University *of Ljubljana*
Faculty *of Civil and Geodetic Engineering*

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

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spa-**ce**.net conference

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INTRODUCTION

The process of urbanization altered the surface …

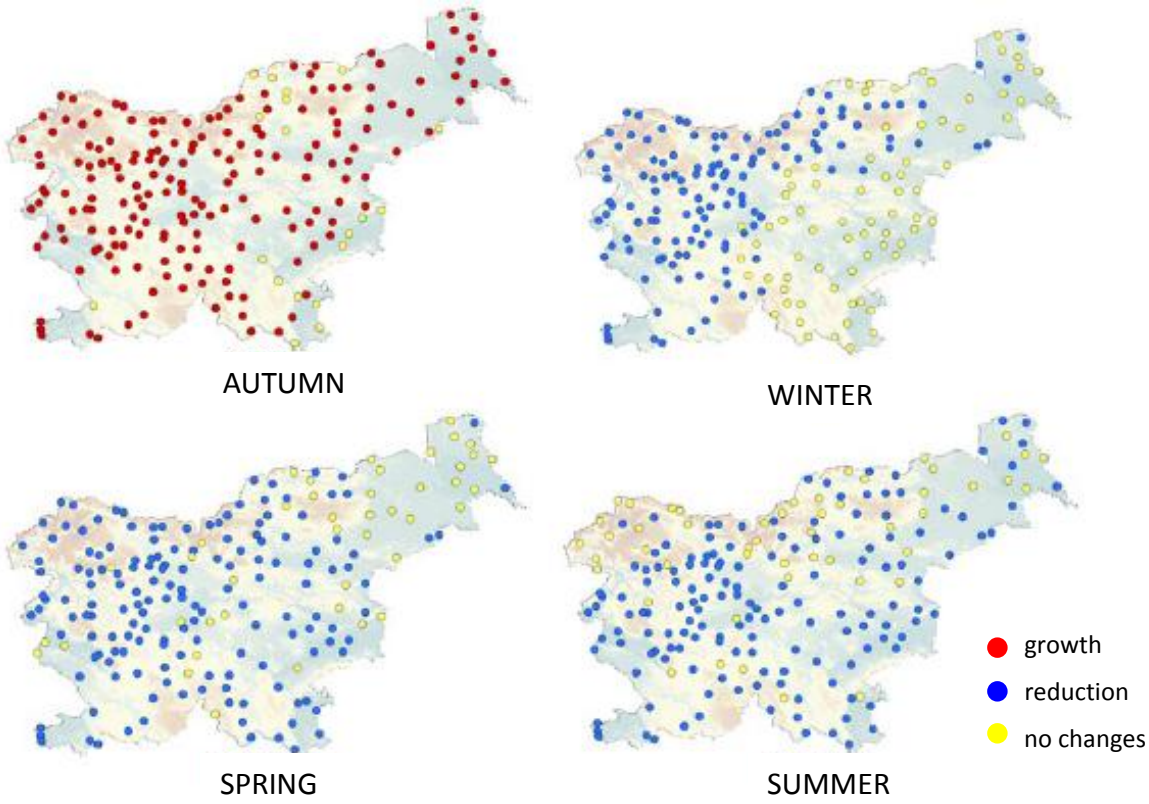
INTRODUCTION

CLIMATE CHANGE

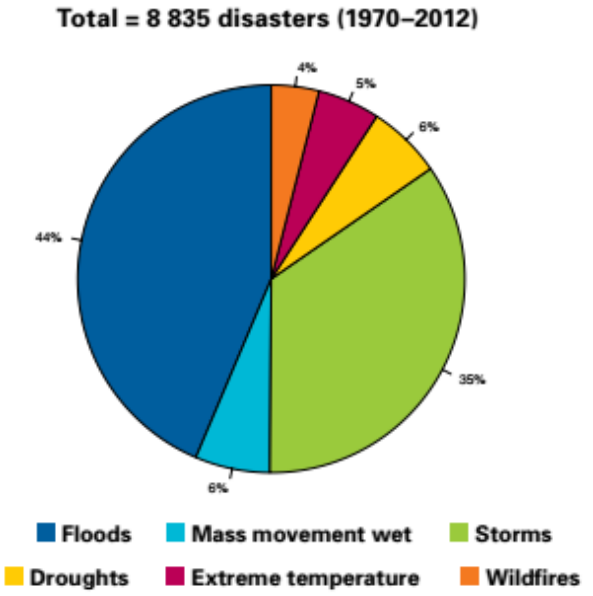
→ increase in number of heavy rainfall events

