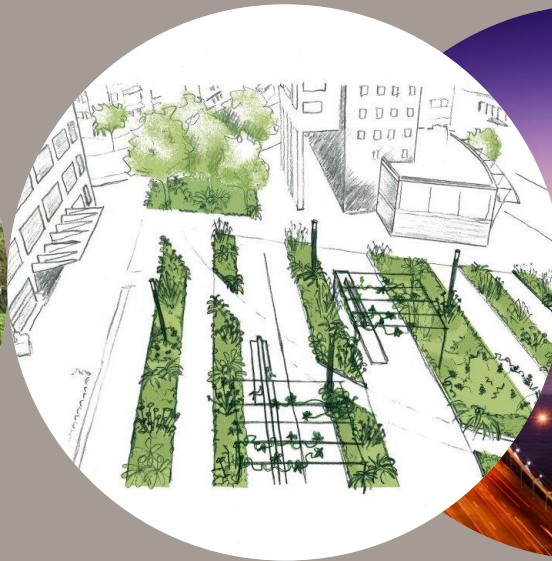


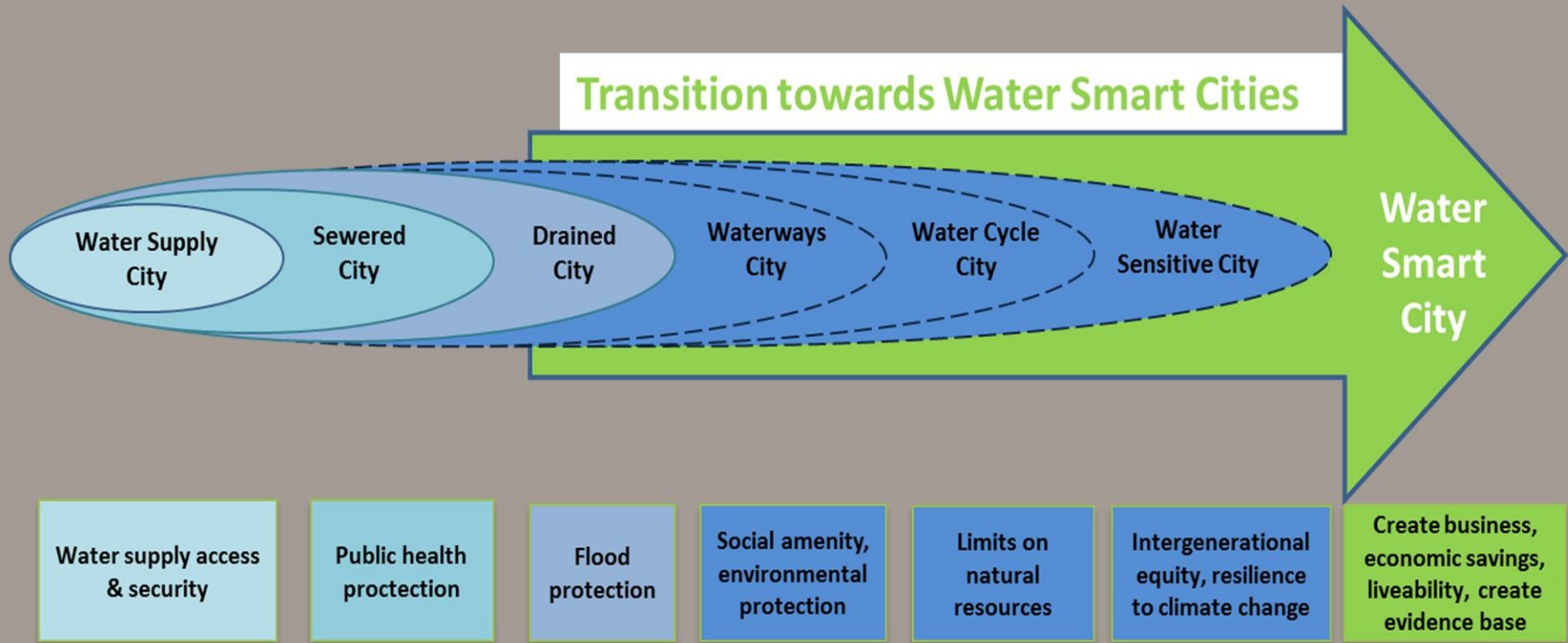
Nature-based solutions for water smart and climate resilient cities

