URBAN HEALTH AND WELLBEING
A SYSTEMS APPROACH

Advancing Health and Wellbeing in the Changing Urban Environment: Implementing a Systems Approach

Franz W. Gatzweiler

ROLAC – San Salvador
Oct 11-12, 2016

INTERNATIONAL COUNCIL FOR SCIENCE

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UNITED NATIONS UNIVERSITY

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SUMMARY

Understanding how the city behaves as a complex social-ecological-technological system,

by applying a systems approach,

enables us to activate peoples' (collective) potentials for urban health and wellbeing.

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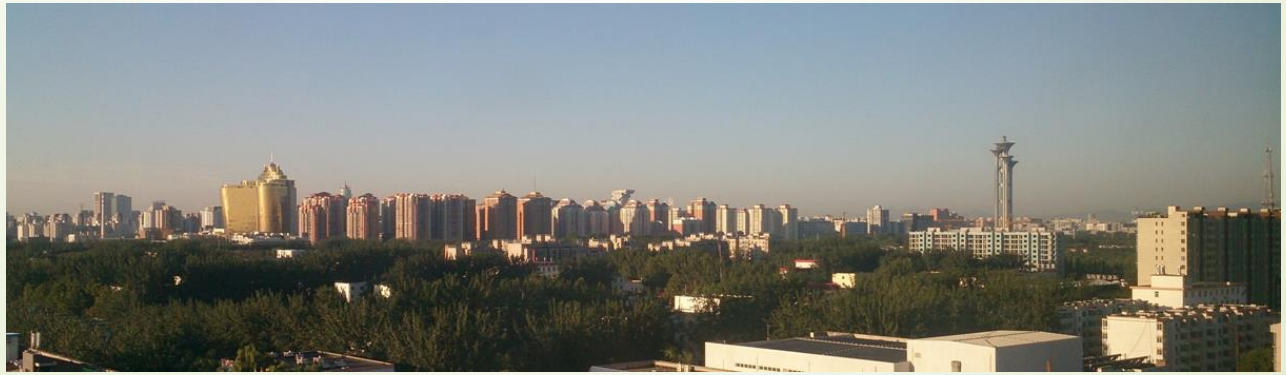
Invitation 1:

Think about urban health issues from a systems perspective



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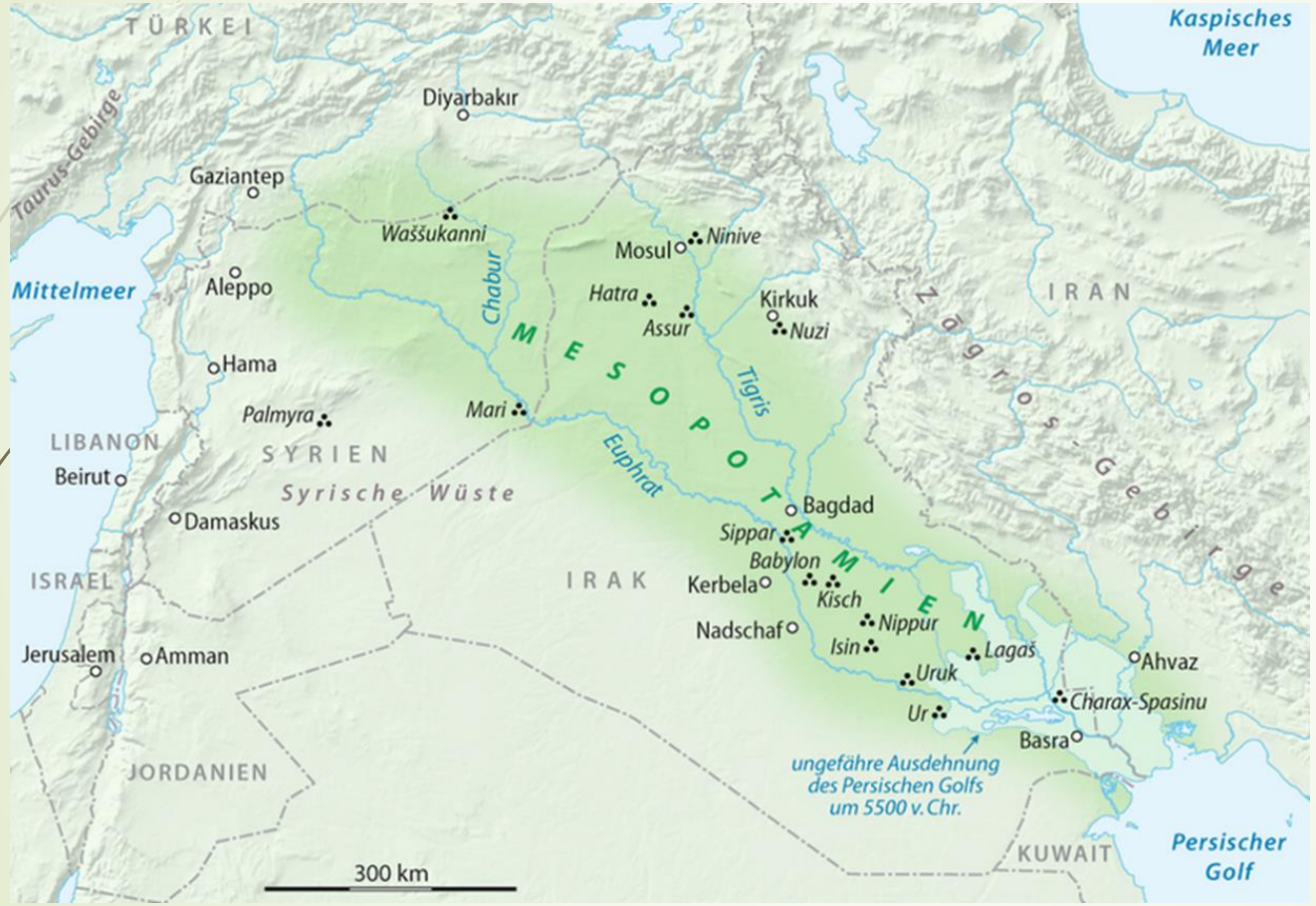
Space



Nördlingen, Bavaria, Germany
City wall from 1327

Hakka Tulou, Fujian, China

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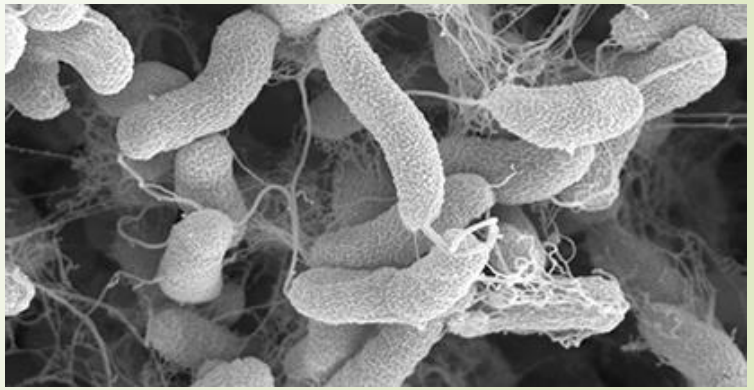
John Snow discovered the link between micro-organic water pollution and cholera -- by interconnected thinking.

Cholera - an acute diarrhoeal infection caused by ingestion of food or water contaminated with the bacterium *Vibrio cholerae*



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Not being able to make the link between disease and hygienic conditions is a symptom of limitations in (knowledge) space.

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Declining urban health as a symptom of opportunity space constraints

Urban evolution from the perspective of opportunity spaces

1. Advantages of settlements over nomadic life.
2. Settlements confined to land and phys. space
3. As population densities grew, „spaces“ for development stagnated, public health declined, environments polluted/deteriorated

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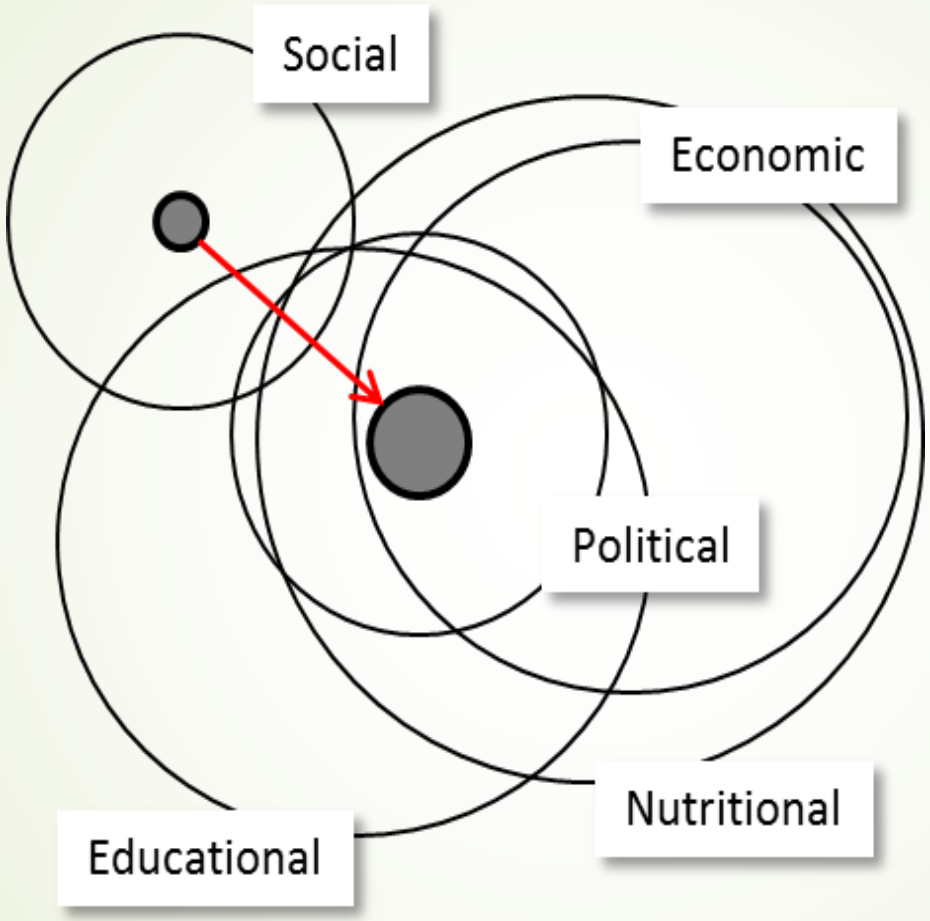
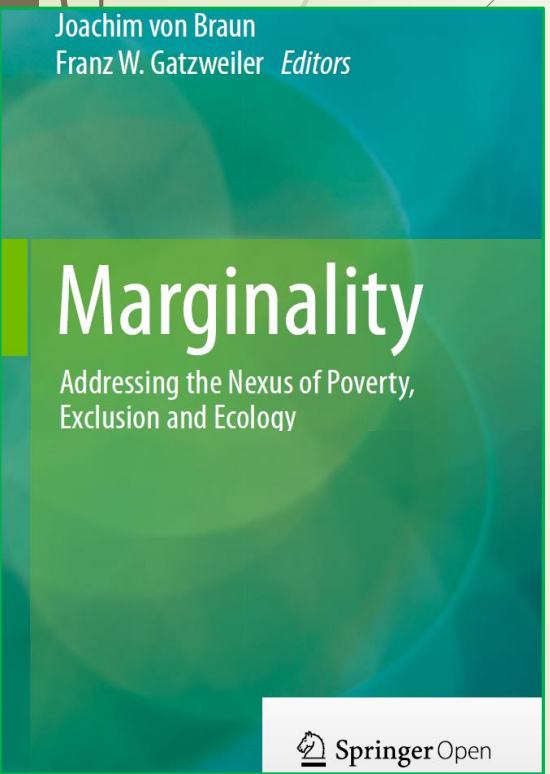
Space = capabilities



Changing position and condition to reduce marginality within a multidimensional system:

- the large circles represent systemic dimensions (social, economic, political, etc.),
- the two smaller shaded circles represent marginalized individuals or groups,
- the arrow represents the direction of change toward the center of more than one system (= reduction of marginality)



"Distance": in terms of transactions- and interdependence costs, i.e. effort required to change and maintain a position.

Source:
von Braun, J., Gatzweiler, F.W. (eds.). 2014. Marginality – Addressing the Nexus of Poverty, Exclusion and Ecology. Springer Netherlands. (open access)

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Opportunity spaces can be widened and deepend for urban health:

- Improving or expanding living area/housing
- Increasing knowledge
- Extending, improving social networks
- Building infrastructure to improve mobility, communication, connectivity
- Encouraging innovation, trade and exchange
  - By institutional entitling, empowering, patenting, protecting,….

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Dead (destructive) capital

= an asset that cannot easily be bought, sold, valued or used in/as an investment

, does not create value
, creates poverty, environmental destruction, pollution,…

Examples:
House in slum; No title for land and house; no legal infrastructure for selling or buying, mortgage

Constrained/unused social and human capital (knowledge) - people do not develop their full capabilities

- Lack of access to education and employment

Not developing the inteligence with the data we have available – because of constrained information processing capabilities

Dead capital can be put into value by creating an enabling institutional infrastructure

Source: de Soto, Hernando. The Mystery of Capital: Why Capitalism Triumphs In the West and Fails Everywhere Else, New York, NY: Basic Books, 2000

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From a developmental perspective:

The rapid increase in people/space (**density**) has outpaced processes of **infrastructure development** (technological, institutional, social, economic, financial,…) resulting in high amounts of „dead capital“ preventing linkages btw knowledge and action, and allowing for environmental and human health risks to (re)emerge.

„Dead capital“ can put to life by embedding it into supportive infrastructure networks (e.g. institutional, legal, social, economic) which values and triggers metobalic flows (data, energy, resources, rights).

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The World Economic Forum estimates that the current global investment gap for infrastructure is $1tr per annum

"Better transit,
- efficient freight networks,
- reduction of congestion,
- improved connectivity,
- greater capacity,
- better communications,
- more efficient water systems,
- clean energy,
- stable power supplies

are vital tools in creating stronger, better connected economies.