→ changes in river discharges

→ increase in the frequency of flood events and economic losses



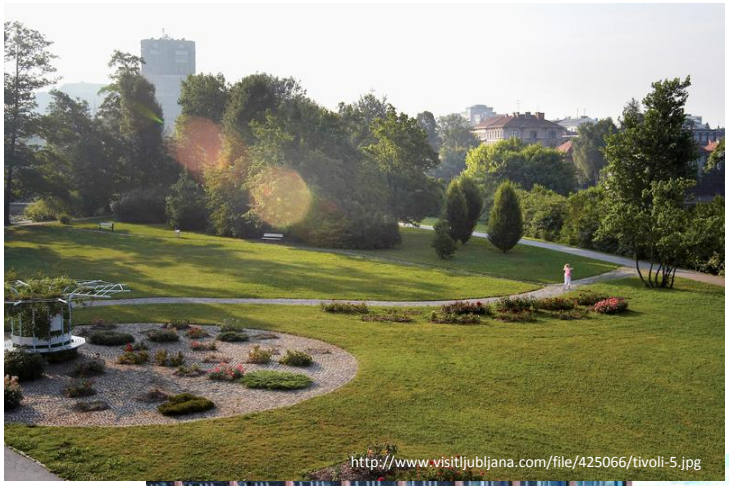
Source: ARSO (2006) Podnebne razmere v Sloveniji (The climatic conditions in Slovenia).

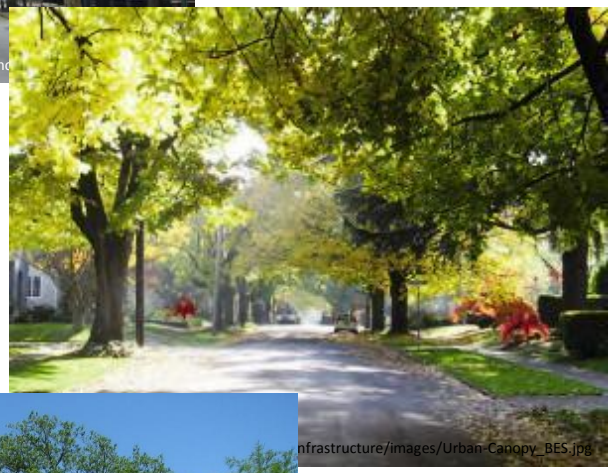


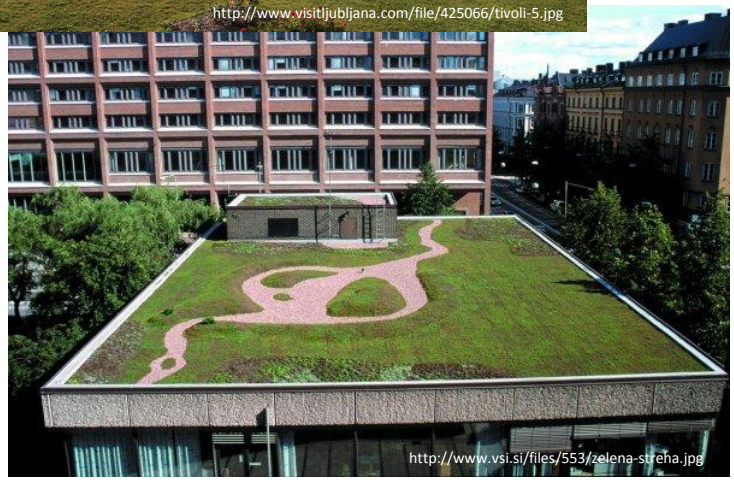
Source: World Meteorological Organization (2014) Atlas of mortality and economic losses from weather, climate and water extremes (1970–2012).

