



University of Ljubljana
Faculty of Civil and Geodetic Engineering

CAN URBAN TREES REDUCE THE IMPACT OF CLIMATE CHANGE ON STORM RUNOFF?

Katarina ZABRET, Mojca ŠRAJ

spa-ce.net conference

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INTRODUCTION

The process of urbanization altered the surface ...



<http://i.imgur.com/zdlr3.jpg>



http://www.mass.gov/envir/smart_growth_toolkit/images/Ag-vs.jpg

INTRODUCTION

CLIMATE CHANGE

- increase in number of heavy rainfall events
- changes in river discharges
- increase in the frequency of flood events and economic losses



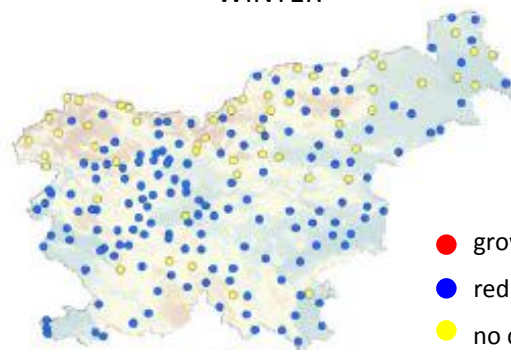
AUTUMN



WINTER



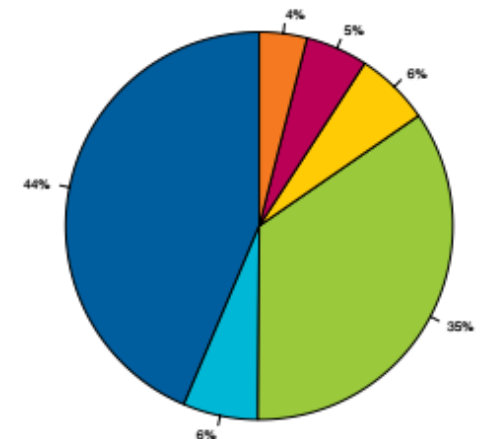
SPRING



SUMMER

- growth
- reduction
- no changes

Total = 8 835 disasters (1970–2012)

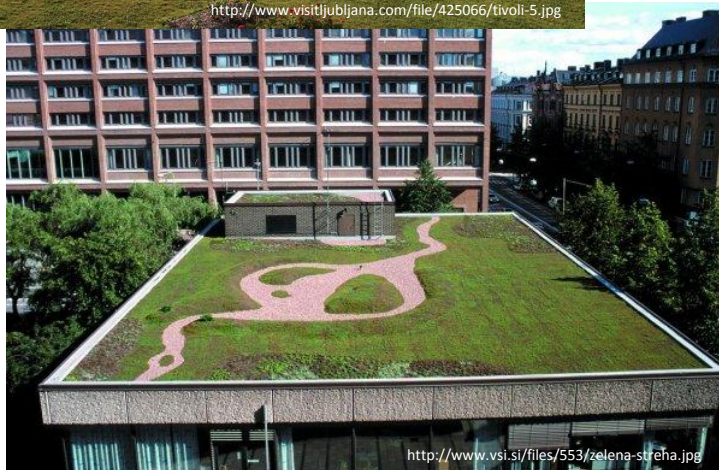


- Floods
- Mass movement wet
- Storms
- Droughts
- Extreme temperature
- Wildfires

