



Integrated European
Long-Term Ecosystem
Critical Zone &
Socio-ecological Research
Research Infrastructure

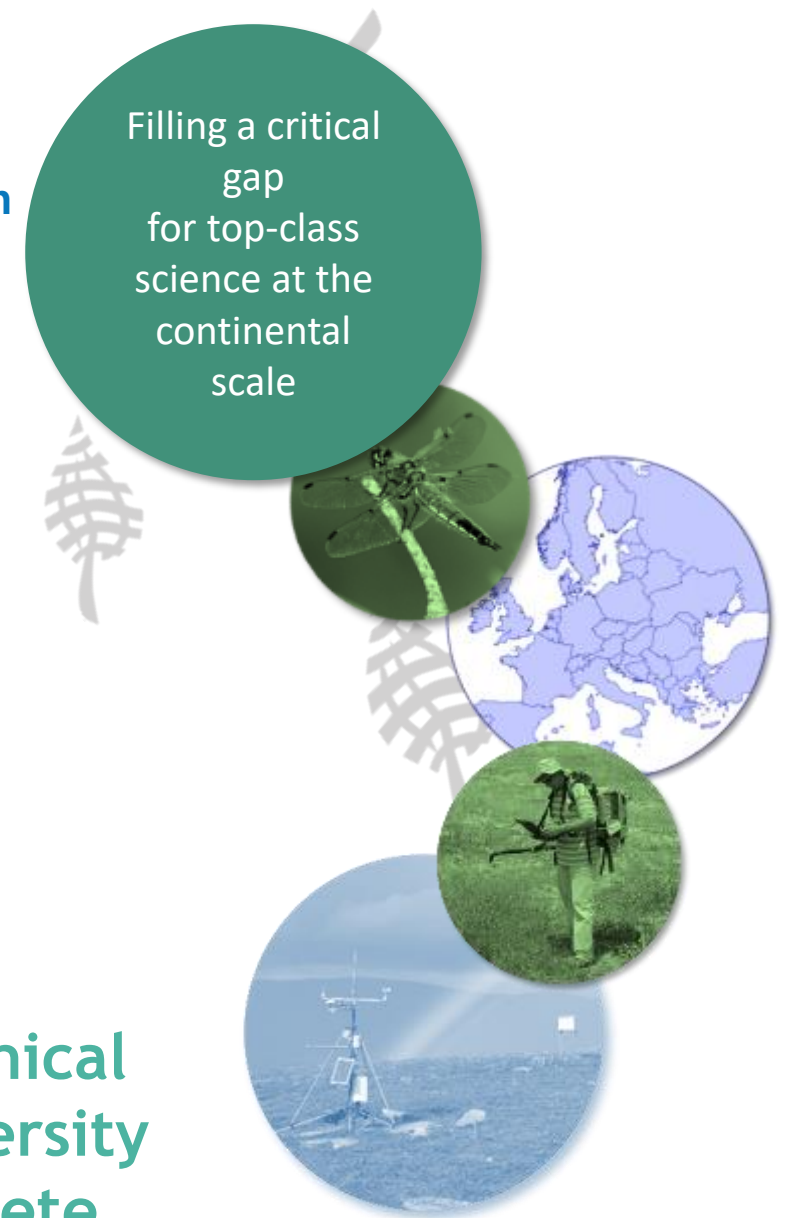
Nature-Based Solutions for Climate Change Adaptation and Mitigation

Taiwan International Water Week 2020
Water Resources Agency, Taipei Sept 23-25, 2020

Professor Nikolaos P. Nikolaidis



Technical
University
Of Crete



Grand Societal Challenges



Climate Change



Food Security



Water Security



Disaster Risk



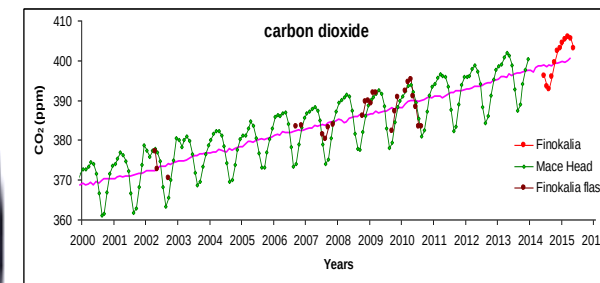
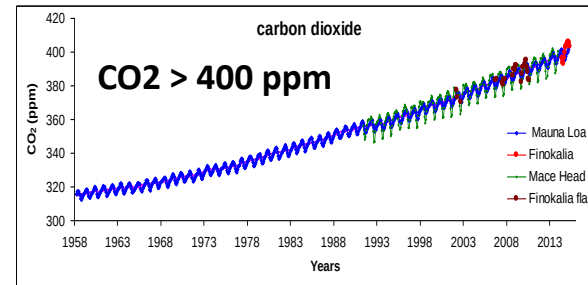
Human Health



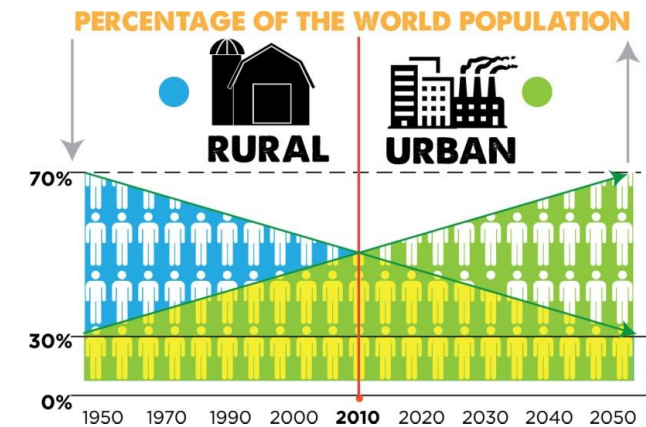
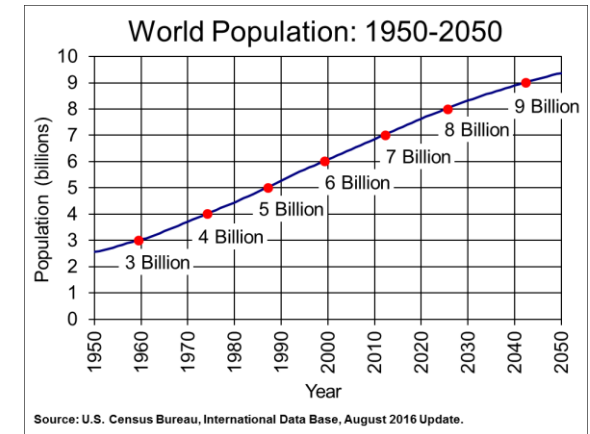
Economic and
Social
Development



Food – Water – Energy Nexus



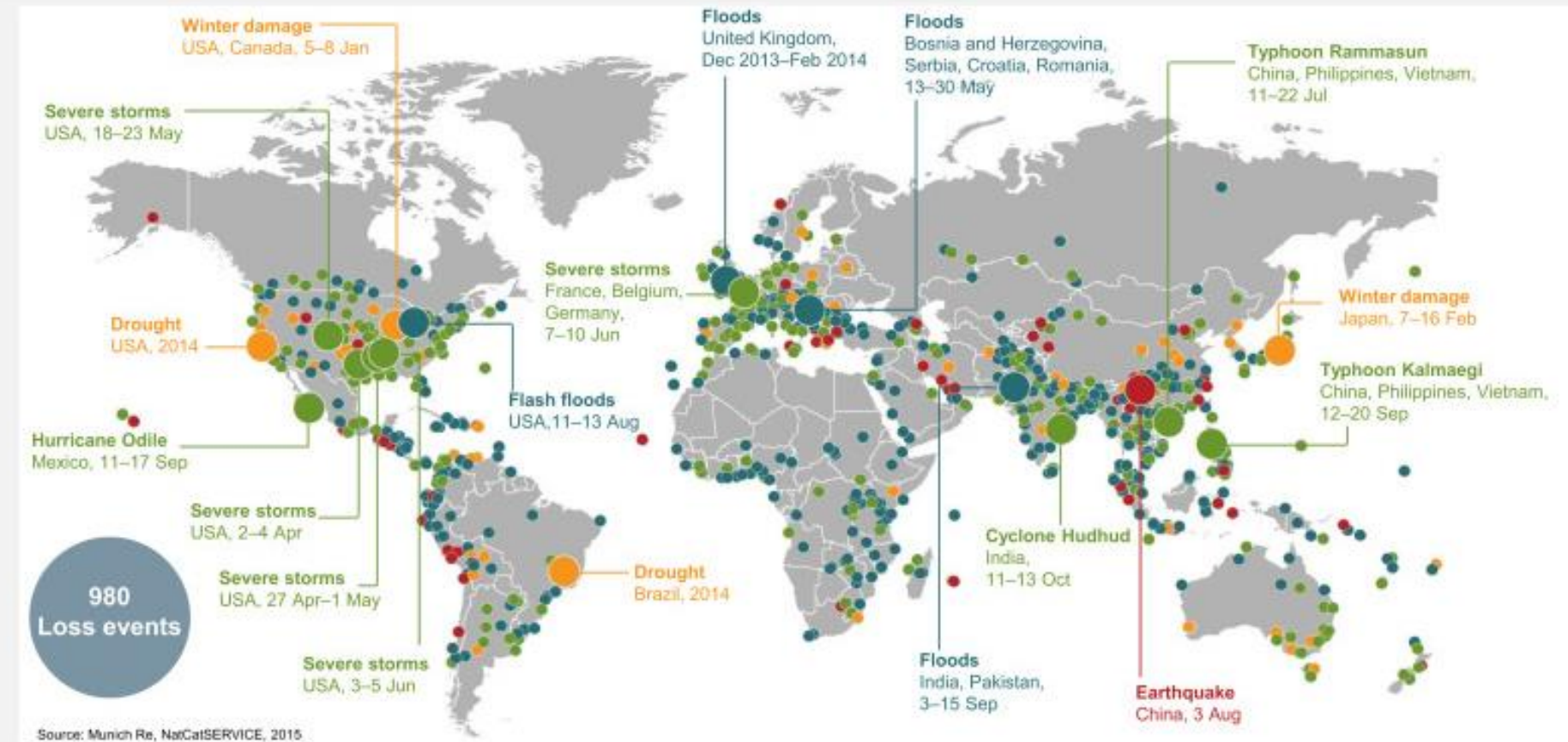
**50% increase in GHG
685 ppm CO₂ and
3-6° C temperature rise**



Loss events worldwide 2014 (NatCatSERVICE - Munich RE)

Climate Change Impacts

- Water scarcity, droughts and extreme temperatures
- Storms, floods, ice and snow
- Sea level rise



○ **Loss events**

○ **Selection of catastrophes**
Overall losses ≥ US\$ 1,500m

● **Geophysical events**
(Earthquake, tsunami, volcanic activity)

● **Meteorological events**
(Tropical storm, extratropical storm, convective storm, local storm)

● **Hydrological events**
(Flood, mass movement)

● **Climatological events**
(Extreme temperature, drought, wildfire)

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Contents lists available at [ScienceDirect](http://www.sciencedirect.com)

Weather and Climate Extremes

journal homepage: www.elsevier.com/locate/wace

Trends in weather related disasters – Consequences for insurers and society

Peter Hoeppe

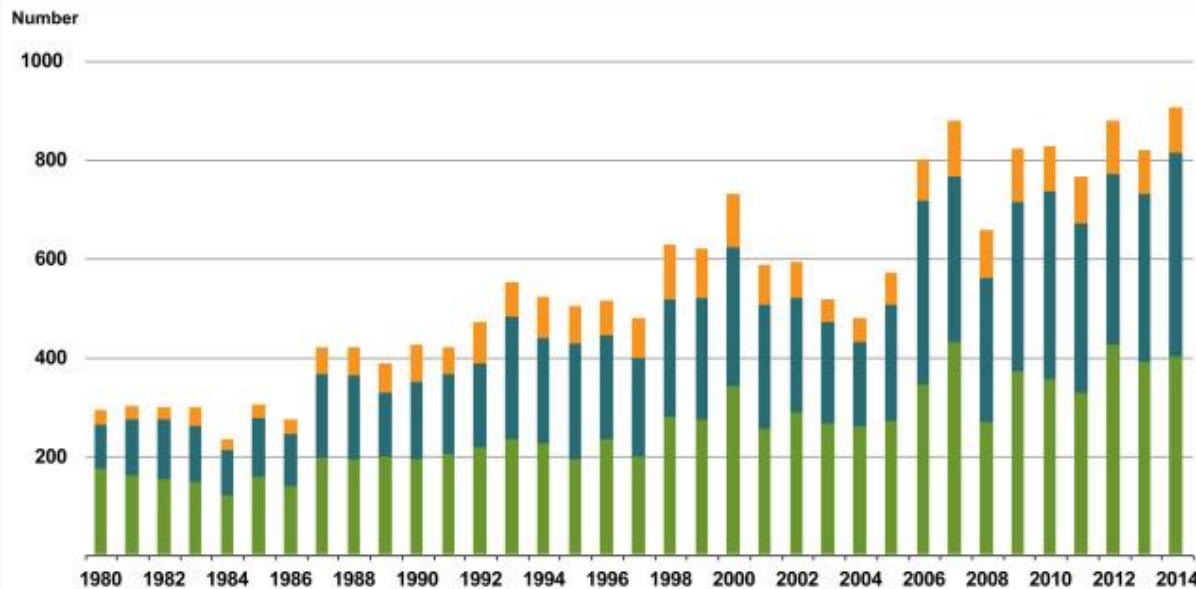
Head of Geo Risks Research/Corporate Climate Centre, Munich Re, Munich, Germany

Trends in Hydro-Meteorological Loss Events

NatCatSERVICE

Weather related loss events worldwide 1980 – 2014

Number of events



■ **Meteorological events**
 (Tropical storm, extratropical storm, convective storm, local storm)

■ **Hydrological events**
 (Flood, mass movement)

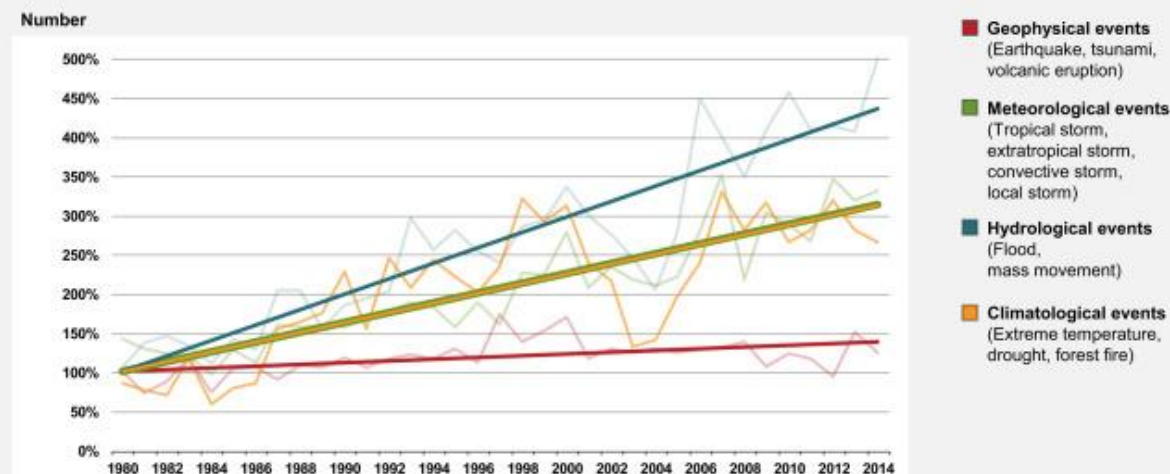
■ **Climatological events**
 (Extreme temperature, drought, forest fire)