Infrastructure as an asset class is therefore becoming increasingly attractive to private investors"

https://www.arcadis.com/media/3/7/E/%7B37E96DF6-82D5-45A6-87D8-5427637E736D%7DAG1015_GIII%202016_ONLINE%20FINAL_SINGLE%20PAGES.pdf

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Understanding urban health from a systems approach, enables to unlock peoples´ potentials for improving health

Two pathways to address urban health disorders

Urban Health disorders
Human Health and Urban Environmental

Not understanding urban systems complexity (uncertainty)

Understanding urban systems Complexity (health risks) (modeling, simulation)

Freedom

Freeing (unlocking) peoples´ capabilities

1. Valuing urban system functions; control; prediction, planning

2. Engaging people in decision making, collective action/inteligence

Making the case:

Urban health risks in the world

New health risks in changing urban environments

with

Prof. Yong-Guan Zhu
Institute of Urban Environment
Chinese Academy of Sciences
Email: ygzhu@iue.ac.cn

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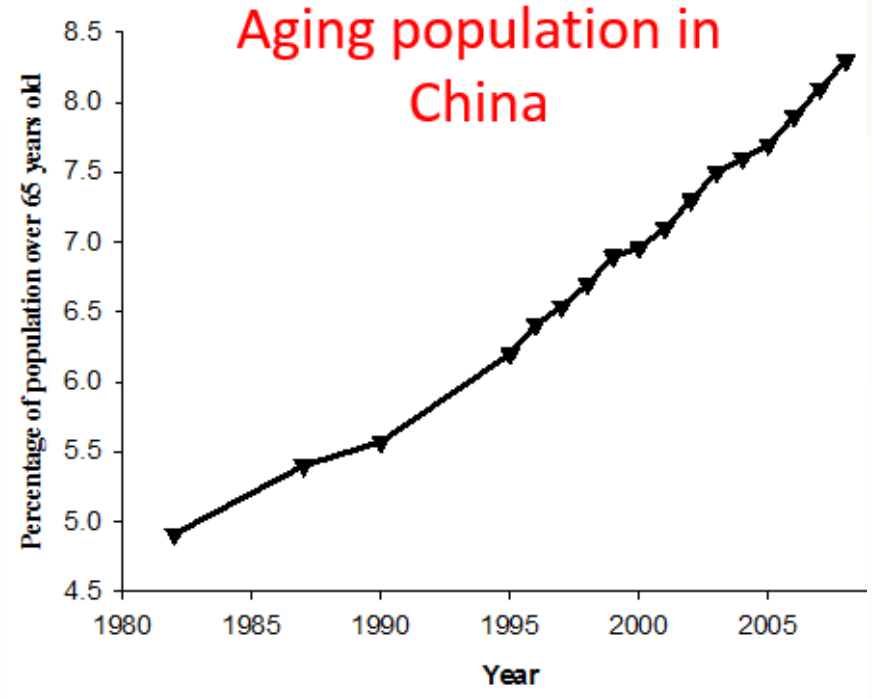
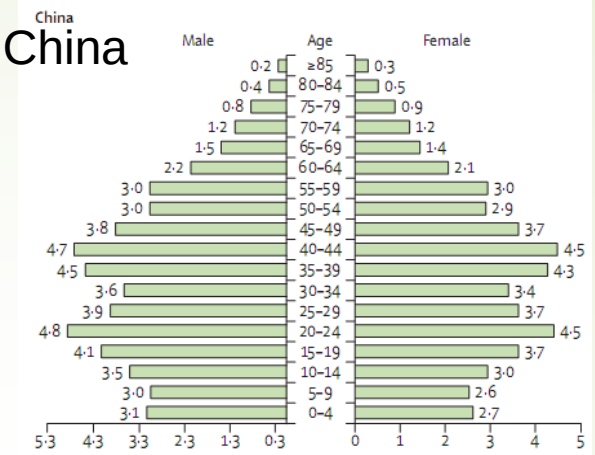
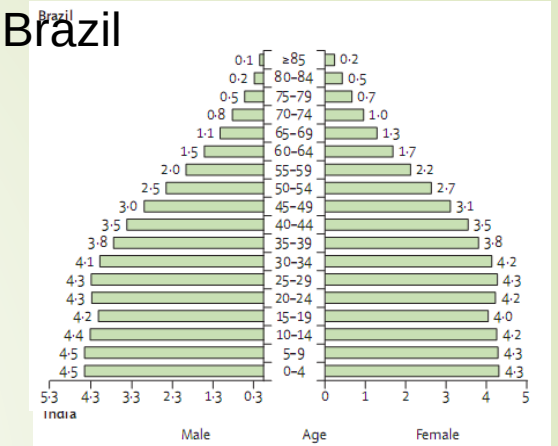
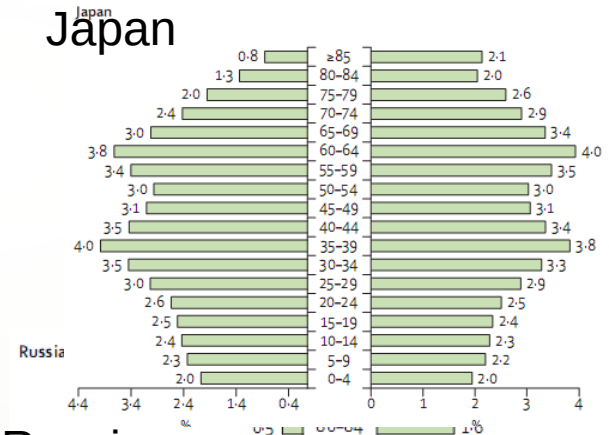




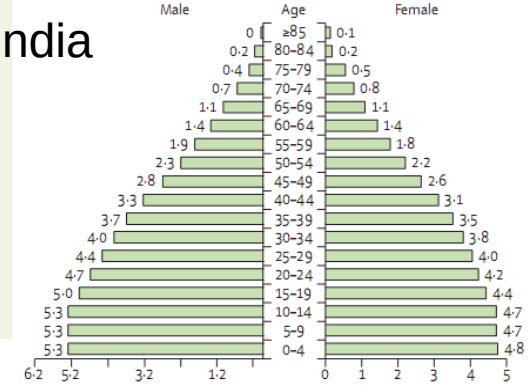
China



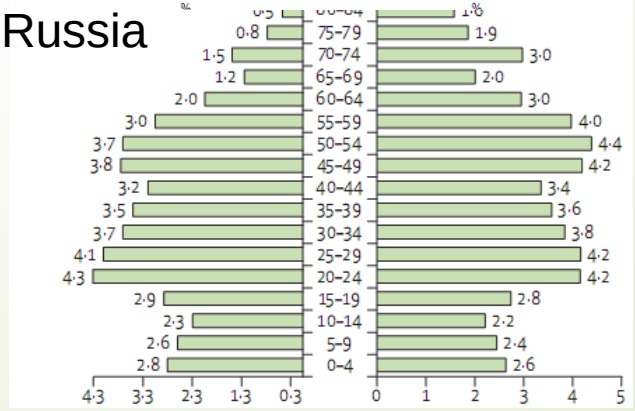
Brazil



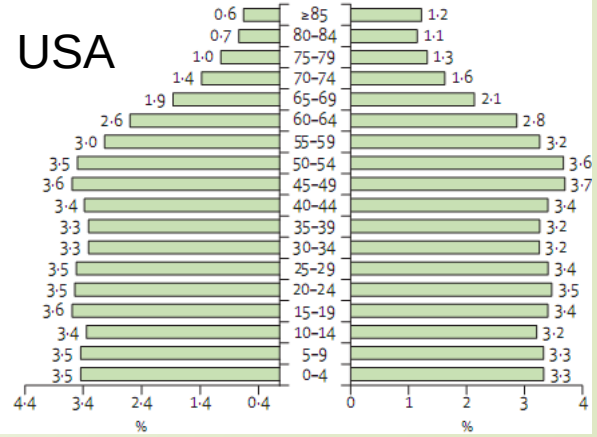
Japan



India



Russia



USA

Age distribution profiles of six countries in 2010 (Lancet, 2012)

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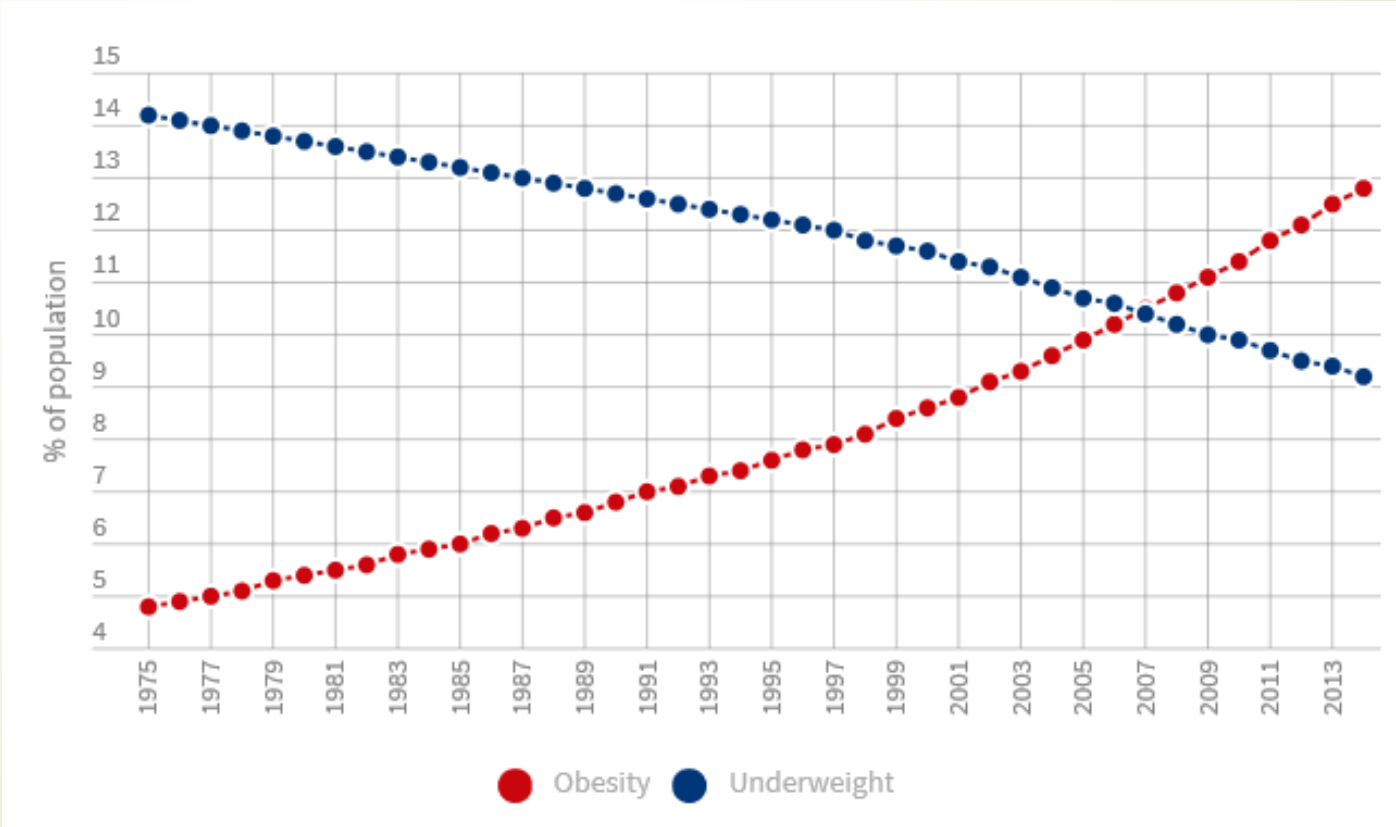
Obesity surpassed undernourishment, globally

Four-decade analysis suggests that one-fifth of the world's population will be obese by 2025.

Source: nature trend watch, doi:10.1038/nature.2016.19682
The Lancet 2 April 2016



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Urban microbiome

Trains are full of more than just people: bacteria stick to seats more effectively than they do to metal poles.

Hanski et al., PNAS, 2012

(Microbial) biodiversity can be surprisingly strongly associated with atopy, a common immune
dysfunction of modern era.

Microbes in the city can be found in the atmosphere (A), water (B), buildings (C), roads (D), subways (E), soil (F), vegetation (G), combined sewer overflow (CSO) outfalls (H), and green roofs (J).

