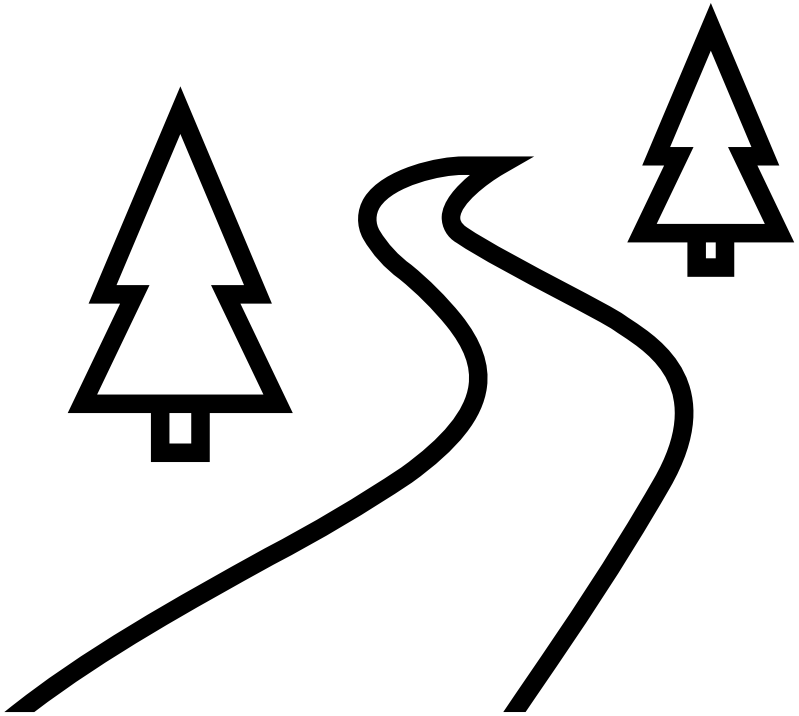
National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

The value of green in urban development: The use of a Digital Twin

Joyce Zwartkruis, Ton de Nijs, and many others

esri
TYGRON
Zwolle
Amersfoort
kadaster
FUTURE CITY foundation
Rijksinstituut voor Volksgezondheid en Milieu
Ministerie van Volksgezondheid, Welzijn en Sport
PROVINCIE UTRECHT

Outline



- What is the Green benefit planner?
- Connection with digital twins in ESRI & Tygron
- Application by municipalities
- Lessons learned and ambitions

Societal challenges

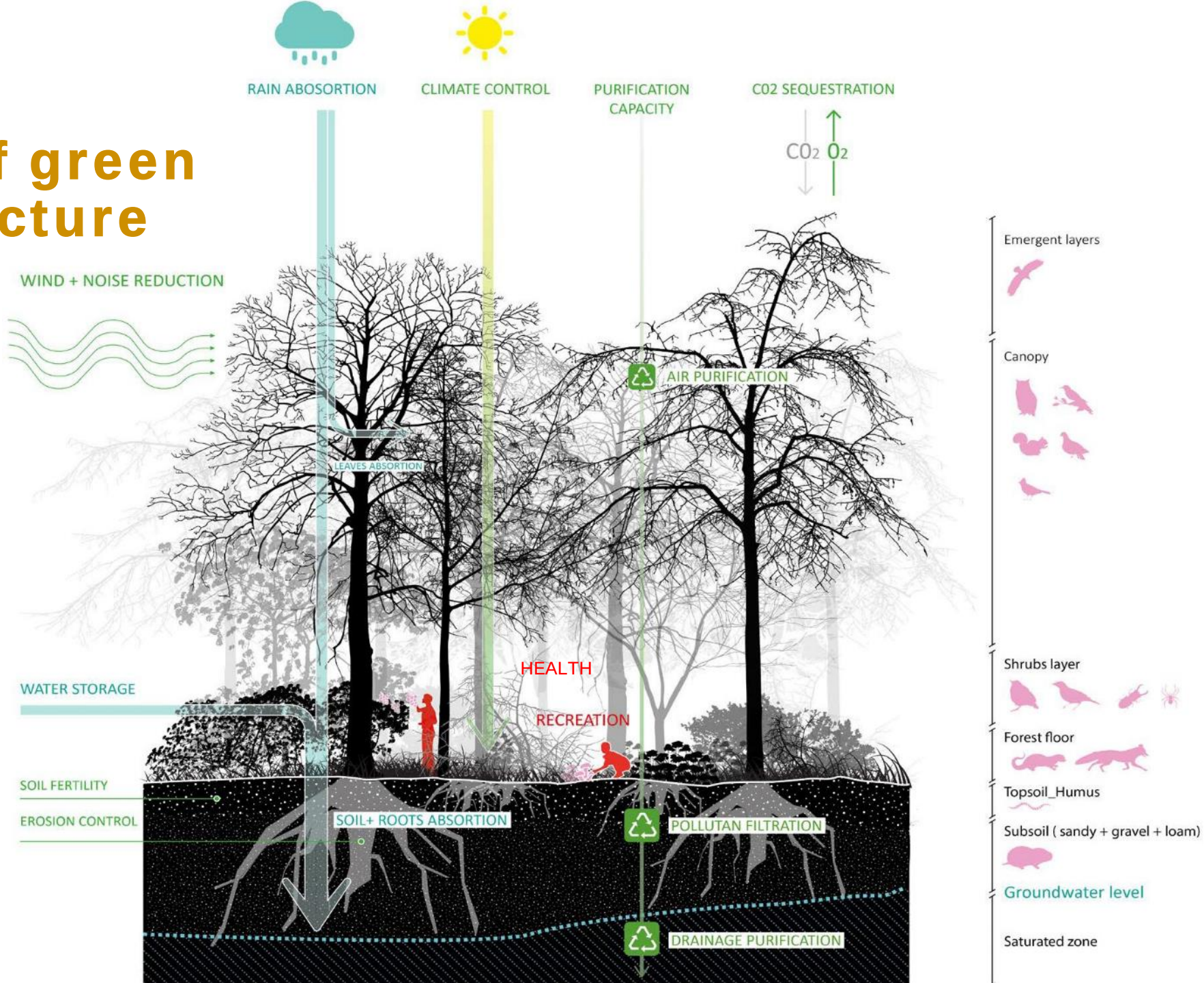
- Residential building
- Employment
- Energy transition
- Mobility
- Livability
- Health
- Climate adaptation
- Climate mitigation
- Biodiversity
- Etc….

