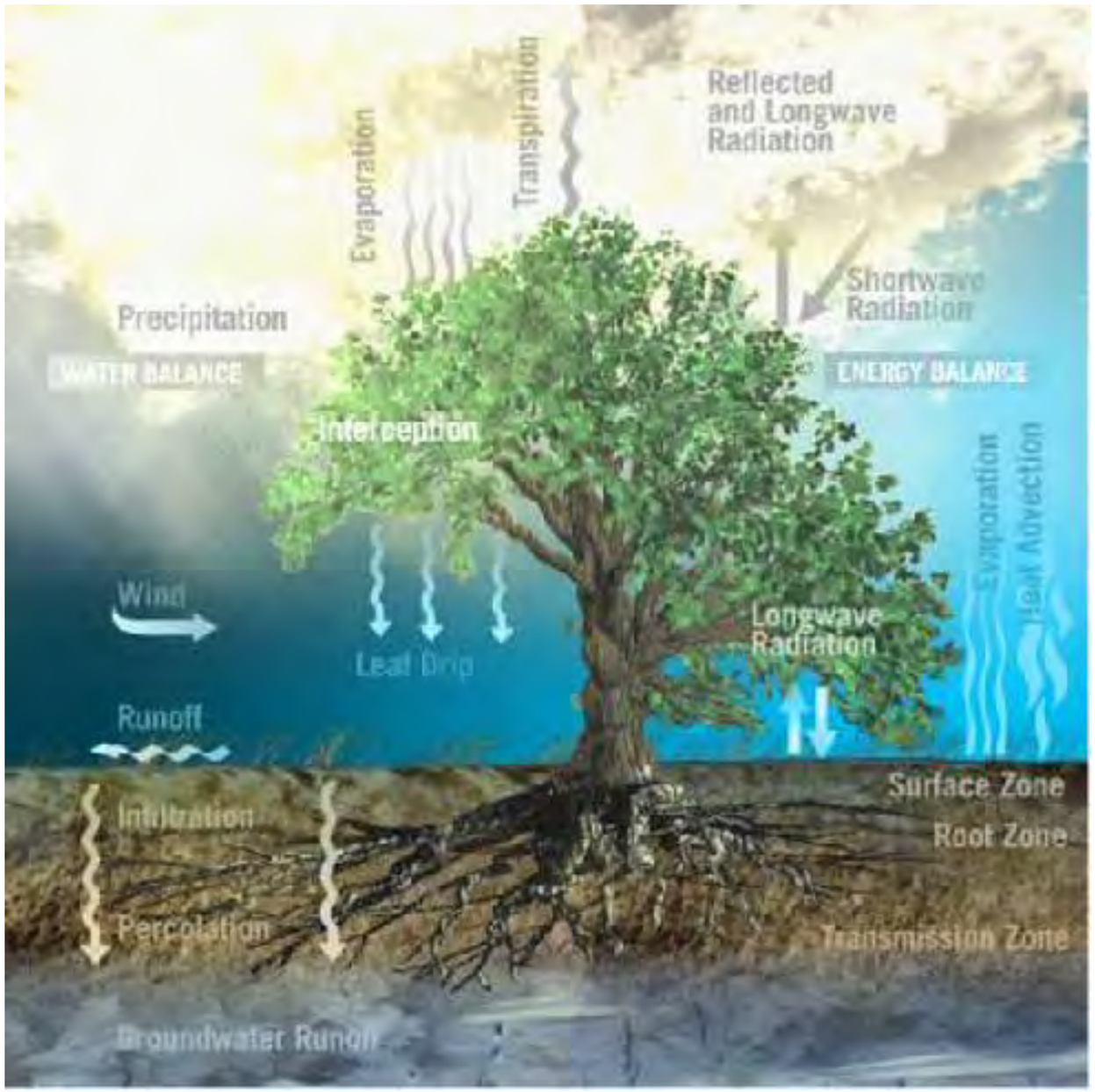
UBC School of Architecture and Landscape Architecture
LARC 444/553 Green Network Planning

February 4, 2019

Valuing Green Systems: Ecosystem Services

TODAY



What are ecosystems services?

Why?

Evaluative methods

A case study of Southeast False Creek (SEFC)

ECOSYSTEM SERVICES

What are ecosystem services?

ECOSYSTEM SERVICES

What are ecosystem services?

The benefits that people obtain from ecosystems.

Ecosystems and their Services (report), Millenium Ecosystem Assessment, 2005

ECOSYSTEM SERVICES

Why do we need the ecosystem services approach?

2005 MILLENIUM ECOSYSTEM ASSESSMENT

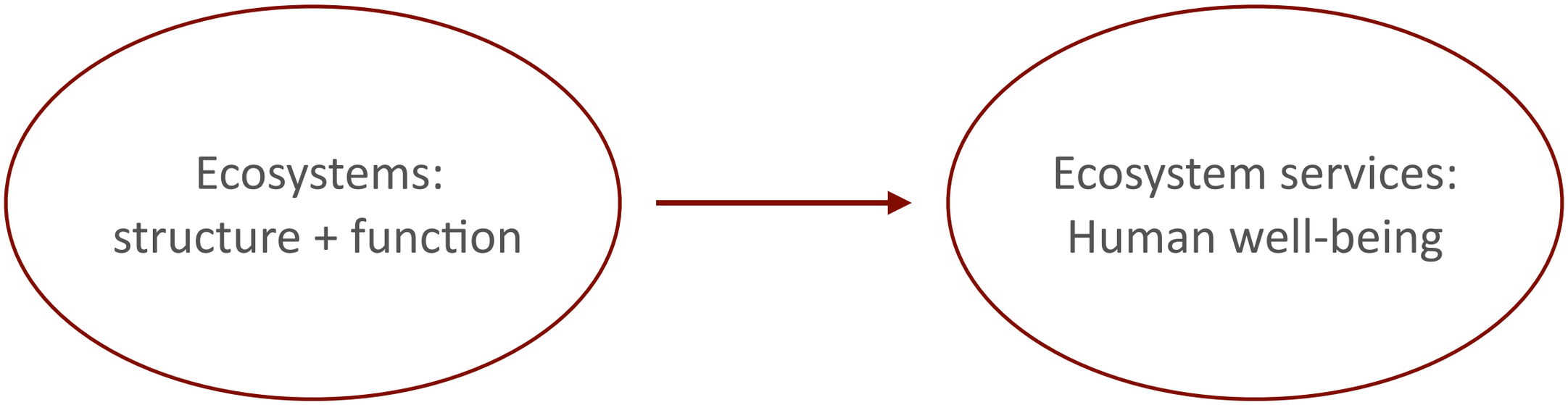
>1,360 experts worldwide

"The bottom line of the MA findings is that human actions are depleting Earth's natural capital, putting such strain on the environment that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted."

i.e. human actions impair the ability of the planet to support humanity (E.O. Wilson's paradox)

The Millennium Ecosystem Assessment (MA):
Attribution: United Nations Secretary-General Kofi Annan in 2000
Initiated in 2001, Report 2005

ECOSYSTEM SERVICES



ANTHROPOCENTRIC PERSPECTIVE

- functioning ecosystems provide benefits to humans

- society values ecosystems for their “services” to human well-being

- **economics perspective**> benefits as “good” and “services”

ECOSYSTEM SERVICES CATEGORIES

PROVISIONING SERVICES

Products obtained from ecosystems

REGULATING SERVICES

Regulation benefits of ecosystems

CULTURAL SERVICES

Non-material benefits of ecosystems

SUPPORTING SERVICES

services necessary for ecosystems to function

Categories of ecosystem services as defined by Millennium Ecosystem Assessment

MILLENIUM ECOSYSTEM ASSESSMENT

Categories/ types of ecosystem services

Provisioning Services

Products obtained from ecosystems

- Food
- Fresh water
- Fuelwood
- Fiber
- Biochemicals
- Genetic resources

Regulating Services

Benefits obtained from regulation of ecosystem processes

- Climate regulation
- Disease regulation
- Water regulation
- Water purification
- Pollination

Cultural Services

Nonmaterial benefits obtained from ecosystems

- Spiritual and religious
- Recreation and ecotourism
- Aesthetic
- Inspirational
- Educational
- Sense of place
- Cultural heritage

Supporting Services

Services necessary for the production of all other ecosystem services

- Soil formation
- Nutrient cycling
- Primary production

MILLENIUM ECOSYSTEM ASSESSMENT

What about biodiversity?

