BEYOND MUSEUMS

Tools for Promoting the Natural and Cultural Water Heritage

12 WEBINARS
Every Friday from
October 22nd, 2021 to
January 21st, 2022
13.00 -15. 00 CET

Ancestral Hydrotechnologies for climate emergency

Using the past to rescue the future

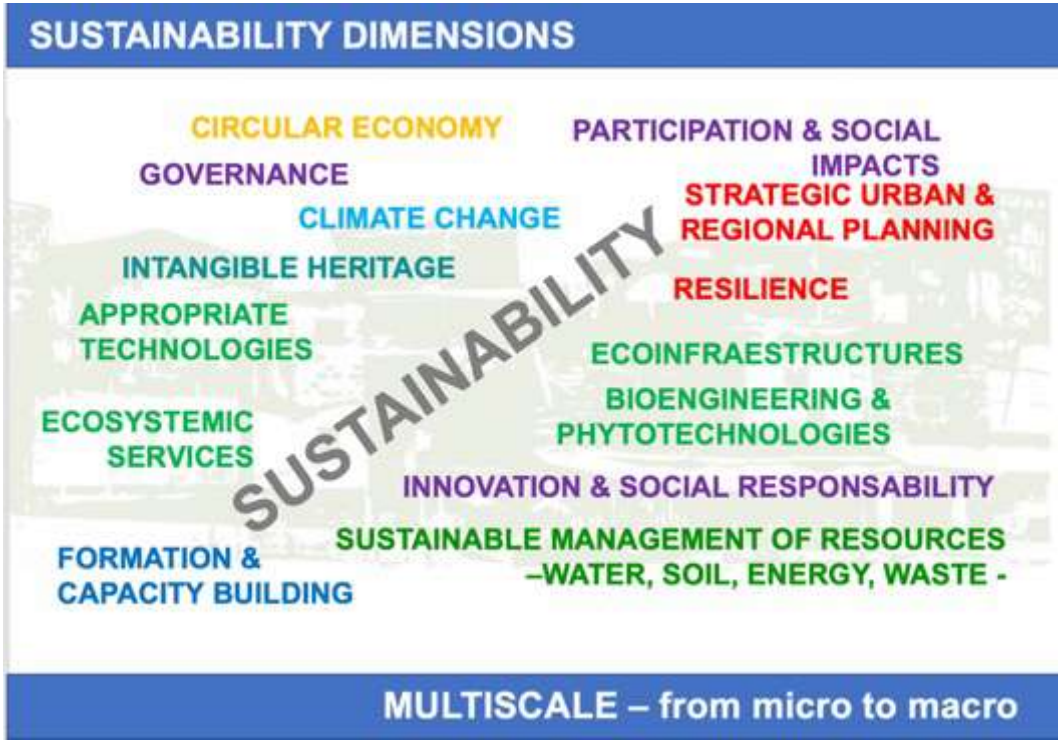
Dr. Jordi Morató
Microbial Ecologist / Sustainability Science
jordi.morato@upc.edu
http://www.unescosost.org

UNESCO
Naciones Unidas
Organización Educativa, Científica y Cultural

UNIVERSITAT POLITÈCNICA DE CATALUNYA BARCELONATECH
Cátedra UNESCO de Sostenibilidad

UNESCO CHAIR ON SUSTAINABILITY

AT UNIVERSITAT POLITÈCNICA DE CATALUNYA - BARCELONATECH



http://www.unescosost.org

UNESCOSOST IN NUMBERS

THE UNESCO CHAIR ON SUSTAINABILITY (UNESCOSOST)

ESTABLISHED AT THE POLYTECHNICAL UNIVERSITY OF CATALONIA IN

1996

Is an organization dedicated to articulate and facilitate a multi-networking collaboration between different institutions in Europe and Latin America and the Caribbean, focused on knowledge and best practices transfer in sustainable human development, from local scale to the global level.

The work carried out over the last

20 YEARS

has contributed to turn UNESCOSOST into a model and a pole of innovation and excellence in matters related to the sustainable human development, especially in sustainable water resources management in innovative technologies to meet social, environmental and economic needs, and in the design and articulation of transformation participative projects oriented to SDG.

United Nations Educational, Scientific and Cultural Organization · International Hydrological Programme

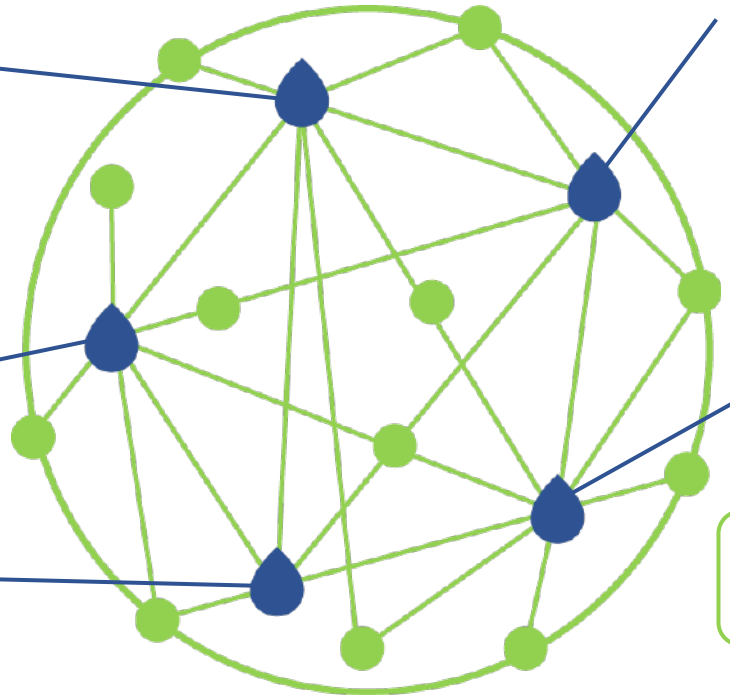
The UNESCO Water Family

Since the inception of IHD, UNESCO has been developing a network of networks, often called the UNESCO Water Family. Today, as IHP is working on its eighth phase (IHP-VIII), the UNESCO Water Family operates globally as a network which includes:

UNESCO staff located at the Paris headquarters of the IHP Secretariat and the Regional Hydrologists located in the UNESCO field offices

IHP National Committees representing the Programme in **169** Member States

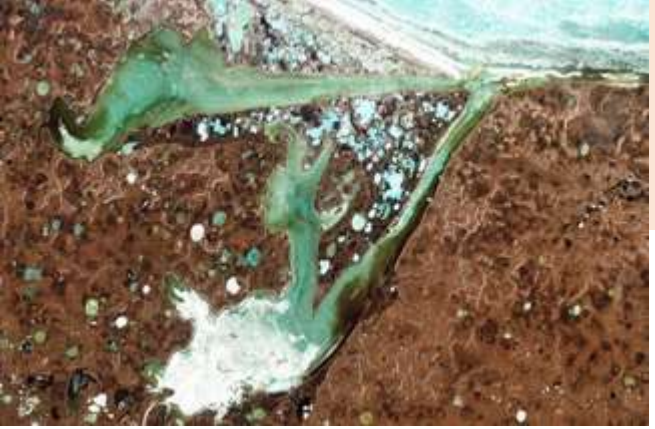
37 water-related Category 2 Centres under the auspices of UNESCO



The World Water Assessment Programme (WWAP), with its secretariat hosted and led by UNESCO in Italy and which produces the periodic World Water Development Report

56 UNESCO Water Chairs and UNITWIN networks

Together, they represent more than **1500** water experts worldwide



A WORLD IN CLIMATE HEALTH EMERGENCY

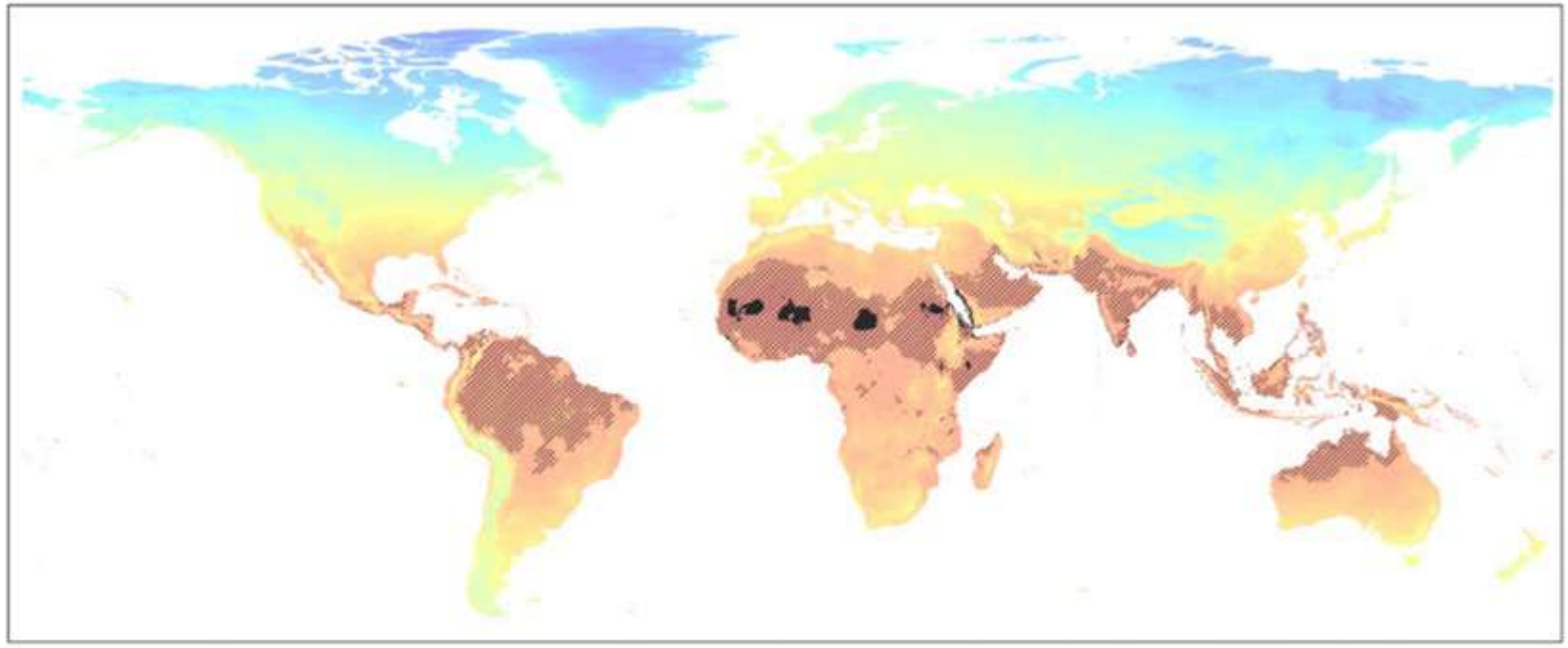
Future of the human climate niche

Chi Xu (徐驰)[a,1], Timothy A. Kohler[b,c,d,e], Timothy M. Lenton[f], Jens-Christian Svenning[g], and Marten Scheffer[c,h,i,1]

[a]School of Life Sciences, Nanjing University, Nanjing 210023, China; [b]Department of Anthropology, Washington State University, Pullman, WA 99164; [c]Santa Fe Institute, Santa Fe, NM 87501; [d]Crow Canyon Archaeological Center, Cortez, CO 81321; [e]Research Institute for Humanity and Nature, Kyoto 603-8047, Japan; [f]Global Systems Institute, University of Exeter, Exeter, EX4 4QE, United Kingdom; [g]Center for Biodiversity Dynamics in a Changing World, Department of Bioscience, Aarhus University, DK-8000 Aarhus C, Denmark; [h]Wageningen University, NL-6700 AA, Wageningen, The Netherlands; and [i]SARAS (South American Institute for Resilience and Sustainability Studies), 10302 Bella Vista, Maldonado, Uruguay

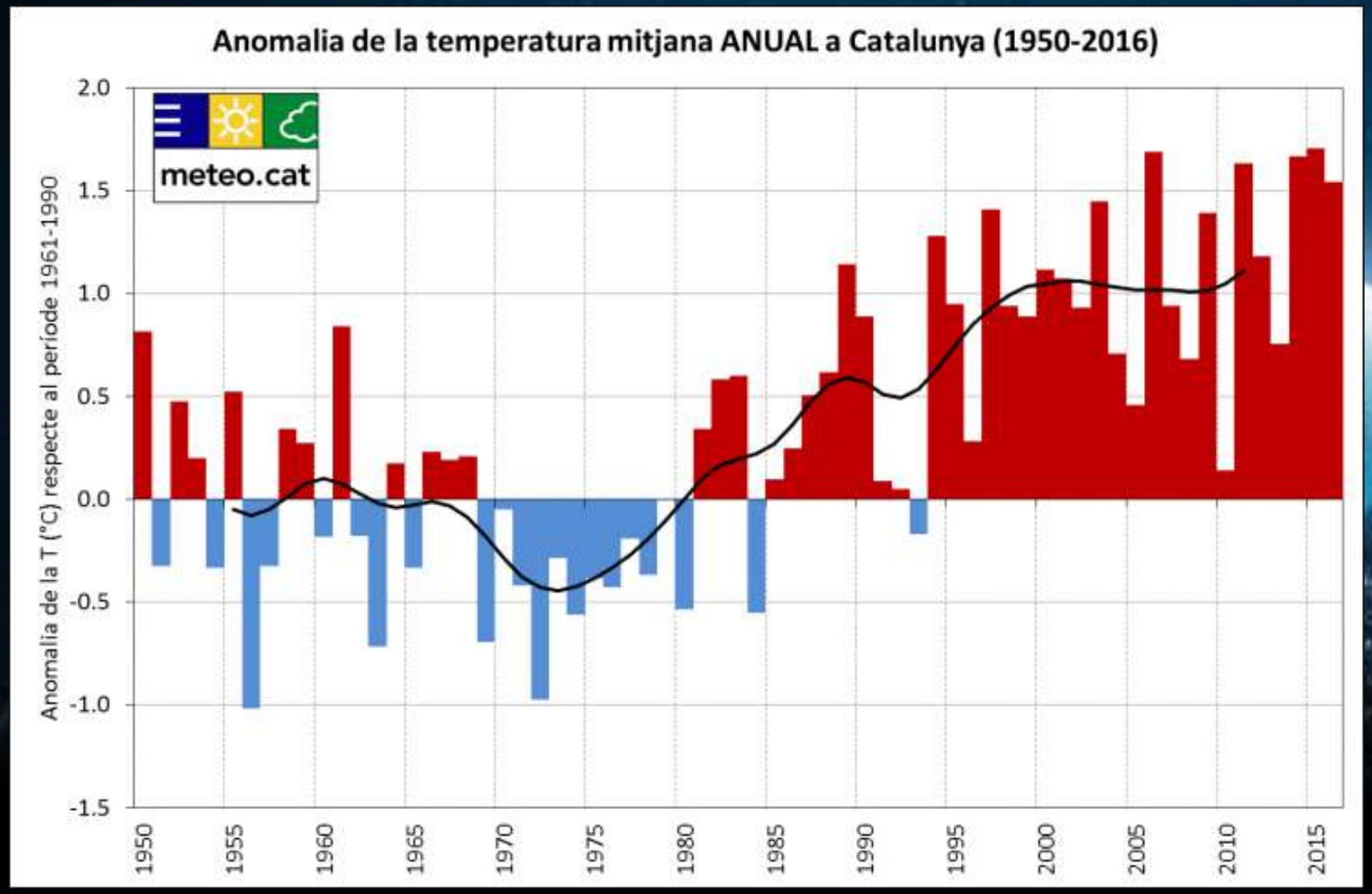
HUMAN CLIMATE NICHE
(mean annual T)
11-15 ºC

