henschotermeer	**2**
Opdeheuvelrug.nl	**2**

Survey

This section presents the results of the survey review conducted on the existing survey conducted by Kantar Public in request of the Province Utrecht in 2022 across various areas in the National Park Utrechtse Heuvelrug (Kantar Public, 2023b). The survey's completeness and questions related to behaviour change were assessed to provide insights and recommendations for facilitating a modal shift from car use to more sustainable mobility options within the park.

Why a survey?

Conducting a survey is a fundamental aspect of social and market research, aiming to investigate the experiences and characteristics of different social groups or discern the opinions of customers regarding products, services, and companies (Gideon, 2012). Research consistently highlights the unique characteristics of each location, necessitating tailored interventions to address specific challenges and leverage opportunities effectively (Banerjee, 2003; Bridger & Luloff, 1999; Goddard, 2005; Muthuri et al., 2008; Valente, 2012). National parks, being embedded within intricate ecological, social, and cultural landscapes, require nuanced strategies that resonate with their unique attributes and visitor values. Incorporating

the components of the COM-B model into survey design promises to offer comprehensive insights into visitors' capabilities, opportunities, and motivations, thereby facilitating targeted interventions to promote sustainable transportation choices.

The knowledge collected by surveying forms the basis for developing contextually relevant interventions that maximise effectiveness while minimising unintended consequences. Thus, the imperative of surveys lies not only in recognizing the uniqueness of each location but also in utilising this understanding to drive informed decision-making and sustainable management practices tailored to the specific needs of Utrechtse Heuvelrug National Park. Moreover, Involving local communities and park visitors in the survey process fosters ownership and engagement with proposed measures, enhancing community buy-in and cooperation. Those who are more committed to the environment may also be those engaged in more sustainable practices (Barr et al., 2011).

Conducting surveys on a timely basis aids in evaluating their effectiveness over time (Gideon, 2012). Regular assessment of visitor perceptions and behaviour through surveys enables monitoring of implemented measures, identification of areas for improvement, and adaptation of strategies, fostering continuous learning and refinement of behaviour change initiatives.

Analysis of the current survey

The current survey collects data on visitors' perceptions of accessibility, amenities, and reasons for not using sustainable transportation. However, it lacks a comprehensive exploration of visitors' capabilities, opportunities, and motivations related to sustainable transportation. Most of the questions are practical and about the place and number of visits, they do not explore underlying motivations, therefore these questions were deemed irrelevant for this analysis. For example, Q0012 and Q021 directly question behaviour. This can be useful but these questions should be supported with supplementary questions targeting the capability, opportunity, and motivation. The only question that targets motivation, opportunity and capability is Q047. Q047 asks why the participant did not use sustainable transportation to access the park and lists options to choose from. Even though this question is a great start to locate the issue, it is still very broad and does not consider how to solve the issue.

Thus, it can be concluded that the survey lacks questions about the knowledge of the participants about sustainable transportation options and their availability. While the survey touches upon physical and social opportunities, it lacks depth in assessing barriers and facilitators related to sustainable transportation infrastructure and social norms. The survey partially explores reflective and automatic motivations but lacks detailed insights into visitors' attitudes, beliefs, and preferences towards sustainable transportation.

Based on these findings questions were established. These questions are based on the findings from the literature, the COM-B model, and the review. The advisors propose adding the following questions to address the identified gaps:

Table 3.3 *Proposed survey questions.*

Component	Questions
Physical Capability	Have you ever used sustainable transportation (e.g., biking, walking, public transit) to visit Utrechtse Heuvelrug National Park? Is there a limiting factor as to why you are not able to use sustainable transportation in terms of physical aspects?
Psychological Capability	How confident do you feel in navigating public transportation routes to reach Utrechtse Heuvelrug National Park? Do you feel knowledgeable about the availability and accessibility of sustainable transportation options to the park?
Reflective Motivation	How do you determine which transportation to use? How important is it to you personally to use sustainable transportation to visit Utrechtse Heuvelrug National Park? Are you aware of any environmental initiatives or campaigns promoting sustainable transportation to the park, and do they influence your transportation choices?
Automatic Motivation	How do you determine which transportation to use? On a typical day, how likely are you to consider using sustainable transportation options (e.g., biking, walking, public transit) to travel to recreational destinations like Utrechtse Heuvelrug National Park?

Physical Opportunity	How easy do you find it to access sustainable transportation options (e.g., bike lanes, public transit stops)? Do you perceive any barriers in using sustainable transportation to reach Utrechtse Heuvelrug National Park, such as lack of bike racks or insufficient public transit connections?
Social Opportunity	To what extent do your friends, family, or colleagues influence your choice of transportation? Are there any social norms or expectations within your social circle regarding transportation choices?

Methodology

Framework

COM-B Model

The research framework that is used in this study to conceptualise behaviours is the COM-B model as designed by Michie et al. (2011). The COM-B model argues there are three key factors that influence behaviour change, namely Capability (C), Opportunity (O), and Motivation (M). Figure 3.1 shows the interrelation of the components of the framework. The COM-B model Is relevant for this research as it helps structure and trace back the steps which lead to a certain (desired) behaviour; in this case the adoption of sustainable transportation. By examining the interplay of Capability, Opportunity, and Motivation, this research seeks to identify strategies for increasing awareness and fostering a preference for sustainable transportation options.

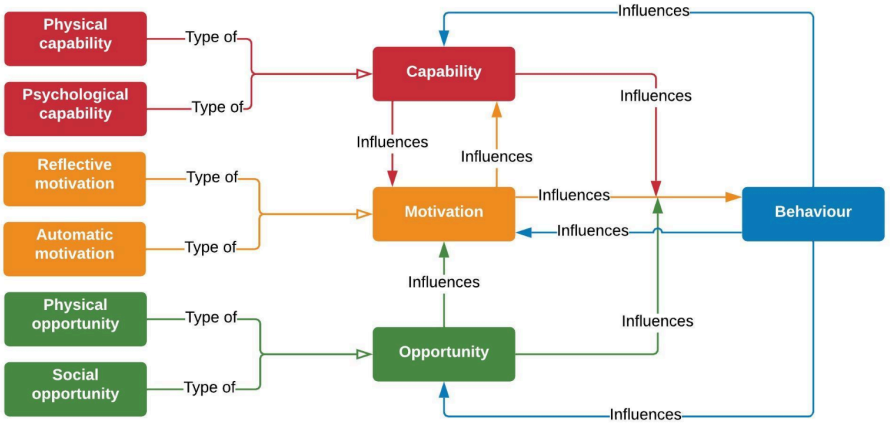


Figure 3.1. The COM-B model of behaviour (West & Michie, 2020).

The component capability refers to the individual's physical and psychological capability to participate in the activity. In this context, physical capability refers to the capability to move and access sustainable transportation, this may address the extent to which regular, but also physically disabled people's ability to use sustainable transportation. Psychological capability refers to the individual's mental functioning and level of knowledge about the desired behaviour.

The component 'opportunity' refers to the external factors that facilitate the execution of behaviour, including the physical opportunities provided by the environment and social

opportunities. The physical opportunity may describe the individual's financial and material resources to exhibit the desired behaviour. However, it may also include accessibility to information about sustainable transportation. The social opportunity includes the social norms and culture influencing behaviour.

The component ‘motivation’ refers to the internal processes that influence the decision-making process. This encompasses reflective motivation, which involves deliberate thought processes and evaluations of available choices. The component also encompasses automatic motivation, which involves habits, spontaneous impulses, and inhibitions. In this context, the analysis will explore visitors' attitudes, beliefs, values, and perceived benefits or barriers associated with sustainable transportation options. The aspect of ‘preference’ can be placed in this component of the framework. To enhance motivation, it is beneficial to transform a desired behaviour from a perceived obligation to a personal preference by fostering reflection on the benefits associated with engaging in that behaviour.

The COM-B model aids in structuring this research by providing a clear framework to guide our investigations into the interplay of Capability, Opportunity, and Motivation in driving behaviour change towards sustainable transportation options. The question ‘How can we raise awareness and change preferences?’ is strongly linked to social and behavioural change aspects. It allows us to organise our analysis, identify key areas for intervention, and develop targeted strategies to increase awareness and foster a preference for eco-friendly travel within the NPUH visitor community. By identifying the specific factors that may be preventing behaviour change, practitioners can develop targeted strategies to promote the adoption of new behaviours and practices (Askham, 2023). Moreover, because the report consists of three distinct data collection and analysis methods the framework helps to structure all three parts in a cohesive manner, so conclusions can be drawn in a similar manner. Ultimately, this structured approach enhances the coherence and effectiveness of our research efforts in addressing the central question of raising awareness and changing preferences for sustainable transportation.

Sustainable Transportation Information Website Evaluation (STIWE) Framework

In addition to conducting a literature review, an evaluation of websites informing on the Utrechtse Heuvelrug was conducted to assess the accessibility and quality of information

concerning sustainable transportation options to the park. Assessing the websites which currently inform visitors targets the opportunity component of the COM-B framework.

