# TRANSITIONING TOWARDS SUSTAINABLE VISITOR MOBILITY FOR NATIONAL PARK UTRECHTSE HEUVELRUG

Consultancy Project Global Sustainability Science (GEO3-2423) Whole report: 11613 Integrative section: 1892 Subgroup 1: 4729 Subgroup 2: 4992





Subgroup 1: Car Mobility

Erwin Vanhouwe Jorn Meijsen Lea Fuhrmann Xiao Yang Subgroup 2: Public Transport

Lia Sweetman Misha Midavoodi Gaia Zanaboni Ilse van der Giessen Client: Utrechtse Heuvelrug

Jeroen Heemsbergen

# TABLE OF CONTENTS

Integrative Advice       4         Situation       4         Complication       4         Research Questions       4         Integrated Advice 1: Marketing Campaign       4         Integrated Advice 2: Integrated Mobility Map       4         Car Mobility.       5         Advice       5         Results and Evidence       5         Public Transport.       5         Advice       5         Results and Evidence       6         1. Integrative Advice       7         1.1. Integrative Advice       7         1.1. Stuation       7         1.1. Stuation       7         1.1.2. Complication       8         1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       12         2.1. Introduction       13         2.2.1. paid parking       13         2.2.2. paid parking       14         2.3. Druktemonitor       15         2.4. ADVICE       13         2.2.5. Future-proofing parking lot boundaries       16         2.3. ADVICE       17         2.3. Internoting dear physical parking outside parking areas       20	Integrative Executive Summary	4
Situation       4         Complication       4         Research Question       4         Sub-questions       4         Integrated Advice 1: Marketing Campaign       4         Integrated Advice 2: Integrated Mobility Map       4         Car Mobility       5         Advice       5         Results and Evidence       5         Advice       5         Advice       5         Results and Evidence       6         1. Integrative Advice       7         1.1. Integrative Introduction       7         1.1. Situation       7         1.2. Complication       8         1.1.4. Sub-questions       8         1.2.4 Complication       10         2.5 Environmental impacts of parking plates with electric charging stations	Integrative Advice	4
Complication       4         Research Question       4         Sub-questions       4         Integrated Advice 1: Marketing Campaign       4         Integrated Advice 2: Integrated Mobility Map       4         Car Mobility       5         Advice       5         Advice       5         Results and Evidence       5         Public Transport       5         Advice       5         Results and Evidence       5         Results and Evidence       5         Results and Evidence       6         1. Integrative Introduction       7         1.1. Integrative Introduction       7         1.1.1. Situation       7         1.1.2 Complication       7         1.1.3. Usetion       8         1.2.4 Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       10         2. Car Mobility       13         2.2.1. paid parking       13         2.2.2. paid parking       14         2.3. Dividemonitor       15         2.4. ADVICE       17         2.3. Lowide parking places with electric charing stations       17	Situation	4
Research Question         4           Sub-questions         4           Integrated Advice 1: Marketing Campaign         4           Integrated Advice 2: Integrated Mobility Map         4           Car Mobility         5           Advice         5           Results and Evidence         5           Public Transport.         5           Advice         5           Results and Evidence         6           1. Integrative Advice         7           1.1. Integrative Introduction         7           1.1. Stuation         7           1.2. Marketing Campaign         9           1.3. Integrated Mobility Map         10           2. Car Mobility         12           2.1. Introduction         13           2.2.1 paid parking         13           2.2.2.1 paid parking         13           2.2.3.2 promoting the druktemonitor         15           2	Complication	4
Sub-questions       4         Integrated Advice 1: Marketing Campaign       4         Integrated Advice 2: Integrated Mobility Map       4         Car Mobility       5         Advice       5         Results and Evidence       5         Public Transport       5         Advice       5         Results and Evidence       5         Results and Evidence       6         1. Integrative Advice       7         1.1. Integrative Introduction       7         1.1. Situation	Research Question	4
Integrated Advice 1: Marketing Campaign       4         Integrated Advice 2: Integrated Mobility Map       4         Car Mobility.       5         Advice       5         Results and Evidence       5         Public Transport.       5         Advice       5         Results and Evidence       6         1. Integrative Advice       7         1.1. Integrative Introduction       7         1.1. Situation       7         1.1. Situation       7         1.1.3. Question       8         1.1.4. Sub-questions       8         1.1.4. Sub-questions       8         1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       12         2.1. Introduction       13         2.2.2. paid parking       13         2.2.3. Promoting the druktemonitor       15         2.2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3.1. paid parking       12         2.4. Methodology       22         2.3.2.5. Environmental impacts of parking outside parking areas       20	Sub-questions	4
Integrated Advice 2: Integrated Mobility Map       4         Car Mobility       5         Advice       5         Results and Evidence       5         Public Transport       5         Advice       5         Results and Evidence       5         Results and Evidence       6         1. Integrative Advice       7         1.1. Integrative Introduction       7         1.1. Situation       7         1.1. Situation       7         1.1. Situation       7         1.1. Superstore       8         1.1.4. Sub-questions       8         1.1.4. Sub-questions       8         1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       12         2.1. Introduction       13         2.2.1. paid parking       13         2.2.2. paid parking       13         2.2.3. Promoting the druktemonitor       14         2.2.4. DVICE       17         2.3.1. paid parking       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3.1. paid parking       17         2.3.2. parking database       <	Integrated Advice 1: Marketing Campaign	4
Car Mobility       5         Advice       5         Results and Evidence.       5         Public Transport       5         Advice       5         Results and Evidence.       6         1. Integrative Advice       7         1.1. Integrative Introduction       7         1.1. Integrative Introduction       7         1.1. Situation       7         1.1. Struation       7         1.1.3. Question       7         1.1.4. Sub-questions       8         1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       10         2.1. Introduction       13         2.2.1. paid parking       13         2.2.2. paid parking       13         2.2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3. ADVICE       17         2.3. In paid parking       12         2.4. ADVICE       17         2.3. Druktemonitor       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.3.5. Environmental impacts of parking outside parking are	Integrated Advice 2: Integrated Mobility Map	4
Advice       5         Results and Evidence       5         Public Transport       5         Advice       5         Results and Evidence       6         1. Integrative Advice       7         1.1. Integrative Introduction       7         1.1. Integrative Introduction       7         1.1. Situation       7         1.1.3. Question       7         1.1.4. Sub-questions       8         1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       12         2.1. Introduction       13         2.2. ADVICE       13         2.1. Introduction       14         2.2.3. Promoting the druktemonitor.       15         2.2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3. ADVICE       17         2.3.1. paid parking.       17         2.3.2.5. Environmental impacts of parking outside parking areas       20         2.3.4. Environmental impacts of parking outside parking areas       20         2.3.5. Environmental impacts of parking outside parking areas       20         2.4. Autodology <td>Car Mobility</td> <td>5</td>	Car Mobility	5
Results and Evidence       5         Public Transport.       5         Advice       5         Results and Evidence       6         1. Integrative Advice       7         1.1. Integrative Introduction       7         1.1. Situation       7         1.1. Situation       7         1.1. Substrain       7         1.1. Superstrain       7         1.2. Complication       13         2.2. A Divice       13         2.2.1 paid parking       13	Advice	5
Public Transport.       5         Advice       5         Results and Evidence       6         1. Integrative Advice       7         1.1. Integrative Introduction       7         1.1. Situation       7         1.1. Situation       7         1.1. Question       7         1.1.3. Question       8         1.1.4. Sub-questions       8         1.1.4. Sub-questions       8         1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       12         2.1. Introduction       13         2.2. paid parking       13         2.2.1. paid parking       13         2.2.2. paid parking       14         2.2.3. Promoting the druktemonitor       15         2.2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3. ADVICE       17         2.3.1. paid parking       17         2.3.2. Prive monitor       19         2.3.3. Druktemonitor       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.4. Autodogy       22	Results and Evidence	5
Public Transport.       5         Advice       5         Results and Evidence.       6         1. Integrative Advice       7         1.1. Integrative Introduction       7         1.1.1. Situation       7         1.1.2. Complication       7         1.1.3. Question       8         1.1.4. Sub-questions       8         1.1.4. Sub-questions       8         1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       12         2.1. Introduction       13         2.2. ADVICE       13         2.2.1. paid parking       14         2.2.3. Promoting the druktemonitor       15         2.2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3. ADVICE       17         2.3.1. paid parking       17         2.3.2. parking database       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.4.4. Environmental impacts of parking outside parking areas       20         2.4.4. Environmental impacts of parking outside parking areas       20         2.4.4. E	Public Transport	F
Advice       3         Results and Evidence       6         1. Integrative Advice       7         1.1. Integrative Introduction       7         1.1. Situation       7         1.1. Situation       7         1.1. Sub-questions       8         1.1. A Sub-questions       8         1.1. Sub-questions       8         1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       12         2.1. Introduction       13         2.2.1. paid parking       13         2.2.2. paid parking       13         2.2.3. Promoting the druktemonitor       15         2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-profing parking places with electric charging stations       17         2.3. ADVICE       17         2.3. Druktemonitor       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3.1. Introduction       28         3.2. Advice       29         3.2.1. Encoraging the use of OV-bikes       29	Advice	
1. Integrative Advice       7         1.1. Integrative Introduction       7         1.1.1. Situation       7         1.1.1. Situation       7         1.1.2. Complication       7         1.1.3. Question       7         1.1.4. Sub-questions       8         1.1.4. Sub-questions       8         1.1.4. Sub-questions       8         1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       12         2.1. Introduction       13         2.2. ADVICE       13         2.1. Introduction       13         2.2. Aptice       13         2.2.1. paid parking       14         2.2.3. Promoting the druktemonitor       15         2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3. I. paid parking       17         2.3. Druktemonitor       19         2.3. Druktemonitor       19         2.3. Environmental impacts of parking outside parking areas       20         2.4. Abthodology       22         2.4. Abthodology       22         2.4. Data collection and	Results and Evidence	5 6
1. Integrative Advice       7         1.1. Integrative Introduction       7         1.1.1. Situation       7         1.1.2. Complication       7         1.1.3. Question       8         1.1.4. Sub-questions       8         1.1.4. Sub-questions       8         1.1.4. Sub-questions       8         1.1.4. Sub-questions       8         1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       12         2.1. Introduction       13         2.2.2. paid parking       13         2.2.2. paid parking       13         2.2.2. paid parking       14         2.3. Promoting the druktemonitor       15         2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3. Druktemonitor       19         2.3. Druktemonitor       19         2.3. Environmental impacts of parking outside parking areas       20         2.4. Methodology       22         2.4. Methodology       22         2.4. 2. Data collection and analysis       23         3. Public Transport       27		0
1.1. Integrative Introduction       7         1.1.1. Situation       7         1.1.2. Complication       7         1.1.3. Question       8         1.1.4. Sub-questions       8         1.1.4. Sub-questions       8         1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       12         2.1. Introduction       13         2.2.1. paid parking       13         2.2.2. ADVICE       13         2.2.3. Promoting the druktemonitor       15         2.2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3.1. paid parking       17         2.3.2. parking database       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.3.5. Environmental impacts of parking outside parking areas       20         2.4. Data collection and analysis       23         3.1. Introduction       28         3.2.4. Environmental impacts of parking outside parking areas       20         2.4. Data collection and analysis       23         3.3. Public Transport       27         3.1. Introduction	1. Integrative Advice	7
1.1.1. Situation       7         1.1.2. Complication       7         1.1.3. Question       7         1.1.4. Sub-questions       8         1.1.4. Sub-questions       8         1.1.4. Sub-questions       8         1.1.4. Sub-questions       8         1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       12         2.1. Introduction       13         2.2. ADVICE       13         2.2.1. paid parking       13         2.2.2. paid parking       13         2.2.3. Promoting the druktemonitor       15         2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3.1. paid parking       17         2.3.2. parking database       19         2.3.3. Druktemonitor       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.4. Methodology       22         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3.1. Introduction       28         3.2.Advice       29         <	1.1 Integrative Introduction	7
1.1.2. Complication       7         1.1.3. Question       8         1.1.4. Sub-questions       8         1.1.4. Sub-questions       8         1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       12         2.1. Introduction       13         2.2. ADVICE       13         2.2.1. paid parking       13         2.2.2. paid parking       13         2.2.2. paid parking       13         2.2.2. paid parking       13         2.2.3. Promoting the druktemonitor       15         2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3. ADVICE       17         2.3. ADVICE       17         2.3. parking database       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.3.5. Environmental impacts of parking outside parking areas       20         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3.1. Introduction       28         3.2 Advice       29         3.2.1. Encouraging the use of OV-bikes<	1 1 1 Situation	7
1.1.3. Question       8         1.1.4. Sub-questions       8         1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       12         2.1. Introduction       13         2.2. ADVICE       13         2.2.1. paid parking       13         2.2.2. paid parking       13         2.2.3. Promoting the druktemonitor       15         2.2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3. ADVICE       17         2.3.1. paid parking       17         2.3.3. Druktemonitor       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.4. Methodology       22         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3.1. Introduction       28         3.2. Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2. Changing the availability of TIER e-bikes and e-scooters       31	1.1.2. Complication	7
1.1.4. Sub-questions       8         1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       12         2.1. Introduction       13         2.2. ADVICE       13         2.1. paid parking       13         2.2. paid parking       13         2.2. Promoting the druktemonitor       15         2.3. Promoting the druktemonitor       15         2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3. Druktemonitor       19         2.3. J. paid parking       17         2.3. J. paid parking       17         2.3. Druktemonitor       19         2.3. Druktemonitor       19         2.3. Environmental impacts of parking outside parking areas       20         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3.1. Introduction       28         3.2 Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2. Changing the availability of TIER e-bikes and e-scooters       3	1.1.3. Question	
1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       12         2. 1. Introduction       13         2.2. ADVICE       13         2.1. paid parking       13         2.2. apaid parking       14         2.2. paid parking       14         2.2. apaid parking       14         2.2. paid parking       14         2.2. paid parking       14         2.2. constructing clear physical parking lot boundaries       16         2.2. Future-proofing parking places with electric charging stations       17         2.3. ADVICE       17         2.3. paid parking       17         2.3. paid parking       17         2.3. Druktemonitor       19         2.3. Druktemonitor       19         2.3. Environmental impacts of parking outside parking areas       20         2.3.5. Environmental impacts of parking outside parking areas       20         2.4. Methodology       22         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3.1 Introduction       28         3.2 Advice       29         3.2.1 Incrouraging the use of OV-bikes       29	1.1.4. Sub-questions	8
1.2. Marketing Campaign       9         1.3. Integrated Mobility Map       10         2. Car Mobility       12         2.1. Introduction       13         2.2. ADV/CE       13         2.2.1. paid parking       13         2.2.2. paid parking       14         2.2.3. Promoting the druktemonitor       15         2.2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3. ADV/CE       17         2.3.1. paid parking       17         2.3.2. parking database       19         2.3.3. Druktemonitor       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.3.5. Environmental impacts of parking outside parking areas       20         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3.1. Introduction       28         3.2. Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2. Changing the availability of TIER e-bikes and e-scooters       31	1.2. Markating Compaign	0
1.3. Integrated Mobility Map       10         2. Car Mobility       12         2.1. Introduction       13         2.2. ADVICE       13         2.2.1. paid parking       13         2.2.2. paid parking       14         2.3. Promoting the druktemonitor       15         2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3. ADVICE       17         2.3. Druktemonitor       19         2.3. Druktemonitor       19         2.3. Druktemonitor       19         2.3. Environmental impacts of parking outside parking areas       20         2.3. Environmental impacts of parking outside parking areas       20         2.4. Methodology       22         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3. Public Transport       27         3.1. Introduction       28         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31	1.2. Markeung Campaign	9
2. Car Mobility       12         2.1. Introduction       13         2.2. ADVICE       13         2.2.1. paid parking       13         2.2.2. paid parking       14         2.2.3. Promoting the druktemonitor       15         2.4. constructing clear physical parking lot boundaries       16         2.5. Future-proofing parking places with electric charging stations       17         2.3. ADVICE       17         2.3.1. paid parking       17         2.3.2. parking database       19         2.3.3. Druktemonitor       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.3.5. Environmental impacts of parking outside parking areas       20         2.4. Methodology       22         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3.1. Introduction       28         3.2. Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31	1.3. Integrated Mobility Map	10
2.1. Introduction       13         2.2. ADV/CE       13         2.2. ADV/CE       13         2.2. paid parking       13         2.2.2. paid parking       14         2.2.3. Promoting the druktemonitor       15         2.2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3. ADV/CE       17         2.3.1. paid parking       17         2.3.2. parking database       19         2.3.3. Druktemonitor       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.3.5. Environmental impacts of parking outside parking areas       20         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3.1. Introduction       28         3.2. Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31	2 Car Mobility	12
2.1. Introduction       13         2.2. ADVICE       13         2.2. ADVICE       13         2.2. paid parking       14         2.2. paid parking       14         2.2. Promoting the druktemonitor       15         2.2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3. ADVICE       17         2.3.1. paid parking       17         2.3.2. parking database       19         2.3.3. Druktemonitor       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.3.5. Environmental impacts of parking outside parking areas       20         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3.1. Introduction       28         3.2. Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31		12
2.2. ADVICE132.2.1. paid parking132.2.2. paid parking142.2.3. Promoting the druktemonitor152.2.4. constructing clear physical parking lot boundaries162.2.5. Future-proofing parking places with electric charging stations172.3. ADVICE172.3.1. paid parking172.3.2. parking database192.3.3. Druktemonitor192.3.4. Environmental impacts of parking outside parking areas202.3.5. Environmental impacts of parking outside parking areas202.4.1. analytical framework222.4.2. Data collection and analysis233. Public Transport273.1. Introduction283.2. Advice293.2.1. Encouraging the use of OV-bikes293.2.3. Changing the availability of TIER e-bikes and e-scooters31	2.1. Introduction	13
2.2.1. paid parking.       13         2.2.2. paid parking.       14         2.2.3. Promoting the druktemonitor       15         2.2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations.       17         2.3. ADVICE       17         2.3.1. paid parking.       17         2.3.2. parking database.       19         2.3.3. Druktemonitor       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.3.5. Environmental impacts of parking outside parking areas       20         2.4. Methodology       22         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3. Public Transport       27         3.1. Introduction       28         3.2 Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31	2.2. ADVICE	13
2.2.2. paid parking.       14         2.2.3. Promoting the druktemonitor       15         2.2.4. constructing clear physical parking lot boundaries.       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3. ADVICE       17         2.3.1. paid parking.       17         2.3.2. parking database       19         2.3.3. Druktemonitor       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.3.5. Environmental impacts of parking outside parking areas       20         2.4. Methodology       22         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3. Public Transport       27         3.1. Introduction       28         3.2 Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31	2.2.1. paid parking	13
2.2.3. Promoting the druktemonitor       15         2.2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3. ADV/CE       17         2.3.1. paid parking       17         2.3.2. parking database       19         2.3.3. Druktemonitor       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.3.5. Environmental impacts of parking outside parking areas       20         2.4. Methodology       22         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3. Public Transport       27         3.1. Introduction       28         3.2 Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31	2.2.2. paid parking	14
2.2.4. constructing clear physical parking lot boundaries       16         2.2.5. Future-proofing parking places with electric charging stations       17         2.3. ADVICE       17         2.3.1. paid parking       17         2.3.2. parking database       19         2.3.3. Druktemonitor       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.3.5. Environmental impacts of parking outside parking areas       20         2.4. Methodology       22         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3. Public Transport       27         3.1. Introduction       28         3.2 Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31	2.2.3. Promoting the druktemonitor	15
2.2.5. Future-proofing parking places with electric charging stations       17         2.3. ADVICE       17         2.3.1. paid parking       17         2.3.2. parking database       19         2.3.3. Druktemonitor       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.3.5. Environmental impacts of parking outside parking areas       20         2.4. Methodology       22         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3. Public Transport       27         3.1. Introduction       28         3.2.Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31	2.2.4. constructing clear physical parking lot boundaries	16
2.3. ADVICE172.3.1. paid parking172.3.2. parking database192.3.3. Druktemonitor192.3.4. Environmental impacts of parking outside parking areas202.3.5. Environmental impacts of parking outside parking areas202.4. Methodology222.4.1. analytical framework222.4.2. Data collection and analysis233. Public Transport273.1. Introduction283.2 Advice293.2.1. Encouraging the use of OV-bikes293.2.2. Increasing the marketing of public transport303.2.3. Changing the availability of TIER e-bikes and e-scooters31	2.2.5. Future-proofing parking places with electric charging stations	17
2.3.1. paid parking.172.3.2. parking database192.3.3. Druktemonitor192.3.4. Environmental impacts of parking outside parking areas202.3.5. Environmental impacts of parking outside parking areas202.3.5. Environmental impacts of parking outside parking areas202.4. Methodology222.4.1. analytical framework222.4.2. Data collection and analysis233. Public Transport273.1. Introduction283.2 Advice293.2.1. Encouraging the use of OV-bikes293.2.2. Increasing the marketing of public transport303.2.3. Changing the availability of TIER e-bikes and e-scooters31	2.3. ADVICE	17
2.3.2. parking database.       19         2.3.3. Druktemonitor       19         2.3.4. Environmental impacts of parking outside parking areas       20         2.3.5. Environmental impacts of parking outside parking areas       20         2.4. Methodology       22         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3. Public Transport       27         3.1. Introduction       28         3.2 Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31	2.3.1. paid parking	17
2.3.3. Druktemonitor192.3.4. Environmental impacts of parking outside parking areas202.3.5. Environmental impacts of parking outside parking areas202.4. Methodology222.4.1. analytical framework222.4.2. Data collection and analysis233. Public Transport273.1. Introduction283.2 Advice293.2.1. Encouraging the use of OV-bikes293.2.3. Changing the availability of TIER e-bikes and e-scooters31	2.3.2. parking database	19
2.3.4. Environmental impacts of parking outside parking areas202.3.5. Environmental impacts of parking outside parking areas202.4. Methodology222.4.1. analytical framework222.4.2. Data collection and analysis233. Public Transport273.1. Introduction283.2 Advice293.2.1. Encouraging the use of OV-bikes293.2.2. Increasing the marketing of public transport303.2.3. Changing the availability of TIER e-bikes and e-scooters31	2.3.3. Druktemonitor	19
2.3.5. Environmental impacts of parking outside parking areas202.4. Methodology222.4.1. analytical framework222.4.2. Data collection and analysis233. Public Transport273.1. Introduction283.2 Advice293.2.1. Encouraging the use of OV-bikes293.2.2. Increasing the marketing of public transport303.2.3. Changing the availability of TIER e-bikes and e-scooters31	2.3.4. Environmental impacts of parking outside parking areas	20
2.4. Methodology       22         2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3. Public Transport       27         3.1. Introduction       28         3.2 Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31	2.3.5. Environmental impacts of parking outside parking areas	20
2.4.1. analytical framework       22         2.4.2. Data collection and analysis       23         3. Public Transport       27         3.1. Introduction       28         3.2 Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31	2.4. Methodology	
2.4.2. Data collection and analysis       23         3. Public Transport       27         3.1. Introduction       28         3.2 Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31	2.4.1. analytical framework	
3. Public Transport       27         3.1. Introduction       28         3.2 Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31	2.4.2. Data collection and analysis	23
3. Public Transport       27         3.1. Introduction       28         3.2 Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31		
3.1. Introduction       28         3.2 Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31	3. Public Transport	27
3.2 Advice       29         3.2.1. Encouraging the use of OV-bikes       29         3.2.2. Increasing the marketing of public transport       30         3.2.3. Changing the availability of TIER e-bikes and e-scooters       31	3.1. Introduction	28
3.2.1. Encouraging the use of OV-bikes	3.2 Advice	29
3.2.2. Increasing the marketing of public transport	3.2.1. Encouraging the use of OV-bikes	29
3.2.3. Changing the availability of TIER e-bikes and e-scooters	3.2.2. Increasing the marketing of public transport	30
	3.2.3. Changing the availability of TIER e-bikes and e-scooters	31