Provisioning Services

Products obtained from ecosystems

- Food
- Fresh water
- Fuelwood
- Fiber
- Biochemicals
- Genetic resources

Regulating Services

Benefits obtained from regulation of ecosystem processes

- Climate regulation
- Disease regulation
- Water regulation
- Water purification
- Pollination

Cultural Services

Nonmaterial benefits obtained from ecosystems

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Supporting Services

Services necessary for the production of all other ecosystem services

- Soil formation
- Nutrient cycling
- Primary production

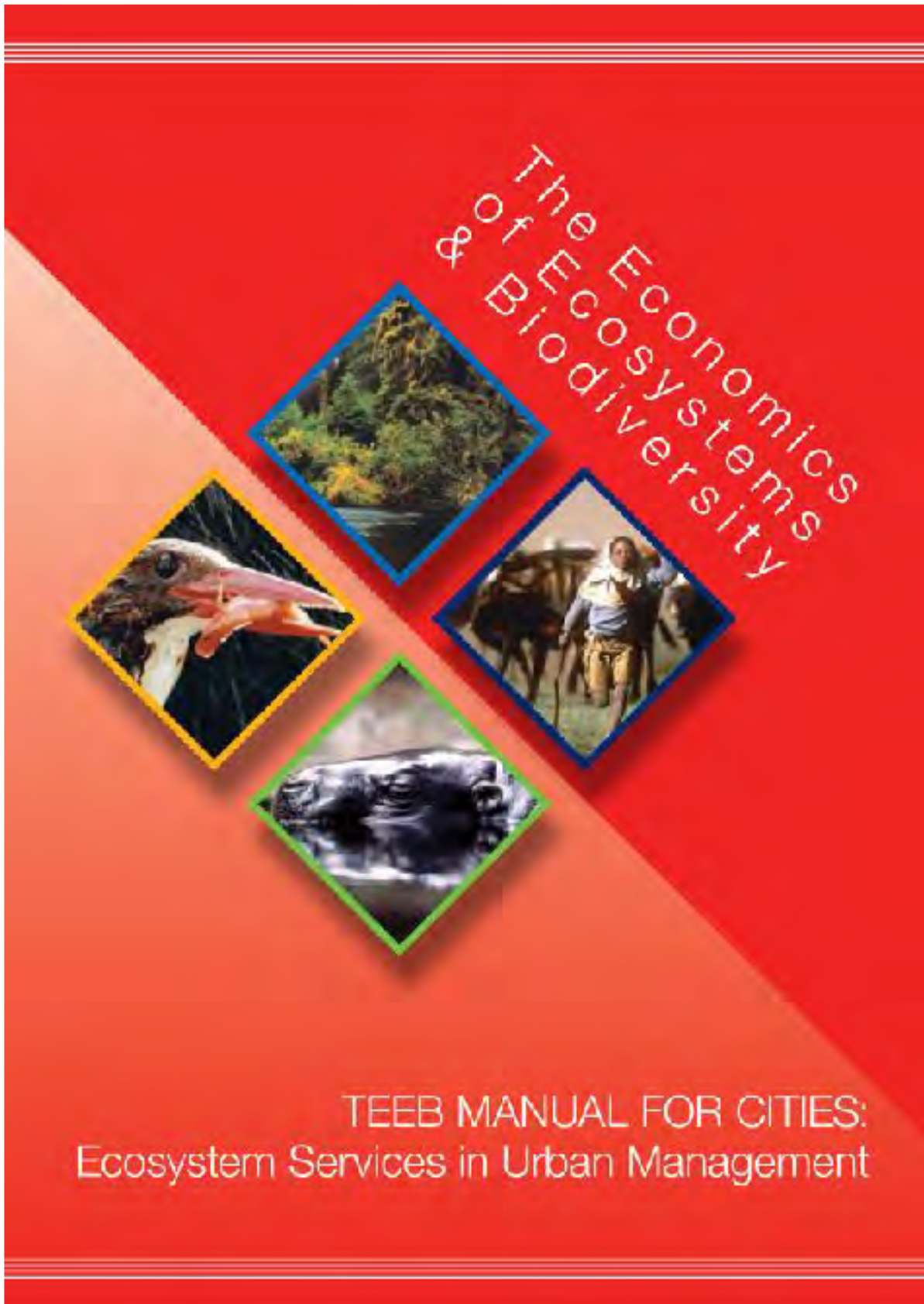
TEEB- THE ECONOMICS OF ECOSYSTEMS & BIODIVERSITY

TEEB
— a global initiative focused on “making nature’s values visible”

Measuring ecosystem services

Putting **$$ values** on ecosystem services

http://www.teebweb.org



TEEB- THE ECONOMICS OF ECOSYSTEMS & BIODIVERSITY

- assess the **trade-offs** (ecological, socio-cultural, economic and monetary) involved **in the loss of ecosystems and biodiversity**

- delineating between **functions, services and benefits** is important

- essential to evaluate the **'cost'** side of the equation as well as **benefits**

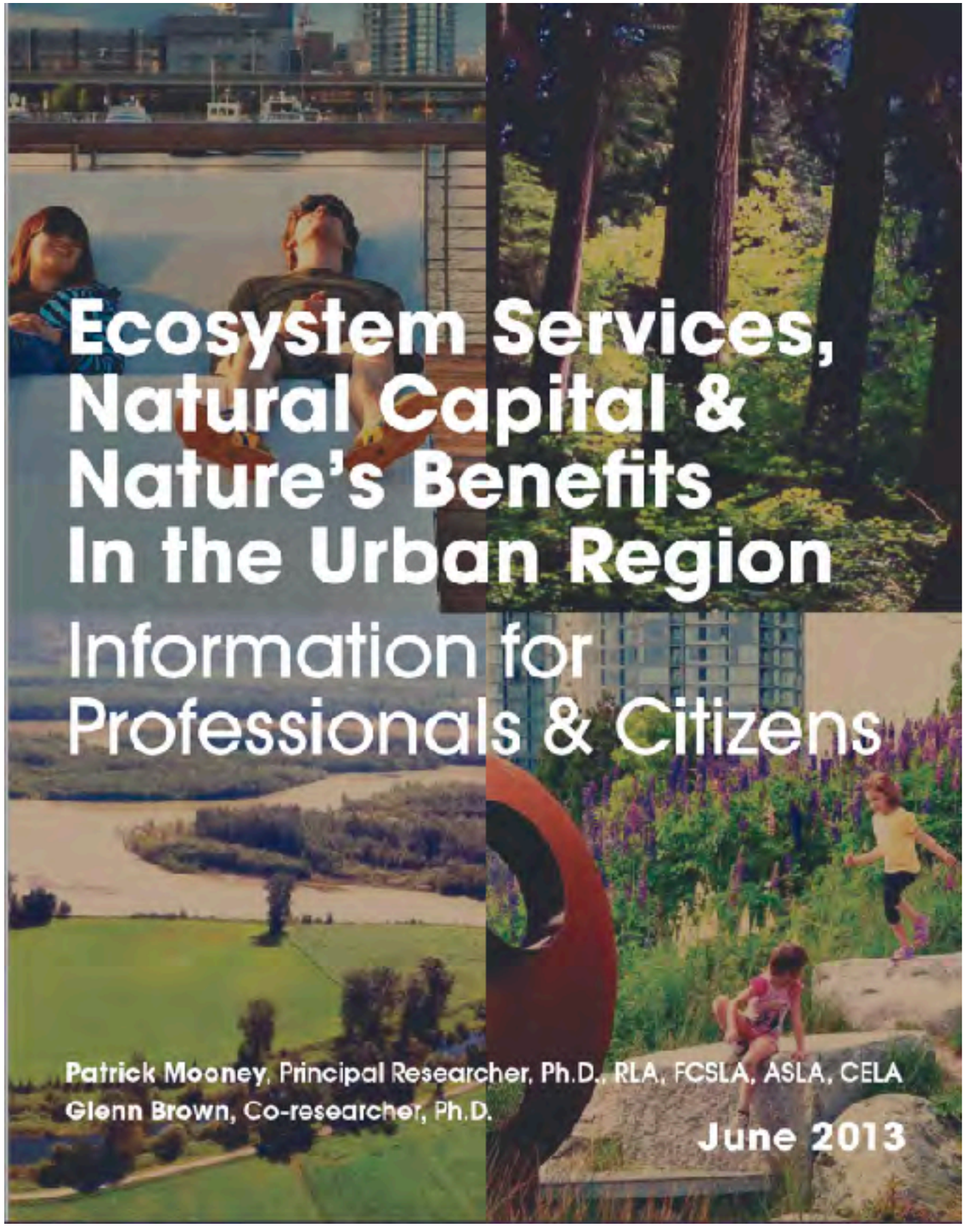
APPLICATION IN PRACTICE

Mooney and Brown

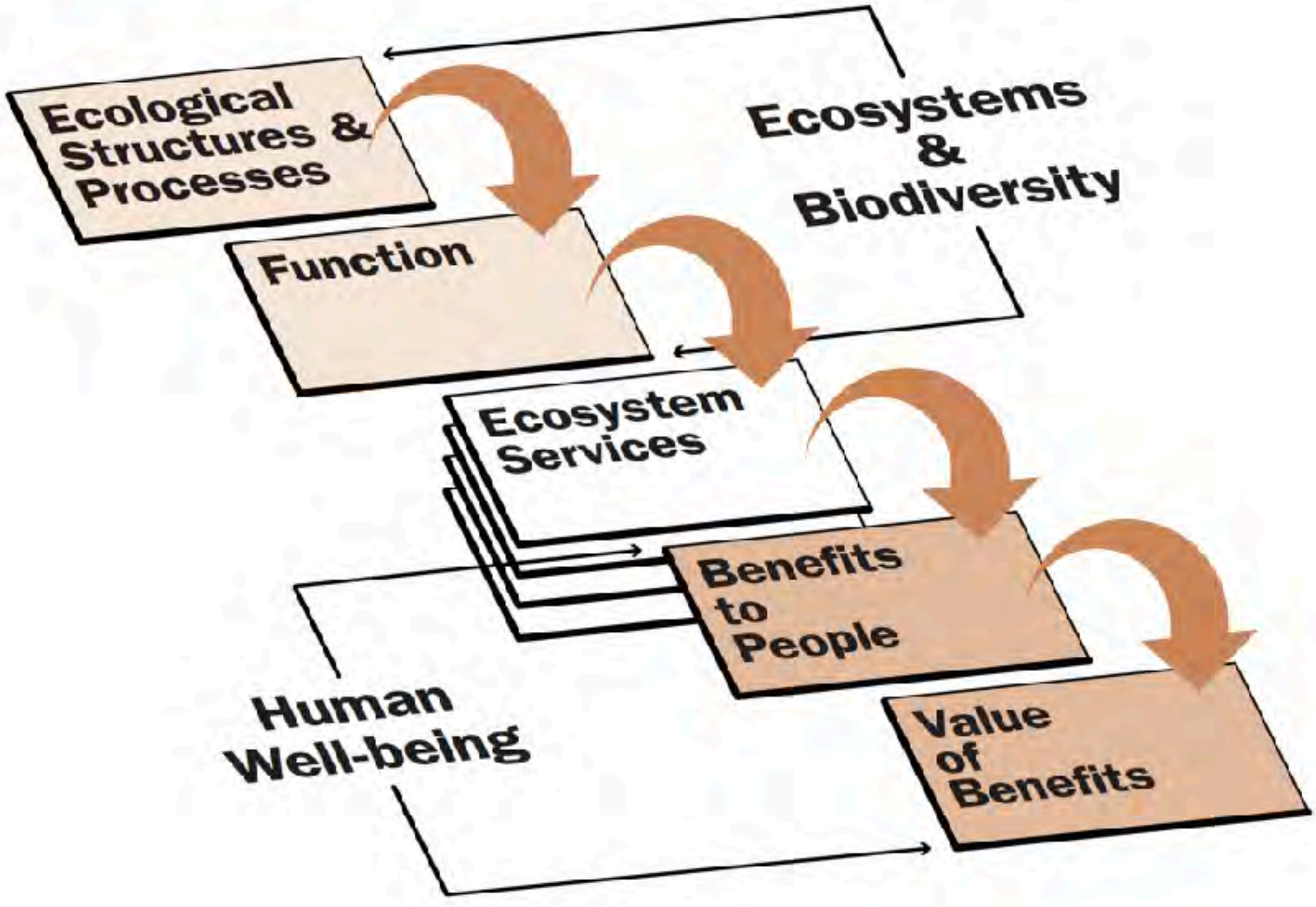
"This document introduces ecosystem services, natural capital and nature's benefits.. and how those can be applied in urban regions."