INTRODUCTION

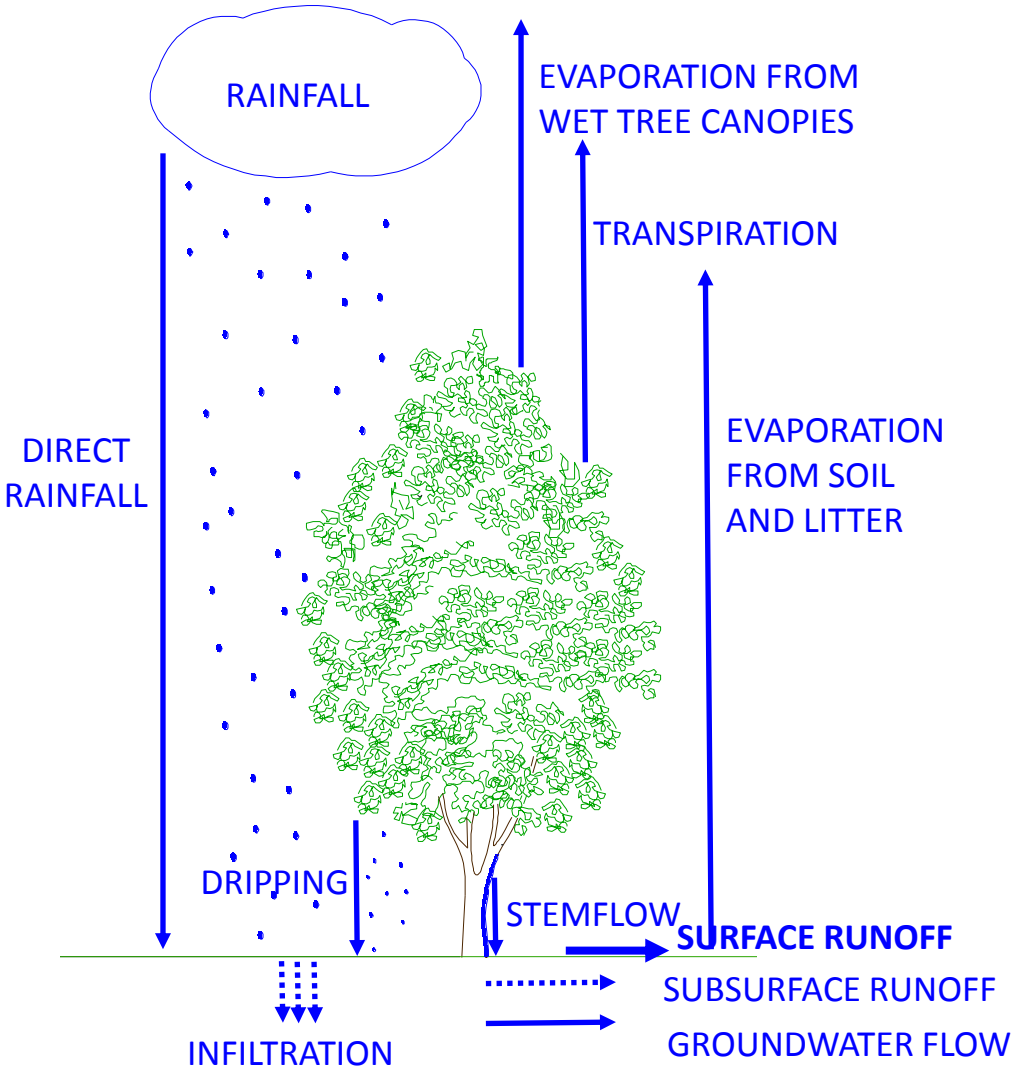
GREEN INFRASTRUCTURE - one of the solutions of reducing the climate change impact