1	4-	4.	-2	0	2	2

3.2.4. Buses 3.2.5. Stimulating sustainable behaviour change	31 
<ul> <li>3.3. Results and Evidence</li> <li>3.3.1. Interviews</li> <li>3.3.2. OV-bikes</li> <li>3.3.3. Buslines</li> <li>3.3.3. Data from survey</li> </ul>	
<ul><li>3.4. Methodology</li><li>3.4.1. Analytical framework</li><li>3.4.2. Data collection and analysis</li></ul>	
4. Bibliography	
Scientific sources	
Grey literature	44
Grey literature	
Grey literature 5. Appendices Appendix A: Visitor Survey	
Grey literature 5. Appendices Appendix A: Visitor Survey Appendix B: Energy Analysis	
Grey literature 5. Appendices Appendix A: Visitor Survey Appendix B: Energy Analysis Appendix C: Data Collection on Map Information	
Grey literature 5. Appendices Appendix A: Visitor Survey Appendix B: Energy Analysis Appendix C: Data Collection on Map Information Appendix D: Interview Angelique van Gasteren (NS)	
Grey literature 5. Appendices Appendix A: Visitor Survey Appendix B: Energy Analysis Appendix C: Data Collection on Map Information Appendix C: Interview Angelique van Gasteren (NS) Appendix E: Interview Joost van Heeckeren (NS)	
Grey literature 5. Appendices Appendix A: Visitor Survey Appendix B: Energy Analysis Appendix C: Data Collection on Map Information Appendix C: Data Collection on Map Information Appendix D: Interview Angelique van Gasteren (NS) Appendix E: Interview Joost van Heeckeren (NS) Appendix F: Interview Nils Verkennis (TIER)	
Grey literature	

# INTEGRATIVE EXECUTIVE SUMMARY

# INTEGRATIVE ADVICE

# SITUATION

In the National Park Utrechtse Heuvelrug, the owners of nature reserves, the province Utrecht, and the municipalities in and around the Utrechtse Heuvelrug work together with each other and other organisations to protect and develop the area. National Park Utrechtse Heuvelrug is a non-profit organisation that brings the different parties together. By combining forces of the collaboration, they are dedicated to preserving, protecting and optimising the area through projects and initiatives (National Park Utrechtse Heuvelrug, 2022).

## COMPLICATION

The biggest priority of the Utrechtse Heuvelrug is to preserve nature for future generations. The increase of traffic in natural areas is of concern since not only the natural values, but also the values for which many people like to visit the area, such as the quietness and solitude, are threatened (Beunen et al., 2006). Thus, due to the increased number of visitors, the Utrechtse Heuvelrug is facing more challenges regarding its sustainability goals and values.

## RESEARCH QUESTION

How can the Utrechtse Heuvelrug transition towards sustainable visitor mobility?

## SUB-QUESTIONS

The report is divided into two subsections, with each having corresponding research questions. The first subgroup focuses on understanding how car mobility can be structured more efficiently, and the second subgroup sees how public transport can be improved upon, to reduce the use of cars as the primary form of transport to the Utrechtse Heuvelrug. The car mobility group answers the following question: "How can car mobility in the Utrechtse Heuvelrug be more efficiently organised, in terms of sustainability?". The public transport subgroup answers the question: "In what ways can public transport be improved in the Utrechtse Heuvelrug to motivate visitors to use it?"

## INTEGRATED ADVICE 1: MARKETING CAMPAIGN

A campaign promoting the Druktemonitor, public transport, OV-bikes and behaviour change in general, supported by the revenue stream of a paid parking system.

Paid parking would cause two main things, incentivising visitors to choose other modes of transport, and introducing a new stream of income. This additional money is recommended to be invested into the destinations to raise visitor awareness of the alternative modes of transport.

INTEGRATED ADVICE 2: INTEGRATED MOBILITY MAP

Integrate information on public transport and OV-bikes into the interactive map. Make one clear mobility map with all options of transport and make this accessible and more apparent on the website of National Park Utrechtse Heuvelrug.

The goal of this advice is to create an easy platform for people to assess the transport possibilities. This overview is now only available in a fragmented manner, putting it all in one central place would allow for a higher awareness of alternative modes of transport.

# CAR MOBILITY

## ADVICE

- 1. Paid parking could introduce diverse benefits to the mobility of the national park, including efficient management of parking, emission reduction and increased budget inflow.
- 2. The goal of a parking database is to provide accessible and clear parking information for visitors which could reduce the crowdedness of certain parking spots, conflicts with BOAs and environmental damages.
- 3. Promoting the Druktemonitor would play a role in the distribution of car hotspots.
- 4. Constructing clear physical parking lot boundaries would limit the environmental damages caused by incorrect parking.
- 5. By future-proofing parking places with electric charging stations, electric car owners will be incentified to take it over the fossil fuel variant.

## **RESULTS AND EVIDENCE**

- 1. Paid parking would cause a reduction of up to 5.100 tons in CO<sub>2</sub> emissions. An estimated 500,000 to 1.000.000 euro/year revenue stream.
- 2. Almost 60% of the visitors from the survey came by car, emphasising the need for a car parking database.
- 3. 0% of the visitors interviewed actively used the Druktemonitor before they got there. With almost half of them not knowing what the Druktemonitor is.
- 4. Erosion, soil compaction and pollution could be caused by improper parking. Boundaries would prevent that.
- 5. It is expected that the electric car industry could grow by 34% by 2030. 58% of visitors travel a medium to very long distance, justifying the need for charging.

# PUBLIC TRANSPORT

## ADVICE

- 1. Encouraging the use of OV-bikes as an alternative.
- 2. Increasing the marketing of public transport by presenting the negatives of car transport and offering deals if one makes use of public transport.
- 3. Changing the availability of TIER e-bikes and e-scooters would add another sustainable mode of transport.
- 4. Increasing the frequency of buses and adding shuttle buses to and from public transport hotspots.
- 5. Stimulating sustainable behaviour change in general.

**RESULTS AND EVIDENCE** 

- 1. Interviews with Joost van Heeckeren and Angelique van Gasteren established the importance and opportunities of OV-bikes.
- 2. The buslines in the vicinity of the national park were mapped for an overview of possible improvement. An interview with Ed van der Zee established the possibilities around increasing bus frequency and shuttle buses.
- 3. An interview with Nils Verkennis indicated the possibilities of TIER e-bikes and scooters.
- 4. Literature review for information about sustainable mobility behaviour change.

# 1. INTEGRATIVE ADVICE

## **1.1. INTEGRATIVE INTRODUCTION**

#### 1.1.1. SITUATION

The Utrechtse Heuvelrug was formed about 150.000 years ago during the ice age, and it consists of 20.000 acres of connected forest and heath. It is in the middle of urban areas, including and surrounded by multiple municipalities (National Park Utrechtse Heuvelrug, 2022). In the national park, the owners of nature reserves, the province Utrecht, and the municipalities in and around the Utrechtse Heuvelrug work with each other and other organisations to protect and develop the area. National Park Utrechtse Heuvelrug is a non-profit organisation that brings different parties together. By combining forces of the collaboration, they are dedicated to preserving, protecting and optimising the area through projects and initiatives (National Park Utrechtse Heuvelrug, 2022). In January 2018, 17 parties that are involved with nature and cultural heritage in the Utrechtse Heuvelrug, signed the cooperation agenda for National Park Utrechtse Heuvelrug. In this agenda, common ambitions and activities for the coming years are committed. These ambitions include enhancing the quality and quantity of nature, landscape, and cultural history; increasing visitor experience and accessibility: efficient and effective surveillance and enforcement; the growing economic basis for nature; making the value of nature more visible; and extending the unique values of the national park to the surrounding rural and urban areas (Nationaal Park Utrechtse Heuvelrug, 2021).

#### 1.1.2. COMPLICATION

The biggest priority of the Utrechtse Heuvelrug is to preserve nature for future generations. However, nature areas are popular destinations for leisure activities which makes preservation a challenge (Beunen et al., 2006). During COVID-19, in the years 2020 and 2021, there was a drastic increase in the number of visitors and recreational tourists in the national park (van Unen, 2020). What makes this park so unique is that it lies in the middle of urban areas. Most of the visitors come to the park by car which leads to damage to nature. For example, increased parking has environmental impacts such as vehicle-induced pollutants and noise emission impacts (EI-Fahel & Sbayti, 2001). Parking at the side of the road also harms the soil and thus nature (Park, Manning, Marion, Lawon, & Jacobi, 2008). Besides, the increase in visitors has created conflicts between visitors and BOAs (stands for Buitengewoon Opsporings Ambtenaar or Extraordinary Investigation Officers, in English), because these new visitors have less experience with nature (Bureau voor Ruimte & Vrije Tijd, 2020). An increase in traffic in natural areas is of growing concern since not only the natural values, but also the values for which many people like to visit the area are threatened, such as the quietness and solitude (Beunen et al., 2006). Thus, due to the increased number of visitors, the Utrechtse Heuvelrug is facing more challenges regarding its sustainability goals and values. It is important that people, who want to visit the area, want to go there in a sustainable way. However, the dependency on cars as a means of transport is created because of the lack of suitable alternatives. There are still limits to the accessibility to the nature areas by public transport (Beunen et al., 2006). There is a knowledge gap in how the transport of the increasing number of visitors in the Utrechtse Heuvelrug can be dealt with in a sustainable way. Coming up with more sustainable mobility alternatives that are accessible and attractive to visitors is therefore relevant to be able to enjoy nature in the long term. A balance between the demand of visitors and the human impact on the environment is needed.

#### 1.1.3. QUESTION

National parks are essential when it comes to maintaining ecological biodiversity, as well as providing education and enjoyment to many (Clarke, 2021). Although the Utrechtse Heuvelrug provides great recreational opportunities for many citizens, the maintenance of the park's nature must come first. On this account, the Utrechtse Heuvelrug is striving to transition towards a form of visitor mobility that will allow the park to thrive, while still permitting people to visit nature (Heemsbergen, n.d.). Therefore, the main research question that will be addressed throughout this report is the following: How can the Utrechtse Heuvelrug transition towards sustainable visitor mobility? This question tackles the current mobility problem where cars are the dominant mode of transport to access the national park (Bureau voor Ruimte & Vrije Tijd, 2020). This causes damage to the environment since cars are one of the more polluting modes of transport (BEIS, 2019). By answering the overarching research question, it will be possible to understand what the sustainable options for visitors are when it comes to accessing the National Park Utrechtse Heuvelrug. If sustainable transport is successfully implemented, the negative impacts that the current visitor mobility is having on the national park can be greatly reduced.

#### 1.1.4. SUB-QUESTIONS

The report is divided into two main subsections. Each has a corresponding subresearch question. The first subsection answers the following question: *"How can car mobility in the Utrechtse Heuvelrug be more efficiently organised, in terms of sustainability?"*. This sub-question is answered by the car mobility subgroup. The other subquestion is: "In what ways can public transport be improved in the Utrechtse Heuvelrug to motivate visitors to use it?". This sub-question is answered by the sequentiate transport subgroup. The report is divided into these two separate sections to understand how car mobility can be structured more efficiently, and to see how public transport can be improved upon, to reduce the use of cars as the primary form of transport to the Utrechtse Heuvelrug.

Although cars and public transport are very different and require separate attention, they both work together in achieving a sustainable mobility system in and around the national park. The specialisation of the subgroups is chosen based on the most logical methods that require attention to increase sustainable mobility, cars, and public transport. Cars are the current dominant mode of transport; therefore, it is important to understand, track, and reduce the use of this type. Public transport is seen as the main replacement for car-based travel to the national park because this type can be significantly improved upon. Therefore, it is important to understand the current situations of the different elements of public transport and how these can be improved upon.

The findings of each individual sub-group contribute to the overall findings to see how cars and public transport can work simultaneously in achieving a sustainable mobility network. Both types of transport need to be used integratively in order to ensure the

national park's accessibility because it is not realistic to make everyone use one specific type of transport. A combination of findings from both subgroups is fused together, forming this integrative advice.

## 1.2. MARKETING CAMPAIGN

### Advice: A campaign promoting the Druktemonitor, public transport, OV-bikes and behaviour change in general, supported by the revenue stream of a paid parking system.

A reduction of the polluting, car-related travel requires a combination of increasing public transport usage and decreasing the attractiveness of cars. The latter can be tackled by implementing a paid parking system, which significantly impacts the mode of transport people are willing to consider. Moreover, people indicated a higher preparedness to pay if the additional revenue would be used in a beneficial manner. An in-depth analysis regarding paid parking can be found in section 2.2.1.

To occupy the space left behind by the presumed reduction of cars, public transport and OV-bikes can be utilised. People may not be fully aware of the benefits of these modes of transport and need an extra push to become motivated. A campaign could positively affect the willingness of visitors to take these alternative modes of transport. An in-depth analysis of the encouragement of OV-bikes and public transport can be found in sections 3.2.1 and 3.2.2, respectively.

It is recommended to include the promotion of the Druktemonitor, an online map which describes how busy different areas in the province in the campaign as well. The performed survey indicated a low awareness and utilisation of this platform, denoting its low effectiveness in achieving its purpose. Lastly, a general form of behaviour change can be addressed through the campaign. Because by promoting sustainable behaviour, climate action can be increased. This would implicitly support the transition towards a more sustainable mobility system.

These pieces of advice complement each other by assuring a comprehensive mobilitygrid, despite a change in the mode of transport. Benefits of the shift in transport modes range from decreased CO<sub>2</sub> emissions and ecological damage to increased awareness of mobility options.

The recommended campaign, funded by the proceeds of paid parking, could exist in a physical, as well as digital format. Physically, posters or signs could be placed at parking places; these could display confronting information about their mode of transport. Moreover, alternatives can be promoted in the same manner, giving visitors an idea of what they could do. Digitally, the campaign could be publicised on the national park's website, social media, and the newsletter with the same strategy as for the physical option. It is recommended to perform a combination of physical and digital campaigns to reach visitors of the entire visitor demography.



Figure 1.2.1. An overview of the connections between car and public transport sections in the scope of promoting sustainable transition by marketing campaign.

Aiming to integratively promote the transition towards sustainable mobility for National Park Utrechtse Heuvelrug, a marketing campaign on publicising public transport and reducing the attractiveness of cars is highly recommended. An overview of the connections between two sections is provided by figure 1.2.1. The detailed assessment of each component can be found in the corresponding chapters.

## 1.3. INTEGRATED MOBILITY MAP

### Advice: Integrate public transport and OV-bikes into the interactive map. Make one clear mobility map with all options of transport and make it easily accessible on the website.

Aiming to improve the sustainability of visitor mobility, an integrated mobility map on the website is recommended. It is designed to facilitate visitors to explore the diversity of transport modes for reaching the Utrechtse Heuvelrug and the parking options while arriving by car. Even though it is certainly possible to come to the national park by other means than a car, the majority often ignore the other options due to simplicity and habit (see section 2.3.2). Many people are not even aware that there are OV-bikes at multiple stations around the national park (see section 3.3.2).

By visualising the main train stations and OV-bike stations on a map as well as indicating the possible bus lines, the accessibility of public transport will become clearer. Moreover, the visitors who would initially come by car are thus also targeted by integrating the parking guidance on the same map. The detailed assessment and data collection parking information can be found in sections 2.2.2 and 2.4.2. While looking for parking spots, the possibility of arriving by public transport is also provided, thus, can be considered as an alternative to pursue a more sustainable and

environmentally friendly lifestyle. The following map (*figure 1.3.1*) is made as an example of an interactive mobility map after integrating mobility information on public transport and private car sectors. The zoom-in/out function is advised to be applied on the website to provide further insight. The zoomed-in map including parking information can be found in section 2.2.2.



Figure 1.3.1. The diagram of an interactive mobility map after integration (green area = National Park Utrechtse Heuvelrug).

Furthermore, an extension of the map can be applied to better facilitate the sustainability of visitor mobility in the long run. With an interactive parking map, the projected car park traffic and the live situation of availability of each parking spot will become accessible on the website. Thanks to the integration of public transport options, alternatives will be provided through the same map as soon as notifying the crowdedness of parking spots.

# 2. CAR MOBILITY

By Erwin Vanhouwe, Jorn Meijsen, Lea Fuhrmann and Xiao Yang Consultancy Project Global Sustainability Science (GEO3-2423) Word count: 4734





## 2.1. INTRODUCTION

During the COVID-19 pandemic, the number of visitors to the National Park Utrechtse Heuvelrug increased to new highs (Bureau voor Ruimte & Vrije Tijd, 2020). Reported in various local and national newspapers, the park suffered from overflowing parking lots in and around the area, because of the surge in visitor numbers (Glaap, 2020). This led to an amalgamation of social, as well as environmental issues. For example, BOAs were busy trying to organise and enforce the flow of visitors, which led to numerous minor conflicts (Heemsbergen, n.d.). Moreover, the overflowing parking lots meant that visitors were parking their cars in no-parking zones, those zones often being protected land from the national park. Parking on this land damaged the flora and fauna on and below it. Furthermore, the increased car traffic led to higher levels of air pollutants, such as carbon oxides, nitrogen oxides, particulate matter, volatile organic compounds, and benzene (Green Vehicle Guide, n.d.), being emitted in the area around the national park.