- target audience- professionals and decision-makers

(translated TEEB for planning professionals & governments)



ECOSYSTEM FUNCTIONS & ECOSYSTEM SERVICES



Mooney and Brown 2013

READING:

Mooney, Patrick, "A Systematic Approach to Incorporating Multiple Ecosystem Services in Landscape Planning and Design," Landscape Journal Volume 33 No. 2, 2014, pp. 141-171.

a qualitative approach

for planning and design applications

A Systematic Approach to Incorporating Multiple Ecosystem Services in Landscape Planning and Design

Patrick Mooney

ABSTRACT This paper uses a contemporary perspective on ecosystem services to propose a method by which projects designed for sustainability may more fully capture or enhance ecosystem services. A comprehensive Ecosystem Services Evaluation Matrix is used to evaluate three designed landscapes at different scales. The matrix is then incorporated into a revised sustainable landscape planning and design process. This approach uses evaluative tools within a decision making process to incorporate a broader range of ecosystem services in landscape planning and design.

KEYWORDS Landscape architecture, landscape planning, ecosystem services, sustainability, landscape performance

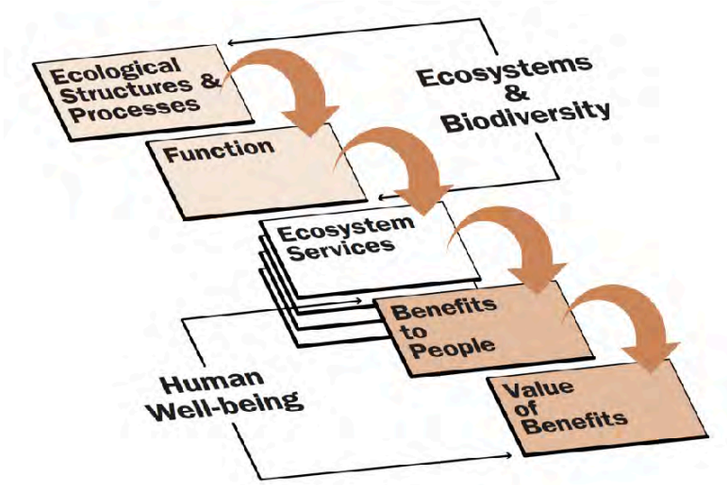
INTRODUCTION

While most landscapes are suitable for multiple purposes and can be shaped by people to provide a diverse array of material and immaterial goods, services, and benefits (known hereafter as ecosystem services) (Wiggering et al. 2006; Mastrechio 2009; de Groot 2006), design and land-use decision making often does not fully consider or assess these services. Consequently, highly productive, multifunctional landscapes become less valuable, single-function landscapes (de Groot and Hein 2007; Wallace 2007). Similarly, in site planning and landscape design, the range of ecosystem services that may accrue from the landscape is often not fully considered or realized. Application of an ecosystem services approach to landscape planning decision making (de Groot et al. 2010) reverses ecosystem degradation, facilitates the conservation and enhancement of ecosystem services as well as the creation of positive synergies among ecosystem services (Millennium Ecosystem Assessment 2005).

After examining multiple approaches to defining ecosystem services and their integration into landscape management, this article proposes the Ecosystem Services Evaluation Matrix as a tool for a systematic integration of multiple ecosystem services into sustainable landscape planning and design. Conceptual development of the approach evolves from an examination of contemporary literature on ecosystem services and landscape design, planning, and management. The approach proposes the use of a kit of evaluative tools to assess diverse ecosystem services created through landscape planning and design. After applying the Matrix in evaluating three Canadian design case studies, the article proposes revisions to the sustainable landscape planning and design process to more explicitly integrate ecosystem services evaluation into the design process. Case studies evaluated in this article

Landscape Journals 33:2 ISSN 0277-2426

ECOSYSTEM SERVICES EVALUATION MATRIX



Category	Ecosystem Service
BIODIVERSITY	
	Marine and aquatic biodiversity
	Terrestrial habitat
PROVISIONING SERVICES	
	Food
	Raw Materials
	Fresh water
	Medicinal resources
	Ornamental plants
REGULATING SERVICES	
Climate and Atmosphere	Carbon sequestration & storage
	Extreme event mitigation
	Pollution mitigation- Air
	Pollution mitigation- Water
	Pollution mitigation- Soil
	Climate regulation
Pollination	Pollinator species
Hazard regulation	Reduced hazard risks
	Disease, pest regulation
Water	Drought mitigation
	Waste-water treatment
Soil	Reduced erosion
	Maintenance of soil fertility
CULTURAL SERVICES	
	Social cohesion
	Sense of identity
	Mental well-being
	Physical well-being
	Recreation
	Tourism
	Aesthetics/ inspiration
	Spiritual experience
SUPPORTING SERVICES	
	Nutrient cycling
	Water cycling
	Soil preservation
	Primary productivity

Mooney, Patrick, “A Systematic Approach to Incorporating Multiple Ecosystem Services in Landscape Planning and Design,” Landscape Journal Volume 33 No. 2, 2014, pp. 141-171.

ECOSYSTEM SERVICES EVALUATION MATRIX

		Yes or no?	High, mod, low value	
Regulating Services				
Climate and Atmosphere	Carbon sequestration and storage	X	M	Woody plants, and wetlands sequester significant carbon.
	Moderation of Extreme Weather events.			
	Pollution Mitigation (Air)	X	L	Street trees uptake gaseous and particulate pollutants and all plants release oxygen.
	Pollution Mitigation (Water)	X	M	All surface runoff is cleansed in bioswales and the wetland before being released into False Creek.
	Pollution Mitigation (Soil)			
	Local Climate and Air Quality regulation	X	M	Since the neighbourhood is heated with heat extracted from sewage, Co2 release is greatly