MAT > 29ºC
50 year scenario

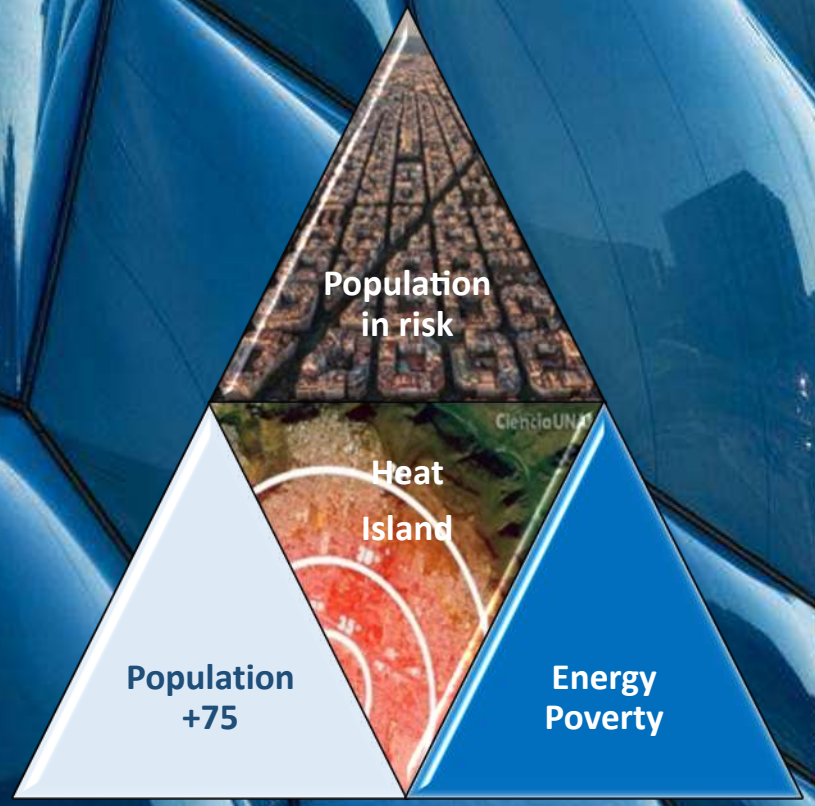


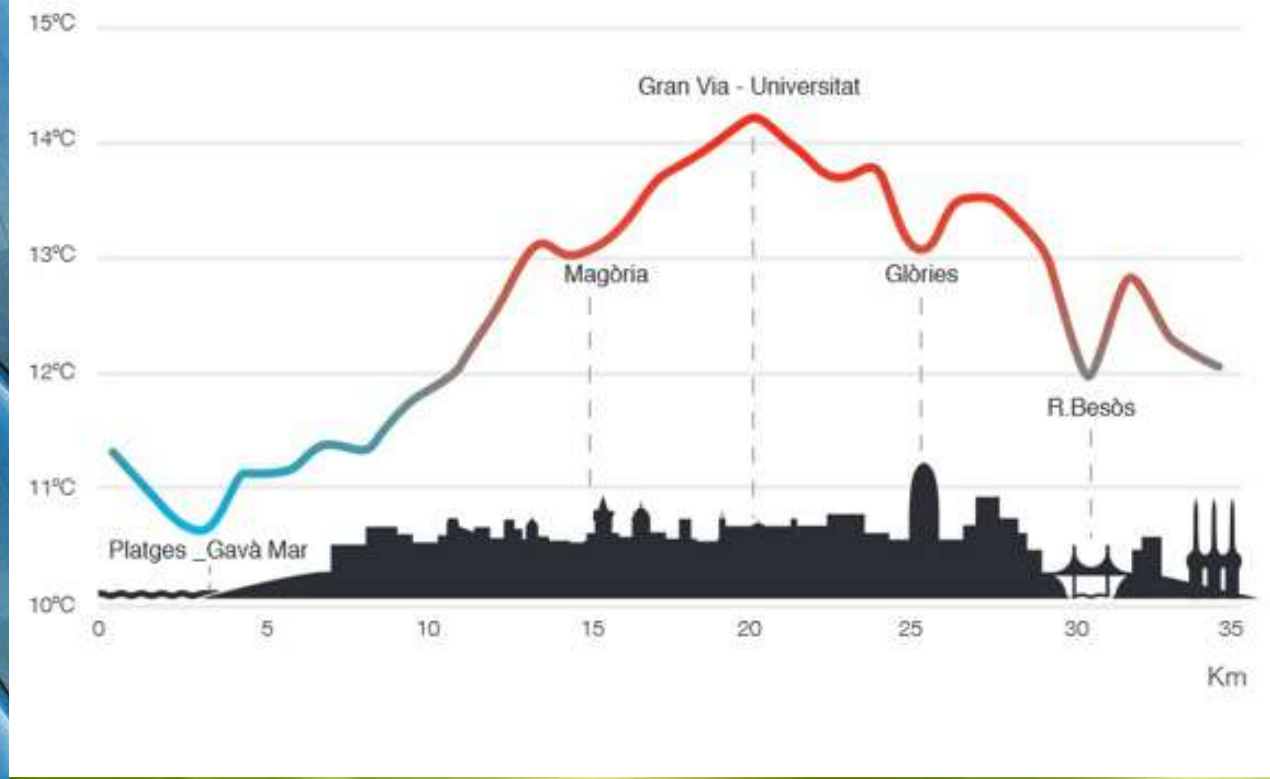
PNAS May 26, 2020 117 (21) 11350-11355; first published May 4, 2020 https://doi.org/10.1073/pnas.1910114117

The average temperature has increased 1,6 º C since **1950** in Catalonia.



HEAT ISLAND EFFECT





Climate Extreme Events

Drought in Catalonia - 2007 winter – 2008 spring

Climate Extreme Events

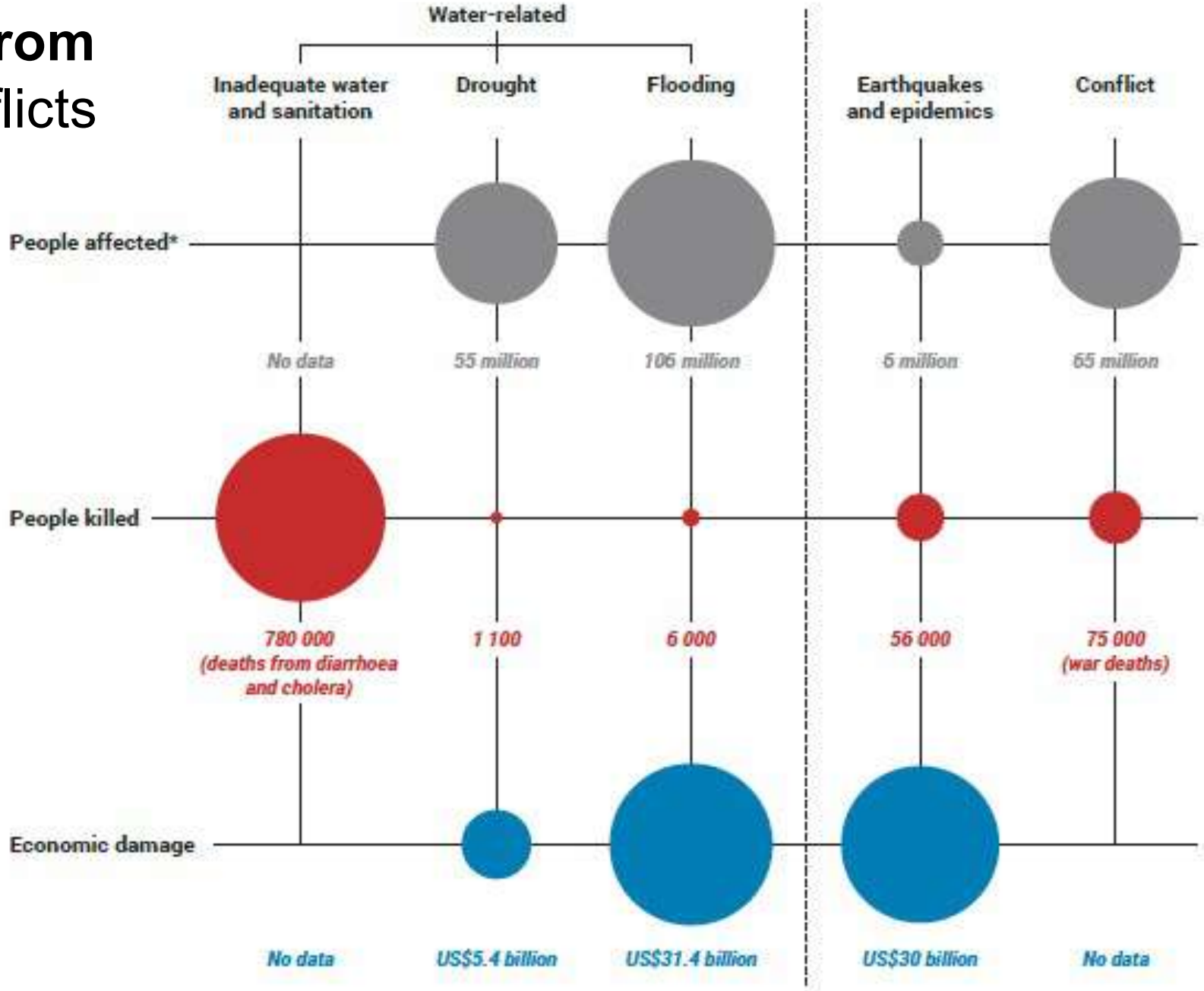
11.10.2018
Sant Llorenç des Cardassar, Mallorca
13 dead

Joana Biarnés, 1962

Terrassa Rubí

1962

Average **annual impact from water problems** and conflicts



PBL Netherlands Environmental Assessment Agency, 2018

AN OVERCROWDED URBAN WORLD

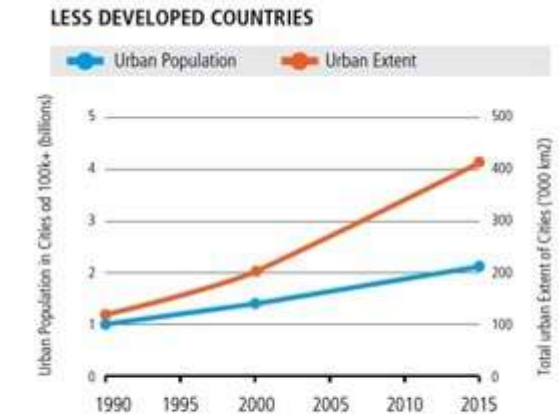


Figure 3: Urban population and urban extent in Less Developed Countries (UN-Habitat, New York University, Lincoln Institute of Land Policy (2016)

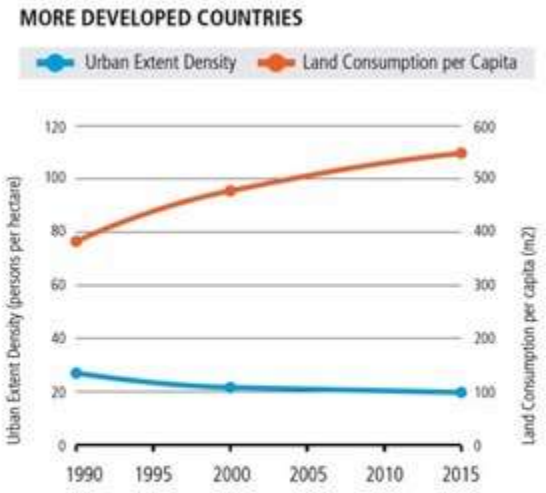


Figure 4: Urban extent density and land consumption per capita in More Developed Countries (UN-Habitat, New York University, Lincoln Institute of Land Policy (2016)

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AN OVERCROWDED URBAN WORLD - NOT PLANNED

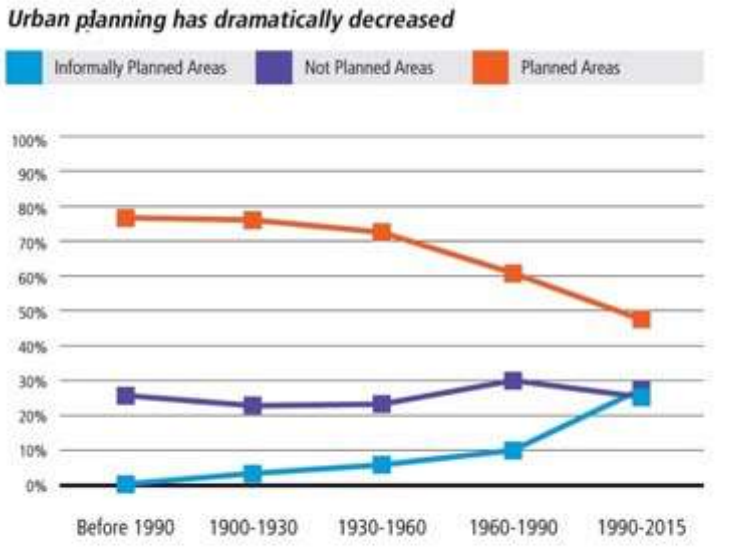


Figure 5: Proportion of urban expansion areas planned, informally planned and not planned (before 1990 to 2015) (UN-Habitat, New York University, Lincoln Institute of Land Policy (2016)

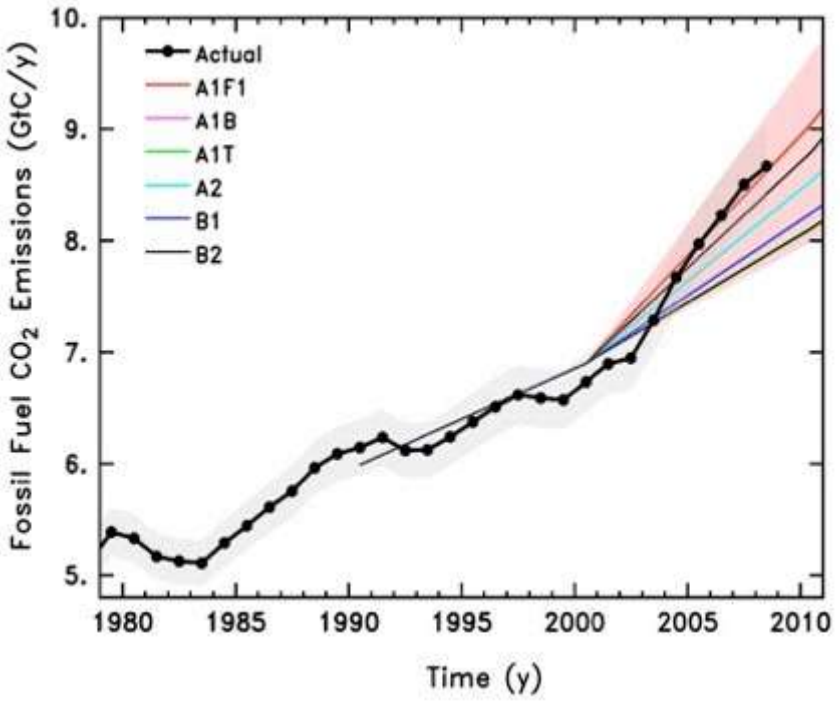
Territorial model that spreads and expands to exploit resources

City as a consumption system

2% surface

50% population

>75% GHG emissions



CAN WE LEARN FROM THE PAST TO ADAPT TO FUTURE?

LEARNING FROM THE PAST

Knowledge of the specific socio-cultural and technical system of an area is essential to understand how a local population has coexisted with extreme events in the past, managing their adaptation to the environment.

Chia, Colombia - 2010

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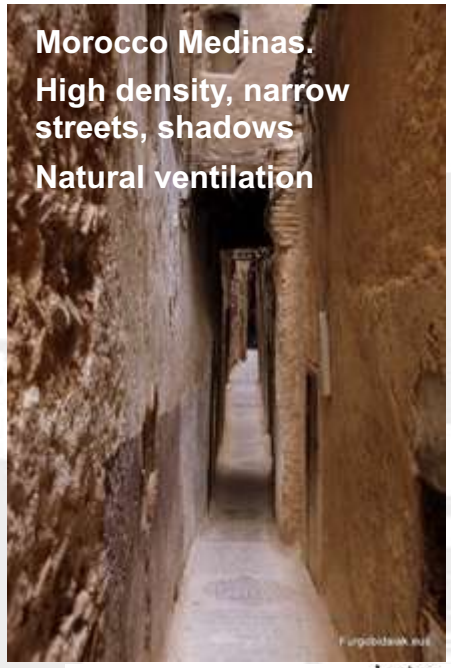
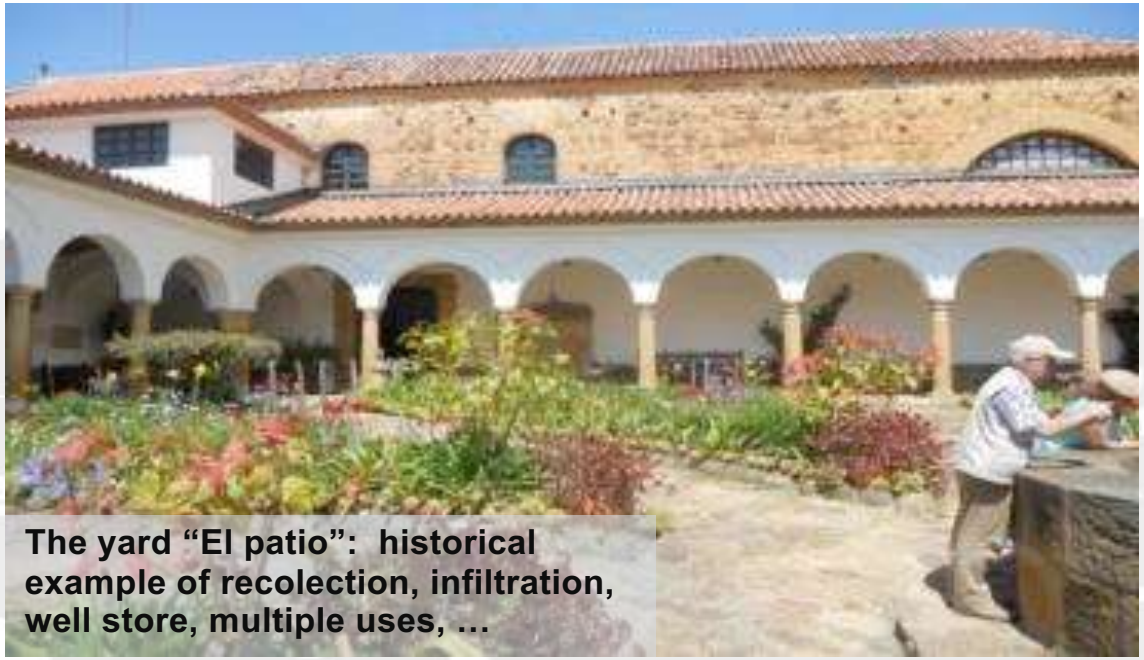
SETS – SOCIO-ENVIRONMENTAL & TECHNICAL SYSTEMS ... & CULTURAL

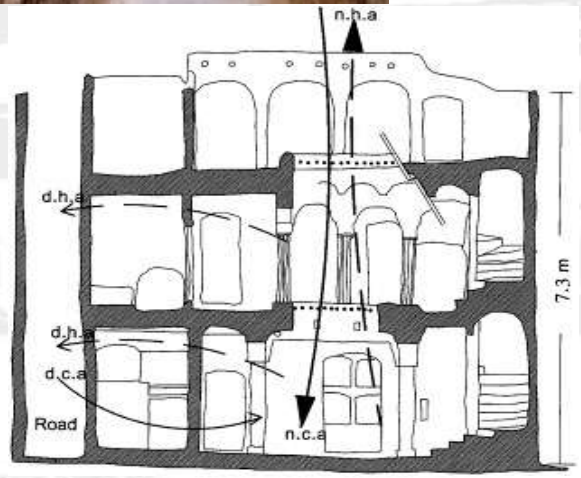


Human beings have been historically able to adapt to extreme conditions.

