Green infrastructure and ecosystem services to tackle climate change in Chilean cities

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Urban green infrastructure

Green Infrastructure Research Group
http://thegirg.org/

UGI: interconnected network of green spaces that preserve the functions of natural ecosystems and provides benefits to the population.

Table ES.2 Potential topics and benefits of green infrastructure grouped according to main ecosystem service types

Habitat services

1. Biodiversity/species protection:
   - (a) habitats for species
   - (b) permeability for migrating species
   - (c) connecting habitats

Regulating services

1. Climate change adaptation:
   - (a) mitigating urban heat island effect
   - (b) strengthening ecosystems' resilience to climate change
   - (c) storing floodwater and ameliorating surface water run-off to reduce the risk of flooding
2. Climate change mitigation:
   - (a) carbon sequestration
   - (b) encouraging sustainable travel
   - (c) reducing energy use for heating and cooling buildings
   - (d) providing space for renewable energy

Provisioning services

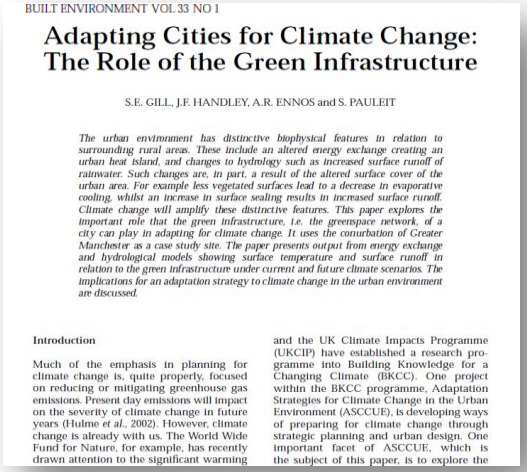
1. Water management:
   - (a) sustainable drainage systems — attenuating surface water run-off
   - (b) fostering groundwater infiltration
   - (c) removal of pollutants from water
2. Food production and security:
   - (a) direct food and fibre production on agricultural land, gardens and allotments
   - (b) keeping potential for agricultural land
   - (c) soil development and nutrient cycling
   - (d) preventing soil erosion

Cultural services

1. Recreation, well-being and health:
   - (a) recreation
   - (b) sense of space and nature
   - (c) cleaner air
   - (d) tourism/ecotourism
2. Land values:
   - (a) positive impact on land and property
3. Culture and communities:
   - (a) local distinctiveness
   - (b) opportunities for education, training and social interactions
   - (c) tourism opportunities

European Environment Agency (2011)

UGI: can help to address CC: (1) increasing resilience levels, and; (2) provision of ES contributing to face of CC (mitigation and adaptation).



BUILT ENVIRONMENT VOL 33 NO 1

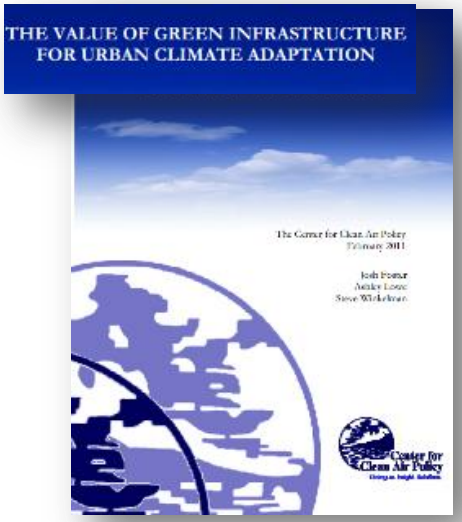
Adapting Cities for Climate Change: The Role of the Green Infrastructure

S.E. GILL, J.F. HANDLEY, A.R. ENNOS and S. PAULEIT

The urban environment has distinctive biophysical features in relation to surrounding rural areas. These include an altered energy exchange creating an urban heat island, and changes to hydrology such as increased surface runoff of rainwater. Such changes are, in part, a result of the altered surface cover of the urban area. For example less vegetated surfaces lead to a decrease in evaporative cooling, whilst an increase in surface sealing results in increased surface runoff. Climate change will amplify these distinctive features. This paper explores the important role that the green infrastructure, i.e. the greenspace network, of a city can play in adapting for climate change. It uses the conurbation of Greater Manchester as a case study site. The paper presents output from energy exchange and hydrological models showing surface temperature and surface runoff in relation to the green infrastructure under current and future climate scenarios. The implications for an adaptation strategy to climate change in the urban environment are discussed.