Background Image: Alfred Hutter
Source: http://www.thenatureofcities.com/2014/12/03/invisible-city-life-the-urban-microbiome/

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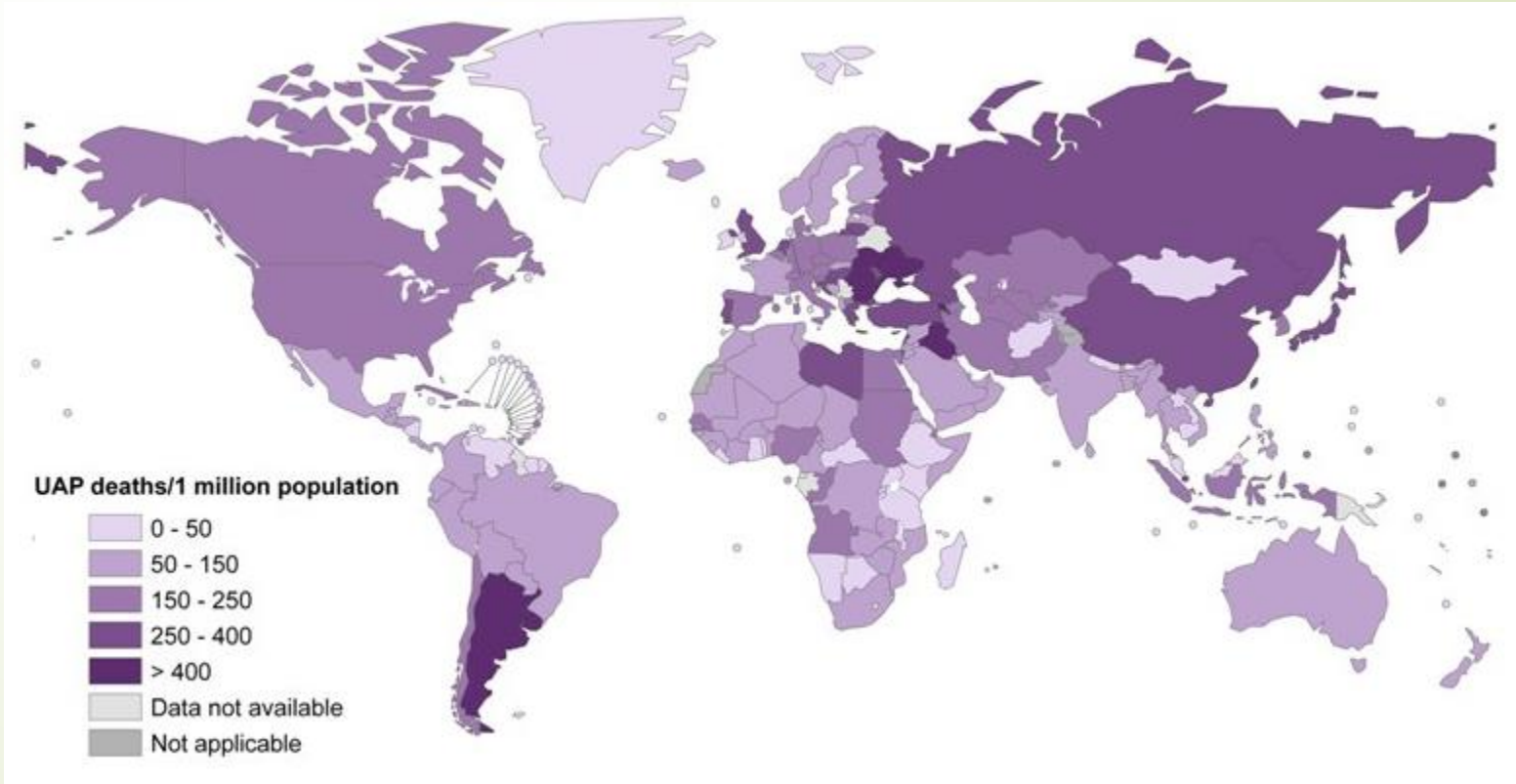
Urban Air Pollution

Urban air pollution is linked to up to 1 million premature deaths and 1 million pre-native deaths each year.
Higher levels in developing and emerging countries

Mhd Zaaba Zakeria



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Heart diseases and cancer

Average age-adjusted mortality rate from heart disease and cancer tend to be higher (in US cities) than national averages.

Rodwin, V. 2000
Health Policy and Management, Wagner School of Public Service, New York University
http://www.nyu.edu/projects/rodwin/urbanhealth.html#footsix

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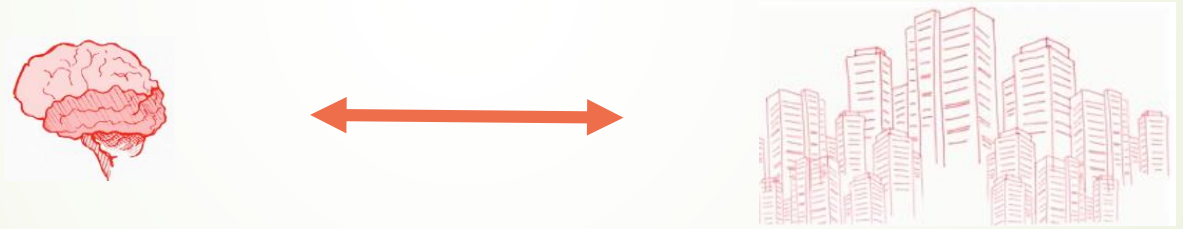
Complex interaction btw human health and urban environment

City life effects human stress related emotional processing



City living interacts with human brains and can increase mental health problems

Source: Stress in the city: Mazda Adli

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Mental health

Research by Andreas Meyer-Lindenberg of the Central Institute of Mental Health in Mannheim, Germany

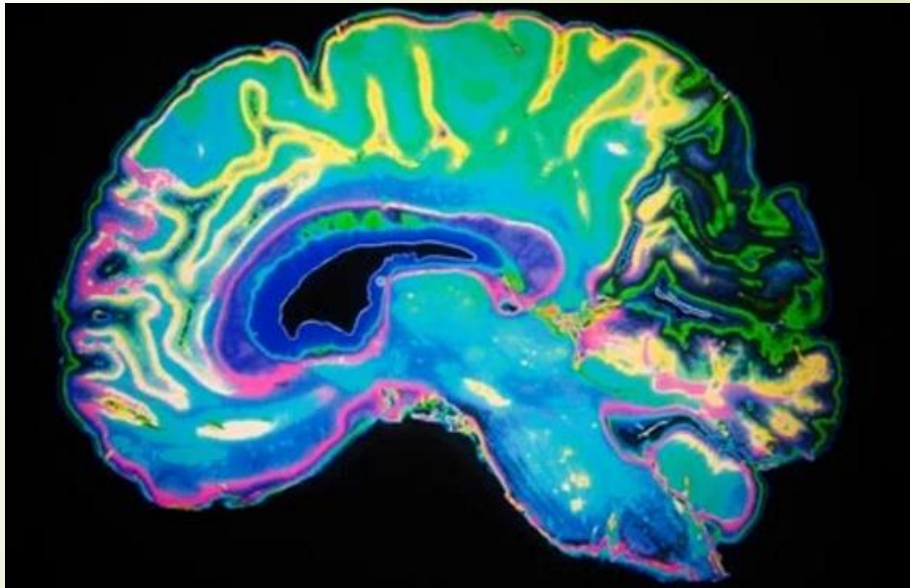
In stressed citydwellers, the amygdalas appeared more active on the scanner;
Less so in people who lived in small towns
In people who lived in the countryside, least of all.

The amygdalas are known to be involved in processing threats and fear.

Our brains are not well adapted to deal with stress in crowded urban environments.

2019
ISUH + IUPHAR + UHWB conference on Mental health in cities

Loneliness in crowds



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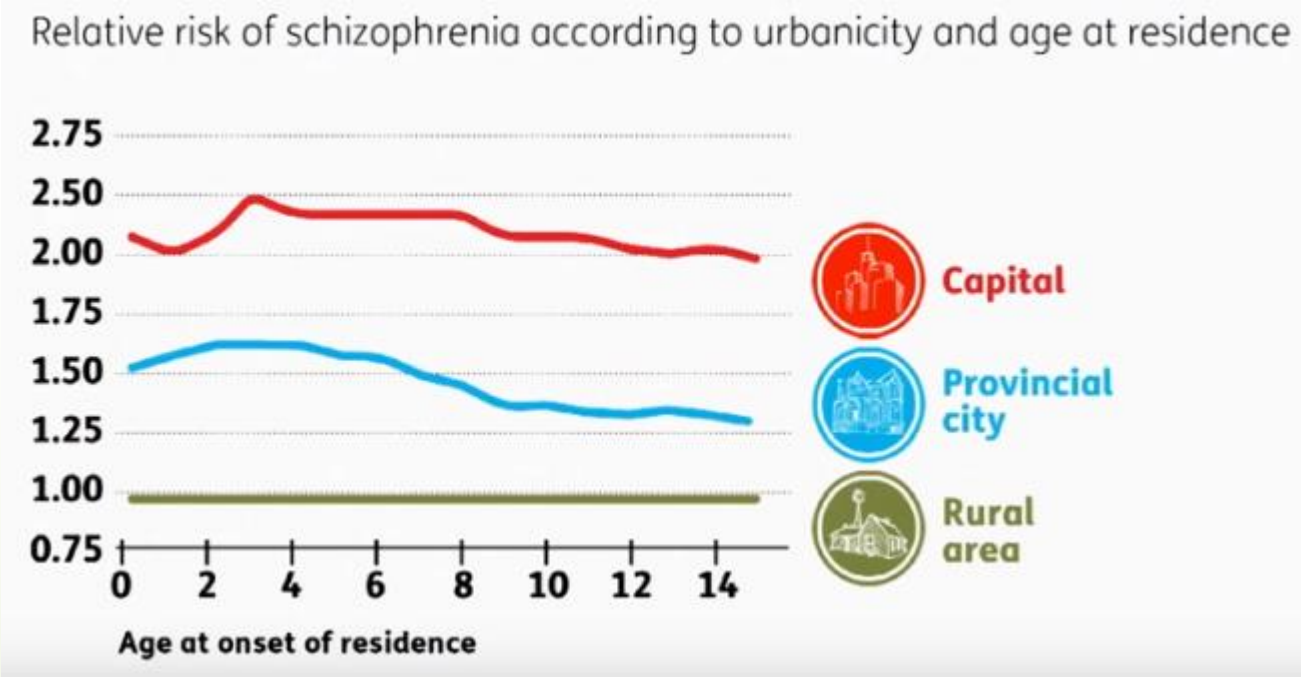
Mental health

The risk of schizophrenia is twice as high in cities than in rural environments

The larger the city, the higher the risk.

Depression:
40% higher risk in cities



Source: Stress in the city: Mazda Adli

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Infectious diseases in cities

"New megacities can be incubators for new epidemics, and zoonotic diseases can spread in a more rapid manner and become worldwide threats"

Tanja Strand, Uppsala University, Sweden, Infection Ecology and Epidemiology 2015, 5: 27060 - http://dx.doi.org/10.3402/iee.v5.27060

Traditional rural infectious diseases turn urban

New York City has one of the largest populations of rats in the United States.

* infestation with one or more intestinal parasitic worms

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The programme

Health and Wellbeing in the changing urban environment: a systems approach

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What we do

1. **Promote a systems approach** to human health & wellbeing in a changing urban environment among scientists and decision-makers

2. **Strengthen capacity** to conduct research on human health & wellbeing in a changing urban environment using a systems approach

3. **Advocate for funding** of systems approaches for human health & wellbeing in changing urban environments

4. **Enhance understanding and knowledge** of systemic urban health & wellbeing issues among multiple scientific disciplines & urban sectors

5. **Influence the international policy agenda** to encompass urban health initiatives

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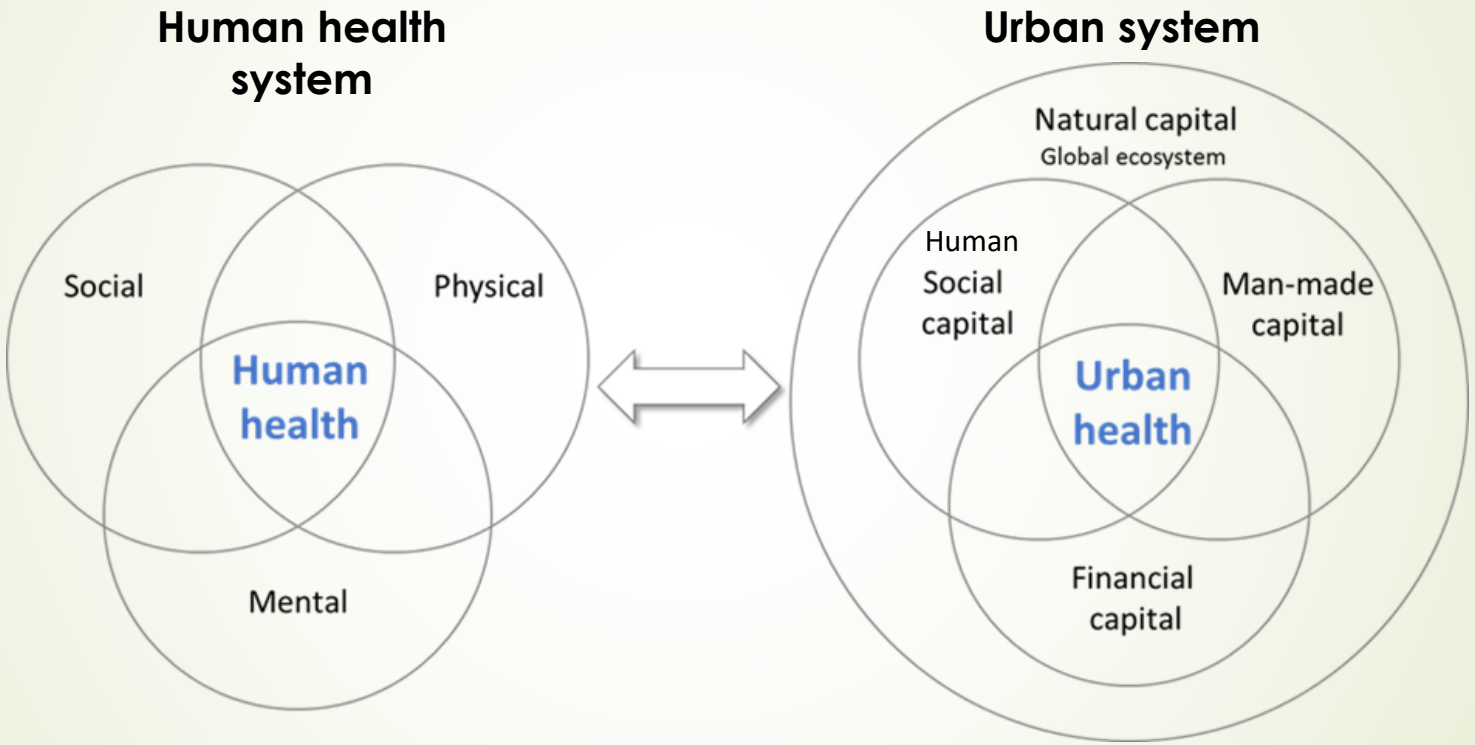
Goal: Healthy lives in healthy cities

Human health and urban environmental health are co-determined and co-evolve



A **healthy city** is "one that is continually creating and improving those physical and social environments and expanding those community resources which **enable people to mutually support each other in performing all the functions of life and in developing to their maximum potential.** (Hancock, undated)

→ Enabling people (healthy and well) by taking care of our environments

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The city as a complex adaptive system provides functions/goods and services

Building the urban socio-ecological infrastructure




Habitat and supporting	Provisioning	Regulating	Cultural
Physical space and infrastructure for living and working in the city. Green (e.g. parks), blue (e.g. lakes), and grey (roads and buildings) environments are created **to provide basic life support functions**, like shelter, waste management, water treatment and sanitation, production of goods and energy provision. The habitat functions make the city a livable place by providing the hardware which enable material, energy and data flows – thereby facilitating urban metabolisms.	Goods and services provided by the urban system some of which can be exchanged on markets, provided by the public or co-produced. Goods include e.g. food, water, manufactured goods, medicines, computers, or books. Services include e.g. access and use of roads, communication and other **public infrastructure**, security, waste management, health care and education systems, disaster response and emergency systems. The provision and production of goods and services can be organized publically, privately or in combinations of both.	Benefits derived from having a system of rules and regulations in place which by means of which the urban system is governed (in the social space) and managed (in the economic and technological space). **Institutional infrastructure** regulating social interactions and other urban metabolisms, e.g., regulating access to public places and services, markets and businesses, traffic, the collection and use of data, food safety and environmental standards in the urban economy. Formal and informal rules, norms and conventions are part of the urban institutional environment.	Benefits created in urban socio-cultural spaces. Social space and liberties for economic and political innovation, exchange of ideas, creativity from exposure to cultural diversity and different forms of cultural expression, recreation and leisure, **space for spiritual enrichment, art and cognitive development.** E.g. cultural events, religious places, “Heimat” (sense of belonging), exhibitions, libraries, cultural heritage values (e.g., historical places), cultural diversity.