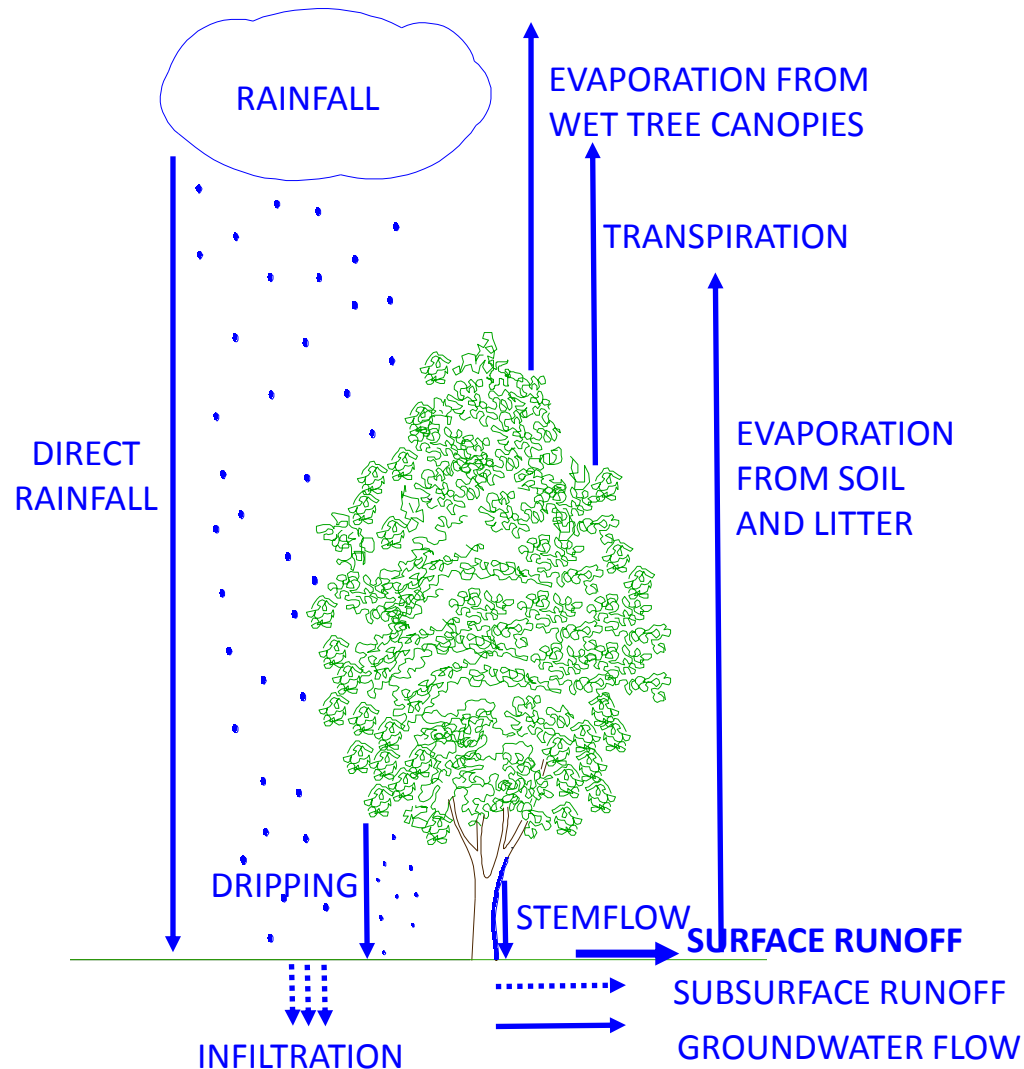
Source: World Meteorological Organization (2014) Atlas of mortality and economic losses from weather, climate and water extremes (1970–2012).