Introduction

Much of the emphasis in planning for climate change is, quite properly, focused on reducing or mitigating greenhouse gas emissions. Present day emissions will impact on the severity of climate change in future years (Hulme *et al.*, 2002). However, climate change is already with us. The World Wide Fund for Nature, for example, has recently drawn attention to the significant warming and the UK Climate Impacts Programme (UKCIP) have established a research programme into Building Knowledge for a Changing Climate (BKCC). One project within the BKCC programme, Adaptation Strategies for Climate Change in the Urban Environment (ASCCUE), is developing ways of preparing for climate change through strategic planning and urban design. One important facet of ASCCUE, which is the subject of this paper, is to explore the

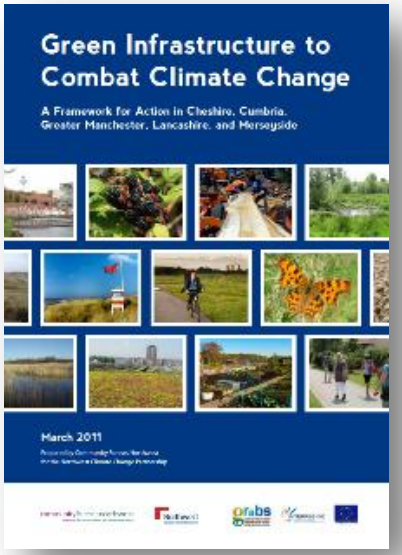


THE VALUE OF GREEN INFRASTRUCTURE FOR URBAN CLIMATE ADAPTATION

The Center for Clean Air Policy
February 2011

Josh Foster
Ashley Lowe
Steve Winkelman

Center for Clean Air Policy



Green Infrastructure to Combat Climate Change

A Framework for Action in Cheshire, Cumbria, Greater Manchester, Lancashire, and Merseyside

March 2011

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NATURE CLIMATE CHANGE | CORRESPONDENCE

Adapting to climate change through urban green infrastructure

Stuart R. Gaffin, Cynthia Rosenzweig & Angela Y. Y. Kong

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Nature Climate Change 2, 704 (2012) | doi:10.1038/nclimate1680
Published online 27 September 2012

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To the Editor —

[illegible] key and [illegible] case for the many values of using 'ecosystem-based approaches to adaptation' (EbA) to address current and future climate change. However, their article did not mention the burgeoning use of this approach within cities to alleviate climate-related impacts and other environmental...

Adapting to Climate Change

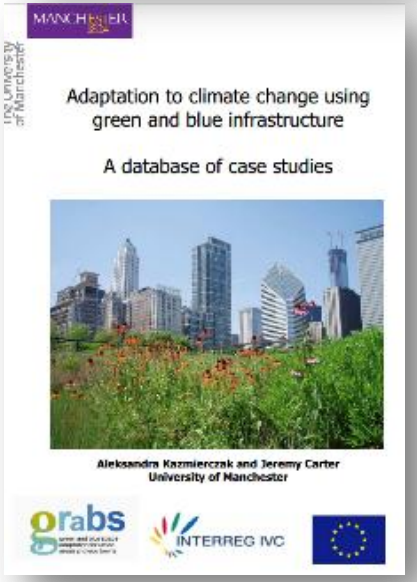
Green infrastructure

Adapting to Climate Change

Green infrastructure

Green infrastructure planning increasing connectivity, multifunctionality, and landscape performance in the built environment

AEA



MANCHESTER

The University of Manchester

Adaptation to climate change using green and blue infrastructure

A database of case studies

Aleksandra Kazmierczak and Jeremy Carter
University of Manchester

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INTERREG IVC

In developing countries elaborating green infrastructure plans to face climate change is just starting…

Research Goal

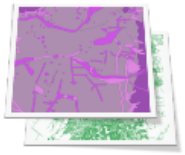
(1) To analyze urban climate and urban green infrastructure in six Chilean cities.