To carry out this evaluation, firstly a framework was created to systemically rank the websites of locations within the park on the quality of the provided information. This was done because the national park is not one confined area but rather a combination of different towns, municipalities and recreational areas. Therefore, in order to increase the awareness among individuals about sustainable transportation to the park, it is necessary to evaluate not one location but multiple.

The criteria used to evaluate the website partially originated from a paper researching design elements that help designers and researchers to facilitate the user in the best possible manner. Garret et al. (2016) formed a list of relevant elements regarding website design and user facilitation. The elements relevant for increasing awareness among individuals regarding sustainable transport were selected and implemented in this framework. Along with the design elements that were deemed important by Garett et al (2016), new criteria were constructed, such as 'Availability of sustainable transportation information' and 'Promotion of sustainable transport relative to car use'. The criteria "Availability of sustainable transportation information" was constructed to allow evaluation of the degree of information regarding sustainable transport, whereas the criteria 'Promotion of sustainable transport relative to car use' looks into how much sustainable transport is prioritised. Furthermore, 'Navigation' critiques the difficulty of navigating the website. In addition to that, the criteria 'Graphical representation' evaluates to what degree the website uses multimedia content, contrasting colours and icons. Lastly, the simplicity of the website is analysed to confirm users will not get confused by the design of the website.

Table 3.4 *Score system for website quality.*

Level 1	0-5 pts	Website is of insufficient quality, it requires improvement.
Level 2	6-10 pts	The website is regarded as medium quality, with room for improvement.
Level 3	11-15 pts	The website is deemed as good, comparable to the baseline.

Table 3.4 provides the definitions per quality level. This quality level can give a rather quick and general sense of which websites need more adjustments in order to have a bigger impact on the awareness of the visitors.

Data collection

Literature review

To find the right studies for the literature review the database Google Scholar was chosen as this database covers a wide range of journals and conference papers and is freely accessible (Haddaway et al., 2015). Employing various combinations of keywords such as ‘’sustainable mobility awareness’’ "persuasive technologies", and "behavioural change" searches were conducted. Appendix A provides a detailed breakdown of the search terms utilised and the papers identified through these specific queries. The results were filtered based on their year of publication; only papers published after 2000 were taken into account because of the fast-moving nature of transport options and internet availability. Afterwards, the papers were filtered on relevancy by first examining their title, and consequently, for the remaining papers the abstract, introduction and conclusion were examined on relevancy. Only papers that discuss and/or implement manners of behavioural change or manners to increase awareness were taken into account.

Website Evaluation

To ensure effectiveness in the evaluation, an exemplary website from a Nature Park in Slovenia was used as the benchmark on which the levels will be determined. This website was used as the benchmark because it contains the desired design elements which contribute to making the user more aware of sustainable transportation options. By providing the websites a score based on these predetermined design elements, common challenges and recurring issues can be identified, pinpointing areas in need of improvement.

In order to collect the data, table 3.1 was utilised and filled in per website, the criteria get a relative score compared to the baseline website of the Triglavski Narodni Park located in Slovenia. Websites of busy recreational areas within the National Park Utrechtse Heuvelrug were gathered so that the evaluation and possible changes will indeed be impactful.

List of evaluated websites:

1: Nationaal Park Utrechtse Heuvelrug

2: Henschotermeer

3: Pyramide van Austerlitz

4: Nationaal Militair Museum

5: Ouwehands Dierenpark Rhenen

6: Opdeheuvelrug

Survey

Firstly, academic articles on surveys for behaviour change, interventions and methods were collected to provide insights into the effectiveness of surveys in understanding and influencing behaviours relevant to the research topic. By conducting a search using the keywords "survey AND behaviour’’ or ‘’survey AND behaviour AND measures" on Google Scholar relevant literature was identified. These articles offer insights into the utility of surveys in assessing behaviour change, whether this method is effective and valuable, and best practices and methodological considerations for implementing surveys in behavioural

research. The relevance of the found articles to the topic was determined by reviewing the abstracts and conclusions of these articles.

Furthermore, the data from the existing survey ‘’Bezoekersonderzoek Recreatie Gebieden Utrecht’’ was collected (Kantar Public, 2023b). This data contributes to the justification of the chosen methodological approach. This available survey provides valuable insights into visitor behaviours and preferences within recreational areas, serving as a potential reference point or supplementary data source for the study at Utrechtse Heuvelrug National Park.

Data analysis

Literature review

Once the literature was collected, it was systematically organised for analysis (Popenoe et al., 2021). This was done by creating a table (Appendix 3.1) to catalogue the sources, including bibliographic information such as author, title, publication year, and key findings. Then the relevant findings from each source were extracted by identifying recurring themes or concepts. These were in turn synthesised and interpreted by analysing the recurrence of effective strategies and their relationship with other findings. Finally, the findings of the data analysis were reported in a clear and coherent manner by writing the literature review that described the key themes, and findings and discussed their implication.

Website Evaluation

The gathered data from the websites is displayed in the table 3.1, 3.2, and 3.4, in order to analyse this data the interplay between these tables needs to be understood. Table 3.1 assigns a score to multiple criteria per website, the total score per website allows the framework to give a quality level to the individual websites, which is then displayed in table 3.2. What each quality level entails is stated in Table 3.4. These tables work together to visually display the state of each website regarding how well they convey sustainable transport to the park. Whereas Table 3.2 allows perception of the general quality of the site in regard to increasing awareness of sustainable transport, table 3.1 provides a deeper insight into the aspects of the website that can be improved.

Survey

Firstly, by summarising data from surveys for behaviour change and interventions, insights into effective strategies and measures for promoting sustainable transportation choices were gained. This approach ensures that the survey at Utrechtse Heuvelrug National Park is informed by existing literature and evidence-based practices, enhancing its relevance and potential effectiveness. Moreover, the analysis of the Bezoekers Onderzoek Recreatie Gebieden Utrecht survey allows for the identification of gaps in the current questionnaire in relation to the COM-B model, which conceptualises behaviour change as a function of capability, opportunity, and motivation. By aligning the survey questions with the COM-B model, the research team ensures a comprehensive assessment of the factors influencing sustainable transportation choices at the national park.

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Appendix 1.A

Interview with Baqme, Sven Velthuis [transcription]

Julija

[Start of the interview and introduction round of the client, the project and its main goals- and the interviewers]

Julija

[...] So that is why we would like to talk to you and find out a bit about how we could install e-bikes, what are some boundaries, and what are some drivers for installing such modes of transport. We are focusing on three train stations. They are smaller train stations because we were advised that this would be more viable for change. These stations are in or near the national park. We have looked into your services before and we found out that there are no operating bike hubs in the park. Is that correct?

Sven (Baqme)

We are not operating there yet, no. Correct.

Julija

Would be interested in operating in the park in general. What about the stations we picked, they were sent in the email as well. We added the number of visitors there as well. Would that be interesting for you?

Sven (Baqme)

Yeah, that would be potentially interesting, for sure.

Julija

What would be some things that would encourage you to go there? Is it because it is a park and there are a lot of visitors?

Sven (Baqme)

Yeah. So mainly what we are trying to do with Baqme is to replace short car rides in urban areas. So mainly in cities, and that is our main mission. But that does not take away the fact that a lot of people use it recreationally. So by far the most of our rides are functional, which means dropping the kids at school or going to work. But around 2020, 5% of the rides were also just for fun. So, for example, in Rotterdam, they go to the lake, in The Hague, they go to the beach. So we also see a peak on Saturdays, for example, which is not a workday, so you can kind of refer to peoples' use of the bike.

Julija

Okay. What are some challenges you face when facilitating sustainable transportation?

Sven (Baqme)

So I think we work through the biggest challenges, which are the bikes and the technology around it. TO rent it. The main challenge is staying profitable. So obviously, these bikes are quite expensive, thousands of euros. We need to buy or lease them for that we need to attract money and we need to pay back that money at a certain point. So it is important for us that the bikes are being used. We know for sure that every bike we had in our existing cities, for example, Rotterdam, they are going to be fine, they are going to be profitable and they are going to make the business work. Also it has to do with the fact that the costs are lower because we have 300 bikes here. So for us it is very easy to go to the bikes, swap the batteries and do some repairs. That is harder

when the bikes are further away and there are maybe only three bikes, for example, you can imagine that the costs go up because we need to either hire service there or drive there even, which is expensive for three bikes. So the main challenge here is financing. That's the biggest challenge for us because one bike in Den Dolder is not going to cut it. We are not going to have a commercial case there. Most likely.

Julija

From what I am hearing from you, it is important to make it profitable. In that case, would you say that these smaller stations are attractive for you or would you be more willing to implement them at stations that have bigger traffic? So there are stations in the park, that have 3000 or more visitors. Would that be more interesting for you? Or is it also okay if it is a smaller station?

Sven (Baqme)

I think the most important thing is to reach the biggest amount of people for that use case. The use case is driving around nature. So step one would be where do most people start. Is that maybe Utrecht? And does it then make more sense to put the bike somewhere in the direction of the park, but still in Utrecht? I do not know exactly how far it is. I think 10-20 kilometres around that. That is perfectly doable with the bike. So then I would say are people going to take the train to a small station and get the bike there? Or are they just going to stay in their city, take the tram maybe, or walk to the bike and start from there? That will be my first thinking about building a commercial without any financial health.