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NatCatSERVICE

Loss events worldwide 1980 – 2014

Number of events with relative trend



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Global Loss Events 1980-2014

21,700 Loss events



1,740,000 Fatalities*



*Number of fatalities without famine

Overall losses** US\$ 4,200bn



**Losses in 2014 values, adjusted to inflation based on country CPI

Insured losses** US\$ 1,100bn



**Losses in 2014 values, adjusted to inflation based on country CPI

Geophysical events
(Earthquake, tsunami, volcanic activity)

Meteorological events
(Tropical storm, extratropical storm, convective storm, local storm)

Hydrological events
(Flood, mass movement)

Climatological events
(Extreme temperature, drought, forest fire)

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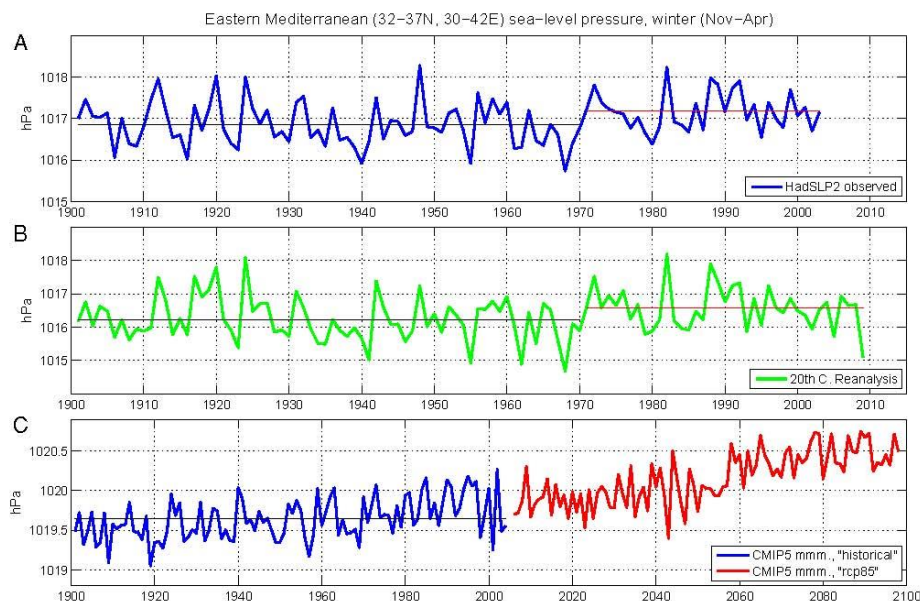
Climate change in the Fertile Crescent and implications of the recent Syrian drought

Colin P. Kelley^{a,1}, Shahrzad Mohtadi^b, Mark A. Cane^c, Richard Seager^c, and Yochanan Kushnir^c

^aUniversity of California, Santa Barbara, CA 93106; ^bSchool of International and Public Affairs, Columbia University, New York, NY 10027; and ^cLamont-Doherty Earth Observatory, Columbia University, Palisades, NY 10964

Edited by Brian John Hoskins, Imperial College London, London, United Kingdom, and approved January 30, 2015 (received for review November 16, 2014)

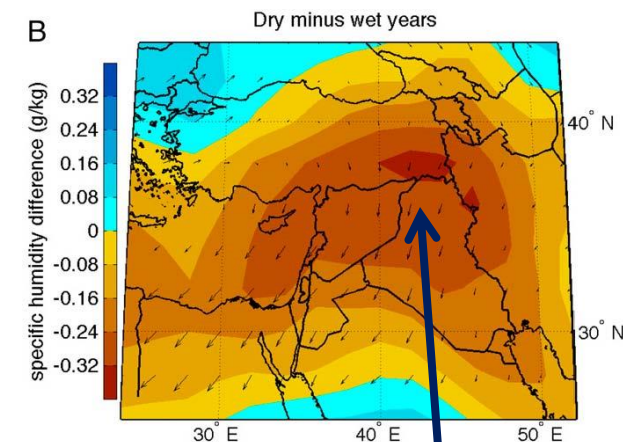
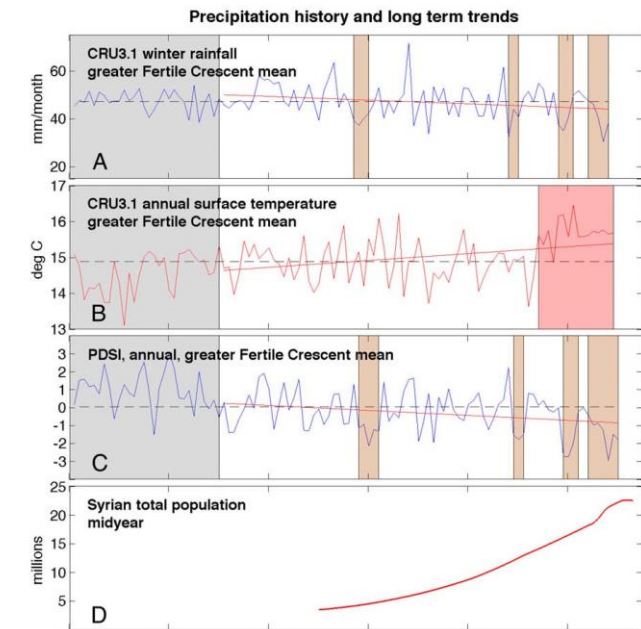
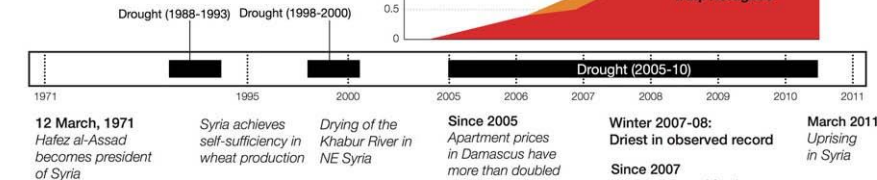
Before the Syrian uprising that began in 2011, the greater Fertile Crescent experienced the most severe drought in the instrumental record. For Syria, a country marked by poor governance and un- Syria's water security by exploiting limited land and water resources without regard for sustainability (10). One critical consequence of these unsustainable policies is the



Timeline of Events Prior to the 2011 Uprising

1970s–1990s

Agricultural policies promote production of staple crops, leading to increase in number of groundwater wells and use of inefficient and outdated irrigation methods



Climate Change → Higher sea level pressure → multi-year droughts → urbanization

Fertile crescent
climate anomaly

Land Management and Critical Zone Science: Treetop to Bedrock



Soil Ecosystem Functions:

- Food and biomass production
- Biodiversity
- Carbon sequestration
- Water filtration and transformation
- Raw material
- Landscape and heritage

Soil ecosystem functions are derived from the dynamic actions of plant, animal and microorganism communities and the non-living environment interacting as a unit.

Humans have not integrated themselves in the soil ecosystem, but depended on its services for sustenance.

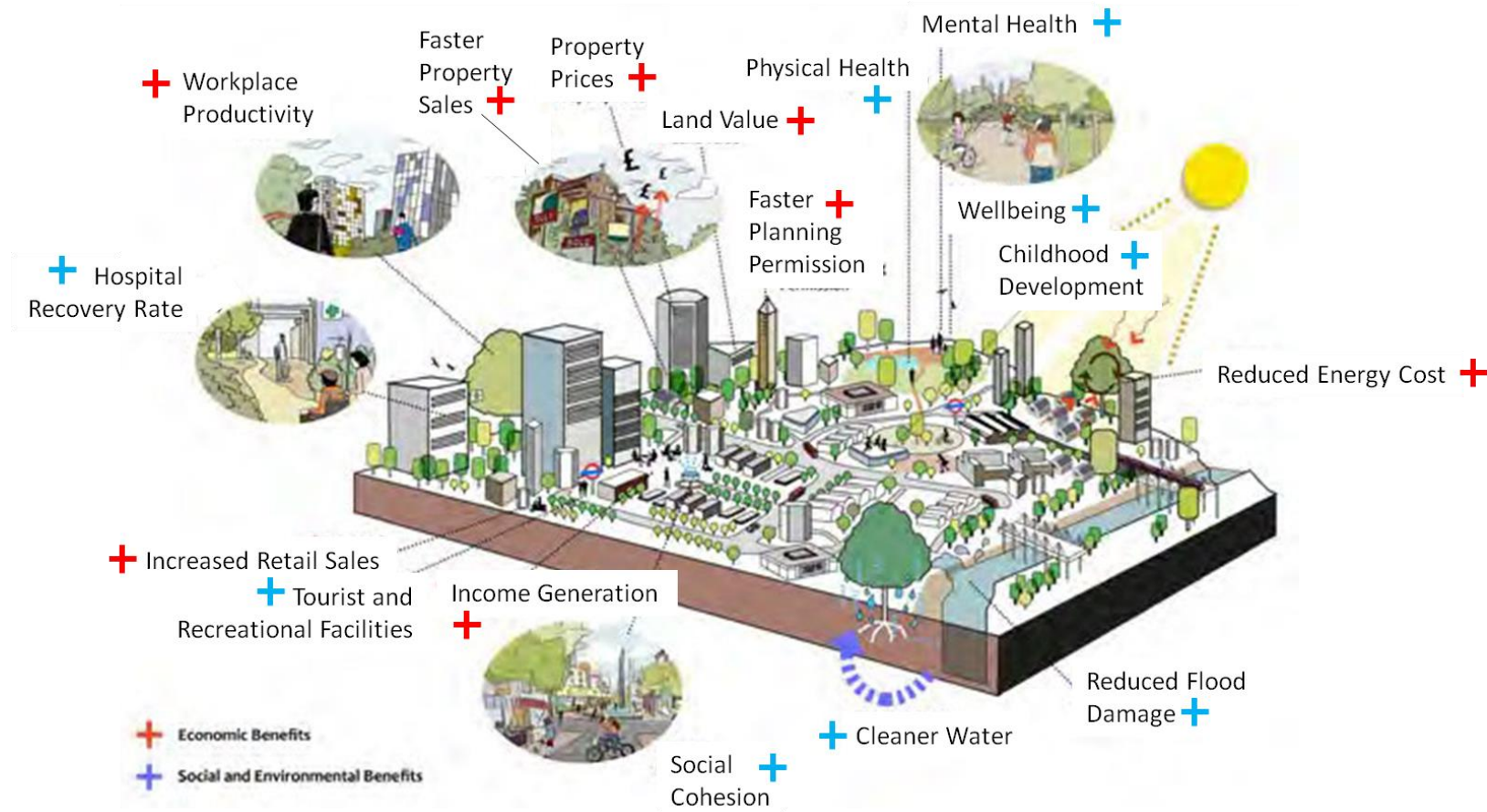
Solutions inspired by NATURE – The Grand Engineer

Nature Based Solutions

Living solutions inspired and supported by nature that simultaneously provide environmental, social and economic benefits and help to build resilience

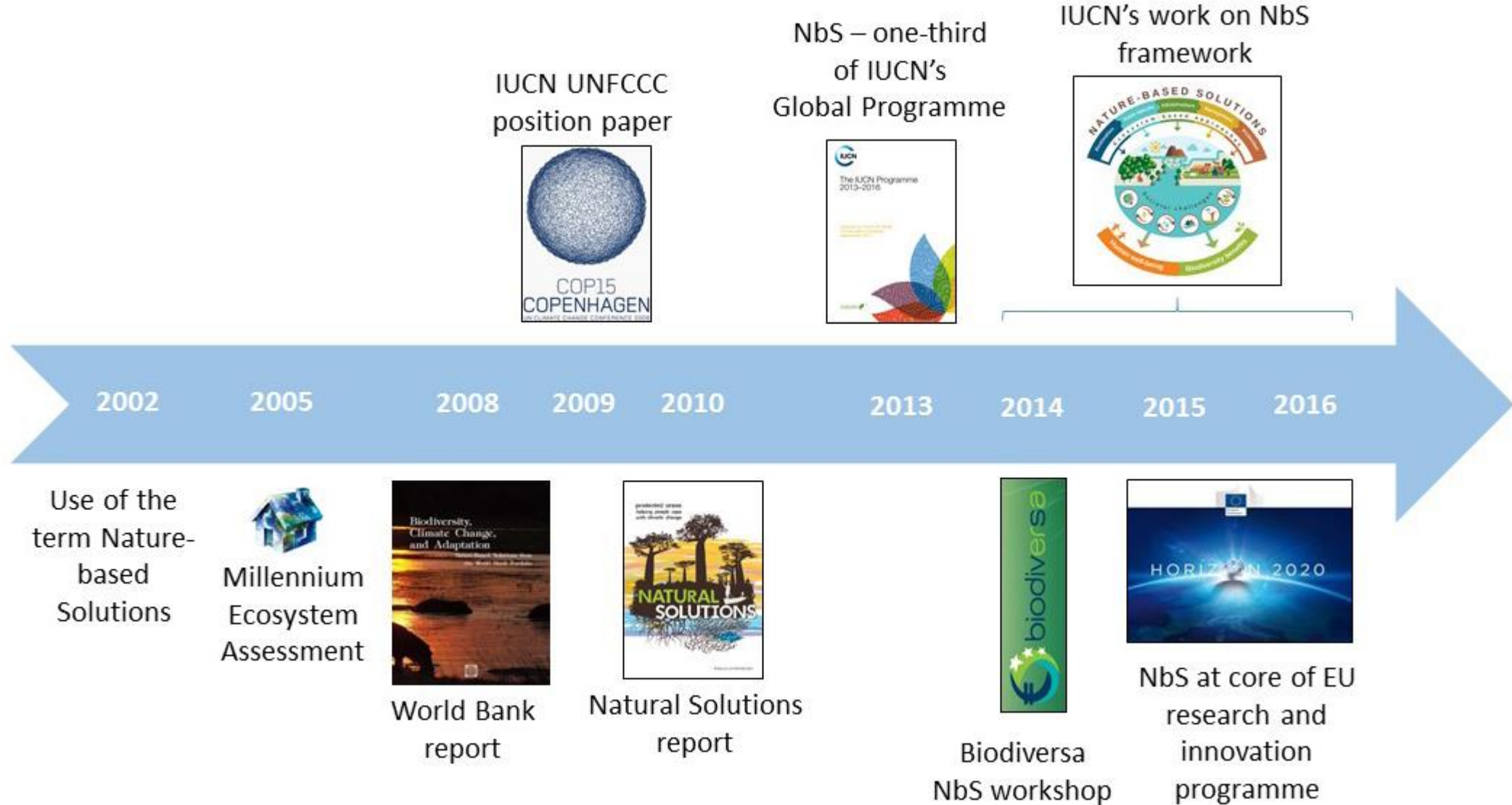
Solutions that bring more nature and natural features and processes into cities, landscapes and seascapes, through locally adapted, resource-efficient and systemic interventions

Green Infrastructure Benefits
(Sustainable Cities Collective –
Pinterest image collection)



Benefits and co-benefits

Timeline for the evolution of NbS



The ThinkNature Platform

<https://platform.think-nature.eu>

Nikolaos Nikolaidis 



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WELCOME TO THE THINKNATURE PLATFORM!

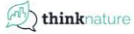
A multi-stakeholder communication platform supporting the understanding and promotion of Nature based Solutions (NbS).