Table 1. Change in green area in cities in ha per time period (based on Landsat satellite data)

Periode:	1984 - 1989	1989 - 1999	1999 - 2006	2006 - 2015
Den Haag	-60	-56	-25	+5
Utrecht	-141	-38	-82	+3
Rotterdam	-129	-53	-38	-3
Amsterdam	-44	-40	-24	+2
Heel Nederland	-19542	-7180	-5002	+2077

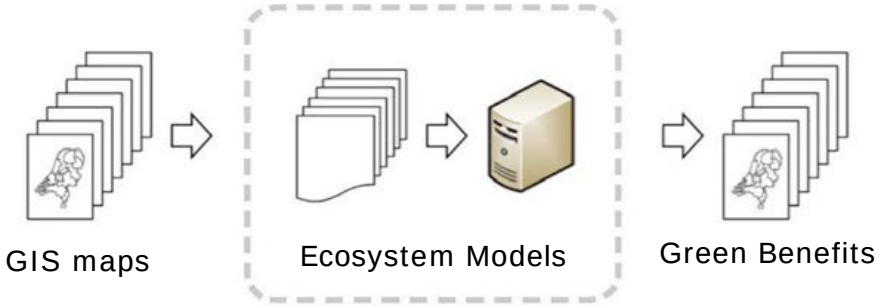
Bron Imagem Groenmonitor. (pers. comm. Niels van de Graaf)
https://www.imagem.nl/oplossingen/dashboards/monitor-groen-grijs/

