University Alliance for Sustainability

Spring Campus, April 11-15, 2016
Research Workshop I: "Climate Governance in International Comparison"
Organized by Prof. Miranda Schreurs

Nikolai Bobylev, PhD

Sustainability, resilience, and climate change adaptation: synergy or conflict in urban development?

Towards sustainable, liveable, smart, climate- neutral, resilient……cities

E-mail: n.bobylev@spbu.ru

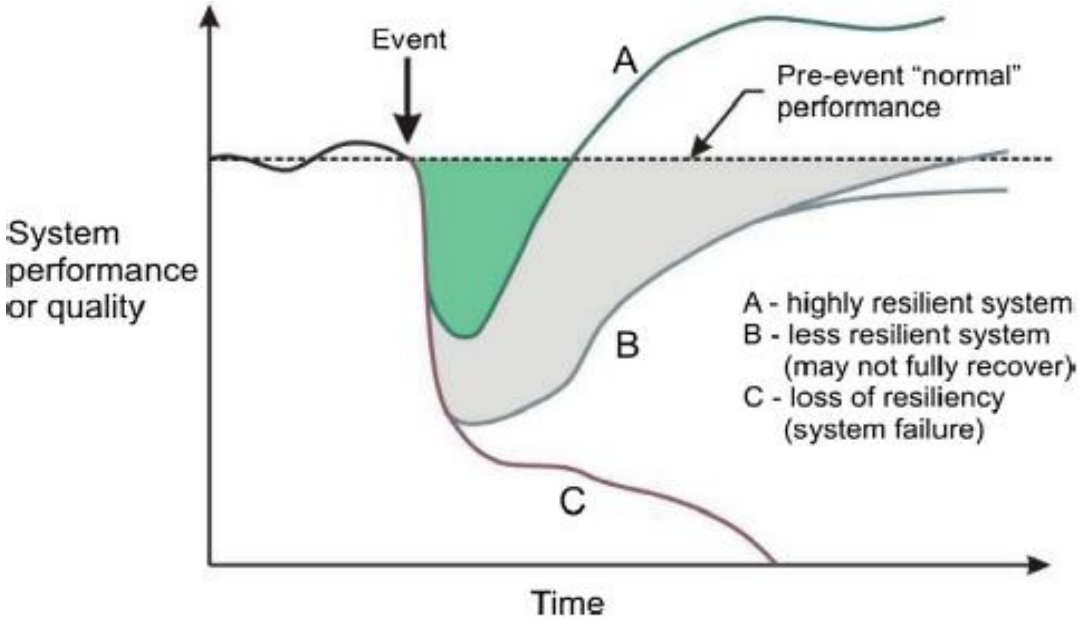
Overview

- Concepts of sustainable development and resilience
- Resilience theory approaches
- Sustainability science approaches
- Bounce-back-ability, adaptability, transformation
- Global environmental change and climate change
- Urbanisation and land cover change
- Urban Physical Infrastructure
- Urban Physical Infrastructure and Climate Change
- Urban Physical Infrastructure and Governance
- Adaptation versus Mitigation and Resilience versus Sustainability
- Sustainability and resilience goals in urban development

Concepts of sustainable development and resilience

Sustainable development is that which 'meets the needs of the present without compromising the ability of future generations to meet their own needs' (Brundtland, 1987).

Resilience from a physical and natural sciences perspective implies the 'capacity of a system to absorb disturbance and reorganize while undergoing change to still retain essentially the same function, structure, identity, and feedbacks' (Walker et al. 2004, 1). This is translated into the two essential categories: 'bounce-back-ability' and adaptability (DeVerteuil & Golubchikov, 2016).



Conceptual definition of resilience – performance response functions (Sterling and Nelson, 2013)

Bounce-back-ability, adaptability, transformation

Contrasting elements of adaptation and transformation (Redman, 2014).

Adaptive	**Transformative**
Incremental change	Major, potentially fundamental, change
Respond to shock	Action in anticipation of major stresses
Maintain previous order	Create new order, open ended
Build adaptive capacity	Reorder system dynamics
Emergent properties guide trajectory	Build agency, leadership, change agents

Sustainability and resilience – background

Contrasting elements of resilience and sustainability(Redman, 2014).