A continuous dialogue & interaction on NbS to:

- steer dialogue through forums and debates
- identify, communicate & promote successful NbS
- identify regulatory, economic & technical barriers
- foster collaboration at local, regional, national & EU levels
- develop synergy with other projects on NbS



News – Events – Social Media and Networking Hub

Home NbS knowledge hub

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- identify regulatory, economic & technical barriers
- foster collaboration at local, regional, national & EU levels
- develop synergy with other projects on NbS



Upcoming Events

5th European Urban Green Infrastructure Conference - EU-GIC 2019 London Olympic Park, London
April 10, 2019 to April 11, 2019

Survey on NbS
Survey on EU Research and Innovation needs on Nature Based Solutions

[Go to survey](#)

Cooperation Manifesto
NATURE-BASED SOLUTIONS
Re-naturing cities through the cooperation and support of the European Nature-Based Solutions Projects

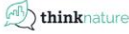
[Sign the Manifesto](#)

Number of signatures collected: 217



Paris Forum on Nature-Based Solutions
ThinkNature is announcing the Paris Forum on Nature-Based Solutions
Addressing Major Societal Challenges:
• Climate Change Adaptation and Mitigation,
• Risk Management and Resilience

[More information](#)

ThinkNature Summer School 2019

ThinkNature is announcing the Summer School Nature-Based Solutions
• From Theory to Practice, 2-6 September 2019, Chania, Greece

[Register Now](#)

NbS101: Nature-based solutions for beginners
Material for those who want to know more about Nature based Solutions (NbS)

[Learn more](#)

NbS101

"An NbS Hub, unique contact point for online dialogue, knowledge repository and networking."

Latest entries

ThinkNature Webinar 1

NbS Resource Document Report
This report was prepared by Emmanuelle Cohen-Grozdan, Nikolaos Nikolaidis, Nadja Kobisch (as ThinkNature webinar speakers) and ThinkNature webinars Team in order to provide an overview of the 1st.
Submitted on March 27, 2019 - 15:46m

Discussion - Q&A: M. Samamunis, T. Armour, D. Theodorou, FORTH - ThinkNature Webinar 2

Video/ Webinar Resource Webinar 2
This recording concerns the discussion and Q&A section during the second ThinkNature webinar of 14/3/2019 about "Technology and Practice of NbS". This webinar invited scientists, potential NbS.

Networking Hub

Bringing together multi-disciplinary expertise to deliver ambitious NbS

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Greece - HERAKLION CRETE



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Case Study Hub – Knowledge Repository - Dialogue



Case Studies

Home NbS Knowledge Hub

"A NbS Case Studies Hub"

Explore exemplary NbS case studies worldwide and learn from best.

Topics Go

Regions Go



NbS Case Studies



Operationalising ecosystem services in urban land-use planning in Sibbesborg near Helsinki

Exploring how ecosystem services can be integrated in a land-use planning process using a real-life planning case. A special focus is on multifunctional green infrastructure and applying new tools to operationalise ecosystem services in the plans in a participatory way.

Scale
Local
Regions
Ecosystems
Urban, Rivers and Lakes



Valuation of urban ecosystem services in Oslo

Conducting an integrated assessment and valuation of urban ecosystem services, which supports urban management and decision-making in Oslo. This synthesises the external and limitations of the concepts of ecosystem services and natural capital in an urban and Norwegian context.

Scale
Local
Regions
Ecosystems
Urban



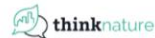
Towards the design and implementation of a green infrastructure strategy in Vitoria-Gasteiz

Demonstrating the benefits of incorporating a network of green spaces in the urban planning. This multifunctional "green infrastructure" network supplies ecosystem services and benefits to the city.



Supporting sustainable land use and water management practices in the Kiskunság National Park, Hungary

Supporting sustainable land use and water management practices. By identifying the main problems and involving local stakeholders the basis will be laid for the later resolution of the water-management conflicts in the area and the introduction of



NbS Knowledge Hub

Home NbS Knowledge Hub

Knowledge Repository

A Hub for online resources on NbS state-of-the-art practise.

Search Sort by

Latest entries

ThinkNature Webinar 1

NbS Resource Document Report
This report was prepared by Emmanuelle Cohen-Shacham, Nikolaos Nikolaidis, Nadja Kobisch (1st ThinkNature Webinar speakers) and ThinkNature Webinars Team in order to provide an overview of the 1st.
Submitted on March 27, 2019 - 5:34pm

Discussion - Q&A, M. Santamours, T. Armour, D. Theochari, FORTH - ThinkNature Webinar 2

Video/Webinar Resource Webinar
This recording concerns the discussion and Q&A section during the second ThinkNature webinar at 14/3/2019 about "Technology and Practice of NbS". This webinar invited scientists, potential NbS.
Submitted on March 19, 2019 - 5:27pm

Effective Practices and New Concepts in the Design and Implementation of NbS, D. Theochari - ThinkNature Webinar 2

Video/Webinar Resource Webinar
This recording concerns the first presentation about NbS water-related practices, presented by Dimitra Theochari during the second ThinkNature webinar at 14/3/2019 about "Technology and Practice of NbS".
Submitted on March 19, 2019 - 5:20pm

Technology and Practice on NbS, T. Armour - ThinkNature Webinar 2

Video/Webinar Resource Webinar
This recording concerns the second presentation about NbS landscape practices, presented by Tom Armour during the second ThinkNature webinar at 14/3/2019 about "Technology and Practice of NbS".
Submitted on March 19, 2019 - 5:18pm

Cooling our Cities: Advances in Science and Design for the Mitigation of Urban Heat, M. Santamours - ThinkNature Webinar 2

Video/Webinar Resource Webinar
This recording concerns the first presentation about mitigating climate change in urban areas, presented by Mathews Santamours during the second ThinkNature webinar at 14/3/2019 about "Technology and Practice of NbS".
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Submitted on March 19, 2019 - 5:18pm

NBS Latest Documents

ThinkNature Webinar 1

Updated date: March 27, 2019 - 5:34pm
This report was prepared by Emmanuelle Cohen-Shacham, Nikolaos Nikolaidis, Nadja Kobisch (1st ThinkNature Webinar speakers) and ThinkNature Webinars Team in order to provide an overview of the 1st ThinkNature webinar "NbS Concept, Practices and Benefits" about the presented issues by speakers, panel results and the discussion (attendees' questions and speakers' answers) in the end of the Webinar. Effective Practices and New Concepts in the Design and Implementation of NbS - ThinkNature Webinar 2

Updated date: March 19, 2019 - 4:45pm

This document concerns the third presentation about NbS water-related practices, presented by Dimitra Theochari during the second ThinkNature webinar about "Technology and Practice of NbS". This webinar invited scientists, potential NbS practitioners, market actors and end users, to discover aspects relevant to technology and practice of NbS. In the context of this webinar, the above-mentioned issues were presented by major NbS experts and the attendees had the opportunity to participate in short surveys and pose their own questions regarding the presented issues to the speakers.

Technology and Practice on NbS - ThinkNature Webinar 2

Updated date: March 19, 2019 - 4:45pm

This document concerns the second presentation about NbS landscape practices, presented by Tom Armour during the second ThinkNature webinar about "Technology and Practice of NbS". This webinar invited scientists, potential NbS practitioners, market actors and end users, to discover aspects relevant to technology and practice of NbS. In the context of this webinar, the above-mentioned issues were presented by major NbS experts and the attendees had the opportunity to participate in short surveys and pose their own questions regarding the presented issues to the speakers.

Cooling our Cities: Advances in Science and Design for the Mitigation of Urban Heat - ThinkNature Webinar 2

Updated date: March 19, 2019 - 4:31pm

Upcoming Events

3rd European Urban Green Infrastructure Conference - EUGIC 2019 London
Olympic Park, London
April 10, 2019 to April 11, 2019

NbS Videos

Discussion - Q&A, M. Santamours, T. Armour, D. Theochari, FORTH - ThinkNature Webinar 2

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Participate in the Dialogue!

Forums and Debates under Four Priority Areas and Enhance Your Knowledge on NbS. Join the Discussion, Get A

Sustainable Urbanisation in cities



This domain will initiate and sustain dialogue among the various stakeholders (private and public sector, architects, practitioners, policy maker), on nature-based solutions in the context of degraded ecosystems restoration. The dialogue will address the expanding resource needs for land within Europe and how to prioritize agriculture, forestry, energy, transport and industry. The role of combined efforts in this field as well as innovative techniques for restoring and reclaiming land, such as soil fertility restoration techniques...

Restoring degraded ecosystems using NbS



This domain will initiate and sustain dialogue among the various stakeholders (private and public sector, architects, practitioners, policy maker), on nature-based solutions in the context of degraded ecosystems restoration. The dialogue will address the expanding resource needs for land within Europe and how to prioritize agriculture, forestry, energy, transport and industry. The role of combined efforts in this field as well as innovative techniques for restoring and reclaiming land, such as soil fertility restoration techniques...

Climate Change Adaptation and Mitigation



This domain will initiate and sustain dialogue among the various stakeholders (private and public sector, architects, practitioners, policy maker), on nature-based solutions in the context of climate change adaptation and mitigation. The dialogue will address integrated and holistic solutions that meet both adaptation and mitigation objectives and are applicable across different sectors such as integrating materials, green and blue infrastructure, and

Risk Management and Resilience



This domain will initiate and sustain dialogue among the various stakeholders (private and public sector, architects, practitioners, policy maker), on nature-based solutions in the context of risk management and resilience of NbS. The dialogue will address methods for combining NbS for risk management in various levels such as reduction of pollution, carbon storage, preservation of

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The ThinkNature Handbook – Capacity Building

Main Contents:

1. INTRODUCTION
 2. SCOPE
 3. CLASSIFICATION OF NATURE-BASED SOLUTIONS
 4. MULTIPLE AND MULTI-SCALE BENEFITS
 5. TECHNOLOGY AND PRACTICE
 6. FINANCING AND BUSINESS MODELS
 7. POLICY AND DECISION MAKING MECHANISMS
 8. FUTURE PERSPECTIVES
- ANNEX
- CASE STUDIES' PORTFOLIO



NBS Classification – 100 NBS

Based on the degree of intervention/level and type of engineering

TYPE 1 - no or minimal intervention in ecosystems - better use of natural/ protected ecosystems

- Protection and Conservation Strategies
- Urban Planning Strategies
- Monitoring
- Coastal areas

TYPE 2 - NBS for sustainability and multi-functionality of managed ecosystems

- Urban Green Spaces Management
- Waste Management

TYPE 3 - Design and management of new ecosystems

•Water

- Natural and semi-natural water bodies and hydrographic networks
- Constructed wetlands and built structures for water management
- Urban Blue infrastructure
- Coastal areas

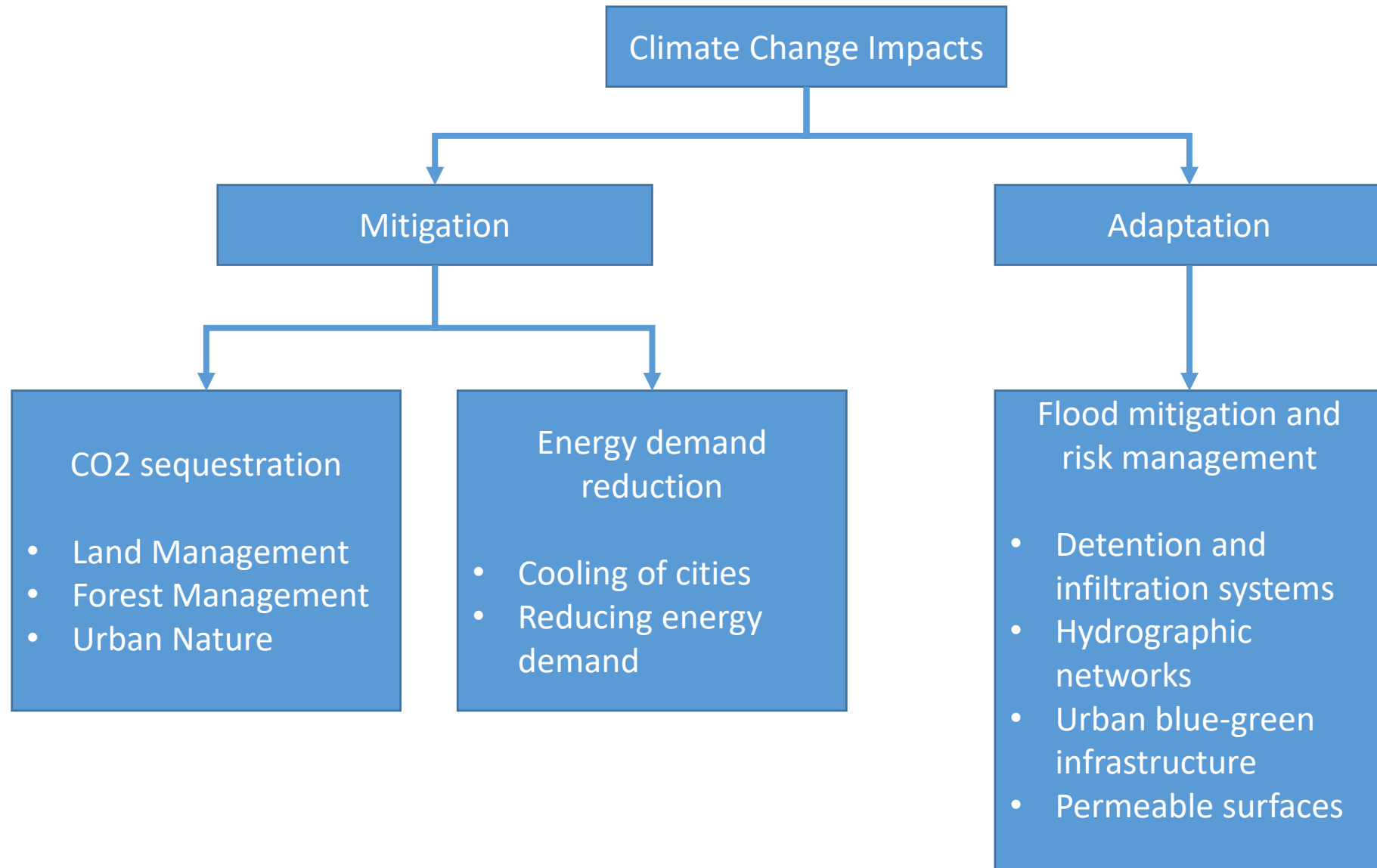
TYPE 3 - Design and management of new ecosystems

•Ground

- Parks and gardens
- Urban network structures
- Structures for food and resources production
- Ecological restoration
- Choices of plants
- Systems for erosion control
- Works on soil