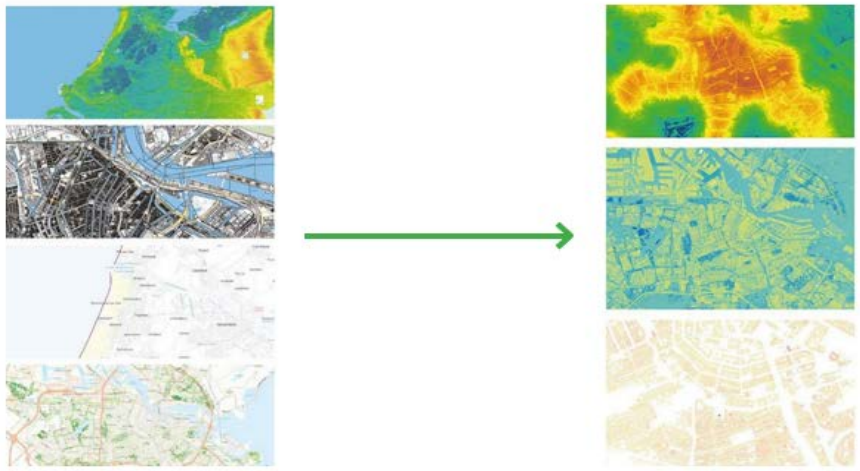
Benefits of green infrastructure



GreenBenefitPlanner

Estimation of Benefits Ecosystem Services





Health

Avoided patients	patiens / year
Avoided health - related labour cost	euro / year

Physical activity

Cycling	min / year

Air quality

Pm10 retention	kg / year

Urban cooling

Average temperature decrease	C 0 by area

Real estate

Increase in real estate value	euro / year

Water storage

Aditional storage in green areas	m^3

Carbon storage

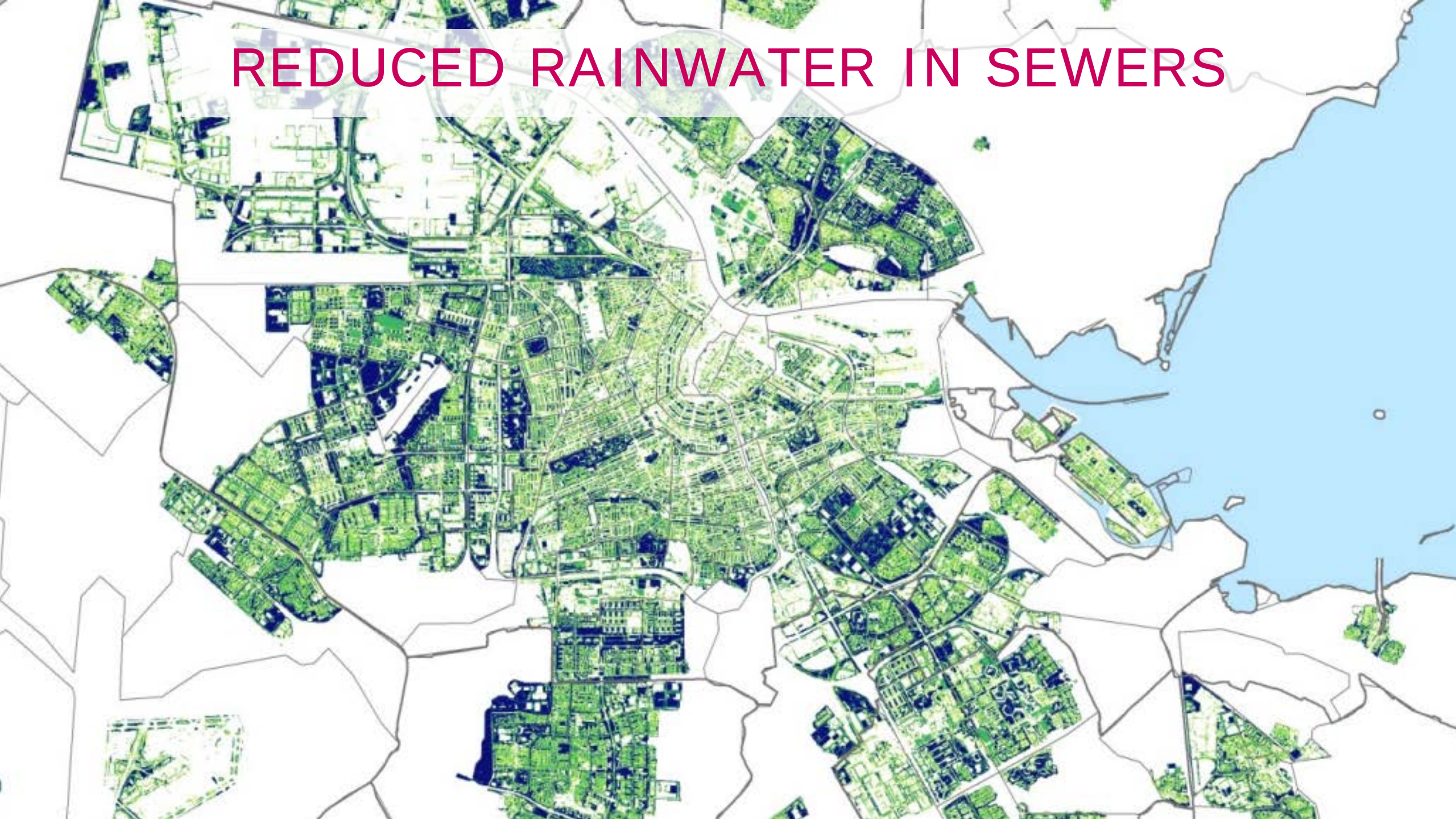