Understanding **how a local population have been co-existing with extreme events and conditions in the past, managing and adapting to their environment.**



The yard "El patio": historical example of recolection, infiltration, well store, multiple uses, …

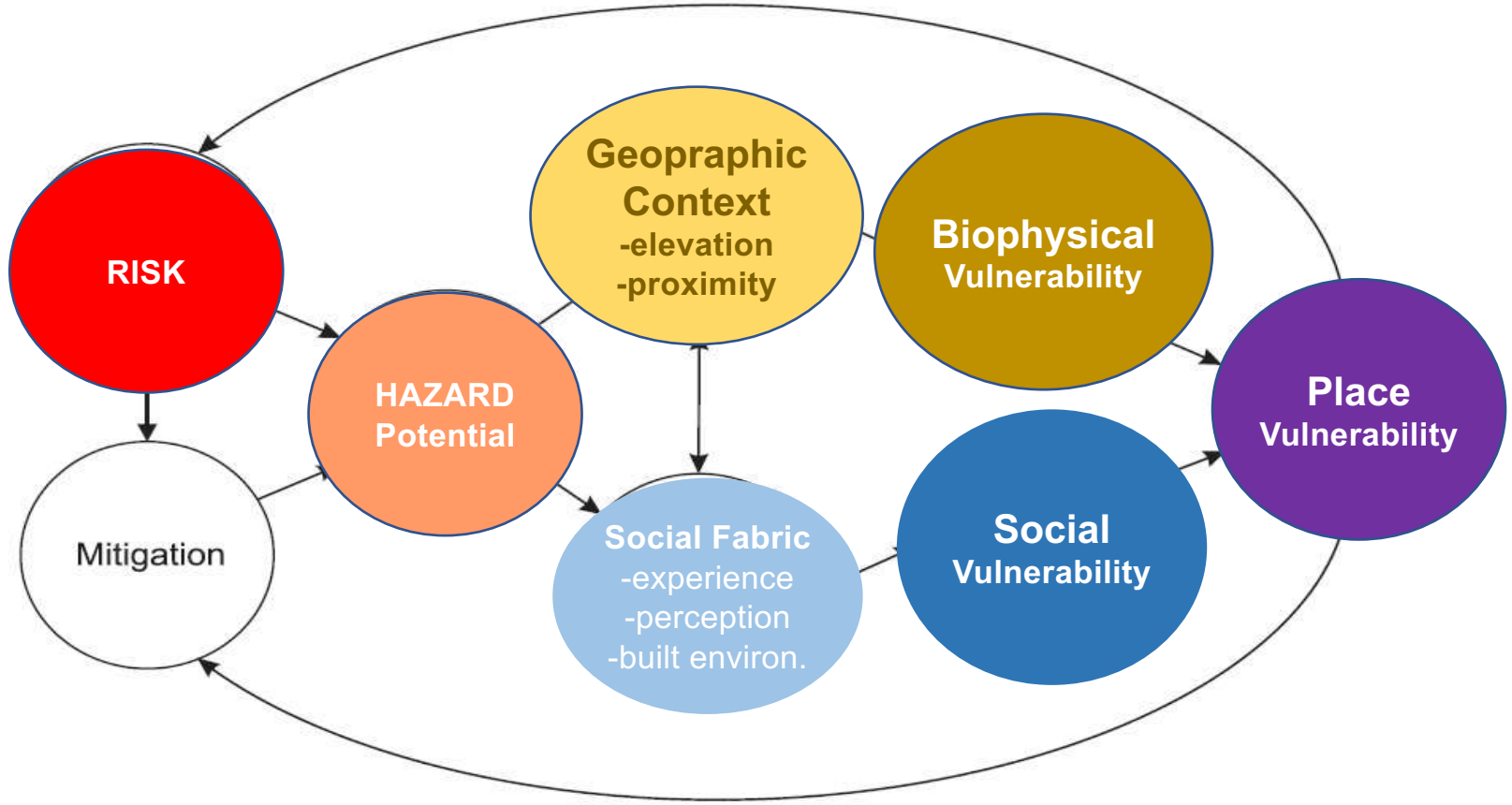


Recover, understand and transfer the specific socio-cultural and technical systems (SETS), the **intangible heritage, basic to improve climate adaptation**

SOCIAL FABRIC – VULNERABILITY

Social Fabric: Experience of community with different threats, and its capacity to confront them, to recover and to adapt (to the presence and to the effects).

The place: Physical geography and its characteristics of built territory.



Cutter, S.L., Boruff, B.J. & Shirley, W.L. (2003). 'Social Vulnerability to Environmental Hazards', *Social Science Quarterly*, Vol. 84, No. 2: 242-261.

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SOCIAL FABRIC & TRADITIONAL ECOLOGICAL KNOWLEDGE (TEK)

Indigenous peoples and local communities have been recognized as key social actors for conservation and sustainable development

Article 8j of the Convention on Biological Diversity (CBD) of the United Nations (UN).

Traditional Ecological Knowledge (cumulative body of multigenerational knowledge, practices and beliefs)

TEK, developed in direct contact with nature, engineered to sustain rather than exploit resources, fostering symbiosis between species.

+ Cultural Diversity
+Resilience

Pawarando – Embera Katío (Cordoba, Colombia)

From the Darwin "survival of the fittest" to "survival of the most symbiotic." (Margulis, 1998).

SOCIAL FABRIC & TEK

Traditional knowledge on **adaptation to land use** in seasonal climate behaviour has progressively been forgotten from people´s memory and from institutional territorial planning.

Northeastern Brazil, Bahia State.

From the concept of...

Struggle against drought

to...

Living/coexist with the semiarid

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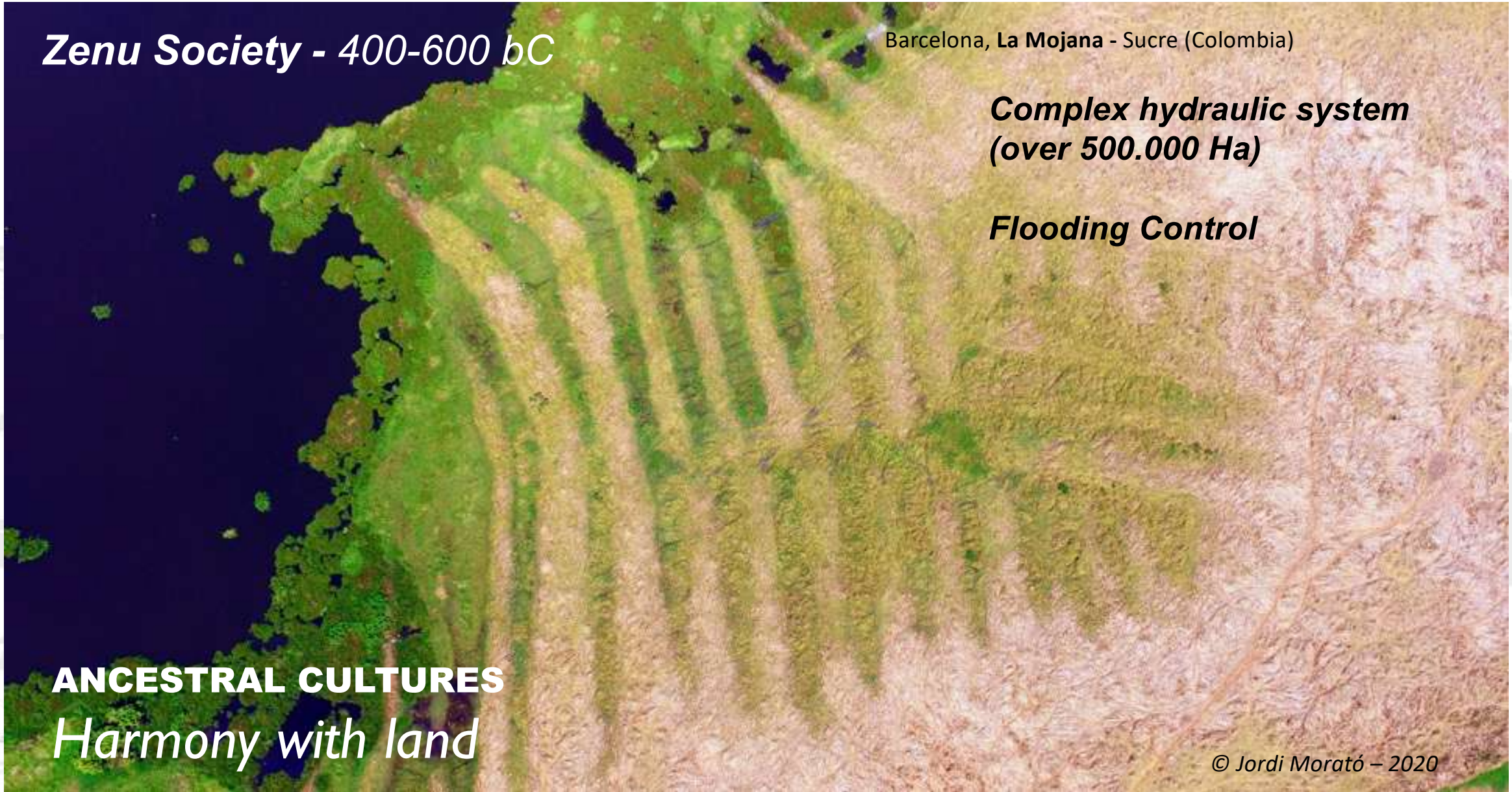
Ancestral Hydrotechnologies: Hydraulic Zenú System



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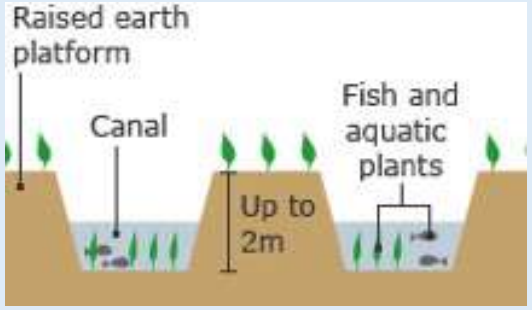
Ancestral Hydrotechnologies: Hydraulic Zenú System

Barcelona, **La Mojana -** Sucre (Colombia)

Ancestral Hydrotechnologies: Hydraulic Zenú System

Rainy Season

Seeds and crops are protected from being washed away



Turning excess water to advantage (400 bC)

Large expanses of land under water for several months, no crops left.

Problems in both seasons, flooding in winter, drought in dry season (Today)

Dry Season

Water and sediments are a source of irrigation and nutrients.

Floodwater drains nutrients, leaving a sandy soil in which is hard to grow crops

Nexus Water - Energy – Food - Ecosystems

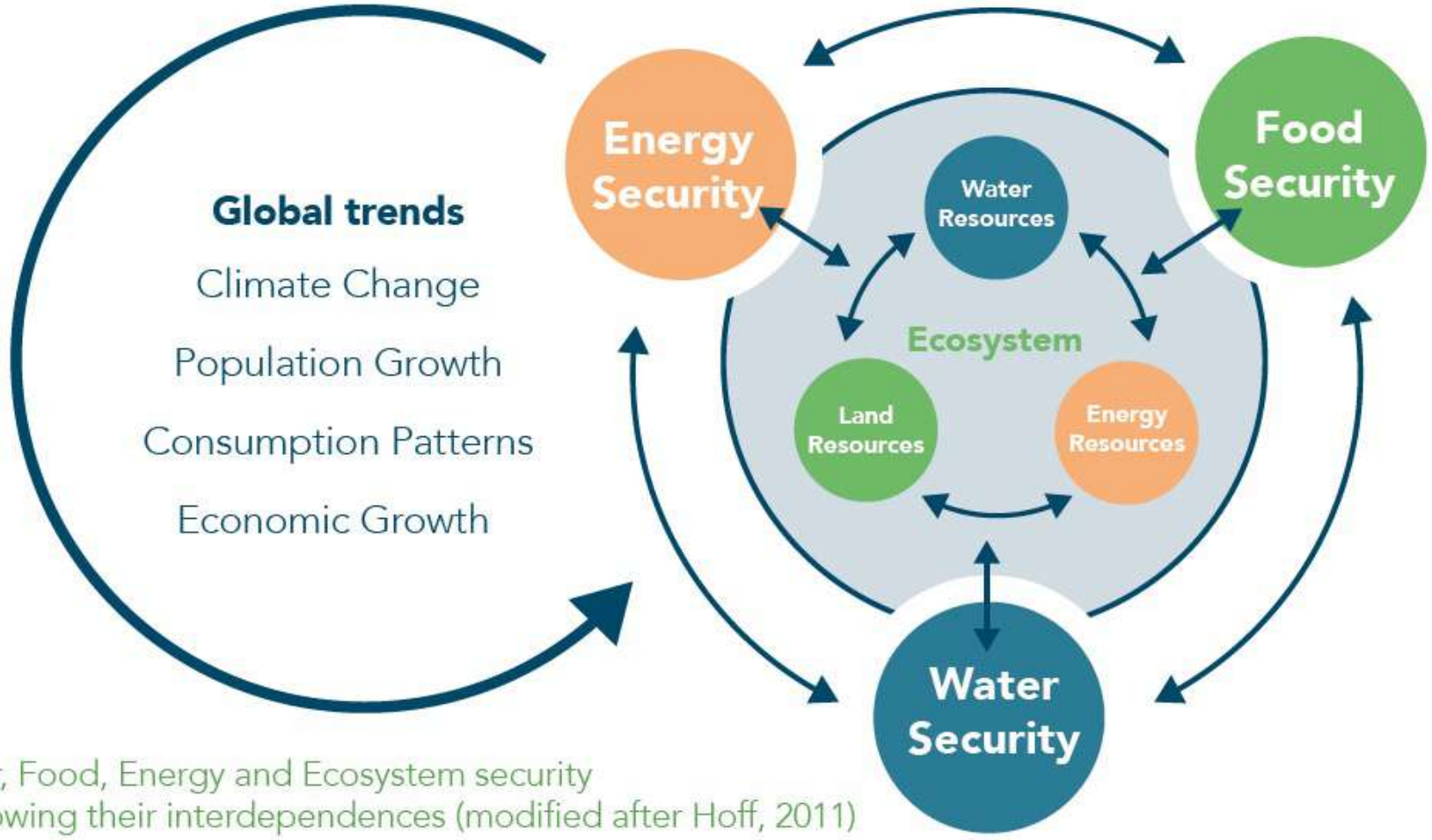


Figure 1.
The Water, Food, Energy and Ecosystem security Nexus showing their interdependences (modified after Hoff, 2011)

ANCESTRAL HYDROTECHNOLOGIES

JAISALMER, Rajastán, India – 1150 d.C

In Jaisalmer, they **collect every drop of rainwater** and designed **52 permanent bodies of water** around the city, in a public-private partnership

"If the elephant is submerged there will be water for 6 or 7 months"

160mm/year

(...)

"Its reputation is that it never dries"

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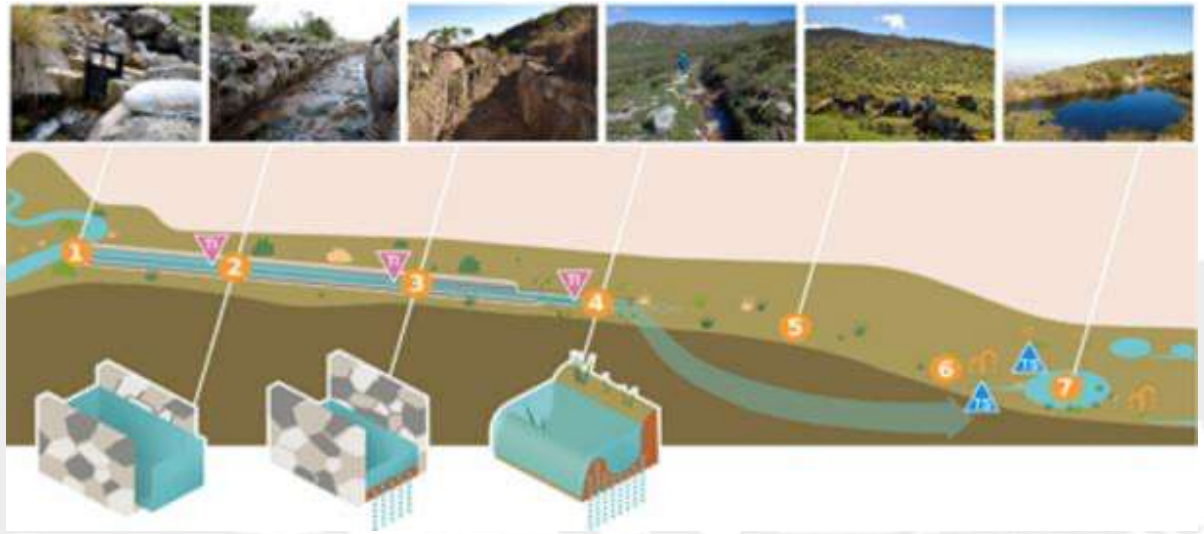
ANCESTRAL HYDROTECHNOLOGIES: AMUNAS



AMUNAS - Raining harvesting above 4,400 meters through **ditches,** taking water to previously identified areas with fractured rocks on the mountain.