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Type of urban system service	Description of urban system services	Examples of health benefits and risks
Habitat and supporting	**Physical space and infrastructure for living and working in the city**. Green (e.g. parks), blue (e.g. lakes), and grey (roads and buildings) infrastructure and space are created to provide basic life support functions, like shelter, waste management, water treatment and sanitation, production of goods and energy provision. The habitat services make the city a livable place by making the hardware and structures available which enable material, energy and data flows – thereby facilitating urban metabolisms.	Housing-related health risks • Allergies and asthma as a result of accumulation of indoor pollutants and dampness • Spread of infectious diseases • Microbiome of the built environment increases or disrupts immune system regulation, exaggerate or suppresses inflammation. • Respiratory and cardiovascular diseases from indoor air pollution • Risk of airborne infectious diseases because of inadequate ventilation • Illness from temperature extremes • Risks of home injuries • Health benefits from urban green space: • Reduction of urban heat • Offsetting of greenhouse gas emissions • Attenuating storm water • Providing urban residents spaces for physical activity and social interaction • Exposure to microbiota which educates the human immune system

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Type of urban system service	Description of urban system services	Examples of health benefits and risks
Provisioning	**Goods and services provided by the urban system** some of which can be exchanged on markets, provided by the public or co-produced. Goods include e.g. food, water, manufactured goods, medicines, computers, or books. Services include e.g. access and use of roads, communication and other public infrastructure, security, waste management, health care and education systems, disaster response and emergency systems. The provision and production of goods and services can be organized publically, privately or in combinations of both.	• Unhealthy urban food environments are associated with increased obesity • Urban farmers markets increase healthier food choices • Access to pharmaceuticals and medicines • Access to public health facilities • Transport and communication infrastructure can improve social networks • Social determinants of health • Health insurance • Hospitals • Clean water • Sanitation facilities

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Type of urban system service	Description of urban system services	Examples of health benefits and risks
Regulating	**Benefits derived from having natural regulation mechanisms and man-made system of rules and regulations in place** by means of which the urban system is governed (in the social space) and managed (in the economic and technological space). Institutional infrastructure regulating social interactions and other urban metabolisms, e.g., regulating access to public places and services, markets and businesses, traffic, the collection and use of data, food safety and environmental standards in the urban economy.	• **Climate and temperature regulation by urban vegetation and technology** • Air purification, run-off mitigation, decomposition of waste, noise reduction. • Human immune system regulation by exposure to microbiota • Policing and public safety • Enforcement of traffic rules and road safety • Food safety standards and controls • Disease control regulations • Hygiene regulations/standards • Medical law • Public health law • Construction regulations • Standards in the Control of Hazardous Substances • Environmental regulations

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Type of urban system service	Description of urban system services	Examples of health benefits and risks
Socio-cultural	**Benefits created in urban socio-cultural spaces.** Social space and liberties for economic and political innovation, exchange of ideas, creativity from exposure to cultural diversity and different forms of cultural expression, recreation and leisure, space for spiritual enrichment, art and cognitive development. E.g. cultural events, religious places, "Heimat" (sense of belonging), exhibitions, libraries, cultural heritage values (e.g., historical places), cultural diversity.	• "If the role of cultural systems of value in health is ignored, biological wellness can be focused on as the sole measure of wellbeing, and the potential for culture to become a key component in health maintenance and promotion can be eroded." (Napier et al. 2014: 1607) • Cultural diversity in healthcare system increases inclusion of minorities. • **Cultural competence can improve quality of healthcare; culturally adapted healthcare can improve patient understanding and health outcomes.** • Culture's dictation of female and male roles that limit women's mobility and ability to seek health care.

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Transdisciplinary knowledge and systems approach

are compatible

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A transdisciplinary approach to urban health

"Urban health issues are socially complex and multi-dimensional that are affected and constrained by the environmental and political contexts in which they occur. (…), **an understanding of the complexity and uniqueness of health problems that arise in urban environments is beyond the scope of any one discipline**."

Converging Disciplines. A Transdisciplinary Research Approach to Urban Health Problems

Kirst, M. et al. 2011, Chapter 1, pp. 3-11

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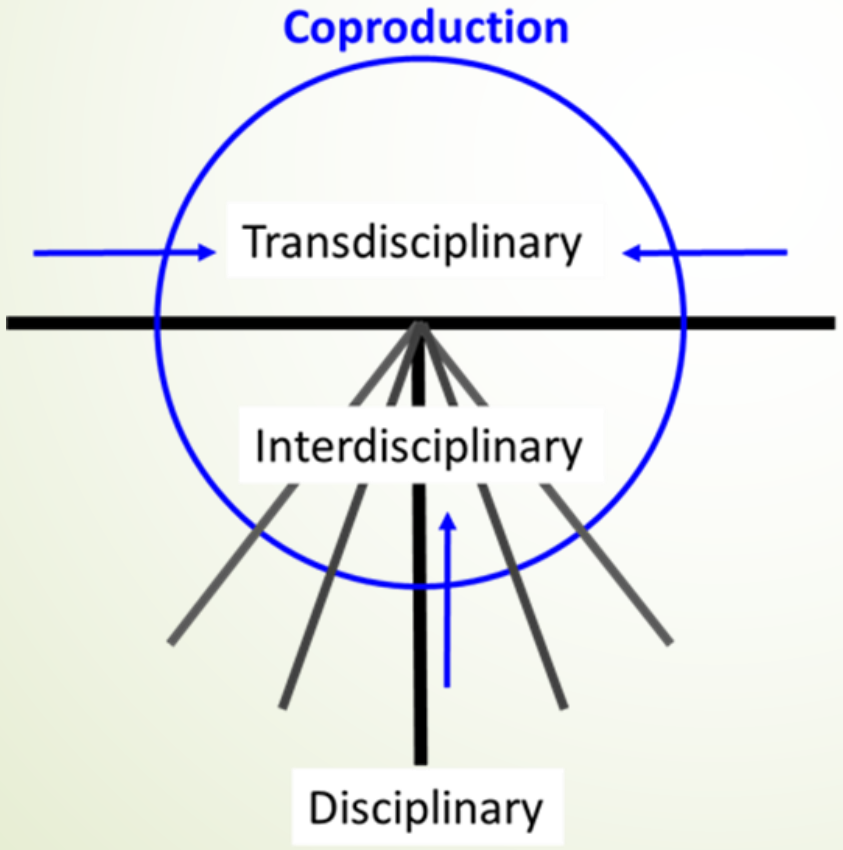
Academic self-reflecion

A systems approach to urban health and wellbeing

recognizes that the process of knowledge creation itself is part of the problem.



Dueto cities being complex, self-organizing systems, they are also partly unplanable, unpredictable and uncontrolable.

We cannot apply a science to those problems which assumes that with time everything is knowable.

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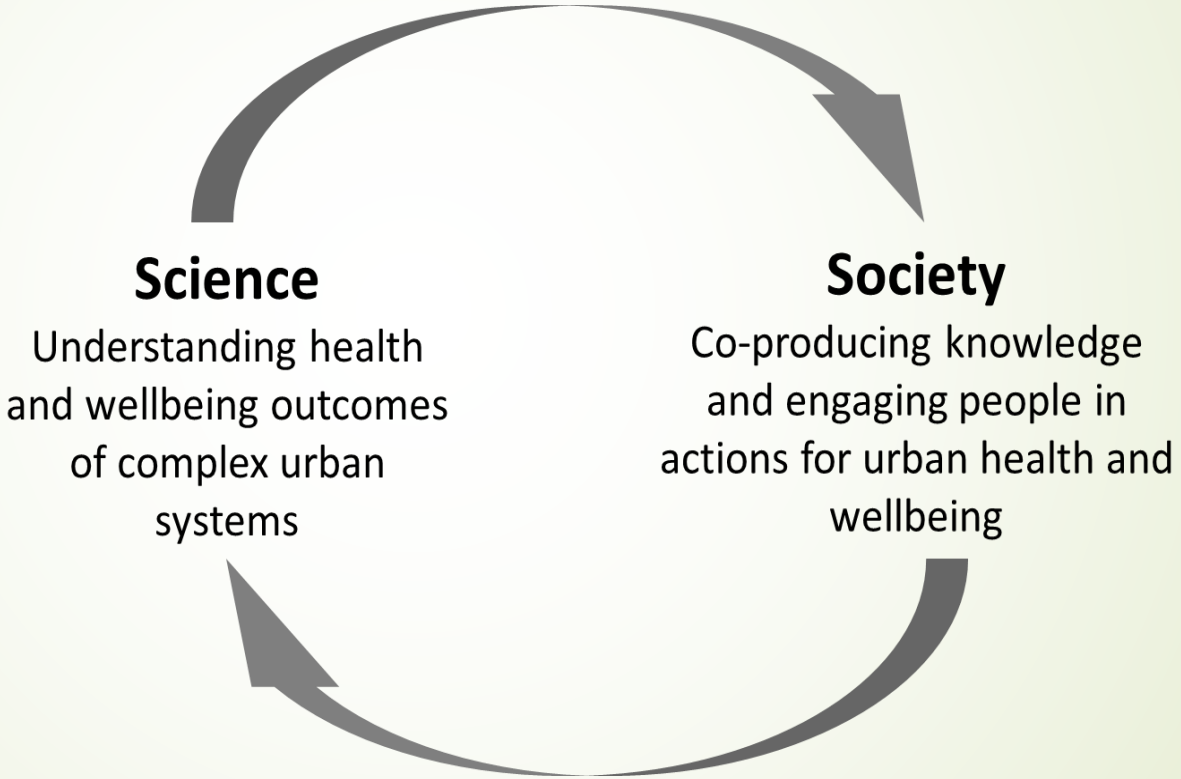
A systems approach to urban health and wellbeing



Science is part of a societal (complex dynamic) system in which knowledge for urban health and wellbeing is constantly generated and needs to be put into action.

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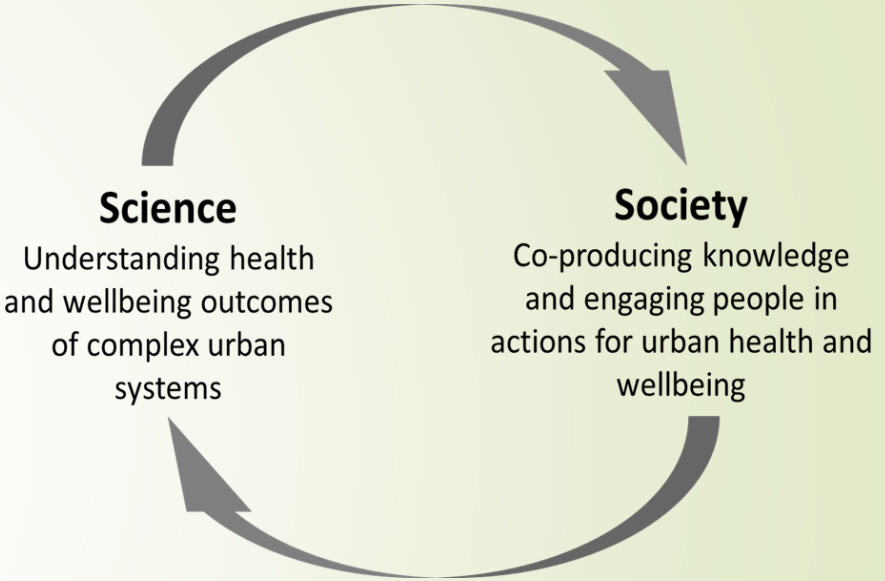
A systems approach to urban health and wellbeing…

…aims at getting the urban metabolisms going;

stimulating flows of energy, resources and data/information;

thereby **enabling people to make use of their potentials** and the potentials of urban system goods and services.



A systems approach breaths life into dead capital and unused potentials.
A systems approach enables information processing capabilities and learning.