(2) To analyze the Mapocho's riparian corridor and its surrounding in terms of current and potential contribution for to cope climate change by evaluating three key ecosystem services: (a) cooling effect, (b) flood mitigation, and (c) routes for non-motorized transport.

Study area

Study area: 200 meter buffer surrounding the Mapocho river where it pass through the urban area of Santiago, and beyond 2,000 meters upstream and downstream the built-up-area. This area include 11 different municipalities.

Methods



- GIS techniques
- Municipal inventories
- Census data

- Remote sensing
- Aerial photographs

- Field work
- Measurements
- Surveys

Evaluation of key ecosystem services

Temperature regulation
- Mobile transects
- HOBO temperature loggers

Flood mitigation
- PRMS Flood areas
- Indicators of land use and population density

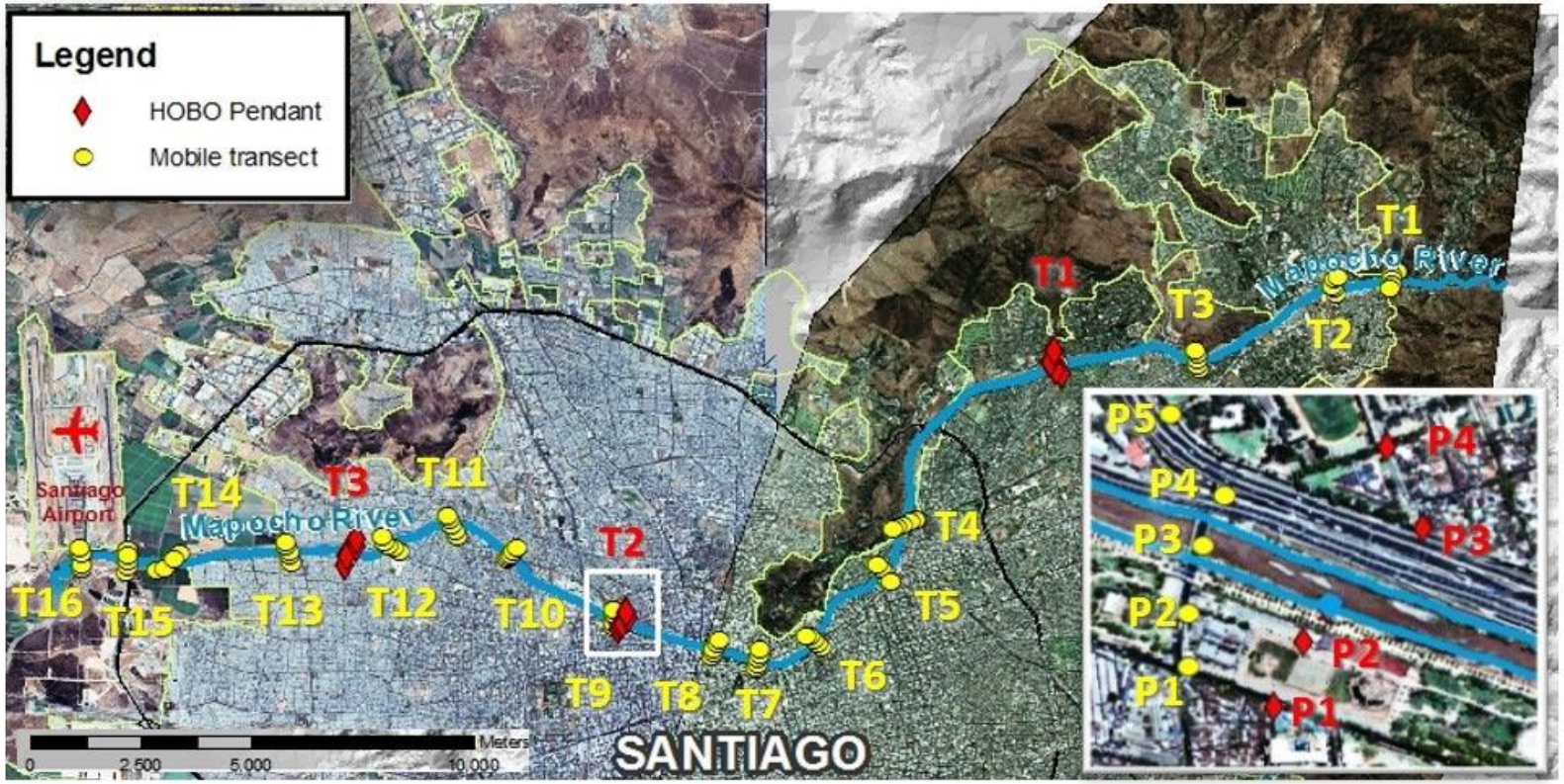
Routes for non-motorized transport
- Road Infrastructure
- Use and frequency of use of riparian parks