Resilience theory approach	**Sustainability science approach**
Change is normal, multiple stable states	Envision the future, act to make it happen
Experience adaptive cycle gracefully	Utilize transition management approach
Origin in ecology, maintain ecosystem services	Origin in social sciences, society is flawed
Result of change is open needed, emergent	Desired results of change are specified in advance
Concerned with maintaining system dynamics	Focus is on interventions that lead to sustainability
Stakeholder input focused on desirable system dynamics	Stakeholder input focused on desirable outcomes

Sustainability and resilience – a research question

Sustainability and resilience goals (Bobylev, 2016 based on Redman, 2014)

Resilience theory approach	**Sustainability science approach**
Differences	
Safe, reliable, available now	Minimal consumption, the future goal
Concrete actions to get concrete results	Doing the right things
Utilitarianism to resolve immediate problems	A way of life, a religion (?)
Similarities	
Long term resilience?	Short term (practical) sustainability
Research challenge	
Resilience actions can help or not help future sustainability	Sustainability actions help future resilience

Adaptation versus Mitigation and Resilience versus Sustainability

An example: Adaptation to climate change

A problem of urban water runoff after heavy rain:

climate change increases occurrence of extreme weather events (including urban flash floods)

Ensuing problems:

- Flooding and inundation
- Untreated water discharge into surface water bodies;
- Infrastructure damage;
- Disruption if critical (vital) urban services

Adaptation versus Mitigation and Resilience versus Sustainability

An example: Adaptation to climate change

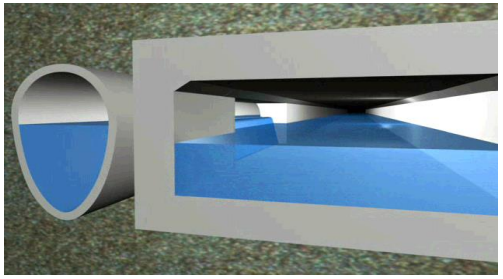
A problem of urban water runoff after heavy rain

Conventional solutions:

- Reduce runoff (trees, green zones); (resilient & sustainable)
- Increase capacity of drainage infrastructure (resilient & not sustainable)

Smart city solutions (resilient & sustainable)

- Manage runoff between city areas (valves, barriers, automated water management (smart grids)).
- Inform citizens to temporary cut domestic water use (e.g. for one-two hours).



Adaptation versus Mitigation and Resilience versus Sustainability

A problem of urban water runoff after heavy rain

G-Cans Tokyo: resilient & not sustainable

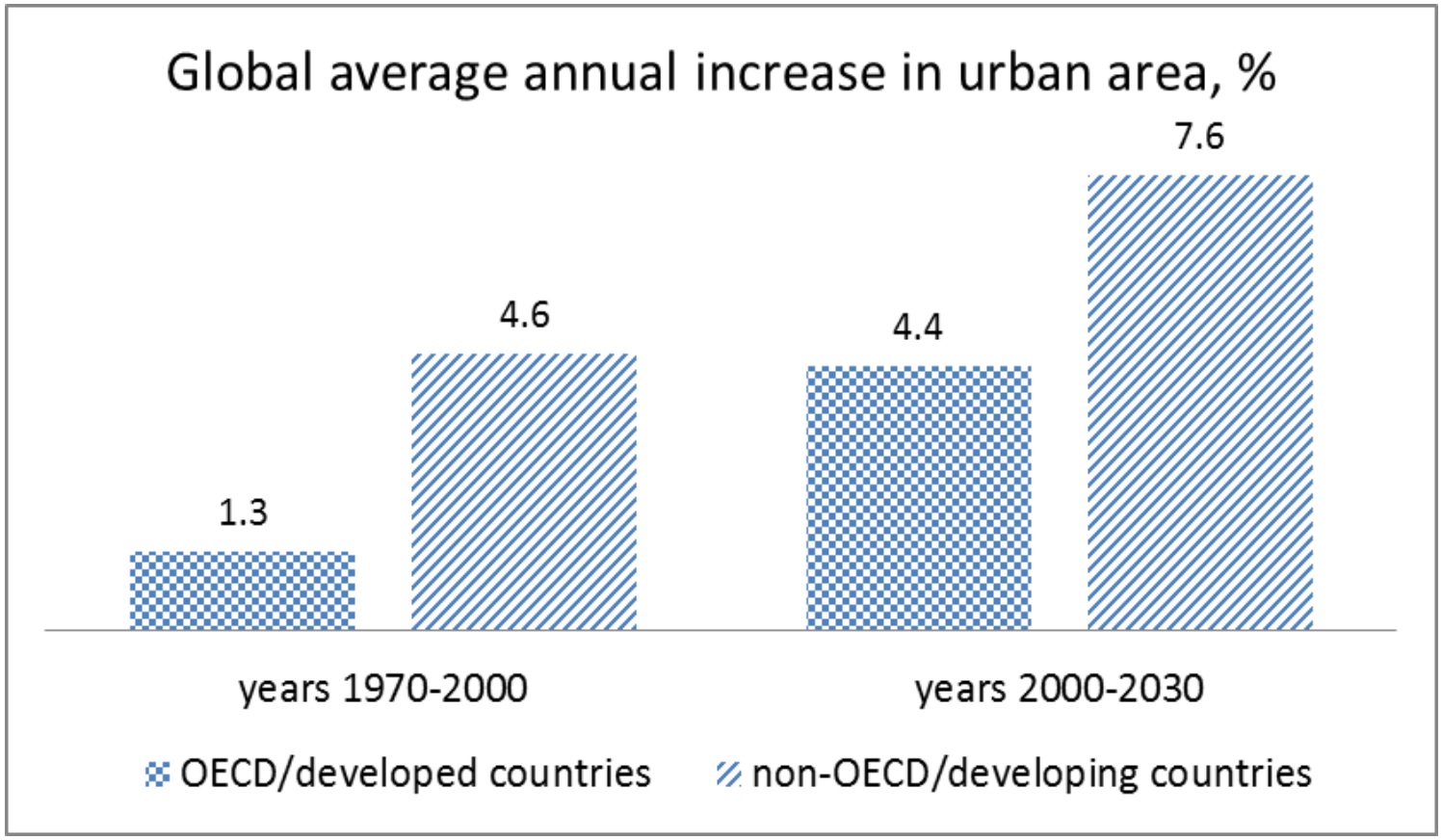
- Resolves urgent problem
- Uses a lot of resources to build and operate
- Stems form an unsustainable land use decisions (unmanaged excessive runoff)
- De facto facilitates climate change