RAINFALL INTERCEPTION



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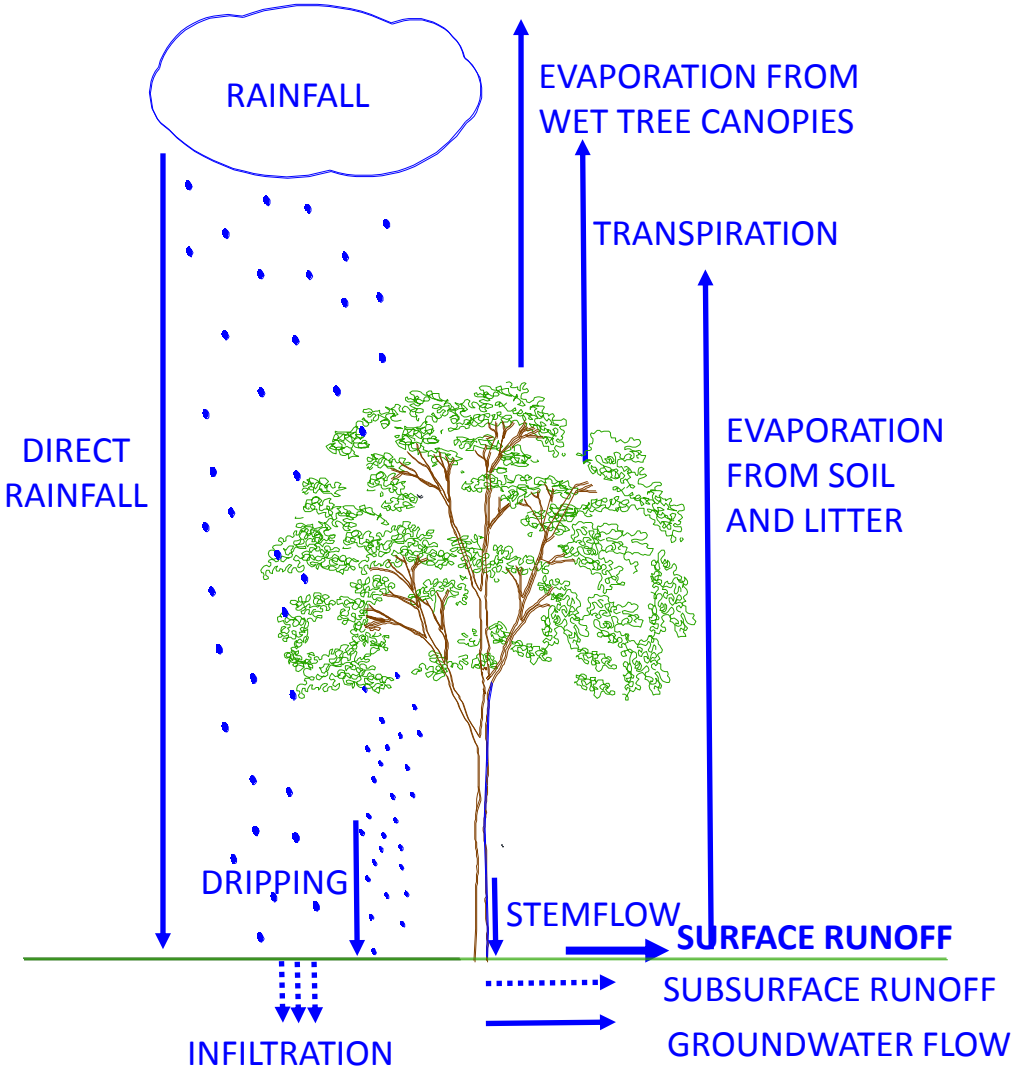