Cooling effect
Mitigation - Adaptation

Flood mitigation
Adaptation

Non-motorized transport
Mitigation

Methods



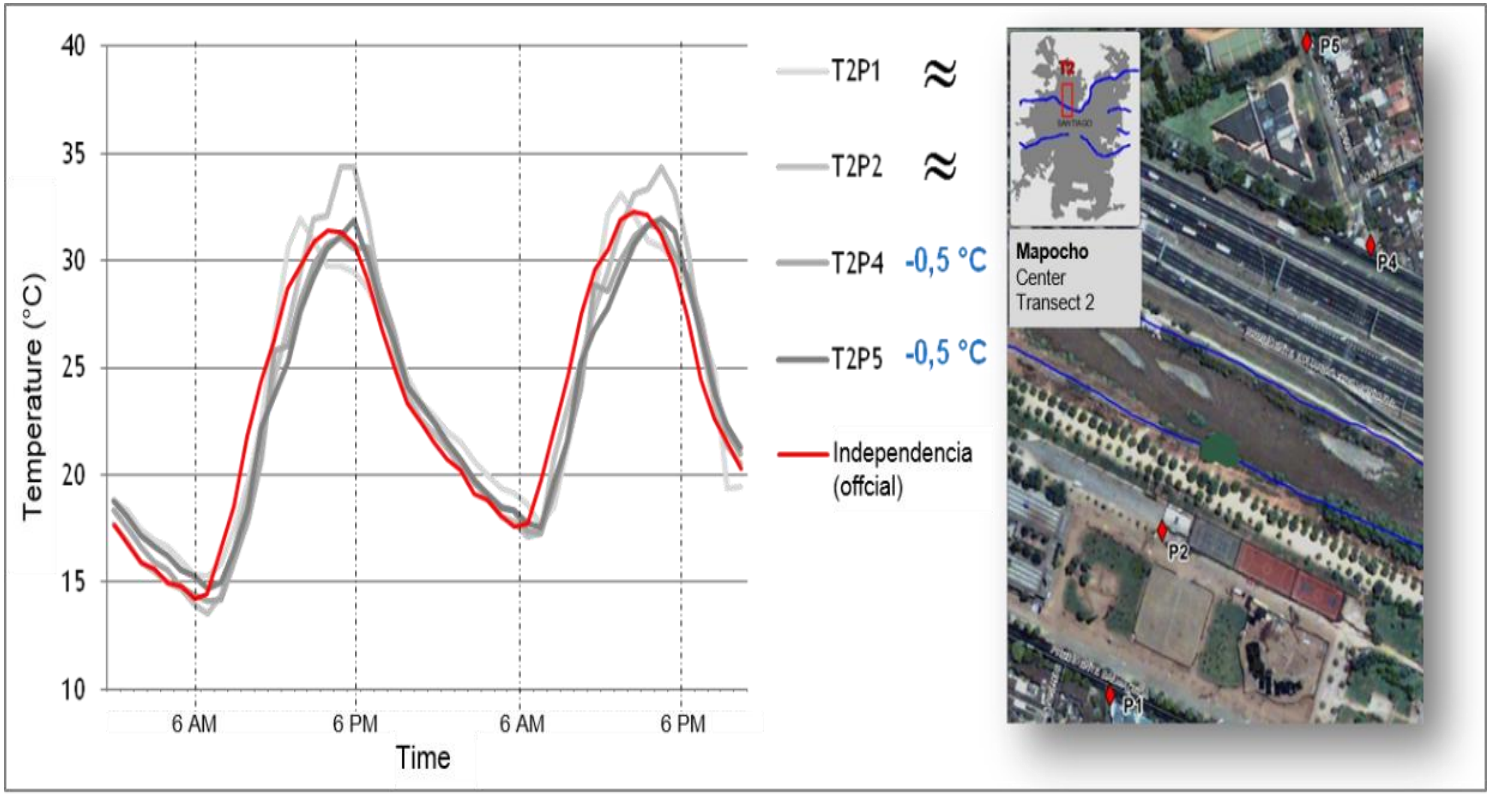
Fixed data loggers (HOBO pendant)