Therefore, there is a great need to focus on the possibilities to reduce the issues concerning car mobility, whilst simultaneously reducing the environmental impacts of car-related travel; thus, this sub-group will be targeting this aspect of the sustainable mobility transition. This will be done by answering the question, aforementioned in the integrated section; "How can car mobility in the Utrechtse Heuvelrug be more efficiently organised, in terms of sustainability?". The question is supplemented by three sub-questions:

- 1. What is the current state of the car infrastructure in and around the Utrechtse Heuvelrug?
- 2. What can be done to make the car mobility at the Utrechtse Heuvelrug more sustainable?
- 3. What are the impacts of more sustainable car mobility to the Utrechtse Heuvelrug?

## 2.2. ADVICE

#### 2.2.1. PAID PARKING

Paid parking could introduce several benefits to the sustainable mobility of the National Park Utrechtse Heuvelrug.

The performed surveys indicate that hourly paid parking enforcement translates into reduced car movements. Some visitors tend to resort to other modes of transport, e.g public transport, bikes and by foot, as well as reducing their number of visits to the national park. The latter is not favourable as the Utrechtse Heuvelrug must sustain its current visit ability; therefore measures could be put in place to ensure visitability in the future.

Hourly parking of 1 and 2 euros is expected to reduce the energy demand due to transport-related sources towards the Utrechtse Heuvelrug by an average of 19.0 and 29.3% respectively. This reduction is caused by changes in modes of transport and reduced travel distance. The average energy saved accounts for between 39 and 60 TJ, or equal to the yearly energy consumption of a small village (482 to 741 households) (Nakagami et al, 2008). Hourly prices of 3 euros

or higher are deemed unreasonably high because these high prices do not correspond to a significantly higher energy reduction. A more detailed explanation can be found in the results and evidence section.

Hourly parking of 1 and 2 euros is expected to reduce CO<sub>2</sub> emissions due to transport-related sources towards the Utrechtse Heuvelrug by 18.8 and 29.0% respectively. Hourly prices of 3 euros or higher are deemed unreasonably high because these high prices are not justified by the CO<sub>2</sub> reductions connected to them. A more detailed explanation, including graphs, can be found in the results and evidence section.

The increased revenue stream could be used towards the preservation of the Utrechtse Heuvelrug.

Discussion with visitors made it clear that the willingness for paid parking increased if the revenue would be used to improve and preserve the Utrechtse Heuvelrug. The incorporation of paid parking in the car infrastructure is estimated to result in a cash flow of 500.000 to 1 million euros a year, at an hourly tariff of one euro. Note that this is a great simplification of real-world processes and is prone to change.

Whether it is for a leisurely walk or to walk the dog, most visitors at the Utrechtse Heuvelrug stay for a few hours. Moreover, the operation of paid parking on an hourly basis requires an additional investment of human and infrastructural resources. Alternatives such as daily passes, annual passes, senior discounts, and credit card points can also be taken into consideration.

According to the conversations with respondents, the majority do not mind paying for parking, however, the cost of parking per time slot can affect their choice of parks and the duration of their stay.

The alternatives are seized as pathways to aid a smooth transition of the new strategy - paid parking, especially for visitors who have a habit of coming to the Utrechtse Heuvelrug.

#### 2.2.2. PAID PARKING

The main idea of building up a parking database is to provide accessible and clear parking information for visitors. Thus, assisting visitors in planning their own itinerary, reducing conflicts between visitors and BOAs and tracking the environmental and ecological changes in the vicinity of the parking lots. Aiming to achieve these goals, the following advice is proposed.

Though the website '<u>https://www.np-utrechtseheuvelrug.nl/</u>' has specified there are free and ample parking spaces (referring to Groene Entrees and TOPs) all around the park, the relevant information is not integrated for visitors. Furthermore, the interactive map oriented via hyperlink is absent on the website. Therefore, a parking map including the basic information of parking lots (i.e., name, postal code and location) is required to be accessible on the website (see *Figure 2.2.2.1*.). Detailed information can be found in the follow-up sections.



TOP's 1: TOP Slot Zeist, Zinzendorflaan 1. 3703 CE Zeist 2: TOP't Jagershuys, Jagersingel 15, 3707 HW Zeist 3: TOP Station Driebergen-Zeist, 3972 NG Driebergen Rijsenburg 4: TOP Beauforthuis, Woudenbergseweg 70, 3711 AB Austerlitz 5: TOP Bergse Bossen, Traali 299, 3971 GM Driebergen 6: TOP Nationaal Bomenmuseum Gimborn, Velperengh 13, 3941 BZ Doorn 7: TOP Huis Doorn, Langbroekerweg 10, 3941 MT Doorn 8: TOP Amerongen, Burgwal 6, 3958 ER Amerongen 9: TOP Rhenen Centrum, Kerkstraat 1, 3911 LD Rhenen Groene Entree: 1: Groene Entree Kaapse Bossen, Leersumsestraatweg 0, 3491 MN Doorn 2: Groene Entree Moogstraat. Hoogstraat 0, 3941 MN Doorn 3: Groene Entree Recreatie Doornse

Gat, Leesumsestraatweg 0, 3941 MN Doorn

Figure 2.2.2.1. Integrated parking map (adapted from the TOPs distribution map from ROUTESINUTRECHT.nl).

## 2.2.2.1. EXTENSION OF PARKING MAP

Considering that the number of visitors may continue to rise, it would be wise to make a more extensive map, which contains information on capacity, expected passenger volume and distance from dog walking spots.

The performed survey indicated that 55% of visitors come by car, the reason they hesitate to change their mode of transport is mostly due to age restrictions (e.g. not able to bike) and the demand to bring their dogs. It would be helpful to include the aforementioned extensive components in the map system.

#### 2.2.3. PROMOTING THE DRUKTEMONITOR

Promote the Druktemonitor amongst the visitors of the Utrechtse Heuvelrug. This can be done in inexpensive ways, such as by including it in the Utrechtse Heuvelrug newsletters or highlighting it on the homepage of the National Park Utrechtse Heuvelrug website.

The Druktemonitor has the potential to play an invaluable role in reducing the stress of cars at the park and the different parking lots. Nevertheless, according to the data from the survey, the majority of the surveyees had either not heard of this initiative, or had heard of it but "do not worry about [it]". By promoting this initiative, more people will become aware of it and may choose to look at it and change their parking places according to the crowdedness of certain areas.

According to the survey results, around 46% of surveyees have not heard of the Druktemonitor, while 23% know about it but do not worry about [it]. Thus, the full potential of the monitor to reduce traffic in specific parking lots is not being used.

## 2.2.4. CONSTRUCTING CLEAR PHYSICAL PARKING LOT BOUNDARIES

Construct clear physical boundaries of the parking lots, for example by building fences, placing boulders or logs, or planting tree lines; an example of this can be found in *Figure 2.2.4.1.* Doing so will help protect land on which people may illegally park their cars on.



Figure 2.2.4.1. Example of the use of logs as a physical barrier at a parking lot (Cheney, 2021)

Currently, many of the parking lots at the Utrechtse Heuvelrug rely on relatively vague physical boundaries for people to park within, e.g. there is a lack of a continuous fence, or something with the same effect, around the parking lot; this means there is no clear boundary to the end of the parking lot. On low traffic days, this does not pose too big of an issue; however, on days where many visitors drive to the park, cars will abuse this fact and park on areas that are not meant to be parked on, damaging protected land. With concrete boundaries, this could be avoided.

The construction of physical barriers will simply prevent visitors from being able to park their cars on land that should not be parked on. Such measures, to prevent cars from parking illegally, have been successfully implemented in many national parks, such as Acadia National Park (Daigle, & Zimmerman, 2004).

The construction of such barriers will reduce the environmental impact vehicles have at the Utrechtse Heuvelrug.

A combination of environmental impacts will be avoided, as stated in section 2.3.4., i.e. the results of the literature review. Among these impacts are: soil

compaction and erosion, loss of vegetation cover, and loss of floral species diversity.

#### 2.2.5. FUTURE-PROOFING PARKING PLACES WITH ELECTRIC CHARGING STATIONS

Gradually adding more electric car charging stations to designated parking places in the coming years.

The performed survey indicated that not a lot of people are coming by electric car at the moment. However, as the current trend in electric vehicle sales indicates, the percentage of electric cars sales should go up to 34% of all total car sales in 2030. With this huge increase in electric cars, providing electric charging ports to the parking places could incentivise electric car owners to park their car at the parking place and thus prevent illegal parking next to the forest. Furthermore, this would increase the possibility for people that live further away to come by their electric car, instead of a gasoline car. Thus reducing the amount of  $CO_2$  in the roads nearby the national park, which reduces the environmental damage to the forest. As the survey shows, 58% of people who come by car have travelled a distance that it would be worthwhile to charge your electric car. So the charging stations would be a useful addition for those people.

Adding electric charging stations to parking places will reduce the amount of illegal parking for electric car owners and incentivise the use of electric transport to the park, therefore reducing the harmful impact of  $CO_2$  on the park.

## 2.3. ADVICE

#### 2.3.1. PAID PARKING

The calculations, described in the methodology section 2.4, resulted in a variety of useful figures regarding energy consumption and  $CO_2$  emissions. While energy consumption and  $CO_2$  emissions are tightly linked, only the final  $CO_2$  emissions will be discussed in this section.



Figure 2.3.1.1. The total amount of CO₂-equivalent emissions due to transport-related sources towards the national park.

 $CO_2$ -equivalent emissions indicate the total amount of greenhouse gases put into the form of  $CO_2$  according to their weight, e.g., methane equals to 25 times its amount in the form of  $CO_2$  (EPA, 2016). The  $CO_2$ -equivalent emissions range between 11.2 and 17.5 thousand tons, which is equal to the yearly carbon footprint of 1167 to 1824 individuals (Druckmann & Jack, 2009). The range originates due to uncertainties in visitor count and travel distance.



Figure 2.3.1.2. CO<sub>2</sub>-equivalent emissions for different hourly rates of paid parking (in orange) in comparison to the current situation (in red).

Based on the responses from the performed survey, CO2 reductions are calculated by evaluating the changes in transport that respondents indicated for different hourly rates. Introducing paid parking for one euro an hour is expected to reduce  $CO_2$  emissions by 2.11 thousand tons for the low estimate and 3.29 thousand tons for the high estimate, or an 18.8% reduction. A two-euro hourly rate results in a 3.3 and 5.1 thousand tons reduction, or a 29.0% reduction. An hourly rate of 3 euros an hour indicates only a relatively small improvement over the 2 euros an hour with a reduction of 32.4%. Finally, the 4-, 5- and 6-euro variants show similar results of a 34.1% reduction.

Several respondents of the survey indicated that they would only be willing to pay for parking if the revenue would be dedicated towards the preservation and optimisation of the Utrechtse Heuvelrug. This general thought is supported by scientific literature, where people tend to pick products that are connected to some form of charity (Strahilevitz, 1999). Therefore, it is advised to stimulate this process further by promoting the destinations of the revenue. Despite reduced car-related travel due to the paid parking, an hourly tariff of one euro is still expected to bring in between 500.000 and 1.000.000 euros a year according to the collected survey data.

#### 2.3.2. PARKING DATABASE



Figure 2.3.2.1. (1) Distribution of visitors by means of mobility; (2) distribution of visitors by means of purpose; (3) distribution of visitors by means of age range.

The distribution of interviewed visitors indicated that 58% of them came by car. Due to the purpose of dog walking (22% of the respondents) and the distribution of visitors by means of the age range (i.e., 41% are above 55 years old), an accessible and integrated parking map can significantly assist visitors in planning their own itinerary.

#### 2.3.3. DRUKTEMONITOR

The response to the Druktemonitor-related question has been visualised through the use of a pie chart in *Figure 2.3.3.1*. Most noticeable is the lack of usage of the monitor, where zero percent of the surveyed population used the Druktemonitor before travelling to the Utrechtse Heuvelrug. This pattern can be seen in the knowledge-based section of the question as well, where 46% had never heard of the Druktemonitor before. The remaining respondents either did not worry about knowing the crowdedness or didn't use the Druktemonitor at the time of the survey but used it before. Notable is that at the time of surveying the parking spots were relatively quiet, which, according to several respondents, they knew beforehand, reducing the need to check the Druktemonitor.



Figure 2.3.3.1. Distribution of visitor knowledge and use of the Druktemonitor initiative.

#### 2.3.4. ENVIRONMENTAL IMPACTS OF PARKING OUTSIDE PARKING AREAS

The literature review, described in the methodology, indicated a potentially significant negative environmental impact of people parking on non-designated parking areas, particularly in natural areas, such as the Utrechtse Heuvelrug.

One of the main impacts associated with the aforementioned issue is accelerated soil compaction and erosion (Webb, Ragland, Godwin, & Jenkins, 1978) (Daigle, & Zimmerman, 2004) (Park, Manning, Marion, Lawon, & Jacobi, 2008). Soil compaction is a type of physical soil degradation that affects soil structure, decreases root penetration, and limits water and air infiltration (Nawaz, Bourrie, & Trolard, 2013); this process increases the risk of soil erosion. This is particularly significant as the process of soil erosion is strongly associated with water quality degradation, especially surface water, as a result of pollution (Ratta, & Lal, 1998) (Sthiannopkao, Takizawa, & Wirojanagud, 2006) (Issaka, & Ashraf, 2017). Furthermore, this association is not limited to the particular site of erosion but can also affect any water bodies in the same basin. In the context of the Utrechtse Heuvelrug, this means water bodies which animals may depend on, such as for drinking or other activities, could become polluted.

Another potential environmental impact of this type of parking is loss of vegetation cover and/or floral species diversity (Webb, Ragland, Godwin, & Jenkins, 1978) (Westcott, & Andrew, 2015). This occurs due to soil disturbance from the tires driving over the area (Assaeed, Al-Rowaily, El-Bana, Abood, Dar, & Hegazy, 2019).

#### 2.3.5. ENVIRONMENTAL IMPACTS OF PARKING OUTSIDE PARKING AREAS

Our survey indicates that 48 out of 88 people come by car to the national park, which is almost 55% of all visitors. Of these 48 cars, only three of them were fully electric and 4 of them were hybrid cars. These account for 14,5% of the cars visiting, which means that 85,5% of the visitors who come by car run their cars on fossil fuels (as *Figure 2.3.5.1.* shows). According to the Rijksdienst voor Ondernemend Nederland and Rijkswaterstaat, there are a total of 381,815 electric cars in the Netherlands (31-12-2021), which includes full-electric cars as well as hybrid cars (Nederland Elektrisch, 2021). This is a total of 4.33% of all cars in the Netherlands. Although this might not seem as much right now, the amount of electric cars has more than tripled in the last five years. Additionally, recent studies show that the electric cars have between 10 - 17% of the global car sales (excluding hybrid cars) and by 2030 this could grow to 34% (IEA, 2021).



Figure 2.3.5.1. Amount of cars sorted by fuel type

With the massive increase in electric cars in the coming years, it is also crucial to know how far people travel to the park. This information can be used for the necessity of providing electric charging stations for cars at parking places. In *Figure 2.3.5.2*. It can be seen that the majority of people travel either a very short, medium or long distance. Obviously, for people that travel a very short distance, the charging ports are not necessary, however, for people who have travelled medium, long and very long, the charging ports could be an incentive to park at this parking place. In total that comes down to 58% of cars travelling to the Park.



Figure 2.3.5.2. Travel distances categorised; Very short: 0-5km; Short: 5-10 & 10-15 km; Medium: 15-20 & 20-30km; Long: 30-40 & 40-50km; Very long: 50+ km

# 2.4. METHODOLOGY

#### 2.4.1. ANALYTICAL FRAMEWORK

To structure and guide our analysis, the SWOT (Strengths, Weakness, Opportunities, Threats) framework is selected to devise a successful strategy for sustainable visitor mobility for National Park Utrechtse Heuvelrug. Based on the initial SWOT framework, a few more components are added to establish a feasible and comprehensive pathway towards sustainable mobility in Utrechtse Heuvelrug specifically. By proposing, comparing and combining potential strategies (presented as advice in the previous sections), this analytical framework will also integrate components of affiliation (A) and contradiction (C). Moreover, a list of key factors are included to facilitate the assessment from the perspectives (i.e., S, W, O, T, A and C).

Regarding the aim of developing sustainable visitor mobility in the section of private cars, a series of main concerns on implementing transformative strategies are identified and listed as key factors in *Figure 2.4.1.1*. (POPs Toolkit, n.d.): (1) knowledge: the current knowledge reserve and information tracking status; (2) cost-effectiveness: the economic analysis that compares the relative costs and outcomes (i.e., impacts) of the action; (3) potential to reduce conflict: the conflict has been evaluated in the introduction section; (4) social acceptance: the willingness of behavioural change and the preference of transformative actions from the public; (5) responsibilities: multi-party participation in policymaking, legal framework and environment management as well as media and events campaigns.

By evaluating the aforementioned key factors, the concerns and perceptions from both internal origin (the Utrechtse Heuvelrug) and external origin (the environment) regarding the transition towards sustainable visitor mobility are identified as follows (see *Figure 2.4.1.1*.).

	Helpful to achieve the objective	Harmful to achieve the objective	
Internal Origin (attributes of the NGO)	<ol> <li>Connection with various stakeholders</li> <li>Direct contact with visitors</li> </ol>	<ol> <li>Multi-party consultation is always required</li> <li>May be limited as to keep consistency with other national parks</li> </ol>	
External Origin (attributes of the environment)	<ol> <li>Awarenss of sustinability and environmental protection is rising</li> <li>Benefit from the strategies</li> </ol>	<ol> <li>Environmental damages due to improper parking</li> <li>Car emissions may affect air quality</li> </ol>	Key Factors:
Interation within strategies	<ol> <li>Significantly reduce conflicts</li> <li>Aid ecological protection in the area</li> </ol>	<ol> <li>May receive negative feedback due to paid parking</li> <li>Both need to be operated and updated by time</li> </ol>	<ul> <li>Cost-effectiveness</li> <li>Potential to reduce conflict</li> <li>Social acceptance</li> <li>Responsibilities</li> </ul>

Figure 2.4.1.1. The SWOTAC framework (adapted from SWOT framework SWOT analysis diagram, 2007 & POPs Toolkit, n.d.).

In order to test the feasibility of the hypothesised strategies and improve them, a survey will be conducted to illustrate the visitors' profiles (see appendix A). Furthermore, literature review and statistical analysis were applied as well.

#### 2.4.2. DATA COLLECTION AND ANALYSIS

For this subsection, the methodology was divided by the results, i.e. energy analysis, parking database, Druktemonitor, environmental impacts, and future-proofing of parking. This was done for simplification purposes, due to the interconnectedness of the methods used in the various results; for example, the energy analysis used a literature review, survey, and calculations.

#### Energy Analysis

For the energy analysis, the framework by Blok & Nieuwelaar (2018) was used. The required data for this framework was gathered through the form of a literature review in combination with performing a survey. The Excel sheets used for the calculations can be found in appendix B.

The survey resulted in data regarding the mode of transport, range of travel distance, number of people per vehicle and data on paid parking willingness. Moreover, the mode of transport included the specific fuel type of the vehicles to enable a separation of fuel in the energy analysis process.

The willingness of paid parking was established to calculate possible energy and emission savings due to reduced car-based travel. Visitors were asked to set, if any, a maximum hourly payment for parking. Subsequently, they were asked what effects the paid parking would have on their transport towards the Utrechtse Heuvelrug, including using a different mode of transport or decreasing their frequency of visits. These results were finally used to redo the energy analysis with increasing hourly rates for the paid parking.

The total number of visitors was established by approaching several stakeholders who have performed research in the area. The final range of visitor count was taken from extensive research requested by the Utrecht Province that indicated a total number of between 6.75 and 8.25 million visitors in 2019 (NBTC, 2019). Note that these are not unique visitors, because recurring visits are accounted for.

The final required data category was the average fuel economy of the different modes of transport, this includes the transmission efficiency, engine efficiency, mechanical efficiency and energy for accessories. This data was acquired through a variety of literature-based sources that stated the fuel economy in litres or kWh (for electric cars). For public transport, the average occupancy was assumed to be 20 and 75 persons for buses and trains, respectively. These assumptions are based on observations due to the lack of reliable information regarding this topic in the area. The remaining sources for the necessary data for the energy analysis are n.d. (2014), Vattenfall (2021), Dekrie (n.d.), Toyota (n.d.), Pelkmans et al. (2001), Crow (2018) and NS (n.d.).

With all the required data gathered the next step of the energy analysis can be started, the calculations. These calculations are performed through fivefold steps which are; distance travelled, amount of fuel used, 1st order ERE, 2nd order ERE, and emissions.