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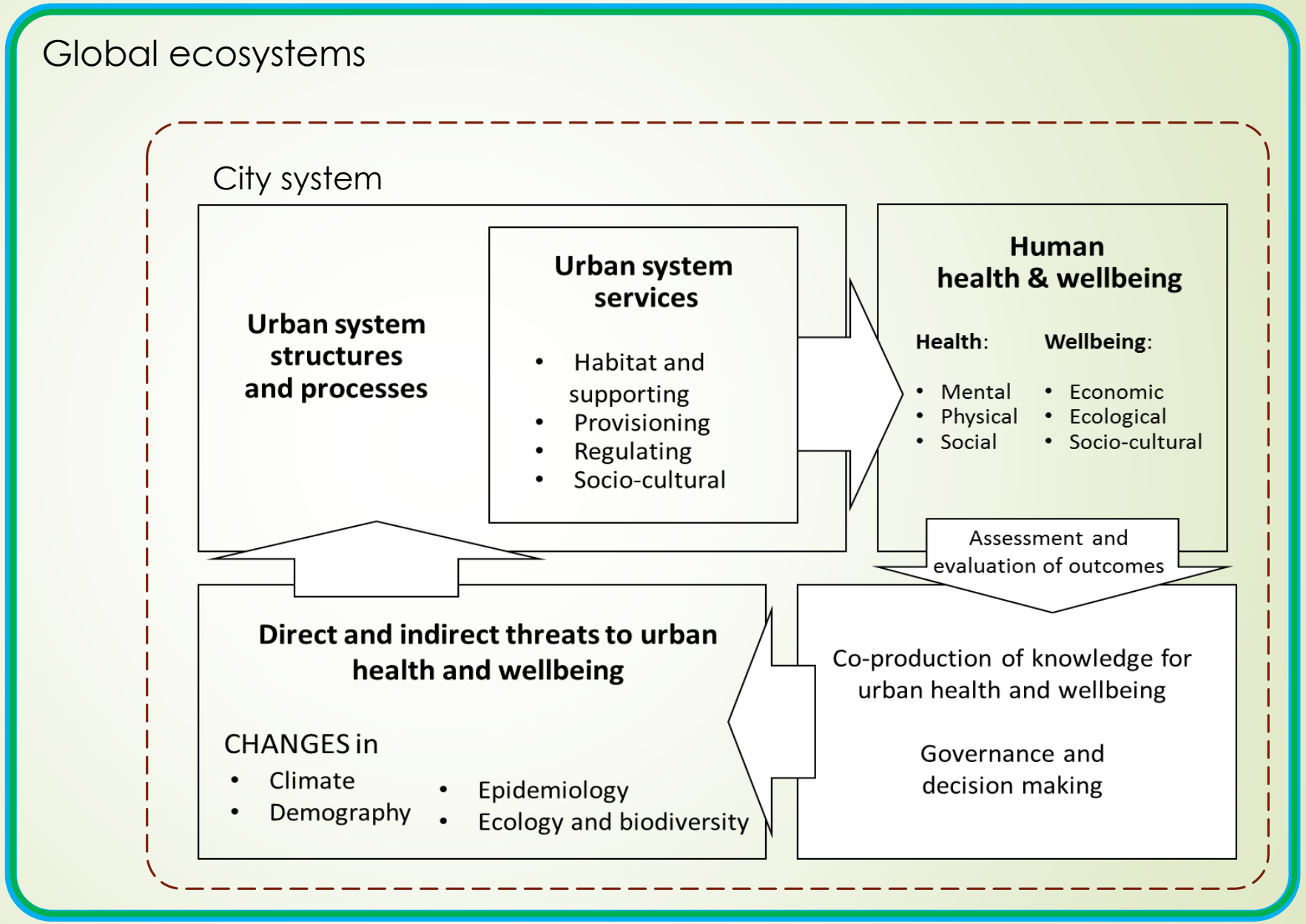

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Check out
www.urbanhealth.c

Zagreb Declaration for Healthy Cities

Health and health equity in all local policies

2008

Fondazione Giangiacomo Feltrinelli

Milan Urban Food Policy Pact. Selected Good Practices from Cities

Edited by Thomas Forster, Florence Egal, Arthur Getz Escudero, Marielle Dubbeling and Henk Renting

DHAKA STATEMENT ON URBAN HEALTH IN SUSTAINABLE DEVELOPMENT

International Conference on Urban Health Dhaka, Bangladesh, May 2015

A Call for Action

2014

XIAMEN STATEMENT ON SYSTEMS THINKING FOR URBAN HEALTH AND WELLBEING

The ICSU global interdisciplinary programme, *Health and Wellbeing in the Changing Urban Environment: a Systems Analysis Approach*, recognizes that:

Cities and other urban settlements are expanding rapidly, and are both the predominant human habitat and the future of humanity;

Cities and the processes of urbanization offer great opportunities for health and wellbeing but also present challenges to health, including the emergence of broad social and geographic inequities;

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Articles

RESEARCH AND PRACTICE

Curr Nutr Rep
DOI 10.1007/s13668-016-0179-1

Original Research

Journal of Primary Care & Community Health

PREVENTING CHRONIC DISEASE
PUBLIC HEALTH RESEARCH, PRACTICE, AND POLICY
Volume 13, E69 MAY 2016

TOOLS AND TECHNIQUES

Agent-Based Modeling of Chronic Diseases: A Narrative Review and Future Research Directions

Yan Li, PhD; Mark A. Lawley, PhD; David S. Siscovick, MD, MPH; Donglan Zhang, PhD; José A. Pagán, PhD

EXAMPLES

- Systems approach in **science**: various models
- Systems approach in **practice**: Safe Systems Approach (Traffic)
- Systems approach in **decision making**: learning processes, policy cycle

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Integrated decision making for urban health and wellbeing

RESEARCH COUNCILS UK

Gateway to Research

Innovate UK

Innovate UK A new integrated decision-making tool for urban health and policy evaluation QCumber-envHealth

Lead Research Organisation: University of Edinburgh
Department Name: Sch of Geosciences

Go back

Overview | Organisations | People

Abstract

Decision-making and planning in rapidly growing urban centres require integrated assessment tools to determine impacts on environmental exposure, health and well being and inequalities. However, there is a lack of practical tools of sufficient spatial detail with which to determine current and future integrated exposure and health risks and to evaluate public policy options. In particular, despite the increasing availability of data, environmental datasets are limited to a few urban monitoring sites and information rich health microdata usually have restricted access (for confidentiality reasons). Moreover, spatio-temporal risk models are required to link exposure and health data to health outcomes and hence determine changes in risk from different policy and planning options. The overall aim of this project is

Funded Value:
£224,214
Funded Period:
Nov 15 - Oct 17
Funder:
NERC

→ Invitation with www.complexcity.org for seminar in China

Integrate:

1. Science + policy making
2. Soft + hard modeling
3. Scientific&precise + heuristic knowledge
4. Scientists and societal stakeholders

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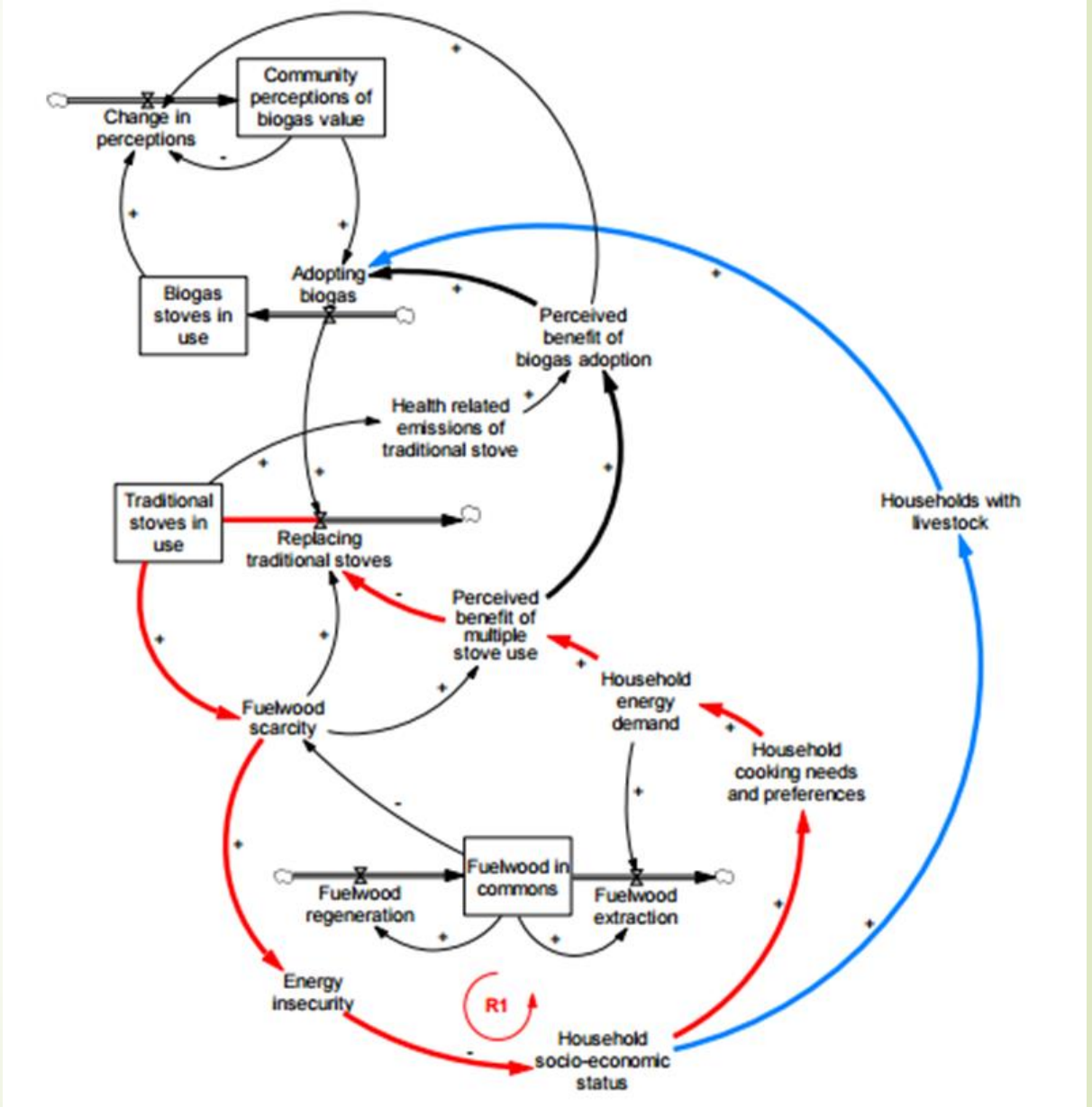
System Dynamics modeling

System dynamics model to examine the set of socio-economic and ecological factors which play a role in determining a household's decision to adopt biogas.



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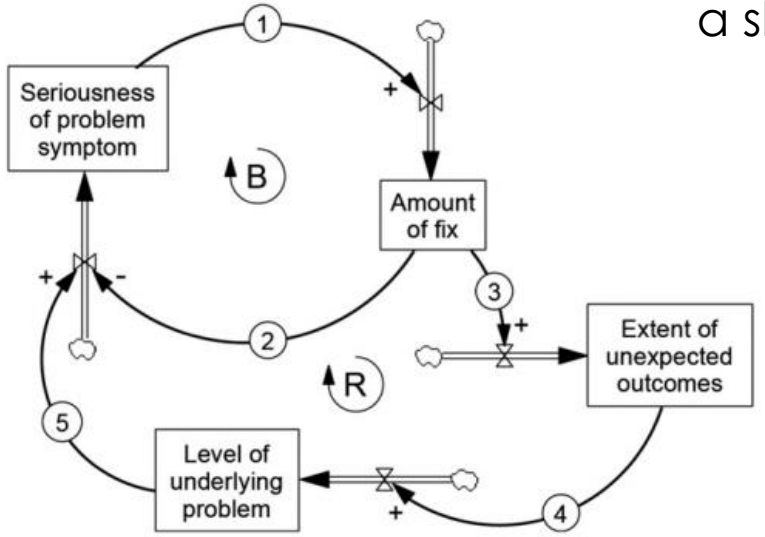
Low-order system dynamics Models (LOSD)

LOSD models have few state variables (≤5), illustrate the non-linear effects caused by feedback and accumulation, and focus on endogenous dynamics generated within well-defined boundaries.

LOSD models can help a transdisciplinary group to develop a shared, coherent view of the problems that they seek to tackle



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A role for low-order system dynamics models in urban health policy making

Barry Newell [a,b,*], José Siri [b]

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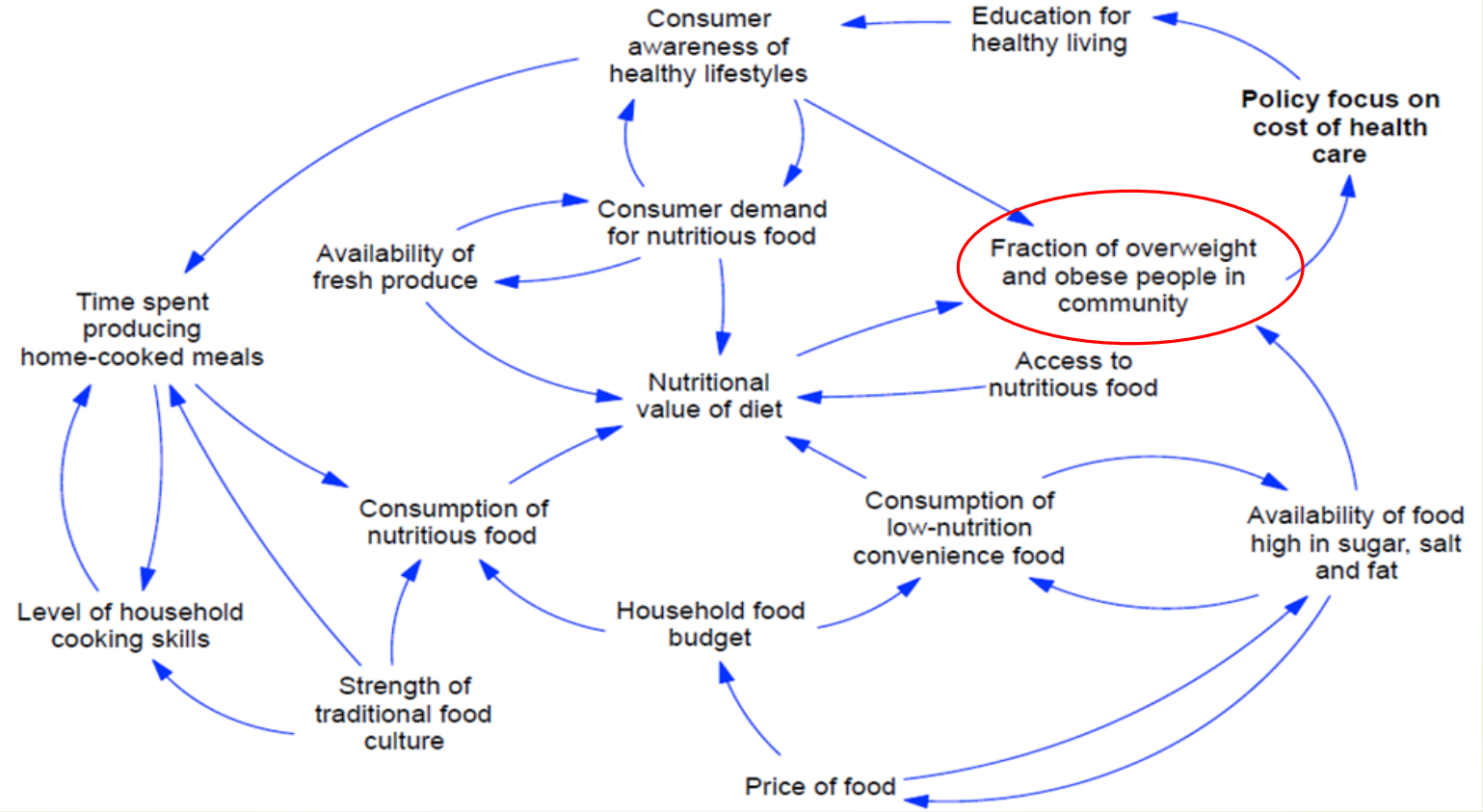
Conceptual collaborative modeling (CCM)