Southeast False Creek A CASE STUDY

LOOK AT SEFC 3 WAYS

- introduction to urban design

- ecosystems services evaluation

- observational study

SOUTHEAST FALSE CREEK

NOTABLE FOR

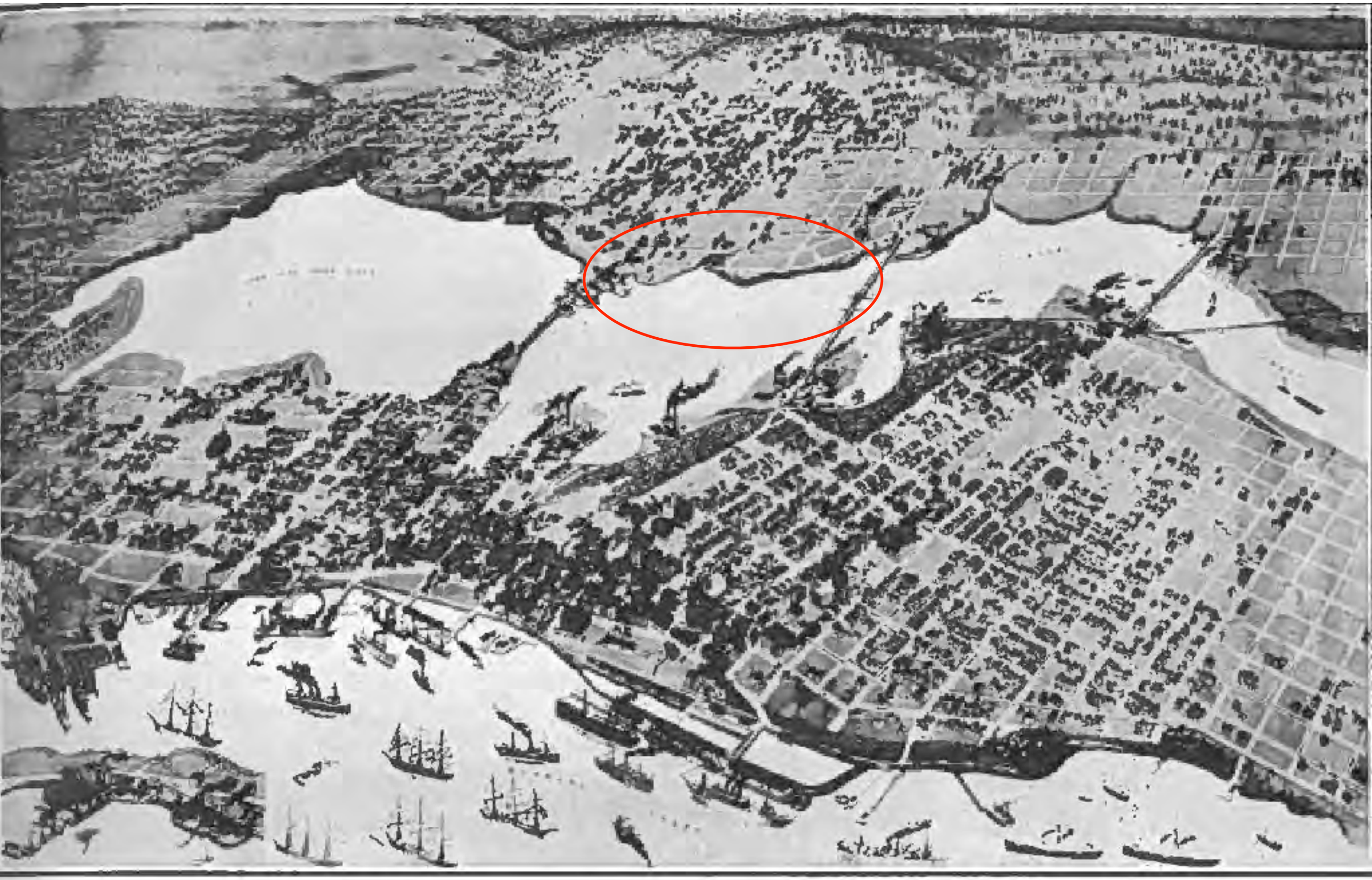
Brownfield redevelopment

2010 Olympics Athletes Village

1st LEED Gold neighborhood

Integrates habitat, water & agriculture into a high density neighbourhood

VANCOUVER 1898



Vancouver in 1898. From an Old Lithograph.

SOUTHEAST FALSE CREEK 1970s

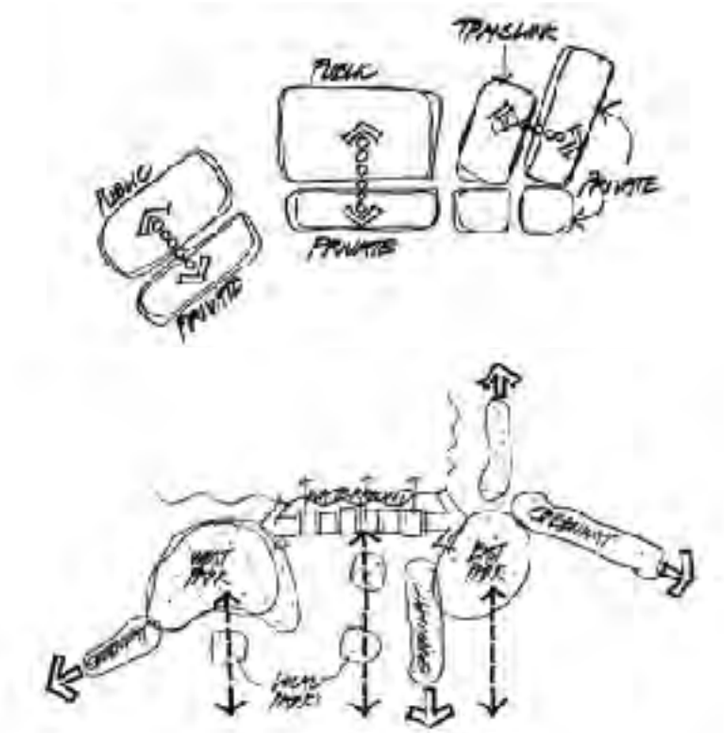
SOUTHEAST FALSE CREEK

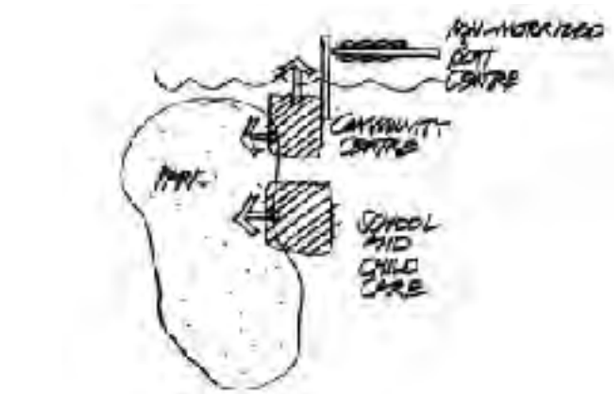
View from Cambie Bridge pre-development

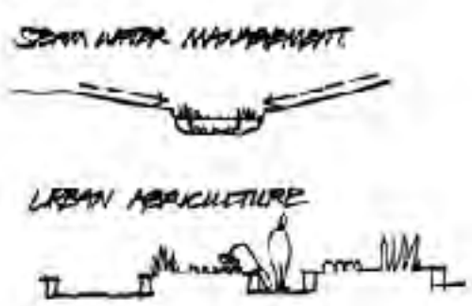
2006

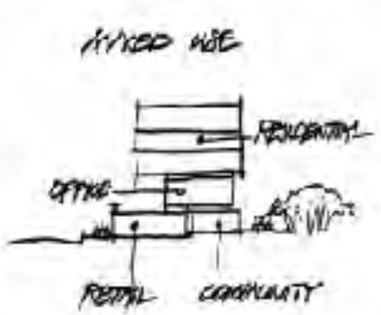
2015

2017-8









1999 Southeast False Creek Policy

GOALS

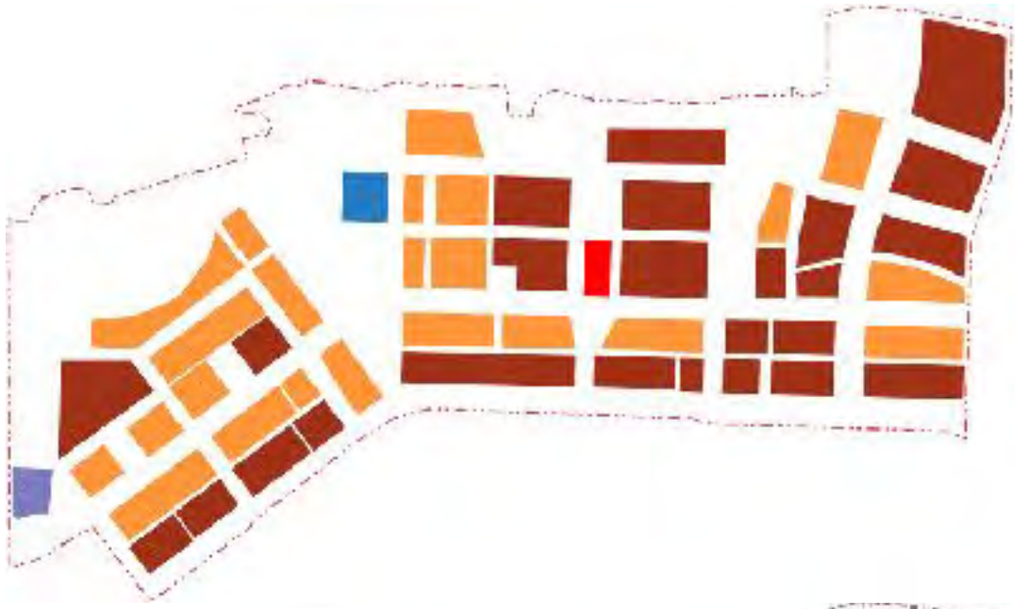
Develop—

- a diverse mixed use neighbourhood
- with family housing
- for people to live, work, play & learn

