

Assessment of ecosystem services related to urban green spaces in flood management: a review and development of a methodology

MARÉCHAL Justine, MAHY Grégory,
BOGAERT Jan, DUFÈRENE Marc

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INTRODUCTION

MA

TOPICS OF THIS STUDY

3 key concepts:

- ✿ Ecosystem services
- ✿ Urban green spaces
- ✿ Flood management

DEFINITION OF KEY CONCEPTS

Ecosystem services:

Many urban ecosystem services with major importance already exist
Interest of ecosystems services do not exist, they can be improved and evaluated

It is a sub-very specific and LOCAL ecosystem services instead of GLOBAL ecosystem services

DEFINITION OF KEY CONCEPTS

Urban green spaces:

Relatively recent concept due to the urban nature conservation movement
Vision of the population: urban green spaces = public spaces

IN THIS STUDY: urban green spaces = every pervious land cover



Urban green spaces ↔ Green infrastructure

Green infrastructure = interconnected network of natural areas and other open spaces that conserves natural ecosystems values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife.



Urban green spaces = part of green infrastructure



Urban green spaces <-> Green infrastructure

Green infrastructure = interconnected network of natural areas and other open spaces that conserves natural ecosystems values and functions, sustains clean air and water, and provides a wide array of benefits to people and wildlife.



Urban green spaces = part of green infrastructure

DEFINITION OF KEY CONCEPTS

Flood management:

Floods are associated with heavy rainfalls or thawing snow conditions

These conditions may lead to rapid accumulation or runoff of surface waters

IN THIS STUDY: flash flood due to heavy rainfall which leads to a sewer capacity exceedance

? Why are urban areas subject to all conceivable forms of flooding ?

- The wide range of geographic locations
- The high proportion of impervious areas



? Why are urban areas subject to all conceivable forms of flooding?

- 💧 The wide range of geographic locations
- 💧 The high proportion of impervious areas

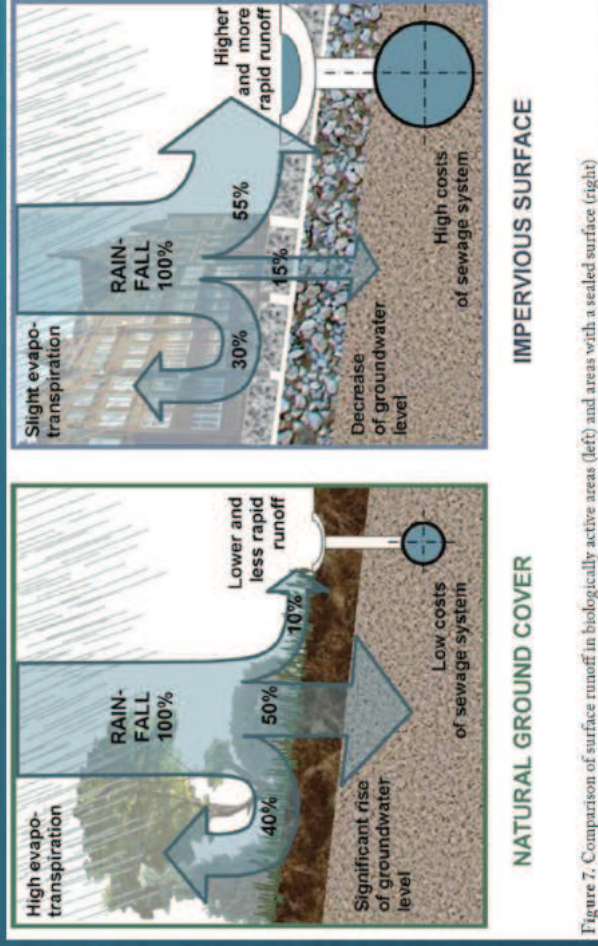
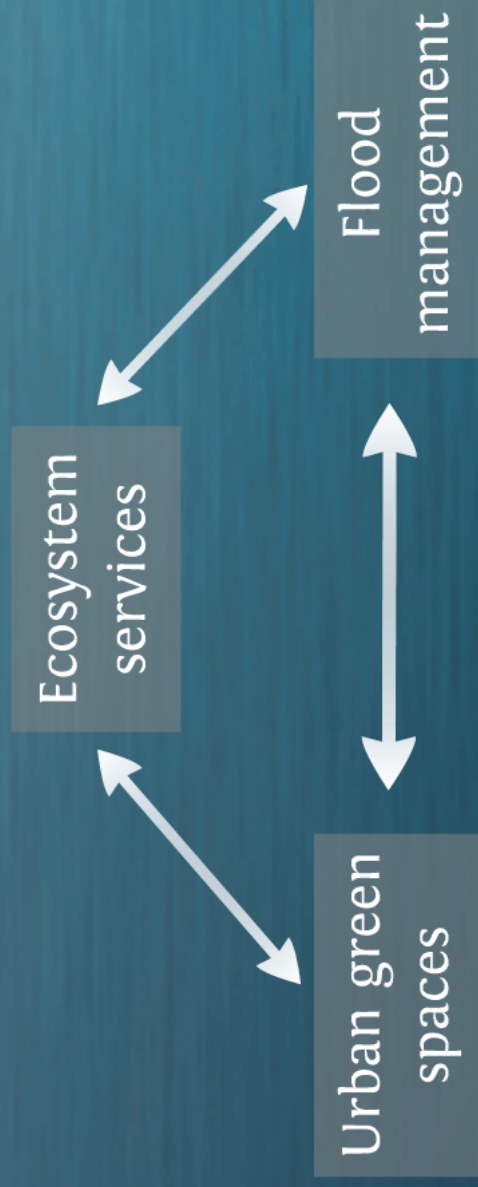