•Building and Structures

- Green roofs
- Green Walls
- Vegetated Pergola
- Materials



NBS practices in urban areas

Coupling green roof & urban farming



Farming fields in New York City

Therapeutic gardens



Herb garden in Southmead Hospital, UK

Vertical mobile gardens



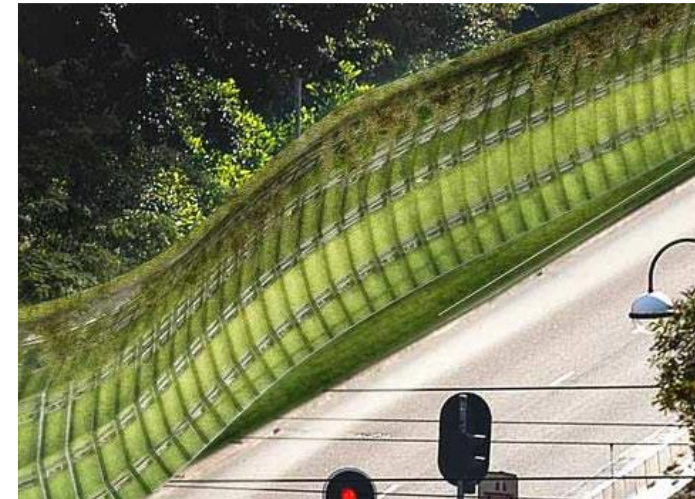
CityTree



Green covering shelters



Green barriers



Rebuilding nature in the landscape

Green corridors



Lisbon Green Corridor

Rural land management: Agroforestry



Agroforestry in Montpellier

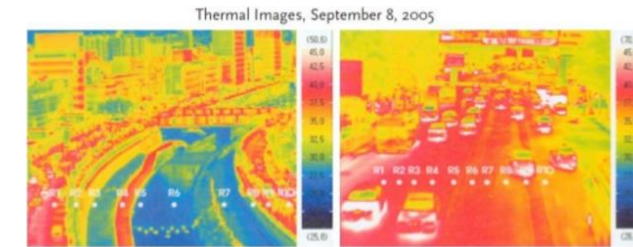
Constructed wetlands



Constructed wetland, Gorla Maggiore, Italy

Seoul, Korea: Opening up of Cheonggyecheon River

Urban Regeneration and Climate Change Adaptation



Opening up of Cheonggyecheon River in **Seoul (Korea)**

Copenhagen Cloudburst Management Plan



Location

Copenhagen,
Denmark



Region

Northern Temperate



Ecosystem

Urban



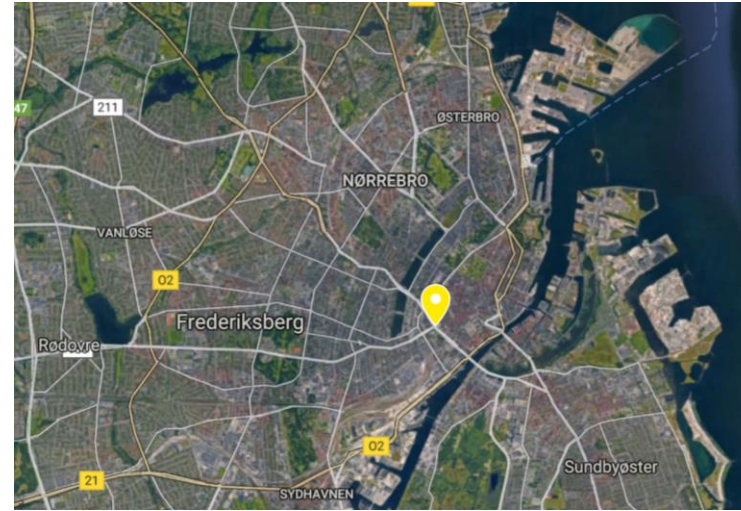
Goals

- Enhancing sustainable urbanisation
- Developing climate change adaptation; improving risk management and resilience

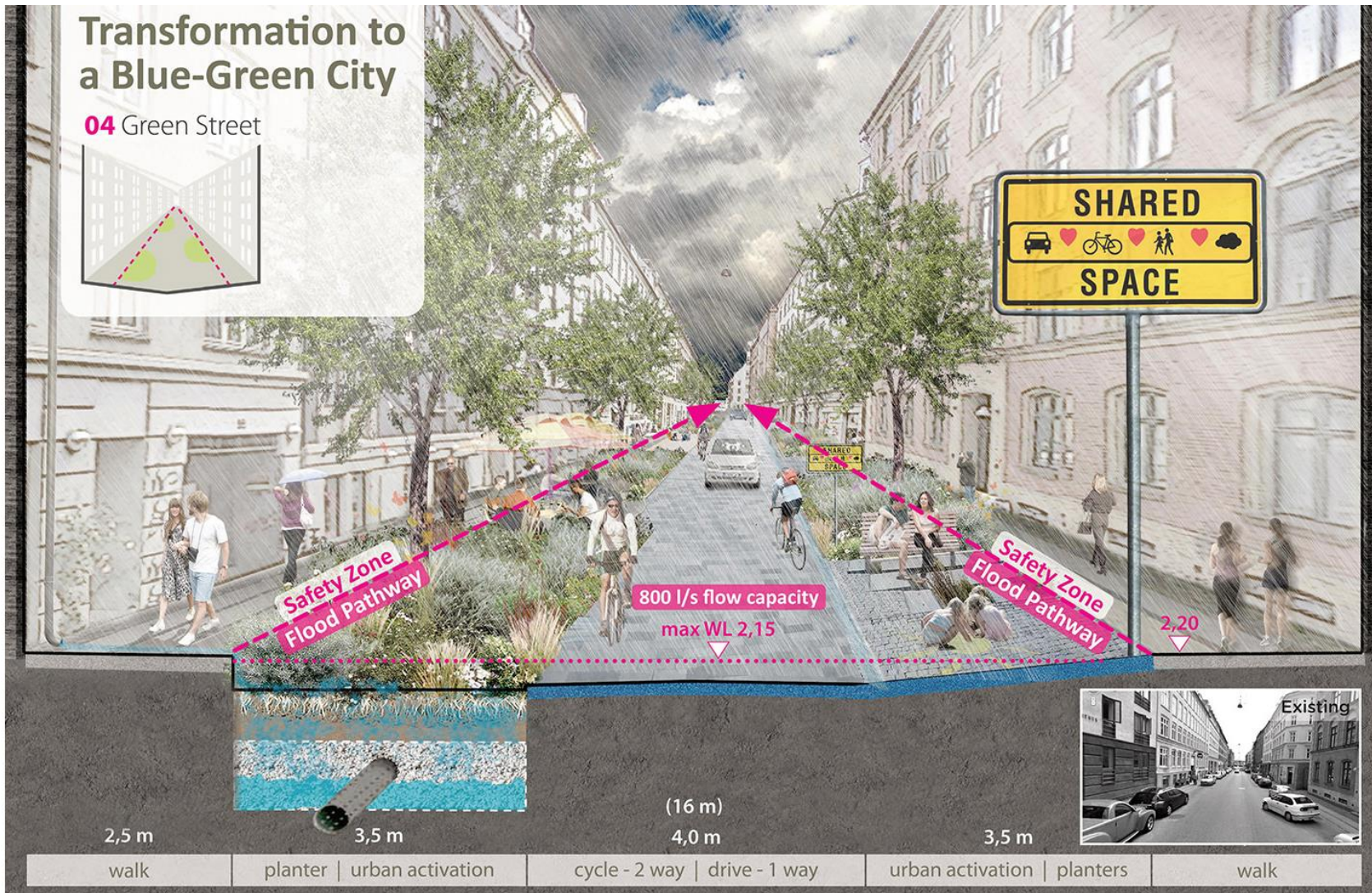


Action

Nature-based
solutions and the
insurance value of
ecosystems



Copenhagen Cloudburst Management Plan



Photos Credit: Ramboll and Ramboll Studio Dreiseitl

Yanweizhou Wetland Park

Multi-functional nature-based watershed management and ecosystem Restoration

Keywords

Human well-being,
Biodiversity,
Landscape,
Green infrastructure,
Green space
management (including
enhancing/ conserving
urban biodiversity,
Resilience

Timeframe

Design: 08/2010-
10/2013 Construction:
2014-2015

Awards

2015WAF Landscape of
the Year

Client

Jinhua Municipal

Government

Design Team

Turenscape- Kongjian

Yu



Credit: Turenscape architects



NBS implementation barriers

- Technical,
- Policy or legislative,
- Market, and
- Communication barriers.



*Vertical Forest realized in the centre of Milan
Architect Stefano Boeri*

Inadequate technical knowledge regarding the design and implementation of NBS has been identified as an obstacle for effective implementation .

The **knowledge gaps** refer to the design, implementation and maintenance of NBS, the quantification of the benefits and co-benefits, and the monitoring and assessment of the effectiveness of NBS.

Focus on:

- NBS co-design (participatory methods)
- Observatory science needed

Through an example



The new rooftop farm in Paris will be the largest of its kind in the world. Photograph: Valode & Pistre Architectes Atlav AJN



Ecosystem Restoration NBS Case Study

Koiliaris CZO - Riparian Forest Restoration and Flood Protection



Article

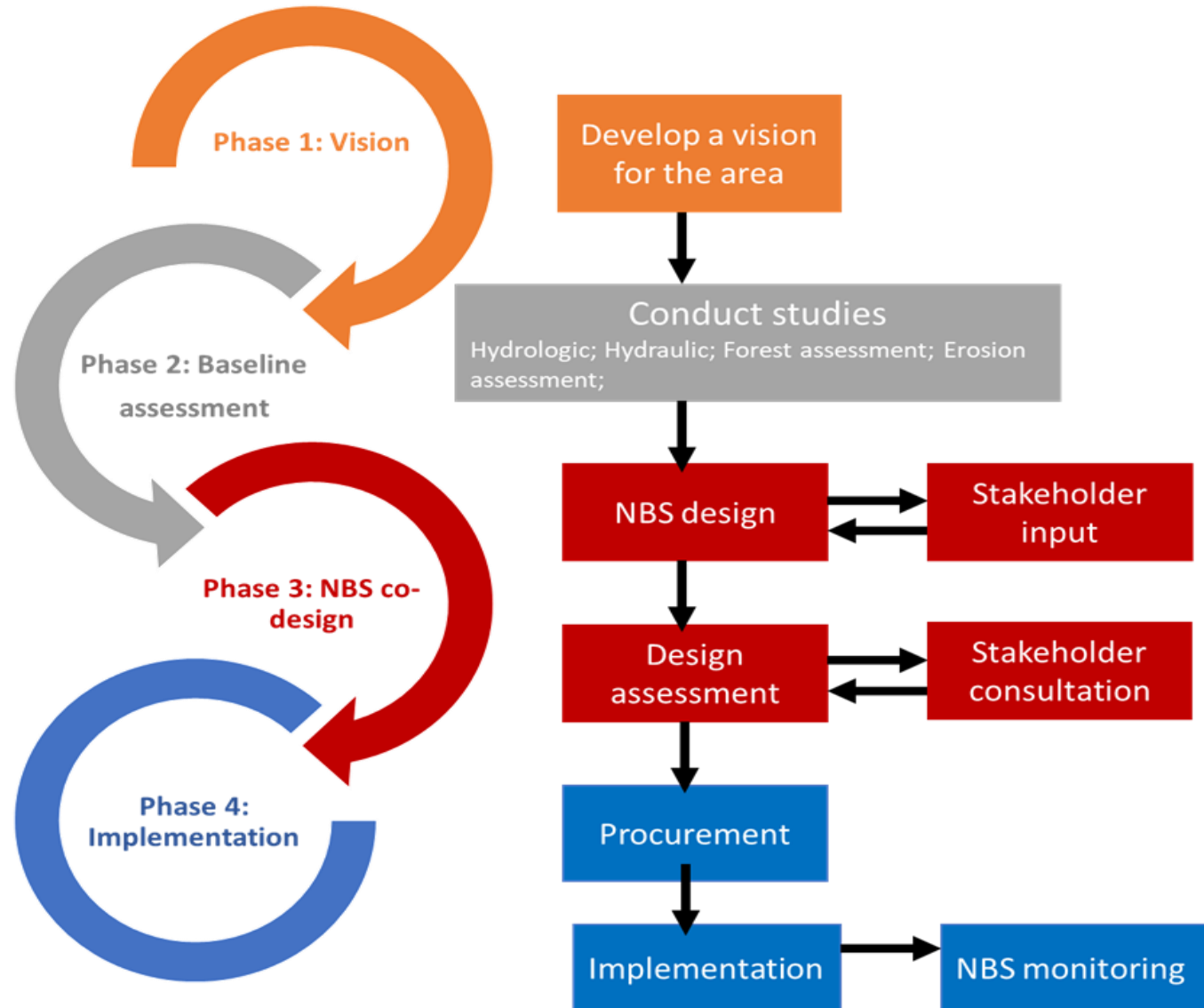
Vision-Based Decision-Making Methodology for Riparian Forest Restoration and Flood Protection Using Nature-Based Solutions

Maria A. Lilli ^{1,*}, Sofia D. Nerantzaki ¹, Christos Riziotis ¹, Manolis Kotronakis ¹,
Dionissis Efstathiou ¹, Dimitris Kontakos ^{2,3}, Petros Lymberakis ², Manolis Avramakis ²,
Antonis Tsakirakis ², Konstantinos Protopapadakis ¹ and Nikolaos P. Nikolaidis ¹

Decision-making methodology scheme for NBS implementation

Objective:

Develop a vision-based decision-making approach to designing and implementing NBS that would act as a driver to overcome potential barriers and enhance the social acceptability of the project.



Phase 1 – Developing the Vision

Koiliaris Critical Zone Observatory

- Hydrometeorological data
- Geochemical data
- Soil surveys (Biological and geochemical)
- Soil Formation and Degradation studies
- Experimental plots (soil fertility studies)
- Sustainable water and soil management

- Semi-arid climate
- Thin soils
- 300 Km from Sahara

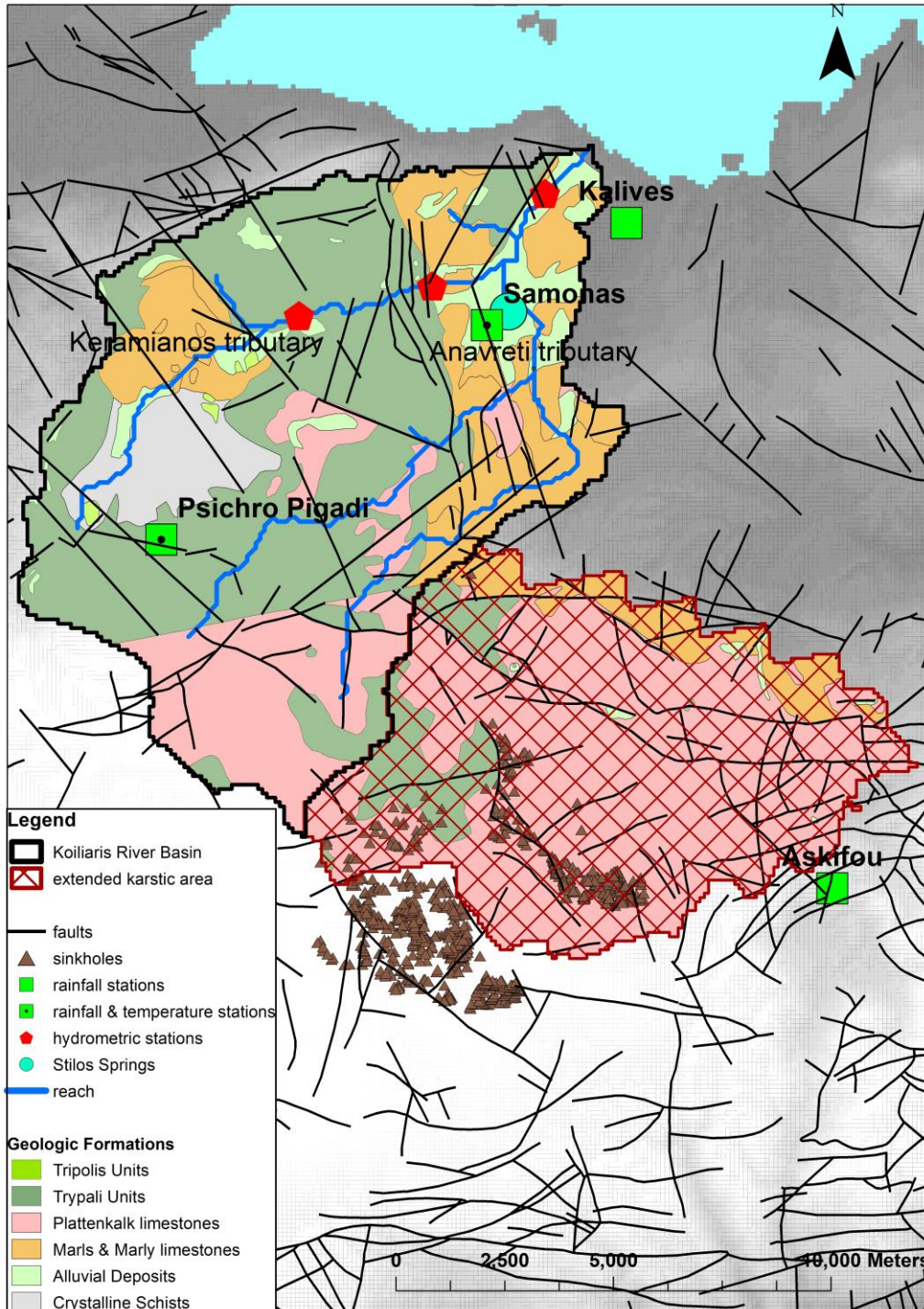




Greek Speleological Society: Chania
1110 m below surface (1600 -490 m)
Liontari sinkhole