Julija

Okay, that's very helpful. Thank you for that insight. I am also wondering what are some criteria for implementing the rental bike at the stations, for example threshold of travellers, but also whether there are local buses. What kind of permits do you need? What are some other technical barriers?

Sven (Baqme)

So we only work together with municipalities. We do not just go somewhere and start in most cities where it is not possible anymore. So we work on a permit base. So for example, we have a permit in our existing cities, Rotterdam, Amsterdam, and The Hague, it is all on a permit basis. It also gives us protection from other companies that are trying to do the same because they are not allowed to. That does not take away the fact that we can operate on private terrain; so private, public space, private space to operate there. I know the land around the stations is usually managed by ProRail or NS stations, so they need to permit us to operate there. So that is the technicality, we need permission from someone to provide there. Secondly, we also want people for us to be there. So if the Utrechtse Heuvelrug association around it says we do not want you there, then we are not really inclined to come there, because these things can only work if there is complete support of all the stakeholders. If they really do not want us there, for example, which I can imagine they would say to maybe a moped on gasoline that wants to operate there. Yeah, that does not work. So cooperation with the stakeholders is very important for us also in terms of marketing. Imagine if we operate there, that the option is being shown to visitors, a possible way of transport.

Reelika

I have a follow-up question about the permissions. How often do you get turned down by a municipality or the private stakeholder that you are not allowed in that space? How long would the process approximately be to get a permit, for example from the municipality?

Sven (Baqme)

So, as you may know, there are only two companies in Holland which do what we do. So it's us and another company, and usually there is a tender. So, for example, Amsterdam did a tender because they wanted shared e-cargo bikes. So they started the process. We can subscribe to the process and they pick a winner, so to say, and

then you can operate in the permit. So we are not really getting rejected to operate somewhere. It is more that they ask us to subscribe to the process and then say yes or no.

Julija

Okay. Yeah. Also, with the limitations and kind of technicalities, what is usually the time frame? So, for example, to obtain this permit and to install your bikes? How long does it usually take or does it depend on the case?

Sven (Baqme)

Well, if it is a city, this can take months, the whole process, from the part of the concept permit to placing the bikes. But for example, we were also operating in Ede-Wageningen, which is a smaller town quite close to province, on the border. So they requested and really wanted us to come. They are also helping us financially because it is only 15 bikes. So for us, it would not make sense commercially that we would have done it without their request. I think we did it [carried out the whole process] in a couple of weeks. So the main limitations are getting the bikes, buying the bikes, and getting the bikes delivered, which is not a problem right now. In the current bike market, there is a lot of overstock. So usually the limit is how fast can our partner act and how fast can they get permission? Cities usually need to get it through their relations, their municipality, and political parties, they need to agree to it. Private companies or associations, they can act quickly. I think, like the national park, they should be able to say yes or no, basically.

Julija

And you said that you got the financial support from the municipality in the smaller towns. Is that something you expect in these cases where you only can install a few bikes, or is it something that you look into yourself?

Sven (Baqme)

No, we cannot do that because we are a company. So if we buy a bike and it is up to us, we are going to put it in Rotterdam, because we are going to make money and we can pay it back. If we are just going to put tree bikes somewhere in a national park, it is extremely risky for us because, first of all, there are weather effects. In the winter, it is kind of hard to get riders [visitors] there, whereas in the winter in the city, there is still usage. The costs are higher for those bikes [in the national park], for us to maintain them, to repair them, to swap the batteries. So, yes, concretely, we would need financial support to get break even, and then we can operate.

Julija

From what I understand, the financial support from the municipality will depend on the case. Depending on what you estimate the usage would be, correct?

Sven (Baqme)

No, we have a standard price because there is a standard price for us to break even, and then it doesn't really matter if it is three bikes or fifteen, as long as it's under 100, that price is relatively stable. Because the biggest cost for us is paying back the bike to the company or the bank.

Julija

Can I ask you, of course, you don't have to share, but how much this one bike provision for one bike would cost for the municipality to support?

Sven (Baqme)

In a smaller area, it's around €250 a month then we pay it back completely. And of course, we can make separate agreements on the revenue that we generate. So I can imagine, for example, in a national park, the rides are going to be long, relatively, because people will probably buy a day pass, so they can use the bike for the whole day. Thus, they don't need to worry about minute price. We can talk about a revenue share for them to decrease

the cost, the complete financial risk, we cannot take it. If there's upside, so let's say the bikes are really generating a lot of money in the summer, it is also not fair for us to take that complete amount. So there's a case to be made to then share that revenue with, for example, the national park for them to decrease their costs.

Julija

I was wondering, you talked about the promotion. Do you also have ways to promote your bikes in these smaller areas? Or is it something that you expect the stakeholders who are working with you in collaboration to also participate in this promotion?

Sven (Baqme)

Yes, we at least expect them to mention it in their information channels, like websites, to at least mention that we're there. They don't need to buy or add space. We can do that, but at least it legitimises us being there. So if we get the support from, for example, a national park, that would already help. We can put stickers on the national parks on the bike. That also helps. For example, in Ede, there are municipality stickers on the bike. That helps people understand that it's not just a random rental bike, but it's more of a cooperation.

Julija

How do you promote your bikes yourself?

Sven (Baqme)

So to be completely honest, we don't spend a lot of money on marketing because the product is the marketing. The bikes are on the street, people see them every day. The biggest marketing is people using the bike and other people seeing them. And of course, the major use case is kids. So you can imagine a mom or dad arriving at school with the kids in a Baqme, other people see that and then the domino starts falling. But we do sometimes marketing, light online marketing, ads, social media, and things like that.

Julija

Beyond the help to promote your bikes and ease the permit process, is there something else you expect from the collaboration with stakeholders, such as the municipality or the park?

Sven (Baqme)

I mean, all those organisations, they talk to each other, so for them to share their experience with other cities or associations, that would be helpful. Maybe we can experiment a little bit. For example, instead of swapping the batteries, we can have a charging station for a fixed bike. Other companies do that. So for them to allow us to experiment.

Julija

And currently you operate only within the Netherlands, is that correct?

Sven (Baqme)

We are also in Ghent, Belgium.

Julija

Are you looking to expand? Because the park is also working on a bigger sustainability mobility project and it is also in Germany and Belgium. Is it something that you are also interested in being promoted and are you going to be expanding?

Sven (Baqme)

Yeah. Our current focus in the next one, two years is Holland. Because there is so much to still do here. That does not mean we cannot do smaller partnerships abroad. So, like you are saying, the national park in Germany

makes a lot of sense, but there needs to be a local team that operates the bikes. So more of a franchise partnership in which we supply the bikes and the technology, and the local team picks up the operation.

Julija
Okay, thank you. So far, I got all the questions I need. Is there anything you're interested in as an addition?

Reelika
Do you know approximately how many bikes you have operating in the Netherlands in general right now?

Sven (Baqme)
Yeah, 400.

Reelika
And in Belgium?

Sven (Baqme)
In Belgium, it is now around 30. It is a small part, but we will start in Utrecht and Amsterdam this year, and then we'll go to 1500 bikes.

Julija
Okay, thank you. Do you have any further questions for us about the project, or is there something you would like to add that you feel like we need to know?

Sven (Baqme)
Are you only focused on bikes or also other modes of transport?

Julija
So what we are trying to do is facilitate this last leg of the journey from the train station to the park. So people avoid using cars in the park. And either they come by train and take this convenient either path by walk or bike, or e-bike or buqme. We are looking also for people to come by the car, park their car there so it is not parked somewhere within the park, and they can make that last part of the journey sustainably. So we're looking at everything.

Sven (Baqme)
Okay. So the bikes cannot go into the park?

Julija
They can go into the park we are looking at. So buqme and electrical bikes would still be a sustainable way to enter the park.

Reelika
There are quite a lot of bike paths inside the park as well as walking paths. So that is what we are trying to figure out. What would be the best kind of solutions and trying to kind of get an overall view? What are the motives as well? For example, you as still like a stakeholder in that sense, or like a mobility provider. What are your motives and barriers?

Sven (Baqme)
Yeah, that makes sense. I think an interesting statistic is that over half of our rides are replacing car rides. It is researched by CE Delft.

Julija
[end of the interview and thanking notes]

Appendix 1.B

Interview with TIER, Nils Verkennis [transcription]

Julija
[Start of the interview and introduction round of the client, the project and its main goals- and the interviewers]

Nils (TIER)
Oh, clear. And so you're doing this as part of your master studies or your bachelor's studies at Utrecht University for National Park, I believe, right?

Julija
[Explanation about the course and the connection to the client]

Nils (TIER)
Okay, all clear!

Julija
First, we would like to understand the situation with the TIER and what are the main obstacles and opportunities. So in general, would you be interested in facilitating your services in the park for now?