Dynamic relationships between variables for food security and the proportion of obese people in urban communities. (Proust and Newell 2016)

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The sensitivity model by F. Vester

1. System Description

2. Set of Variables

	Variablenliste
1	Lebensqualität
2	Wirtschaftskraft des Ortes
3	Öffentlicher Nahverkehr
4	Image des Ortes
5	Freizeitangebot
6	Autogerechte Verkehrswege
7	Arbeitsplätze
8	Gäste und Besucher
9	Kultur-Angebot

Variablenbeschreib
7 Arbeitsplätze
Arbeitsplatzangebot im:
- Dienstleistungsbereich
- Kurbetriebe, Krankenhä
- Handwerk
- Einzel- und Großhandel
- Mittelständ. Industrie
- Gastgewerbe
- Landwirtschaft

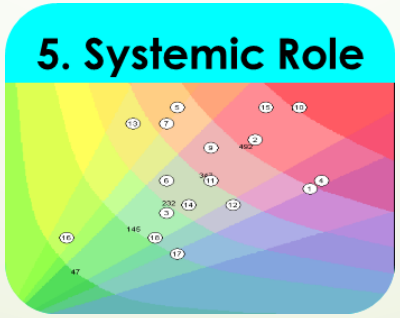
3. Criteria Matrix

Kriterien	Wirtschaft	Beteiligte	Raumnutzung	Befinden	Umweltbezug	Infrastruktur	Regeln u. Gesetze
	LEBENSBEREICHE						
	● VOLL zutreffend ○ TEILWEISE zutreffend						
1	Ausbildungsstand			○	●		○	○
2	Interessen und Vorstellunge				○	●			○
3	wirtschaftliche Situation	●						
4	persönl. Möglichkeiten	○	○		●			
5	günstiger Wohnort		○	●		○	○	○
	Kontakte		●		●			

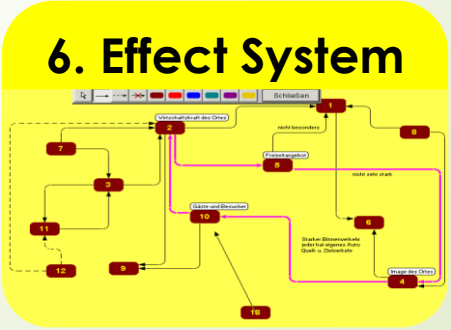
4. Influence Matrix

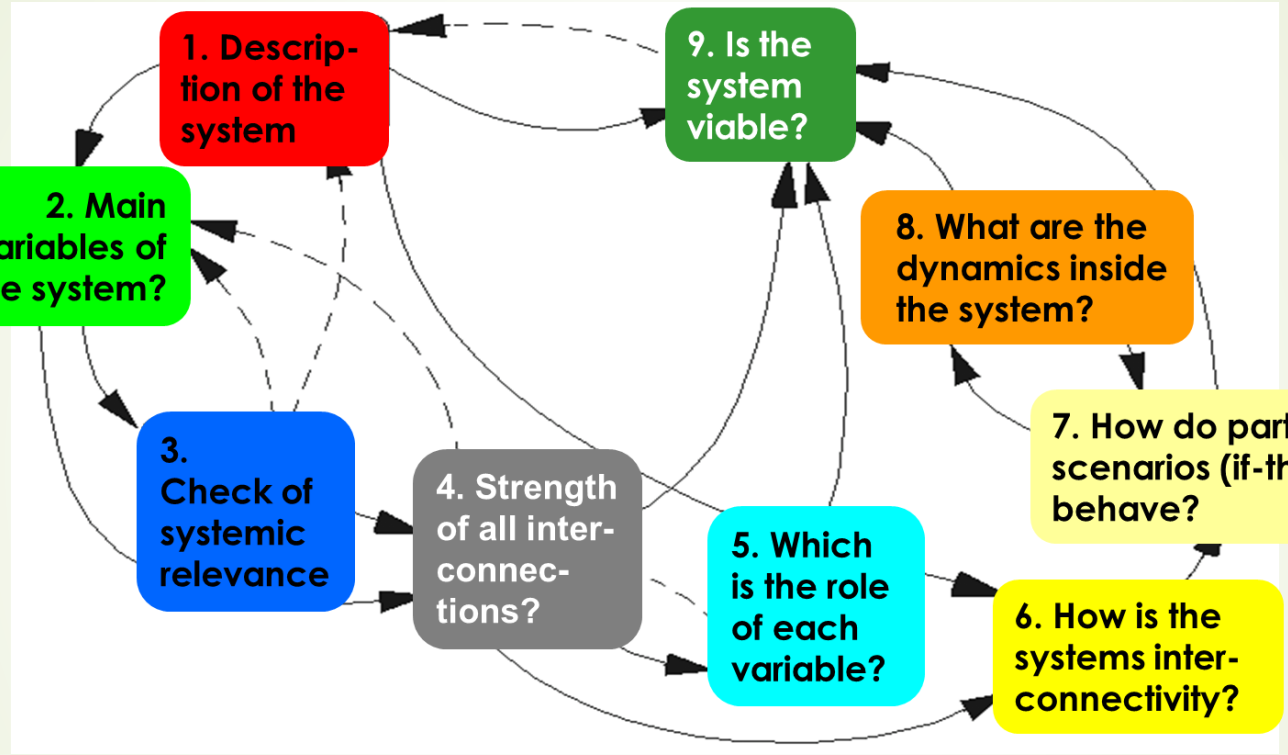
Wirkung von ↓ auf →	1	2	3	4	5	6	7
1 Mitarbeiterqualifikation	X	0	0	1	1	1	1
2 Wirtsch. Kapazitätsauslastung	0	X	1	0	0	0	2
3 Gutes Image des Werkes	0	0	X	0	0	1	0
4 Wertvorstellung der MA	1	0	1	X	1	1	1
5 Effiziente Organisation	1				X		
6 Mitarbeiterzufriedenheit						X	
7 Herstellungskosten							X
Mitarbeitermotivation							

5. Systemic Role

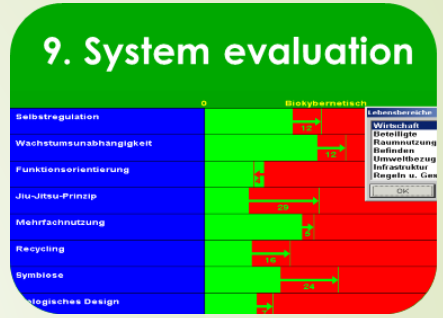


6. Effect System

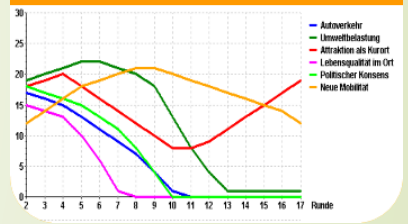




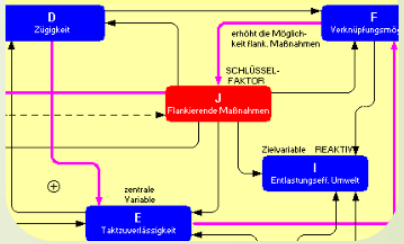
9. System evaluation



8. Simulation



7. Partial Scenarios



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A SYSTEMS APPROACH

Applications of the sensitivity analysis

1. **How can municipalities develop sustainable viability?**
   (e.g. "New Mobility" in Bad Aibling, Oberstdorf, Berchtesgaden in Bavaria)
2. **Which are the critical factors in our system?**
   (e.g. "Air traffic safety in Europe"- Eurocontrol Brussels, Austrocontrol Vienna)
3. **How can a region be developed?**
   (52 mountain and rural communities in the Swiss Kanton Wallis 2011)
4. **Is our early warning system sensitive enough?**
   (Long lasting risk dialogue of twelve international insurance companies)
5. **What are the consequences of intended measures upon the company?**
   (Innovation strategy in mechanical engineering and car industry)
6. **Which are the relevant control levers for functional politics?**
   (e.g. analysis of interdependencies of political control, Kanton Schaffhausen 2001-2004, Regional analysis of five municipalities Preetz Land 2004-2007)

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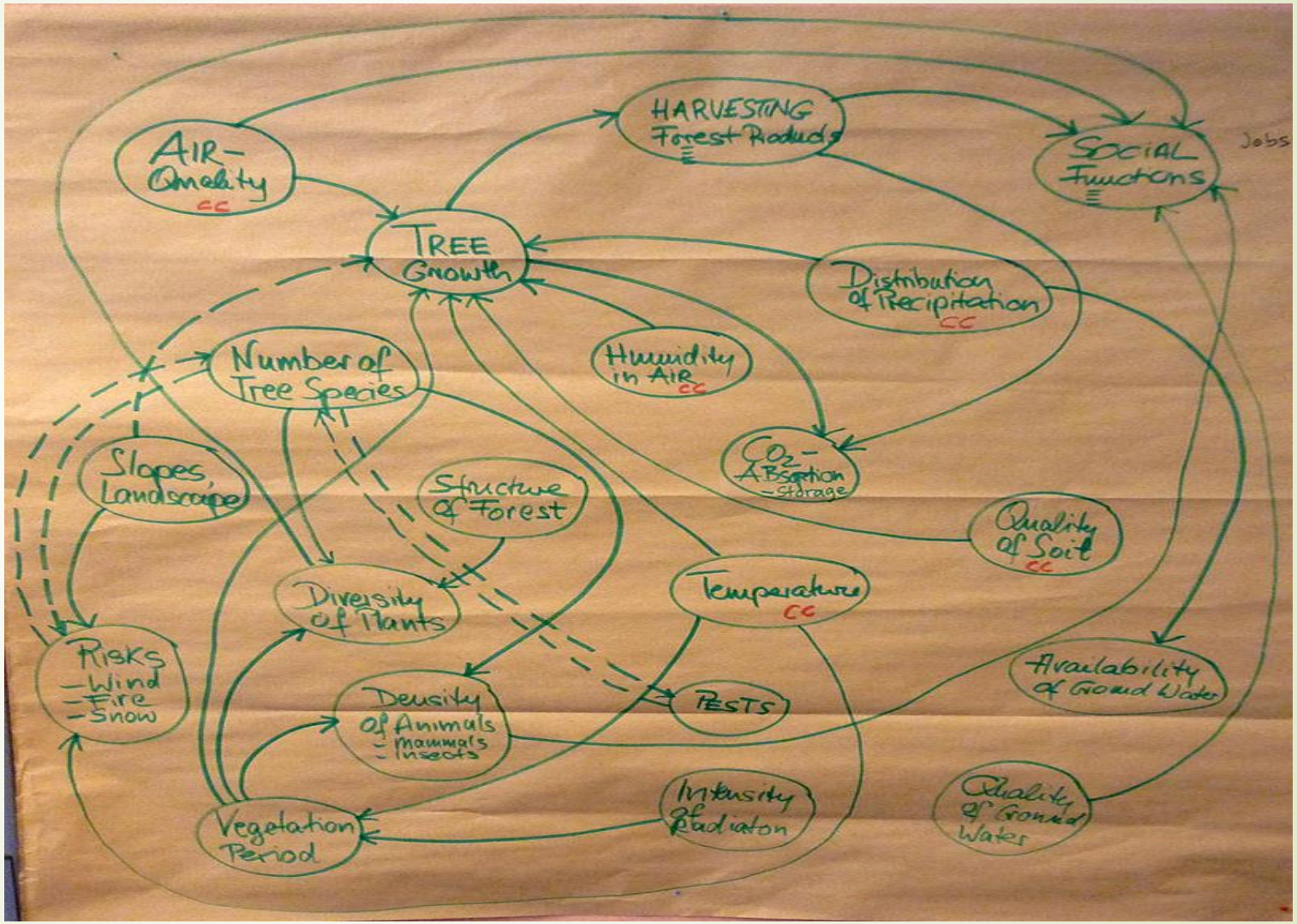
1. System description



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2. Defining variables

Variable“ are the influence factors in a system
They can be of ***qualitative*** or ***quantitative*** nature
We try to represent the main aspects by ***20-30 system relevant*** variables
Variables can be ***operationalized*** with the help of fuzzy scales

List of variables

1	Co2 Concentration
2	Stand productivity
3	Forest products (wood)
4	Employment in forest sector
5	Management of tree species
6	Structure of forest
7	Rate of CO2 - sequestration
8	Quality of soil
9	Biodiversity (non tree)
10	Abiotic damages
11	Biotic damages
12	Ground Water availability