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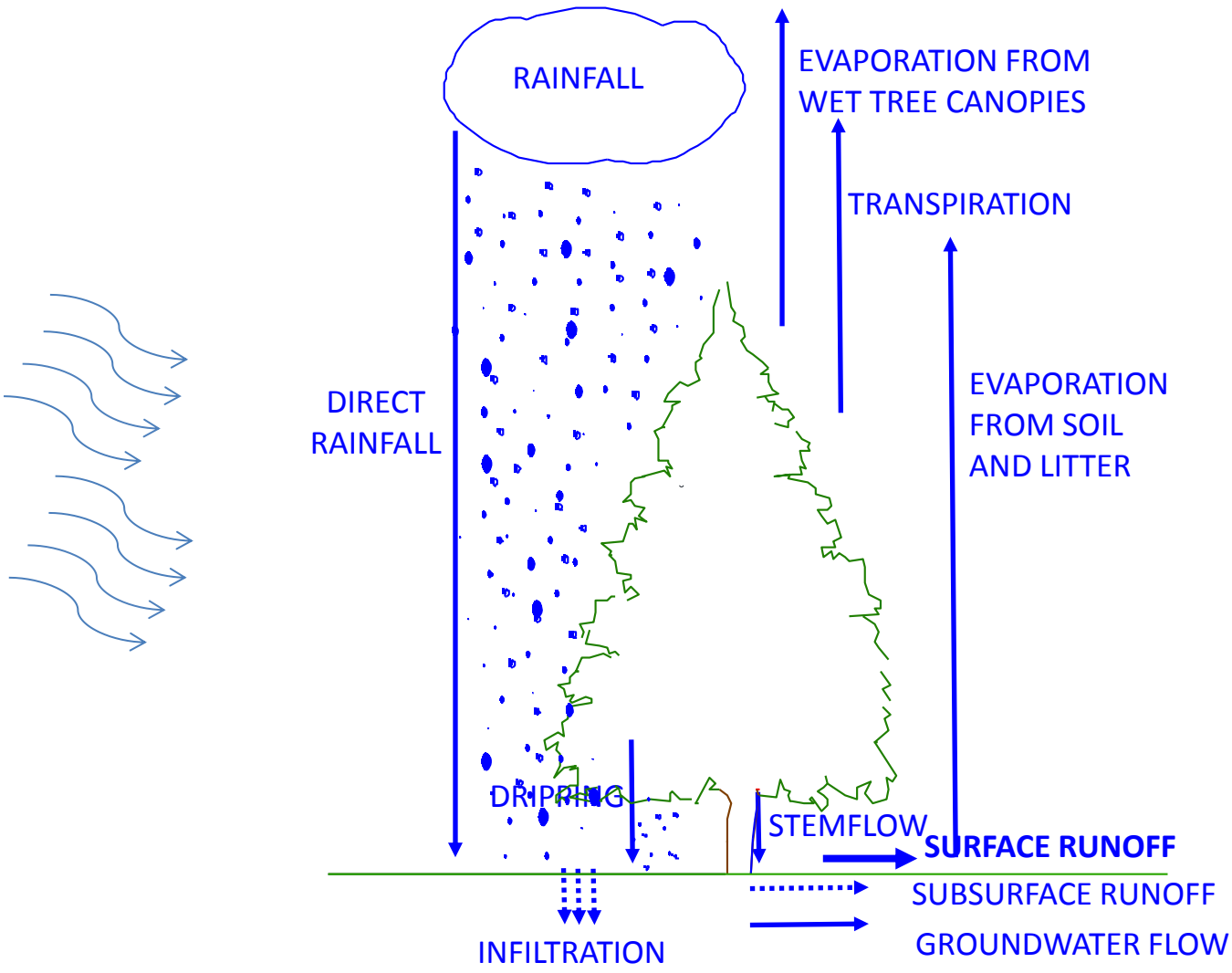


SITE DESCRIPTION

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 loger
- 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