Summer, 2011

Mobile transects

January 11, 2011 (morning, afternoon, night)

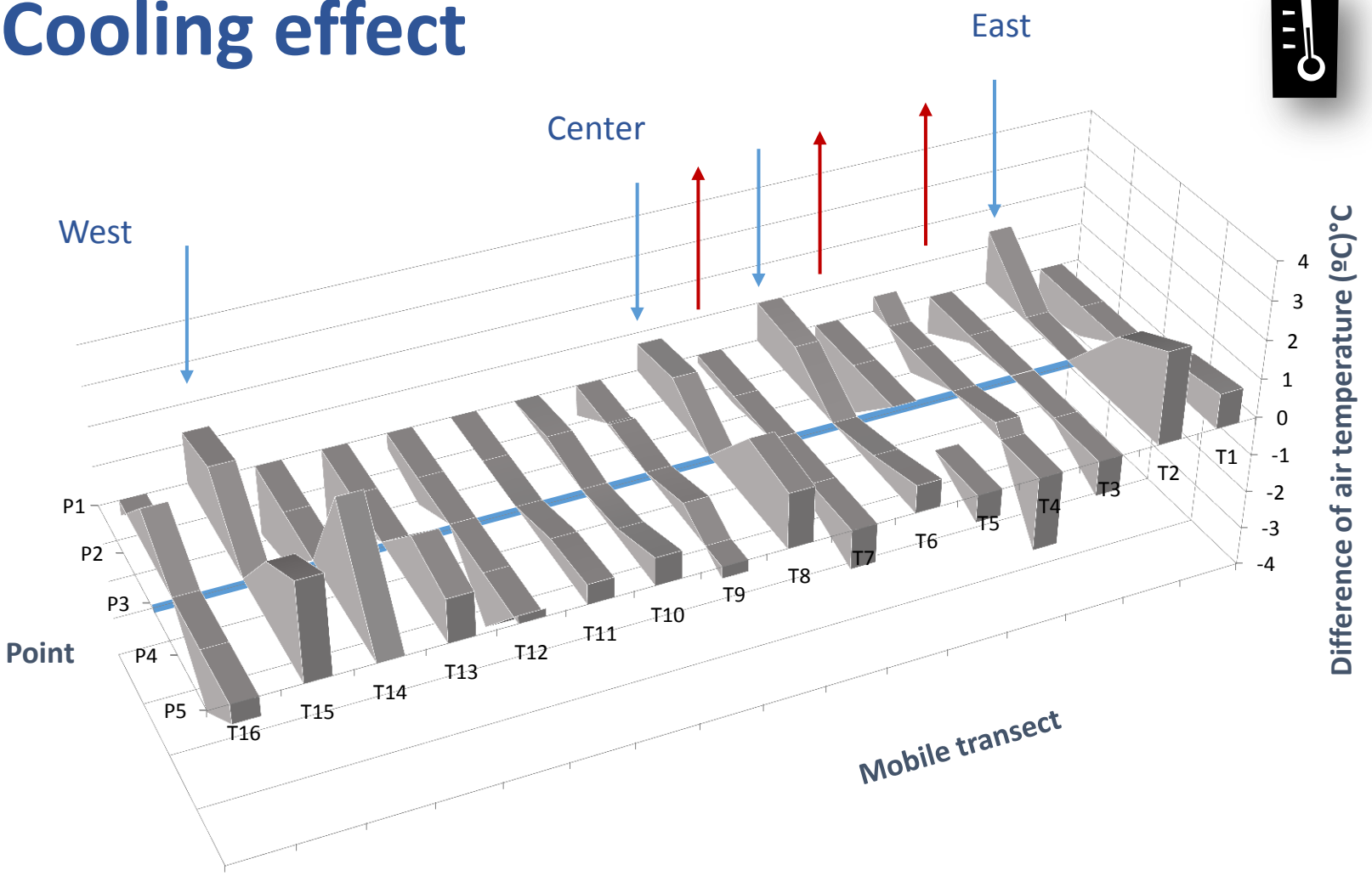
Cooling effect



Air temperature for the two hottest days registered in summer 2011 (HOBO).

Point 4 and 5, that represent border of the stream are 0.5°C cooler than urban reference station (Independencia), but this values are not statistically significant ($p < 0.05$).