Upon entering the rock, the **water slowly moves within it to emerge, months later, through the springs (springs or puquios),** that are between 1,500 and 1,800 meters below.

1 km Amuna
225.000 m3 /year

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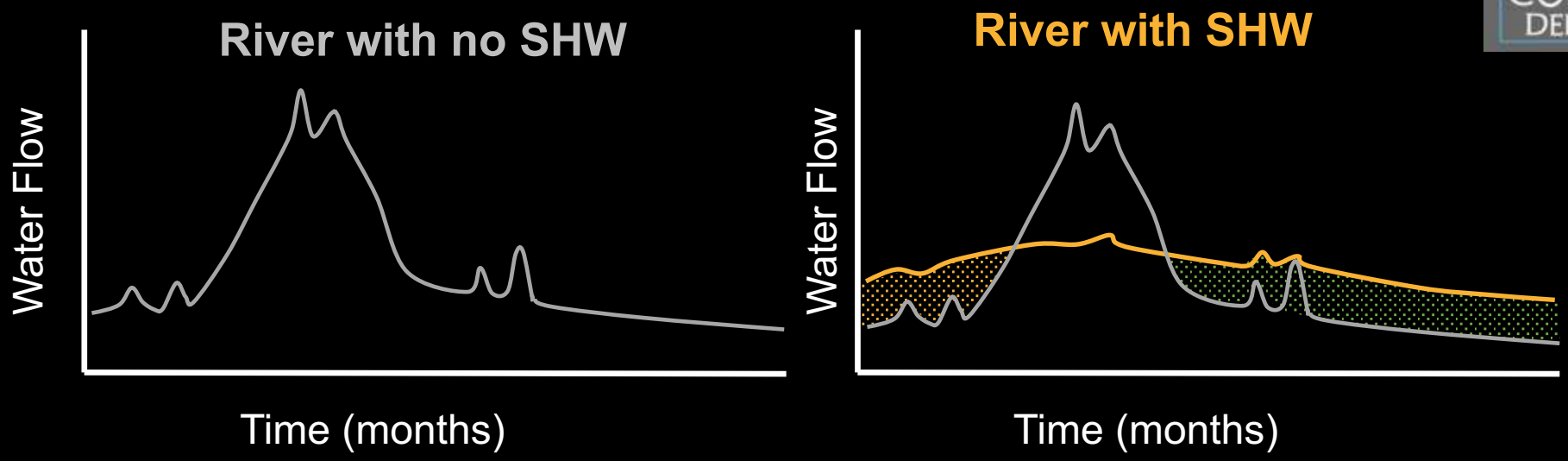
ANCESTRAL HYDROTECHNOLOGIES: AMUNAS

SOWING AND HARVESTING WATER



“Acequias de Careo” Sierra Nevada – Granada, SPAIN

CAN WE REPLICATE ANCESTRAL HYDROTECHNOLOGIES?

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ANCESTRAL HYDROTECHNOLOGIES FOR FUTURE RESCUE

Construction and Implementation of an Ancestral Model of amphibian culture for Adaptation to Climate Change, Socio-Ecosystem Resilience and the Conservation of wetlands

It has several ridges (Camellones), channels (natural and artificial) and water reservoirs (deep ponds / dikes)

Association of producers, fishermen, farmers and agroecological artisans of Purísima Córdoba

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ANCESTRAL HYDROTECHNOLOGIES FOR FUTURE RESCUE

ANCESTRAL HYDROTECHNOLOGIES FOR FUTURE RESCUE

WOMEN EMPOWERMENT

Community Empowerment Workshops for the APROPAPUR Association and follow-up to community work

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ANCESTRAL HYDROTECHNOLOGIES FOR FUTURE RESCUE

AGROECOLOGY

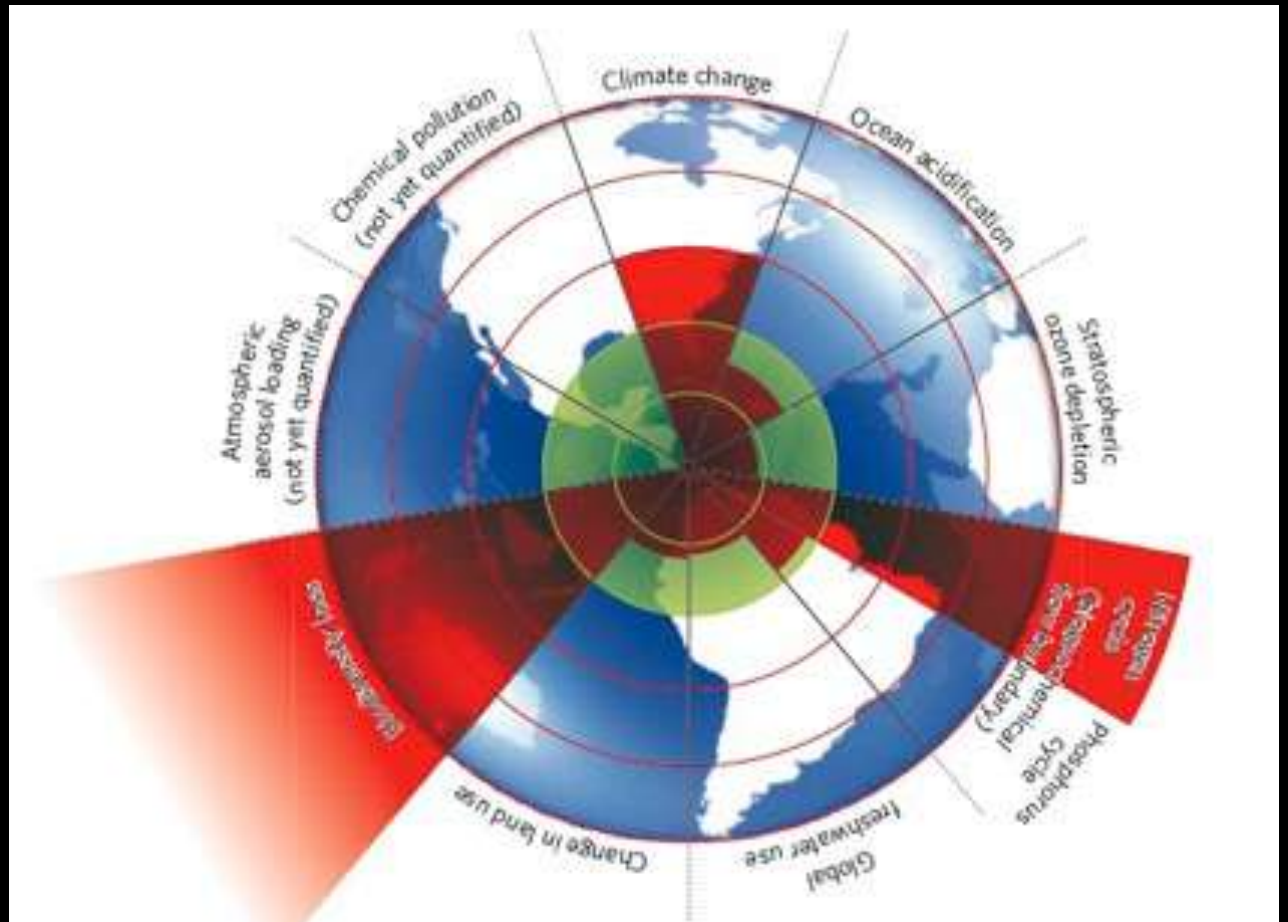
Productions in less than 3 months.
50 kg of BEANS in 7 camellones
36 kg of WATERMELON lin 1 camellon.

HOW CAN WE EXTEND THE USE OF ANCESTRAL HYDROTECHNOLOGIES FOR CLIMATE EMERGENCY?

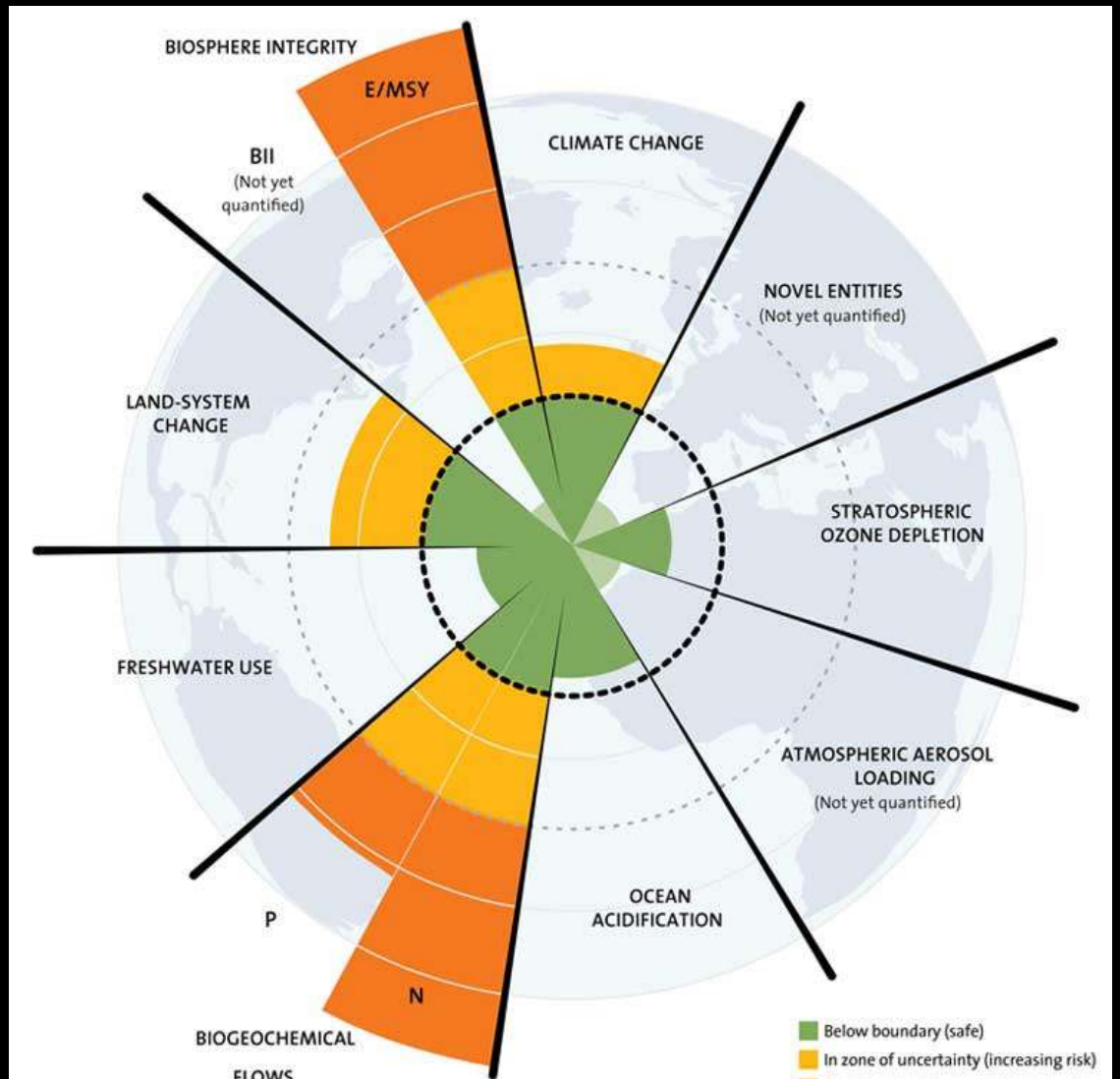
Nature **461**, 447-448 (24 September **2009**)

Earth's boundaries?

An attempt to quantify the limits of humanity's load on our planet opens an important debate.



Steffen et al. **2015.** Planetary Boundaries: Guiding human development on a changing planet. Science Vol. 347 no. 6223



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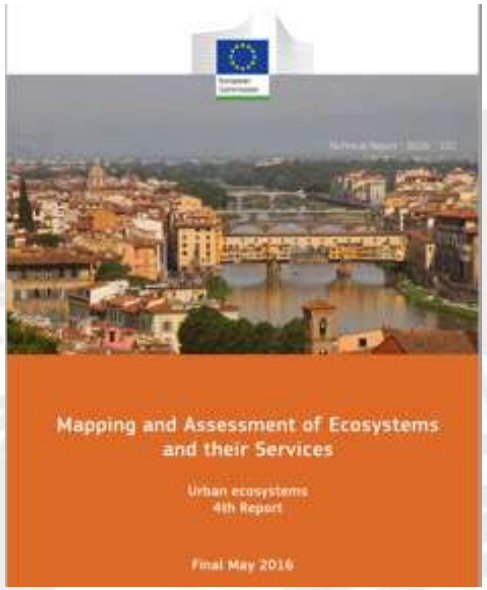
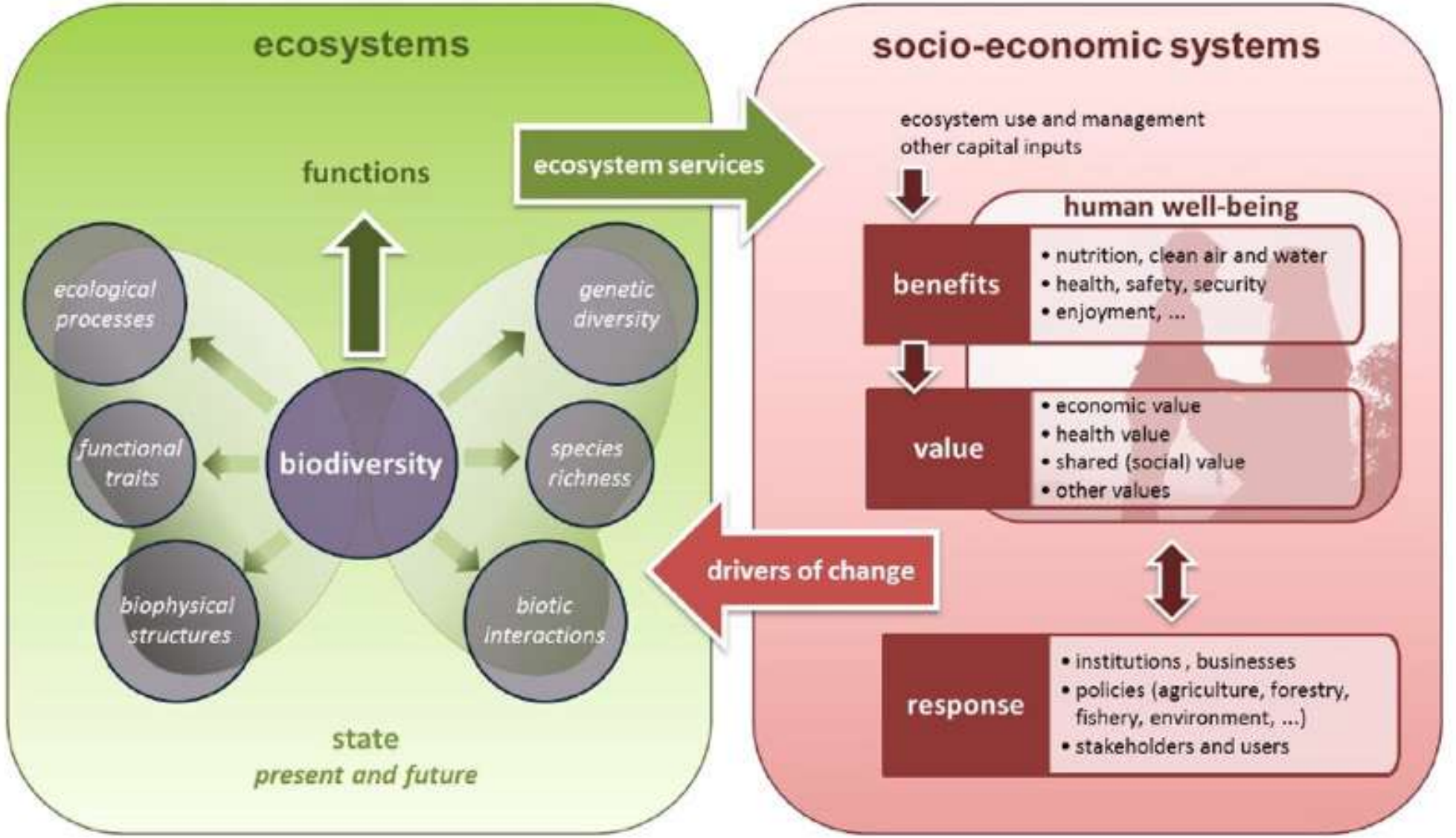
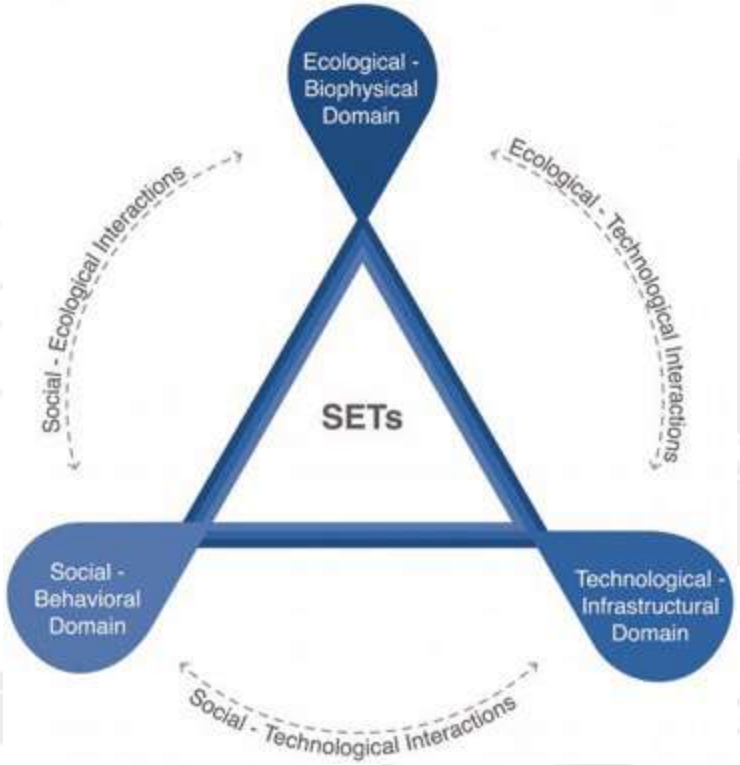
Mapping and Assessment of Ecosystem Services