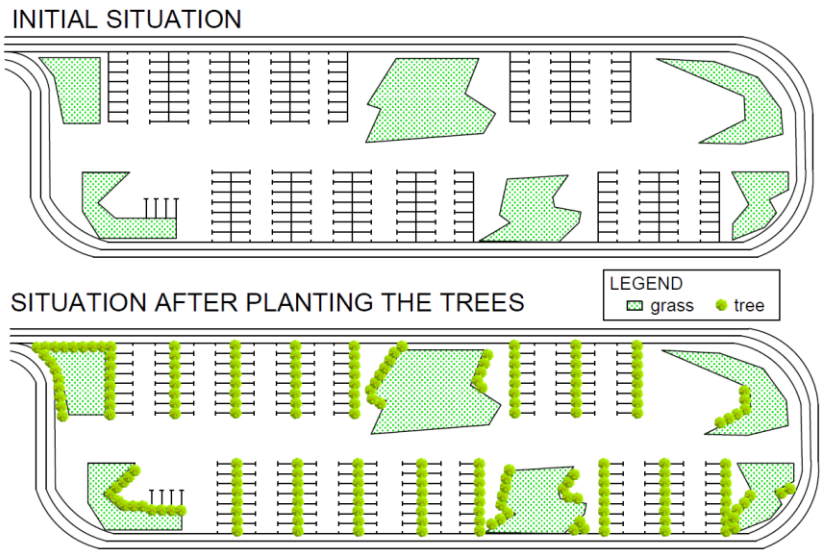
1672 mm

- 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 m^2 parking lot



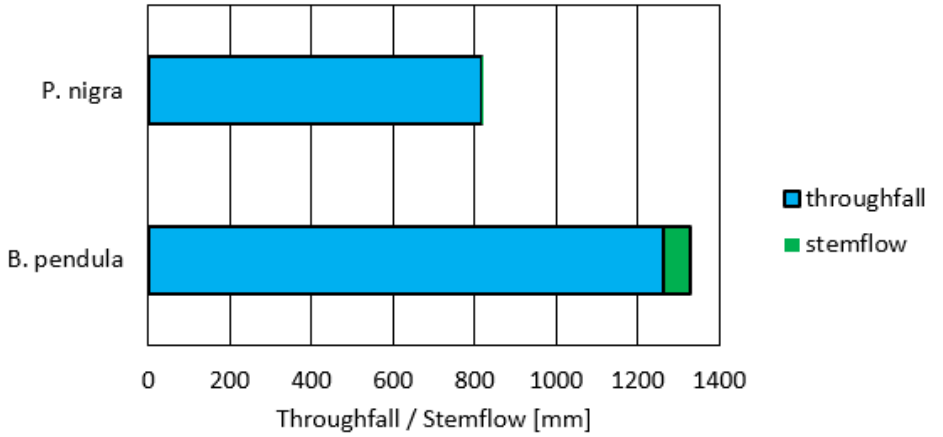
RESULTS OF MEASUREMENTS

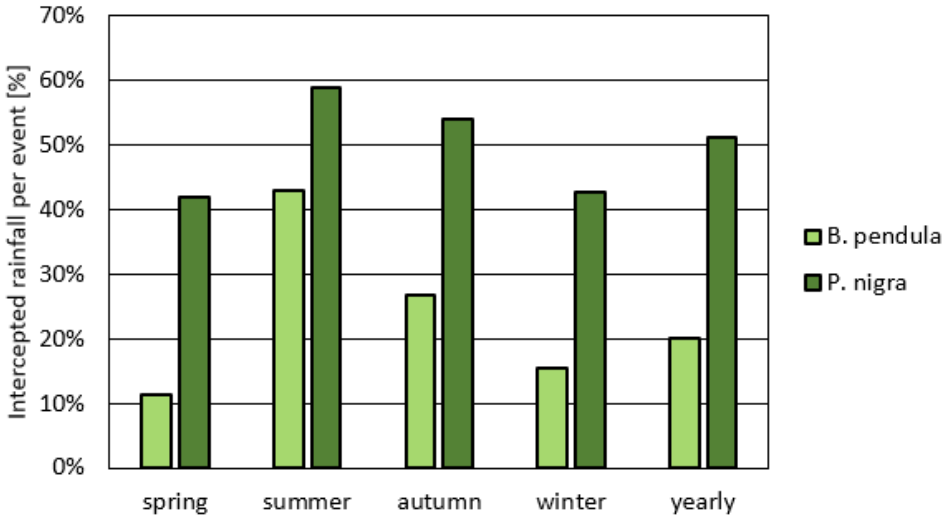
RAINFALL INTERCEPTION

B. pendula
Throughfall: 75.4 %
Stemflow: 4.0 %
Interception: 20.6 %

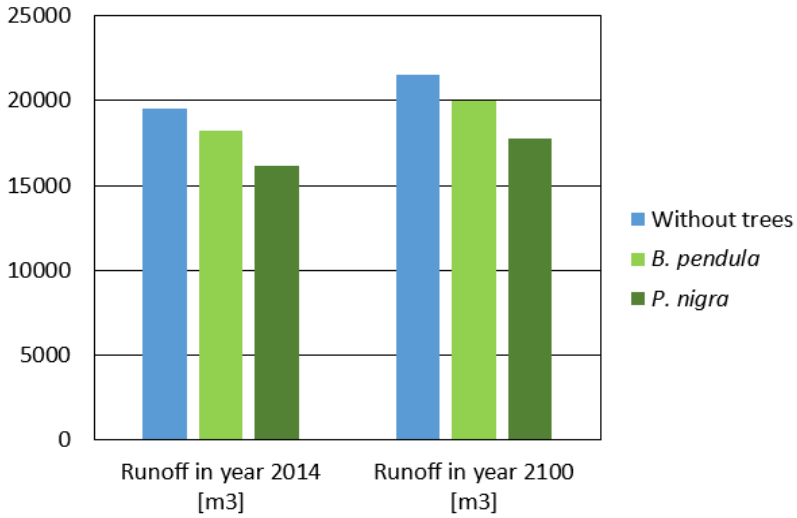
P. nigra
Throughfall: 49.0 %
Stemflow: 0.7 ‰
Interception: 51.0 %