INTRODUCTION

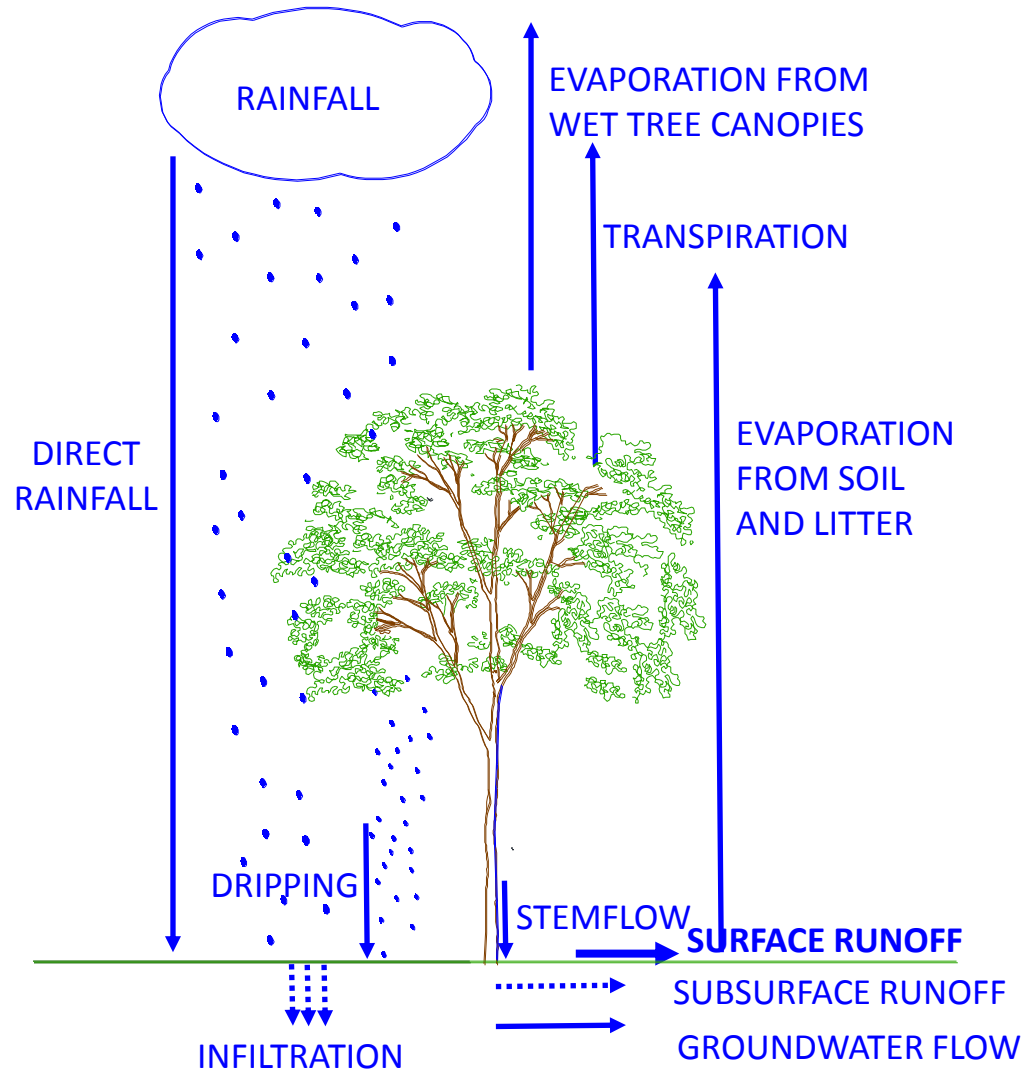
GREEN INFRASTRUCTURE - one of the solutions of reducing the climate change impact