With highest levels of—

- social equity
- liveability
- ecological health
- economic prosperity

COMPACT COMMUNITY



COMPLETE COMMUNITY

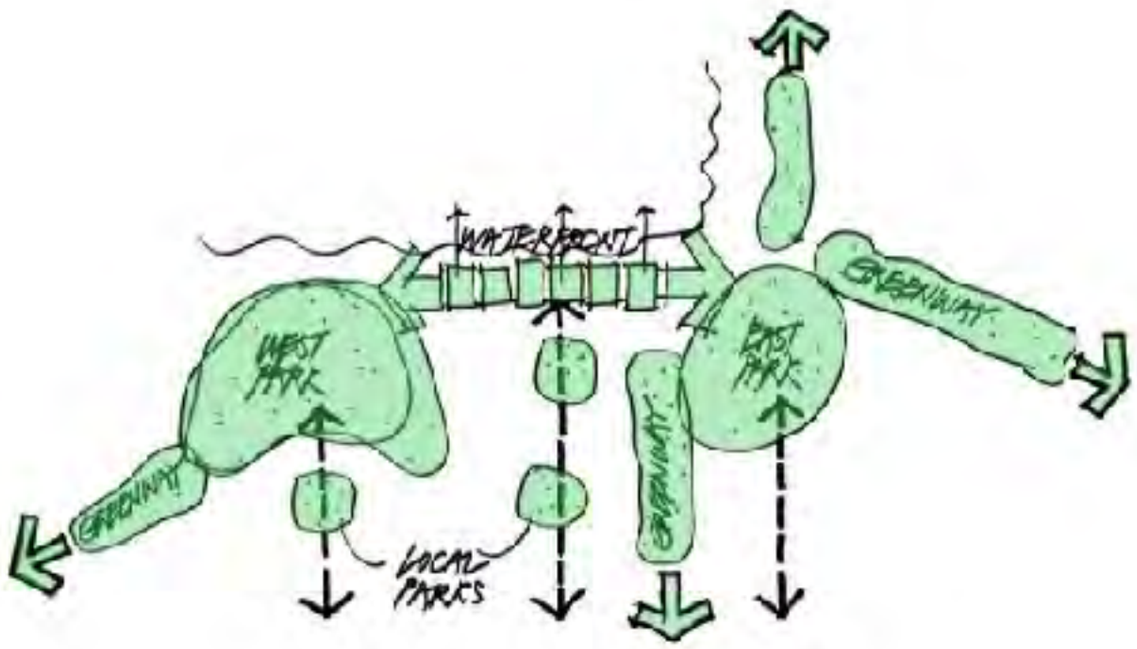
CONNECTED COMMUNITY

BIOPHILIC COMMUNITY

GREEN NETWORKS

City-wide function:
The last leg of a 22 km waterfront greenway

Connections to adjacent neighborhoods



GREEN SPACE

32% of the land is reserved for Public Open Space

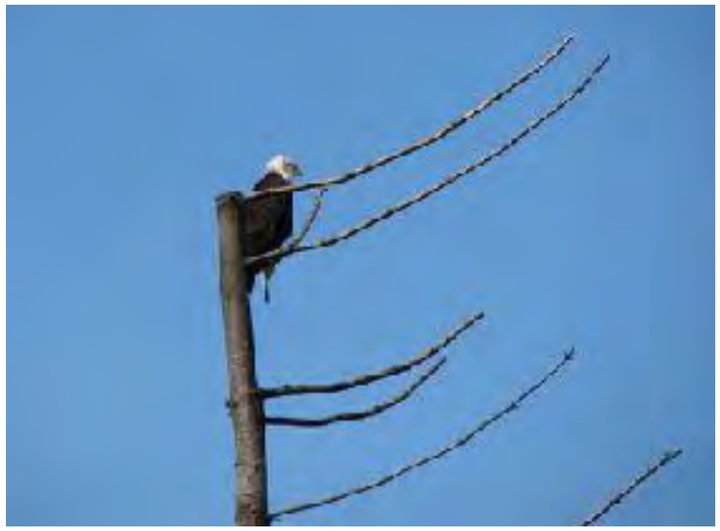
Fully public waterfront

3 major parks
1 public square
Semi-private courtyards

habitat creation
rainwater management
food production


Gardens
Dog park
Wetland
Playground
Habitat
island
N

HABITAT CREATION



Wildlife returning to False Creek:

Eagles

Waterfowl

Songbirds

Beaver

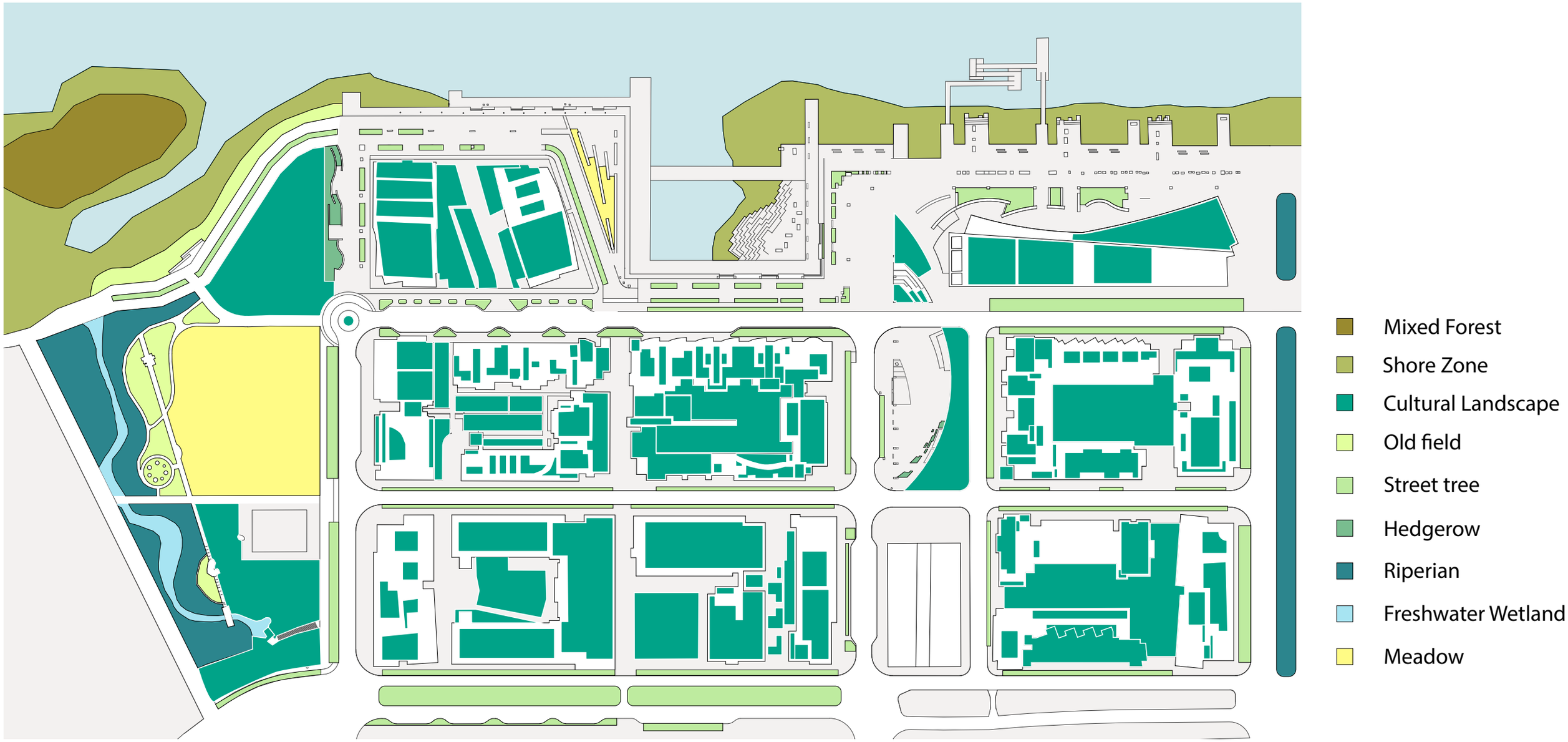
Coyotes

River otter

Herring

Beaver dam and birdhouse in Hinge Park

HABITAT CREATION



adapted from Mooney and Brown 2013

GREEN INFRASTRUCTURE

Stormwater wetland

Harvest rainwater for irrigation

40% effective impervious area
50% of roofs green

90% Native Plants

100% stormwater filtered

ECOSYSTEMS SERVICES ASSESSMENT-

Dr. Patrick Mooney

Biodiversity	Maintain or increase biodiversity (includes genetic diversity)	X	H	Bioswale and wetland
	Habitat for Native species	X	H	Maintain the diverse habitat types of the site.

- 7 habitat types created on site
- quality habitat replaces poor habitat @ 2:1 ratio
- 88% - 96% native plants in Hinge Park and Habitat Island
- wildlife returning to the site (herring, beaver, birds, eagles, heron….)

Provisioning Services				
	Food	X	L	Rooftop Gardens and the Community Garden
	Raw Materials	X	L	Native plants provide resources for First Nations
	Fresh water	X	H	Rooftop capture and storage for irrigation
	Medicinal Resources			Native Plants Provide resources for First Nations

Landscape and roof plan for housing co-op Durant Kreuk Ltd.

Regulating Services				
Climate and Atmosphere	Carbon sequestration and storage	X	M	Woody plants, and wetlands sequester significant carbon.
	Moderation of Extreme Weather events.			
	Pollution Mitigation (Air)	X	L	Street trees uptake gaseous and particulate pollutants and all plants release oxygen.
	Pollution Mitigation (Water)	X	M	All surface runoff is cleansed in bioswales and the wetland before being released into False Creek.
	Pollution Mitigation (Soil)			
	Local Climate and Air Quality regulation	X	M	Since the neighbourhood is heated with heat extracted from sewage, Co2 release is greatly

- 302 trees planted by 2014
- Estimated CO_2 sequestration of trees ***over 50 years*** = 568 kg.
- Estimated O_2 production of trees = 1.782 million kg.

REGULATING, cont'd

				reduced.
	Maintain or increase pollination	X	M	Native plantings provide habitat for native pollinators.
Hazard Regulation				
	Reduction in Landslide Potential			
	Reduced Flooding			
	Noise Reduction			
	Disease and pest Regulation			
Water	Seasonal drought mitigation	X	H	On site irrigation system eliminates effect of summer drought on plants.
	Waste-water Treatment			
Soil	Maintenance of Soil Fertility			
	Reduced Erosion			

Cultural Services				
	Social Cohesion	X	M	Site is highly used by a wide demographic.
	Sense of identity			
	Mental and physical well-being	X	H	Significant access to urban nature will give these benefits.
	Recreation	X	H	Numerous opportunities for cycling walking kayaking, park use and socializing exist in the public realm.
	Aesthetic appreciation	X	H	Aesthetically attractive community with access to water views.
	Tourism	X	M	Vancouver is experiencing increased bike tourism. The public seawall is an important destination for cyclists in the city.

100% of residents are within <5 minute walk of nature

High recreation and active transportation opportunities

2016 POST OCCUPANCY STUDY- EVIDENCE OF CULTURAL SERVICES

Cynthia Girling, Kejia Zheng, Marjan Ebneshahidi

Who is using the public realm at the Olympic Village?

What spaces are most used?

How & when are people using the public spaces?

How do people travel to and through the neighbourhood?

What spaces to people value? Why?