All of these steps are performed on the six modes of transport that exert emissions; gasoline-, diesel-, electric-, and hybrid cars as well as LNG (natural gas) buses and diesel trains.

The distance travelled per mode of transport is based on an extrapolation of the survey data, in combination with the established total number of visitors. Both the total number of visitors and the distance travelled include a range of uncertainty, this range is accounted for by introducing an uncertainty factor taken from the minimum and maximum of both variables.

The number of fuels used can be established by multiplying the distance travelled by the fuel economy of that specific mode of transport. This allows for an overview of how many litres of certain fuels are used related to the transport towards the Utrechtse Heuvelrug. Notable is that the electric car fuel is stated as kWh instead of litres.

A first-order ERE indicates the energy consumption of a process including conversion factors for electricity production. The energy contents of the different fuels types were extracted from Blok & Nieuwelaar (2018) which results in the simplistic multiplication of the number of litres multiplied by the energy content of these fuels. The electric car requires additional attention to the production process of the electricity. For this, a simplified electricity system of the Netherlands was used with 52% generation by gas-fired power plants, and 27% generation by coal-fired power plants, with the remainder being supplied by renewable energy sources (IEA, 2020). Lastly, a distribution loss of 5% (Blok & Nieuwlaar, 2018) was used to account for transport losses. The efficiency losses of the power plants (50% and 60% respectively) in combination with the distribution loss and fuel consumption can be translated into the first order ERE.

The second-order ERE extends on the idea of the first order ERE by including energyconsuming processes during the extraction, transport and conversion. The energy related to these processes is defined in a second-order ERE factor provided by Blok & Nieuwelaar (2018); these factors differ between a variety of fuel sources. The first order ERE values were multiplied with the corresponding second-order ERE factors. Note that the same distribution of electricity production was used as described in the first order ERE.

Lastly, the emissions can be established by multiplying the second-order ERE with the average CO<sub>2</sub> emissions per MJ of fuel. These values were again provided by Blok & Nieuwelaar (2018). Note that the same distribution of electricity production was used as described in the first order ERE.

Respondents to the survey were given the opportunity to indicate what effect possible paid parking would have on their choices. Some respondents used this opportunity to explain their wish that the increased revenue would go directly towards the National Park Utrechtse Heuvelrug, or towards Vereniging Natuurmonumenten.

A loose estimate of revenue is based on the 2019 visitor count (NBTC, 2019) in combination with data gathered from the survey. Data from the survey include the mode of transport, maximum paid parking tariff and the effect of paid parking on one's mode of transport. By combining all of the named variables an estimate can be made

on the future number of vehicles still going to the national park at a tariff of 1 euro. Note that this estimate is rough as it is difficult to predict future parking behaviour due to a variety of factors.

#### Parking Database

According to the official website of the Utrechtse Heuvelrug, there are free and ample parking lots at various *groene entrees* (green entrance in English) and *TOPs* (i.e., Toeristische Overstappunten, tourist transfer point in English) as it is located near the main highways A12 and A28. However, the information on all nearby parking lots (*groene entree* and *TOPs* included) can not be displayed by searching for the name of the park or its postcode. The *interactive kaart* function (interactive map in English) still remains to be accomplished (see <u>https://www.np-utrechtseheuvelrug.nl/activiteiten/plan-je-bezoek/praktische-informatie/</u>).

Location information of *groene entrees* and TOPs are left to be integrated for viewing. Furthermore, the distribution of visitors by means of mode of mobility was concerned to test the necessity of putting time and effort into building a parking map. Therefore, a sketch of a parking map including the fundamental information of parking lots (i.e., name, postal code and location) are collected and integrated (*Figure 2.2.2.1*). The detailed data collection procedure is attached in appendix C.

In addition, the idea of developing a more extensive map is based on the visitors' profiles after conducting the survey. The categorising of visitors' age range and purpose of visiting are taken into consideration while brainstorming new components in the extensive parking map.

#### Druktemonitor

The advice regarding the Druktemonitor was based on data collected from one question in the conducted survey. This question pertained to the awareness and/or the use of the Druktemonitor by visitors who travelled to the Utrechtse Heuvelrug; it reads as follows, "Did you check the Druktemonitor before travelling here?". The possible answers to this question were: "Yes", "No, I do not know what this is", "Not this time", and "No, I do not worry about this". The different responses each related to a different user or knowledge class, regarding the Druktemonitor; either they have or haven't heard about the initiative, and either they do use it or they do not. Using the responses to this question, i.e. the percentages of each of the responses, a general consensus regarding the current use of the Druktemonitor was established.

#### Environmental Impacts

In order to get an insight into the environmental impact of illegally parked cars, as well as the solutions to combat this issue, a literature review was conducted. This was done, as collecting data and conducting research was not feasible within the timeframe of the project. Moreover, interviews with experts were not possible due to the specificity of the issue at hand.

To become familiarised with- and investigate concepts related to the environmental impacts of parking and car use, several blogs and news articles were located using a Google search. Referenced authors in those blogs and news articles, led to additional scientific articles relating to the field of car mobility in natural areas, such as national

parks. Scientific articles were found via Google Scholar, whilst peer-reviewed journals and journal articles were found using Springer, Scopus, and JSTOR.

Whilst searching the aforementioned resources, some of the descriptors and search terms used during the research included *environmental impacts of parking in natural areas, off-road parking impacts, parking on protected areas impact, the impact of parking on grass and soils,* and *illegally parked national park.* During the analysis of sources for the review, works cited in articles were also reviewed for references to possible experts in the field, as well as to search for information from referenced sources of articles. A resource was evaluated and included as a reference based on relevance to the topic at hand, credentials of the author and the journal. Articles' dates were not restricted, due to a lack of articles concerning the researched topic.

#### Future-proofing parking places with electric charging stations

In order to gain more information on the number of electric cars that come to the park, the questions on fuel type and distance travelled in our survey were used. These questions read as follows: "What type of fuel does your car run on?" and "What type of fuel does your car run on?". The fuel type answers were then used to compare them with literature and national data on car ownership by fuel type. Furthermore, literature was analysed on the potential and growth in the electric car sector, and electric car sales.

The distance question was further analysed by categorising them into five different categories namely, "Very short: 0-5km; Short: 5-10 & 10-15 km; Medium: 15-20 & 20-30km; Long: 30-40 & 40-50km; Very long: 50+ km". These were categorised in this way to gain a better understanding of how many people had to travel far and who did not have to travel far. This data could then be used to see if electric charging stations would be necessary in the nearby future.

# 3. PUBLIC TRANSPORT

By Lia Sweetman, Misha Midavoodi, Gaia Zanaboni and Ilse van der Giessen Consultancy Project Global Sustainability Science (GEO3-2423)

Word count: 4992





# 3.1. INTRODUCTION

The National Park Utrechtse Heuvelrug is in the centre of urban areas. However, this does not entail that people go to the park by public transport. Public transport comes in many forms, but it can be defined as "a system that moves people from one area to another in an efficient, affordable manner" (Remix, 2021). In the Utrechtse Heuvelrug, this includes trains, buses, and OV-bikes. In the current situation, according to the Regional Bureau for Tourism Heuvelrug & Vallei (2022), there are multiple train stations in the area and from these stations, there are bus connections that depart a few times an hour in every direction.

However, from our own experience and data from a performed survey, waiting times between buses are long and opportunities for shared bicycles and OV-bikes are limited. This decreases the attractiveness of travelling by public transport to the natural area. According to Beunen et al. (2006), accessibility to nature areas by public transport is limited and the comfort of travelling by car is highly appreciated. Therefore, most people transport to the area by car. Statistics show that especially the older population mostly use their car to travel and that alternatives are rarely used by the elderly (Luiu et al., 2018).

When it comes to previous literature on sustainable mobility in national parks, there is often an institutional focus; the aspect of voluntary behaviour changes to drive a transition towards more sustainable travel to nature is not often reported (Higman, 2013). Knowledge about the behaviour of the visitors of the Utrechtse Heuvelrug has high social and scientific relevance because with this information, efforts can be made to improve the accessibility and attractiveness of public transport. When public transport is designed more adequately, more people would choose to go to the area by train, bus, or OV-bike. This is of high importance since it is more sustainable to travel by public transport instead of by car. Public transport improves fuel efficiency, reduces air pollution, and improves commuters' productivity (Remix, 2021). This would also decrease the amount of damage caused to nature due to cars parking inadequately and solve the issue of overcrowding the park with cars.

Thus, there is a need for other types of transportation that are more attractive for people to stop using their cars. The quality of public transport networks needs to be adequately considered. Otherwise, there will remain a dependency on alternative travel modes, such as cars (Dodson et al., 2011). The aim of this research is to identify the barriers for people who decide not to use public transport and develop a plan to address this. Therefore, the main research question of this section is "In what ways can public transport be improved in the Utrechtse Heuvelrug to motivate visitors to use it?". To be able to answer this research question, it is broken down into two questions:

- 1. What are the barriers for visitors of Utrechtse Heuvelrug to choose public transport?
- 2. In what way can public transport overcome these barriers and become more accessible and attractive to visitors of Utrechtse Heuvelrug?

## 3.2 ADVICE

#### 3.2.1. ENCOURAGING THE USE OF OV-BIKES

In order to encourage park visitors to move away from the use of cars and towards public transport, it is necessary to inform the users that OV-bikes are a feasible alternative. This can be done for example by displaying these bikes as one of the main travel options on the website <u>https://www.np-utrechtseheuvelrug.nl/</u>, since this is a reference point for new visitors.

Using OV-bikes as part of the travel modes to the national park can reduce the overall time of travel. Currently, if potential visitors search on 9292.nl (as advised on the <u>https://www.np-utrechtseheuvelrug.nl/</u> website), they are presented with options that involve taking a train to one of the train stations surrounding the park, and thereafter taking a bus that will bring the visitors closer to the park itself. However, the connections between the trains and buses are not always smooth, and the waiting time for the bus can be rather long. Therefore, if the visitors were to be aware of the possibility of a travel time reduction by using an OV-bike, they will be more likely to transition to public transport.

For example, to visit the popular outlook tower "De Kaap", if OV-bikes were an option, it would only take 34 minutes to reach Utrecht Centraal Station (17-minute sprinter to Maarn + 17-minute bike ride), whereas, the option of public transport given by google maps take approximately an hour (involving a sprinter, bus and a walk). From the data of the performed survey, shown in appendix A, the answer to the question "What was the main reason why you did not choose to go by public transport?" was mainly that the travel time was too long or too inconvenient. Therefore, by reducing both travel time and inconvenience of bus connections, visitors will have fewer barriers in their transition to public transport.

There are already OV-bikes available at various stations, but this travel mode is not advertised as a viable option, neither on the National Park Utrechtse Heuvelrug website nor on the 9292.nl app (the most used tool in the Netherlands to search for public transport routes). This means that the alternative option of OV-bikes is already present but is not publicised to users. Driebergen-Zeist has 150 OV-bikes, whereas the other stations (Maarn, Rhenen, Soest and Veenendaal) have between 0 and 8 bikes. These numbers are shown in the result section below. Even though these numbers are low, Joost van Heeckeren, an NS stations manager for the stations in Utrecht, explained in an interview that the number of bikes per station is dependent on the demand for said bikes (see result section 3.3.1, quotes from Joost van Heeckeren).

Therefore, if the bikes become more demanded (which can happen once visitors are encouraged to use them as a form of transport to the park), the number of bikes present in the station can be adapted accordingly. Furthermore, in July of this year, a pilot for OV e-bikes in Driebergen-Zeist will begin. Many respondents from the survey were concerned with the fact that the cycle to the Utrechtse Heuvelrug was too long. Therefore, if/when e-bikes are introduced in the train station of Driebergen-Zeist, these visitors can make use of this mode of transport, and benefit from the reduction of travel time and will no longer be an issue in terms of distance since electric bikes reduce the physical strain of the cycle.

The national park must advertise the possibility of using OV-bikes; Angelique van Gasteren from NS explained in an interview that OV-bikes are mainly used by social-recreative travellers, which corresponds with the type of visitors that go to the park (see result section 3.3.1, quotes from Angelique van Gasteren).

Therefore, if OV-bikes were to be advertised throughout the park in the form of signs (that could for example include messages such as "you are a 20-minute OV-bike ride away from X train station"), it is likely that visitors would be open to using them. OV-bikes are very reasonably priced ( $\in$ 4.15 per 24 hours) and give users the freedom of using the bikes for the entire day without worrying about paying extra; this is a large benefit when talking about visitors that often travel to the park for full-day trips.

#### 3.2.2. INCREASING THE MARKETING OF PUBLIC TRANSPORT

For people to switch to the use of public transport, the public transport options need to be marketed and promoted. One such way is to point out the consequences and effects on the environment by using the car to come to the park. In the parking lots, large posters or signs could be placed, where numbers and calculations on the difference in emissions between using the car and using public transport are displayed.

Many people might not be aware of the environmental benefits of using public transport and some people need an extra push to be motivated. They may not be aware of their ecological footprint by using the car, so by using shocking, confronting, and catchy phrases, they may start to think about this more. These signs should be placed at strategic spots, forcing the visitors to look at them. These posters could be a part of a campaign by the national park to promote the use of public transport. The same information about the benefits of using public transport could also be put in the newsletter.

David Eerdmans from the province of Utrecht states that now there is little budget for marketing in the transport sector, referring to the bus company Syntus (see appendix G). Ed van der Zee, a traffic and transport engineer at Syntus also confirms this and says he would like to see the marketing improved. Now there are some small marketing initiatives, but he would like to see the marketing in a more aggressive way (see appendix H).

Another way of making the use of public transport more attractive is by offering the ones who come to the park by public transport a deal, where they receive additional benefits when travelling by public transport. The organisation NS offers its travellers deals, also called 'dagje uit' (the dutch phrase for "day out/day trip").

When talking to Angelique van Gasteren from NS, she mentioned this as an option for the Utrechtse Heuvelrug (see appendix D). The idea of this is that when people go to certain places by train, they can make use of this combination deal and get free access to something or a discount, such as a free lunch or beverage. A partnership could thus be formed between the national park and NS. For example, people who come by train to the national park could be given a free drink and snack at one of the restaurants in the Utrechtse Heuvelrug. This can almost be seen as getting a reward for making a sustainable choice. People find travelling to the park by public transport inconvenient and it takes longer. However, by getting something in return, they are most likely more accepting of the fact that their journey may take a little longer. This is also a win-win for the Restaurants at the National Park. People who would not have come to the

restaurant initially, are more likely to visit the restaurant because of the coupon and in the end might spend more money there.

#### 3.2.3. CHANGING THE AVAILABILITY OF TIER E-BIKES AND E-SCOOTERS

TIER e-bikes and e-scooters should be organised at a regional level. They should also be placed at the Driebergen-Zeist station to decrease the distance of travel to the Utrechtse Heuvelrug National Park. U-passes should be extended to the Utrechtse Heuvelrug to gain a discount on TIER e-bikes and scooters.

Furthermore, if the mobility of TIER were to be organised at a more regional level, it would be easier to regulate these areas because then there would be no legal obstacles.

TIER is an organisation in Utrecht that provides e-bikes and e-scooters in the city. These means of transportation are placed nearby central hubs and other crowded areas in Utrecht. In collaboration with the city, parking zones and explicit non-parking zones are defined (Redactie, 2021). According to an interview with Nils Verkennis, it is currently not possible to park bikes or scooters outside the city. TIER for now only has a permit for Utrecht and not for the regions outside the city, such as Utrechtse Heuvelrug. TIER does not have a plan yet to expand to rural areas. This is because they would need new permits for this. This permit is hindered because "the sharing mobility" is organised at the urban level. Each city has its own permit system to regulate sharing mobility.

When people can go from Driebergen-Zeist Station to Utrechtse Heuvelrug National Park, this would be within 10 to 15 km. Thus, creating a parking zone for TIER e-bikes and e-scooters at Driebergen-Zeist Station would make travelling by public transport or only via the shared bicycles and scooters more attractive.

According to Nils Verkennis, TIER tries to make the use of their e-bikes and escooters as attractive as possible (Appendix F). The biggest obstacle for consumers is the presence of vehicles. People want to get to their destination as quickly as possible. However, when there is only a small density of parking zones, this becomes more difficult. TIER focuses on short distances, from 10 to 15 km. Thus, going from Utrecht city to Utrechtse Heuvelrug National Park, would be too far.

When TIER e-bikes and e-scooters are going to be placed in the region of Utrechtse Heuvelrug, it would be advised that people from these municipalities are also able to become a U-pass holder. Then, more people can afford and thus use TIER e-bikes and e-scooters.

TIER e-bikes and e-scooters should be available for everyone. People with a low income from the following municipalities can apply for a U-pass: Utrecht, Houten, De Bilt, IJsselstein and Stichtse Vecht. With this pass, they receive a 75% discount on TIER e-bikes and e-scooters.

#### 3.2.4. BUSES

Increase the frequency of Syntus buses and add shuttle buses from train stations during school holidays and national holidays.

Buses from lines 58, 381 and 575 should depart more frequently since they are going only once per hour and cross popularly visited areas of the Utrechtse Heuvelrug.

As you can see in *Figure 3.3.3.1. - 3.3.3.4.* from the results section, there are four regional lines in the Utrechtse Heuvelrug: lines 50, 58, 381 and 575. Line 50 is the main bus line in the Utrechtse Heuvelrug, since it goes from Utrecht, Zeist, Driebergen, Doorn, Leersum, Amerongen, Elst, Veenendaal, Rhenen to Wageningen. Note that *Figure 3.3.3.1.* is only one of the several timetables per day. This bus goes rather frequently, every 15 minutes between Utrecht and Elst and every half an hour between Elst and Wageningen. However, this line only crosses one station in the Utrechtse Heuvelrug, which is Driebergen-Zeist station. Thus, to access the Utrechtse Heuvelrug in a combination of a train and bus, would be more difficult.

As you can see in *Figures 3.3.3.1. - 3.3.3.4.*, lines 58, 381 and 575 run once per hour. These lines are important to the National Park Utrechtse Heuvelrug since they have important stops nearby the park including popular spots such as Austerlitz. Therefore, it would be advised that especially lines 58, 381 and 575 would depart more frequently, for example, once per half hour.

Unfortunately, according to Ed van der Zee from Syntus, they do not have many travellers to the park. However, when suggested increasing the bus frequency, he says there would usually be more passengers, but it is difficult to know how many people are coming to a park and plan a bus line according to that (Appendix H).

Creating shuttle buses from train stations to the National Park of Utrechtse Heuvelrug during the school holidays and public holidays would help meet the demand for transport during these periods.

According to Syntus Utrecht (2021), Synthus Utrecht tries to adapt its timetable to the demand of transport. It mentions there are fewer travellers during the school holidays and public holidays and therefore they are using fewer buses on several lines. When a ride is cancelled, this is stated in the 'Note' column. In this footnote, it also indicated which period it concerns. For these periods, it would be advised to create a shuttle bus from train stations to the national park. With the shuttle buses, transporting to the national park by public transport will become easier which will motivate people to go with the shuttle bus instead of by car. In the interview, Ed van der Zee mentioned that shuttle buses could be a feasible option and Syntus could cooperate with the park for this (Appendix H).

#### 3.2.5. STIMULATING SUSTAINABLE BEHAVIOUR CHANGE

For people to use the car less and public transport/bikes more, it is necessary to implement behaviour change strategies. There are different ways to do so, and the ones listed below are the result of a literature review, since it was not possible to gather data about this from the interview/survey because of the lack of behaviour change initiatives at the national park.

The sections follow the same structure used by Gallo and Marinelli (2020). These researchers conducted a literature review on the existing policies for sustainability concluding that there are 3 main topics: socio-economic, environmental, and technological policies. To see behaviour change, implementing only one policy is not enough, but rather the optimal scenario looks at multiple policies combined as well as the implementation of most of the advice in this paper.

Socio-economic policies

- Incentives and taxes: making pay for parking for instance; the Municipality of Utrecht could be an important stakeholder to get on board for this.
- Improving quantity and quality of public transport: possibility of buying a public transport annual pass to the park that would save people money. The development of a marketing strategy with Syntus is also a good option to raise awareness on the possibility of going to the park via buses.
- High quality for bicycle parking: building more parks for bikes would encourage people to come by bike more.