Science and practical implementation

October 2018, Dr. Robbert Snep & Tim van Hattum

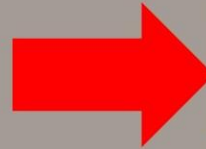


Transition Towards Water Smart Cities

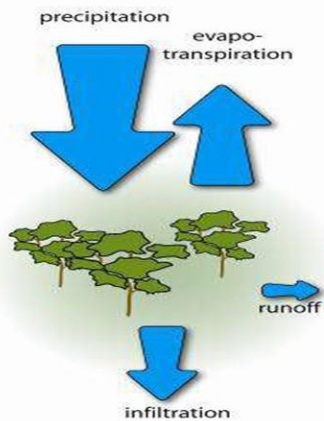


*Rain water as commodity,
not as nuisance!*

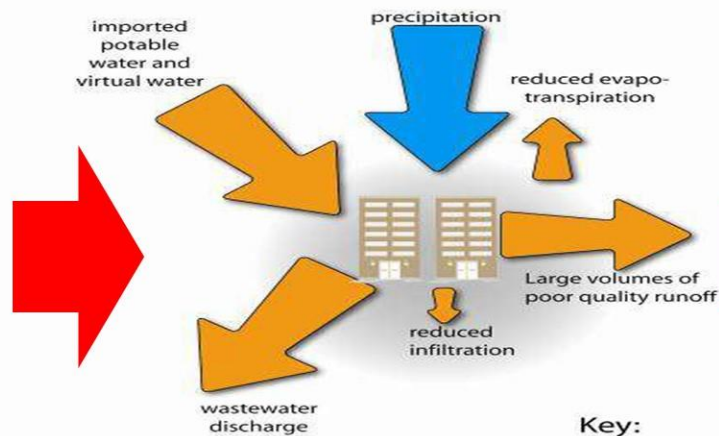
We have to change the way we think about water → city as catchment



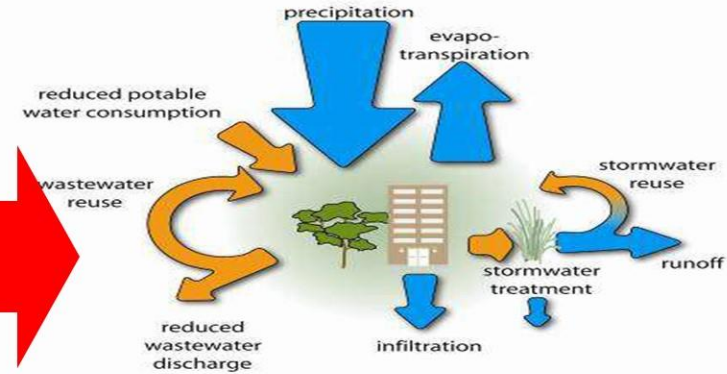
natural water balance



Urban water balance



WSUD water balance



Key:

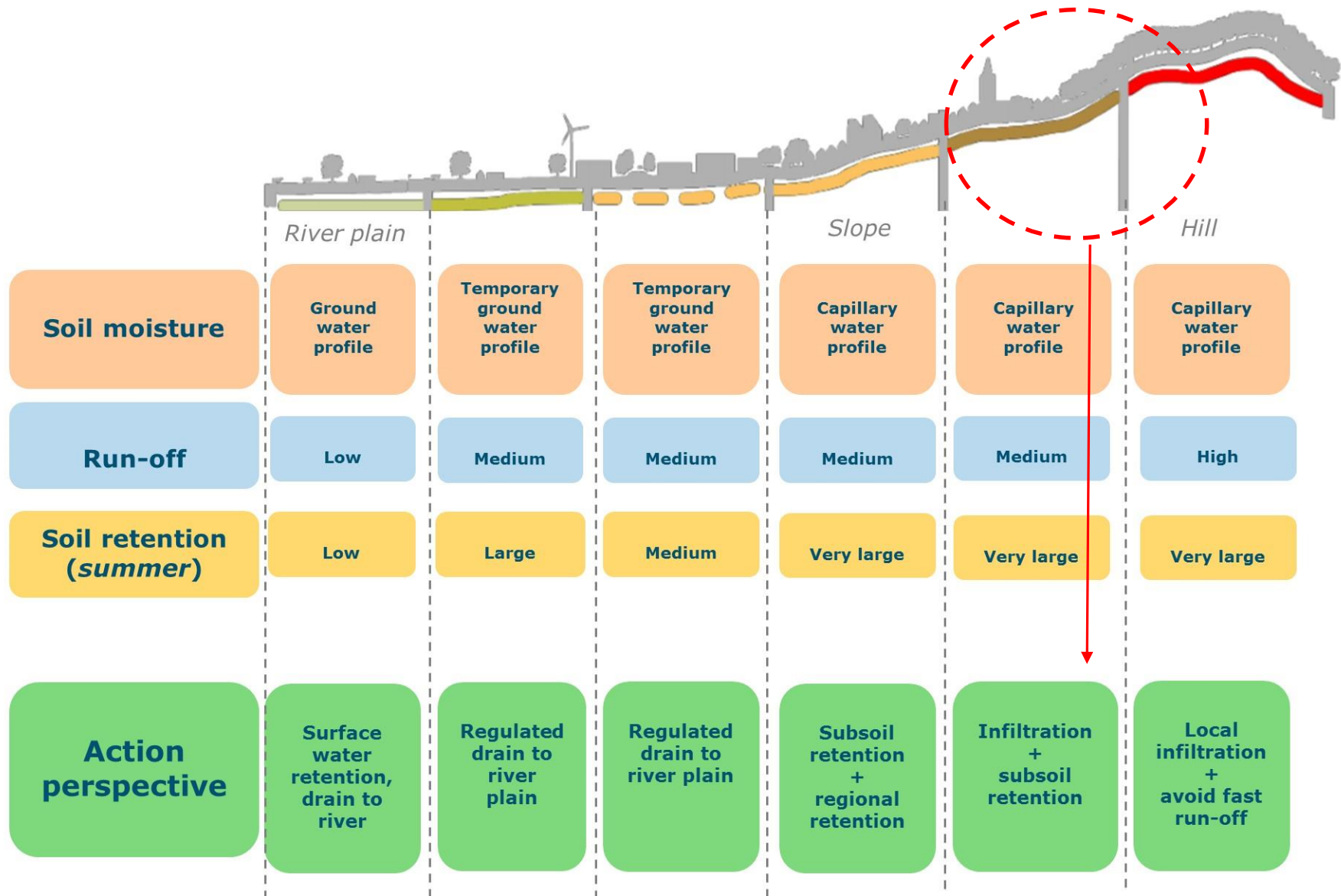


natural state

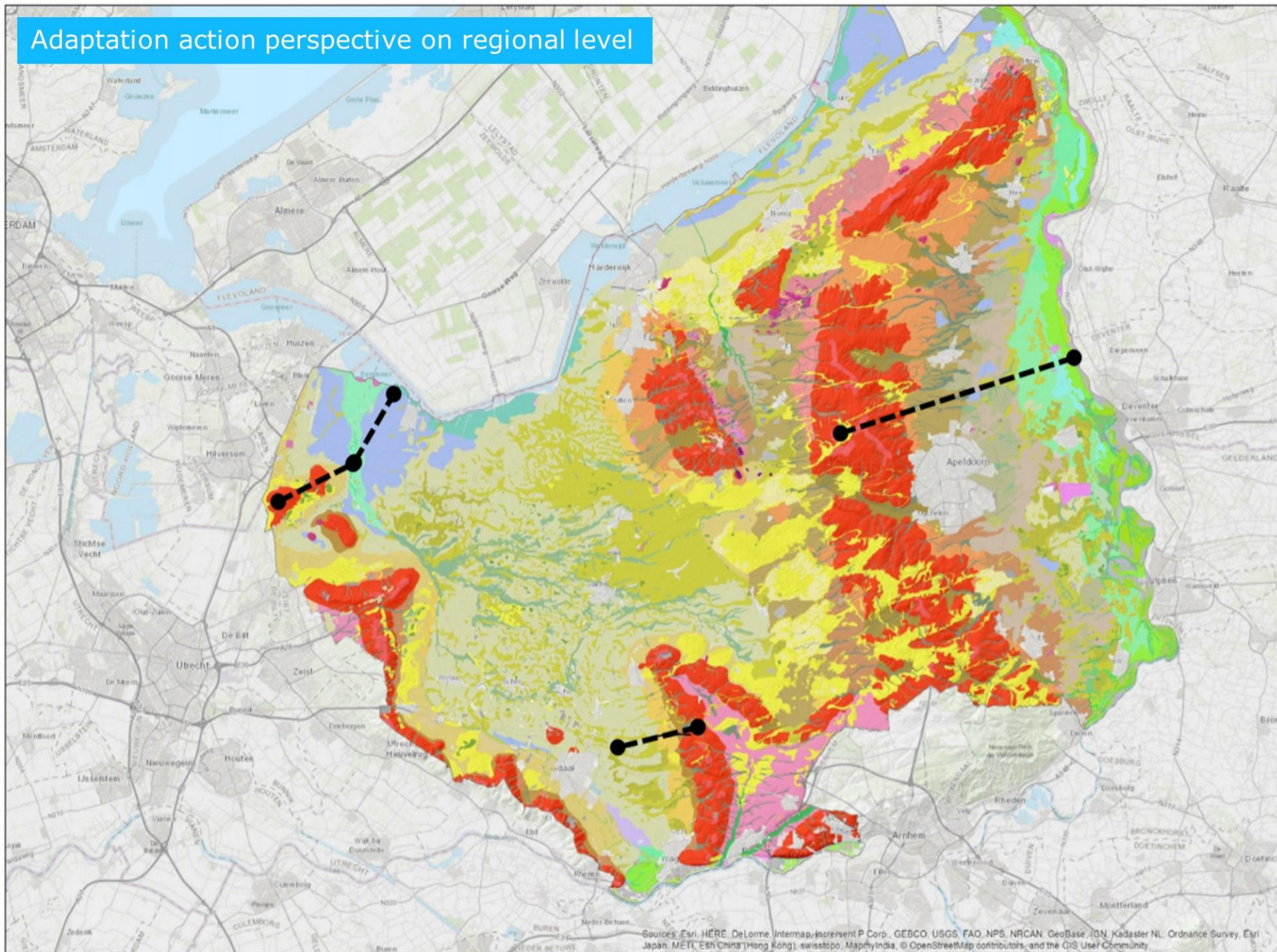


altered state

Landscape based adaptation



Adaptation action perspective on regional level



Adaptation Planning Support Toolbox: Measurable performance information based tools for co-creation of resilient, ecosystem-based urban plans with urban designers, decision-makers and stakeholders

Frans H.M. van de Ven^{a,d,*}, Robbert P.H. Snep^b, Stijn Koole^c, Reinder Brolsma^a, Rutger van der Brugge^a, Joop Spijker^b, Toine Vergroesen^a

^aDeltares, P.O. Box 85467, 3508 AL Utrecht, The Netherlands

^bAlterra Wageningen University & Research, P.O. Box 47, 6700 Wageningen, The Netherlands

^cBosch Slabbers landscape architects, Ie Sweelinckstraat 30, 2517 GD Den Haag, The Netherlands

^dDelft University of Technology, Dept. Water Management, Stevinweg 1, 2628 CN Delft, The Netherlands

ARTICLE INFO

Article history:

Received 8 February 2016

Received in revised form 14 June 2016

Accepted 16 June 2016

Available online xxx

Keywords:

Urban climate adaptation

Collaborative planning

Green infrastructure

Ecosystem-based adaptation

Planning support system

Performance indicators

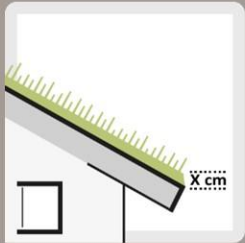
ABSTRACT

Currently, most tools, guidelines and benchmarks for urban adaptation raise awareness on climate change impacts, assess the current situation and/or address the need for adaptation on a policy-level. However, tools that have the potential to support the development of adaptation solutions in the actual urban planning and design practice seem to be missing. The Adaptation Planning Support Toolbox (APST) to fill this gap. This toolbox supports urban designers, designers and practitioners in defining the program of demands, in setting adaptation goals, in selecting from more than 60 blue, green and grey adaptation measures and with informed decision making on the implementation of adaptation plans. The APST provides quantitative, evidence-based performance indicators, a design workshop, to feed dialogues among stakeholders on where and how which ecosystem-based adaptation measures can be applied. Applications of the APST in various settings and context in cities on different continents have illustrated the added value of the toolbox in bringing policy and practice together with help of science. With more and more cities worldwide that will make the step from policymaking to actual adaptation-inclusive urban (re)development practice we foresee a growing demand for such tools.