Additional carbon storage	kg

Commissioned by LNV
Collaboration PBL, WEnR, CBS

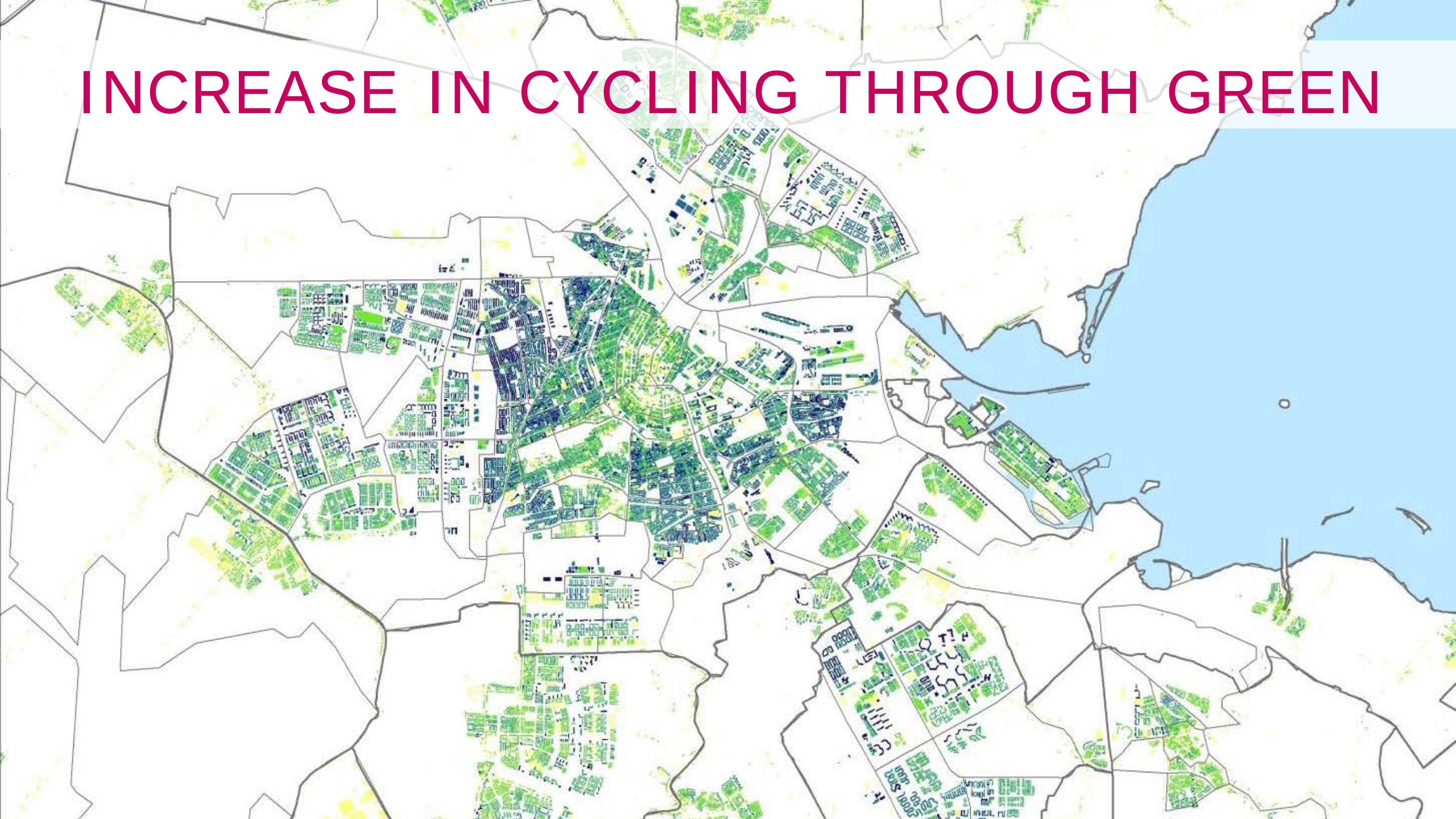
Example

DE URBANISTEN

REDUCED RAINWATER IN SEWERS



INCREASE IN CYCLING THROUGH GREEN

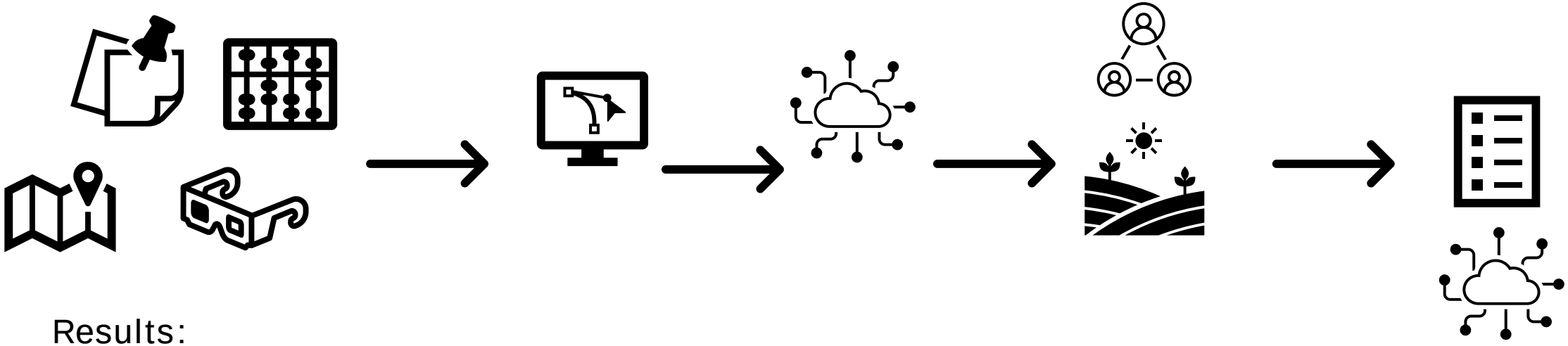


Benefits of Greening in Amsterdam

Indicator	Unit	Green Neighborhoods	Green Network	Urban parks
PM10 retention	kg/green ha/yr	9.6	-	8.9
PM10 retention	thousand €/green ha/yr	0.54	-	0.47
Reduced number of visits to GP	visits/green ha/yr	11	5	4
Reduced health costs due to urban green	thousand €/green ha/yr	10	4	3