Environmental policies: However, increasing climate awareness has been shown to change mobility behaviours only to a limited extent, therefore the advice is to prioritise socio-economic and technological policies (Higham et al., 2013)

- Promotion of cycling as a sustainable practice: in a possible campaign or marketing strategy, this topic could be included.
- Creation of limited traffic zones: the close areas to the park can be turned into car-free zones.
- Creation of 30-zone: by limiting speed around the park, there would be improvements in terms of sound pollution.
- Air pollution and green-house gases awareness (Green New Deal: halving cars by 2030): possibly showing data that proves that air quality grows bad at the park as more cars come (losing the advantage of going into 'nature'), also greenhouse gases cause climate change and damage flora and fauna. Increasing awareness of environmental problems has been shown to influence the attitude of travellers (Kim & Lee, 2013).
- Highlighting the negative impact that a car has on the environment (Coskun et al., 2015).

Technological policies

- Electric vehicles: promoting their use as well as building charging stations.
- Promotion of shared mobility: in case there was a parking fee, shared cars could get a discount, promoting ways to share cars online (blabla car).
- Possibility of installing more roadside detectors: to analyse mobility patterns further and take more concrete action.
- Persuasive technologies: test and help the promotion of UbiGreen app, Perseus, TRIPZOOM, I-Tour, Green Daily Apps, MatkaHupi... 65% of studies report successful results for these apps in changing behaviour to more sustainable mobility behaviours (Anagnostopoulou et al., 2018).
- SaveMyBike app shows areas where it is safe to park somebody's bike and also makes it possible to find a stolen bike through sensors, and also has a rewarding system for low emissions (SaveMyBike, 2018).

# 3.3. RESULTS AND EVIDENCE

#### 3.3.1. INTERVIEWS

### QUOTES FROM AN INTERVIEW WITH JOOST VAN HEECKEREN (NS)

"And if we see that one of the station OV bikes are rented every day, in the future, we can place more bikes, so we try to monitor this and anticipate on that."

"If there are questions or complaints from travellers that there are not enough bikes, we will anticipate that to see if it is possible to play some more."

"I don't know the numbers but last year it grew. It's bizarre."

"COVID has changed a lot in those things. But before this, we could, well I should ask it to the specialist, but I know there were so many bikes that needed more than we could produce last year."

### QUOTES FROM AN INTERVIEW WITH ANGELIQUE VAN GASTEREN (NS)

"The people that use OV-bikes the most are social-recreative travellers; so the people that are travelling for example by train to a nice city and want to use a bike to visit it."

"The focus on marketing OV-bikes is that it is healthy, it is nice, ... always happy people are portrayed."

"Our purpose is not to earn money from OV-bikes, our purpose is for people to use the train more."

### QUOTES FROM AN INTERVIEW WITH NILS VERKENNIS (TIER)

"We have a permit for Utrecht and not outside it. We would need a new permit for that."

"There must be sufficient support to realise this. It must be attractive for a company to establish itself there. In rural areas, this is often more difficult because there is less demand. You already indicated that there is a bus once an hour, this is too little. But we see that there are not many movements from the city to the rural area. This also concerns long distances (between 20-25 km). We focus on shorter distances, of 10-15 km."

"Yes, parking zones in Driebergen Zeist would be interesting. We would need a new permit for this."

"What makes it difficult is that "the sharing mobility" is organised at the urban level with its own permit system to regulate sharing mobility. But mobility does not stop beyond municipal boundaries. If this was organised on a regional level, it would be easier to regulate these types of areas. Then there would be no legal obstacles. At the moment, different agreements apply to each municipality."

"TIER falls under the U-pass. U-pass holders are people from Utrecht with a lower income. With the pass, they get a discount on public transport (this means a 75%)

#### QUOTES FROM AN INTERVIEW WITH ED VAN DER ZEE (SYNTUS)

#### "... we don't have many travellers to the park."

Do you think that more buses and hour would increase the number of passengers? "Usually there would be more passengers. So, depending on multiple things; you must make sure that people will use the bus line or otherwise they won't be in high frequency."

"Yeah, but if you talk about a normal regular bus line you can estimate the passengers there will be. If you're talking about in a park or something, then you don't know how many people are coming. So, you cannot plan a bus line on that."

"No. We have tourist buses to another place: from Monday to Friday. They are reasonably filled. But strangely enough on the weekend there are not many passengers."

About marketing: "Yeah, posters, or gifts. Yeah. I would like to see it otherwise, more aggressively." "We made an appointment with Sythus to collaborate more with the marketing compartment. So that there will be a better plan to get all together. But that has not been implemented yet."

Do you think there would be a possibility to create a shuttle bus specifically for the national park? "It could be. For instance, if you talk specifically about Koningsnacht, for specific events, we cooperate in these things. So, we could cooperate, for instance, with the park."

#### 3.3.2. OV-BIKES

In Table 3.3.2.1. the data on the availability (pre-corona and after corona) of OV-bikes at train stations in the Utrechtse Heuvelrug area is shown. The train stations located in the Utrechtse Heuvelrug are shown in bold. Other information important to this data is that in April, OV-bikes with a new lock will be placed in station Amersfoort. In May, OV-bikes with a new lock will be placed in Driebergen-Zeist. And probably, in July, there will be a pilot with OV e-bikes in Driebergen-Zeist. The other locations will receive the new lock in 2023. This information has been obtained from Odette Zwinkels, an architect and planner at NS stations.

	Number of OV-bikes	Availability before COVID-19	New slot*
Amersfoort	432	Sufficient	460
Baarn	32	Sufficient	32
Bilthoven	32	Insufficient	45
Den Dolder	6	Sufficient	6
Driebergen-Zeist	150	Sufficient	150
Hilversum Sportpark	25	Sufficient	25
Hollandsche Rading	24	Sufficient	27
Maarn	0	Sufficient	0
Rhenen	4	Sufficient	4
Soest Zuid	8	Sufficient	8
Veenendaal Centrum	4	Sufficient	7
Veenendaal West	10	Sufficient	10

Table 3.3.2.1.	Data on	OV-bikes	in Heuvelrug	area

\*The numbers in the new slot are preliminary forecasts and subject to change.

#### 3.3.3. BUSLINES

SU U-LINK Va	an U	trec		5 116	ldir	way	em	ige	T / V	een	ene	aal				1 2		Uti	reci	ΠĽ
NIET geldig van 11 juli t/m 26 augustus 2022																				
Opm	erking:	U		U		U		U		U		U	U			U		U		
Utrecht, CS Jaarbeurszijde	v	17:11	17:19	17:26	17:34	17:41	17:49	17:56	18:04	18:11	18:20	18:29	18:39	18:50	19:00	19:17	19:32	19:47		20:02
Utrecht, Neude		17:15	17:23	17:30	17:38	17:45	17:53	18:00	18:08	18:15	18:24	18:33	18:43	18:54	19:03	19:20	19:35	19:50		20:05
Utrecht, Stadsschouwburg		17:17	17:25	17:32	17:40	17:47	17:55	18:02	18:10	18:17	18:26	18:35	18:45	18:56	19:05	19:22	19:37	19:52		20:07
Utrecht, Oorsprongpark		17:20	17:28	17:35	17:43	17:50	17:58	18:05	18:13	18:20	18:29	18:38	18:48	18:59	19:08	19:25	19:40	19:55		20:10
De Bilt, KNMI		17:24	17:32	17:39	17:47	17:54	18:02	18:09	18:17	18:24	18:33	18:42	18:52	19:03	19:11	19:28	19:43	19:58		20:13
Zeist, Jordanlaan		17:27	17:35	17:42	17:50	17:57	18:05	18:12	18:20	18:27	18:36	18:45	18:55	19:06	19:14	19:31	19:46	20:01		20:16
Zeist, Het Rond		17:35	17:43	17:50	17:58	18:05	18:13	18:20	18:28	18:35	18:44	18:53	19:03	19:14	19:20	19:37	19:52	20:07		20:22
Driebergen, Station Driebergen-Zeist	A	17:42	17:50	17:57	18:05	18:12	18:20	18:27	18:35	18:42	18:51	19:00	19:10	19:21	19:27	19:44	19:59	20:14		20:29
Driebergen, Station Driebergen-Zeist	V		17:52		18:07		18:22		18:37		18:53				19:29		20:01			20:31
Driebergen, Traaij			17:57		18:12		18:27		18:42		18:58				19:33		20:05			20:35
Driebergen, Akkerweg			17:59		18:14		18:29		18:44		19:00				19:35		20:07			20:37
Doorn, Woestduinlaan Zuid			18:04		18:19		18:34		18:49		19:05				19:40		20:12			20:42
Doorn, Centrum			18:11		18:24		18:39		18:54		19:10				19:44		20:16			20:46
Leersum, Donderberg			18:18		18:30		18:45		19:00		19:16				19:49		20:21			20:51
Leersum, Halfeiken			18:21		18:32		18:47		19:02		19:18				19:51		20:23		20:25	20:53
Amerongen, Dorp			18:25		18:36		18:51		19:06		19:22				19:55		20:27		20:29	20:57
Elst, De Molen			18:28		18:39		18:54		19:09		19:25				19:58		20:30		20:32	21:00
Elst, Franseweg			18:32						19:13										20:35	1
Veenendaal, Bergweg			18:37						19:18										20:40	
Veenendaal, Stat. Centrum/Kerkew.			18:40		1				19:21		1				1				20:43	1
De Klomp, Stat. V'daal-de Klomp			18:51						19:31										20:51	
Rhenen, Tasveld					18:46		19:01				19:32				20:04		20:36			21:06
Rhenen, Station/Tuinlaan					18:54		19:09				19:40				20:12		20:44			21:14
Rhenen, Ouwehands Dierenpark					18:55		19:10				19:41				20:13		20:45			21:15
Nageningen, Nudenoord					19:00		19:15				19:46				20:18		20:50			21:20
Wageningen, Busstation	Α				19:04		19:19				19:50				20:22		20:54			21:24

U = Deze rit wordt uitgevoerd door U-OV.

Figure 3.3.3.1. Line 50 U-link from Utrechts Central Station to Wageningen/Veenendaal
maandag	t/m	vrijdag	
---------	-----	---------	--

58

van Hilversum naar D'bergen-Zeist via Bilthoven/Maartensdijk

Syntus Utrecht

Opmerking:													
Hilversum, Station V	7:11	8:11	9:11	10:11	11:11	12:11	13:11	14:11	15:11	16:11	17:11	18:11	19:22
Hilversum, Utrechtseweg	7:16	8:16	9:15	10:15	11:15	12:15	13:15	14:15	15:16	16:16	17:16	18:15	19:26
Hollandsche Rading, Vuurse Dreef	7:22	8:22	9:21	10:21	11:21	12:21	13:21	14:21	15:22	16:22	17:22	18:21	19:32
Maartensdijk, Rotonde	7:26	8:26	9:24	10:24	11:24	12:25	13:25	14:25	15:26	16:26	17:26	18:24	19:35
Maartensdijk, Fazantlaan	7:30	8:30	9:28	10:28	11:28	12:29	13:29	14:29	15:30	16:30	17:30	18:28	19:39
Maartensdijk, Koningin Julianalaan	7:32	8:32	9:30	10:30	11:30	12:31	13:31	14:31	15:32	16:32	17:32	18:30	19:41
Bilthoven, Albert Cuyplaan	7:38	8:38	9:36	10:36	11:36	12:37	13:37	14:37	15:38	16:38	17:38	18:36	19:47
Bilthoven, Station	7:43	8:43	9:39	10:39	11:39	12:41	13:41	14:41	15:42	16:42	17:42	18:39	19:50
Bilthoven, Zonneplein	7:50	8:50	9:45	10:45	11:45	12:48	13:48	14:48	15:49	16:49	17:49	18:45	19:56
De Bilt, KNMI	7:57	8:57	9:51	10:51	11:51	12:54	13:54	14:54	15:56	16:56	17:56	18:51	20:02
Zeist, Jordanlaan	8:00	9:00	9:54	10:54	11:54	12:57	13:57	14:57	15:59	16:59	17:59	18:54	20:04
Zeist, Busstation	8:14	9:11	10:05	11:05	12:06	13:09	14:09	15:09	16:12	17:12	18:11	19:05	20:15
Zeist, Ziekenhuis	8:18	9:15	10:09	11:09	12:10	13:13	14:13	15:13	16:16	17:16	18:14	19:08	20:18
Zeist, Prinses Mariannelaan	8:22	9:20	10:13	11:13	12:14	13:17	14:17	15:17	16:21	17:21	18:18	19:12	20:22
Driebergen, Station Driebergen-Zeist A	8:30	9:28	10:21	11:21	12:22	13:25	14:25	15:25	16:29	17:29	18:25	19:19	20:29



maandag t/m vrijdag

<b>381</b> van Zeist Busstation naar Driebergen-Z. via Austerlitz														
Opmerking:														
Zeist, Busstation V	6:10	7:10	8:15	9:18	10:18	11:18	12:18	13:18	14:18	15:24	16:30	17:36	18:38	19:36
Zeist, Woudschoten	6:17	7:17	8:22	9:25	10:25	11:25	12:25	13:25	14:25	15:31	16:37	17:43	18:45	19:43
Austerlitz, KNVB Campus	6:19	7:19	8:24	9:27	10:27	11:27	12:27	13:27	14:27	15:33	16:39	17:45	18:46	19:44
Austerlitz, Dorpsplein	6:23	7:23	8:28	9:31	10:31	11:31	12:31	13:31	14:31	15:37	16:43	17:49	18:50	19:48
Driebergen, Bergse Bossen	6:29	7:30	8:35	9:37	10:37	11:37	12:37	13:37	14:38	15:44	16:50	17:56	18:56	19:54
Driebergen, Traaij/Arnhemsebovenweg	6:31	7:33	8:38	9:39	10:39	11:39	12:39	13:39	14:41	15:47	16:53	17:59	18:58	19:56
Driebergen, Station Driebergen-Zeist A	6:40	7:43	8:48	9:48	10:48	11:48	12:48	13:48	14:51	15:57	17:03	18:09	19:07	20:05

Figure 3.3.3.3 Line 381 from Zeist Busstation to Driebergen-Zeist via Austerlitz

# 3.3.3. DATA FROM SURVEY



Figure 3.3.4.1. Mode of transport taken to the park

Figure 3.3.4.1 shows that most people go to the park by car (59%), only 17% go by bike and the smallest percentage by public transport (4%). This proves the need for a change to be made in order to move people away from the use of cars.



Figure 3.3.4.2. The number of visitors coming to the park per distance travelled

*Figure 3.3.4.2.* shows that the largest group of visitors are those who travel only 0-10 km to reach the park (30 out of 69 survey responders), therefore it should be feasible for these to come by public transport/bike.



Figure 3.3.4.3. Reason for travelling by car

Figure 3.3.4.3. shows how most people choose the car because of convenience. Therefore, if public transport was made more convenient, it would be easier to get people to transition to that form of transport.

# 3.4. METHODOLOGY

The methods explained in this section aim to help effectively answer the main research question "In what ways can public transport be improved in the Utrechtse Heuvelrug to motivate visitors to use it?". A literature review, expert interviews, and a survey of the visitors of National Park Utrechtse Heuvelrug were used. The literature review is mostly used for information on sustainable mobility behaviour in general. The expert interviews are used for more specific information about mobility in Utrechtse Heuvelrug

and the survey to gain insight into the perception of the visitors around this issue. Together these results allowed for answering the main research questions. The gathered data is analysed and shaped into results that are used to give advice on improving public transport in Utrechtse Heuvelrug.

# 3.4.1. ANALYTICAL FRAMEWORK

To structure the analysis, the EAST is used as the analytical framework. This framework is shown in *Figure 3.4.1.2*. EAST is an already existing framework that can be applied to behavioural insights. These insights are important to use especially for the sub-research question: how can public transport become more attractive for visitors of the Utrechtse Heuvelrug? If there is knowledge about the motivations of people to use which type of transport, this can be used to make public transport more attractive. The main idea behind this framework is to influence behaviour through making sustainable decisions. These decisions are encouraged because they are Easy, Attractive, Social and Timely (Hodgkins, n.d.). These principles are based on a wide range of academic literature. It is a simple framework that is easy to use for policymakers and practitioners to think about effective behavioural approaches (Service, 2014).



Figure 3.4.1.2. EAST framework (Service, 2014)

In the case of changing behaviours to use sustainable types of transport in the Utrechtse Heuvelrug:

- 1. Make it easy: reducing the burden of taking up sustainable transport modes and simplifying the messages can increase the response rate in communication.
- 2. Make it attractive: attention should be drawn towards sustainable transport modes, for example by making it look appealing and making it personal.
- 3. Make it social: showing that using sustainable transport modes is the desired behaviour that most people acquire. Sustainable transport modes should be embedded in a social network. Governments should enable collective action, provide mutual support and encourage spreading behaviours.
- 4. Make it timely: using sustainable transport modes should be incorporated into routines and habits. It should not take longer to transport in a sustainable way than in a not sustainable way. It should also not be more expensive to use a sustainable type of transport (Service, 2014).

# 3.4.2. DATA COLLECTION AND ANALYSIS

# 3.4.2.1. LITERATURE REVIEW

A literature review offers an overview of what is known about sustainable mobility behaviour. This information is useful in a sense of direction of what is important to focus on in the survey and expert interviews. To acquire relevant literature, terms such as "sustainable mobility behaviour" and "sustainable behaviour change" were entered in Google Scholar. Academic papers were selected on their applicability to the scope of our research.

Grey literature is used to get information on the current availability of public transport in Utrechtse Heuvelrug, such as bus and train departure information and the availability of OV-bikes at the stations.

# 3.4.2.2. EXPERT INTERVIEWS

To get more insight into the availability of public transport in the Utrechtse Heuvelrug and where potential improvements are possible, expert interviews were conducted. These provided qualitative outputs while allowing the interviewees to express their views. Experts from NS, Synthus and TIER were contacted through email, based on the relevance of their expertise. The interviews were through a meeting on Teams or a phone call. An outline with questions was sent to the experts beforehand. The interviews were recorded and transcribed through the tool, Otter. The following experts were interviewed:

- Joost van Heeckeren: Stationmanager of a few NS stations in the Randstad;
- Angelique van Gasteren: Format Marketeer OV-bikes;
- Nils Verkennis: TIER Senior Public Policy Manager Benelux;
- David Eerdmans: Province of Utrecht;
- Ed van der Zee: Transport Officer Syntus.

The transcription and/or notes from these interviews can be found in Appendix D, E, F, G and H. Through the interviews, insights are gained about the possibilities regarding public transport in the area and to what extent NS, Synthus and TIER can contribute to this. NS is asked about the possibilities for OV-bikes in and around the Utrechtse Heuvelrug. The data from interviews do not require a specific data analysis method, but the information gained from these interviews will be interpreted by ourselves.

# 3.4.2.3. SURVEY

The best method to gain information about the current habits of the visitors regarding their travel behaviour is through a survey. Therefore, a physical survey was conducted on Thursday 17th of March 2022. On this day, visitors were approached and, when agreed, questioned. The survey was also published in a newspaper at the Utrechtse Heuvelrug site. Hereby, 20 more responses were received. The survey was produced using the tool Qualtrics (see the template in appendix A: Visitor Survey). During the questioning, the answers were put in Qualtrics manually. On this day, 69 responses were obtained.

The survey is used to gain quantitative data on how the visitors travel to National Park Utrechtse Heuvelrug and qualitative data to gain insights into their motivation behind choosing this type of transport. Since the survey is shared with the car mobility section, not all information from the survey is valuable to us. The information that is used in the general section is from the following questions: "What mode(s) of transport did you use to travel to the park?" and "Where did you travel from?". These questions provide information about the frequency of usage of bikes and public transport in the area. From the car section, the questions "If you would choose a different mode of transport, which transport would that be?", "What was the main reason why you did not choose to go by public transport" and "What was the reason why you did not choose to go by bike?". With this information, barriers on choosing public transport and bikes by visitors are obtained. From the bike and public transport sections, output from all questions was used. With this information, opinions and suggestions of the visitors on bikes and public transport in the area were obtained. An overview of the results was analysed by ourselves to be able to draw conclusions.