© 2016 The Authors. Published by Elsevier Ltd. This is an open access article under the CC BY license

(<http://creativecommons.org/licenses/by/4.0/>).

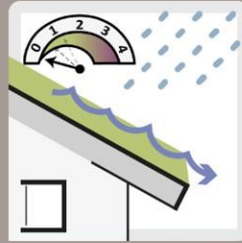
More than 60 nature-based solutions for climate change adaptation



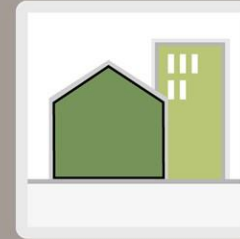
Extensive green roof



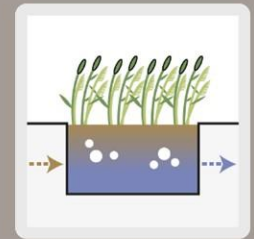
Intensive green roof



Green roof with delayed drainage



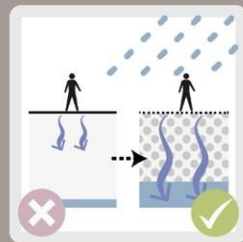
Green wall



Constructed wetland



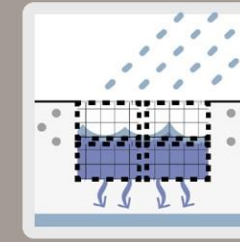
Bioretention pit for trees



Enhancing soil infiltration



Porous pavement



Infiltration units



Water roof



Subsoil water storage



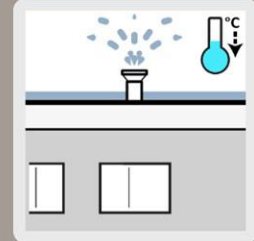
Rain barrel



Water square



Fountain



Wetting pavement



Setup Measures Layers

Snapshots

Documentation New

Scenario

Which scenario to use for calculations:

measures_total_V3_meta-t

Area of interest (m2)

0-10000000

0

Please draw project area

Importance multi-functional landuse

0-1 :

0

Scale level under consideration

- ☐ City
- ☐ Neighbourhood
- ☐ Street
- ☐ Building

Area slope

- ☒ Sloping area
- ☐ Flat area on high ground
- ☐ Flat area on low ground

Soil type

- ☒ Sand
- ☐ Peat
- ☐ Clay
- ☐ Bed rock

Existing type of space

- ☐ Red space (buildings)