SETS – Socio ecological Technical Systems



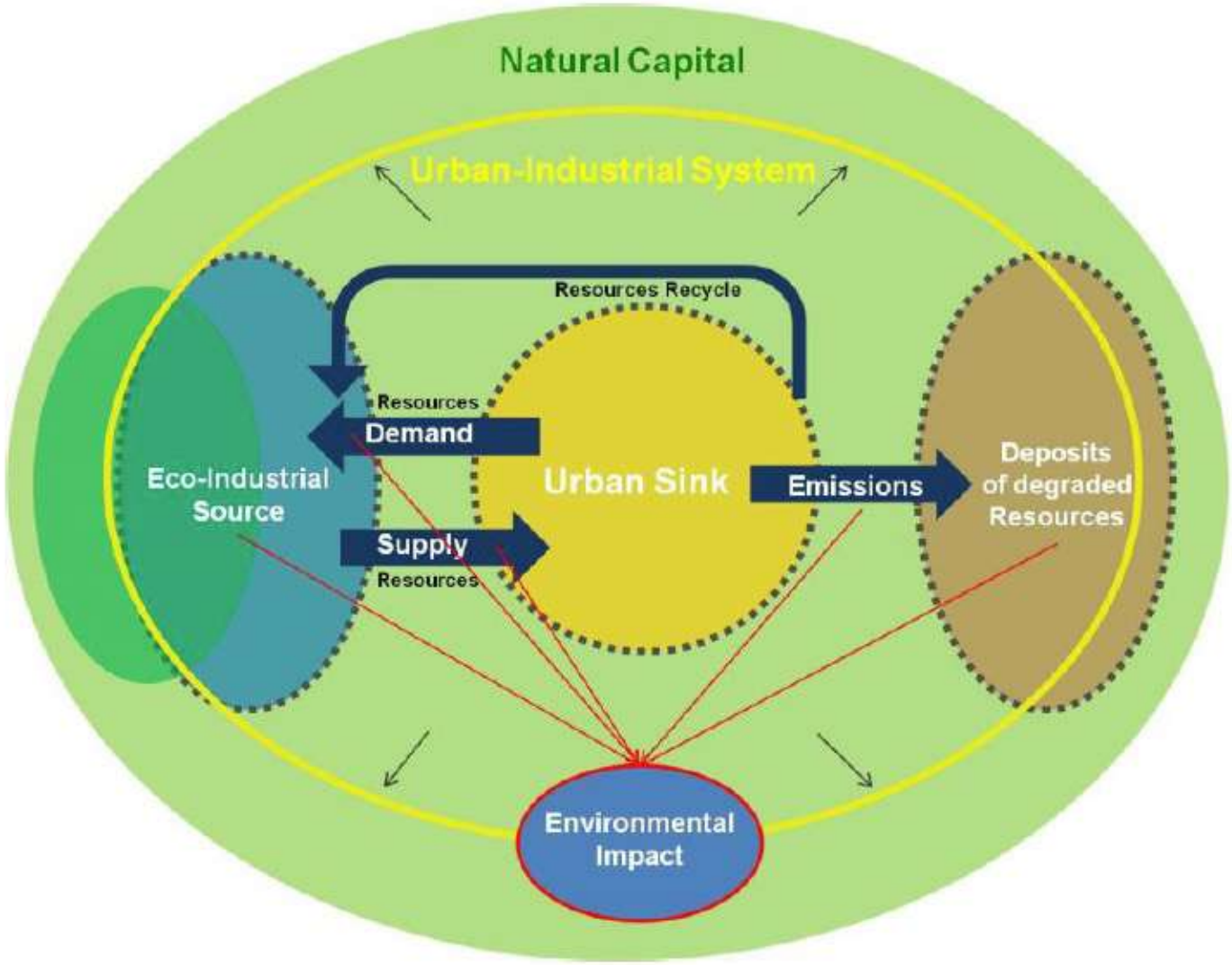


Fig .6. Advanced Ecological Economics Urban-Industrial System Metabolism Model

K. Krumme. "Why smart is not enough - system ecology and strong sustainability as conceptual drivers for experimental cities: Options for an integrated framework on urban transition management. Working Paper, University of Duisburg-Essen, 2016

T. McPhearson, S. T. A. Pickett, N. B. Grimm, J. Niemelä, M. Alberti, T. Elmqvist, C. Weber, D. Haase, J. Breuste and S. Qureshi. "Advancing Urban Ecology toward a Science of Cities." BioScience, vol. 66(3), pp. 198-212, 2016.

SETS – Socio ecological Technical Systems

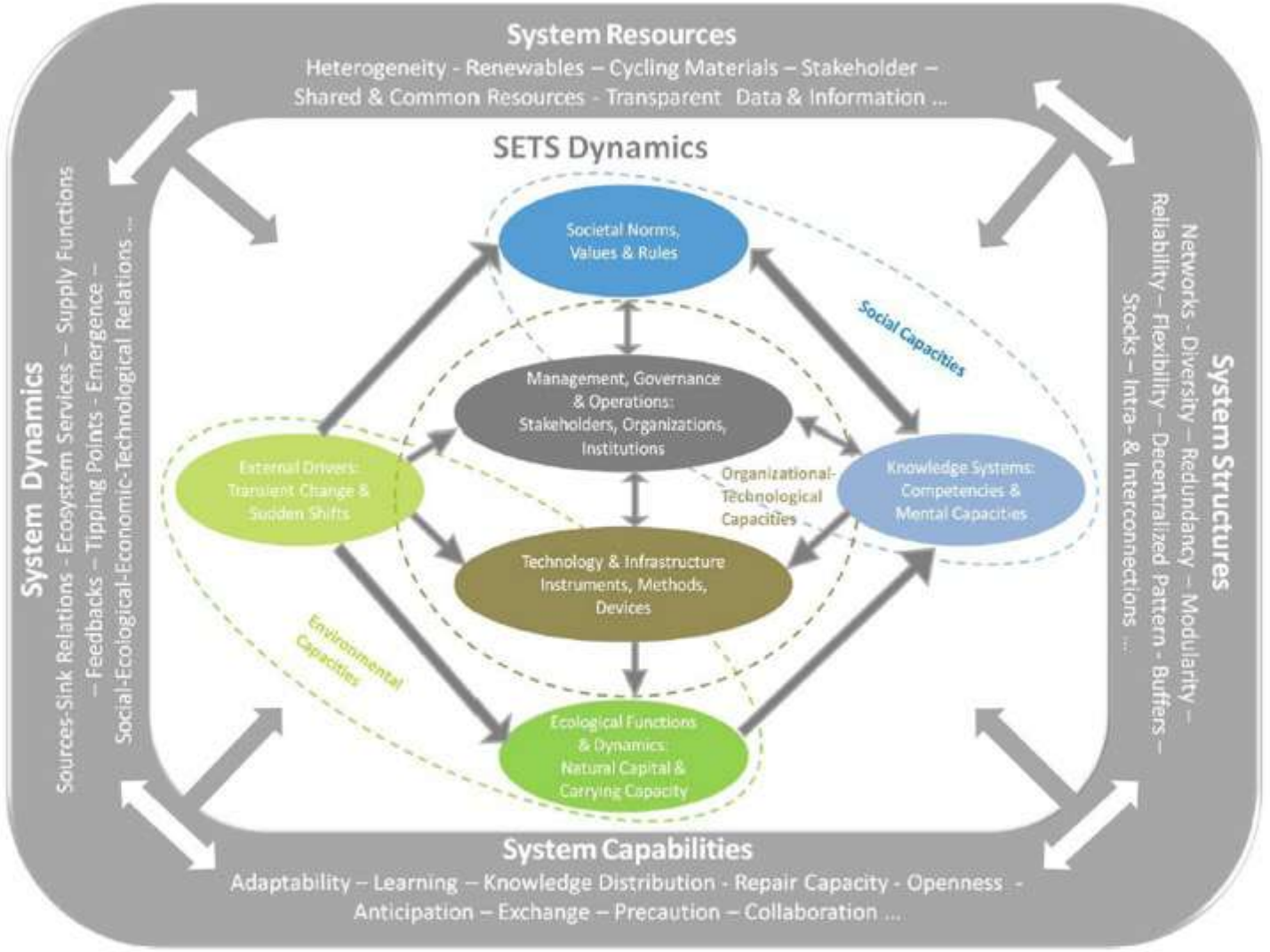


Fig .8. Conceptual Model of Resilience Design Dimensions and SETS Dynamics (own conceptualization with reference to Walker, Holling et al. 2004, Hahn, Schultz et al. 2008)

Biomimicry – NATURE INSPIRING

Appropriate Technologies

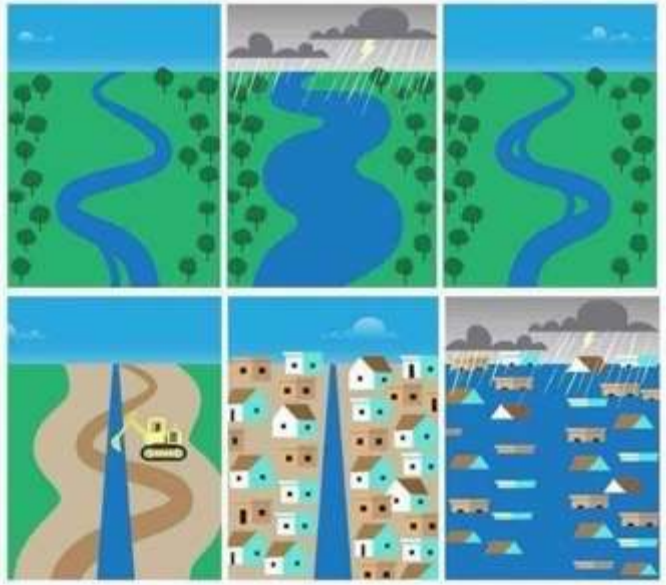
Nature-Based Solutions

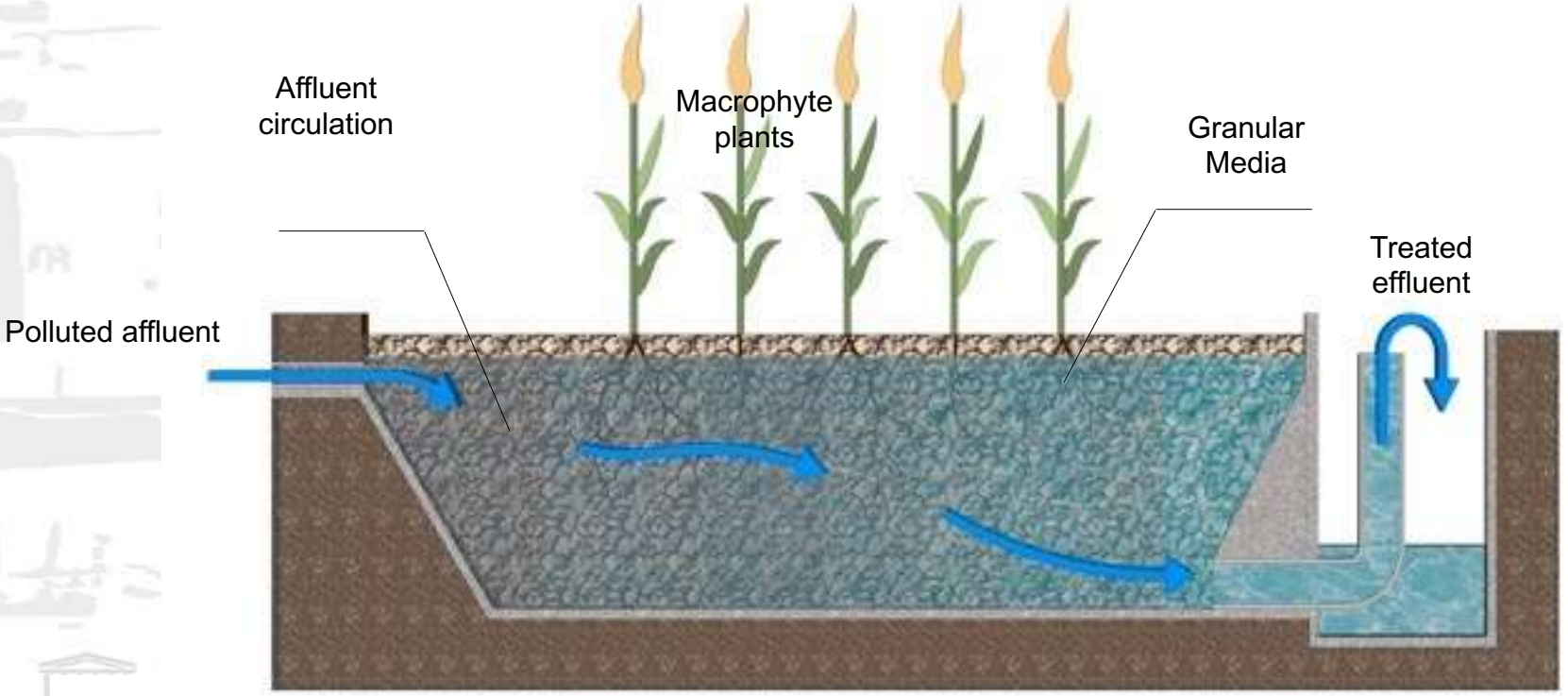
Ecohydrology

Ecotechnologies

Phyototechnologies

Bioengineering





TREATMENT WETLANDS FOR POLLUTED EFFLUENT TREATMENT

NATURE BASED SOLUTIONS

Living solutions inspired by, continuously supported by and utilizing Nature, designed **to address societal challenges** in a **resource efficient and adaptive manner**, while providing **economic, social and environmental benefits**

(EC, 2015)

NATURE BASED SOLUTIONS

Baixo Sul da Bahia, Bahia – Brasil (2015)

PRODUCTOR DE AGUA
Agriculture Runoff & Storm Water Control for Tertiary roads & Aquifer Recharge

ANA
AGÊNCIA NACIONAL DE ÁGUAS

UFBA

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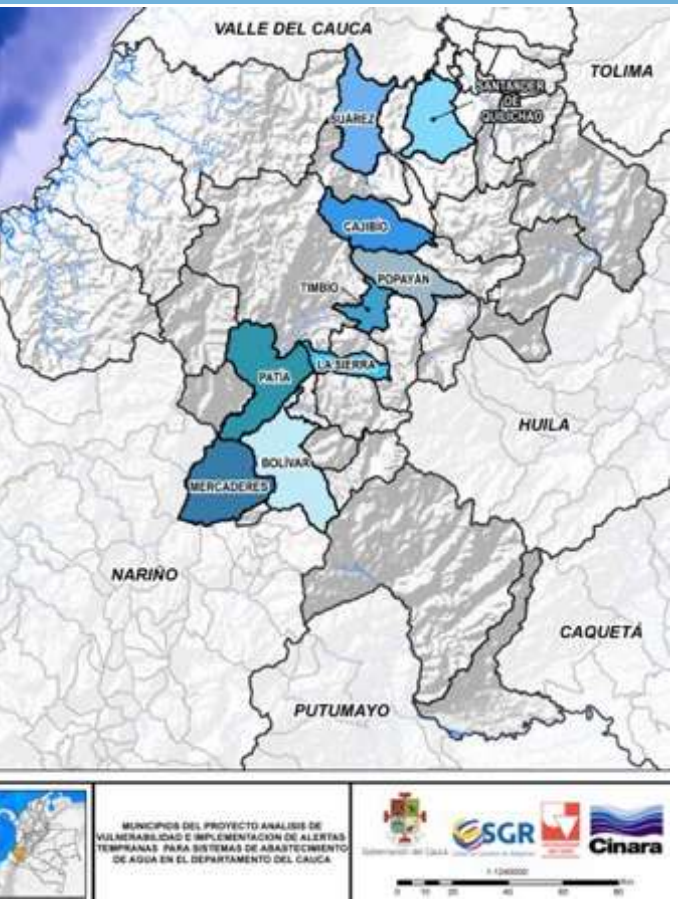
recnet.