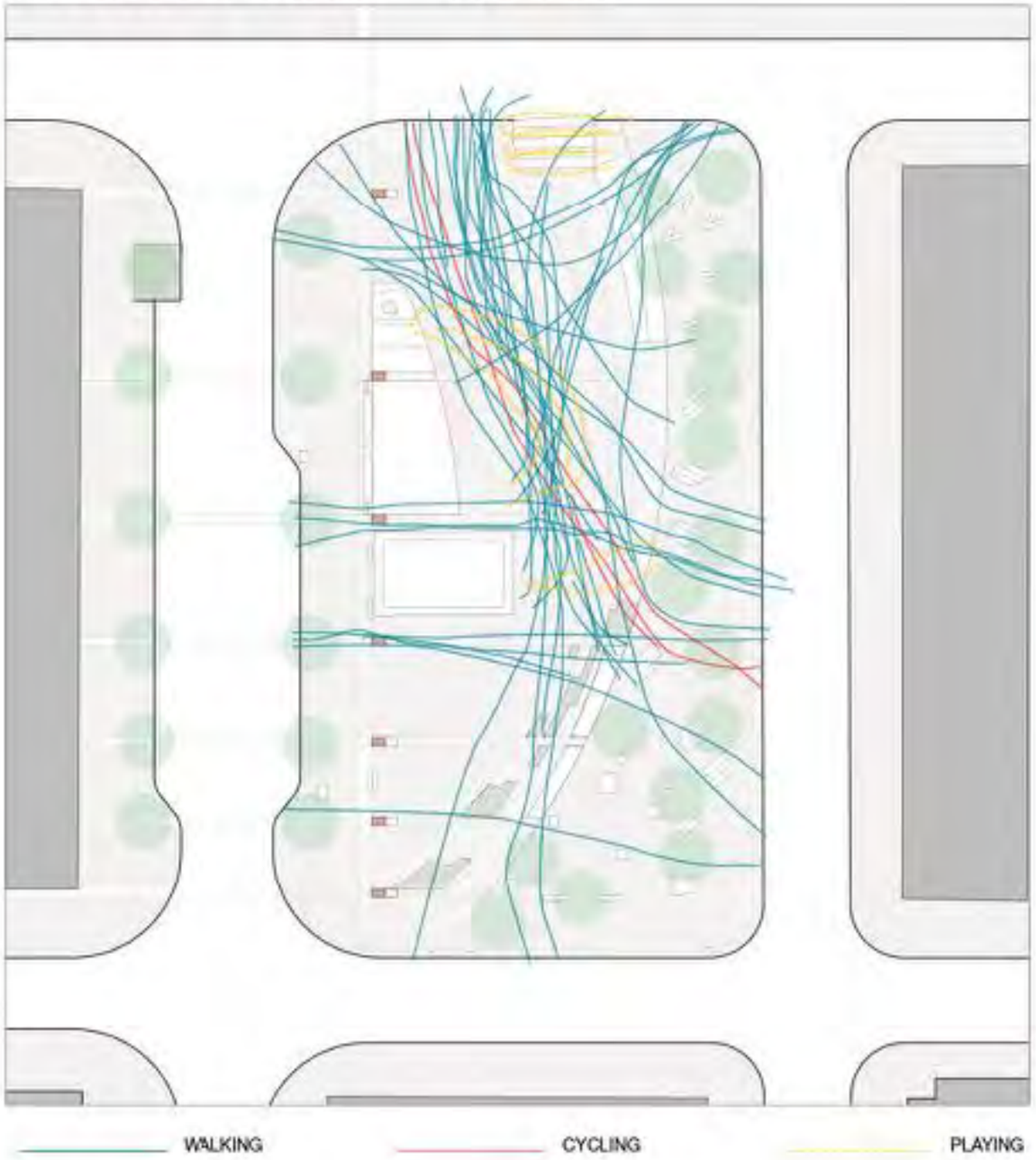
people observed through the videos
135 videos (675 minutes/11.25 hours)

TRACKING

49 people tracked over 12 hours (two days)