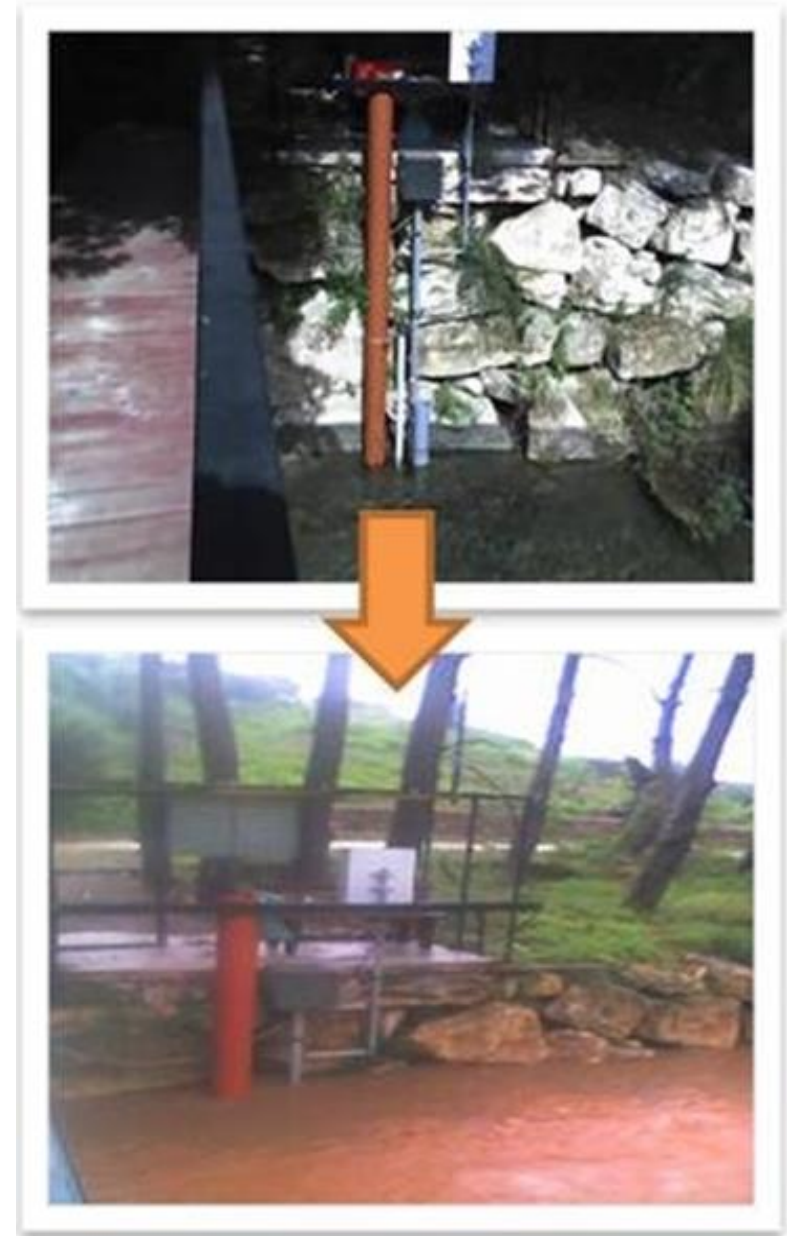
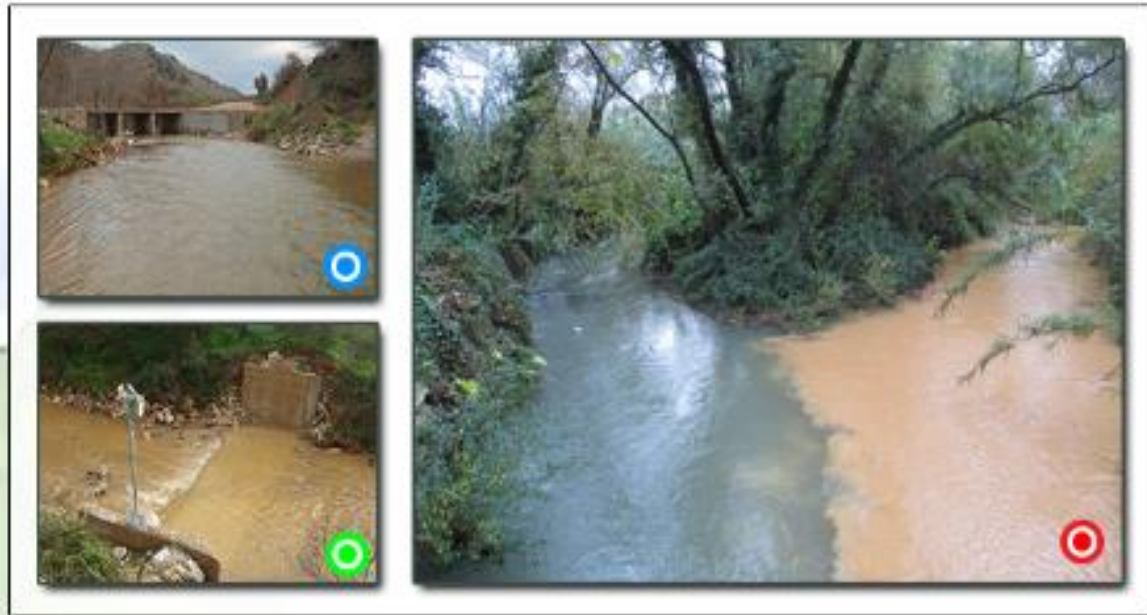
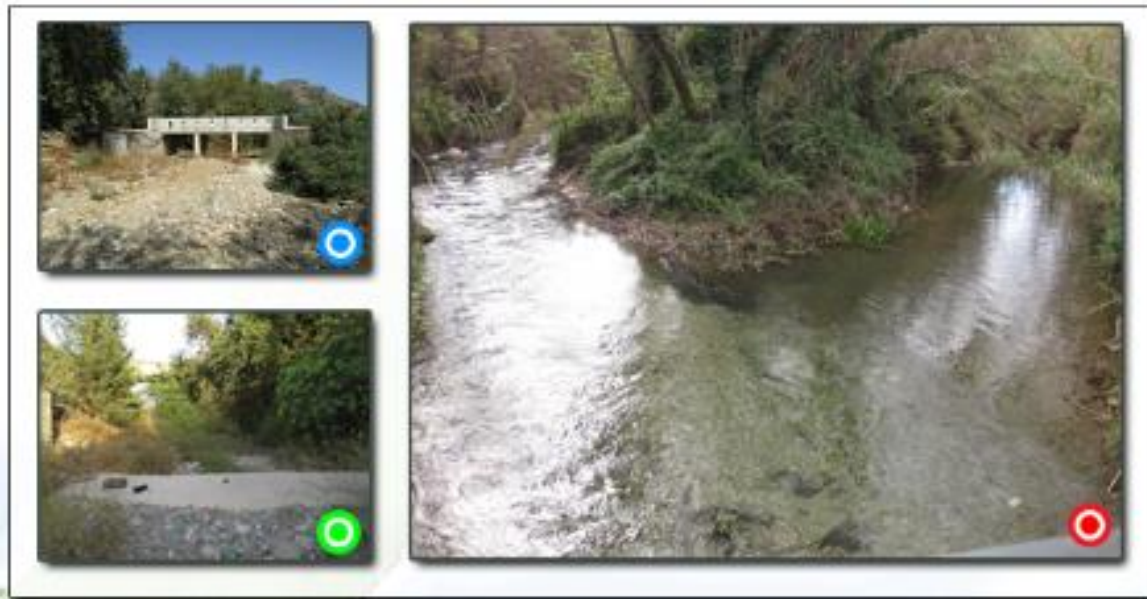


The White Mountains karstic system

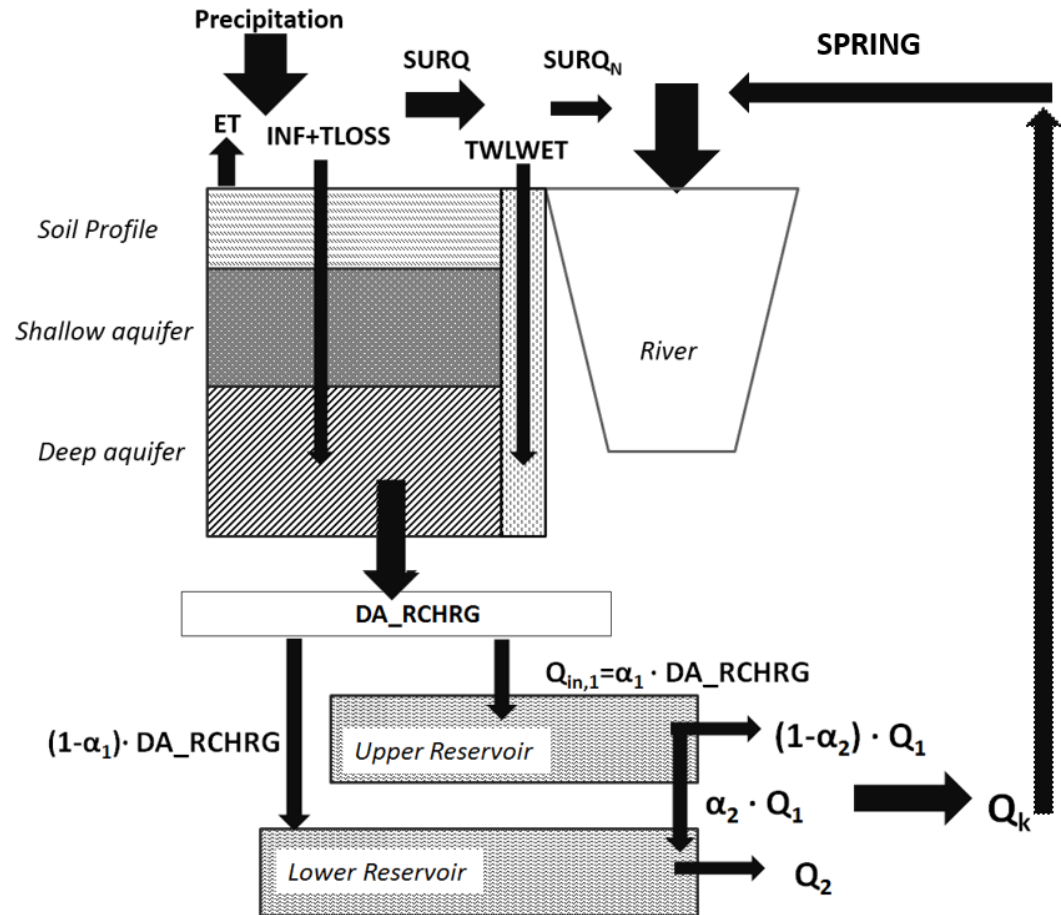
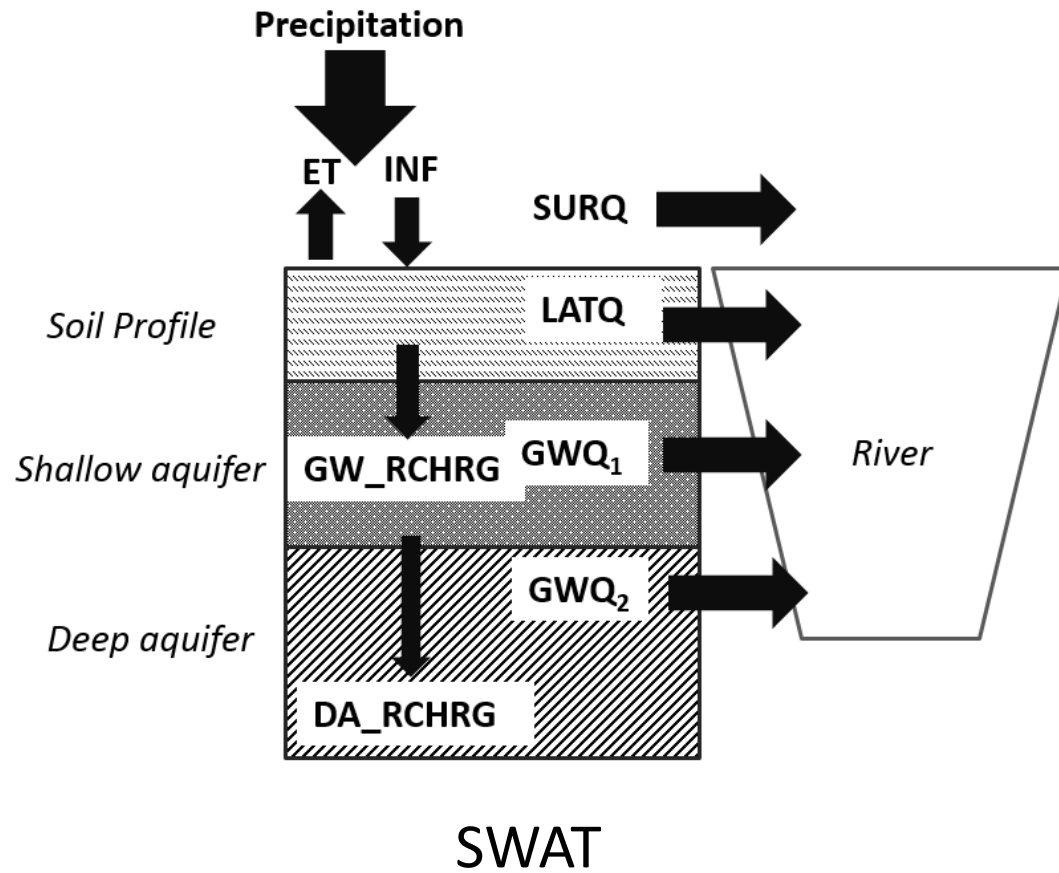


(Moraetis et al., 2010, Nikolaidis et al., 2013, Lilli et al., 2020)