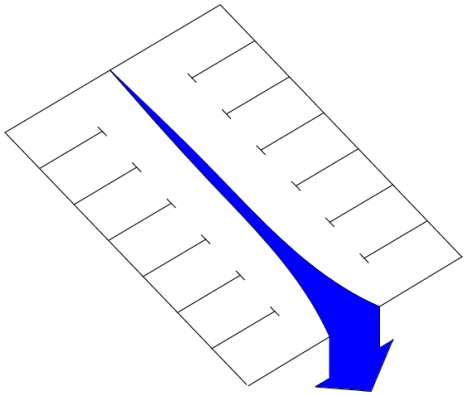
The influence of vegetation and meteorological parameters on amount of rainfall interception:
- Leafed and leafless period
- Rainfall rate and duration

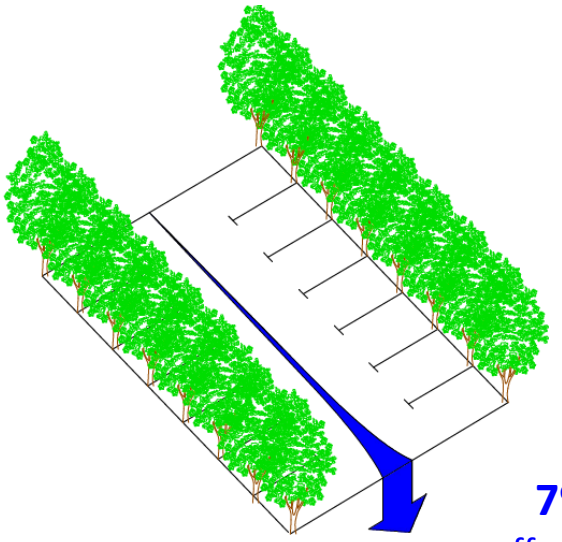




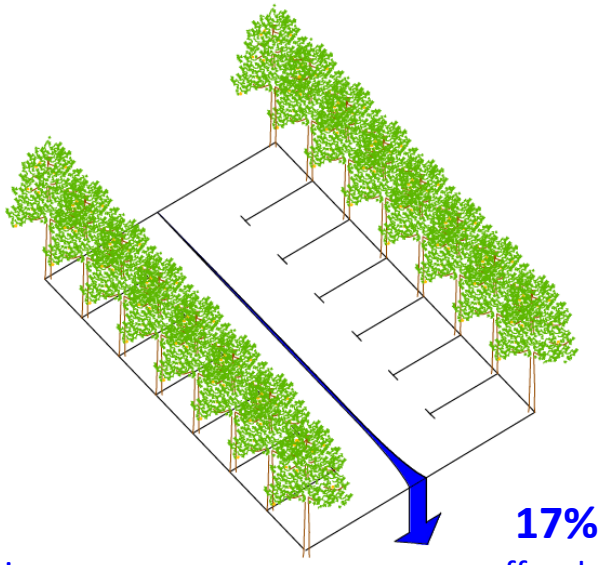
RUNOFF REDUCTION







7%
runoff reduction



17%
runoff reduction

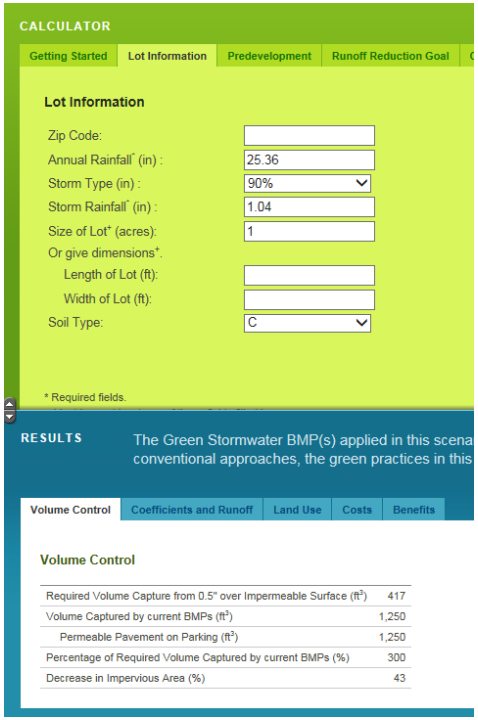
COSTS AND BENEFITS

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



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.