Figure 7. Comparison of surface runoff in biologically active areas (left) and areas with a sealed surface (right)

Source: Januchta-Szostak (2012)

LINKS BETWEEN KEY CONCEPTS



BASIC HYPOTHESIS

- Urban green spaces play a role in the management of pluvial flash floods



**MATERIAL AND
METHODS**

LITERATURE REVIEW

2 steps:

Step 1: Adequate typology of urban green spaces

Step 2: Specific ecosystem services
provided by urban green spaces

Aim: a matrix

urban green spaces VS ecosystem services

TYOLOGY OF URBAN GREEN SPACES

Keywords for the Scopus literature review (article title, abstract or keywords)

urban*

typolog*

green infrastructure

green space*

land cover

+ NGOs reports via Google



Comparison of these urban green spaces typologies

AIM: land-cover or habitat based typology

ECOSYSTEM SERVICES PROVIDED

Keywords for the Scopus literature review (article title, abstract or keywords)

urban*	ecosystem service*	green infrastructure
green space*	valuation	flood*

AIM: identify the specific ecosystem services provided by urban green spaces related to flood management



RESULTS

TYOLOGY OF URBAN GREEN SPACES

Number of existing typologies, with uneasy mix of classifications that relate to:

- use (e.g. recreational),
- type (e.g. public),
- habitat (e.g. woodlands),
- shape (e.g. linear)

DTLR_2002
TYPOLOGY OF URBAN GREEN SPACE
RECREATION GREEN SPACE
INCIDENTAL GREEN SPACE
PRIVATE GREEN SPACE
PRODUCTIVE GREEN SPACE
BURIAL GROUNDS
INSTITUTIONAL GROUNDS
WETLAND
WOODLAND
OTHER HABITATS
LINEAR GREEN SPACE

USE (E.G. RECREATIONAL)
TYPE (E.G. PUBLIC SPACE)
HABITATS (E.G. WOODLANDS)
SHAPE (E.G. LINEAR FEATURES)

NLCD 2001 LAND COVER CLASSES
OPEN WATER
PERENNIAL ICE/SNOW
DEVELOPED, OPEN SPACE
DEVELOPED, LOW INTENSITY
DEVELOPED, MEDIUM INTENSITY
DEVELOPED, HIGH INTENSITY
BARREN LAND (ROCK/CLAY/SAND)
UNCONSOLIDATED SOILS
DECIDUOUS FOREST
EVERGREEN FOREST
MIXED FOREST
DWARF SCRUB
SHRUB SCRUB
GRASSLAND/HERBACEOUS
LICHENS
MOSS
PASTURE/HAY
CULTIVATED CROPS
WOODY WETLANDS
EMERGENT HERBACEOUS WETLANDS

Chosen typology: modified NLCD

- Open water
- Barren land (rock/sand/clay)
- Pasture/Hay
- Grassland/Herbaceous
- Cultivated crops
- Wetlands (Emergent herbaceous or woody)
- Shrub/Scrub
- Deciduous forest (broadleaf)
- Evergreen forest (conifer)
- Mixed forest

DTLR_2002

TYPOLOGY OF URBAN GREEN SPACE

RECREATION GREEN SPACE

INCIDENTAL GREEN SPACE

PRIVATE GREEN SPACE

PRODUCTIVE GREEN SPACE

BURIAL GROUNDS

INSTITUTIONAL GROUNDS

WETLAND

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OTHER HABITATS

LINEAR GREEN SPACE

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BARREN LAND (ROCK/CLAY/SAND)
UNCONSOLIDATED SHORE
DECIDUOUS FOREST
EVERGREEN FOREST
MIXED FOREST
DWARF SCRUB
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ECOSYSTEM SERVICES PROVIDED