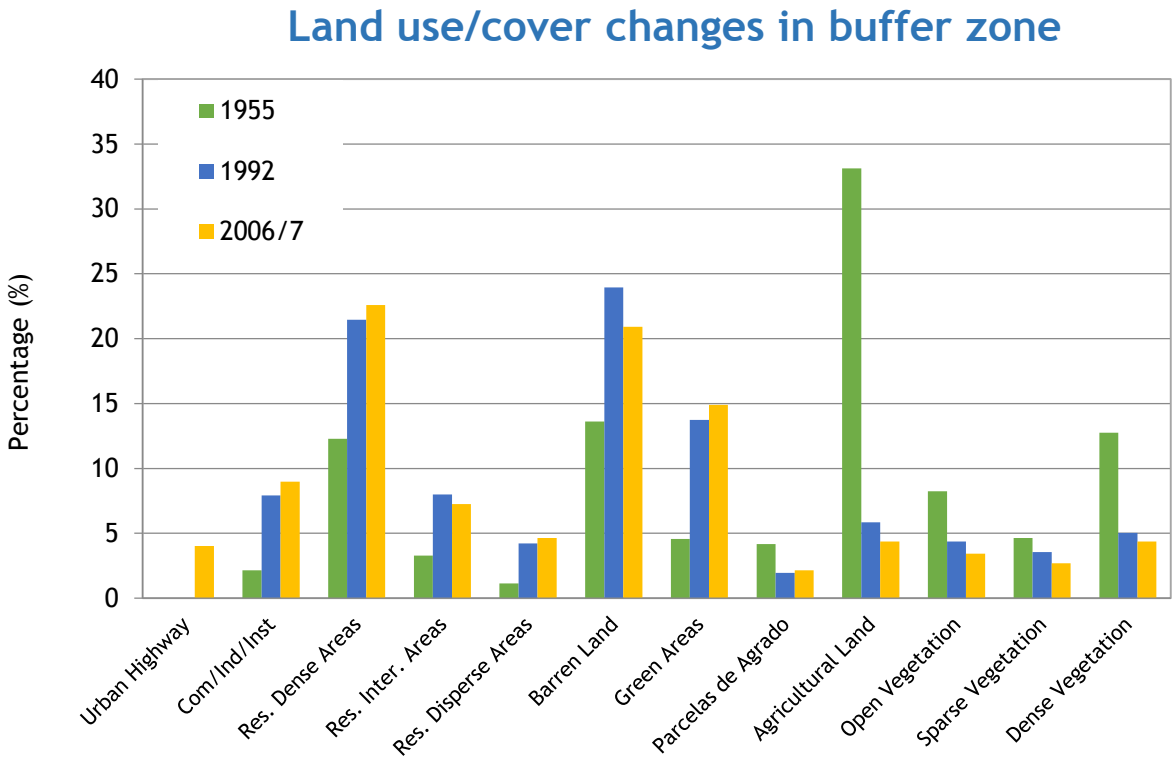
Cooling effect



Mobile transects of air temperature, noon 11/01/2011

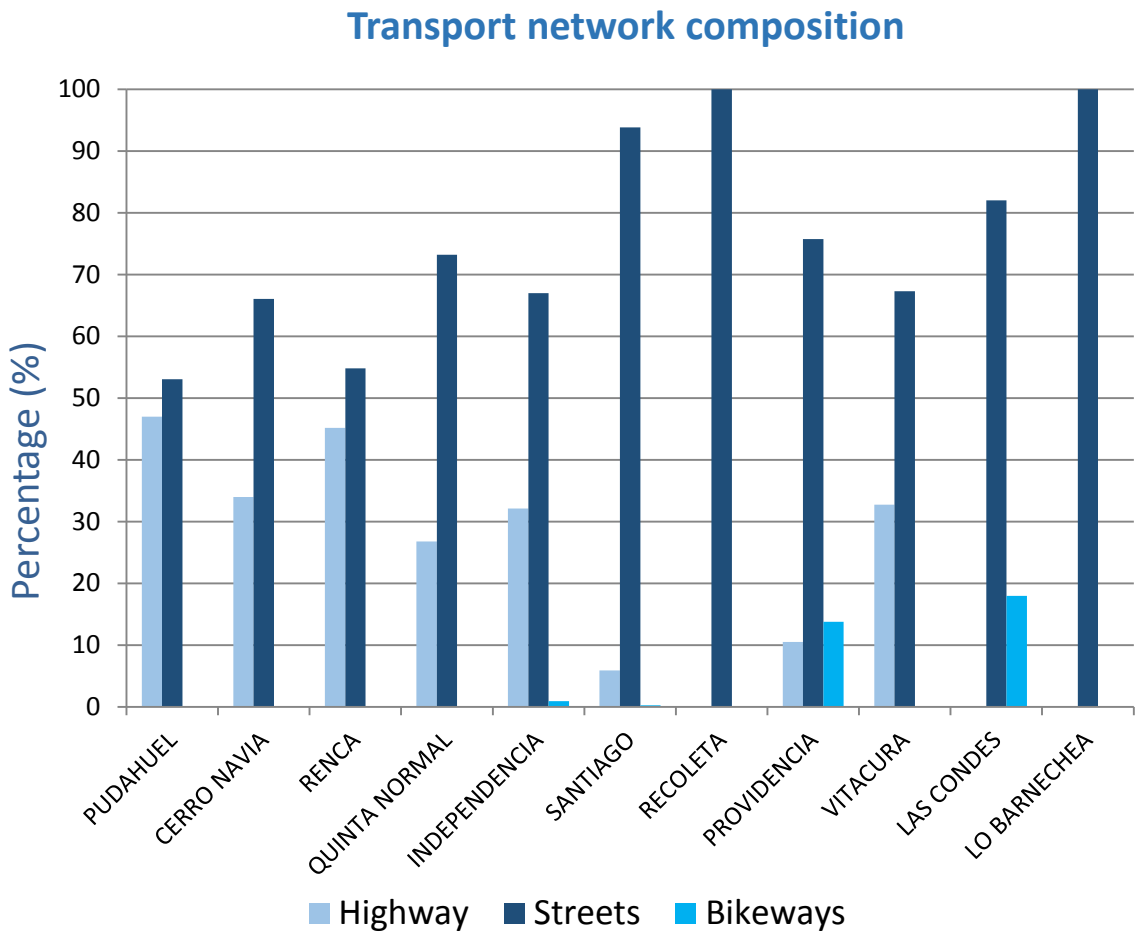
Transects 2, 6, 8 and 15 show the cooling effect of river stream, in both borders.
On the contrary, the transect 3, 5 and 7 are cooler than the river stream.