Many other urban sustainability and resilience problems:

Global Environmental Change:

Climate + urbanization+ biodiversity…..

Facts = Land cover change!



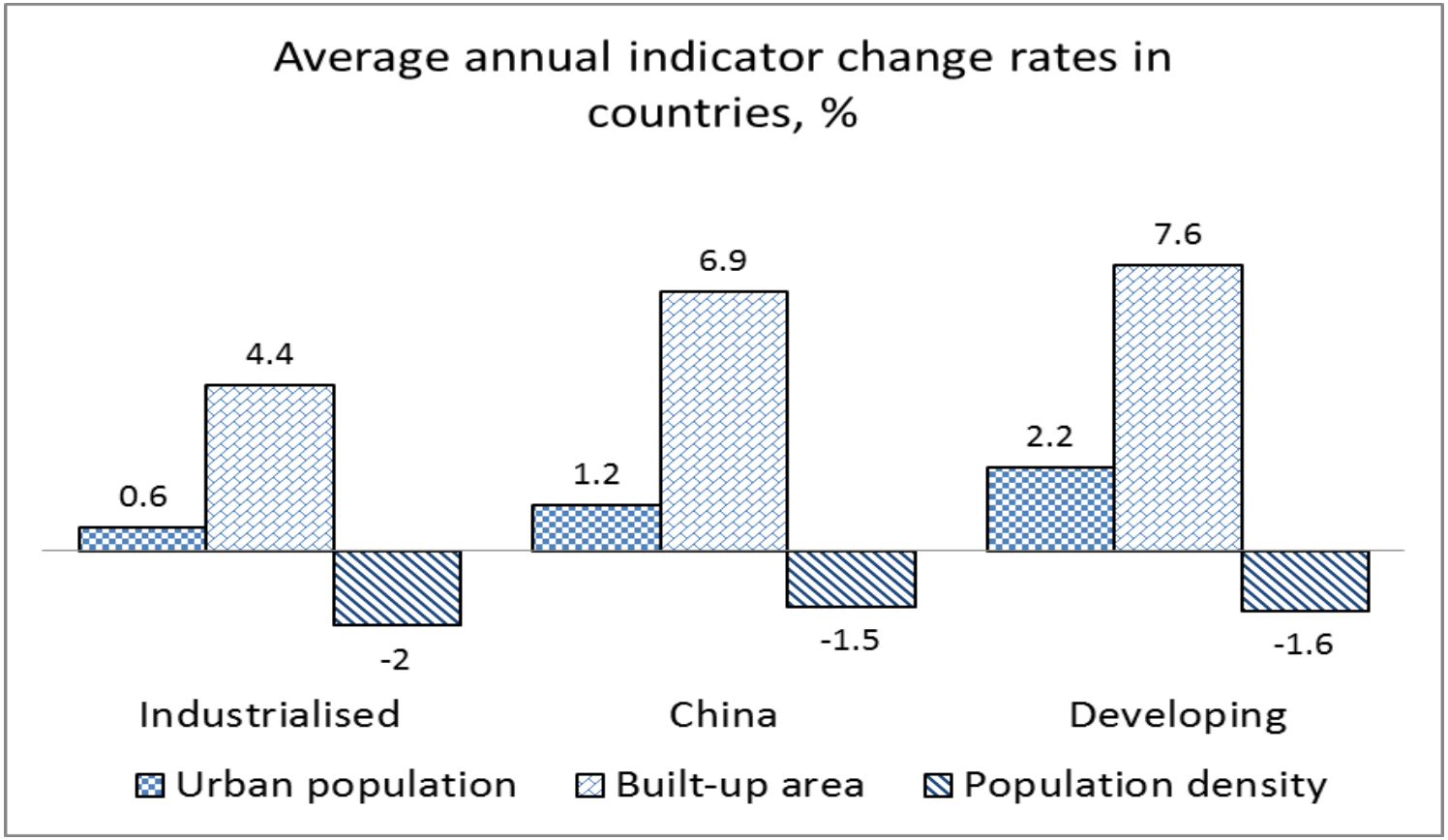
source: Bobylev & Jefferson, Sustainable Infrastructure for Resilient Urban Environments (SIRUE) 2012 – 2015