Temporary Rivers and Flush Floods



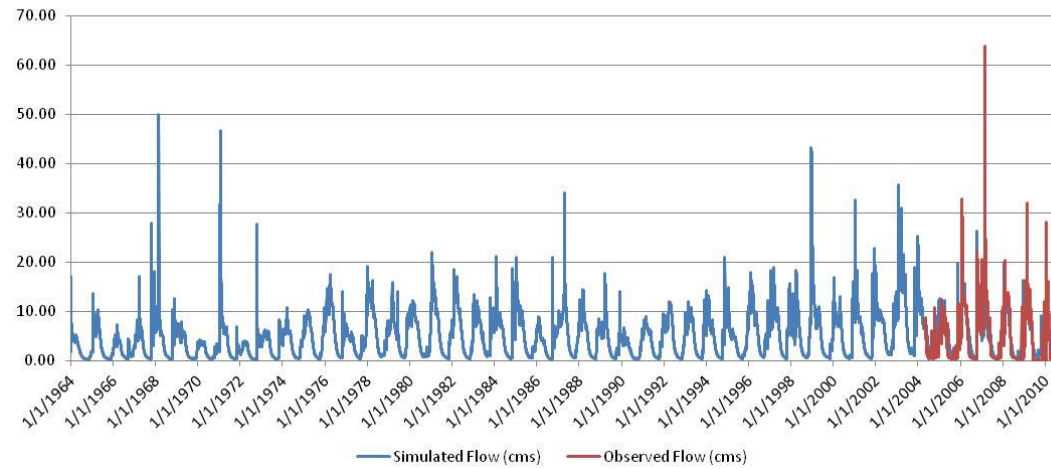
Modeling Framework



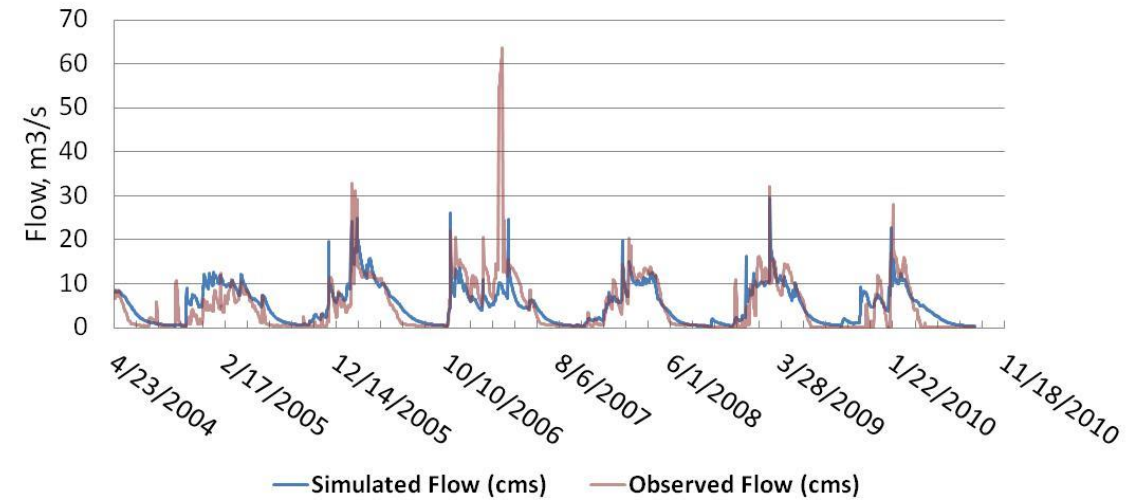
Karst-SWAT

Karst-SWAT Simulation

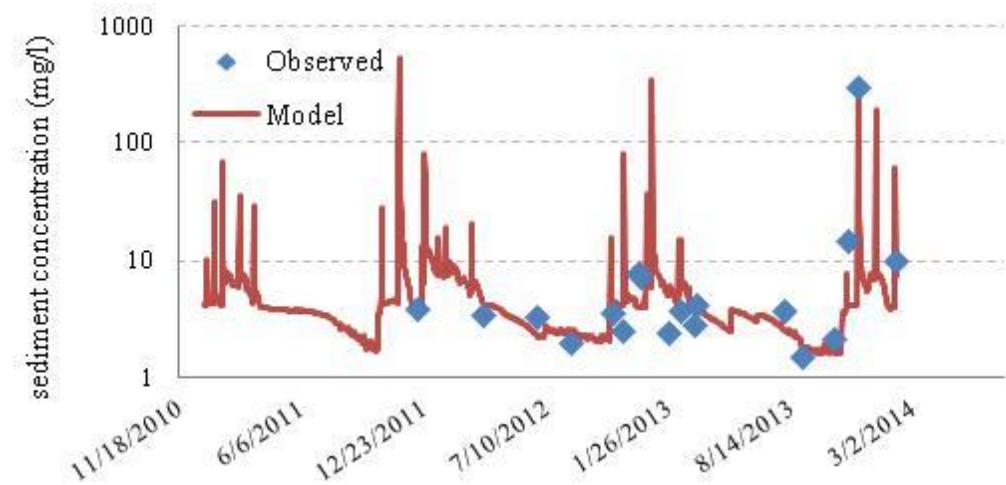
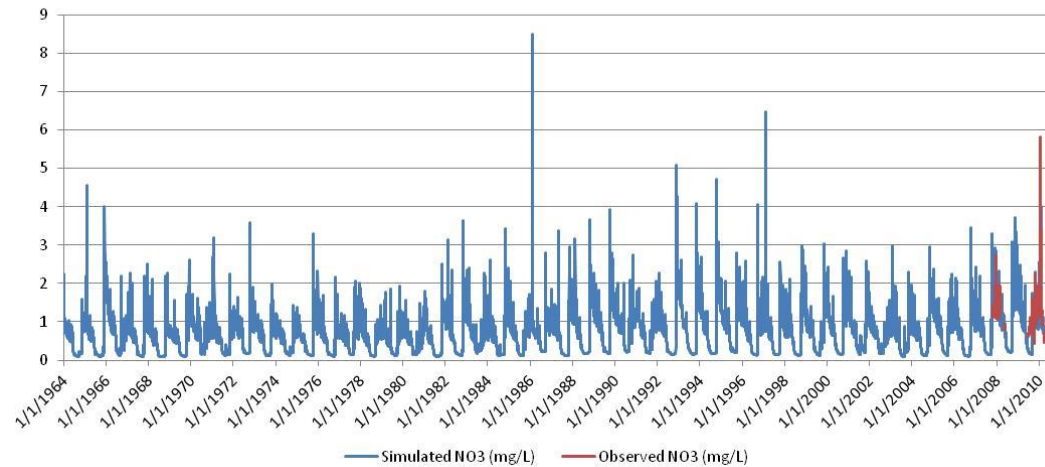
Koiliaris Flow



Flow 2004-2010



River Total NO₃-N mg/L



Climate Change Rainfall and Flow Uncertainty, mm/yr

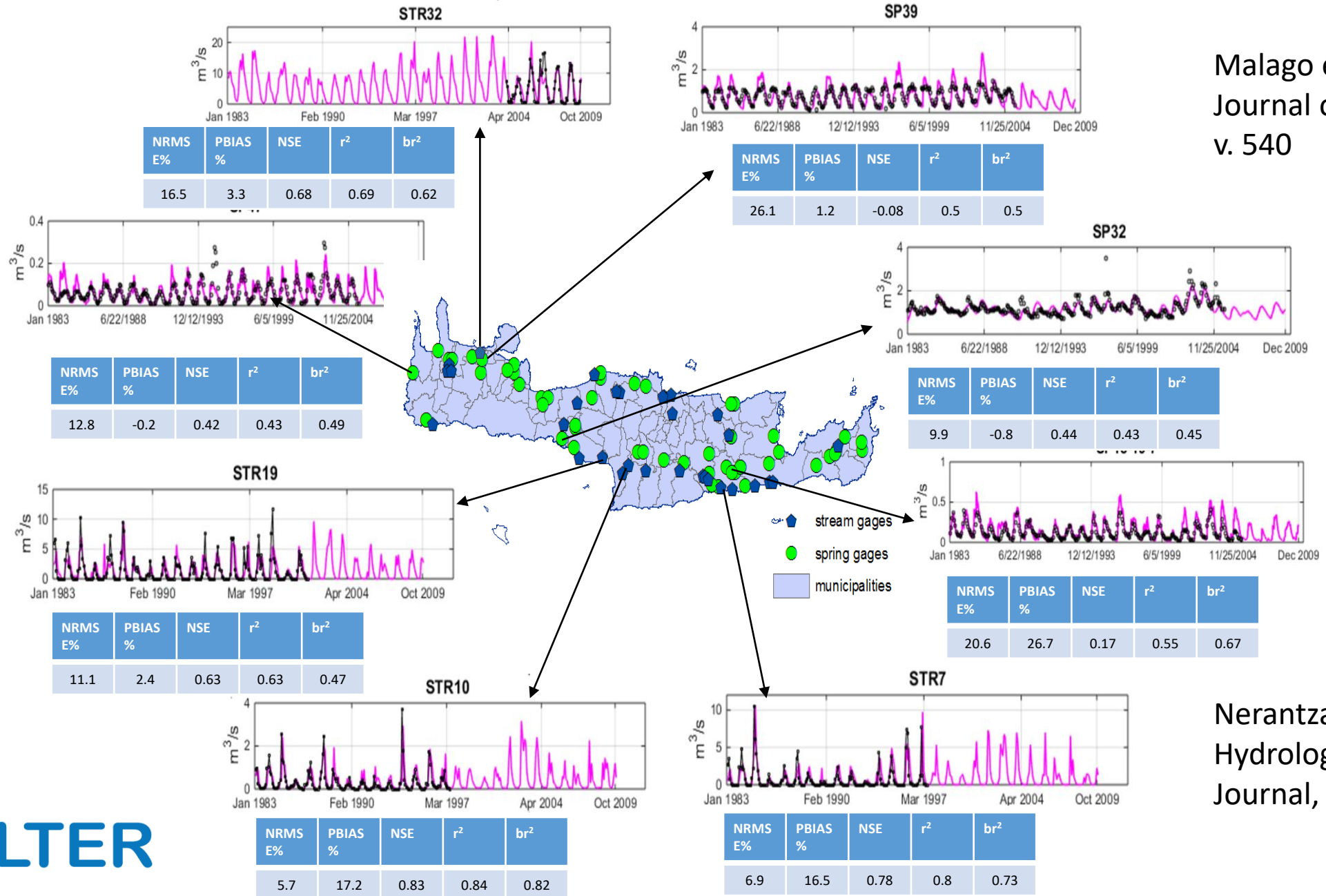


Rainfall and Flow Uncertainty, mm/yr

	Rainfall	Total Flow	Karstic Flow
1974-2018	1120.6 ± 78.4	841.8 ± 89.1	591.3 ± 49.9
2019-2058			
RCP2.6	1426.9 ± 99.2	1111.9 ± 104.0	671.1 ± 57.3
RCP4.5	1008.8 ± 84.3	701.5 ± 87.0	468.9 ± 49.2
RCP8.5	1107.3 ± 71.9	797.2 ± 75.8	514.5 ± 44.5
2059-2098			
RCP2.6	1507.9 ± 135.9	1202.4 ± 153.5	716.3 ± 81.8
RCP4.5	999.8 ± 72.9	682.9 ± 73.6	458.4 ± 44.8
RCP8.5	829.8 ± 69.3	503.2 ± 61.2	348.7 ± 37.81

Scaling up

Crete SWAT Model – Goodness of fit



Malago et al., 2016.
Journal of Hydrology,
v. 540

Nerantzaki et al., 2019.
Hydrological Sciences
Journal, v. 64

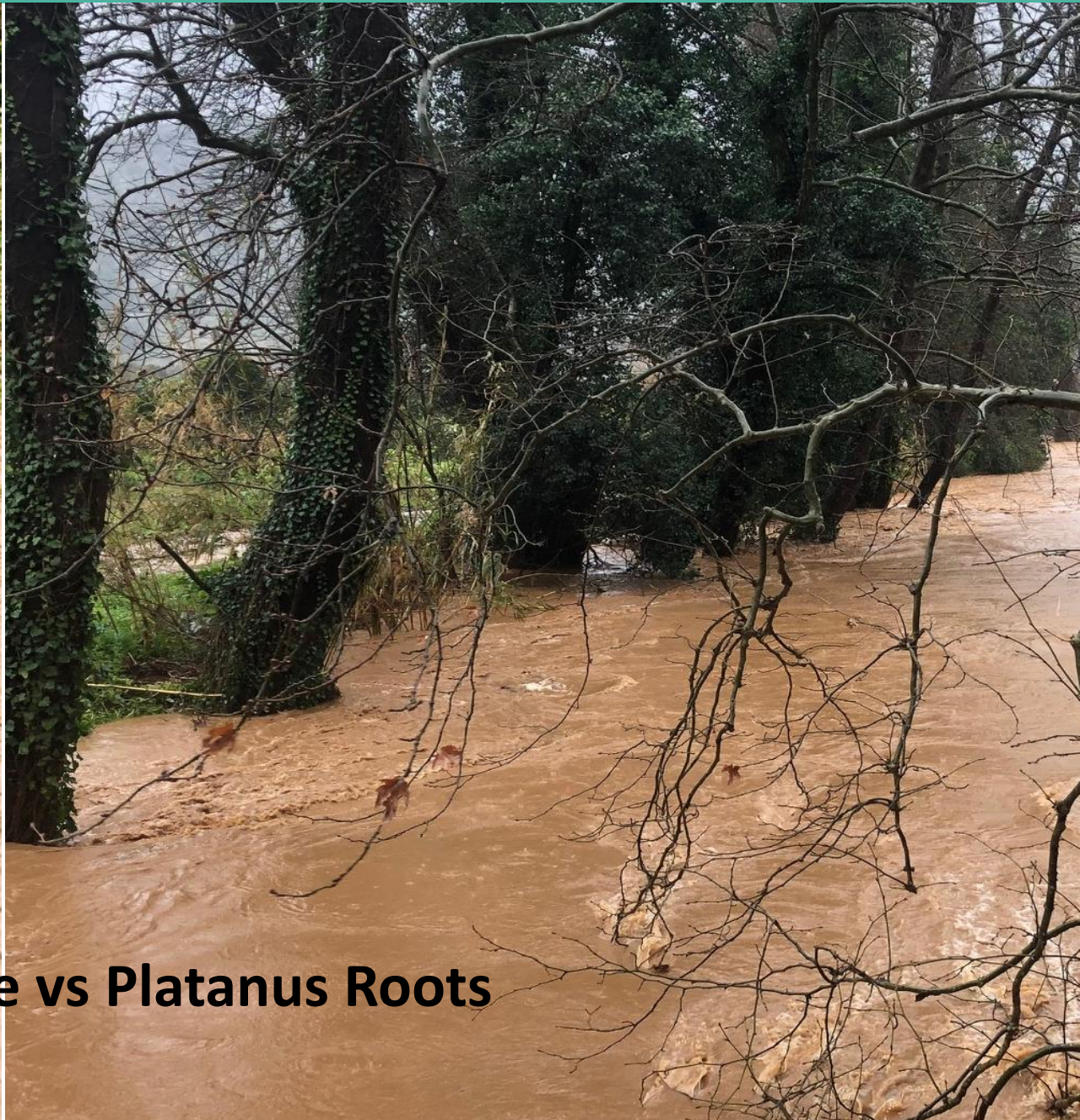


The Riparian Forest

Erosion has been identified as a major problem for the riparian forest.



Nature-Based Solution



Orange tree vs Platanus Roots

Drivers of change

1. 2017 extreme floods in Mandra and
2. 2018 fires in Mati Attica

With 20 and more than 100 people dead.



The vision of the project was to develop bank erosion protection and flood protection using NBS and restore the extent of the riparian forest to 20 m on both sides of the river, creating a 5-km riparian forest corridor that will become the trade mark for the agricultural development of the area.