Overview Detail Export

Target

Contribution

Climate

Storage cap.: 0.0%

Heat red.: 0.0%

Normative runoff: 0.0%

Drought red.: 0.0%

Groundwater recharge: 0.0%

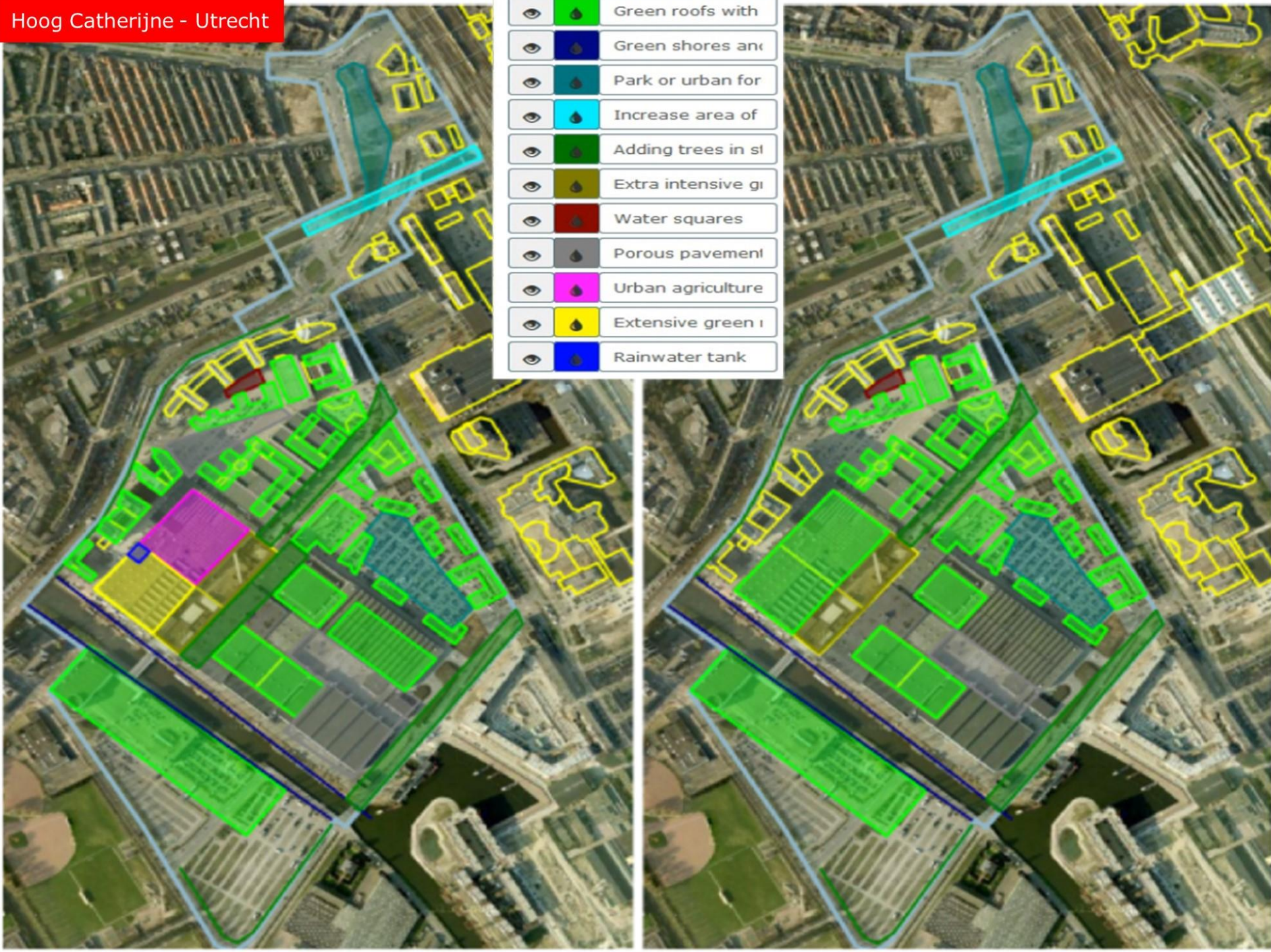
Water quality

Nutrient red.: 0.0%

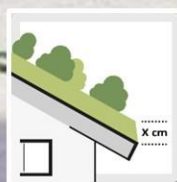
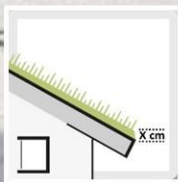
Abs. pollutants: 0.0%

Pathogens red.: 0.0%

Active measures








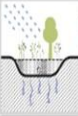
Setup Measures Layers Cases

Search measure

- 

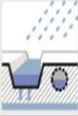
1

Cistern

79.9
- 

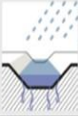
2

Bioretention cell

76.4
- 

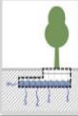
3

Surface drain

69.9
- 


4

Bioswale

69.0
- 


5

Tree cells

68.6
- 


6

Retention basin (wet pond)

64.4
- 

7

Infiltration recreation field

64.1
- 

8

Green open space

63.8



Overview Detail Export Target

Contribution

Climate

Storage cap.	52.4%
Normative runoff	32.0%
Evapotranspiration	10.0%
Groundwater recharge	30.0%



Water quality



Nutrient red.	1.0%
Abs. pollutants	1.6%
Pathogens red.	1.6%



Costs



Construction	100.0%
Annual Maint.	100.0%



Active measures



- 


Project Area
- 


Detention basin (dry)
- 


Urban agriculture
- 


Rainwater harvesting
- 


Adding trees in street
- 


Retention basin (wet)





Recommendations

Water Smart

see water as commodity, be water-sensitive

Landscape-based adaptation

benefit from the underground of your location

Adaptation Support Tool

use the right Nature-based Solution for the right task

create stakeholder support for climate-proof design