Data: Goldewijk K. and Van Drecht G., 2006; OECD 2008, Angel et al, 2005

*tolerances: built-up area equals urban area; OECD countries equals developed equals industrialised countries.

Global Environmental Change:
Climate + urbanization+ biodiversity…..

Policy = Urban sprawl? A Compact city?

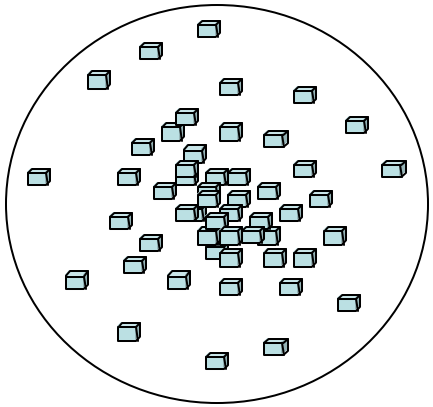


source: Bobylev & Jefferson, Sustainable Infrastructure for Resilient Urban Environments (SIRUE) 2012 – 2015

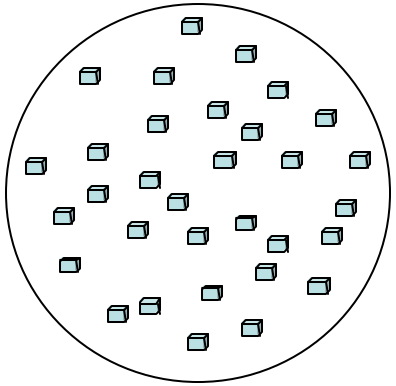
Calculated using data from: China Urban Development Report, 2010; He et al, 2012; UN-Habitat, 2011; Angel et al, 2005; UN-Habitat, 2013. *tolerances: built-up area equals urban area, excluding major green areas and water bodies; OECD countries equals to (1) developed (2) industrialised countries; data for China is for the years 2000 - 2009, data for the urban population is for the years 2010 - 2020, data for urban population density is for the years 1990 – 2000, the rest data is for 2000-2030.

Urban development policies - concepts

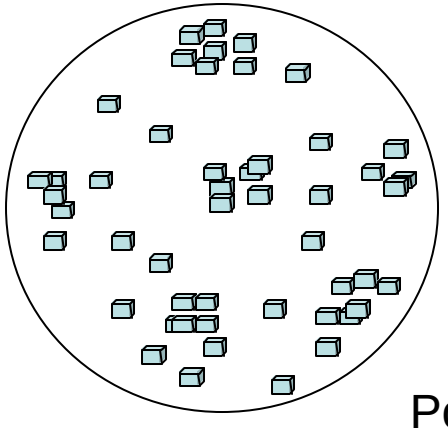
Urban form – should there be a policy?



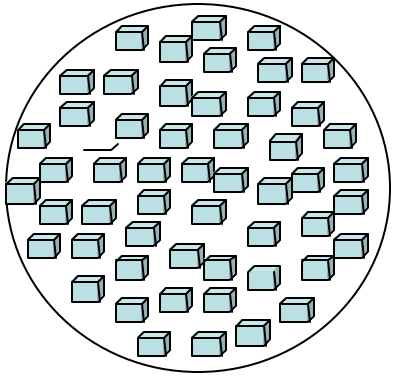
Monocentric



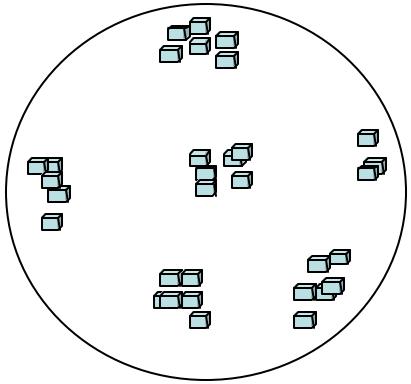
Sprawling



Polycentric



Compact



Combination of activity centers

The importance of Urban Physical Infrastructure

Infrastructure as a major asset:
transport, resource supply networks, waste management, civil defence, other