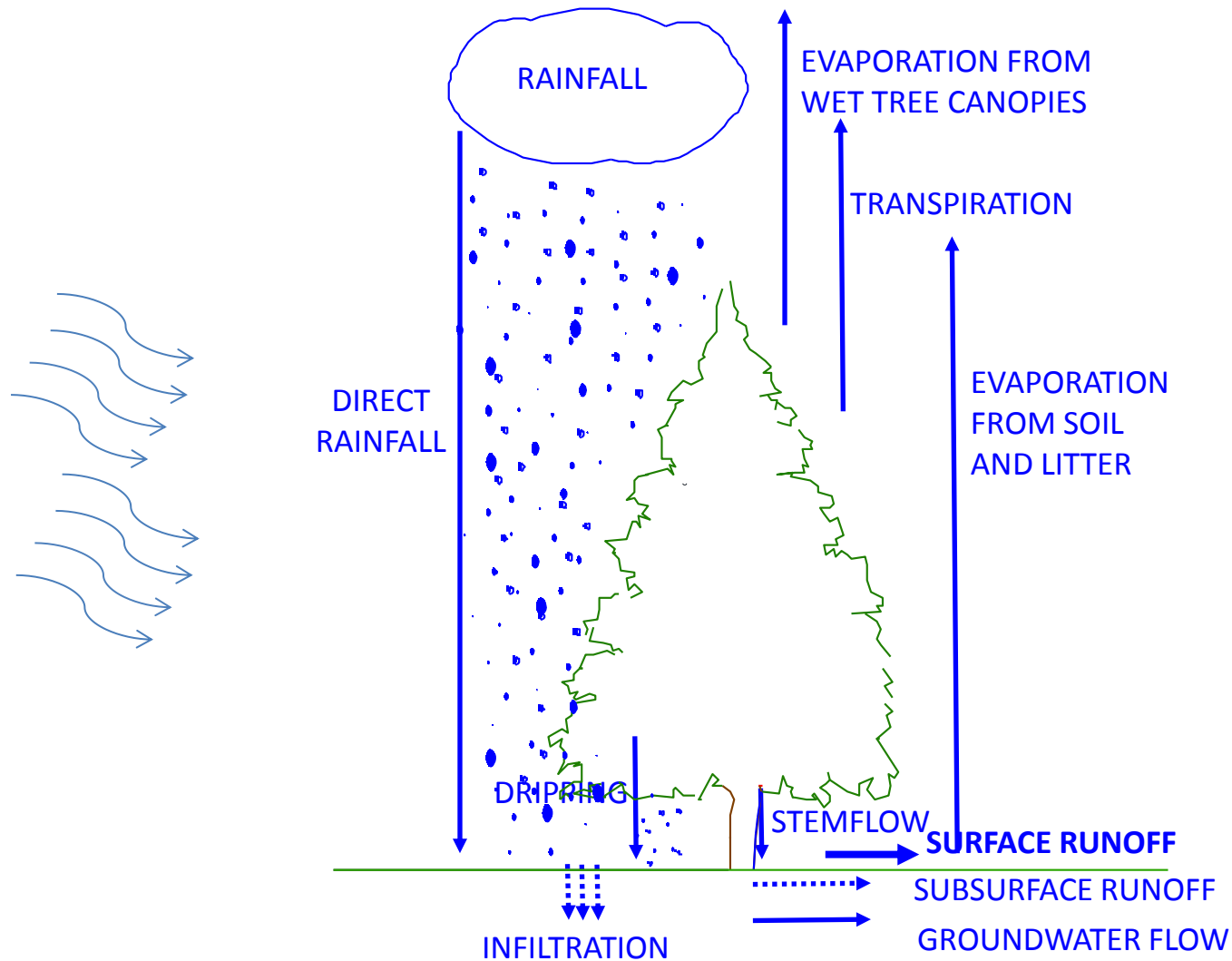
RAINFALL INTERCEPTION



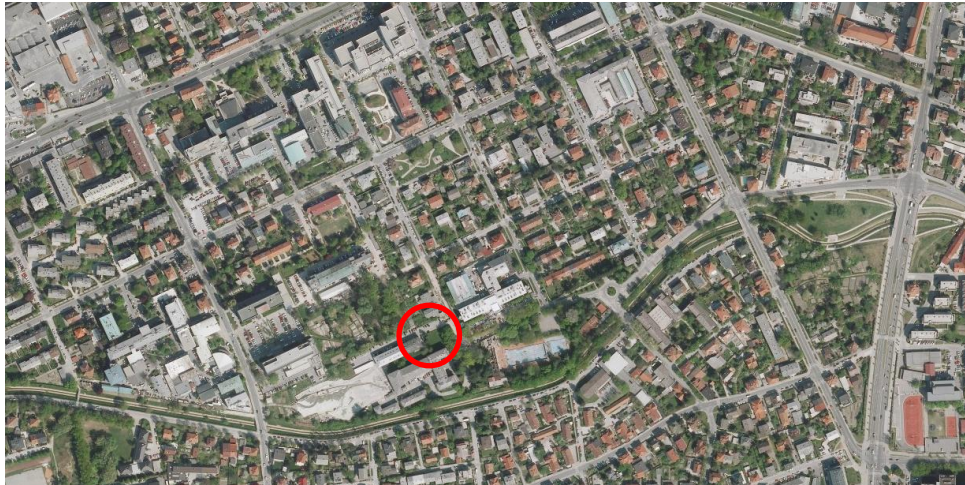
RAINFALL INTERCEPTION



RAINFALL INTERCEPTION



SITE DESCRIPTION



Study plot in Ljubljana, Slovenia

Measurements of throughfall and stemflow under two *Pinus nigra* (black pine) and two *Betula pendula* (birch tree):