84% walked on Seaside Greenway

VILLAGE SQUARE May 7th, 2016



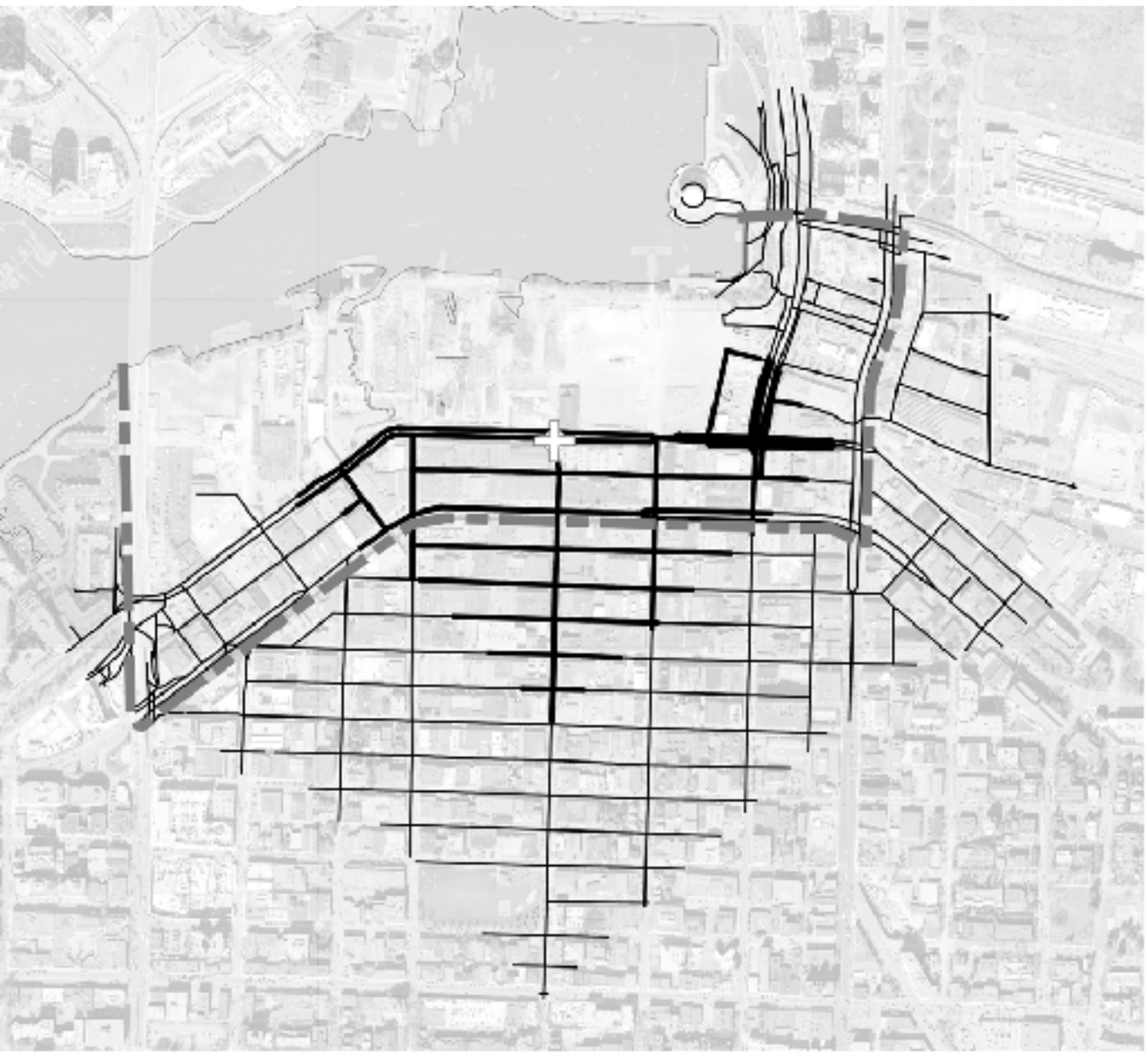
Village Square, May 7, 2016 14:20 pm

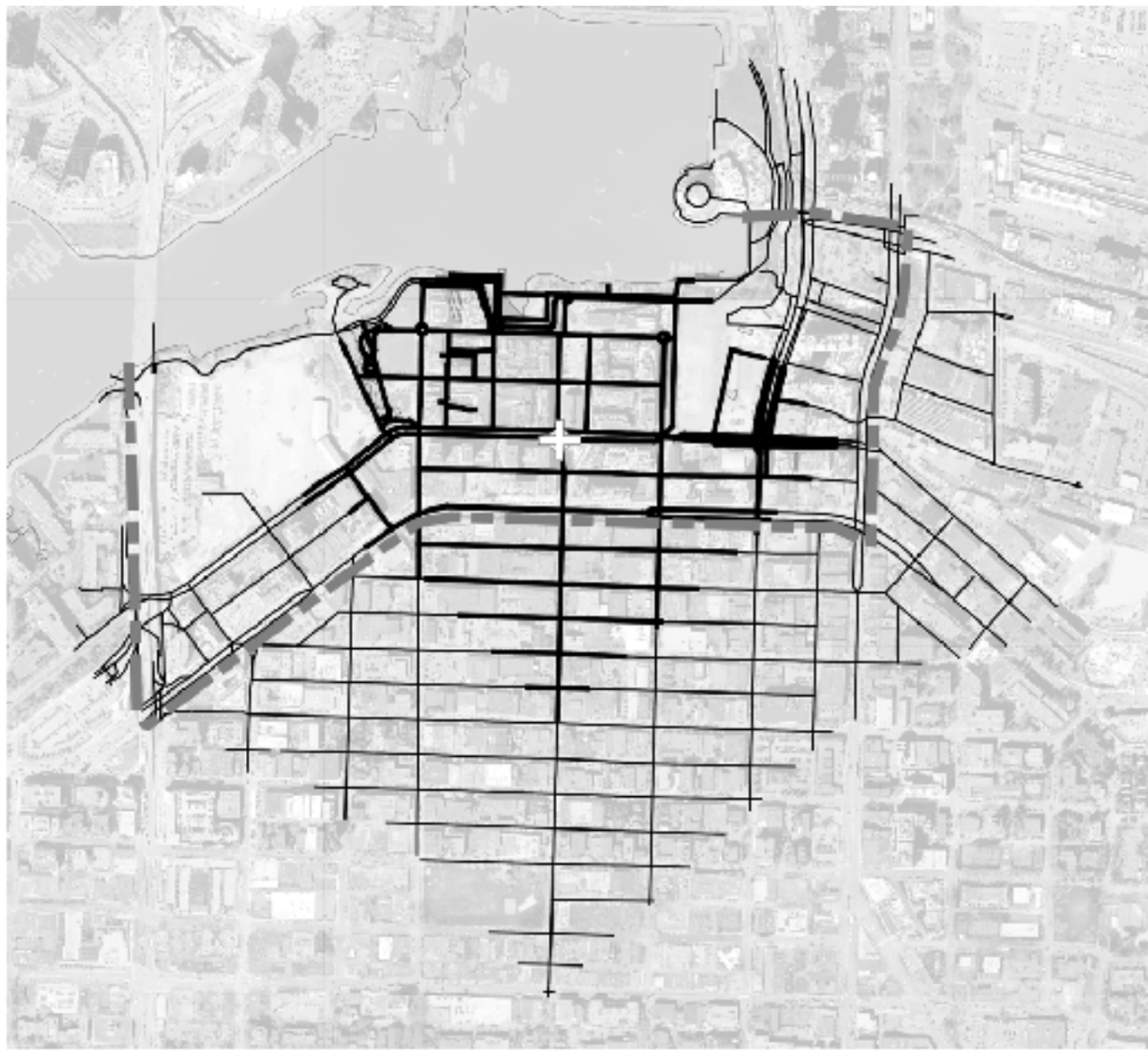
WALKABILITY

Average Walk Score=

95.5

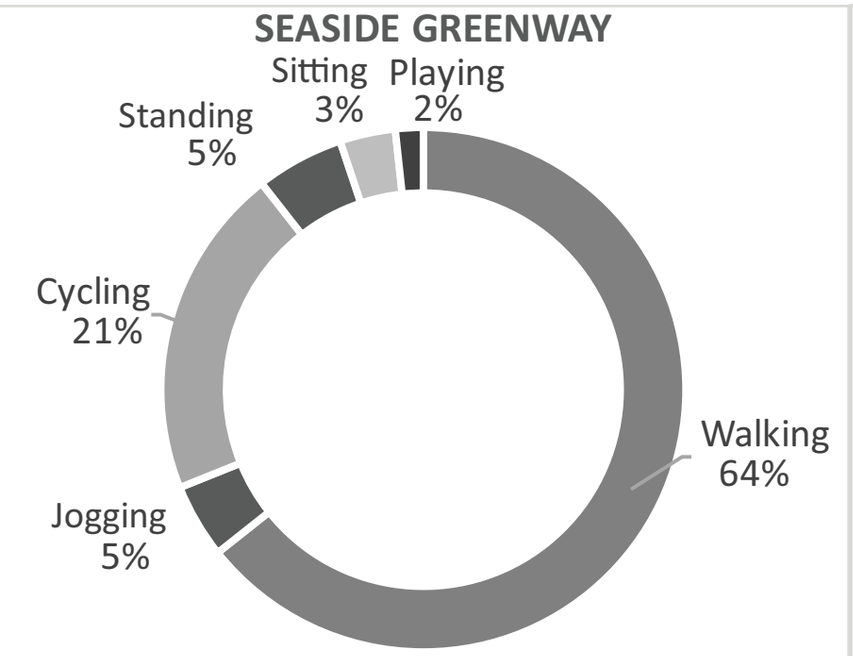
Walker's paradise

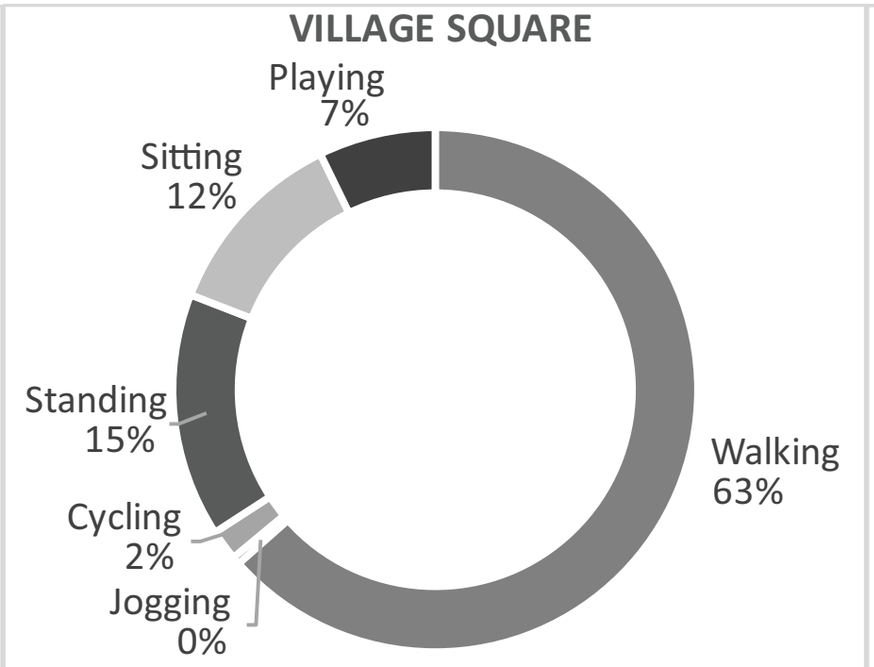


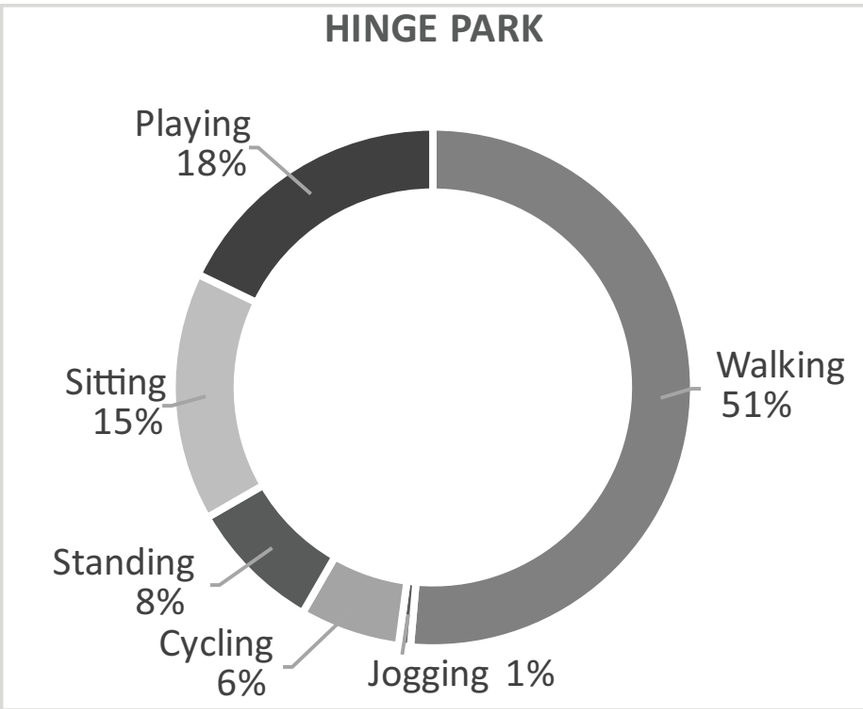


Southeast False Creek Origin 400m Buffer 800m Buffer

WHAT PEOPLE WERE DOING





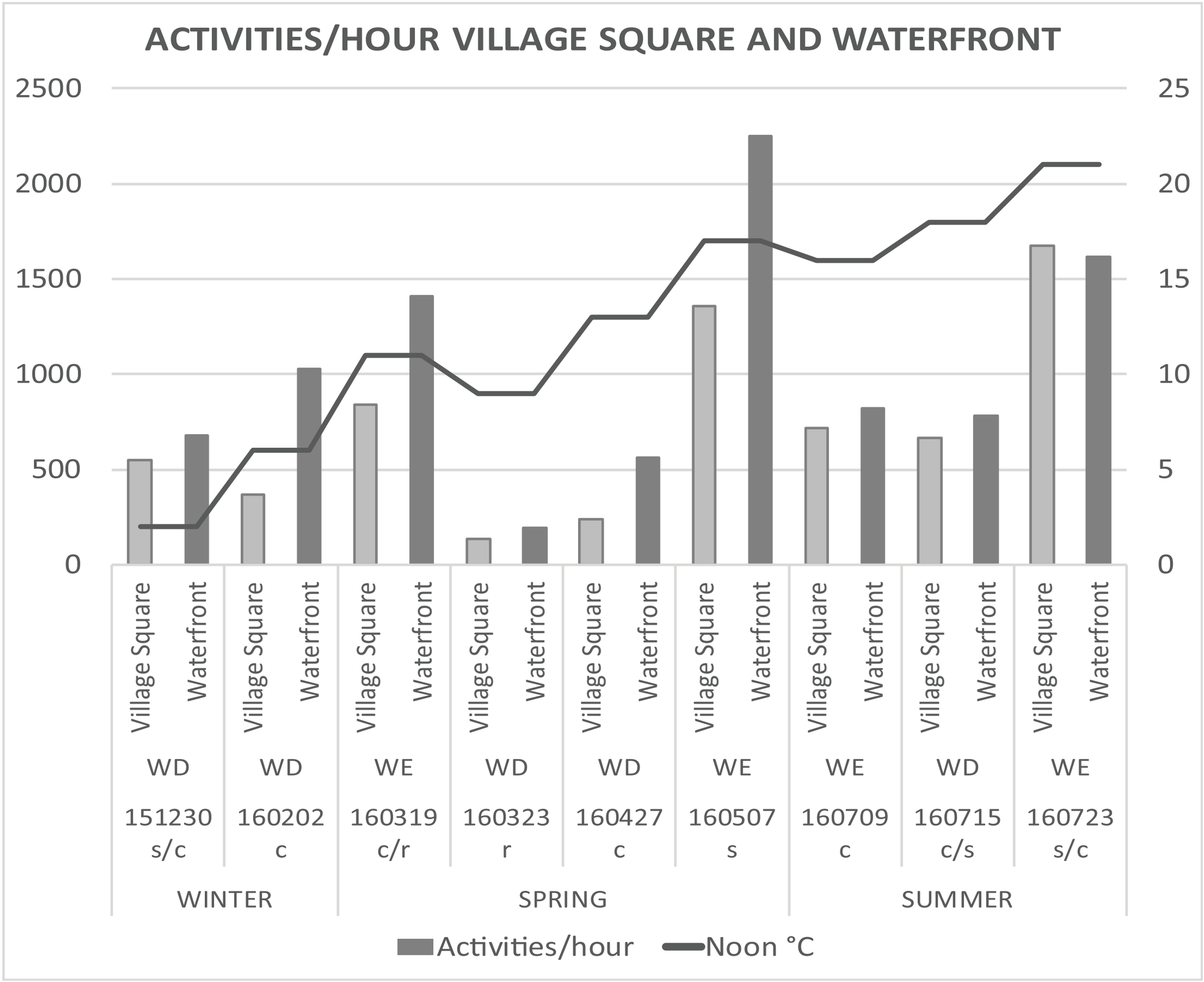


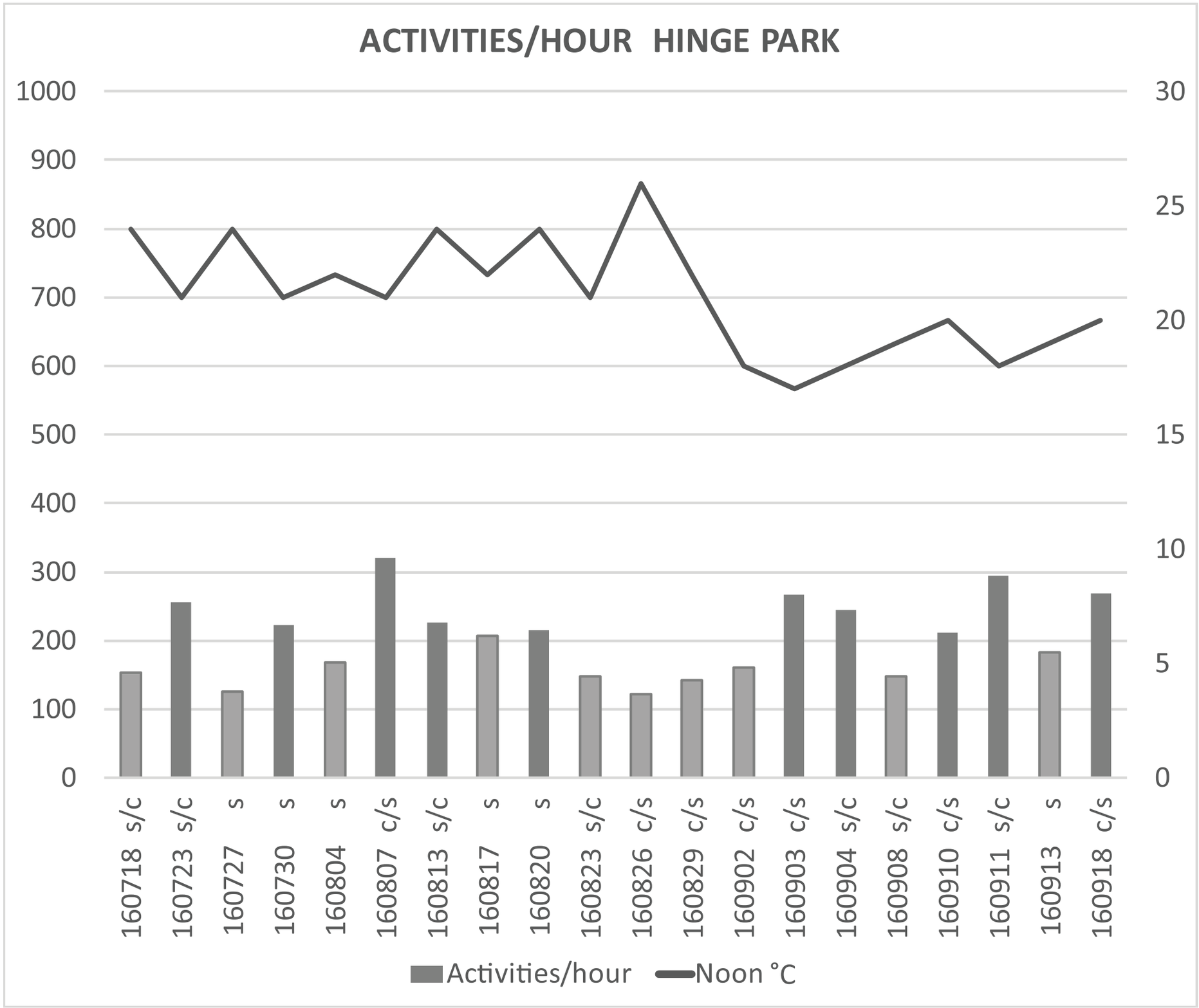
> 10,000 people-activities recorded

From 51% to 64% of activities were walking

From 58% to 90% of activities were active mobility

WHEN?


ACTIVITIES/HOUR VILLAGE SQUARE AND WATERFRONT
2500
2000
1500
1000
500
0
25
20
15
10
5
0
Village Square
Waterfront
WD
WE
151230 s/c
160202 c
160319 c/r
160323 r
160427 c
160507 s
160709 c
160715 c/s
160723 s/c
WINTER
SPRING
SUMMER
Activities/hour
Noon °C


ACTIVITIES/HOUR HINGE PARK
1000
900
800
700
600
500
400
300
200
100
0
30
25
20
15
10
5
0
160718 s/c
160723 s/c
160727 s
160730 s
160804 s
160807 c/s
160813 s/c
160817 s
160820 s
160823 s/c
160826 c/s
160829 c/s
160902 c/s
160903 c/s
160904 s/c
160908 s/c
160910 c/s
160911 s/c
160913 s
160918 c/s
Activities/hour
Noon °C

WHAT PEOPLE SAID

Favorite public space		**Heart of the neighbourhood**	
Waterfront	81	Village Square	86
Village Square	23	Hinge Park	12
Hinge Park	16	First Avenue	4
Other	5		

WHAT PEOPLE SAID

Most important green features of neighbourhood		**Most important nature benefits**	
Urban parks	3.64	Breathing fresh air	3.50
View of the ocean/the mountains	3.32	Relieving stress	3.50
Presence of tree lined streets	3.00	Enjoying the view	3.15
Community gardens	2.92	Feeling restored	2.90
Private gardens	2.24	Being in contact with wildlife	2.50