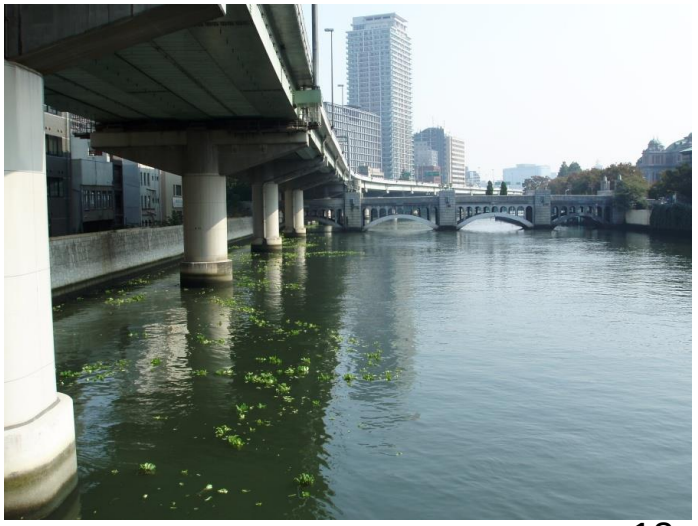
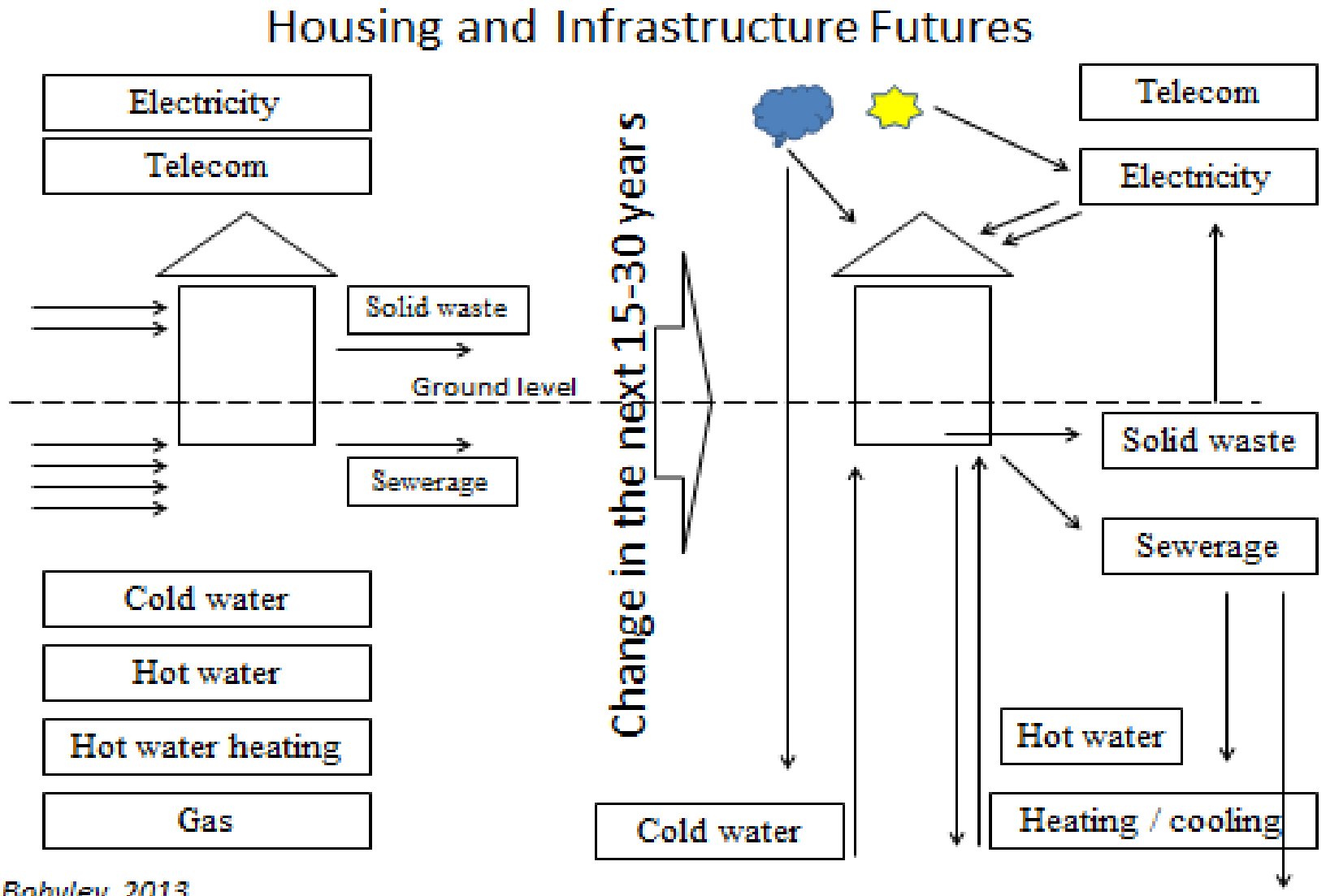