ECOSISTEMIC SERVICES AND RIVER BASIN MANAGEMENT

Ecosistemic Services Analysis in RB and Adaptation to Climate Change



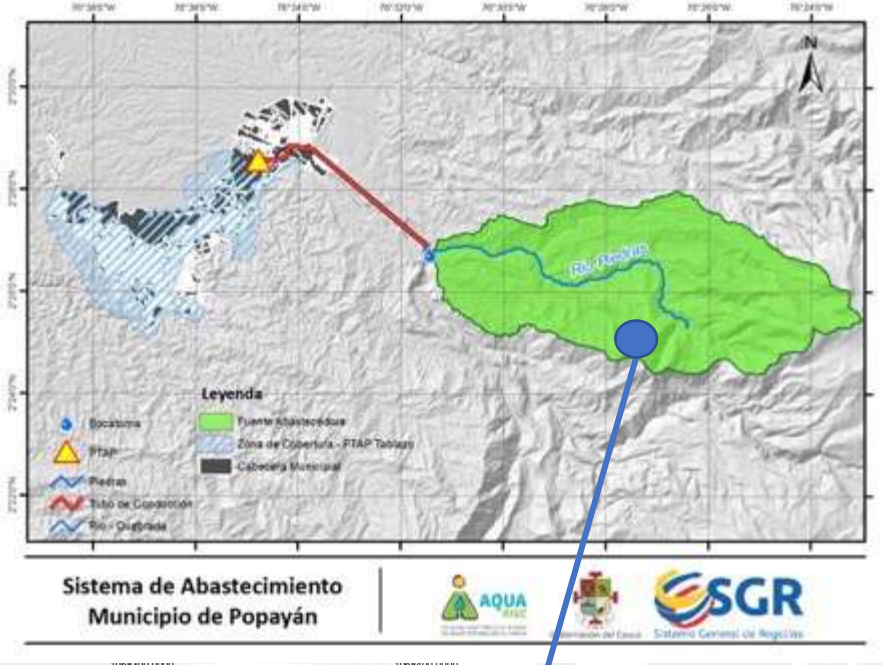
VULNERABILITY ANALYSIS & IMPLEMENTATION OF EARLY ALERTS FOR WATER SUPPLY SYSTEMS IN CAUCA DEPARTMENT (COLOMBIA)

- VULNERABILITY & RISK
- Mehodologies
- Plans
- ECOTECHNOLOGICAL INTERVENTIONS
  - ICT DEVELOPMENT
  - ECOTECHNOLOGIES PILOTS (Buffer Strips, …)
  - WATER SUPPLY PROTECTION
- INTERINSTITUTIONAL NETWORK
  - ARTICULATION STAKEHOLDERS
  - SOCIAL APPROPRIATION AND TRANSFER
- CAPACITY BUILDING

AQUARISC PROJECT (Cauca, Colombia)

URBAN-RURAL

1. Protect upper river basin for water supply improvement at urban scale
2. Diffuse pollution from agriculture/cattle raising
3. Flooding control
4. Drought prevention

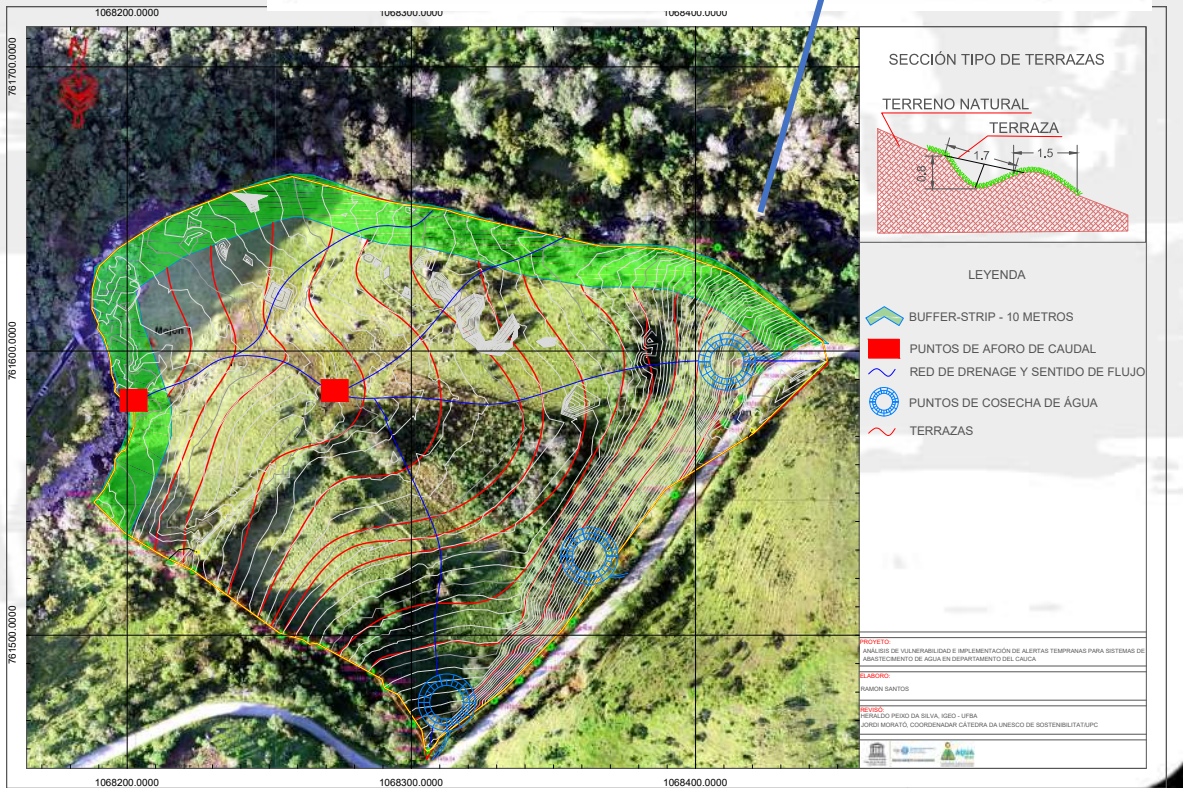


CLIMATE CHANGE PROBLEMS

1. Changes in the **normal months of rain and drought** (modiflcation agricultural calendar).

3. **Heavy/Long rains concentrated in small areas** (landslides, floods).

4. **Prolonged droughts** (lack of water for consumption, losses agriculture).



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NATURE BASED-SOLUTIONS

Flooding control

Erosion prevention

Runoff Management

Aquifer Recharge

A GREENER CITY?

Blue Green Biodiverse Ecoinfraestructures

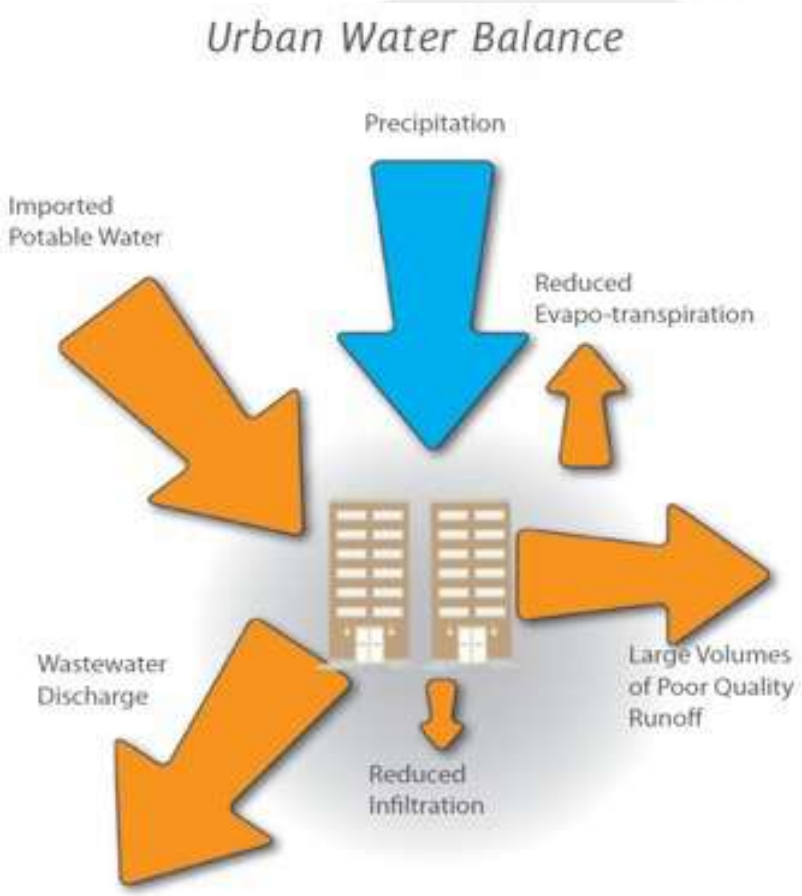
Green Urban Governance

ECOSYSTEMIC SERVICES FROM URBAN BIODIVERSITY

ECOSYSTEMIC SERVICES		
	Regulation	Air filtration Microclimate regulation Noise reduction Rainwater drainage Improvement of wastewater quality
	Provision	Food / medicine supply Shadow **Water**
	Cultural	Pedagogical Aesthetic Social

WATER SENSITIVE URBAN DESIGN – SPONGE CITIES

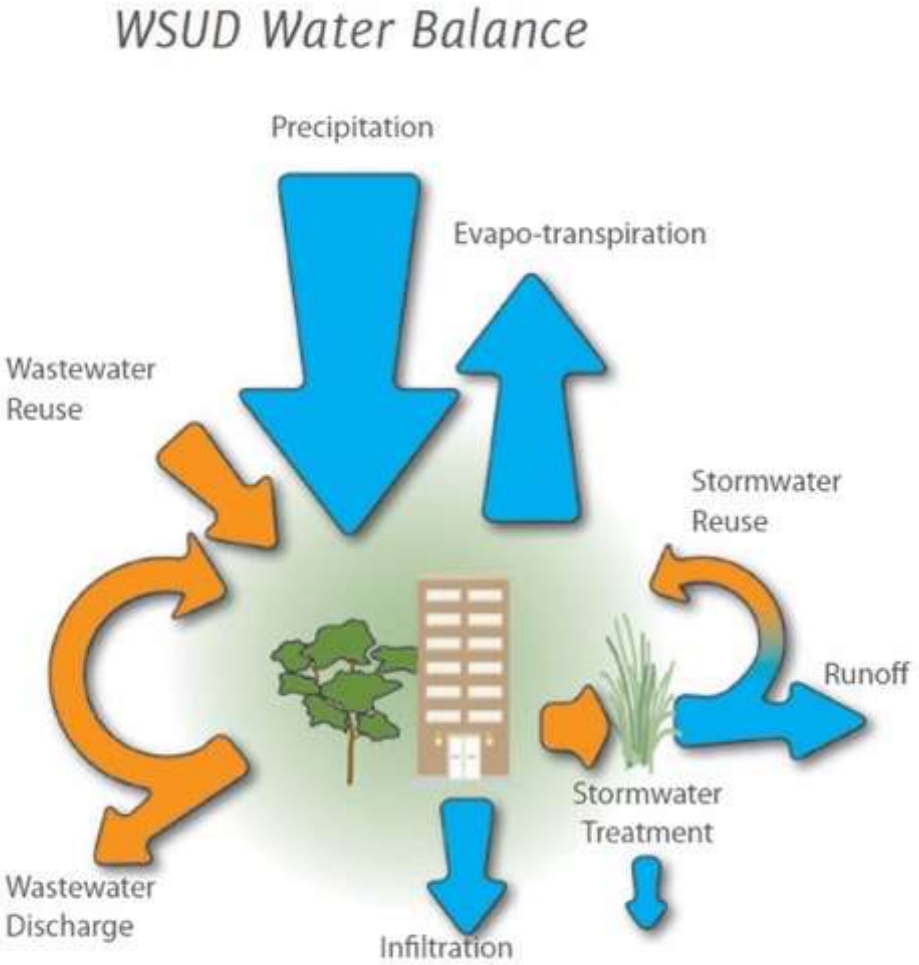
Restore / regenerate the natural balance of water in urban areas
Increase technical and social resilience



+Vegetation
+ Permeability

Use of rainwater
- use of imported water

Sustainable sanitation
Close cycles
Wastewater reuse



WATER SENSITIVE URBAN DESIGN

Infiltration Basins for stormwater and runoff collection

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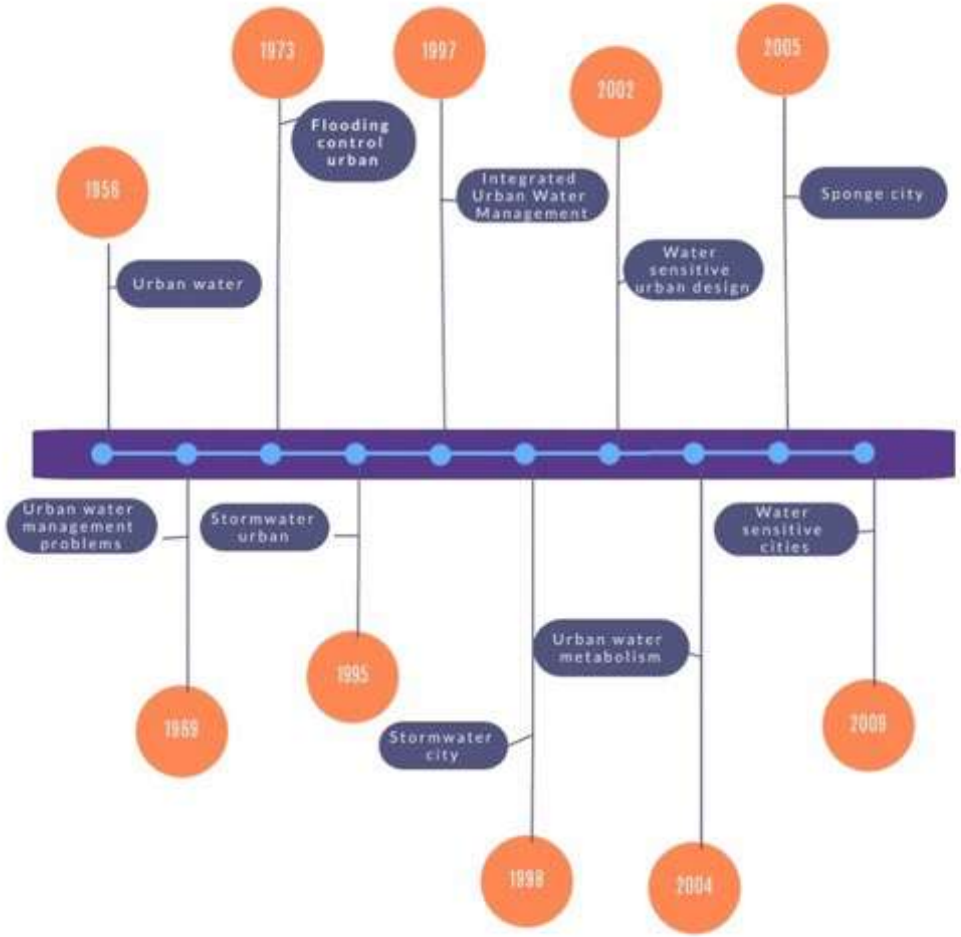
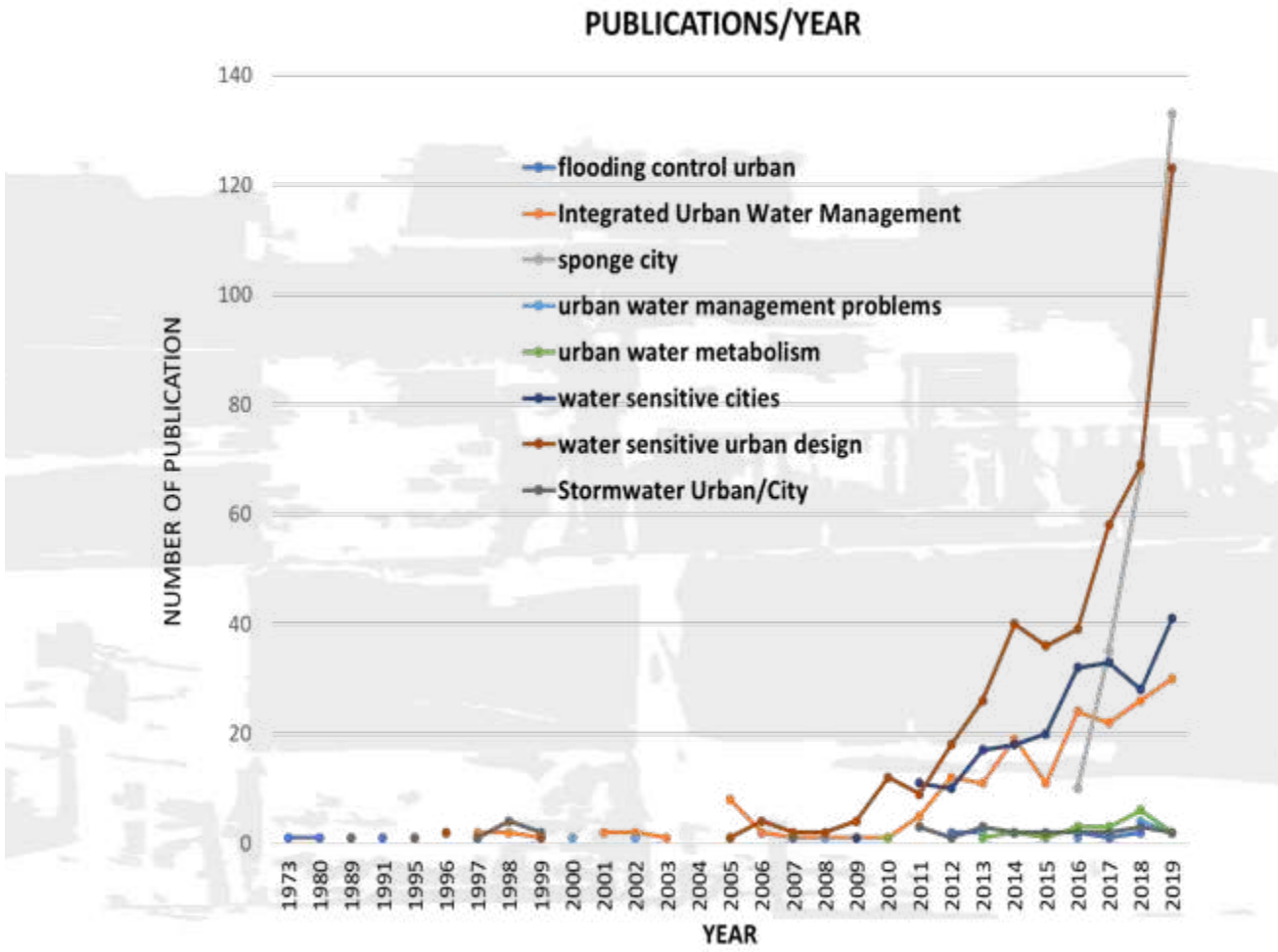
WATER SENSITIVE URBAN DESIGN– SPONGE CITIES