Nils (TIER)
Okay, the answer is quite simple and straightforward. At the moment, I would say no, we are not interested in offering our services in a park. And that is actually simply due to the reason that in order for us to succeed, we need sufficient demand, we need sufficient skill, and we need sufficient density, both of bikes and of potential users in an area. We can offer this skill and density in urban environments, in cities, for instance, in Utrecht, but also in some of the surrounding municipalities, such as Zeist and Nieuwegein. But our product is naturally designed for rural environments, for national parks. In order for us to succeed, we need at least multiple rides per vehicle per day. In a scale like Utrecht, this is very much possible. In the national park, you are of course very dependent on tourism. People who come from outside of the park, who are most likely going to come there by train or by car and then would need to download your app. It is a very small market for us that does not really work for us. I think there are other services that would potentially work.

Nils (TIER)
Perhaps the rental bikes from the public transport authority in the Netherlands. The OV. But our service really needs a scale. It needs density and it needs sufficient potential users full year round, and not just when the sun is shining and people want to go out, such as the case in the park.

Julija
May I ask you what those requirements are? Or is it not something that you can come up from your head?

Nils (TIER)
No, definitely, you want to have full year round usage of the bikes, regardless of seasonal influences, regardless of whether it is weekend or not. Because when do people visit the national park? Most often in summertime and when it is a weekend. We cannot really build a business around summer or weekends. We need to have usage for

all year round. So you need sufficient demand throughout the entire year, and we need to be able to offer sufficient skill so a sufficient number of bikes in a specific area. I mean, to put things into perspective, in Utrecht, we offer 1000 bikes in the entire city. We need to offer sufficient density, so sufficient bikes within, let's say, one square kilometre. And we can do this in urban areas and in cities, but we are not able to do this in rural areas. So within parks, or, I mean, we could potentially put more than 1000 bikes in the national park, but nobody would use them. So there needs to be actually a proper market for our vehicles.

Julija

That is understandable. What are usually the challenges and limitations beyond the amount of usage, let's say, trying to install your services, for example, in Utrecht?

Nils (TIER)

Depends on how you look at it. I mean, first of all, there needs to be a market for your service, right? So there needs to be sufficient people in the city that are looking to make use of your bikes, that want to consider more sustainable modes of transport above the private car, that prefer bikes over public transport in some cases, that are willing to try new forms of mobility. So obviously you would need to have sufficient, let's call them early adapters, or people who are maybe not too old yet and not too much married to their private cars, but are open to trying out new technologies. Well, you know what I mean. I think that is the first thing. And then, of course, there needs to be proper regulation in place that would allow you to run your service in a financially sustainable manner. So, for instance, what would be helpful is if there is not a free market where just everybody with a fleet of shared pipes can enter the market, but where the city would limit the number of competitors based on several criteria, several quality criteria. I think that is from the regulatory perspective, there is, of course, your operation.

Nils (TIER)

You need to be able to run an efficient operation in order to ensure that the cost of operation does not exceed the revenue you generate. And this also brings us back to the criteria that we also need in order to be successful in the city - that is sufficient scale and sufficient density of bikes so that we can efficiently operate all the bikes in the city with not too many people on the ground. I am sure you have seen the bikes around Utrecht. You see them popping up almost everywhere, a lot in city centre, train station, et cetera. But actually, there is 24/7 operation going on in the background to keep these bikes fully charged, keep them operational, to remove bikes with issues, bikes that need to have a checkup at the warehouse, etc. That is a 24/7 operation and that is actually the most expensive part of the whole service that we are providing. And say, we would be offering a lot of bikes in the national park and not a lot of people would be using them, we would still be making a lot of costs to keep them serviceable because, I mean, they are e-bikes, they work with a battery and this battery depletes every week or so.

Nils (TIER)

So even if nobody uses a bike, we still would need to service it. That is super costly, of course. So we have had regulatory, we have had operations, we have had the market. I think I can go on for quite some time, but these are, I think, some of the main considerations and also main challenges to facilitating sustainable transport.

Julija

How long does it usually, if you decide, if you do end up deciding on implementing your services in a city, because all these criteria are met, what is usually the time frame of starting up in a new city? So, for example, when you decided to open your services in Utrecht, how long does it usually take?

Nils (TIER)

So we started in Utrecht almost two and a half years ago, I believe, and we actually submitted a bid to the municipality of Utrecht. It was a competitive tender where the city invited shared mobility operators to submit a proposal to offer shared bikes in the city. I think the whole process between the preparation of the bid and the

actual launch took up, I think, six or seven months. So I think in early January or February or so of 2021, Utrecht opened up the licence procedure. I think we submitted in March. We got the licence award at end of May, beginning of June, and we finally launched the service in October. Now, this is the long route, because it was very pure, aquatic. There are a lot of steps that needed to be taken before we could finally get approval to launch. And then of course, we were also waiting on the vehicles to be shipped on a smaller scale. I think you could look at four weeks needed to launch the service. Maybe even shorter if we already have the bikes and we are already operating in the area.

Nils (TIER)
So, I mean, another city close to Utrecht would ask us, hey, can you maybe launch your bikes in our city? And we would be okay. Sure, that works. We could, I think, even launch within a few weeks time, one, maybe two weeks. So it really depends on how the process looks like.

Julija
And from that I also wonder, can you recall from the back of your head what is the smallest area where you operate? But it is still something that is attractive to you because it does fulfil the criteria of demand and returns.

Nils (TIER)
Yeah. So the smallest city in the Netherlands where we operate currently is Eindhoven, where we offer 850 bikes.

Julija
Okay.

Nils (TIER)
In Utrecht, of course we are also present in surrounding municipalities such as Nieuwegein, Maarssen, Zeist. But we actually look at the operation as one whole. Combined we offer around 1200 bikes in the entire region. So 1000 in Utrecht, 200 in surrounding municipalities. And that is sufficient skill for us to run an efficient operation. We have been operational in Amersfoort, which is close to Utrecht. We were operating, I think 150 bikes, but we did not extend our licence there after two years simply because the demand was not enough for us to cover operational expenses.

Julija
Okay. And do you operate anywhere outside of the Netherlands?

Nils (TIER)
No, we are actually present in more than 20 countries. So the company originates from Berlin. We have our headquarters in Berlin. We are operational in Germany, France, UK, Norway, Sweden, Denmark.

Julija
Okay. So more international.

Nils (TIER)
So it is quite an international. Yeah.

Julija
Do you have any studies done in the Netherlands of what kind of activities do people usually do when they utilise your bikes? So is it to drop off kids at school or is it to recreationally just ride around the city? Or are there any other things?

Nils (TIER)
So the thing they least often do is drop off their kids at school. I think there is maybe more something for the cargo bikes which we do not operate. It is Cargaroo within our user base. It is a mix and I do not have the percentages right now from the top of my head, but it is commuting in the weekend, a lot of social stuff, [i.e.,] going from into the city, going into bars. In the summer, of course, going to the lakes in Utrecht. So I have said during the week there is a lot of commuting. So you can actually see that our usage spikes between eight and ten in the morning and four and six in the evening on the weekday. It shows you that there are a lot of people who are actually using our service to travel from and to work, or from and to a train station, because we also see that almost half of our users also use our bikes in combination with another mode of transport, be it, for instance, the trains. So it really depends on the time of the day, the day and the week, what the main activities are.

Nils (TIER)
But it is a combination of leisure, community, those types of stuff.

Julija
Are there usually length to the rides? Are you aware of what is the average length of the ride that people take?

Nils (TIER)
Yeah. So it also depends on what time of the year we are in. In the summer, people tend to ride a bit longer than in winter, but in general, in the summer it is around 3.5 to 4.5 kilometres. In the winter, it is around three to four kilometres. That is the average distance.

Julija
Surprisingly short. You mentioned the OV-bikes and their potential. Are the OV-bikes a competitor for TIER, or is it too different of a service for you to. Do you consider them when you are implementing your services?

Reelika
To add, as far as I understood that OV launched e-bikes as well. Still a pilot, I guess?

Nils (TIER)
Yeah, it is a super small scale pilot. Indeed. So do we consider them as competitors? Yes. But do we consider them as similar services as we offer? No. So there is some overlap, but there are also differences between our services. For instance, an OV-bike will always have to be returned to the train station. We are way more flexible in that regard. So if you pick up one of the bikes close to the train station, you do not have to bring it back to the train station. So we also cater for single trips rather than round trips at the same time. We also know that, for instance, the of bike has better accessibility to the train stations because you can actually park them in the train station. And we have this kind of buffer around the Utrecht Central station for other train stations. I think it is a bit better, but still coverage within Utrecht Central station is better for the OV-bikes, so there is a competitive advantage for them. But at the same time, if you look at the usage figures for our bikes and for the OV-bikes, you can actually see the same pattern. So when usage of OV-bike spikes as well, we also hit the same needs.

Nils (TIER)
Though we indeed offer bikes. Some people just hate pedalling in the wind. For that, our bikes are a good solution. Others are way more than the regular pedal bike at the same time, I am not sure if you have also seen this, but they are also available via the NS app. So you can also rent our bikes directly from the NS app.

Reelika
That is also a relatively new launch, right? Or like a new partnership?