# 4. BIBLIOGRAPHY

# SCIENTIFIC SOURCES

- 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.
- Assaeed, A. M., Al-Rowaily, S. L., El-Bana, M. I., Abood, A. A., Dar, B. A., & Hegazy, A. K. (2019). Impact of off-road vehicles on soil and vegetation in a desert rangeland in Saudi Arabia. *Saudi Journal of Biological Sciences*, *26*(6), 1187–1193. https://doi.org/10.1016/j.sjbs.2018.05.001
- Beunen, R., Jaarsma, C. F., & Regnerus, H. D. (2006). Evaluating the effects of parking policy measures in nature areas. *Journal of Transport Geography*, 14(5), 376–383. https://doi.org/10.1016/j.jtrangeo.2005.10.002
- 4. Blok, K., & Nieuwlaar, E. (2018). Introduction to Energy Analysis. London: Routledge.
- 5. Coskun, A., Zimmerman, J., & Erbug, C. (2015). Promoting sustainability through behavior change: A review. Design Studies, 41, 183-204.
- Daigle, J. J., & Zimmerman, C. A. (2004). The Convergence of Transportation, Information Technology, and Visitor Experience at Acadia National Park. *Journal of Travel Research*, 43(2), 151–160. https://doi.org/10.1177/0047287504268239
- Druckman, A., & Jackson, T. (2009). The carbon footprint of UK households 1990–2004: a socio-economically disaggregated, quasi-multi-regional input– output model. Ecological economics, 68(7), 2066-2077.
- EI-Fadel, M., & Sbayti, H. (2001). Parking Facilities in Urban Areas: Air and Noise Impacts. *Journal of Urban Planning and Development*, 127(1), 16–33. https://doi.org/10.1061/(asce)0733-9488(2001)127:1(16)
- 9. Gallo, M., & Marinelli, M. (2020). Sustainable mobility: A review of possible actions and policies. Sustainability, 12(18), 7499.
- 10.IEA (2021), Global EV Outlook 2021, IEA, Paris https://www.iea.org/reports/global-ev-outlook-2021

- 11. Issaka, S., & Ashraf, M. A. (2017). Impact of soil erosion and degradation on water quality: a review. *Geology, Ecology, and Landscapes*, 1(1), 1–11. https://doi.org/10.1080/24749508.2017.1301053
- 12.Kelley, K. (2003). Good practice in the conduct and reporting of survey research. International Journal for Quality in Health Care, 15(3), 261–266. https://doi.org/10.1093/intqhc/mzg031
- 13. Kim, J., Fujii, S., & Lee, B. (2013). Strategies to promote sustainable mobility management incorporating heterogeneity. International journal of sustainable transportation, 7(2), 107-124.
- 14. Leigh, D. (2010). SWOT analysis. Handbook of Improving Performance in the Workplace: Volumes 1–3, 115–140. https://doi.org/10.1002/9780470592663.ch24
- 15.Luiu, C., Tight, M., & Burrow, M. (2018). Factors Preventing the Use of Alternative Transport Modes to the Car in Later Life. Sustainability, 10(6), 1982. https://doi.org/10.3390/su10061982
- 16. Murtagh, N., Gatersleben, B., & Uzzell, D. (2012). Self-identity threat and resistance to change: Evidence from regular travel behaviour. Journal of Environmental Psychology, 32(4), 318–326. https://doi.org/10.1016/j.jenvp.2012.05.008
- 17. Nakagami, H., Murakoshi, C., & Iwafune, Y. (2008). International comparison of household energy consumption and its indicator. ACEEE.
- 18. Nawaz, M. F., Bourrie, G., & Trolard, F. (2013). Soil compaction impact and modelling. A review. *Agronomy for sustainable development*, *33*(2), 291-309.
- Park, L. O., Manning, R. E., Marion, J. L., Lawson, S. R., & Jacobi, C. (2008). Managing visitor impacts in parks: A multi-method study of the effectiveness of alternative management practices. *Journal of Park & Recreation Administration*, 26(1).
- 20. Pelkmans, L., De Keukeleere, D., & Lenaers, G. (2001) Emissions and fuel consumption of natural gas powered city buses versus diesel buses in real-city traffic. https://www.witpress.com/Secure/elibrary/papers/UT01/UT01061FU.pdf
- 21. Ratta, R., & Lal, R. (Eds.). (1998). Soil quality and soil erosion. CRC press.
- 22.Shaw, P., & Reeve, N. (2007). Influence of a parking area on soils and vegetation in an urban nature reserve. Urban Ecosystems, 11(1), 107–120. https://doi.org/10.1007/s11252-007-0044-5

- 23. Sthiannopkao, S., Takizawa, S., & Wirojanagud, W. (2006). Effects of soil erosion on water quality and water uses in the upper Phong watershed. *Water Science and Technology*, *53*(2), 45-52.
- Strahilevitz, M. (1999). The Effects of Product Type and Donation Magnitude on Willingness to Pay More for a Charity-Linked Brand. *Journal of Consumer Psychology*, 8(3), 215–241. https://doi.org/10.1207/s15327663jcp0803\_02
- 25.Webb, R. H., Ragland, H. C., Godwin, W. H., & Jenkins, O. (1978).
  Environmental effects of soil property changes with off-road vehicle use. *Environmental Management*, 2(3), 219–233.
  https://doi.org/10.1007/bf01866550
- 26. Westcott, F., & Andrew, M. E. (2015). Spatial and environmental patterns of offroad vehicle recreation in a semi-arid woodland. *Applied Geography*, 62, 97– 106. https://doi.org/10.1016/j.apgeog.2015.04.011

# **GREY LITERATURE**

- BEIS. (2019). Greenhouse gas reporting: conversion factors 2019. Gov.UK. https://www.gov.uk/government/publications/greenhouse-gas-reportingconversion-factors-2019
- Bureau voor Ruimte & Vrije Tijd. (2020, Oktober). Lusten en lasten in tijden van corona: Quick scan bezoekersdrukte in recreatie- en natuurgebieden in Noord-Holland.
- Cheney, J. (2021, February 6). *Hiking the Beautiful Trails at Nolde Forest Environmental Education Center*. Uncovering PA. https://uncoveringpa.com/nolde-forest
- CO<sub>2</sub> emissiefactoren. (2022, 14 February). *Lijst emissiefactoren*. Conducted on Maart 3rd 2022, from https://www.co2emissiefactoren.nl/lijst-emissiefactoren/ Dodson, J., Mees, P., Stone, J., & Burke, M. (2011). The Principles of Public Transport Network Planning: A review of the emerging literature with select examples.
- Crow (2018). CO2-footprint per reizigerskilometer. https://www.crow.nl/staatvan-het-ov/jaargangen/2018/reizigers/co2-footprint-perreizigerskilometer/2018
- 6. Dekrie (n.d.). Bezine, LPG-3 en diesel: de verschillen https://dekrie.nl/wanneeris-diesel-rijden-

interessant#:~:text=Een%20moderne%20diesel%20verbruikt%201,10.000%2 0a%2015.000km%20ligt.

- 7. EPA. (2016). Importance of Methane. *United states environmental protection agency*. https://www.epa.gov/gmi/importance-methane
- Glaap, J. (2020). Drukte in bossen blijft ondanks brandbfief natuurbeheerders. Rtvutrecht.

https://www.rtvutrecht.nl/nieuws/2108156/drukte-in-bossen-blijft-ondanksbrandbrief-natuurbeheerders

- 1. Green Vehicle Guide. (n.d.). Vehicle emissions | Green Vehicle Guide. https://www.greenvehicleguide.gov.au/pages/Information/VehicleEmissions
- Heemsbergen, J. (n.d.). 4\_sustainable\_visitor\_mobility\_UH\_DEF [Class handout]. Blackboard, Utrecht University.
- Higham, J., Cohen, S. A., Peeters, P., & Gössling, S. (2013). Psychological and behavioural approaches to understanding and governing sustainable mobility. Journal of Sustainable Tourism, 21(7), 949-967.
- Hodgkins, S. (n.d.). Behaviour change frameworks in practice. The Socialdesk. Conducted on 25 February 2022, from https://www.thesocialdeck.com.au/blog/cbsm-east-behavioural-changeframeworks-in-practice
- 5. IEA. (2020). The Netherlands 2020, energy policy review. *International energy agency*. https://www.iea.org/reports/the-netherlands-2020
- Mind Tools Content Team. (n.d.). SWOT analysis: Strengths, weaknesses, opportunities, threats. Mind Tools. Retrieved February 24, 2022, from https://www.mindtools.com/pages/article/newTMC\_05.htm
- 7. Nationaal Park Utrechtse Heuvelrug. (2022, January 13). Nationaal Park Utrechtse Heuvelrug. https://www.np-utrechtseheuvelrug.nl
- Nationaal Park Utrechtse Heuvelrug. (2021, 21 December). Samenwerkingsagenda. Conducted on 25 February 2022, from https://www.nputrechtseheuvelrug.nl/activiteiten/over-npuh/het-gebied/
- NBTC (2019). Bezoekersonderzoek recreatiegebieden provincie Utrecht 2019. https://www.provincie-utrecht.nl/sites/default/files/2020-07/Bezoekersonderzoek%20Recreatiegebieden%20provincie%20Utrecht%20 2019.pdf

10.n.d. (2014). Wat kost een auto rijden op benzine. https://watkosteenauto.nl/watkost-een-auto-opbenzine/#:~:text=Een%20gemiddelde%20benzineauto%20rijdt%20ongeveer,z

o'n%201%20op%2011.

- 11.Nederland Elektrisch. (2021, 31 december). Nederland Elektrisch Cijfers en statistieken EV's in Nederland. Geraadpleegd op 23 maart 2022, van https://nederlandelektrisch.nl/actueel/verkoopcijfers
- 12.NS (n.d.) Fossielvrij ondernemen. https://www.ns.nl/overns/duurzaamheid/fossielvrij
- 13. POPs Toolkit. (n.d.). Factors influencing the policy process persistent organic pollutants (POPs) toolkit. Retrieved February 27, 2022, from http://www.popstoolkit.com/riskmanagement/module/step4/policyprocess/influ ences.aspx
- 14. Regional Bureau for Tourism Heuvelrug & Vallei. (2022). Met het OV naar de Heuvelrug. Ontdek wat de Heuvelrug met je doet. Conducted on 24 February 2022, from https://www.opdeheuvelrug.nl/plan-je-bezoek/hoe-kom-ik-er/methet-openbaar-vervoer
- 15. Redactie. (2021, 29 September). TIER lanceert elektrische deelfietsen en deelscooters in. Utrecht. Conducted on March 24 2022, from https://utrecht.nieuws.nl/stadsnieuws/79681/tier-lanceert-elektrischedeelfietsen-en-deelscooters-in-utrecht/
- 16.Remix. (2021, 25 January). 8 Benefits of Public Transportation. Remix Blog. Conducted on 24 February 2022, from https://www.remix.com/blog/8-benefitsof-public-transportation
- 17. SaveMyBike. (2018, November 5). Home page. https://www.savemybike.eu/en/
- 18. Synthus Utrecht. (2021, December). Heuvelrug Streeklijnen. https://www.syntusutrecht.nl/getattachment/Reisinformatie/Dienstregeling/KE O-21-0360-Lijnfolder-Utrecht-2022-Heuvelrug-Digi\_V2.pdf?lang=nl-nl
- 19. SWOT analysis diagram. (2007). [Illustration]. https://commons.wikimedia.org/wiki/File:SWOT\_en.svg
- 20. Toyota (n.d.) Verbruik hybride auto's; hoe zuinig zijn hybride autos. https://www.toyota.nl/hybride/verbruik.json

- 21.van Unen, B. (2020). Extreem druk in de bossen op de Utrechtse Heuvelrug:
  'Dit is gewoon code rood.' AD.nl. https://www.ad.nl/utrecht/extreem-druk-in-de-bossen-op-de-utrechtse-heuvelrug-dit-is-gewoon-code-rood~a514c6cf/
- 22. Vattenfall (2021). Hoeveel verbruikt een elektrische auto. https://incharge.vattenfall.nl/elektrische-auto/hoeveel-verbruikt-eenelektrische-

auto#:~:text=De%20meeste%20elektrische%20auto's%20verbruiken,rijdt%2C %201.500%20kWh%20per%20jaar.

# **5. APPENDICES**

# **APPENDIX A: VISITOR SURVEY**



# Mobility to Nationaal Park Utrechtse Heuvelrug

We are a group of students conducting research on mobility in the National Park Utrechtse Heuvelrug. This study is in collaboration with Utrecht University and Stichting National Park Utrechtse Heuvelrug. Your input will be used to improve mobility options in this area! The survey will only take around 6 minutes. Thanks in advance!

\* = Invoer verplicht





# Mobility to Nationaal Park Utrechtse Heuvelrug

I have been well informed by the students conducting this research about the aim and purpose of this study. I know that participation is voluntary and that I have the option to decide to stop with the survey at any given time, without giving a reason. This survey is completely anonymous. I give consent for the usage of my answers for answering the research questions in this study and understand that this information will be used confidential. \*

\* = Invoer verplicht

<< TERUG VERDER >> VERZENDEN





# Mobility to Nationaal Park Utrechtse Heuvelrug

IF YOU TRAVELLED BY BIKE, please answer these questions If you did not travel by bike, <u>please skip to the next page</u>

What kind of bike did you travel with?	General bike (your own bike) Electric bike OV-bike Other bike-sharing services, namely:
Why did you choose to travel by bike?	
Would you travel by bike again?	Yes No
Could you please elaborate on your previous response? (Why yes, or why no?)	
* = Invoer verplicht	
<< TERUG	VERDER >> VERZENDEN



# Mobility to Nationaal Park Utrechtse Heuvelrug

IF YOU TRAVELLED BY CAR, please answer these questions If you did not travel by car, please skip to the next page

What type of fuel does your car run on?	Gasoline LPG (Gas) Diesel Electricity Hybrid Other:
How many people were in your car during your drive to the park (including yourself)?	1 \$
What were the reasons you chose to travel by car to the park? (you can tick multiple)	Cost Convenience Time Environmental impact Other:

Why did you choose to	
park where you did?	
If the Utrechtse Heuvelrug were to introduce paid parking, how much would you be willing to pay per hour maximum?	1 euro 2 euros 3 euros 4 euros 5 euros 6 euros Other:
What impact would the introduction of paid parking have for you, in terms of visiting the Utrechtse Heuvelrug?	<ul> <li>Nothing would change</li> <li>I would choose a different means of transportation to the park</li> <li>I would go to a different park</li> <li>Other:</li> </ul>
If you would choose a different mode of transport, which transport would that be?	<ul> <li>Private bike</li> <li>Shared bike service</li> <li>Bus</li> <li>Train</li> <li>Other:</li> </ul>
What was the main reason why you did not choose to go by public transport?	
What was the main reason why you did not choose to go by bike?	
* = Invoer verplicht	
	<< TERUG VERDER >> VERZENDEN



# Mobility to Nationaal Park Utrechtse Heuvelrug

IF YOU TRAVELLED BY PUBLIC TRANSPORT, please answer these questions If you did not travel by public transport, <u>please skip to the next page</u>

What type(s) of public transport did you use for your travels? ( <i>you can</i> <i>tick multiple</i> )	Train Bus OV-bike Other:
Why did you choose this type of transport? (you can tick multiple)	It is a sustainable type of transport         It is a fast type of transport         It is a cheap type of transport         It is a social type of transport         It is an attractive type of transport         Other:
Would you consider this a nice journey?	Yes No I do not know
lf yes, what was nice about it? <i>(you can tick multiple)</i>	It was quick         It was easy to use         I used it because other people use it         It was comfortable         Other:
lf no, what was not nice about it? ( <i>you can tick multiple)</i>	<ul> <li>It took very long to get here</li> <li>It was complex and difficult to figure out how to get here</li> <li>It was not a comfortable journey</li> <li>Other:</li> </ul>
lf it was not comfortable, could you elaborate on why you thought so?	A
Did you come across difficulties during your journey? ( <i>you can tick multiple</i> )	<ul> <li>Bus was delayed</li> <li>Train was delayed</li> <li>I couldn't find the bus stop (please note which bus stop this was in "other")</li> <li>Other:</li> </ul>
Would you recommend this transport type to others?	<ul> <li>Yes</li> <li>No</li> <li>I do not know</li> </ul>
Could you please elaborate on your previous response? (Why yes, or why no?)	

Do you have any other				
suggestions on how to				
improve public transport				
to Utrechtse Heuvelrug,				
that weren't discussed				
during this survey?				
* = Invoer verplicht				
	<< TERUG	VERDER SS	VERZENDEN	



# Mobility to Nationaal Park Utrechtse Heuvelrug

Thank you very much for completing this survey! Your responses are extremely valuable to us.

\* = Invoer verplicht



# **APPENDIX B: ENERGY ANALYSIS**

#### Page 1:

Energy Carrier	Average Energy Content (MJ/kg)	Average Energy Content (MJ/litre)	Average Energy Content (MJ/m^3)	Average Energy Content (MJ/kwh)
Hard Coal	26.5	-	-	-
Brown Coal	13.5	-	-	-
Aviation Turbine Fuel	43.9			
Crude Oil	43	-	-	-
LPG, Ethane	46.5	-	-	-
Gasoline	44.8	33	-	-
Diesel	43.4	36	-	-
Heavy Fuel Oil	40.2	-	-	-
Natural Gas	-	-	33.5	-
Wood Pellets	17	-	-	-
Methanol	19.9	15.7	-	-
Ethanol	26.8	21.2	-	-
Electricity	-	-	-	3.6
Hot water (90 C)	0.34	-	-	-
Steam for Heating	2.05	-	-	-
NUTRE Plak K & N	liaundaan E (004		ation to En	a many Amadynaia C

Source: Blok, K., & Nieuwlaar, E. (2018). Introduction to Energy Analysis Second Edition. London: Routledge.

# Page 2:

Fuel Type	Emission Factor (kg CO2/GJ)	Substance	Molar Mass (kg/kmol)	GWP100 (kg CO2 eq/kg)	
Bituminous Coal	95	Carbon Dioxide	44	1	
Lignite	101	Methane	16	28	
Peat	106	Nitrous Oxide	44	265	
Crude Oil	73	HFC-134a	102	1300	
Motor Gasoline	69	PFCs (CF4)	88	6630	
Jet Gasoline	70	PFCs (C2F6)	138	9200	
Jet kerosene	72	Sulphur Hexafluoride	146	23500	
Diesel Fuel	74				
Residual Fuel Oil	77				
LPG	63				
Natural Gas	56				

Source: Blok, K., & Nieuwlaar, E. (2018). Introduction to Energy Analysis Second Edition. London: Routledge.

#### Page 3:

1st Order ERE (MJ)	2nd Order ERE (MJ)	Fuel Consumption (MJ/km)	Emissions (1000x tons C02 eq)	Emissions (kg C02 eq/ km)		
100620104	112694516	2.64	7775922	0.182		
7890852	9784656	2.18	704495	0.157		
736489	854560	0.38	55136	0.025		For graph
8896935	9964568	2.22	687555	0.153		11.240
16125190	19995236	1.64	1479647	0.121		6.250
5850409	7254507	0.60	536834	0.044		17.489
140119979		1.61	11	0.114		
218032997.6	249819984.8	1.61	17.48930697	0.114		
Data from survey						
Number of participants	88			Total distance	difference max/m	in
Gasoline car	38			66423387	0.556045032	
Diesel car	4			6991935	0.556045032	
Electric car	2			3495968	0.556045032	
Hybrid car	4			6991935	0.556045032	
By public transport (LNG bus)	7	Assumption half of travels uses	LNG	18965625	0.556045032	
By public transport (Diesel bus)	7	Assumption half of travels uses	Diesel	18965625	0.556045032	
Average amount of people per car	1.55	* based on the average per car	at the 69 physica	I surveys at the park		
Distance traveled	22.7	28.9	* based on the a	verage per car at the	69 physical surve	ys at the park
nauto.nl/wat-kost-een-auto-op-benzine/#:~:text=Een%	620gemiddelde%20benzineauto%20rijdt%20ongeveer,	zo'n%201%20op%2011.				
wanneer-is-diesel-rijden-interessant#:~:text=Een%20r	moderne%20diesel%20verbruikt%201,10.000%20a%2	2015.000km%20ligt.				
vattenfall.nl/elektrische-auto/hoeveel-verbruikt-een-ele	ktrische-auto#:~:text=De%20meeste%20elektrische%	20auto's%20verbruiken,rijdt%20	%201.500%20kV	Vh%20per%20jaar.		
s://www.toyota.nl/hybride/verbruik.json						

Da	2	$\sim$	Λ	•
гα	y	C	4	•

Transport Mode	Distance Travelled (km)	Amount of Fuel Used (L/kWh)	1st Order ERE (MJ)	2nd Order ERE (MJ)	Fuel Consumption (MJ/km)	Emissions (1000x tons C02 eq)	Emissions (kg C02 eq/ km)
Gasoline car	24900934.75	1778638.2	58695060	65738468	2.64	4535954	0.182
Diesel car	2621151.026	127861.0	4602997	5707716	2.18	410956	0.157
Electric car	1310575.513	68977.7	429619	498493	0.38	32163	0.025
Hybrid car	2621151.026	157269.1	5189879	5812665	2.22	401074	0.153
Public transport (LNG bus)**	12262582.48	450649.9	16223397	20117012	1.64	1488659	0.121
Public transport (diesel train)	12262582.48	163501.1	5886040	7298689	0.60	540103	0.044
Total (minimum)	55978977.27	2746896.9	91026991	105173043	1.61	7	0.114
Total (maximum)	87105809.47	4274295.349	141642097.5	163653990.5	1.61	11.52859502	0.114
			-				
		Data from survey	Euros				
Payment trashold (euros)			5				
5		Percentage of people going to other mode of transport	0.416666667				
		Of which non-emisive modes	0.25				
		Of which by public transport	0.0625				
		Percentage of people not going at all	0.229166667				
Euros	1	2	3	4	5	6	
Percentage of people going to							
another mode of transport	0.229166667	0.354166667	0.395833333	0.416666667	0.416666667	0.416666667	
Towards non-emissive modes	0.125	0.208333333	0.25	0.25	0.25	0.25	
Towards public transport	0	0.041666667	0.0625	0.0625	0.0625	0.0625	
not at all	0.166666667	0.208333333	0.208333333	0.229166667	0.229166667	0.229166667	
Euros	1	2	3	4	5	6	
another mode of transport	11	17	19	20	20	20	
Towards non-emissive modes	6	10	12	12	12	12	
Towards public transport	0	2	3	3	3	3	
not at all	8	10	10	11	11	11	

# APPENDIX C: DATA COLLECTION ON MAP INFORMATION

1. Groene Entrees: (https://www.visitheuvelrug.com/plan-your-visit/how-to-get-here/by-car/greenentrance)



- 1. TOPs (<u>https://www.routesinutrecht.nl/route-informatie/toeristisch-overstappunt-top?search=3941EP&sort=&order=desc</u>)
- TOPs searching by the postal code of Nationaal Park Utrechtse Heuvelrug:

<b>Q</b> 3941EP	
2 resultaten	Meest relevant 🗸 🗸

TOP HUIS DOORN

TOP NATIONAAL BOMENMUSEUM GIMBORN

• Velperengh 13

Langbroekerweg 10
 3941 MT Doorn

Since it is not possible to find out all the parking information by searching by the postal code, it may lead to overload of certain parking lots.