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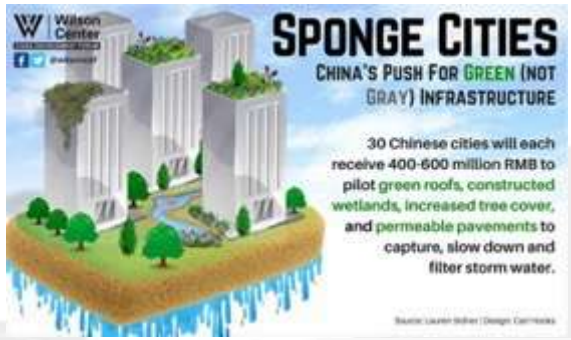
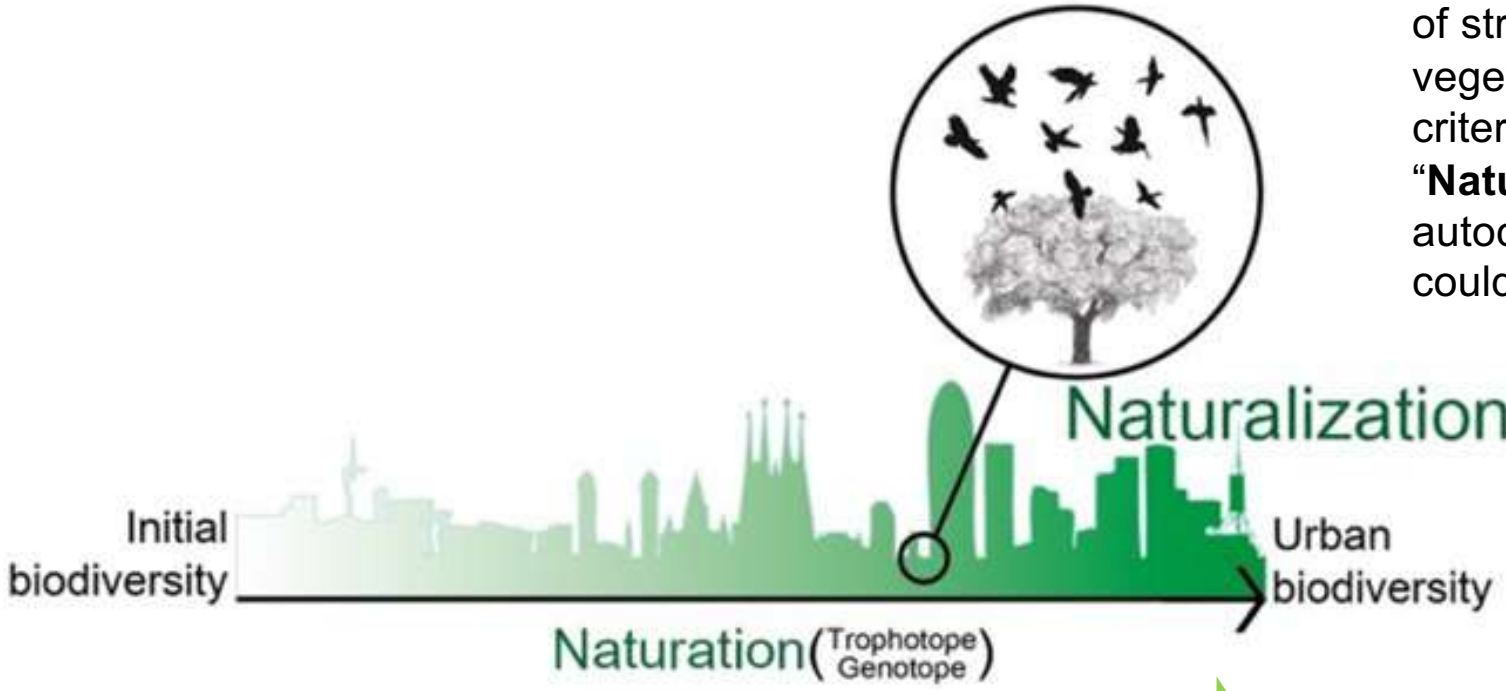
WATER SENSITIVE URBAN DESIGN – SPONGE CITIES



Naturation & Naturalization as a Green Urban Governance tools



Naturation is a process based in the implementation of strategies and actions on urban Green, adding more vegetation and more Green spaces with ecological criteria, and with the purpose to achieve a "**Naturalization**" of the Urban System, or to favor the autochtonous wildlife and flora (Briz, 1999 y 2004) that could not be dangerous.

A good naturated urban system could be a biodiversity reservoir, comparable to a natural reserve area (Boada i Gómez, 2008).

NATURATION
Efforts to provide urban ecosystems with sustainable green spaces

NATURALIZATION
Process of biodiversity entry that is carried out on the basis of naturation.

BIODIVERSITY, one of the best ecosystem quality indicators

Urban biodiversity have direct effects on life quality and wellbeing (and health).

Having **access to the green space is generally beneficial for health**. Exposure to nature is linked to:

Low mortality (Donovan et al., 2013, Gascon et al., 2016, and others)

Better physical and mental health (Gascon et al., 2015; Triguero-Mas et al., 2015)

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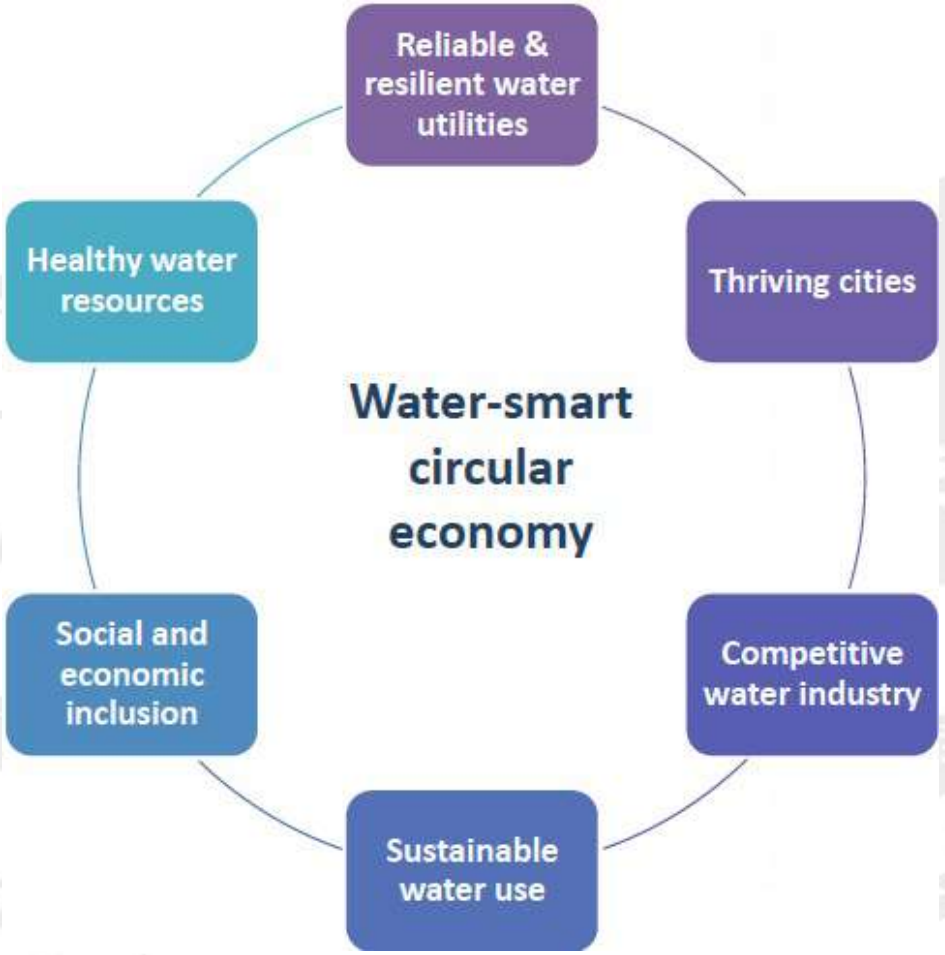
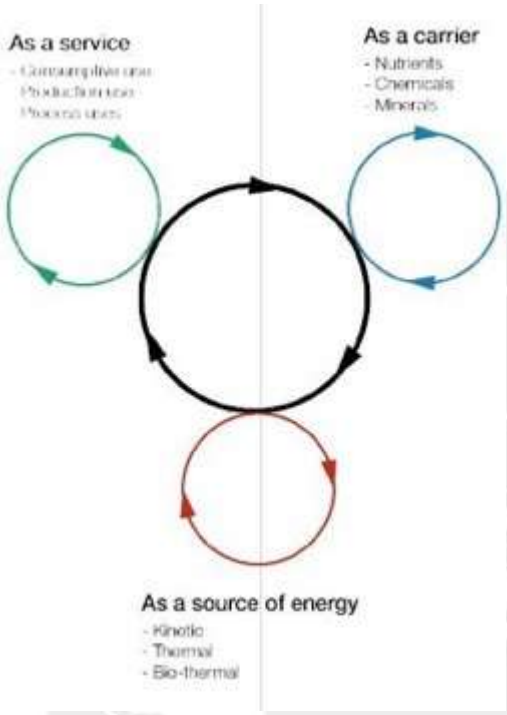
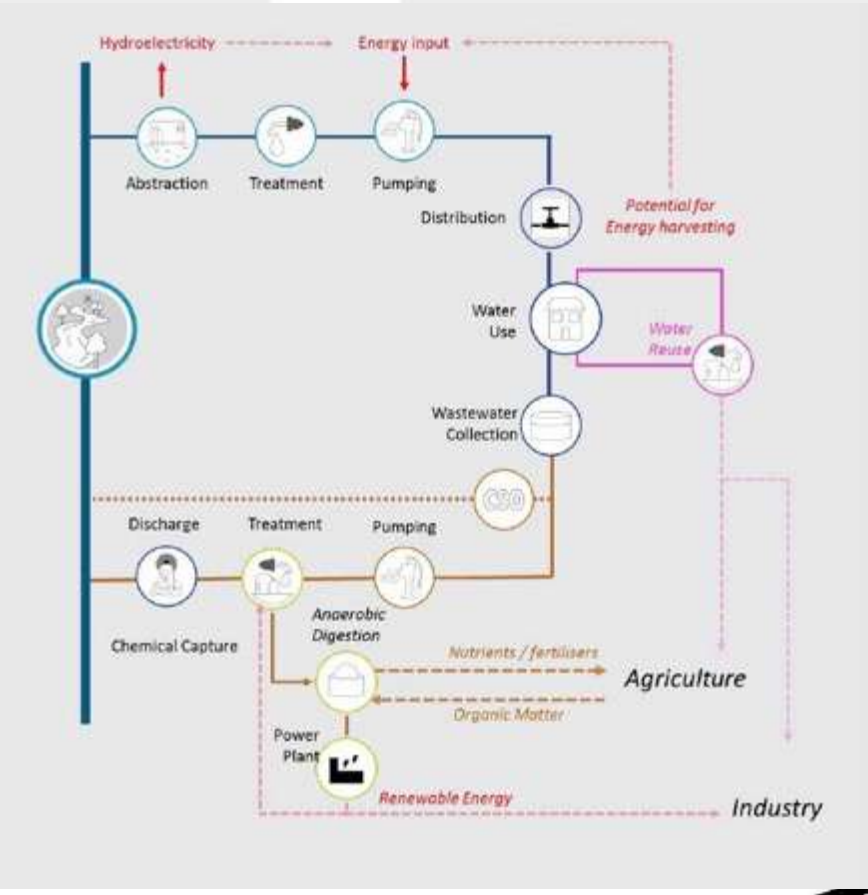
WATER SMART CIRCULAR ECONOMY







HOW TO APPLY?

Community based interventions

Action for Transformation

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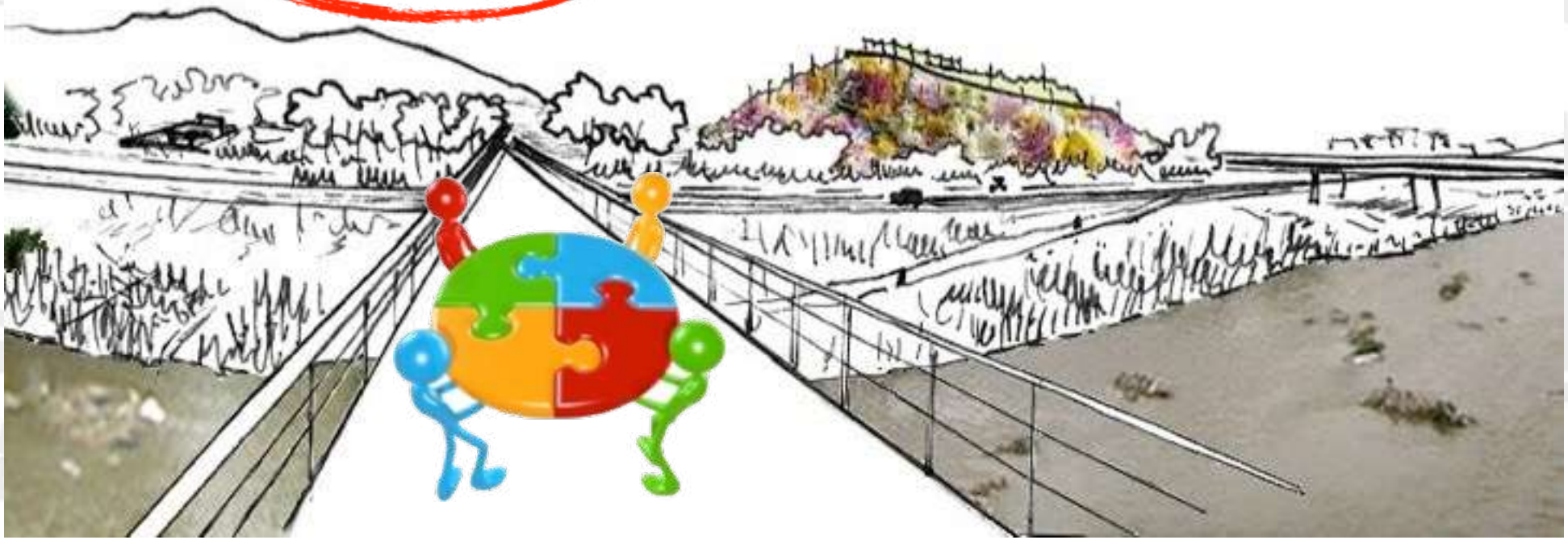
PARTICIPATORY TRANSFORMATION PROCESS

Moravia Week

Open dialogue for technicians and population

Participatory & Inclusive



Inform → Consult → Concert → Involve

#Action for Transformation

CULTIVATING NEW COMMUNITIES

Articulation participative transformation projects From Local Capacity Building

To COMMUNITY EMPOWERMENT

PARTICIPATIVE INTERVENTIONS

Community-based Collaborative Multinetworks (Univ. PubAdmin, Communities)

CO-DESIGN

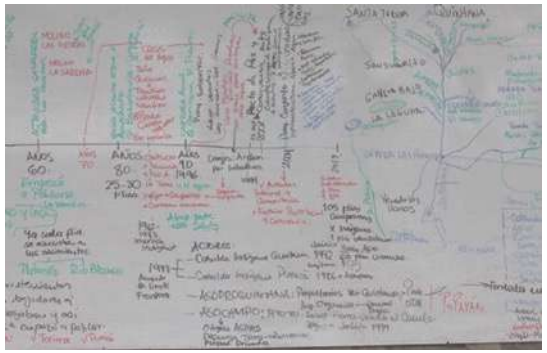
Innovative Technol.