(Most important = 5, least important = 1, scores were scores were weighted averaged)

ECOSYSTEM SERVICES- REPORT CARD

CULTURAL SERVICES

- ✓ Social cohesion
- ✓ Sense of identity
- ✓ Mental well-being
- ✓ Physical well-being
- ✓ Recreation
- ✓ Tourism
- ✓ Aesthetics/ inspiration
- Spiritual experience

SUPPORTING SERVICES

- Nutrient cycling
- ✓ Water cycling
- Soil preservation
- Primary productivity

ECOSYSTEM SERVICES-REPORT CARD

Category		Ecosystem Service
BIODIVERSITY		
	√	Marine and aquatic biodiversity
	√	Terrestrial habitat
PROVISIONING SERVICES		
	√	Food
	√	Raw Materials
	√	Fresh water
		Medicinal resources
		Ornamental plants
REGULATING SERVICES		
Climate and Atmosphere	√	Carbon sequestration & storage
		Extreme event mitigation
	√	Pollution mitigation- Air
	√	Pollution mitigation- Water
		Pollution mitigation- Soil
	√	Climate regulation
Pollination	√	Pollinator species
Hazard regulation		Reduced hazard risks
		Disease, pest regulation
Water	√	Drought mitigation
		Waste-water treatment
Soil		Reduced erosion
		Maintenance of soil fertility

NET BENEFITS/IMPACTS

- soil and other pollution
- jobs (since 1970s, not since 2005)

NET +?

+ new high density buildings
+ new residents
+ 10 ha added green space
+ newly recreated habitat
+ > 300 trees planted

TAKE-AWAYS

Ecosystem Services “value” the services of nature in anthropocentric terms

Language of a capitalist economy- enables cost-benefit analysis

Millenium Ecosystem Assessment and TEEB methods provide deep and rigorous assessment methods…but

Qualitative checklist methods supported with some quantitative estimates more applicable to planning and design work

Mixed methods approaches to assessment may be necessary

SEFC example- new development can provide significant added ecosystem services in cities

QUESTIONS? COMMENTS?

end