Nils (TIER)

Yeah. So we launched this partnership. We actually started the campaign last week.

Reelika
I saw an advertisement in a train. That is why I have heard of this.

Nils (TIER)
Exactly. Yeah, it is super cool. We are actually the first shared bike operator who has this partnership with NS. So it is first in industry. It is relatively new, actually. I do not believe you can rent an OV-bike directly through the app as of yet. So we are first in that one.

Julija
Okay. And then it kind of leads me to the question of also, how do you utilise these collaborations, for example, in promotion, exhibiting the promotion and the train, or how do you utilise collaborations with other stakeholders in the city?

Nils (TIER)
Yeah. In general, I do not consider us as a standalone product nor a standalone solution. Right. You want to be part of the whole mobility network within the city, and that requires you also to connect your services to other platforms in the mobility sector. And so, for instance, if we look at our coverage in the Netherlands, there are a few integrations that help us or a few partnerships that help us build this integration, that help us position ourselves within this product belief network. And that is, for instance, Google Maps. I am sure you're all familiar with that application. If you are planning a trip, you click on the bike icon and you actually also get access to our fleet. You can also see where our bikes are located and Google can actually plan your route from the next TIER vehicle to your destination. That is, I think, one of the most successful partnerships we have going on right now. Another travel planning app is 9292. I am not sure if you're familiar with. Okay, wow, good to hear. That is another one where we are also integrated in. So you landed a trip through 9292, you can actually take one of our bikes as your travel option.

Nils (TIER)
You cannot rent them directly through the 9292 app, but you will be linked to our app, but it does show you the availability of TIER bikes within your area. Then we have the NS integration, which allows us to not only integrate, because there is already quite a strong connexion between the two. I just mentioned that almost half of our trips are taken in combination with a different mode of transport, often it is public transport. And this integration with NS also allows us to digitally integrate our services by making it possible for travellers to rent a TIER bike directly from the NS app. So in general, our strategy is focused on integrating in all those large transport planning apps that commuters also use to plan their trip, just to grow your visibility in a city.

Julija
You mentioned collaborating with bigger apps like Google Maps, also with train stations. What about municipalities? Also, when you are collaborating, because I am aware that there is a need for some permits, how does the collaboration with municipalities themselves work? And is there something you need from municipalities to push your product forward, or are there things in which you have to collaborate with them?

Nils (TIER)
Yeah, of course, there is always a collaboration going on with the cities where you are active. It really depends on how a city regulates shared mobility, how your collaboration looks like. But for instance, the way it is regulated right now in Utrecht, with a permit where only a limited number of operators can obtain one, that is the way it is looking like in most cities nowadays. So in most of the cities, in order to become operational, you need to have a permit. And this permit actually gives you a set of rules that you need to abide in order to be allowed to operate your service. So what we, of course, need from a municipality is a regulatory framework that

allows us to successfully run our scheme, or a service in a financially sustainable way, which also makes the scheme an attractive scheme for its users. What you often see with cities, that they are quite hesitant, they are quite afraid of allowing shared mobility in their city, because they often see a one on one relationship with noise and with parking violations, with vehicles scattered across the city. And the first reaction is, of course, to limit the free movement of those vehicles across the city.

Nils (TIER)

And so they want to prevent bikes from ending up everywhere in the city, which, on the one hand, sounds good from a noisy perspective. On the other hand, it can lead to a service that is super unattractive for users because there are hardly any places where you can park bikes. We have been working very well with the City of Utrecht to come up with a scheme that is as attractive as possible for our users. And if you have any concerns, please do let me know, because we are always trying to improve while at the same time adhering to the concern that the city has with regards to bikes ending up everywhere, leading to polluted streets. So I think that is, in general, the main need we have from cities, a regulatory framework that allows operators to run a successful scheme and be successful in a way that is attractive enough for users to consider your service as a mobility option.

Julija

Okay, thank you. That was a very elaborated answer. I think I have one last question. I also wonder whether TIER requires any supplementary financing from where it is operating or whether it is just within the company.

Nils (TIER)

No. Or at least in this case not. We are not receiving any funding from the city, but that also leads to, let's say, the challenges that I just displayed in the start of the meeting with regards to launching your service where demand is lagging. So say that the national park would be considering to subsidise operators, then I think you would get a different scenario because then operators would not be dependent on the amount of revenue they are generating. And that would actually also help you to build a better business case for such national parks. Now, I am not saying that if they would simply offer a subsidy, we would definitely launch there. I think there are a few more criteria that need to be met, but a subsidy for low performing areas does make it a lot more attractive to a larger service there.

Julija

What are some other criteria that you would need to be met? Would it be the demand despite the financing, or is there anything else that I would not be aware of? Maybe what would kind of be the pushing factor for you if you would get the financing to operate in a park?

Nils (TIER)

Of course it would be the main criteria would be the financial aspect, of course. But then there are some other operational aspects, such as what service level agreements do we have around parking around, number of vehicles that should be active in the park, distribution of vehicles over the different locations in the park. Those are all more operational aspects, but the main one would of course be financing.

Julija

Is that something that you would be interested in considering? Could that be something that the company would be interested in?

Nils (TIER)

Yeah, I understand the question and of course we can always have a discussion on finances and see to what extent we can reach an agreement that caters to both our needs. Definitely. But I am of course very reluctant to right now give you a green light saying yes, if you pay us, then we will definitely do this.

Julija
Yes, of course. I was just wondering what your personal view was on it. Also, do you have an amount that it takes to operate one bike? I do not know if you can disclose it or not. Does it depend on how many bikes you have in the area? Do you know how much it takes to operate this bike?

Nils (TIER)
Yeah, I do. But that is indeed information I cannot disclose. But you can think in the range of a few euros per bike per day.

Julija
Okay. Thank you so much. From my side I have asked all the questions. Reelika and Sanne, would you like to add or ask any follow-up questions?

Reelika
I have one question actually. What do you see as TIER's vision, at least in the Netherlands? Are you trying to aim even higher, to be present in more and more cities? What are your long term and short term goals in that sense?

Nils (TIER)
That is a nice question. So I believe in sustainable growth. And to me sustainable growth means only expand your services there where there is a viable business case, rather than first expand like crazy and open up in all different new cities and then see what works or what does not work. If you look at, for instance, the rapid grocery shopping applications, have been expanding like crazy throughout the country. And all you see right now is them just leaving city after city after city. Because it does not really work in this city, it does not really work in that city. And in the end they will just remain in a few larger cities across the Netherlands. I am trying to work the other way around so conservatively, but responsibly growing the country. And the main thing that is right now actually slowing us down are city regulations. So we would love to launch TIER in Amsterdam, we would love to launch Rotterdam and we would love to launch The Hague. But currently there are no open slots available in these cities for us to obtain a licence. So we are waiting for these cities to publish a licence and then we can apply and then we can launch the city.

Reelika
So does that mean that you need to have another tender?

Nils (TIER)
Exactly, yes. They are just right now not open to other soft mobility providers.

Julija
Thank you so much. I think overall, you have provided us with loads of information. It is going to be valuable, although you are not directly right now interested in the park. Thank you. Do you have any questions for us still? Also, would like to see the report at the end after we have finished it?

Nils (TIER)
Always happy to receive the report. Best of luck for now. Please do reach out if you have any questions. Good luck with the wrap up. Looking forward to the end result. Thank you so much.

Julija
[Thanking credits].

Appendix 1.C

Definitions of the interview codes

Theme 1: Obstacles

Obstacles are variables that are large enough to hinder a successful implementation of the sustainable transportation method from the train station to the NPUH. Under the current theme, only those obstacles to installing or maintaining sustainable transportation methods were accounted for. Any obstacles that do not relate to sustainability transportation provisions were disregarded as this is outside of answering the main research question for this section.

Table A.1.1.

Code	Demand
Brief Definition	Need for the soft mobility option by the consumer.
Full Definition	A need/demand for the soft mobility option that is required, present or missing in the NPUH area.
When to use	When the soft mobility provider mentions demand as defined above as a criterion for the installation of their product at any of the stations under study in this report.
When not to use	When demand, as defined above, is mentioned, however, it does not relate to the criteria for the installation of soft mobility options.
Example	"*[...] when do people visit the national park? Most often in summertime [...] So we need sufficient demand throughout the entire year [...].*" (See Appendix 1.B)

Table A.1.2.

Code	Regulations
Brief Definition	The official allowance/authorisation/rule for installing the soft mobility measure.
Full Definition	The official allowance/authorisation/rule for installing the soft mobility measure issued/regulated by the relevant body that will allow the soft mobility provider to officially/legally operate in the area.
When to use	When the soft mobility provider mentions anything regarding the regulations as defined above, including obtaining permission to

	operate in the NPUH area.
When not to use	When the soft mobility provider mentions regulations that do not relate in any way to the instalment of their services in the NPUH area.
Example	"*[...] how fast can our partner act and how fast can they get permission? Cities usually need to get it through their relations, their municipality, and political parties, [...]. Private companies or associations can act quickly.*" (See Appendix 1.A)

Table A.1.3.