- Steel trough gauge with automatic data logger
- Steel trough gauge with manually collected polyethylene container
- Roving manually-read wedge gauges
- Rubber hose spirally wrapped around the stem

APPLIED ESTIMATIONS

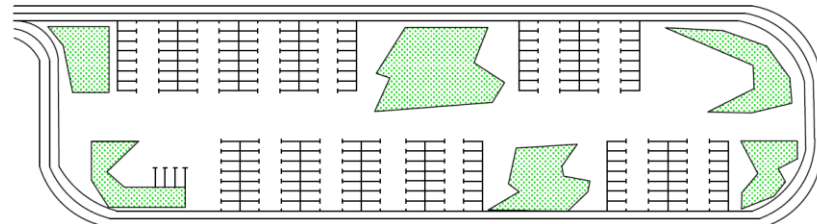
ESTIMATION OF PRECIPITATION SCENARIOS INCLUDING CLIMATE CHANGE

- Year 2014: measured annual precipitation data
1672 mm
- Year 2100: forecasted precipitation by Rakovec and Ceglar (2012)
1839 mm

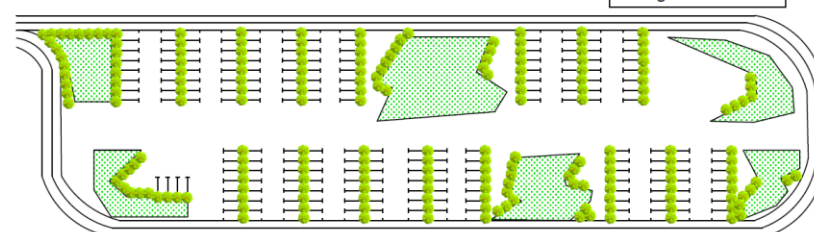
ESTIMATION OF COSTS AND BENEFITS OF PLANTING THE TREES

- Use of online calculator Green Values Stormwater Management Calculator (CNT, 2015)
- Planting of 200 trees on 12,677 m² parking lot