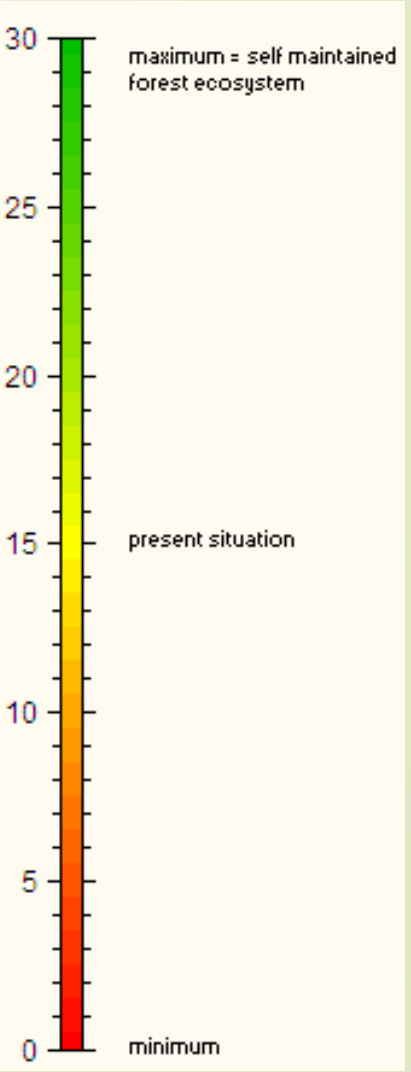
Description of the variables

9 Biodiversity (non tree)

Biodiversity (non productive tree)

Diversity of plants (non tree) and animals
- number of native species
- number of invasive / non native plants

Diversity of animals
- mammals
- non mammals



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3. Criteria matrix

Criteria →		SPHERES OF LIFE							PHYS. CATEG.			DYN. CATEGORY				SYSTEM RELATIONS			
● FULLY applicable ○ PARTIALLY applicable		Economy	Population	Space utilization	Human ecology	Natural balance	Infrastructure	Rules and laws	Matter	Energy	Information	Flow quantity	Structural quantity	Temporal dynamics	Spatial dynamics	Opens through input	Opens through outp.	Influenced f. inside	Influenced f. outside
1	Climate change					●			●	○		○		●		●	●	○	●
2	Abiotic & biotic damages	○				●			●					●	●		●		
3	Wood increment	●		○		○			●	○		●		●	●	○	●	●	
4	Diversity and potential				○	●			●				●		●		○		
5	Public appreciation of EGS		●		●						●			○		●			○
6	Political influence							●			●		●			●		○	●
7	Forest structure & compositi	○		●					●				●		○			●	
8	Forest utilization	●	●				●		●	●	○		●	○	○	○		○	
9	Risk management					●	○				●							●	
10	Water management					●	○		●						●			●	
	Sum:	3.0	2.0	1.5	1.5	5.5	2.0	1.0	7.0	2.0	3.5	1.5	4.0	4.0	5.0	4.0	3.5	5.5	2.5

The set of variables is checked with regard to its systemic completeness.

The set of variables is checked by screening through 18 essential criteria of any viable system.

<u>Crucial question:</u> did we capture all the variables which are needed for representing a viable system (and not only parts of it)

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4. Influence matrix

Inquiry of the strength of relations between the variables (potential and direct effects)

«How do changes in variable X effect direct changes on variable Y?»

0	no relation
1	weak relation
2	proportional relation
3	intensive relation

Result / overview:

- influences
- strength of influences
- interactions in the system
- patterns of relations

Influence by variable ↓ on variable →		1	2	3	4	5	6	7	8	9	10
1	Co2 Concentration	X	2	1	0	0	0	2	1	0	1
2	Stand productivity	1	X	2	2	1	1	2	1	0	1
3	Forest products (wood)	0	0	X	2	2	0	0	0	0	0
4	Employment in forest sector	0	0	0	X	0	0	0	0	0	0
5	Management of tree species	0	2	2	2	X	3	1	1	1	1
6	Structure of forest	1	2	2	1	3	X	2	1	2	1
7	Rate of CO2 - sequestration	2	1	1	0	0	0	X	0	0	0
8	Quality of soil								X		
9	Biodiversity (non tree)									X	
10	Abiotic damages										X

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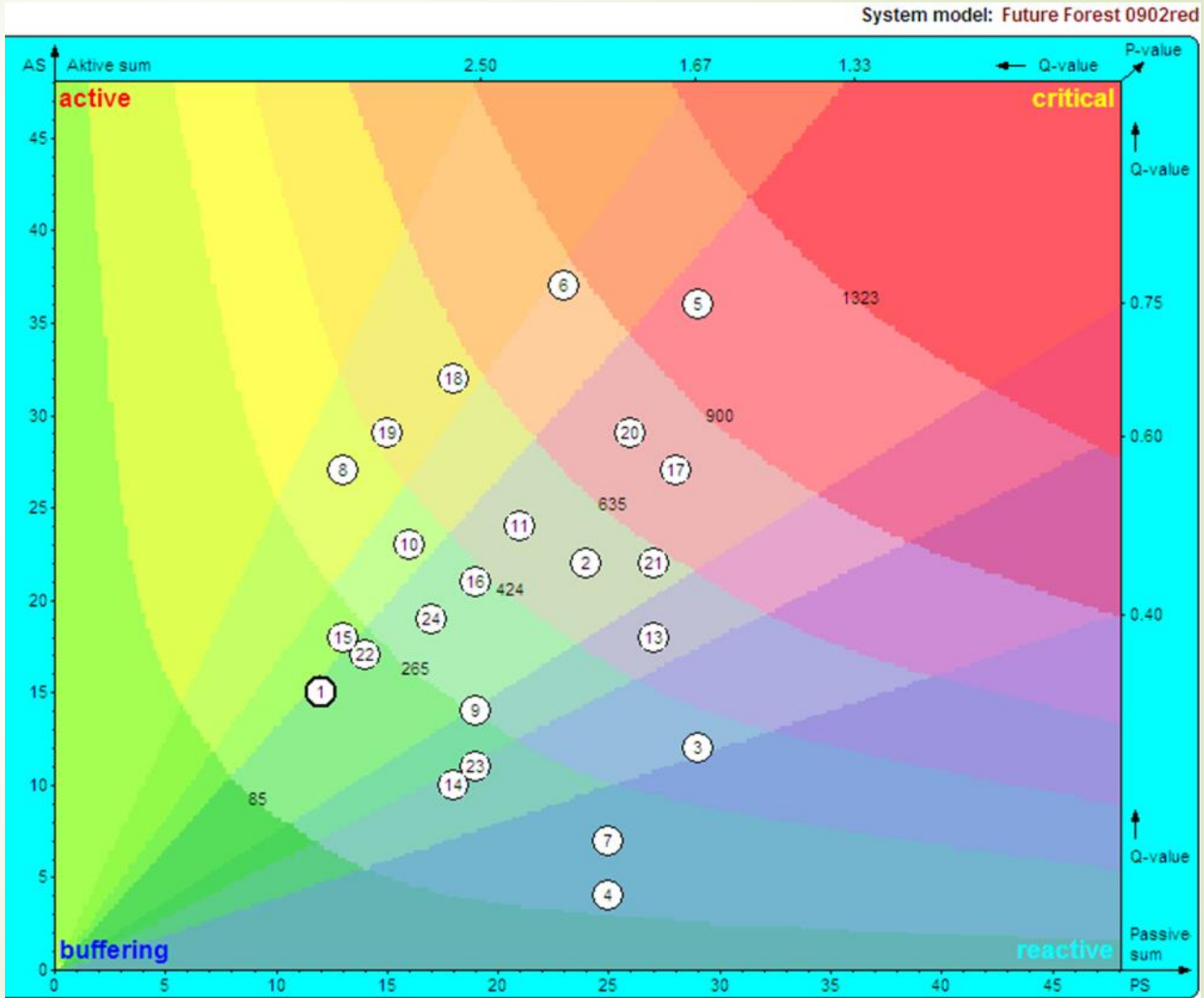
5. Systemic role

Each variable plays a special role in the system: maybe als lever, stabilazer, regulator, indicator or critical factor:
- active
- passive
- critical
- buffering

Also the whole system shows its character:

- buffering and stable
- easy to regulate & change
- highly dynamic
- mainly reacting



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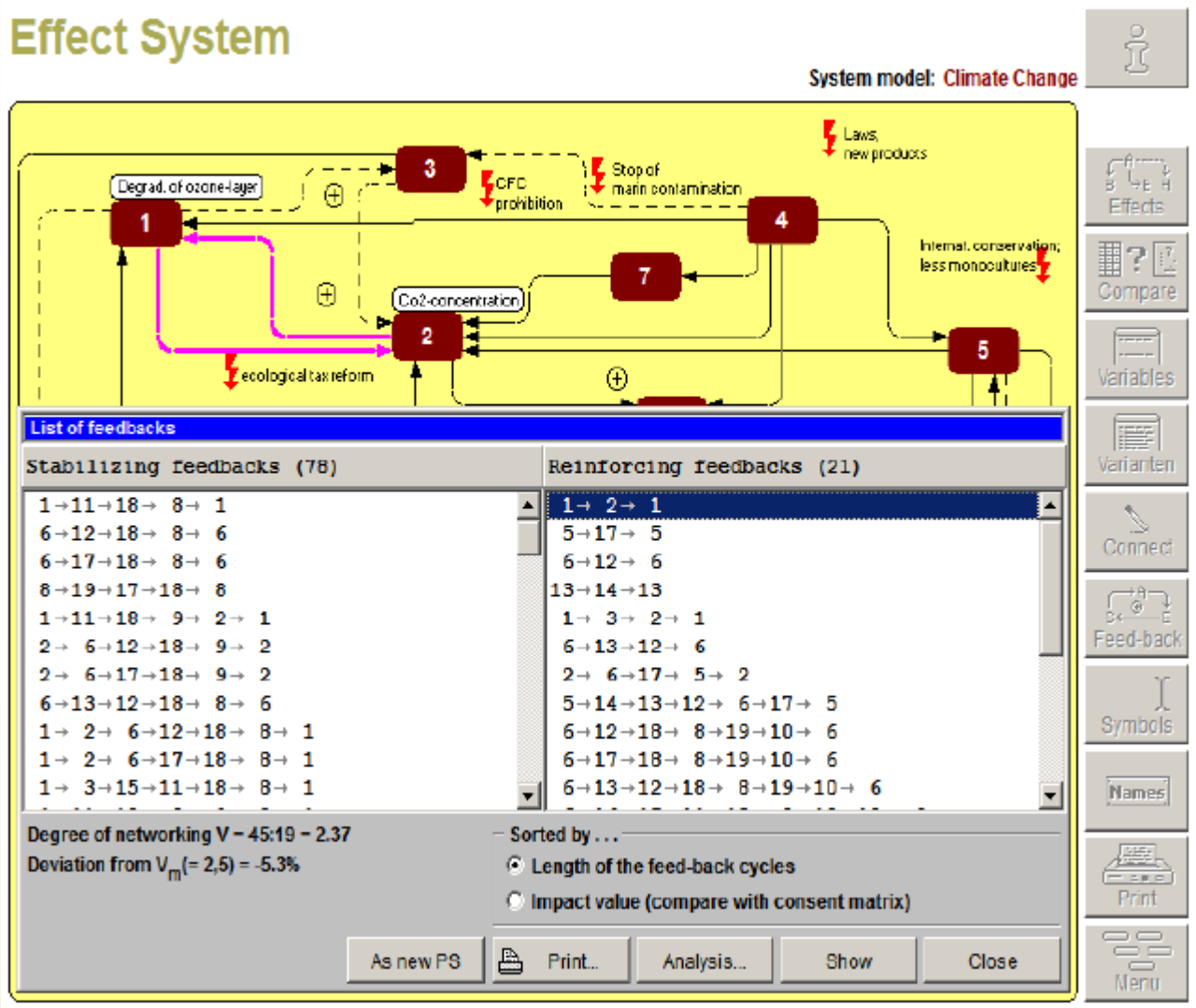
6. Effect system-Visualization of the interconnctions and feedback cycles

Feed-back analysis of the effect system allows recognition of the dominant cycles, the relation between self-control and mutual amplification.