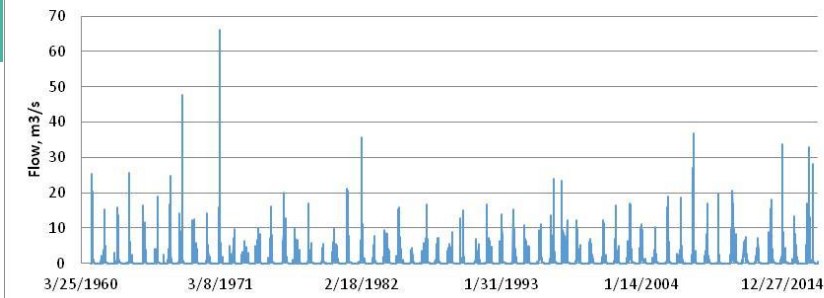
Phase 2 – Baseline assessments

A flood protection study involves the following series of sub studies

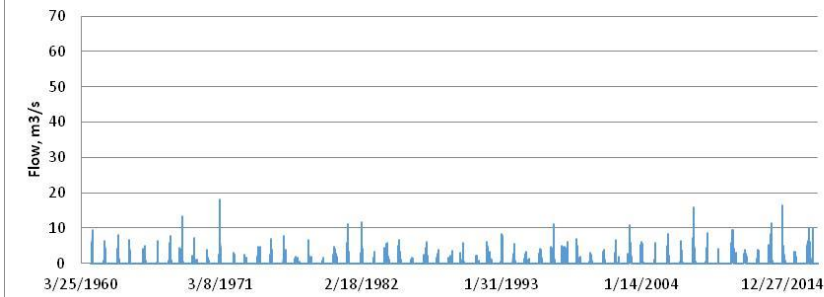
- **Delineation of the flood plain** of the river for the 50-year flood - it involves the following actions:
 - detailed **surveying** of the river and the surrounding area
 - **Hydrologic study** for the identification of the 50-year flood
 - **Hydraulic study** of the resulting floodplain
- Analysis of the **susceptibility to flood erosion**
- Design **measures for flood protection** - evaluation of alternatives
- **Measures for the restoration** of riparian forest- evaluation of alternatives
- Proposed restoration actions and **environmental impact assessment**

Karst-SWAT (Hydrology), HEC-RAC (Hydraulics), BSTEM (Bank Erosion)

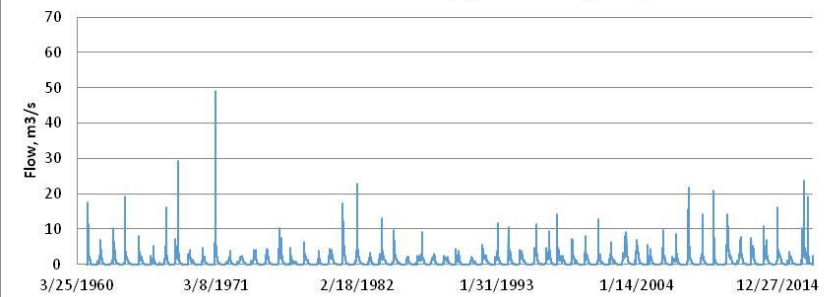
Keranianos @ Gorge Entrance - Flow 1961-2018



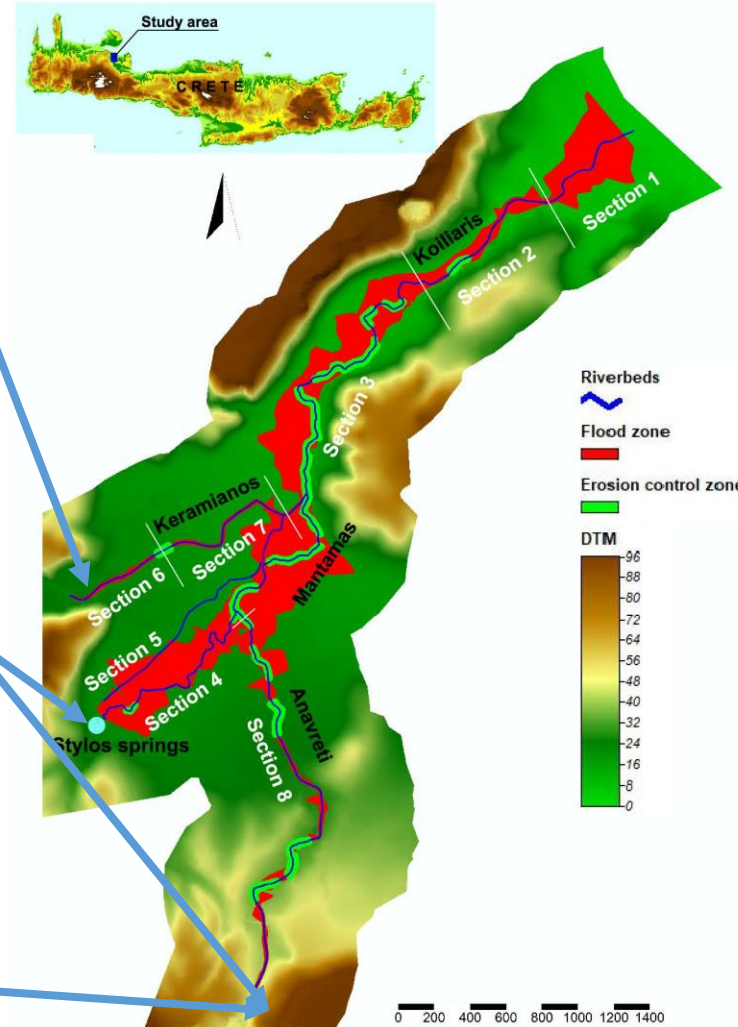
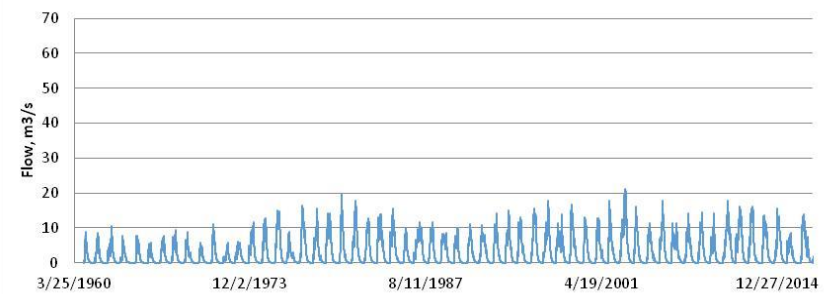
Keranianos @ Gorge Exit - Flow 1961-2018



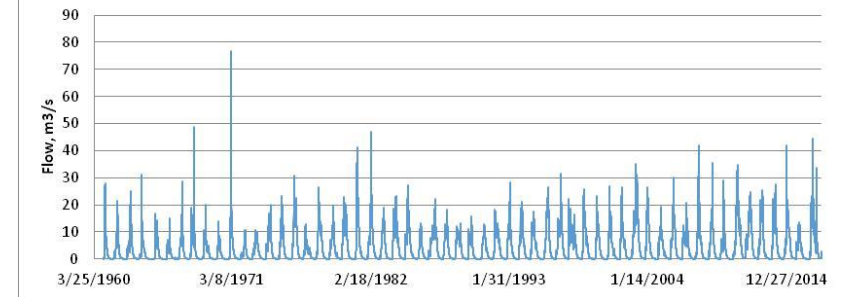
Koiliaris Surface Flow @ Upgradient Springs- 1961-2018



Stylos springs - Flow 1961-2018



Koiliaris @ Agios Georgios- Flow 1961-2018



Modeling 1961-2018

**Average Flow
(Mm3/yr)**

Keramianos tributary

10.1

Stylos Spring

58.5

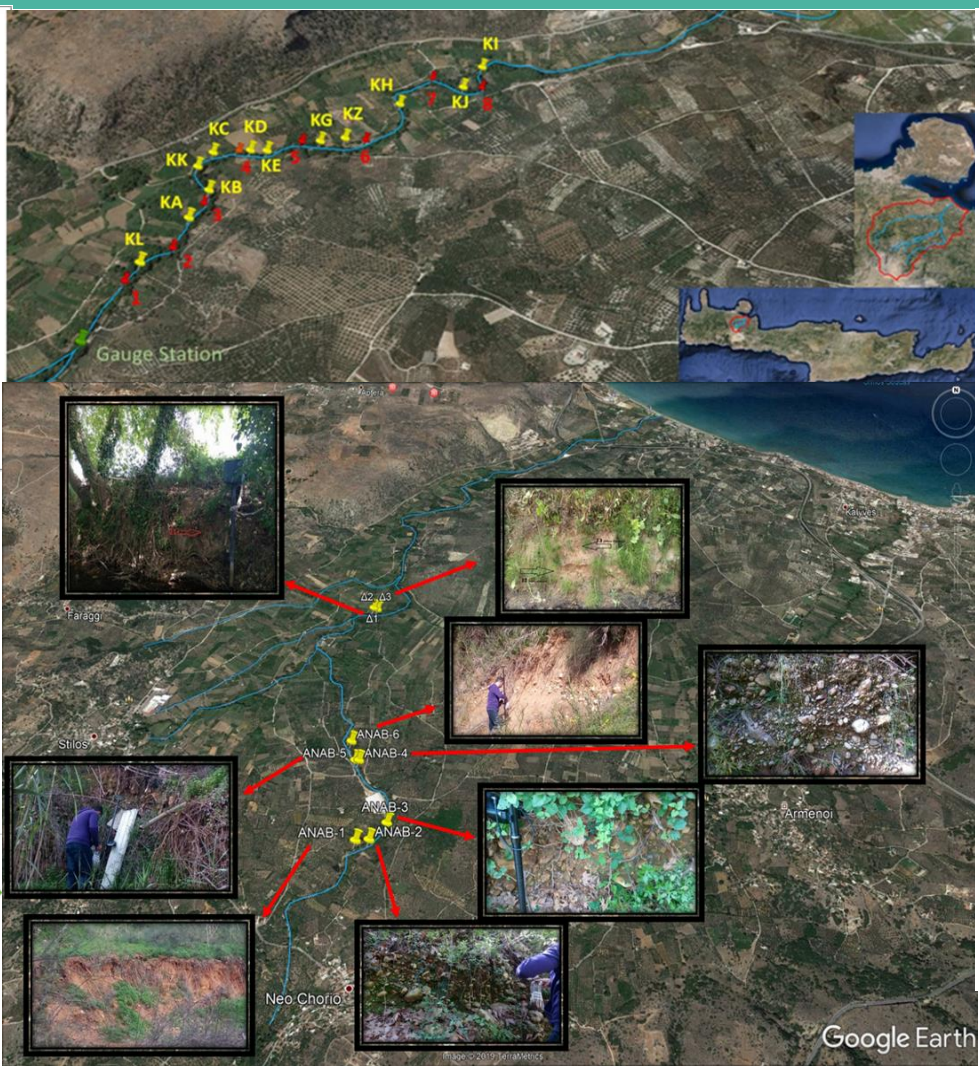
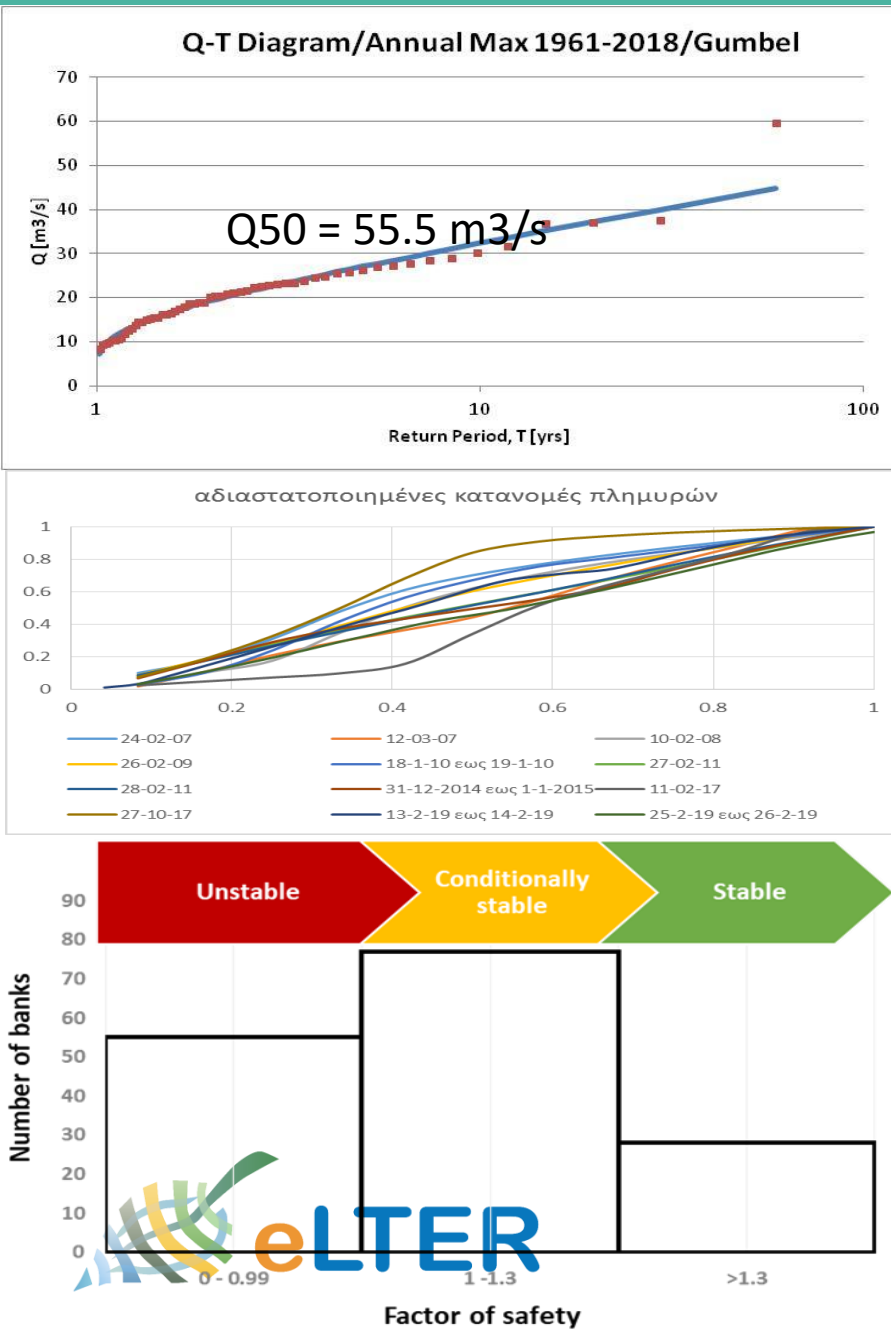
Anavreti Spring and
runoff

69.9

Total Flow

138.5

Hydraulic, bank erosion and forest studies



River bank measurements

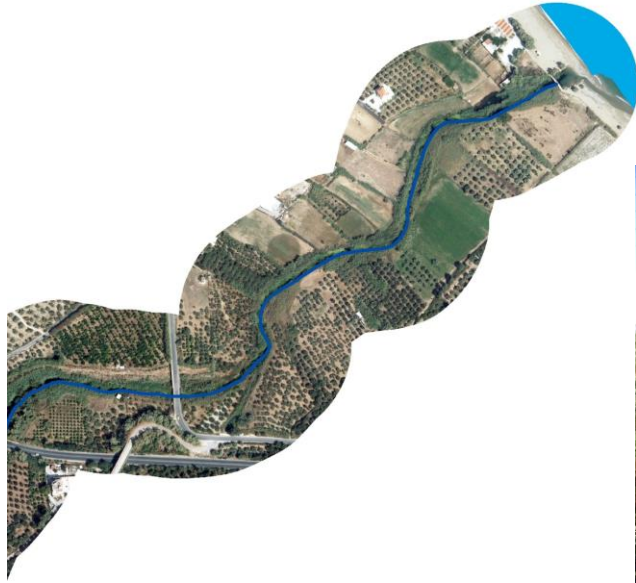
Riparian forest studies



46 plant types

12 allochthones
34 autochthones

Part 1 - *Arundo donax* and *Phragmites australis*.