INITIAL SITUATION



SITUATION AFTER PLANTING THE TREES



RESULTS OF MEASUREMENTS

RAINFALL INTERCEPTION

B. pendula

Throughfall: 75.4 %

Stemflow: 4.0 %

Interception: 20.6 %

P. nigra

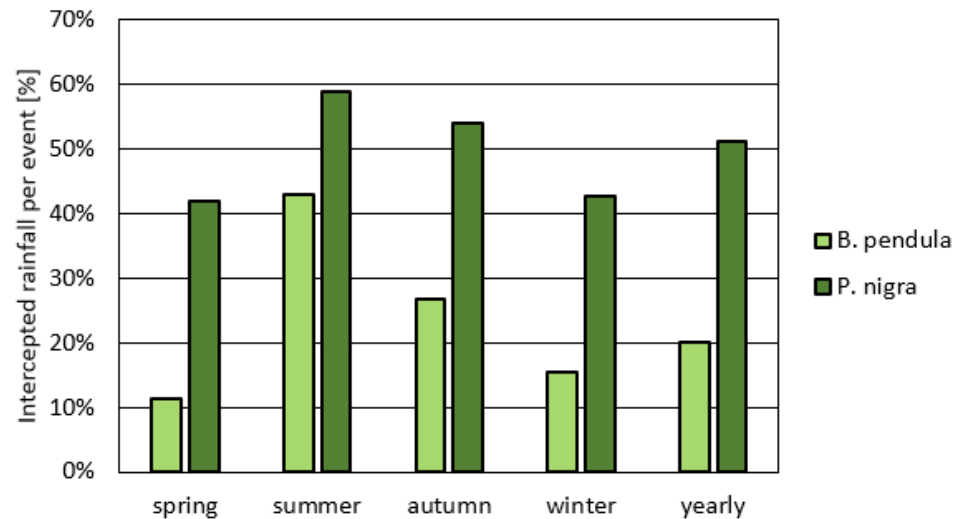
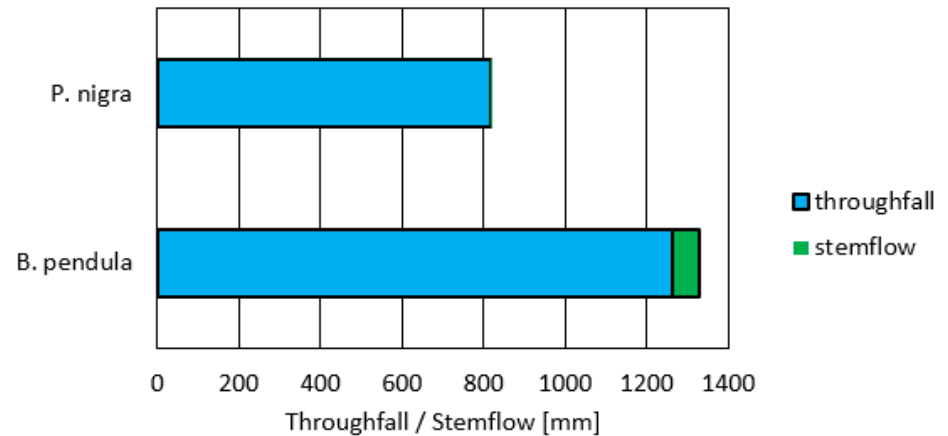
Throughfall: 49.0 %

Stemflow: 0.7 %

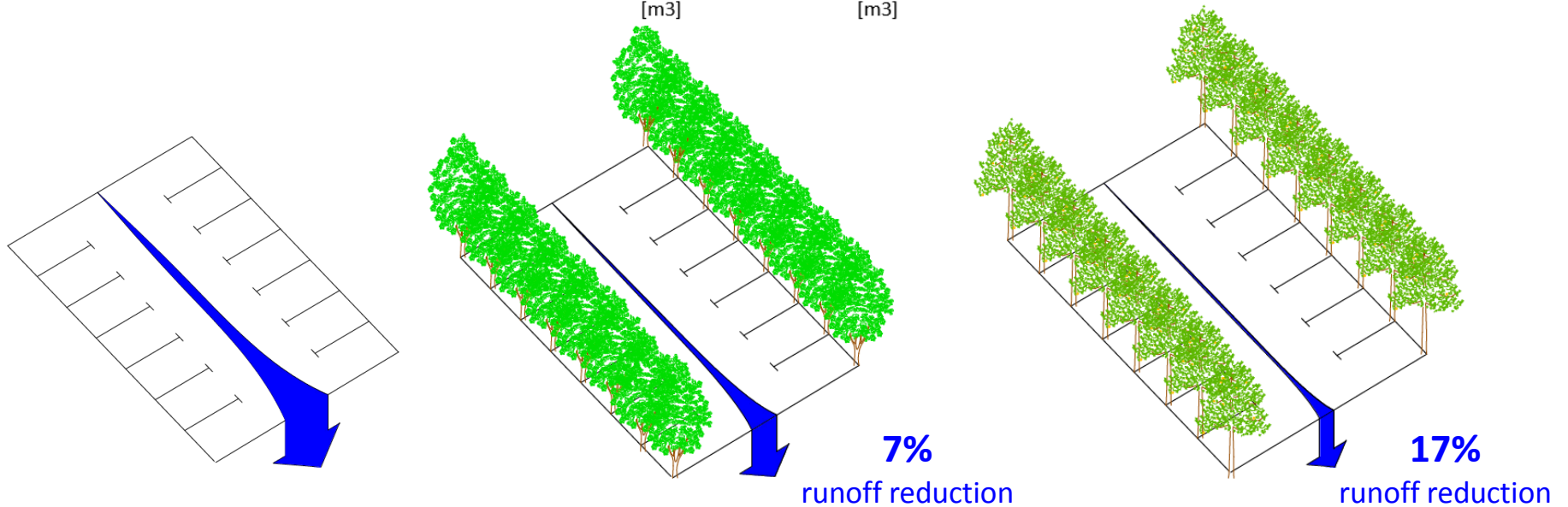
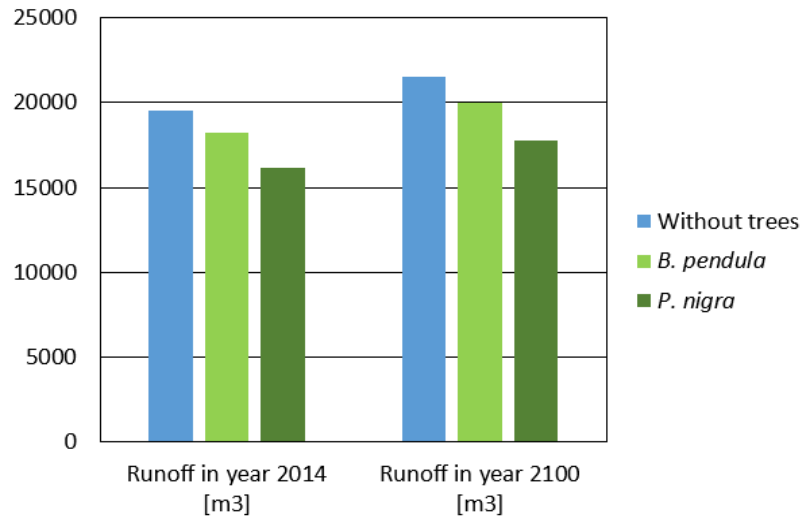
Interception: 51.0 %