Flood mitigation



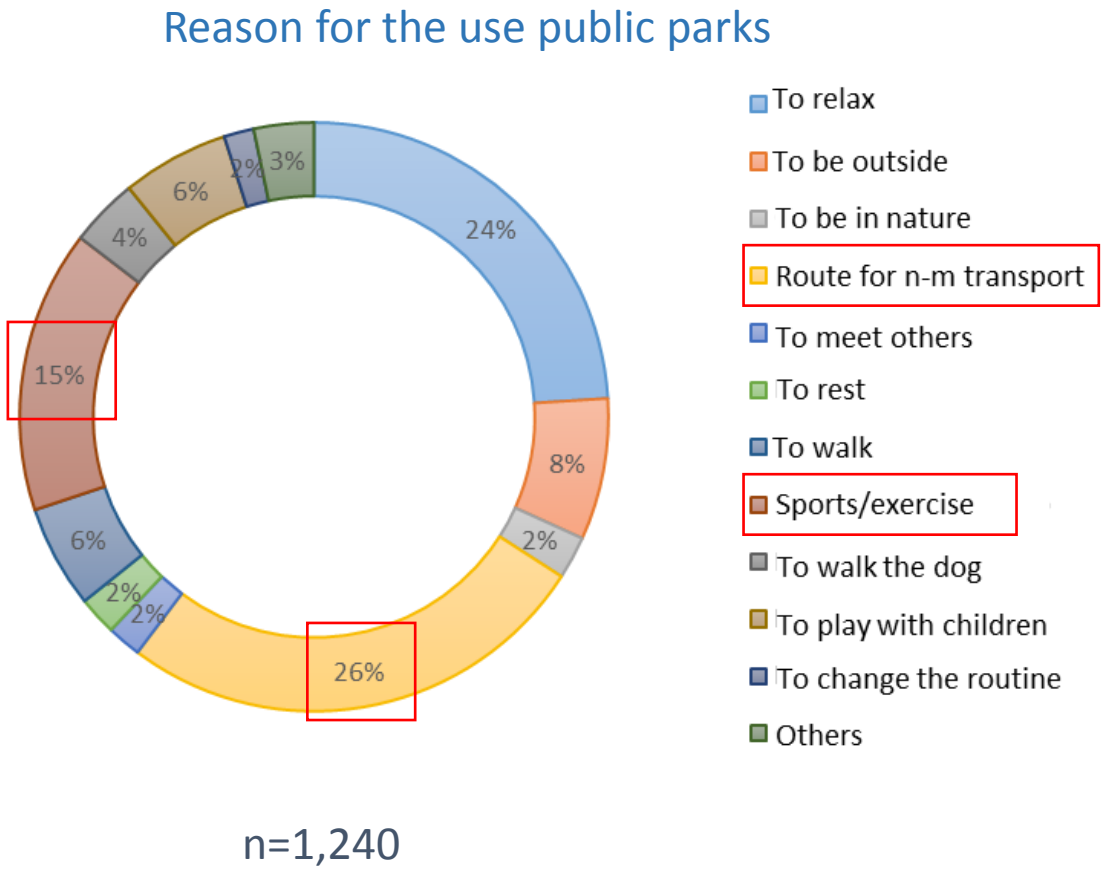
70% of the city population (around 40,000 people) are living within the Mapocho's riparian zone and they are affected by floods, especially in the western section.

Non-motorized transport



90.2% of the transport network in the riparian zone is dominated by streets (78.6%) and urban highways (11.6%). Bikeways represent just 9.8 % of the transport network.

Non-motorized transport



These riparian parks support urban connectivity because they are used importantly as a route for non-motorized transport and running and biking.

Final remarks

- No strong evidence was found that the Mapocho river and its riparian zone are providing a real cooling effect.

- The riparian zone does not act as a flood protection buffer in most of its course.

- Transport infrastructure in Mapochos's riparian zone is motorized oriented, especially for private cars.

The main contribution the Mapocho's riparian corridor (urban parks) to cope with climate change is mitigation of greenhouse gas emission, because is mainly used as route for non-motorized transport.

Fondecyt Grants Nº1130311 and Nº1130305

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