Photo: Nikolai Bobylev

Urban Physical Infrastructure:
adaptation, transformation, transitions?

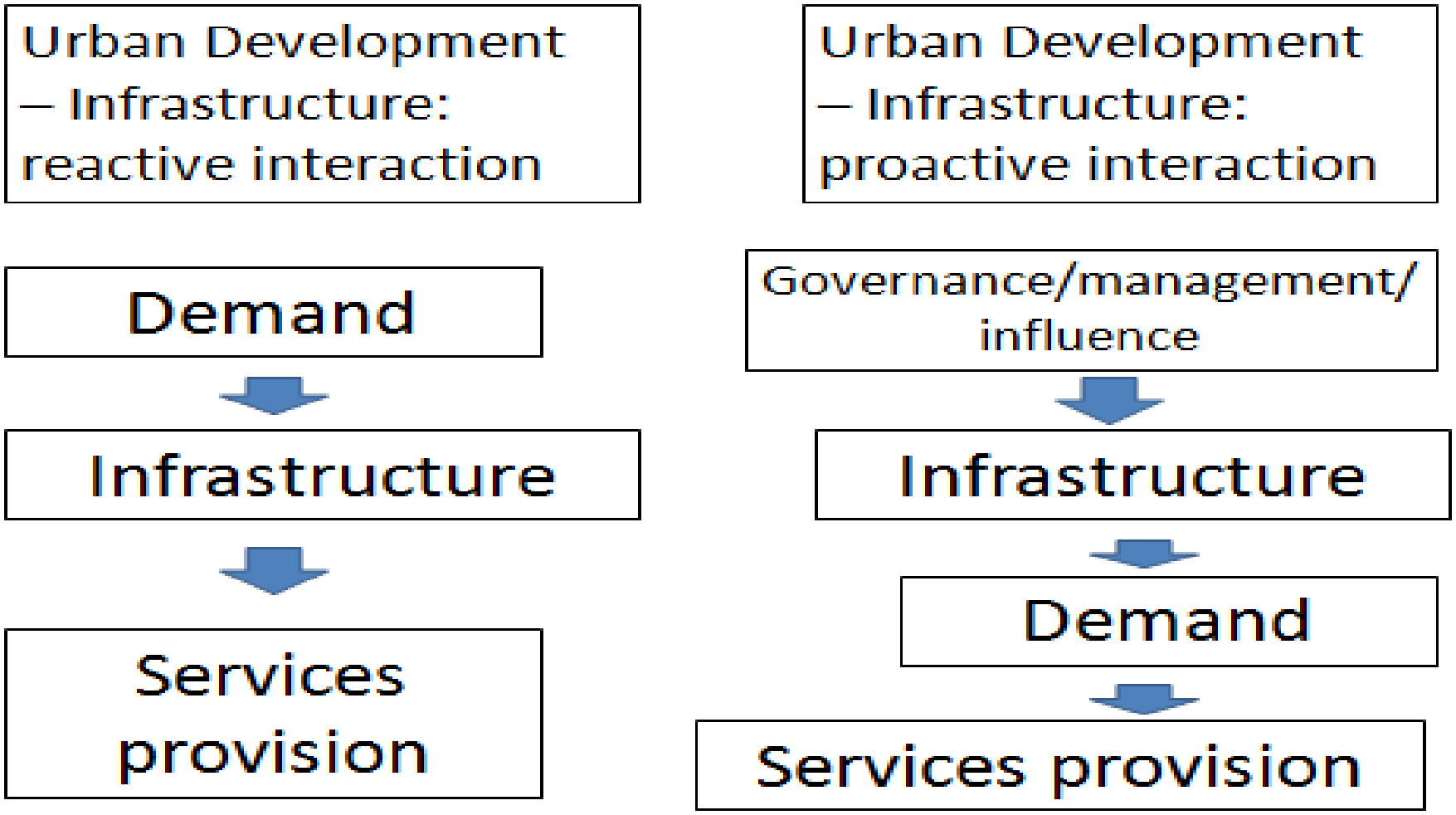


Housing support infrastructure development trends (from Bobylev, upcoming)