The influence of vegetation and meteorological parameters on amount of rainfall interception:

- Leafed and leafless period
- Rainfall rate and duration



RUNOFF REDUCTION



COSTS AND BENEFITS

Costs	Conventional parking lot	Parking lot with trees	Difference
Parking Lot	600,486 €	387,783 €	-35%
Storm water Storage	94,249 €	76,103 €	-19%
Turf	2,818 €	2,818 €	0%
Trees		49,376 €	0%
Tree Box Filters		249,372 €	0%
Additional Soil		123,440 €	0%
Total	697,553 €	888,892 €	27%

Benefits	One year	50 years
Reduced Air Pollutants	32.3 €	947.1 €
Carbon Dioxide Sequestration	21.5 €	628.4 €
Compensatory Value of Trees	49,376.1 €	1,439,198.3 €
Groundwater Replenishment	14.4 €	421.0 €
Storm water runoff reduction	4,093.3 €	214,897.6 €
Total	53,537.6 €	1,656,092.5 €

GREEN VALUES STORMWATER MANAGEMENT CALCULATOR

Centre for Neighborhood Technology, USA

CALCULATOR

Getting Started | Lot Information | Predevelopment | Runoff Reduction Goal

Lot Information

Zip Code:

Annual Rainfall (in):

Storm Type (in):

Storm Rainfall (in):

Size of Lot* (acres):

Or give dimensions*:

Length of Lot (ft):

Width of Lot (ft):

Soil Type:

* Required fields.

RESULTS The Green Stormwater BMP(s) applied in this scenario compared to conventional approaches, the green practices in this scenario are:

Volume Control | Coefficients and Runoff | Land Use | Costs | Benefits

Volume Control

Required Volume Capture from 0.5" over Impermeable Surface (ft ³)	417
Volume Captured by current BMPs (ft ³)	1,250
Permeable Pavement on Parking (ft ²)	1,250
Percentage of Required Volume Captured by current BMPs (%)	300
Decrease in Impervious Area (%)	43

CONCLUSIONS

IMPORTANCE of urban trees in our environment.

Various BENEFITS of urban trees.

Urban trees can REDUCE the storm water runoff.

Green infrastructure HELP cities to ADAPT to climate changes.



SLOVENSKA ULICA NAMA

<http://www.zamestopodveh.org/files/datoteke/projekti/NAMA.jpg>



http://www.lpt.si/uploads/cms/gallery/68/image_496.jpg