PILOT PROJECTS

Acupuncture Int.

COMMUNITY LOCAL NETWORKS

Water Sowers



Sustainable development of settlements with integrated systems of multifunctional eco-infraestructures and cultivation of participatory networks and social, economic, cultural and environmental networks.

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SOCIO-ENVIRONMENTAL RESTORATION AT MORAVIA HILL (MEDELLIN)

- 2.224 families = 10.000 hab.
- 1.500.000 Tons garbage
- 7,6 Ha - 42,5 m max height

2004

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Tecnológico de Antioquia Institución Universitaria

Ajuntament de Barcelona

Centro de Desarrollo Cultural de Moravia-CDCM

Medellín todos por la vida

Alcaldía de Medellín

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SOCIO-ENVIRONMENTAL RESTORATION AT MORAVIA HILL (MEDELLIN)

0.37 m2 public space per inhabitant

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SOCIO-ENVIRONMENTAL RESTORATION AT MORAVIA HILL (MEDELLIN)

Heavy metals

Lead: 403-489 ppm Pb

Chrome: 166-241 ppm Cr

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MORAVIA COMMUNITY GARDEN GROUP

Link the inhabitants to the transformation process **through leisure activities around gardening.**

Promote local identity and social cohesion through **participatory activities for environmental transformation and urban recovery of degraded dump area.**

Buffer-strips

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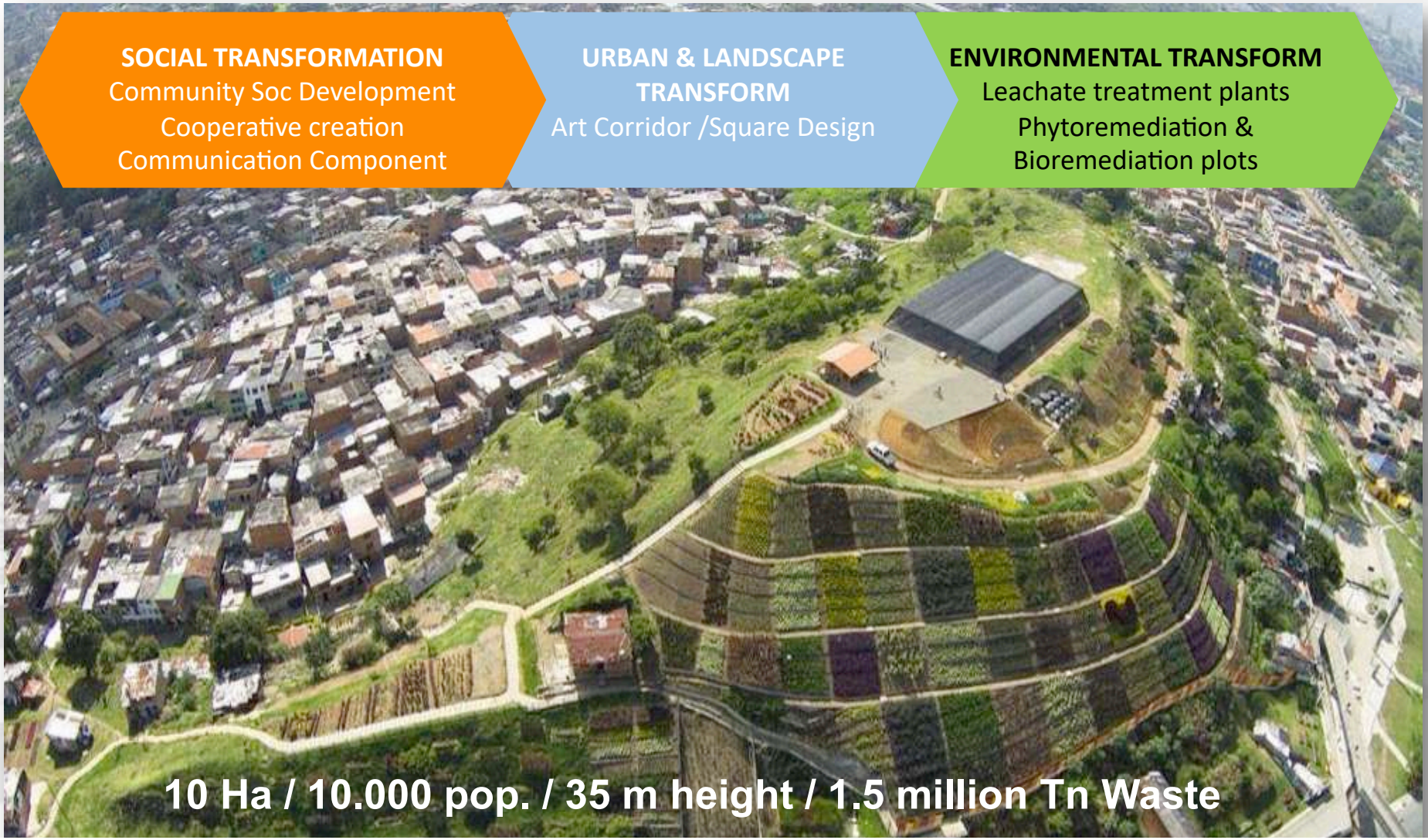
SOCIO-ENVIRONMENTAL RESTORATION AT MORAVIA HILL (MEDELLIN)

SOCIAL TRANSFORMATION
Community Soc Development
Cooperative creation
Communication Component

URBAN & LANDSCAPE TRANSFORM
Art Corridor /Square Design

ENVIRONMENTAL TRANSFORM
Leachate treatment plants
Phytoremediation &
Bioremediation plots



Moravia, Medellín (2005-2015)

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URBAN RUNOFF MANAGEMENT FOR LANDSLIDE RISK CONTROL

Altos de la Estancia
Ciudad Bolivar Bogota.

2.000.000 m^3 displaced material

73 ha.

3.305 Families affected
(15.000 Population)

URBAN RUNOFF MANAGEMENT FOR LANDSLIDE RISK CONTROL

Selected top 20 risk management projects worldwide (UNDRR, Sendai, 2015)

Restoring eroded and degraded areas
Phytotechnologies for runoff water management

Urban Runoff Management - Evaporative biofilters

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URBAN RUNOFF MANAGEMENT FOR LANDSLIDE RISK CONTROL

Methodology for Participative Social Empowerment

Survey of Social Initiatives

Selection Criteria

Identification of different activities that generate local development & reduce vulnerability

Formation

Course (140 h.)

Bioengineering
Landscape
Water Management
Urban Agriculture

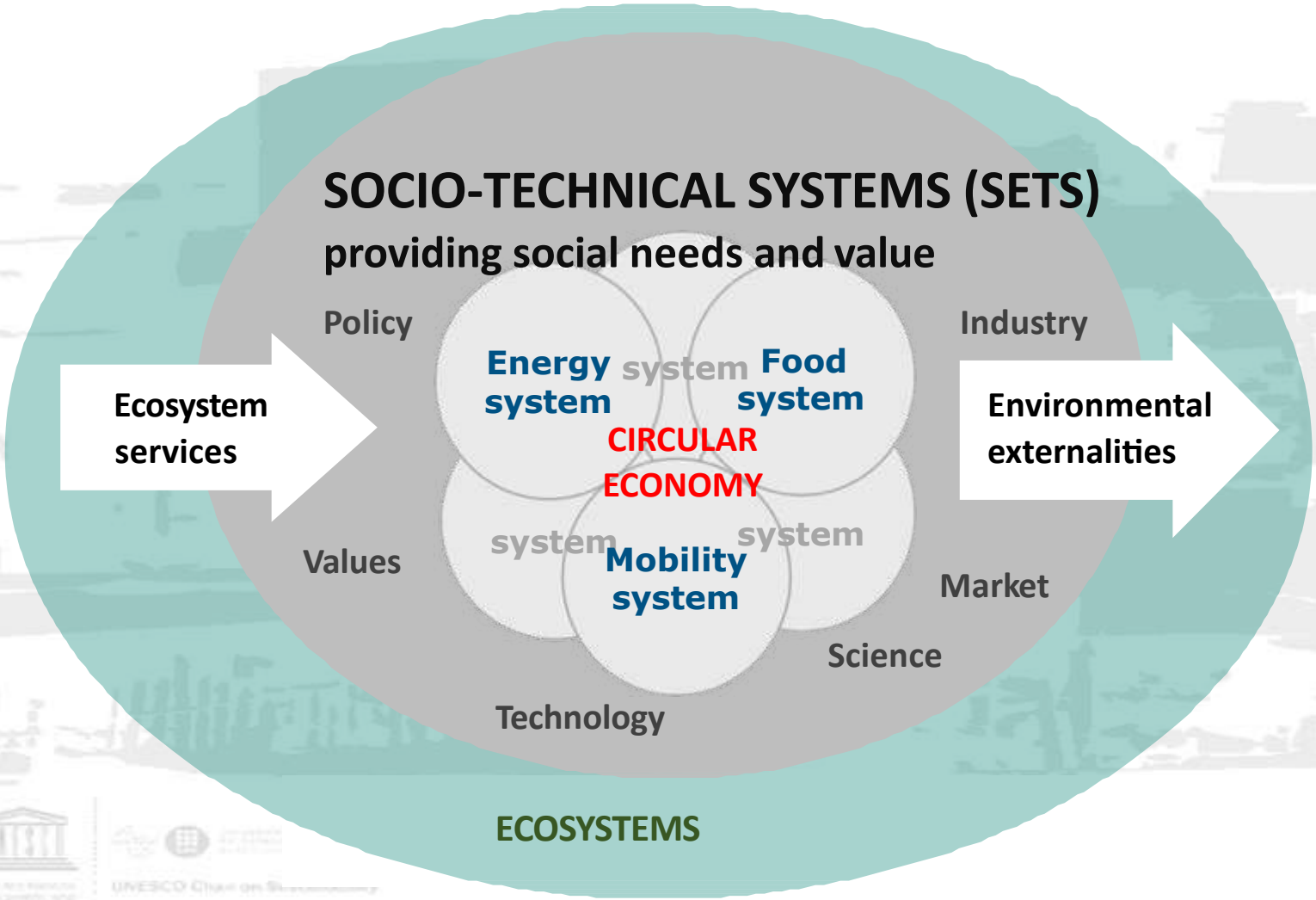
Start-UP Initiatives

1) Agroecologic garden
2) Bioengineering
3) Community Garden
4) Ecoturism, paths...

Project selected among the top 20 risk management initiatives worldwide (Sendai, Japan, 2015)

ANCESTRAL HYDROTECHNOLOGIES FOR FUTURE RESCUE

CONFIGURE NEW SETS, ORIENTED TO CHANGE / SOLVE MOST TRANSITION ISSUES



Learn to live with change and uncertainty

Feed diversity for reorganization and renewal

Opportunity for self-organization and nexus through scales

Combine different types of knowledge

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The opportunities to mainstream NBS in DEVELOPING COUNTRIES

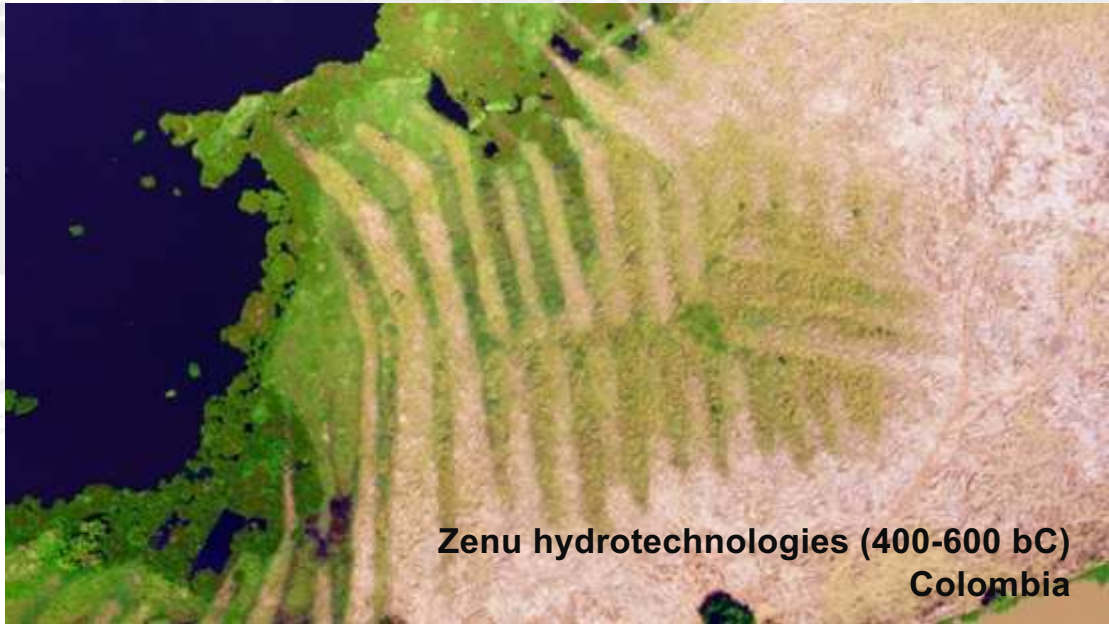
Natural treatment technologies have high potential for aplication in developing countries, particularly by smaill rural communities**.**

Big experience in Participatory Community approach in many countries, especially from local public administrations (Medellin case, on social urbanism).

Multiagency involvement, including local stakeholders, public administrations, international cooperation agencies and climate action funding agencies. **Innovative big national projects to improve conditions in rural areas,** like Produtor de Aguas from ANA in Brazil or AQUARISC in Colombia.

Improving shared technical and scientific knowledge for implementing and managing NBS in cities (different LAC networks, 5 editions of Panamerican Conference on Wetland Treatment Systems, April 28-30 2021)

Traditional/Ancestral Ecological Knowledge and practices in Mexico, Perú, Colombia (Zenu nexus approach), Brazil...



Zenu hydrotechnologies (400-600 bC) Colombia

ANCESTRAL HYDROTECHNOLOGIES FOR FUTURE RESCUE

NBS in LAC – Successful examples


Moravia, Medellin, Colombia


Altos de la Estancia, Bogota, Colombia


Rio Las Piedras, Cauca, Colombia


Villatina, Medellin, Colombia


Programa Produtor de Agua
Baixo Sul da Bahia, Brazil


Ecoducto Rio La Piedad, Ciudad de México

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ANCESTRAL HYDROTECHNOLOGIES FOR FUTURE RESCUE

Knowledge generation and dissemination.
Transfer of best practices at local and regional level

Best Practices on Ancestral Hydrotechnologies

Updated: Mar 21

You can now register for the second event, Good Practices on Ancestral Hydrotechnologies for the climatic, health and food emergency - Case Studies in Ibero-America-, which will be held this coming March 18.

Organizan:

Colaboran:

recnet.

CYTED

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NATURA

Nature-based solutions for Urban Resilience in the Anthropocene

The *NATURA* project links 26 networks in Africa, Asia-Pacific, Europe, North and Latin America

WWW.NATURA-NET.ORG

Cities and urbanized regions worldwide are exposed to extreme weather events and rising seas. They are at risk because their infrastructure often is in disrepair, no longer appropriate for more intense or frequent extreme events, or unable to keep up with rapid urban population growth. Traditional engineered infrastructure, such as stormwater drainage systems or sea walls, is usually designed for only one purpose and seldom can adapt to changing conditions. Solutions that are based on nature–preserving protective ecosystems, incorporating ecological elements or even mimicking nature in built infrastructure, offer flexibility in the face of changing conditions and provide multiple benefits to society, often at relatively low cost.

The Nature-based solutions for Urban Resilience in the Anthropocene (NATURA) project links 26 networks in Africa, Asia-Pacific, Europe, North and Latin America, and globally to enhance connectivity among the world's scholars and practitioners and improve the prospects for global urban sustainability.

NATURA exchanges knowledge, shares data, and enhances communication among research disciplines and across the research-practice divide to advance urban resilience in face of growing threats of extreme weather events.

For more information please contact
Nancy Grimm at nbgrimm@asu.edu or
Timon McPhearson timon.mcphearson@newschool.edu

As an important part of knowledge sharing, researchers and practitioners will work together on applications of nature-based solutions (NBS) in a wide range of social, ecological, and technological contexts addressing five gaps:

- Synergistic benefits of bundles of NBS for urban resilience
- Role of social-cultural (S) context in NBS outcomes
- Role of ecological-biophysical (E) context in NBS outcomes
- Role of technological-infrastructural (T) context in NBS outcomes
- Role of SET interactions in NBS outcomes

Through all-hands meetings, thematic working groups, regional nodes, and synthesis writing workshops, NATURA will accomplish the goals of synthesis and data sharing, and network coordination. Early-career researchers and practitioners will be sponsored by NATURA to pay five-week visits to network partners. Further, NATURA will train postdoctoral scholars and graduate students through learning exchanges to networks around the globe. Through collaboration with partners, international students will be invited to participate in these exchanges, hosted by US networks.

ICLEI

LTER

ENABLE

BiophilicCities

natural capital PROJECT

futureearth

nature in cities

IUCN

recnet.

VIVA PLAN

www.unescosost.org

www.recitynet.org

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