Code	Support
Brief Definition	Support is needed for the maintenance of the product.
Full Definition	Support relates to any services that need to be provided by the soft mobility provider to maintain the product in good shape. This refers to any technical support, collection of the bikes, or their routine maintenance.
When to use	When the soft mobility provider mentions support as defined above, it relates to the installation of their product at any of the stations under study in this report.
When not to use	When support, as defined above, is mentioned, however, it does not relate to the installation of a soft mobility or sustainable transportation option.
Example	"*[...] there is a 24/7 operation going on in the background to keep these bikes fully charged, keep them operational, to remove bikes with issues, bikes that need to have a checkup at the warehouse [...].*" (See Appendix 2)

Table A.1.4.

Code	Financing
Brief Definition	Financing of the soft mobility measure.
Full Definition	Any financing that is mentioned concerning bringing in or installing the soft mobility measure. This can be both financing of maintenance, finances involved in receiving permits, or the costs of the installation.

When to use	When the soft mobility provider mentions any financing involved in implementing their product at any of the stations under study in this report.
When not to use	When financing involved in anything outside of the provision of the soft mobility option is mentioned.
Example	"[Ede-Wageningen] *[...] is helping us financially because there are only 15 bikes.*" (See Appendix 1.A)

Theme 2: Opportunities

Opportunities are variables that lead to successful installations of the soft mobility options between the chosen train stations and the NPUH or allow space for their consideration in the future. Under the opportunities theme, only those opportunities for installing or maintaining sustainable transportation methods were accounted for. Any opportunities that do not relate to sustainability transportation provisions were disregarded as this is outside of answering the main research question for this section.

Table A.1.5.

Code	Sustainability Motivations
Brief Definition	Driving forces that encourage soft mobility providers to contribute to the modal shift.
Full Definition	Sustainability motivations refer to the underlying reasons, incentives, or driving forces that lead soft mobility providers to act in environmentally responsible ways and provide their services as a part of contributing to the modal shift.
When to use	When the soft mobility providers mention any sustainability motivations responsible for soft mobility installation that can facilitate the mobility shift from cars to more sustainable transportation.
When not to use	When the soft mobility providers mention any sustainability motivations do not affect soft mobility installation and do not facilitate the mobility shift from cars to more sustainable transportation.
Example	"*[...] to me sustainable growth means only expanding your services where there is a viable business case [...].*" (See Appendix 1.B)

Table A.1.6.

Code	Collaborating and Partnership
Brief Definition	Collaborations that lead to easier instalment of soft mobility options.
Full Definition	Any collaborative efforts between soft mobility providers and stakeholders involved in the NPUH area that lead to opportunities for the instalment of the soft mobility option.
When to use	When the soft mobility providers mention any expected collaboration with other stakeholders involved in the soft mobility installation or maintenance in or outside of the park that can facilitate the sustainable connectivity between train stations and the NPUH.
When not to use	When the soft mobility providers mention any expected collaboration with other stakeholders that do not facilitate the sustainable connectivity between train stations and the NPUH.
Example	"*[...] there is always a collaboration going on with the cities where you are active. [...] depends on how a city regulates shared mobility, how your collaboration looks like.*" (See Appendix 1.B)

Appendix 2.A

Observations per train station per indicator

In this section the observations when visiting the train stations are listed. This is done per indicator, following the rules of the adapted biophilic design framework.

Station A: Den Dolder

1a. There was some vegetation on the platform and around the train station, but no green roofs and permeable pavements.

1b. There were no clear signs or directions to any place, however, along the train station you can see that there is a bike path in between trees. You could tell that there were green areas nearby. Not near any conventional parks though.

1c. There was no working water amenity (only the bathroom perhaps).

2a. This train station still has a lot of its original features; the building and the ground. The ground is all brick and so is part of the building. Overall, the design of the train station holds many of the original features and materials which you do not see in more modern train stations.

2b. The original building has very neutral earthy tones that blend nicely with the brick flooring. As the train station is not modern, it does give more of a connection to nature.

2c. This category got a score of 5 because it only had 1 trashcan in the whole station which had no division of waste. It is a small station but having at least one more trash can would make the score higher.

3a. The train station was extremely accessible. It had a lot of benches, indoor seating, a big bike park adjacent to the station, and it is right in the city centre of Den Dolder. It does not get a perfect score because the entrance is on a slight incline which could hinder the accessibility to a person on a wheelchair.

3b. There is no signage to the park, so this category gets 1 point. In general, the signage in this train station is very clear and if it were for signage in the station it would get a higher score.

3c. The station integrates well with the surrounding environment, however there is no awareness created for the green surroundings or the national park.

Station B: Baarn

1a. There was very little vegetation and greenery on the platform. Outside on one side there were a lot of trees while on the other side it was mostly roads. There were no green roofs and permeable pavements.

1b. There were no clear signs or directions to any park. On the exit of one side of the train station were a lot of trees and this gave the idea of being in nature.. The other side had a plaza and taxi pickup, and then a small park.

1c. There was no working water amenity (only the bathroom perhaps).

2a. This station has modern platforms but still has its original building as one of the entrances to the station.

2b. The train station and the platform have neutral colours consisting of shades of browns, yellows, and greys.

2c. This category got a score of 6 because it had many trash cans along all platforms. However, there was no division of waste which means it scores low.

3a. The train station was extremely accessible. It had an elevator on every platform, stairs, a lot of benches (which were covered by roofs in case of bad weather, indoor seating (only in the main building connected only to platform 1), and a big bike park adjacent to the station.

3b. There is no signage to the park, so this category gets 1 point. For signage in general, there are a lot of empty boards (see images) that are a wasted opportunity. However, the signage to get to trains is mostly clear.

3c. The station seems well integrated into the area, however lacks awareness of being in the NPUH and other recreational areas nearby.

Station C: Hollandsche Rading

1a. There was little vegetation and greenery on the platform. Outside on one side there was grass and a small hedge. There were no green roofs and permeable pavements.

1b. There were no clear signs or directions to any park. On the exit of one side of the train station were trees which did enhance the nature experience.

1c. There was one properly working water amenity in a suitable place.

2a. This station has modern platforms and no building (except for the small lunch room right next to the tracks). The platform tiling is made from recycled platform tiles.

2b. There are not really any biophilic design elements incorporated in the infrastructure of Hollandsche Rading.

2c. This category got a score of 6 because it had a trash can on each platform, but no option to separate the waste.

3a. The train station was easily accessible. There were both stairs and an inclined walkway to each platform. There were benches of which some were covered by roofs. Also, there is bike parking next to the station. There was no real indoor seating (only the enclosed benches).

3b. There is no signage to the park. The only signs there are show old pictures of what the train station looked like in the past.

3c. The station seems well integrated into the area, however there is no awareness created for properly behaving in the nature area.

Appendix 2.B

Selection of photos of train stations

Station A: Den Dolder

Figure A.2.1: Collage of self-made photos of the environment of the train station of Den Dolder

Station B: Baarn

Figure A.2.2: Collage of self-made photos of the environment of the train station of Baarn

Station C: Hollandsche Rading

Figure A.2.3: Collage of self-made photos of the environment of the train station of Hollandsche Rading

Appendix 2.C

Interview Transcript: Daimy Jansen

Syl
So first of all, we wanted to start with asking you what your role is as a green advisor for NS. And like, how you got to this position? What have you did or have done?

Daimy
Yeah. All right. Well, so we'll start at the beginning. One year ago, I came here as a, how do you say, as a student to work on a big project to make some kind of tool to get a number from the biodiversity. Like, what is the biodiversity and the green on the station's right now, so I made like a tool to calculate that, with like a checklist you can see that. From that part, I got like a job here, as an advisor in green, and especially in biodiversity and ecology. I started with a study in like environmental sciences. So the same, almost same as you guys, but a little bit different in leeuwarden, and I focused on ecology. So that's my background, and I was an ecologist before this as well. So this is why I was brought in here at this specific job. I have worked here like almost a year now I think and with another colleague of mine, we focus like on all the green on every station in the Netherlands. So we have like 400 stations and like some bigger areas next to the railroads. Pro rail has everything next to the rails, so everything that a train passes, that's pro rail's, and we make sure that the green on the train stations, that's the NS part of it, is always good and well managed. So that's like my job right now. And we focus together on everything in the Netherlands, so it's just like the trees and the grasslands, everything is, or can be seen as ours or we have a management for pro rail. I hope I explained it, sorry, my english is not that well like yours, but I will try to cope. And well, my day to day is like give advice when there is like a big project. We make an advice, how they can do it better. Deventer is a good example of how they can do it to be as biodiverse as possible. So that is something we do and just the day to day management of the green stuff on the stations.

Syl
Okay, interesting. Thank you. That's nice for us to have a bit of an idea of what you actually do. So you talked about the biodiversity on stations and then do you have a specific view on how the ideal green biodiverse train station would look like? What type of measures or things are there? What does it entail?