Highlight of ecosystem services related to flood regulation:

INFILTRATION

RUNOFF

Quantitative data transformed into qualitative scale data

Example of data found in the literature

Land use types	Runoff coef (mean)	Reclassement	Runoff coef (mean)	Q
Downtown business	0,825	Recreational with sandy soils	0,125	-
Neighbourhood business	0,625	Parks and cemeteries	0,175	-
Heavy industrial	0,75	Unimproved areas	0,3	-
Light industrial	0,65	Playgrounds	0,275	-
Multi-residential units, attached	0,675	Railroad yard	0,3	-
Multi-residential units, detached	0,5	Suburban residential	0,325	-
Single-family residential	0,4	Single-family residential	0,4	-
Suburban residential	0,325	Cultivated lands with loamy soils	0,425	+
Playgrounds	0,275	Multi-residential units, detached	0,5	+
Railroad yard	0,3	Neighbourhood business	0,625	++
Unimproved areas	0,2	Light industrial	0,65	++
Parks and cemeteries	0,175	Multi-residential units, attached	0,675	+++
Asphalt and concrete	0,825	Heavy industrial	0,75	+++
Brick	0,775	Brick	0,775	+++
Roofs	0,85	Downtown business	0,825	+++
Cultivated lands with loamy soils	0,425	Asphalt and concrete roofs	0,875	+++
Woodlands with sandy soils	0,125		0,85	+++

MATRIX

Ecosystem services

SECTION	PROVISIONING												REGULATION AND MAINTENANCE								CULTURAL		SPECIFIC ISSUE		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	A	B	
	CROPS	LIVESTOCK	FODDER	CAPTURE FISHERIES	AQUACULTURE	WILD FOODS	TIMBER	WOOD FUEL	ENERGY (BIOMASS)	BIOCHEMICALS AND MEDICINE	FRESHWATER	LOCAL CLIMATE REGULATION	GLOBAL CLIMATE REGULATION	FLOOD PROTECTION	GROUNDWATER RECHARGE	AIR QUALITY REGULATION	EROSION REGULATION	NUTRIENT REGULATION	WATER PURIFICATION	POLLINATION	RECREATION & AESTHETIC VALUES	INTRINSIC VALUE OF BIODIVERSITY	INFILTRATION	RUNOFF	
URBAN GREEN SPACES																									
CLASS = ECOSYSTEM SERVICE																									
1 OPEN WATER												1													
2 BARREN LAND (ROCK/SAND/CLAY)																									
3 PASTURE/HAY																									
4 GRASSLAND/HERBACEOUS																									
5 CULTIVATED CROPS																									
6 WETLANDS (EMERGENT HERBACEOUS OR WOODY)									2			1,3,4	1,2,4	2	1	4	2,3,4	4	2,3,4						
7 SHRUB/SCRUB																									
8 DECIDUOUS FOREST (BROADLEAF)																									
9 EVERGREEN FOREST (CONIFER)																									
10 MIXED FOREST																									
11 GREEN ROOFS																									
12 GREEN FACADES																									

Urban green spaces

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Ecosystem services

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URBAN GREEN SPACES CLASS = ECOSYSTEM SERVICE	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	A	B	
	1 OPEN WATER											1													
	2 BARREN LAND (ROCK/SAND CLAY)																								
	3 PASTURE/HAY																								
	4 GRASSLAND/HERBACEOUS																								
	5 CULTIVATED CROPS												1	1	1	1									
	6 WETLANDS (EMERGENT HERBACEOUS OR WOODY)									2			1,3,4	1,2,4	2	1	4	2,3,4	4	2,3,4	4	2,3,4			
	7 SHRUB/SCRUB																								
	8 DECIDUOUS FOREST (BROADLEAF)											4	4	4						4					
	9 EVERGREEN FOREST (CONIFER)													4,5											
	10 MIXED FOREST													5											
	11 GREEN ROOFS													5											
12 GREEN FACADES																									

Urban green spaces



DISCUSSION

DISCUSSION

- ✓ Urban green spaces potentially provide ecosystem services for water regulation and flood management
- ➔ Further research: mapping of urban green spaces for belgian urban case studies and evaluation of ecosystem services provided

Thank you
for your attention

Contact:
justine.marechal@ulg.ac.be



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