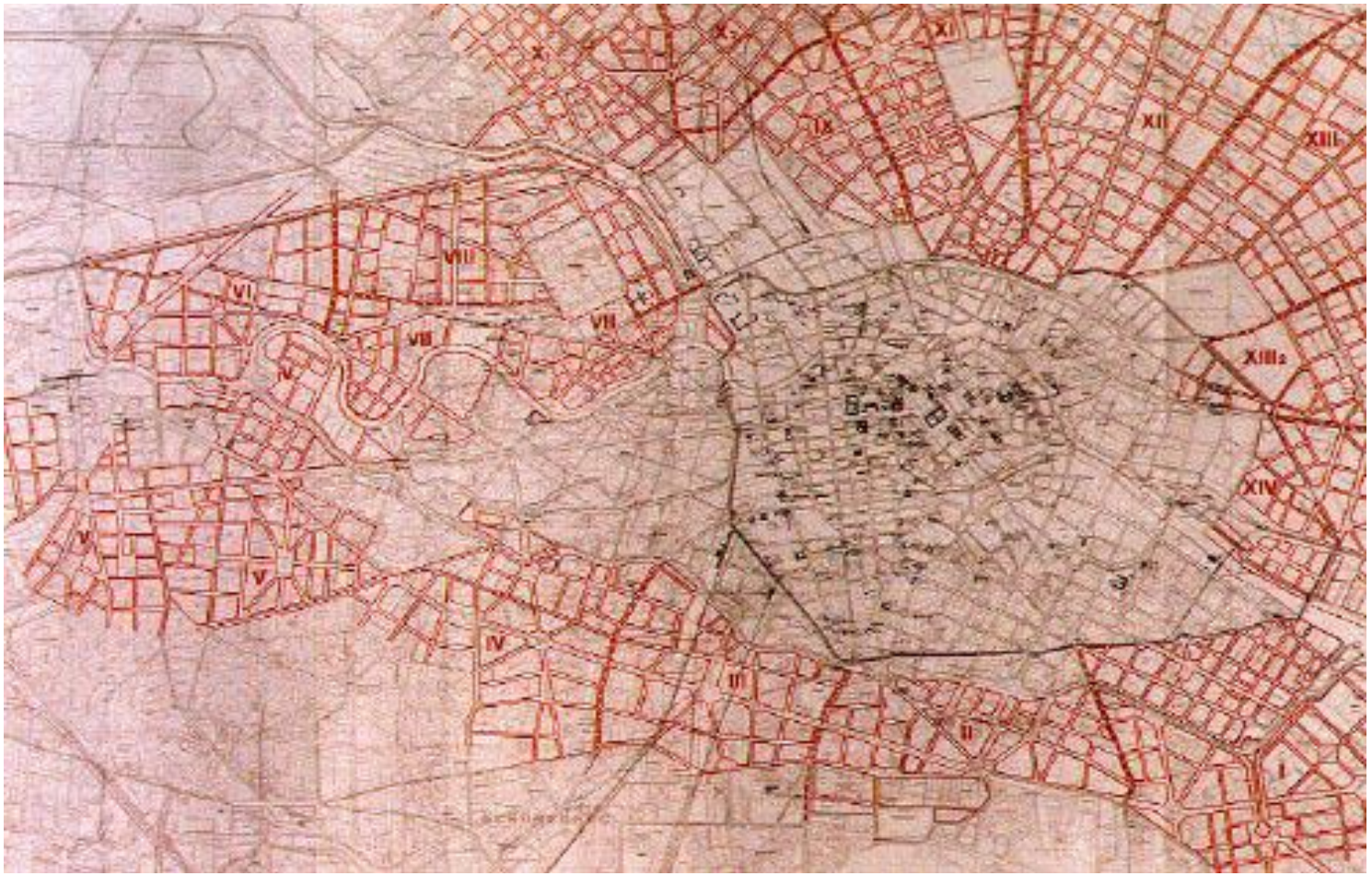
Potential solutions:

Urban Physical Infrastructure Governance

Active policies and strategies aimed at resolving current problems (resilience) in a sustainable way (sustainability culture?)



Potential solutions:
Urban Physical Infrastructure Foresight



City of Berlin Development Plan by Hobrecht, 1862, featuring sewer network corresponding with planned street network and land lots for development. (source: Aust and Stark 1987).