Daimy
Yeah, good question, what we do, we are working on like a big vision right now. I hope it will be finished this year. Uh, it is also like a vision that includes what is the most biodiverse that you can get a station. So if everything is possible, what could you do? And there are of course all kinds of rules like the trees can't be in like a 10 metre zone next to the rail. So safety and especially the lines of sight, those are most important like everybody should see everything. So most of all, the plants shouldn't be higher then one metre so everybody can look over them. That's really important. Sometimes we play a little bit with that with higher trees, so you can look around, but mostly we try, especially on the platform itself. So the platform, that part needs to be safe. That's most important. So the plants and all the green needs to stay quite low.

If you go to Deventer, that's maybe a good example for you when you want to look at something that's also possible. We went beside that rule to not put trees on the platform, but there we have a few smaller trees in Deventer on the platforms. So that's pretty cool, because it normally isn't allowed. So we got that few years ago, so that is quite special and then there are a few other stations where you also see trees on the platforms, that's quite special.
And also we look at the variation, so especially on the platforms, you can imagine it's pretty dry and it gets pretty warm because it's a higher part in the area, so and we can't always use the species from the Netherlands because they aren't quite evolved the way that they can stay on the dry sand and the heat and the the water flows

quickly pretty fast. So we have always tried to combine it with plants from other countries that can contain the dryer and months like in June and July.

Of course, we try to have every plant like it's food for insects, for the bees, or it is just a plant from the Netherlands that can be used for butterflies. We mostly focus on insects because other animals we don't really want on the train stations like. So we focus on the insects.
Education is very important as well, so we want everybody to bring something they learned to home when they step out of the train and they see a green area they can see. Ohh well this can be done at home. So that's pretty important too, but there's one thing where you can not do the education on the platforms. The main focus there is that people need to know where to go and more signs aren't really allowed. So you can't put like signs in the middle of a platform or a station where people just need to focus on where to go. That's also one thing to look at, but like our vision is mostly to have as much variation as possible. So like smaller trees and flower plants on the platforms too. Yep.

Syl
Umm, alright. And then can you explain in your vision what the added value of having green train stations and adding that biodiversity on the platforms and on the train stations adds to the experience for visitors, maybe or to sustainability as a whole?

Daimy
We focus on these three things. You've already said it like how people experience, the travellers and what they see. Most of all, people like it better when there are colourful flowers on a platform then there is only nothin green. Umm, they feel happier.
We have done a checklist a few years ago where we looked at how people reacted when there were new plants planted on the platforms, how they react, are they happier? Are they feeling better? and we see a small significance that it will help the experience with but not that much. So we need to and see how that will go in the future.
And environmentally, especially on the plaza in front of the stations, we try to do as much as possible with the greenery and the water flow. So this is also very important to us and biodiversity as a whole.

I don't know if you know of the CSRD, the European rule. I would put it in a chance because I don't know if I say it right, CSRD and CSDD. These two rules are the European rules that will make sure that bigger companies always have their part in the biodiversity and environmental stuff. So they are quite important for us as well. This is also the reason why we want to do more about biodiversity.

Syl
Yeah. Ok, so these are measures that or rules that in a few years are mandatory to have a certain impact.

Daimy
Yeah. I think in two years or next year already, so it's quite soon.

Syl
Ok.

Daimy
It's like you need to report that you do your part in helping biodiversity loss or to help improve the biodiversity. NS is really into the environmental, like the trains need to be energy neutral. So that's quite important and that's also in the CSRD. So in these reports to the Netherlands, I don't know to whom, but we need to do that. So we have our part in this as well.

Syl
OK, good to know. Interesting.

Daimy
Yeah. and biodiversity is not the most important thing here, especially for us. But environmentally it's that the energy flows. So that's more important than biodiversity because every station is from Pro Rail and you need to quite understand that well and we have it in management for Pro Rail. So that's quite a weird construction, but it is not ours, not our grounds.

Syl
Ok.

Daimy
I think 80% of what we do in management is for Pro Rail and 20% is from NS, but we have it in management for them.

Syl
Do you have the rights to implement everything you want there or do you also always have to ask for permission and problem? OK.

Daimy
Yeah, we do on the stations as well and yeah, like on the platforms, it's all always Pro Rail. So the station itself, it can be from NS, so it is always difficult to know which part is from whom. But, we always need to get it passed Pro Rail if we want to make something new. Sometimes that idea comes from Pro Rail, and we make a plan out of it and we do it together.

Sofia
We're looking at different train stations; some are in like more nature areas and some are more like in the cities. So we're just wondering if there's different like regulation or policy for what you can implement?

Daimy
Yeah, there is. If you look at a station like Utrecht, you can imagine there's almost nothing possible there. Yeah, that's always a little hard to say, but the main focus there is to get everyone around and there are so many people there so green is not really an option, but there are like on the square or plaza in front of train station Utrecht, there are a few trees. So you can always look at options, but the more green areas like in the eastern part of the Netherlands or the north part and even in Limburg, it's one of the prettiest stations I've ever seen because the older look of it and it's also pretty green. And I think people like those stations better because the area is so pretty and green. I think that's also a really good thing to keep in mind that in a really busy city like area the stations are always not that green because there aren't really many possibilities. There are always many more people going around there than in the northern part or eastern parts, but that's why they score lower as well. If you look at the areas with the most forests, then people like it better as well.
Sofia: Another question based on the greenery and adding greenery to the train station. Do you also work on like other measures, or mostly on the biodiversity side?

Daimy
Umm.

Sofia
For example, we were thinking about adding more water taps or like the waste management, do you also deal with that or no.

Daimy
No, that's not my job. I only focus on the green and the management of that, so no, no.

Syl

If you want to think with us a little bit, so if you want to transform a station and to really contribute to the visitor experience for the National Park, so most of the train stations are already in a greener area, but also some bigger ones that are more in built up area in in, in towns and stuff. How would you transform these areas and really focus on the platforms as you suggested, to add the green there and those kinds of things.

Daimy
Yeah. Yep. I think the best thing to focus on is the squares in front of the buildings.
Like every train station has some sort of uh square. You have like the place where you put your bikes and the cars and the taxis and stuff. And that part is the, if you look at the price, the less expensive part, but if you put green on the platforms you have to cancel all trains that come by.
You always need to be in a project where everything is already closed off, so you can do something on the platforms, but also always focus on the other squares and everything because you get more from it, I think. Most of the green on the platform we have right now, they are also connected to a bigger project that has been happening in that area. If you work on the platform the trains have to be shut down, so nothing can come through for safety reasons and it's quite expensive to do so.

Syl
Yeah. Yeah, it makes sense. It's something we are tempted to think about, of course, but that's nice to have your perspective on this, yeah.

Daimy
Yeah, no, of course. Me too. But it's also like the management of it. If you get too close to the side of the platform, you also need two more people. There are many safety rules next to the train that you have to consider. And it’s very good, that's the best way.
It is good. That's the reason I think you can do more outside of the platforms.

Syl
What you said about signage; that it's not allowed to have that on the platform because you already discussed that if you, if you have plants in the platforms, it would be nice to have signs of what they are to have a bit of. So that is not allowed, but would they be allowed in the station hall, like downstairs, or also not?

Daimy
I would really want to put little signs next to our green plants on the platforms because I want people to see it. We have a few examples like where there is a bigger nature area where we do, we really focus on ecological management.

Maybe I can just put a picture in the chat. Further away from the place where people need to see where they need to go, you can put signs. That's not a problem, but mostly it is from the squares and most of the time they are from the municipality. I put a picture in the chat, so it’s quite nice, but it's further away from the part that everybody needs to be focused on getting around.

Syl
Ok. It's hard that you really can't put other things in stations.

Daimy
Yeah, it is. It is, yeah, but I'm it makes sense because you need to see where you are going and everything else is just distraction. A thing we always try to do is that the further away from the platform, the wilder the green may be. It needs to be colourful, easy to maintain and a little bit more biodiverse. But mostly how it looks. It is purely aesthetic pleasing, colourful, and nice. So you can also see the difference between those further away from the platform, the more wild you can be with your green.

Syl

Makes sense, yeah. Ok. How feasible would it be, because we are for the concept of green entrances which is quite a new concept, it's not really something yet, but it's been developed in the MONA project from the EU. It also includes adding and making it easier for people to really use the train stations as a way to get to visiting the national park. So if you go by car, you really have your own transportation measure. If you take the train, you're more dependent on the stations and the trains, of course, so adding water taps and toilets maybe would make it easier to use the train station really as a starting point for your walk or bike ride in the park. Adding such measures, is that possible in train stations or in the squares next to them? Who's in charge of that? Could we suggest it to the client as a possibility. Is that by NS and then you have to of course discuss it with Pro Rail? Do you know anything about this?

Daimy
That's a good question. Yeah. Yeah, we have lots of water taps on the stations already, so there are quite a lot. Toilets, I think almost every station has toilets. You need to pay for it, but you can use it. They don't always work, but, um, they're pretty fine. A water tap is always a possibility. We always look at how busy a train station is, if it is something that is needed, but especially if you want to get a nice start for a walk, it could be an option. And who is in charge of it? I couldn't say, I think it's almost always on NS ground. So NS is in charge, I think that the water tips now are also from NS, but I'm not too sure. But you can suggest it, yeah.