Equal effects: represented by full line ⟶

Opposite effects: represented by a dashed line ⇢



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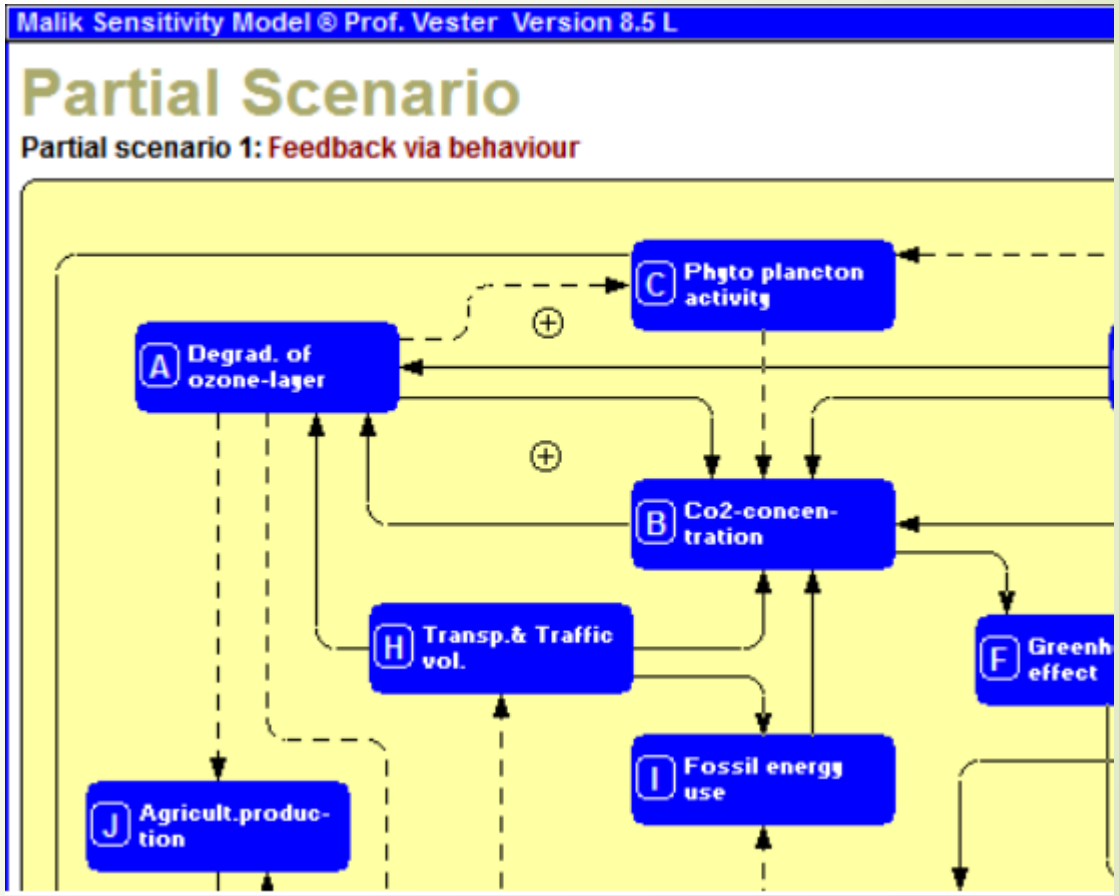
7. Modeling subsystems



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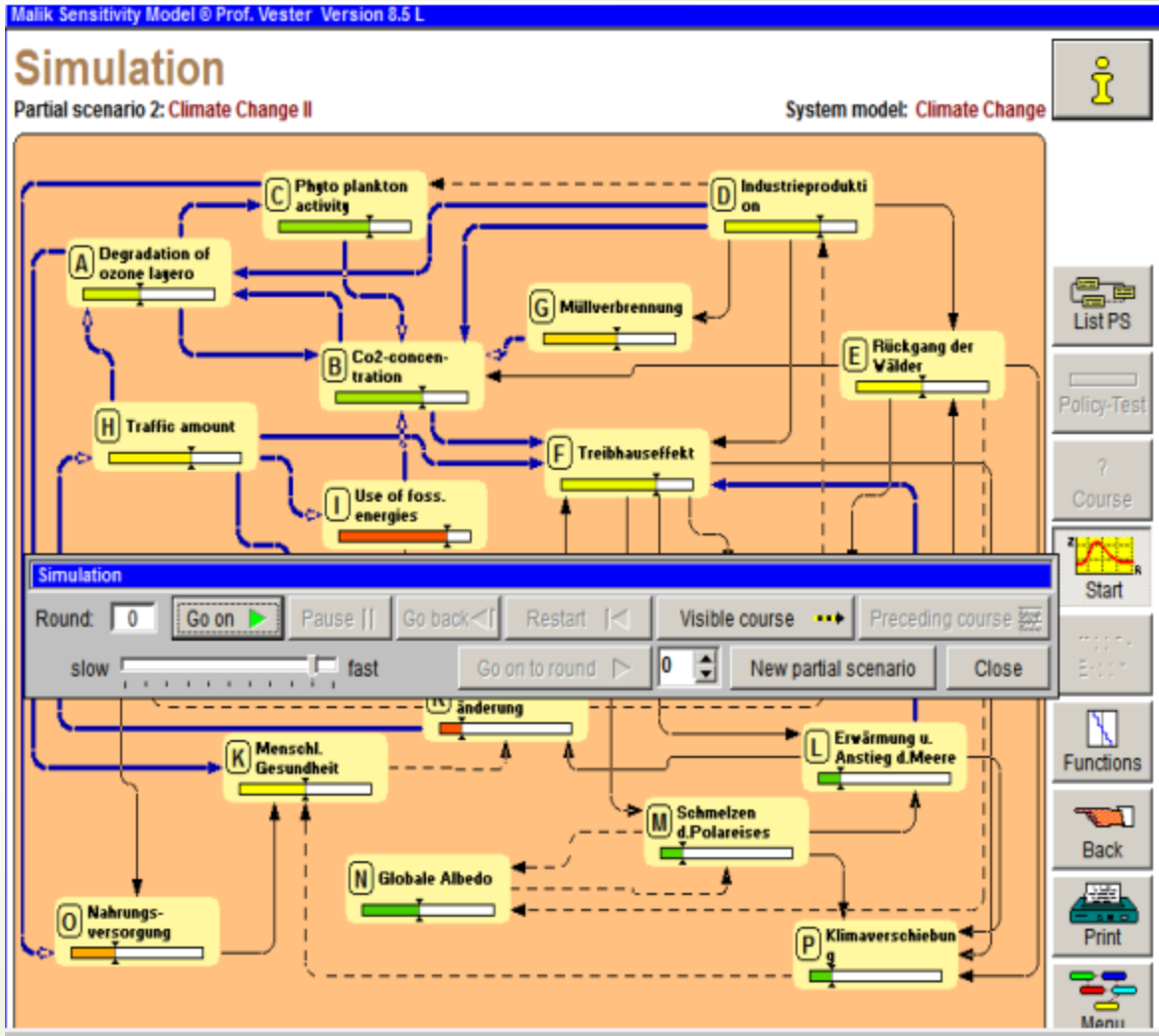
8. Running simulations under partial scenarios

Policy-tests and 'if then' analyses to test different strategies for a selected group of inter-linked variables



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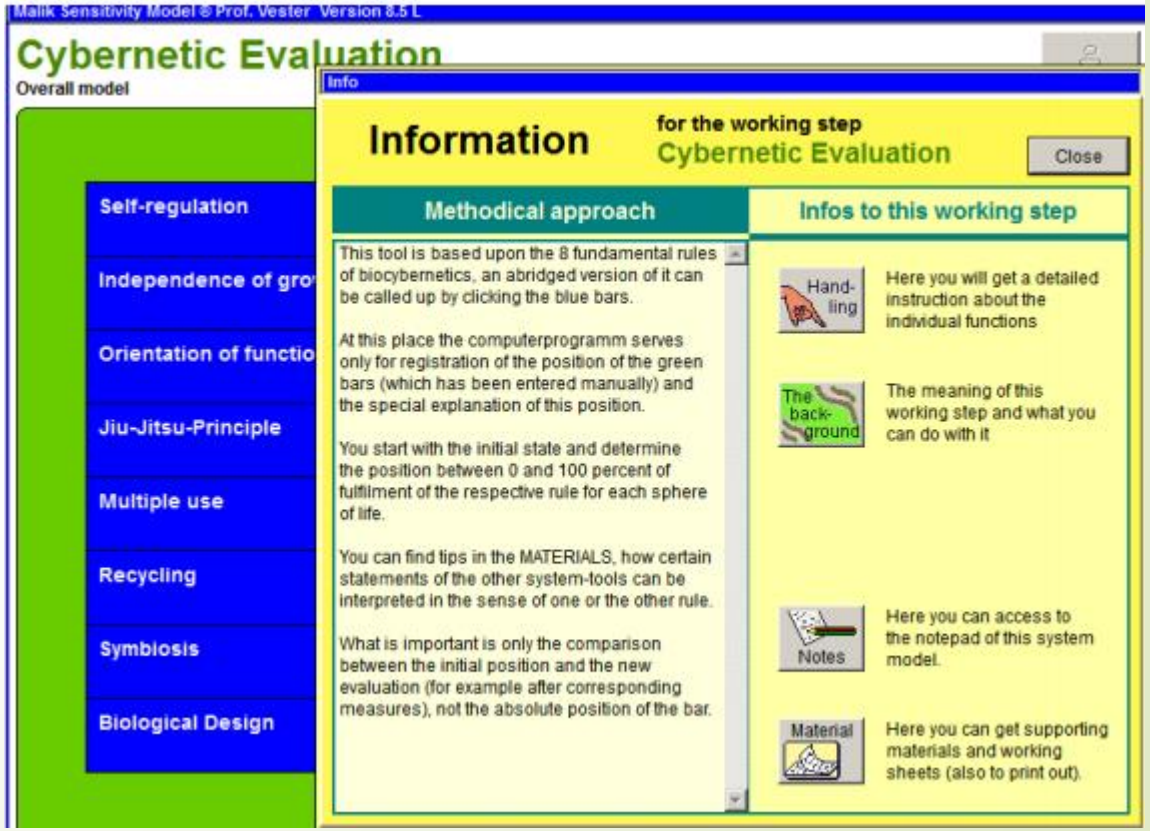
9. Evaluation

Checklist of eight fundamental rules of biocybernetics, wich reflect cybernetic principles of the biosphere



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The safe system approach

National Road Safety Strategy

Australia, New Zealand, Sweden,…

FACTS

- 1.25 million people die / year (WHO)
- 90% of world's fatalities in low- and middle-income countries

→ Transport poses a public health threat; 7th leading cause for global deaths

- SDG target 3.6 pledges to halve the number of global deaths and injuries from road traffic accidents by 2020

Safe system approach:

- Traffic accidents are not just a mistake of the driver but a result of **system failure**
- Not about only looking for the cause or fault, but preventing harm

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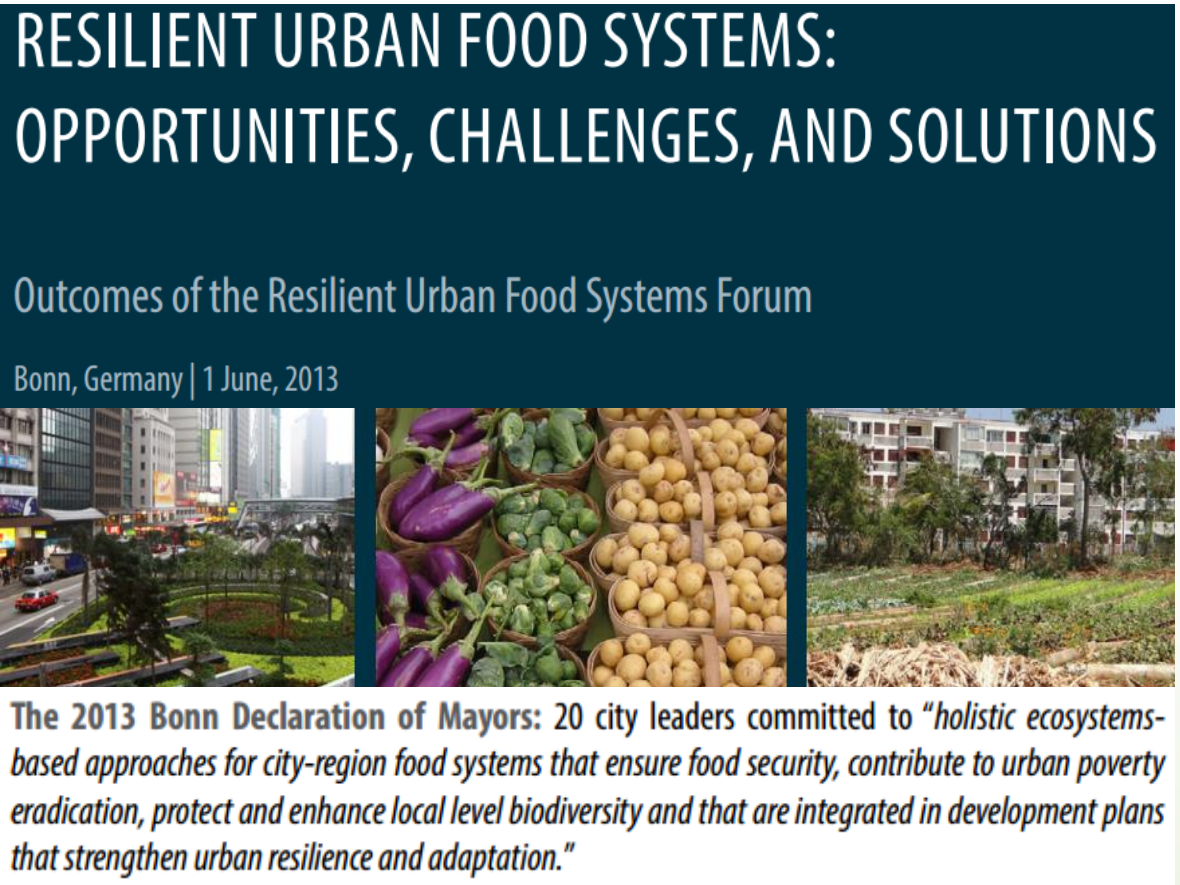
Urban Food Systems Approach

World Mayors Council on Climate Change

ICLEI Local Governments for Sustainability

Resilient Cities 2013



- Food within the urban and regional system
- Ecosystem approach to urban food
- Food security (access, use, availability), especially for the poor
- Re-estabsihing rural-urban linkages, trust in food quality, e.g. CSA (**Community Supported Agriculture**)
  - Consumers want to know where their food comes from, how it is produced and who they buy food from, how to prepare it…
  - Shared risk, upfront payment

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Community Supported Agriculture (CSA)

Touching the Heart Taking Root

CSA in Hong Kong, Taiwan & Mainland China

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The Ecosystems Approach to Urban Environmental Management

Operationalizing the Cities as Sustainable Ecosystems (CASE) Initiative

Hari Srinivas
Chief, Urban Environmental Management Unit,
UNEP-IETC

2003

UNEP

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Resilience.io

The world's first open-source, integrated human-ecology-economics systems platform that enables resilient disaster risk sensitive planning, policy-making, investment and procurement for city-regions globally

Resilience.io is designed as a computer-based platform that provides an integrated systems view of a city-region. It will be an analysis and decision-support tool for collaboration and resilience decision-making.

resilience.io

www.ecosequestrust.org

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Healthy Cities Movement

"The Healthy Cities movement originated in Toronto, Canada, in 1984, with the conference entitled Beyond Health Care. This was driven by 'the growing awareness of the need for "healthy public policy" initiatives as compared with the tendency toward victim-blaming lifestyle approaches to health promotion."

"Within the Healthy Cities movement, health is conceived as a resource for living, stretching beyond the absence of ill-health in medical terms to include quality of life and general well-being"

"The city itself is seen from an **ecological perspective**, providing the context (or 'habitat') for health and functioning as a networked system dependent upon the proper functioning of its parts and connections."

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