Sustainability and resilience goals in urban development

Elements of resilience and sustainability related to urban development, Bobylev 2016

Urban challenges (liveability improvement)	Resilience	Synergy or conflict; strong or moderate	Sustainability
Utility services provisioning	Reliable provisioning of infrastructure services, backup infrastructure	Moderate conflict	Frugal resource use, reduced utility services consumption, saving energy while infrastructure operation
Infrastructure spatial arrangement	Wide, ample space for each infrastructure element to avoid disturbance in case of the other failure	Strong conflict	Tight, aimed at saving space, energy, and materials
Housing	Safe, adapted to withstand disasters	Moderate conflict	Liveable and energy efficient
Public spaces	Designed to have additional capacity for disaster response and reduction	Moderate conflict	Designed to encourage sustainable lifestyles
Transport	Reliable transport links, designed to withstand variety of stresses while maintaining services	Strong conflict	Minimal, aimed at consuming minimal energy
Green and recreational areas	Ample, to adsorb disaster shocks and provide refuge	Strong synergy	Ample, to provide quality of life
Optimal urban form	Polycentric, to diversify risks	Moderate synergy	Compact, to save energy
Society	Coherent and informed	Strong synergy	Coherent and informed
Population and building stock densities	Optimal, not too low to be able to organize common protection (flood management) and not too high to enable disaster response (proximity of emergency services)	Unknown/specific to location	Optimal, not too low to save land and energy and not too high to enable quality of life
Climate change	Increase industrial activities to be able to	Strong conflict	Decrease industrial activities to reduce

Policy Summary

Cities: addressing Sustainability, Resilience

Cities: addressing Global Environmental Change (and climate change)

Cities: Overarching goal: Quality of Life?

Cities: green, *sustainable, liveable, smart, climate-neutral, resilient*

Key policies:

-urban density and efficiency

-master planning, 3D planning, democratic, expert-based, ~~political,~~ coherent with other policies

Alexander von Humboldt Stiftung/Foundation

MARIE CURIE ACTIONS

EUROPEAN SCIENCE FOUNDATION
SETTING SCIENCE AGENDAS FOR EUROPE

Technische Universität Berlin

UNIVERSITY OF BIRMINGHAM

PEOPLE

ITA global perspective
URBAN UNDERGROUND SPACE IN A CHANGING WORLD

UN HABITAT
FOR A BETTER URBAN FUTURE

UEA
University of East Anglia

Thank you for your attention!

E-mail: nikolaibobylev@gmail.com

UNITED NATIONS UNIVERSITY

TECHNISCHE UNIVERSITÄT DRESDEN

Leibniz-Institut für ökologische Raumentwicklung

United Nations Economic Commission for Europe

COMMITTEE ON HOUSING AND LAND MANAGEMENT

references

Projects:

Bobylev & Jefferson: Sustainable Infrastructure for Resilient Urban Environments (SIRUE) 2012 – 2015. European Comission FP7 PIIF-GA-2010-273861 http://cordis.europa.eu/projects/rcn/100003_en.html

Bobylev & Parriaux: SNSF Scientific &Technological Cooperation Programme Switzerland-Russia, Ecole polytechnique fédérale de Lausanne, 2011.

Publications:

Bobylev, N (2016) Underground Space as an Urban Indicator: Measuring Use of Subsurface. Tunnelling and Underground Space Technology, Elsevier. Volume xx, Issues xx,

Bobylev N, Sterling R (2016) Urban Underground Space: A Growing Imperative. Perspectives and Current Research in Planning and Design for Underground Space Use. Tunnelling and Underground Space Technology, Elsevier. Volume xx, Issues xx, ISSN: 0886-7798.

Bobylev N, Hunt DVL, Jefferson I, Rogers CDF, (2013) Sustainable Infrastructure for Resilient Urban Environments. Published by Research Publishing. pp. 906 – 917.

Bobylev, N (2013) Urban physical infrastructure adaptation to climate change. In: J.B. Saulnier and M.D. Varella (eds.), Global Change, Energy Issues and Regulation Policies, Springer.

Sterling, R., Admiraal, H., Bobylev, N., Parker, H., Godard, J.P., Vähäaho, I., Rogers, C.D.F., Shi, X., Hanamura T. (2012) Sustainability Issues for Underground Space in Urban Areas. *Proceedings of the ICE - Urban Design and Planning*, 32p. DOI: 10.1680/udap.10.00020

Bobylev, Nikolai (2009) Mainstreaming Sustainable Development into a City's Master Plan: a Case of Urban Underground Space Use. Land Use Policy, Elsevier.

Photo credits:

Nikolai Bobylev; Berliner Wasserbetriebe and Berlin Institute of Technology;

G-Cans, Tokyo (http://www.g-cans.jp/).