Syl
OK. I think then the challenge is a bit, if I take the things you've said in this interview, that and there are already in most stations, so measures, but maybe not really, there's not really any attention focused on it. So to really induce that green experience, you have to find a way to make sure that if there are already measures in place, to really get more of a focus on them. At the same time we can't point or direct to them because signage is not possible. So that's really I think maybe our challenge and for us to think about.

Daimy
Yeah, I think if you walk away from the platform into the main hall, some stations have the main hall. There you can do more, like signage as well. You see like lots of art these days and other signage that are quite nice, we now have, most stations now have the electric signage. Sometimes there is also news from NS itself. So that is an option to put something in there, especially in an area where people mostly walk around in nature areas. You could put a sign outside in the square where people need to go or where to walk or start that could be done as well. I think that you could, with real green go especially on the square, make people follow the green to the nature area, so that's something I have heard from a few days ago. Somebody said to me that they're on a station in the Netherlands that the municipality is willing to help to make a green road towards the nature areas, but I'm not familiar. But well, they are really thinking about it.

Syl
Cool. Interesting. Yeah, I think for us that could be useful. Indeed outside of the train stations moving into the National Park and for some train stations in that area, it's really nearby. So really, when you go out of the train station, you're already actually in the park and some people don't realise it and some are a bit further away. So we wanted to have a sign to say "that way to start that walk" specifically. We know now that it has to be a bit further away, in the square maybe and probably the municipality has some rights in that.

Daimy
You have to know, like in the main hall and on the platforms, you could put signage on. Maybe. Maybe you will get allowed, but nobody will see it if it's too busy.
So you have to think about what is the right place to put a sign so people really notice it? Because there's a lot happening around every train station. Also, the signs aren't really seen. We've done tests and I think only maybe 15% of the people we asked from the like 200 people have seen it. You have to think about how to make it visual, because it is visual when people can see it, but only if you have the intention to walk and focus on it. the smaller, smaller and, yeah, focus part.

Syl
Ok, I think looking at our questions, I think you answered everything a bit, lots of good suggestions.

Sofia
I just think it's really interesting with the safety, I just hadn't realised that.

Daimy
Yeah. Yeah, you have to keep in mind that the people driving the train have to have a visual line of sight. That's most important. He has to see everything around him, so always be careful with trees or higher parts in the area that he needs to see everything around him. And that's the same for the traveller himself. He needs to feel safe, so that's why we always choose lower green. Safety, safety first.

Syl
Perfect, then. Thank you very much for your time and your information and I hope we can make something nice out of it.

Daimy
Yeah, no problem, of course. Yeah, I'm curious about what you will find. I would advise you to visit a few of those stations to see how the education here happens.

Syl
Thank you very much and good luck with your day today.

Daimy
Yes, thank you too. Thank you. Have a nice day

Syl
Bye, bye.

Sofia
Bye bye.

Appendix 3.A

Article Matrix

	Reference	Key points and strategy for improving awareness or behaviour change	Search string
1	Villanen, M., Vanhamäki, S., & Hämäläinen, R. (2023). Encouraging sustainable mobility: community case study on workplace initiatives in Lahti, Finland. Frontiers in Sustainability, 4. https://doi.org/10.3389/frsus.2023.1158231	Case study, changing automatic behaviour through a pilot test. Personal motivations came forth as main reasons for using sustainable transportation (bikes).	Awareness sustainable mobility
2	Magginas, V., Karatsoli, M., Adamos, G., & Nathanail, E. (2018). Campaigns and Awareness-Raising Strategies on Sustainable Urban Mobility. In Advances in intelligent systems and computing (pp. 264–271). https://doi.org/10.1007/978-3-030-02305-8_32	Promotion, marketing campaigns, online campaigns. Overcome barriers to communicate sustainable mobility. Appeal alternatives by highlighting environmental impacts. Mainly done through the internet.	Awareness sustainable transport
3	Anagnostopoulou, E., Bothos, E., Magoutas, B., Schrammel, J., & Mentzas, G. (2018). Persuasive Technologies for sustainable mobility: state of the art and emerging trends. Sustainability, 10(7), 2128. https://doi.org/10.3390/su10072128	Challenges & Goal Setting, Self-monitoring & Feedback, Tailoring, Social comparison, Gamification and rewards, Suggestion Framing, reduction, tunnelling. Simulation, and cooperation.	Behaviour change sustainable mobility

4	Adaji, I., & Adisa, M. (2022). A Review of the Use of Persuasive Technologies to Influence Sustainable Behaviour. https://doi.org/10.1145/3511047.3537653	Mobile app with feedback, reminders, social comparison, rewards, suggestions, and self- monitoring.	Behaviour change sustainable mobility
5	Mauro, S., Shinde, S., Arnone, M., Zamith, V. M., Rosa, G., & Pietroni, D. (2022). The role of awareness of mobility offer and nudges in increasing sustainable mobility habits of citizens: a case study from the Munich region. 2022 IEEE 46th Annual Computers, Software, and Applications Conference (COMPSAC). https://doi.org/10.1109/compsac54236.2022.00267	Gamification, communication of information, financial compensation.	Awareness sustainable mobility
6	Kim, J., Fujii, S., & Lee, B. (2013). Strategies to promote sustainable mobility management incorporating heterogeneity. International Journal of Sustainable Transportation, 7(2), 107–124. https://doi.org/10.1080/15568318.2011.621099	Attitude change is needed to result in behaviour intention. The perception of the topic should be established positively.	Awareness sustainable transport
7	De Las Heras-Rosas, C., & Herrera, J. (2019). Towards Sustainable Mobility through a Change in Values. Evidence in 12 European Countries. Sustainability (Basel), 11(16), 4274. https://doi.org/10.3390/su11164274	This paper displays the necessity of change towards the perception of sustainable transport.	Behaviour change sustainable mobility
8	Kaspar, J., Mohnke, J., & Vielhaber, M. (2021). GreenTrail – a Sustainable Mobility Concept Advisor (SMCA) tool. Procedia CIRP, 98, 648–653. https://doi.org/10.1016/j.procir.2021.01.169	Greentrail application. Presents a sustainable mobility concept advisor (SMCA) tool allowing to assess an individually best mobility solution for daily life and/or infrequently travels.	Awareness sustainable mobility

9	Marconi, A., Ferron, M., Loria, E., & Massa, P. (2019). Play&Go, an urban game promoting behaviour change for sustainable mobility. IxD&Amp;A, 40. https://dblp.uni-trier.de/db/journals/ixda/ixda40.html#MarconiFLM19	An urban game that exploits gamification for promoting a positive behavioural change of mobility habits. Combined standard gamification elements (e.g., points, badges, leaderboards, real prizes) with personalised game content (i.e., challenges) that is tailored to the player's profile and is focused on encouraging a positive change in the player's behaviour.	Awareness sustainable mobility
10	Zhao, J., & Baird, T. (2014). "Nudging" Active Travel: a framework for behavioral interventions using mobile technology. Transportation Research Board 93rd Annual MeetingTransportation Research Board. https://trid.trb.org/view.aspx?id=1289196	Activity tracking smartphone applications and nudging. Participants described using the app to compare their transportation behaviour to that of family or friends, targeting the social aspect.	Awareness sustainable mobility
11	Göransson, J., & Andersson, H. (2023). Factors that make public transport systems attractive: a review of travel preferences and travel mode choices. European Transport Research Review, 15(1). https://doi.org/10.1186/s12544-023-00609-x	reliability and frequency are important factors for creating an attractive public transport supply.	Sustainable mobility
12	Karatsoli, M., & Nathanail, E. (2021). Social influence and impact of social media on users' mobility decisions. Journal of Sustainable Development of Transport and Logistics, 6(1), 32–48. https://doi.org/10.14254/jsdtl.2021.6-1.3	Social media as critical channels for information, their content can trigger a place visit, a change of transport mode or destination, or plans' cancellation.	Awareness sustainable mobility

13	Mitran, G., Ilie, S., Igret, S. V., & Mihăilescu, Ş. (2019). Sustainable mobility as a result of peoples' awareness on environmental problems generated by transport activity. IOP Conference Series: Materials Science and Engineering, 568(1), 012025. https://doi.org/10.1088/1757-899x/568/1/012025	Providing information and education about sustainable mobility to increase awareness. Particularly through urban mobility plans, as an educational action for environmental protection and sustainable mobility.	Awareness sustainable mobility
14	Loch Lomond & The Trossachs National Park. (2023, March 1). Getting to the Park - Here. Now. All of us. Loch Lomond & the Trossachs National Park. https://www.lochlomond-trossachs.org/plan-your-visit/getting-to-the-park/	Example of how a national park uses an app to promote sustainable mobility.	Sustainable mobility and national parks
15	Loch Lomond & The Trossachs National Park. (2023b, December 14). National Park Partnership Plan 2024-29 - Here. Now. All of us. Loch Lomond & the Trossachs National Park. https://www.lochlomond-trossachs.org/park-authority/get-involved/consultations/draft-national-park-partnership-plan-2024-29/	Example of how other national parks address a shift to less car-based travel.	Sustainable mobility and national parks