• TOPs around the park (GR = groene entree):



- 1: TOP Slot Zeist, Zinzendorflaan 1, 3703 CE Zeist
- 2: TOP't Jagershuys, Jagersingel 15, 3707 HW Zeist
- 3: TOP Station Driebergen-Zeist, 3972 NG Driebergen Rijsenburg
- 4: TOP Beauforthuis, Woudenbergseweg 70, 3711 AB Austerlitz
- 5: TOP Bergse Bossen, Traaij 299, 3971 GM Driebergen
- 6: TOP Nationaal Bomenmuseum Gimborn, Velperengh 13, 3941 BZ Doorn
- 7: TOP Huis Doorn, Langbroekerweg 10, 3941 MT Doorn
- 8: TOP Amerongen, Burgwal 6, 3958 ER Amerongen
- 9: TOP Rhenen Centrum, Kerkstraat 1, 3911 LD Rhenen

# APPENDIX D: INTERVIEW ANGELIQUE VAN GASTEREN (NS)

#### Student

Maybe I can just introduce us a bit. So we are a group of students from University and we are doing a research on sustainable mobility in the area of Utrechtse Heuvelrug. And we've already talked to Joost van Hekelen about ov bikes and the capacity of it in the stations near Utrechtse Heuvelrug and we just have some more specific questions that he couldn't answer. So that's why he gave us your information. And that's mostly about the advertisement of ov bikes.

Angelique van Gasteren

What do you want to know about? advertisement?

Student

Yeah, just do you do a lot of advertisement on ov bikes in general and then also specific in the area of the utrechtse heuvelrug?

#### Angelique van Gasteren

No, we only do that in general. Through campaigns. We've divided it. I work with ns stations, but we are responsible for the format of ov bikes and then we have NS reizigers and they are responsible for the marketing of OV fiets and OV fiets are everywhere in all campaigns of NS but always national. It's on TV, on the radio and online. But it's always a door to door campaign. So if it is a piece of a door to door campaign.

Student

What is a door to door campaign?

#### Angelique van Gasteren

People decide at home if they want to take the car or that they will use OV. So you have to make sure that there is an opportunity to park your car at the station and park your bike at the station. And also when they arrive at the station where they want to go to, then they use ov fiets or taxis or buses to go to their destination. So it's not only the trains that people are interested in, they want to travel from door to door, from the door from their house to the door of their destination. Do you understand?

#### Student

Yes. We're also curious to hear about what you do specifically in your role. So if you would like to introduce yourself a bit as well, we would love to hear.

#### Angelique van Gasteren

Okay. Yes. We have the NS trains and the train stations. I work with the ns stations. We are responsible for the formats and one of the formats is ov fiets but we also have the format guided cycling of the bikes, so to make sure that people have enough space to park their bike near the station or their car. And for Ov fiets we didn't have to do a lot of campaigns or publicity because during the years we got a lot of fans and our challenge for OV fiets is especially if we have enough bikes. So that's the difference between OV fiets and the other bicycles you can rent. Ov fiets is only near the station

and you can not find it somewhere in the city. So you have to travel from the station to your appointment or what you want to do and then back to the station and the other bicycles you can rent in the city for just the city itself. That's the difference between OV fiets and the other bikes you can rent.

#### Student

and if you want to return a bike in another station you have to pay a fee right?

#### Angelique van Gasteren

Yeah it is possible to leave a OV fiets at another station and then you have to pay 10 euros. Because it's very expensive for us because we have to transport all the bikes back to the other station again. It's very expensive and it's therefore that we ask people to pay 10 euros to discourage it a little bit.

#### Student

Yeah, thank you for your answer.

#### Student

We were also wondering, in your marketing do you have a specific focus group?

#### Angelique van Gasteren

Yeah, we do. The people that use it the most we call the social recreational traveller. So the people that are travelling by train to a nice city, and then decide to rent an ov fiets. So it's not it's not business, that's a small part. The biggest part is the social recreational traveller.

#### Student

Could you explain to us a bit more, like the word social creative, what does that mean in practice?

#### Angelique van Gasteren

These are all the people that use the train to go out to have a nice day, mostly older people, friends that are going to a city trip or older people that go biking in another town or they go to the beach etc. People who use the ov bike for the last part. So it's not business. It's not always work or an appointment with a customer. That happens but it is not the biggest group.

#### Student

This surprises me because I would have thought that there were a lot of commuters using this type of bike.

#### Angelique van Gasteren

No, the most are the social recreative.

# Student

Okay, thank you, that's really interesting.

#### Angelique van Gasteren

But it also happens for business. It's not that it's not used by business people. But that group is not as big as the social recreation.

Student Okay, okay, thanks.

#### Student

And in your marketing of the bikes, do you have any specific focus points on how to motivate people to use OV bikes? Like, characteristics or like how to convince them.

#### Angelique van Gasteren

Yeah, you mean the positionering of OV fiets. Yeah it is also that it is healthy, it's nice. Also, always happy people are portrayed. We want to want to carry out that it's nice to rent a OV bike

#### Student

and Do you also mention the environmental benefits of it?

#### Angelique van Gasteren

Not yet but that's what we want to do. It's difficult but what we want is that in the NS app you can see 'oh i cycled 5 kilometres, so that is a co2 reduction percentage of 10% and calories 500. That's what I really like, and that's what I mentioned for the future to focus on. That will take a little time because all the systems have to be made for it, all the technical, the IT things we need and background we have to prepare for this.

#### Student

If I'm correct, if you rent an OV bike, you hire it for like 24 hours or you pay for 24 hours at least. For specific our project. It's about people who go to the Utrechtse Heuvelrug so mostly to like, walk there so they never go there longer than maybe half a day or a day but it's like never 24 hours. So would you consider making it a possibility to also pay for like 12 hours or per hour.

#### Angelique van Gasteren

No net yet. If you have ever rented another bike in the city, you will see that it's very expensive, you pay two euros for one hour. So you think, oh that's not so much. But when you use it for hours you pay something like 10 euros or so. For ov fiets we want to make the costs very low. So we chose to have only one proposition, 24 hours. So you don't have to mind, 'oh it's now been three hours, have to go back because otherwise I need to pay more'. You feel more free, it doesn't matter you have 24 hours so you have all the time you need for the same tariff. But that's our choice and it works because ov fiets is very popular. You have a fixed price. So yeah, I think it's positive because you know what you have to pay. There are no surprises afterwards.

#### Student

I think maybe our last question would be if you measure the success of your campaigns?

#### Angelique van Gasteren

Yeah, we do, NS does. I'm not the one that makes the campaigns that are NS reizigers, do you need figures or?

# Student

No, we're just wondering if it has been successful now or if you have seen more people using it.

#### Angelique van Gasteren

Yes OV fiets contribute to the fact that people use the train more. So it's not that we want to earn money with OV fiets. That's not our purpose. Our purpose is that more people use the train. So everything we do most contributes to the goal of getting more travellers to use the train. So there is not a lot of profit, it is not like we want to make our OV bikes really expensive, that is not the goal, we want more people to use the train.

Student

Yeah, yeah. Okay.

#### Unknown Speaker 15:04

One last question, you mentioned that you don't like specific campaigns, but you only do like general campaigns or national campaigns. Do you think that the company would like to consider doing more specific campaigns once in a while, or is that not part of your strategy or protocol?

#### Angelique van Gasteren

What we do, we have a site called 'dagje uit or spoorwinkel' and there is a combination, so train with OV fiest and something to eat, so in that way we can also do the Utrechtse Heuvelrug, dagje uit in the Utrechtse Heuvelrug.

Student

Okay, yeah, that's a good idea.

#### Student

And how would it be possible to start this type of process? Like, where does the demand need to start? If you know what I mean

Angelique van Gasteren

If you want to promote the Utrechtse Heuvelrug, you mean?

Student Yes, exactly.

Angelique van Gasteren So you want to use NS to promote the Utrechtse Heuvelrug?

#### Student

At the moment, basically everyone goes to the Utrechtse Heuvelrug by car because it's the simplest way. But what we want to try and improve is for people to take public transport because it's better for the environment. But at the moment there are very few OV bikes at the stations around the Utrechtse Heuvelrug and people just don't seem to use them because they don't see this as a fast way to get to the park.

#### Student

And therefore they also use the train less. So I also feel like that point the scope, also of such campaigns will be aligned with our scope like to just make people use the train more.

#### Angelique van Gasteren

And you already checked the bank, vvv website page, all the touristic pages. For the Utrechtse Heuvelrug you can mention that it is possible to go by train and OV bike.

#### Student

Yeah, we checked and it mentions the train but not OV bikes for the most part. Like it mentioned, a combination of trains and buses.

Angelique van Gasteren I have to check what stations at the Utrechtse Heuvelrug have OV bikes, I don't know.

#### Student

We have Driebergen-Zeist, there's a lot of OV bikes but for example, Dorn or Rhenen, which are also near the park they have, like it says on the website they have like two or four bikes or something which is not a lot.

Angelique van Gasteren And it's not possible to reserve an OV fiets.

Student We don't know.

Angelique van Gasteren No not that's not possible. No.

Student Do we have any specific questions left?

Student I think that's about it.

Angelique van Gasteren you can always mail me and then I can give you some more information if you have some more questions afterwards.

Student Yeah, that would be great.

Student Yeah. Thank you so much.

Student I think this has already been very helpful. Angelique van Gasteren

Then I have more time to think how to translate. I speak english but not during my work.

Student Yeah, you did great. Thank you so much.

Angelique van Gasteren Success. If you still have questions mail me and I will try to answer them

Student Great. Thank you so much. Have a great day.

# APPENDIX E: INTERVIEW JOOST VAN HEECKEREN (NS)

Transcription of Interview with Joost van Heeckeren, conducted on Tuesday, March 22

Duration: 24:28

Keywords: OV-bikes, stations, train travellers, NS, Utrecht

Interviewers: Ilse, Gaia, Lia Interviewee: Joost van Heeckeren

# Students:

We are a group of students from Utrecht University, and we are conducting research on sustainable mobility in the area of Utrechtse Heuvelrug and we want to know how people access the park and how they travel there. And yeah, and we are looking into how public transport can be improved and made more accessible for people to use it more than going by car to the area. So, yeah, that's what we're doing. Any additions or? Yeah, so maybe you can introduce yourself a bit more and explain your position at NS.

# Joost:

Yes, well, nice to meet you. My name is Joost van Heeckeren. And I am a station manager with NS stations and short explaining the NS is as separate parts and you have the operation and operation is the trains and people on the train who drive train and check the tickets. Separate from that we have the NS stations, and we are from the buildings and the shops. How do you say I'm sorry, I'm not perfect English, but the grounds around stations, we own this and do some of the exploitation in commerce? Besides this, you have the organisation ProRail. And ProRail is really from the infrastructure. And we and my job, a part of my job is to organise the maintenance of the also of the parts of Prorail. So, in the stations we are responsible for everything about safety, cleaning, and the structure of everything. So, if everything works, but boreal is the owner of a lot of things in the stations and well station manager for 16 stations train stations around Utrecht Centraal. So, I've got all the small stations and from Utrecht till Rhenen. And that's the part of the Utrechtse Heuvelrug. I think well my job is besides that to be the first contact for everyone wants to know something or everyone who has to do something with the station. Not the trains, but everything about the station.

# Students:

Okay, yeah, that's nice. Because there are five train stations, we think in Utrechtse Heuvelrug from Maarn to Veenendaal and all in between.

# Joost:

Yes, and it's also switching yesterday from what's the exact part of The Utrechtse Heuvelrug and it's not really clear, but the on the websites on Wikipedia show a bigger area. So, I'm not sure what's is really the Utrechtse Heuvelrug but my train stations are Driebergen-Zeist, Maarn, Veenendaal en Rhenen. And Veenendaal and Rhenen, those are well the Utrechtse Heuvelrug. So, well. Hope I can help you.

#### Students:

Yeah, I think our first question would be about the availability of OV-bikes. And we saw that in Driebergen-Zeist, there are a lot of OV-bikes, but in all the other stations like a few, maybe two or three. So, we were wondering if there is a reasoning behind this why there aren't more OV-bikes in those smaller stations?

#### Joost:

Yes, of course it's depending on how much it says how much people want to use it. If there, is we can monitor how many times they are used. And if we see that one of the station OV-bikes are every day rented, in the future we can place more bikes, so we try to monitor this and anticipates on that.

#### Students:

But for now, you don't see a lot of people using OV-bikes in those areas or...

#### Joost:

Well, it's Yeah, look, it depends. The stations we talk about now Maarn and Veenendaal are also fairly small stations. And most travellers are going from those stations to Utrecht or Amsterdam for work. So, they are really for the people who live in those villages. And that is not the that's those are not the travellers who use the OV-bikes. It's the other way around. That's how you go somewhere and then you rent an OV-bike to go to your destination. But in stations as Veenendaal West and Veenendaal Centrum, most of the travellers are situated in those villages, so they come to the train station on their own bike. Go to Utrecht, maybe to the job of to an appointment and then take an OV-bike in Utrecht and not in Veenendaal. So, that's why the small stations often don't have so many OV-bikes.

# Students:

Because our idea was because they want to reduce these cars to the Utrechtse Heuvelrug. We were thinking if people come by train, say from Utrecht to Maarn, or Rhenen or one of those stations around the park, then they could use an OV bike to get closer to the park. But if there are no bikes available to begin with, then it's difficult to encourage people to do so. So yeah, we were wondering how NS works with updating like the number of bikes or yeah if they if they consider like this aspect of not so much commuting but more, yeah, people travelling for like leisure things such as going to the park.

#### Joost:

Okay. What's your question because we have this number of bikes and that is what's for this moment. It should be okay. If there are questions or complaints from travellers that there are not enough bikes, we will anticipate on that to see if this possible to play some more. On smaller stations, that's not so easy because at this moment we work with kind of boxes and you probably know there so you need more boxes, at first to place the bike, but not sure choice your results, the new concept, that's the smart slot (slimmer slot), if you've heard of that. However, that's really nice. Because we are well quite far with the tests of this smart slots. And with those slots, you can open it with your train OV chip cards, and we don't need a box we put them in the open space. How do you call it? It's the place where the bikes are standing solely without the box and then it's of course, much easier to place more bikes when needed.

# Students:

Yeah, and as this smart slot thing being implemented anywhere yet are still in the works.

#### Joost:

It has been tested on few stations also in Utrecht and Leidsche Rijn. And I think it's now in Den Bosch. I can check that if you like consensual maybe some more information or maybe someone from these special parts of NS can make time to talk to you about this.

#### Students:

Yeah, it could be interesting to talk to them.

#### Students:

I was wondering if NS does anything to promote OV-bikes more so maybe a lot of people don't know yet about availability of them.

# Joost:

Well, there is some marketing, I think. I'm not really sure but there are a lot of posters on stations to notice so you can notice that you can rent a bike. I think most travellers know about the OV-bike when they would like to rent it. It's really big. I don't know the numbers but the last year it's grown. It's bizarre. And it's I think most people who would like to use it, know that it's there. But there are often marketing campaigns in all kinds of subjects also the OV-bike.

# Students:

And do you have any data or keep track of how many people use OV-bikes in the area of Utrechtse Heuvelrug?

Joost:

I don't have the information, but we do have that. Yes, we have everything. But it's not. That's not my work. Well, we have really specialists for that information. We have investigators in all kinds of subjects. So also, this is. I'm pretty sure that we know exactly how many bikes, which day, which station has been used.

#### Students:

But that data cannot be accessed?

#### Joost:

Oh, maybe. But those questions aren't for me to specialise. So, I can well, maybe you can give me on the mail later on, your exact questions and I'll send it to the specialists and ask if they will answer your questions, with numbers.

# Students: That would be great.

Students:

And I would like to ask another question. Because before you were talking about a growth of OV-bikes, and I will be curious to hear a bit more about that. And if you know the reason or like or if you looked into it, if you know what I mean.

#### Joost:

The growth, you mean?

# Students:

Yeah, because before you briefly mentioned like new use the word bizarre like the last year, this grew a lot and...

# Joost:

We could not well, Corona had COVID has changed a lot in those things. But before this, we could well I should ask it to the specialist, but I know there were so many bikes needed more than we could produce last year. And there are ships full of bikes, maybe I think from China, or something send to the Netherlands and every year we needed more and more and more as was way more than we ever expected. It's a really big success. And it's kind of logic. Well, no, it didn't suspect it. But if you see how easy it is for an audience to use a bike and how many people are used to use a bike and that next to the price on a few maybe you know but other shared bikes are much more expensive than OV-bike. The only problem is you can use it only from a train station then you have to come back to the train station. And other companies of shared mobility have more possibilities to put it where you like, but the price the price is four or five six times the price of an OV-bike. Sometimes it's only 3,85 euros for 24 hours so the no other company can compete with that.

Students:

A very competitive price. Thank you for your answer.

# Students:

Yeah, maybe a bit off topic from the OV-bikes. We were wondering if NS also has connections with for example Synthus, from the bus companies in the area. If you have like conversations on how to improve together with NS and Synthus the mobility to the area?

# Joost:

No, I think that's not what we do. The train stations are what they are. The NS the company, how do I say it, well the bus companies have they get their assignments from the provincial Utrecht, and they have to offer a few lines every year. And so, but there is no there's no cooperation between NS and local bus areas because NS is really country wise network. And it's how can I say that I think but I speak for myself, that the bus companies have to make sure that they are connected with the NS and not otherwise. Because they're well we have two trains on the stations, and we cannot do something else, but I think they try to connect on the trains and they give more detailed travel possibilities to go to places near the train station what's too far to walk. But no don't think we as NS do something together with them.

Students:

Yeah, maybe a bit more general question. But do you have any ideas to make public transport more attractive for people to use to go to the National Park of Utrechtse Heuvelrug?

#### Joost:

Well, of course price because when you are with the family u need four train tickets from say something to Amsterdam to Utrechtse Heuvelrug, and you have car, okay, the benzine is really expensive right now but when you when you buy for train tickets, it's most of the time cheaper to go by car. So that can be, I think the connections are really good. We could not move the train stations. So, what could we do? I think this well what we do is we make it possible for other companies in shared biking as like in Utrecht we have now TIER. Maybe you have heard of them, and I've tried to help them to get some places near the stations. So that the stations are connected with their network, and we work together with TIER and the gemeente Utrecht to make it possible for them. Same on maybe you know this, go about bike? Think they have this place on science park. You are from science park? Not go about.