Reduced health-related labor costs due to urban green	thousand €/green ha/yr	47	21	16
Time spent on outdoor physical activity	thousand min/green ha/yr	1.1	0.8	0.6
Time spent cycling to-from work	thousand min/green ha/yr	2.2	0.9	0.5
Avoided premature deaths from cycling to-from work	lives/green ha/yr	0.016	0.007	0.003
Avoided premature deaths from cycling to-from work	thousand €/green ha/yr	46	20	9
Contribution to property value	thousand €/green ha	202	95	40
Visits to recreation areas	thousand visits/green ha/yr	-	-	-
Visitation expenditures	thousand €/green ha/yr	-	-	-
Reduced rainwater in sewers	thousand m3/green ha/yr	4.8	2.4	2.5
Reduced water treatment costs	thousand €/green ha/yr	3.8	2.6	2.0

Project generic connections

Steps:



Results:

Lessons learned

All codes and documentation public available

Gain experience with involvement of citizens

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esri

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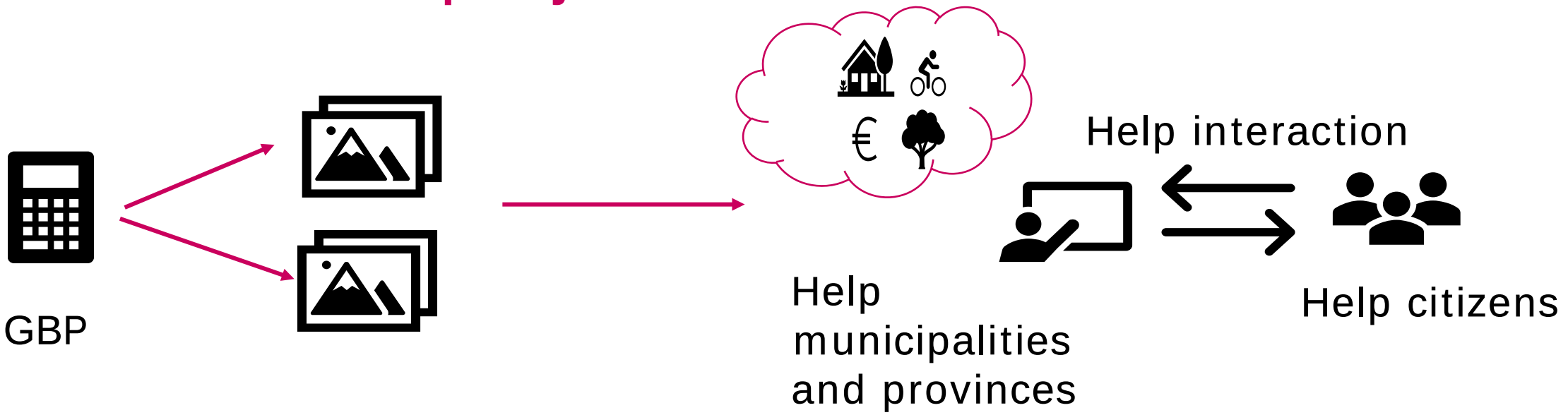
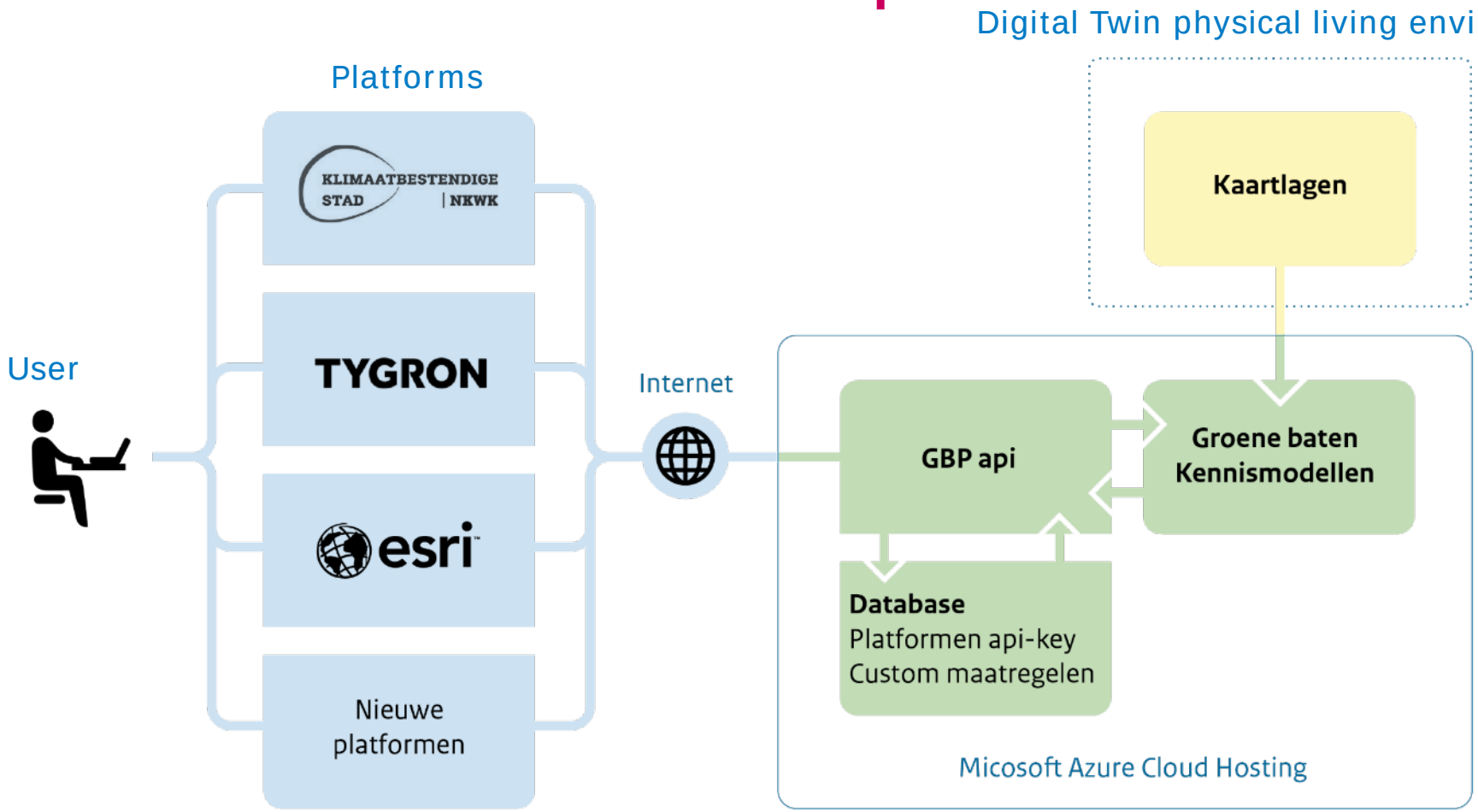
PROVINCIE UTRECHT