#### Students:

We do have some TIER bikes here at Science Park. There is also an orange one, Donkey Republic.

#### Joost:

Donkey Republic, we also work with them together. It was not so successful, must say. But the difference with Donkey and TIER is that TIER they have the electric bikes and that's really a step further than the other bikes and between donkey and the OV-bikes. Yeah, difference between the price was so big. And you will have do not have a better bike. And with TIER, you have of course had something extra, the electric bikes.

# Students:

And I know you said you weren't you're not the expert of the trains more of the train stations. But do you know anything about like, because at the moment the frequency of the trains is like constant throughout the week. But for example, for people that are travelling to go to the Utrechtse Heuvelrug for like leisure activities. I'm sure there are a lot more people going at the weekend, but the frequency of the trains is still relatively low like once every half an hour from for example Utrecht Centraal to Maarn for example. Do you know of NS, like takes into account yeah, the travellers that come from Utrechtse Heuvelrug? Or are they mainly looking at commuting people for work and that kind of stuff.

#### Joost:

So, but youre asking if the frequency will go up? Well, that's on some trajects going on. And also, here the COVID has stopped some thing or make it make a delay. But for example, between Utrecht and Driebergen-Zeist, there is an extra train now. That was last year it wasn't there. So, the between Nijmegen and Amsterdam there is an extra train I think that stops in Driebergen. But the smaller stations I think Maarn, Veenendaal and Rhenen are well in the in the "spits", is there an English word? In the busy times in the morning and in the evening. There are four trains an hour. But I don't think that will be much more in the near future because well there have to be more travellers and there are not more travellers and every 15 minutes to train is quite okay, I think. Of course, every five minutes is better. But that's not possible.

# Students:

Yeah, so I think that's mainly our questions?

Students:

Yeah, maybe just do you know any other people who have a lot of knowledge about this? We can maybe interview or send them questions too.

Joost:

Sure, send me your questions. There's really no problem. We have a lot of specialists and I know a lot about stations in general but this only OV-bike questions. I know people, they can tell you a lot of more, a lot more. So, send me your questions and I will bring you in contact with people and I think they will answer your questions.

Students:

Very nice. Thank you so much. Your input was definitely helpful.

Joost:

Nice, nice to hear. You're very welcome. Well, good luck with your subjects. Thank you so much. Okay, all right.

All:

Okay, all right. Goodbye.

# APPENDIX F: INTERVIEW NILS VERKENNIS (TIER)

Interview with Nils Verkennis, conducted on March 25th 2022.

Interviewer: Ilse van der Giessen Interviewee: Nils Verkennis

Student: What is your position at TIER?

Nils:

I am the public policy manager for TIER.

Student:

Currently, TIER is only provided for in the city, is it true that you can't use/park them outside the city?

Nils:

No, in principle not, we have a permit for Utrecht and not outside it. We would need a new permit for that. Yes, we always have plans to expand, but not specifically for the Utrechtse Heuvelrug.

# Student:

We can imagine that it is fun for many people to go to the Utrechtse Heuvelrug with a TIER scooter or e-bike, would you consider expanding the area? Why/why not?

Nils:

There must be sufficient support to realise this. It must be attractive for a company to establish itself there. In rural areas, this is often more difficult because there is less demand. You already indicated that there is a bus once an hour, this is too little. But we see that there are not many movements from the city to the rural area. This also concerns long distances (between 20-25 km). We focus on shorter distances, of 10-15 km.

# Student:

We also spoke with Joost van Heeckeren and he talked about a collaboration between NS and TIER. Is the aim of TIER to make it easier for people to travel to train stations. Wouldn't it be useful to have TIER bicycles and scooters at stations such as Driebergen-Zeist, from here you could easily cycle to the nature reserve?

Nils:

As a company, it is our goal to be climate neutral and we try to express this to the outside world. We would like to replace car consumption in the city centre and look for an alternative to cars in the city. Yes, parking zones in Driebergen Zeist would be interesting. We would need a new permit for this.

# Student:

What would hinder applying for a permit in this area at the moment?

#### Nils:

What makes it difficult is that "the sharing mobility" is organised at the urban level with its own permit system to regulate sharing mobility. But mobility does not stop beyond municipal boundaries. For example, if city A is adjacent to city B and you have a permit in city A but not in city B, this will make it more complicated. If this was organised on a regional level, it would be easier to regulate these types of areas. Then there would be no legal obstacles. At the moment, different agreements apply to each municipality.

#### Student:

Do you see any other barriers to TIER e-bike or scooter consumers?

#### Nils:

We try to make the use of our bicycles and scooters as attractive as possible. Therefore, TIER should be available to everyone. TIER falls under the U-pass. U-pass holders are people from Utrecht with a lower income. With the pass, they get a discount on public transport (this means a 75% discount on TIER bicycles and scooters). We do this to make the services as attractive as possible. The biggest obstacle is the presence of vehicles. People want to get from A to B as quickly as possible, but if there is too little density of vehicles or parking zones, it becomes more difficult. We do not see the price as an obstacle.

#### Student:

Would you like to increase the capacity of bicycles and scooters or parking facilities as that is the biggest obstacle?

Nils:

We would like to increase the capacity, but for that, we would have to apply for a new permit. We now have a permit in Utrecht that allows us to offer 500 e-bikes and 300 scooters.

# APPENDIX G: INTERVIEW DAVID EERDMANS (PROVINCE UTRECHT)

# Student

Hello, I'm Gaia we've been in contact on WhatsApp Hi nice to finally talk to you. So I'm also here with another student and her name is Misha. If you like we can give first the introduction on our project because I don't know if you read the email or if you were in contact with Jeroen at all.

So in total we're seven students from Utrecht University and we're working on a project for sustainable mobility in the Utrechtse Heuvelrug and that's why we're very interested in talking to you. And, and this is because in the past few years there has been an increase in people go into the national park because of COVID. Of course, sadly. And as a result, a lot of people go there by car, which means that a lot of like natural areas are invaded by too many cars and flora and fauna are damaged but also there is more co2 emission and in general there was a lot of conflicts, especially last year when the weather was nice. So our main point of this consultancy project is to create solutions for the park or come up with a new vision for sustainable mobility. But in general, our main goal will be to decrease cars to the park and increase like the usage of public transport but at the moment we are finding it a bit hard because not a lot of people use public transport and almost everyone just goes there by car out of convenience. And so we're very interested in talking to you and thank you for like your time. Yes.

# David

The project I understand of course, also invited additional Park wants to reduce care usage. Yeah, yeah. That should be interesting to talk about.

# Student

Because we already noticed and we have been there ourselves now a few times and we talked to visitors who came to visit the park and it's really hard to come there by public transport especially by bus because the bus schedule only goes once an hour. So even if people would want to switch public transport, it's just not a very nice option for them because it's so much easier to come by car because public transport is not that accessible and easiest car.

# David

Yeah, not sure if I completely agree with you, but that will come up in the interview. Do you have questions or is this going to be a conversation?

#### Student

We have a couple of questions. But first, would you like to introduce yourself as well and explain us our role because we're not completely sure because you're onto something but not a lot

# David

My name is David, but you knew this already. I work in the province of Utrecht, municipality authority in in our area, which means we are responsible for the regional public transport in the area. Multinational railways in the province. And we have contracts with operators who operate contracts for public transports, say contracts in the Ntherlands as we call them concessions, like contracts.
For the national park, the most important operator is the city of Utrecht. So we are the authority responsible for creating the rules for the public transport and as the operator makes the timetable to make sure enough buses work within the range that we set so we decide how often the buses run. And the operator always makes the timetable and travel information etc.

#### Student

Okay, that's interesting because I thought that the schedule was more up to Syntus, namely the bus companies themselves.

## David

Syntus schedules the actual schedules. We make the rules for the schedule so we set the minimum level.

So that's what we do. I am the manager public transport. So I have a lot of contacts with both operators of Utrecht about the element of public transport. The last few years of course was about the corona crisis, which is also very difficult for public transport because of course, there were less travelers than before covid and still it is quite challenging.

## Student

And then specifically for the area,, how do you decide like how often the buses need to come there for instance, or what is that based on? Is it like based on data or research about the like, what are the basis hours or something or how we decide this?

## David

The province made a document with minimum requirements for this contract. So the minimum service levels, that is always the basis as to fit the requirements, which the province set already a couple of years ago. So that's the minimum and within those levels every year we make a document with a new plan for the route. Here we make a small document with some starting points. Some things we find important, if we want to see change.

This is the documents the operator makes us if we want to change the network of the municipalities and organizations etc. And then, after this consultation is submitted to the province, we decided where this entry goes.

A lot of the proposals of the the operator are based on what they see in the data in how much line is used. The operator can propose to increasing frequenciesbut if the line is not very much used it is difficult.

#### Student

yeah, yeah, indeed. Yeah, that's very interesting. And here I have another question because indeed. Like for instance, while we're talking about initial Park, those lines are not used as much but then how would you promote that or would you promote that? And, yeah, would there be like some kind of interest to do that in the end?

#### David

Yeah, I think this could be an interesting option. It is very difficult to connect public transport to natural areas. They are not very good at that. The National Park is very large and spread out.

So you have all these relations with all these new people traveling, you know, different people traveling coming from different connections.

#### Student

Yeah, I also understand that but then I also feel like that there are a lot of people going to the park but yeah, just not using public transport because even if the area is spread out, like I think the numbers are quite high. To give you some kind of data but they only expected this kind of numbers increasing numbers in 10 years and it's already here. For the National Park but almost everyone is going by car. But then Do you know how, like how to promote, like how to encourage people and promote the use of public transport. Is there someone that promotes the use of buses, is there some kind of marketing behind that?

## David

Both operators every year make a new marketing plan with some actions to promote the usage of public transports. They can be very different. This was actually in the marketing plan.

Depending on where do you think the biggest chances are to increase the usage so that this could be an option. I'm not sure how the operator will look at that. But that could be an option.

#### Student

Okay. And I have another question because I think in the weekend there like almost no buses that go to certain areas of the park. And why is this?

#### David

Yeah. Because you're already said that the buses are not frequent but it depends on the line. There are actually some pretty pretty good lines which goe through the south of the National Park and seven days a week. Really, I guess, also the weekends. There are also other lines that do not go in the weekend and those are the not frequently used lines.

#### Student

Would you be interested if you would notice that there is a demand for those lines to go in the weekend if people would actually be wanting to use those lines more would you then look into that and be willing to change the schedules and make those lines?

#### David

It's always a good thing to increase lines. The only thing is that if we have a huge financial problem with the covid crisis. Last year we decreased the amount of buses in the province. We decreased about eight or 9%. We had tox, we didn't want to, we have to reduce the financial issue at least. We're currently busy with the plans for 2023. There is just no extra money available to increase the lines. We cannot really do these things, that is because if we ask we also have to decrease somewhere else. Makes it very difficult. Yeah.

## Student

Yeah, I understand. It's very sad to hear

## David

Because before the corona crisis we actually were increasing, we were increasing the schedule every year was like you know, four or five%. So this was really going in a good direction before.

And now that the situation is quite different. We hope that next year we can start growing again.

## Student

yeah, let's hope for the best though. And then I have another question I think you know by now and is there something else that the municipality will try can do then to like encourage citizens to take public transport you think aside, like changing schedules.

## David

Yeah, well, I think would be interesting to look at the possibilities of the marketing plan I was talking about with the operator, but there are some possibilities to use the marketing plan every year to to use it to increase the awareness of people that can also use the bus to the National Park.

Perhaps there could be some interesting synergy between communication of the Park and communication with Syntus. Could be interesting.

## Student

It's perfect because we have an interview with Syntus. We have this next Tuesday. So it's very good to telling us this because now maybe we can already like, start the conversation.

Okay, we're talking to Ed.

# David

Okay. Ed is a good person to talk but he is not a marketing guy. Okay. But also ask if you could talk to one of their marketing people. Maybe you can bring anything, that would be nice. You could also ask first about a marketing person.

#### Student

Yeah, yeah. Yeah, that's good. Yeah. And do have, like any other contacts, by the way that you think could be relevant for us like someone in the marketing. Do you know someone or it's just better to go through Syntus?

David

I think it's the easiest would be to go through Syntus.

Student

Okay. Okay. Perfect. That is useful.

David you can do can come back to me and I think I think it should work. If you just ask.

Student

Okay, okay. Thank you very much. Do you have any questions?

David

Did you look into other means like cycling?

# Student

Yeah, we also have looked into OV bikes because they are there at some stations already, but also it is just a few. So we're also the trying making those more accessible and available to visitors. And we also spoke to the company here with like electric bikes and electric scooters to see what the options are there but they don't have the license yet for that area of the city center. So we're also looking into those options. Yes.

# David

I was looking at a map of the year in the National Park and there are quite a few stations which are really located close to the park.

# Student

Yeah, we also have a problem because not everyone is aware that the OV fiets are there. And at the closest stations like Maarn there are no OV fiets.

Yeah. We agree with you but of course there are obstacles everywhere. Do you have any other questions for us?

David Wish you good luck for your projects.

# Student

Yeah. Thank you.

Thank you so much for the lovely conversation. It was very, like insightful for us. And thank you. I know you were very busy this week.

David

Okay. Have a lovely weekend then. Goodbye.

# APPENDIX H: INTERVIEW ED VAN DER ZEE (SYNTUS)

Transcription of Interview with Ed van der Zee, conducted on Tuesday April 5th Duration: 15:46 Key words: buses, passengers, marketing, schedule, Synthus

Interviewer: student Interviewee: Ed van der Zee

Ed van der Zee: My role at Syntus is a traffic and transport station engineer.

# Student:

Nice. And you mentioned you were working on some new transport plan for 2023?

# Ed van der Zee:

Every year we have to make a planning for the next year. And in the plan we have to adjust transportation to the norms at that moment. So, if there are new houses or we want to make this the bus line quicker or interesting, more interesting for the passengers. Then we do that every year. We can make a new plan.

# Student:

We have first some questions about the bus frequency. So how many times an hour the bus comes and what the basis is for the current frequency of buses.

Because we noticed that the frequency of the buses to the National Park is is not very high.

# Ed van der Zee:

No, just because there are not many passengers. If you look at, for instance, to Utrecht we have sometimes eight times an hour bus, but that's because there are a lot of people travelling with us and we don't have many travelers to to the park.

# Student:

And do you think if more buses an hour will be there that there will also be more passengers?

# Ed van der Zee:

Usually there would be more passengers. So, depends on things; you have to make sure that people will use the bus line or otherwise they won't be in high frequency.

# Student:

Yeah, so where do you get the estimations of the number of passengers? Because at the moment the buses aren't very frequent. I think it discourages people from taking public transport and they are more willing to come by car. But maybe if there were more buses then people would be more willing because it's like less waiting time.

Ed van der Zee:

Yeah, but if you talk about a normal regular bus line you can estimate the passengers there will be. If you're talking about in a park or something, then you don't know how many people are coming. So you can't plan a bus line on that.

Student:

So, is it more oriented for commuters or school?

Ed van der Zee: Yep

Student:

Okay. We also noticed that there's no buses at all at the weekend. Is this again, just because you don't think there are enough passengers for that?

Ed van der Zee: Yeah, that's the reason.

Student:

And do you think there are more recreational tourists in the weekends that use the bus?

Ed van der Zee:

No. We have tourist buses to another place: from Monday to Friday. They are reasonably filled. But the weekend strangely enough there are not many passengers.

Student: Which are these tourist buses, where do they go?

Ed van der Zee: Laage Vuursche, do we know that?

Student: No, I don't know it. So they are buses specifically for tourism?

Ed van der Zee: There are bus lines that go to Laage Vuursche which is touristic. And there was a bus on Saturday but with corona it is gone.

Student:

Okay. And do you think the Utrechtse Heuvelrug would also be an option for these tourist buses?

Ed van der Zee:

Oh, well it has to fit in the plan. So it's not only the bus company who will estimate if there is a bus line or not, but it has to be the province of Utrecht or the park itself. They have to talk to each other and make a plan on what to do with the buses and the people they want. It is very difficult to tell people not to come with a car and go with a bus. People won't do that easily.

# Student:

Yeah. And that's what we're trying to investigate as well. So we also talk to people from the province and from NS. Do you often have meetings with these actors as well? By the way, we talked to David, I think you know him, from the province of Utrecht?

## Ed van der Zee:

Yeah. We talk to him weekly. And with NS we talk several times a year, but it's definitely difficult to talk with NS because they determine what they want to do and we have to adjust to that.

## Student:

So you adjust the bus schedules to the train schedules?

Ed van der Zee: Yes.

## Student:

And what type of conversations do you have with David? Is it related also to the scheduling of the buses?

## Ed van der Zee:

We talk about everything, about buses and bus lines and frequencies and routes and everything.

## Student:

And do you know if there are any plans for changes in the bus routes that go to the Utrechtse Heuvelrug?

Ed van der Zee:

No we haven't talked about it anyway. So I don't know. We talked about it.

Student:

And how do you think that's such a conversation would be possible? Because when we talked to him last week, he thinks that it's not possible because of budget because now with Corona, they're way less travellers. So his suggestion was also to talk with you about the marketing strategy and to really focus on like getting more people to take buses. And so I would be curious to know from you what you know about the marketing strategy of Synthus because David was saying that he knows that as of now somebody in Syntus is working on a marketing plan. But I don't know how much you know about this. And I'm also just curious to know what you think about this advice and like if you agree or if you see I see a window of opportunity to possibly increase the schedule rather than really pointing at the sole marketing.

# Ed van der Zee:

I make planning, scheduling plan, how many buses and how many times the bus will be coming. And then the marketing plan is adjusted to that. So they try to get people in the bus depending on how I schedule the buses. It should be that also like touristic parks, that marketing is coming beforehand, before we make the scheduling plans. So that you can get money somewhere to finance stuff. But it's another story. Another way to look at it Student:

and do you know what type of marketing campaigns have been done, like how do they advertise buses?

Ed van der Zee:

Yeah, posters, or gifts. Yeah. I would like to see it otherwise, more aggressive.

Student:

Yeah. In what way? Do you have an example?

Ed van der Zee:

I don't think you can get people in bus with it gadgets. Maybe once but not structured.

Student:

But then why is this the current plan? Like is there a lack of like budget for a more extensive marketing campaign or, what do you think would be needed?

# Ed van der Zee:

We made an appointment with Sytus to collaborate more with the marketing compartment. So that there will be a better plan to get all together. But that has not been implemented yet.

## Student:

Alright. And we saw I think on the Sythus site or something that in school holidays and national holidays there were less buses. Is there an option to increase this? Because maybe people in these periods more often visit national parks.

Ed van der Zee:

If we see an increase in the number of passengers then we do that, so increase the frequency. 50% of the purchase is financed by the province and 50% we have to do ourselves and when we see that the amount of passengers is decreasing, then we tend to take trips out of the schedule, because the buses aren't filled anymore. And then it is too expensive to try to move buses around in the country. Because they are empty. Yeah, almost empty.

# Student:

And even in these holiday periods, you don't see an increase in passengers?

Ed van der Zee: No.

Student:

Okay.

Yeah, it's kinda, I just think it sounds kind of tricky, because the marketing is also adjusted to the schedule, like the marketing will get maybe more people on the buses, but then if it's done after you scheduled the buses, which is a result of decreasing people, then it just sounds like less and less people are gonna come if you know what I mean. So yeah, I don't know. It sounds very tricky.

Ed van der Zee:

Yeah, it is. Yeah. To be more specific, if you want to have a bus line to park or something, you have to be specific and you have to co-work with with the park itself and with Provence and maybe more people to get the bus line to the park, I guess.

Student:

And does Syntus do these type of collaborations?

Ed van der Zee: Yes.

Student:

Do you think there would be maybe a possibility to create like a shuttle bus specifically maybe for the national park or something like that?

Ed van der Zee:

It could be. For instance if you talk specifically about Koningsnacht, for specific events, we cooperate in these things. So we could cooperate for instance with the park.

Student: Yeah, that's interesting. Okay, I didn't really have any other questions. Um, well, thank you. I think it has been great help. One last thing. Will there be anyone from the marketing like team that you could give us the contact of?

Ed van der Zee: Yeah.

Student: That will be great. I had sent you an email about it already, but I'm not sure you saw.

Ed van der Zee: Oh, I will give her name.

Student:

Okay. Thank you so much. That will be very helpful because, yeah, that's also a feasible option. It seems at least from the side of the province of Utrecht. Yeah. Okay, okay. Thank you so much for otherwise for your time. It was very interesting. Good luck with all your planning. Thank you. Thank you. Yeah. Have a great day.