Goal of the project



Integrated assessment
Together with citizens
Visual representation in 3D

Architecture Green Benefitplanner



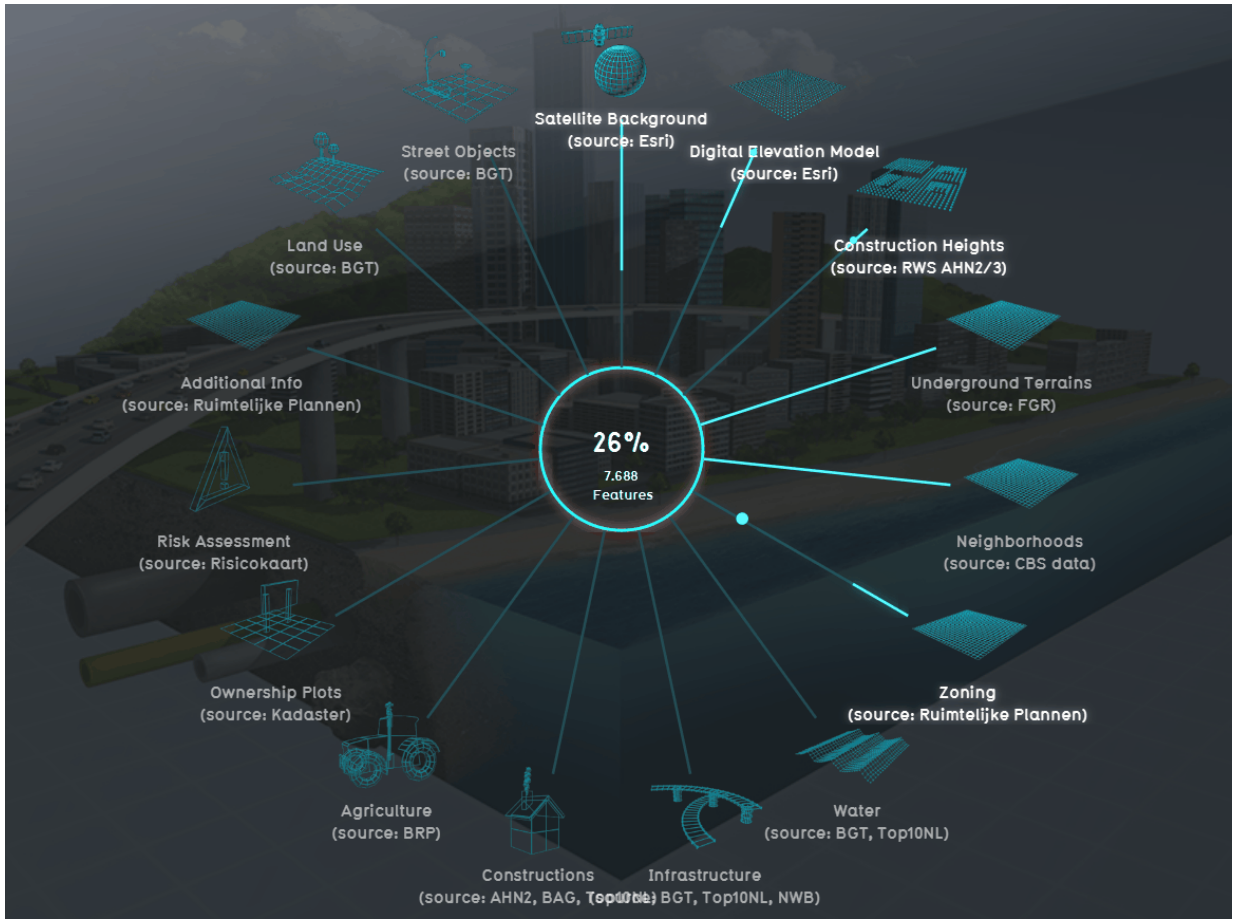
Application

Schuilenburg Area

Tygron

- Digital infrastructure to adress questions regarding spatial planning
- Combination of (geo-)data, models & applications
- Solve challenges:flooding, drought, heat waves, energy, housing, infrastructure, liveability and economy

Digital Twin with Open data in Tygron



Dynamic Digital Twin based on:

- Basic registrations
- AHN 3
- Risk maps
- And many others

GBP in Amersfoort Schuilenburg

https://youtu.be/Yu6gvFBcblM

Zelf gebruiken? Mail support@tygron.com

Application

Nieuwe Veemarkt

Zwolle

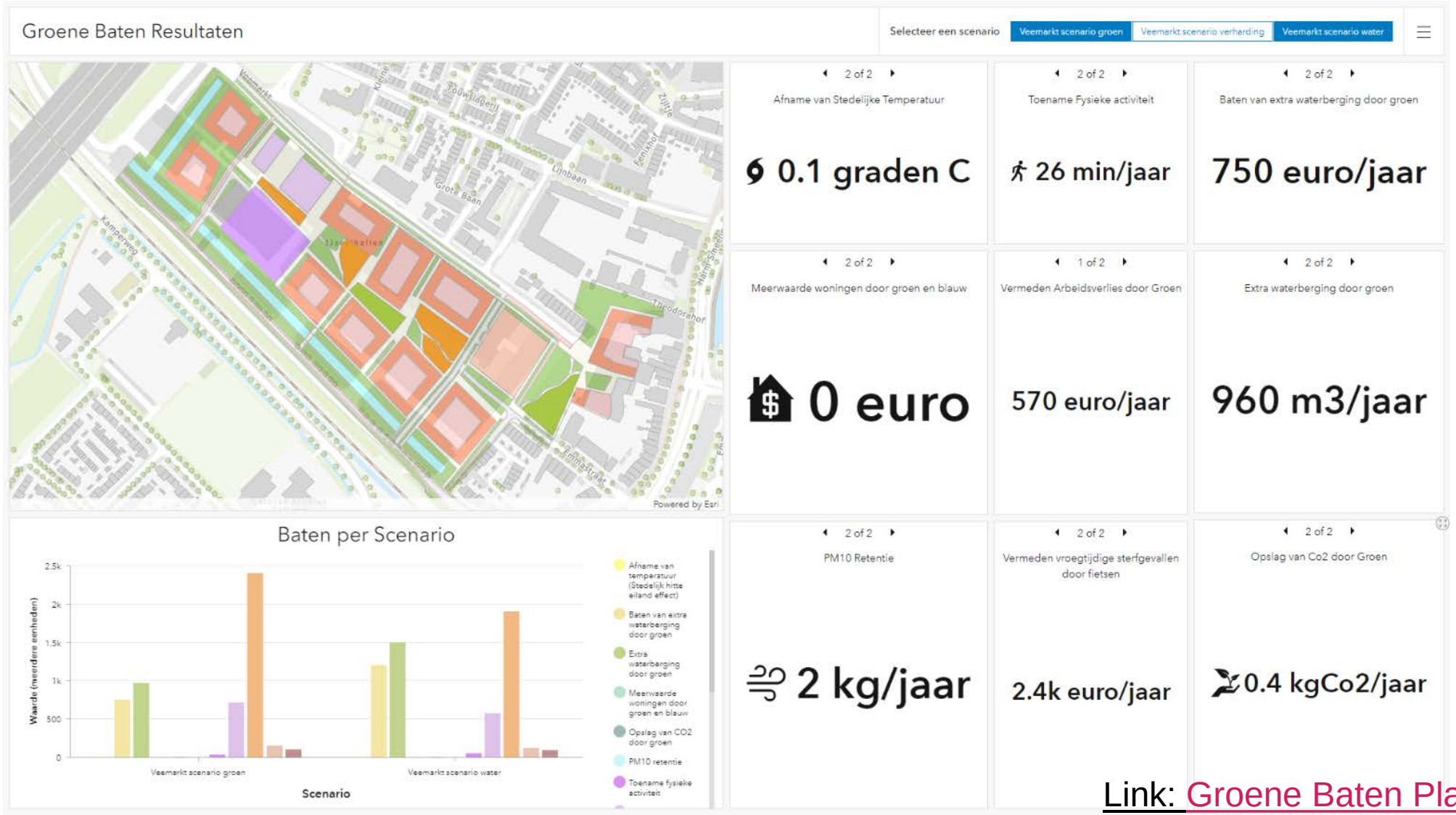
ESRI Urban modeller

- Increase efficiency planning process
- Overview all projects and plans in the city, 1 spot for all plans.
- Interactive tools for experimentation with spatial plans in different scenarios

Nieuwe Veemarkt – 3D ontwerp

WebApp Green Benefit Planner

Dashboard (example)



Link: Groene Baten Planner en ArcGIS

Lessons learned

Science-> practice

Demands new way of working

Different target groups

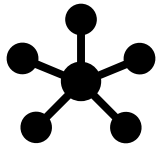
Tool for discussion

Integrated approach

Visualisation depends on the question and proces

Lessons learned and ambitions

- Organise management and maintenance
  - Start up
  - Longer term



- Generic connection
  - Tygron and ESRI
  - API key can be used by others as well

Ambition

- Towards a healthy and green benefitplanner
- Develop a modular system

Data- en Kennishub
Gezond Stedelijk Leven

Take Home Message:

Tools for sustainable area development

- Insight into the value of nature-based solutions
- Explore solutions with stakeholders
- Test measures and possible scenarios
- Support transitions in urban areas
- Based on 'State-of-the Art' Knowledge

More information?

- RIVM: Waarde van groen en water in de stad in beeld
- Atlas Natuurlijk Kapitaal: Groene Baten Planner (including video explanation)
- Esri: Groene Baten Planner en ArcGIS
- Tygron: Tygron NL Geodesign Platform | De baten van groen in integraal perspectief
- API: GBP API documentation (for technicians)

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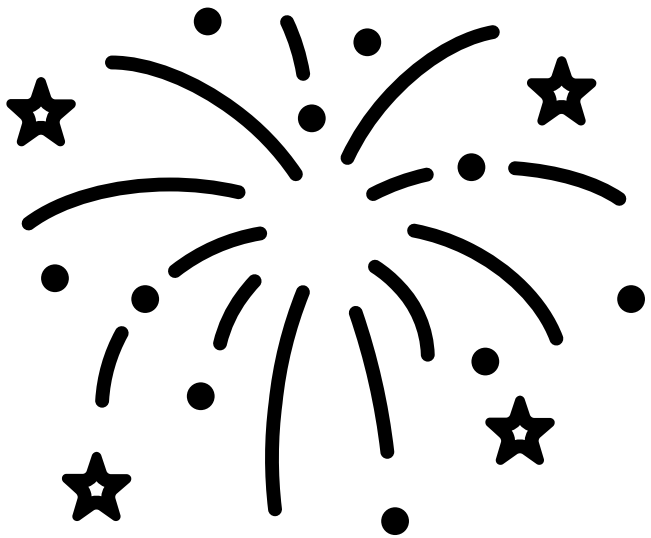
How to use the API?

API key: https://api2.gbpapi.nl/api/doc/
Check information:
https://atlasnatuurlijkkapitaal.nl/groene-baten-planner



Natural Capital Assessment API

Green and Blue in the city models

Created by RIVM
TDB

assessmentRequest — Show/Hide | List Operations | Expand Operations

POST /assessmentRequest

measures — Show/Hide | List Operations | Expand Operations

DELETE /deleteMeasureCollection

GET /getMeasureCollection

POST /measureCollection

model — Show/Hide | List Operations | Expand Operations

GET /modeldata/{model}

user — Show/Hide | List Operations | Expand Operations

POST /generateAPIKey

Questions?

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