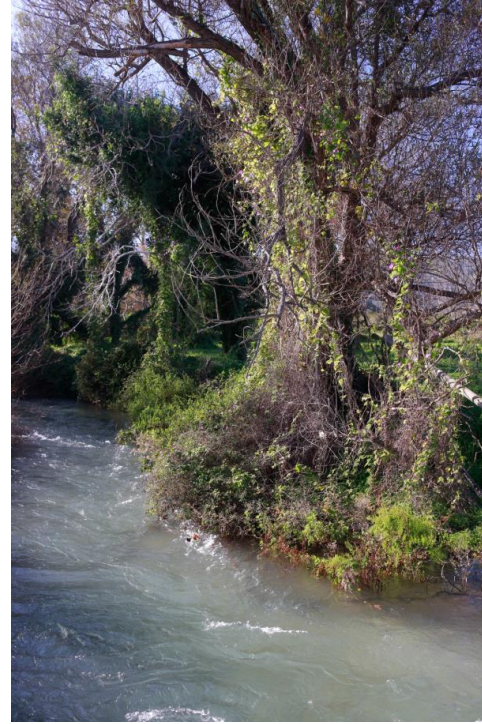
Part 2 - *Arundo donax* flowed by *Sicamore* and white willows



Part 3 – Riparian forest of Sicamore and White Willow



Part 4 Riparian vegetation with white willows (*Salix alba*) and sycamore trees (*Platanus orientalis*) interrupted by agricultural fields



Phase 3 – NBS co-design

The flood zone after the NBS implementation

Stakeholders

Municipality of Apokoronas

Municipality of Apokoronas Council (4 major parties)

The Departments of the Decentralized Administration:

Environment and Spatial Planning

Water Division and

Forestry

Ephorate of Antiquities of Chania (Ministry of Culture and Sports),

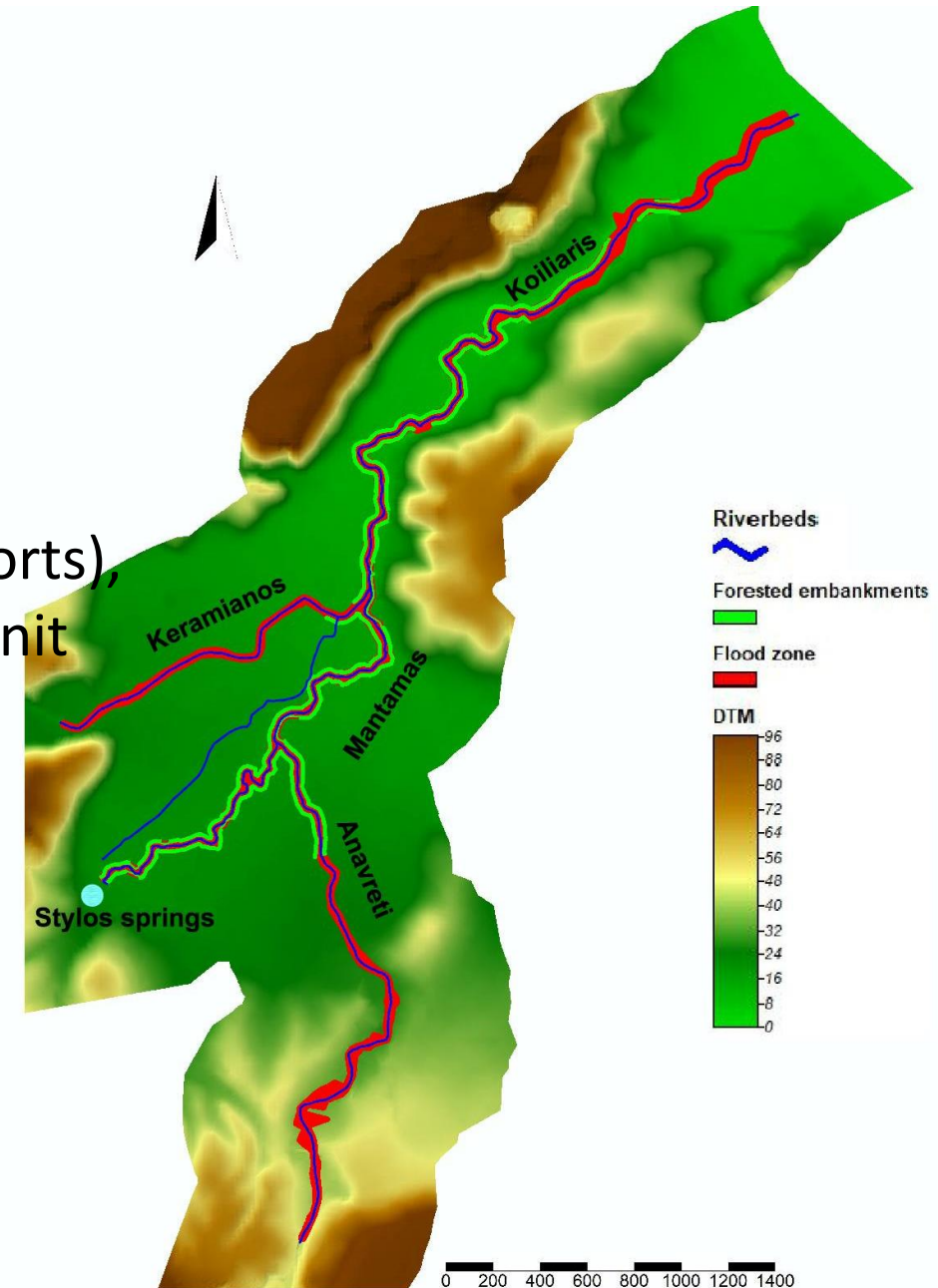
Environmental and Water Resources Unit –Chania Regional Unit

Regional Council

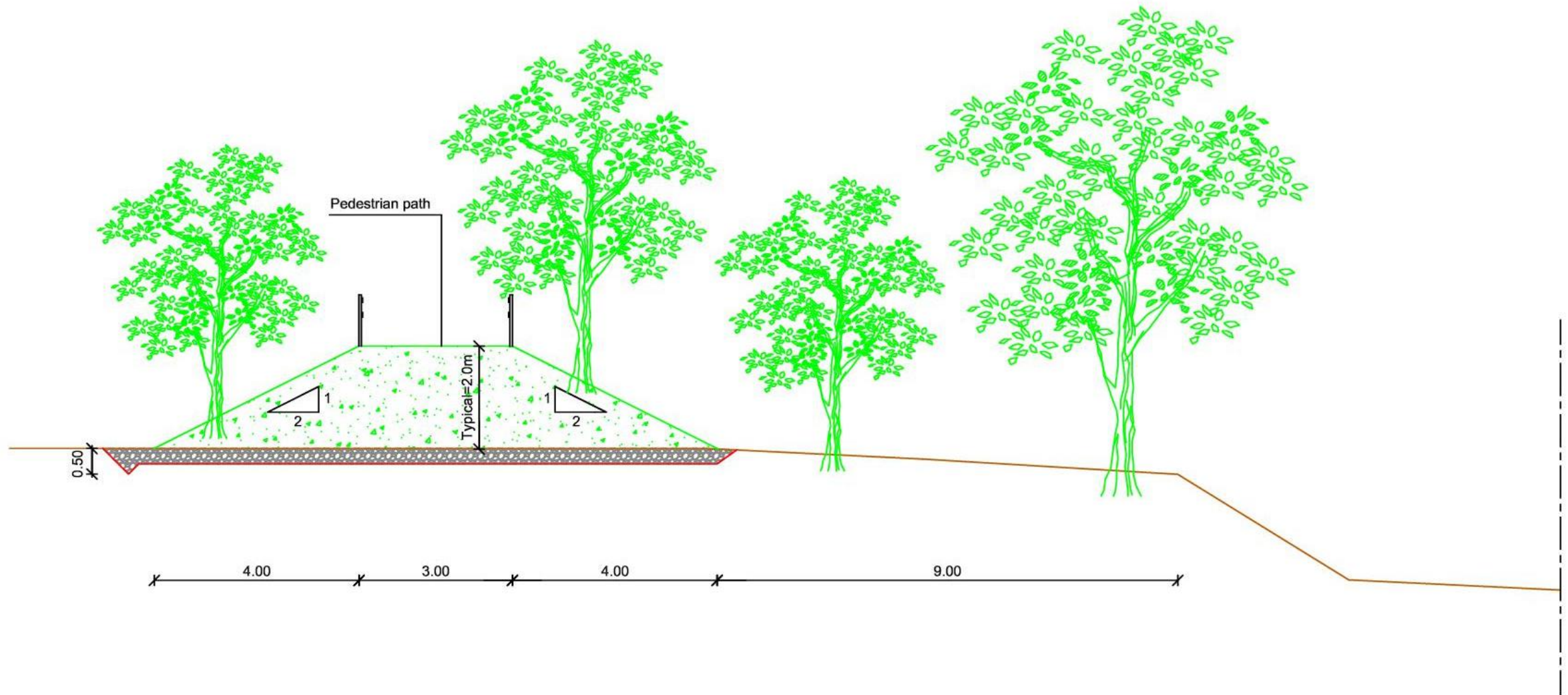
Local Farmer's Association

Development Organization of Crete

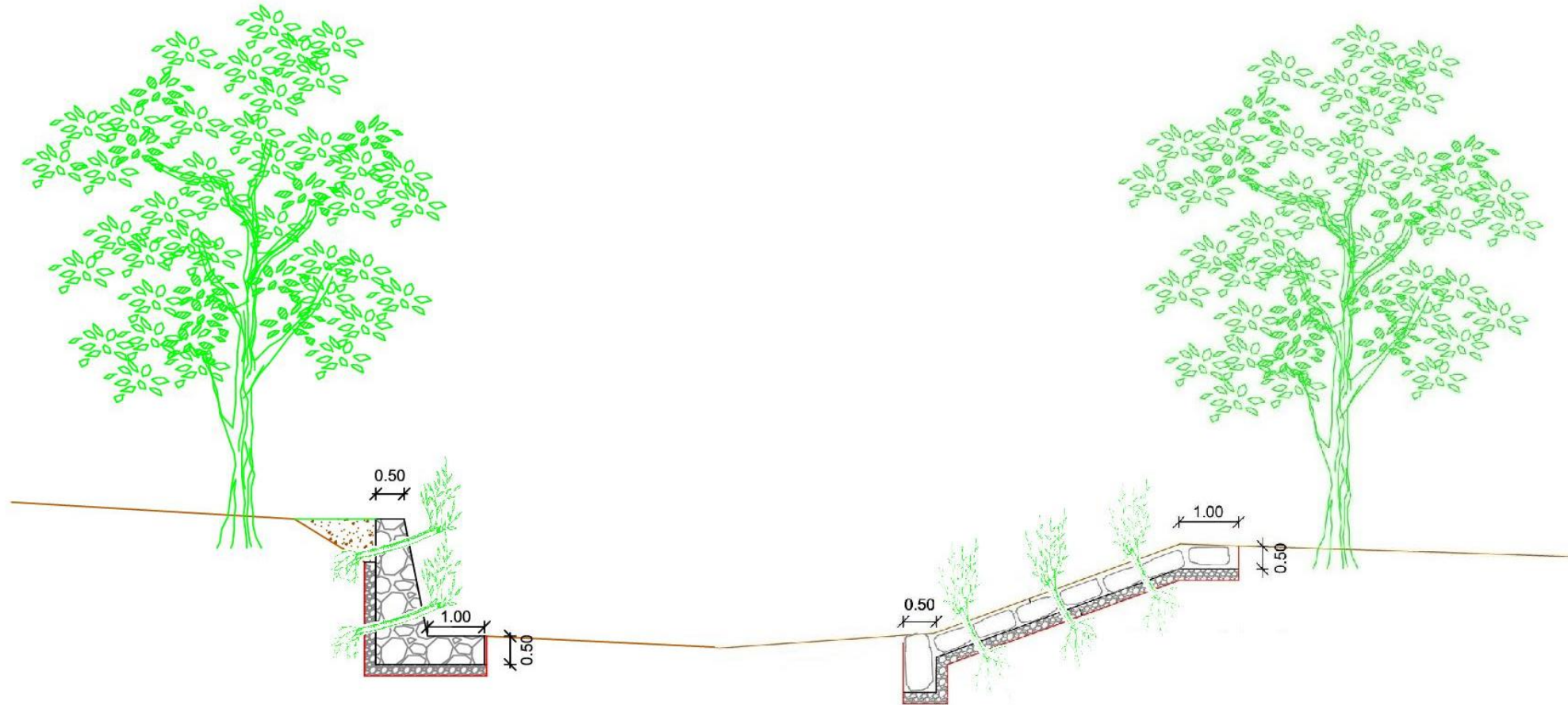
Various related NGOs



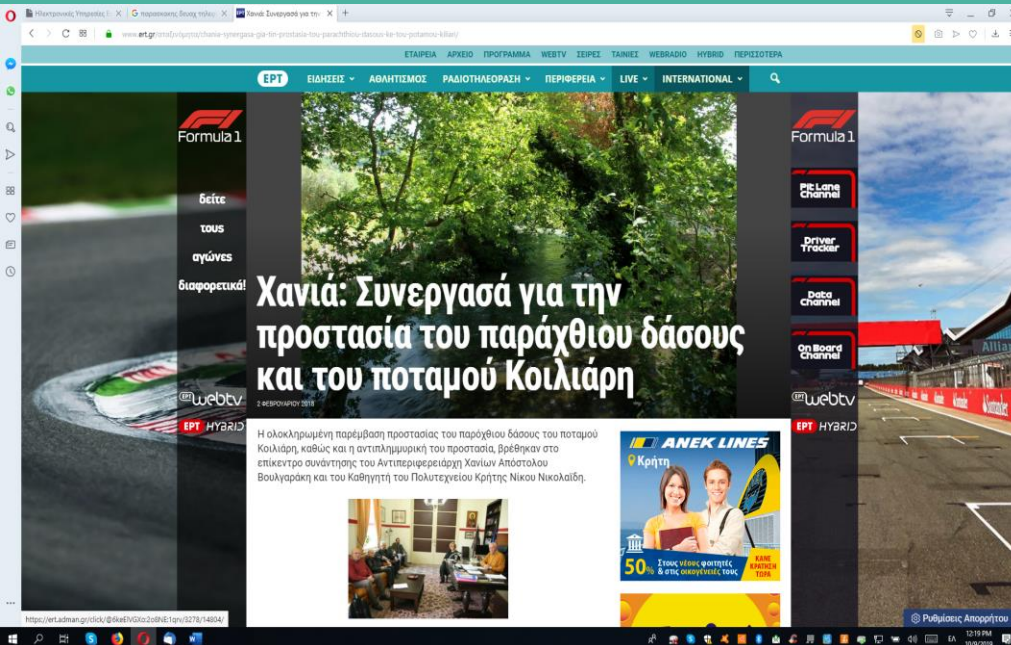
Flood protection design



Design of the restoration of the eroded banks with vegetated walls and rip-raps

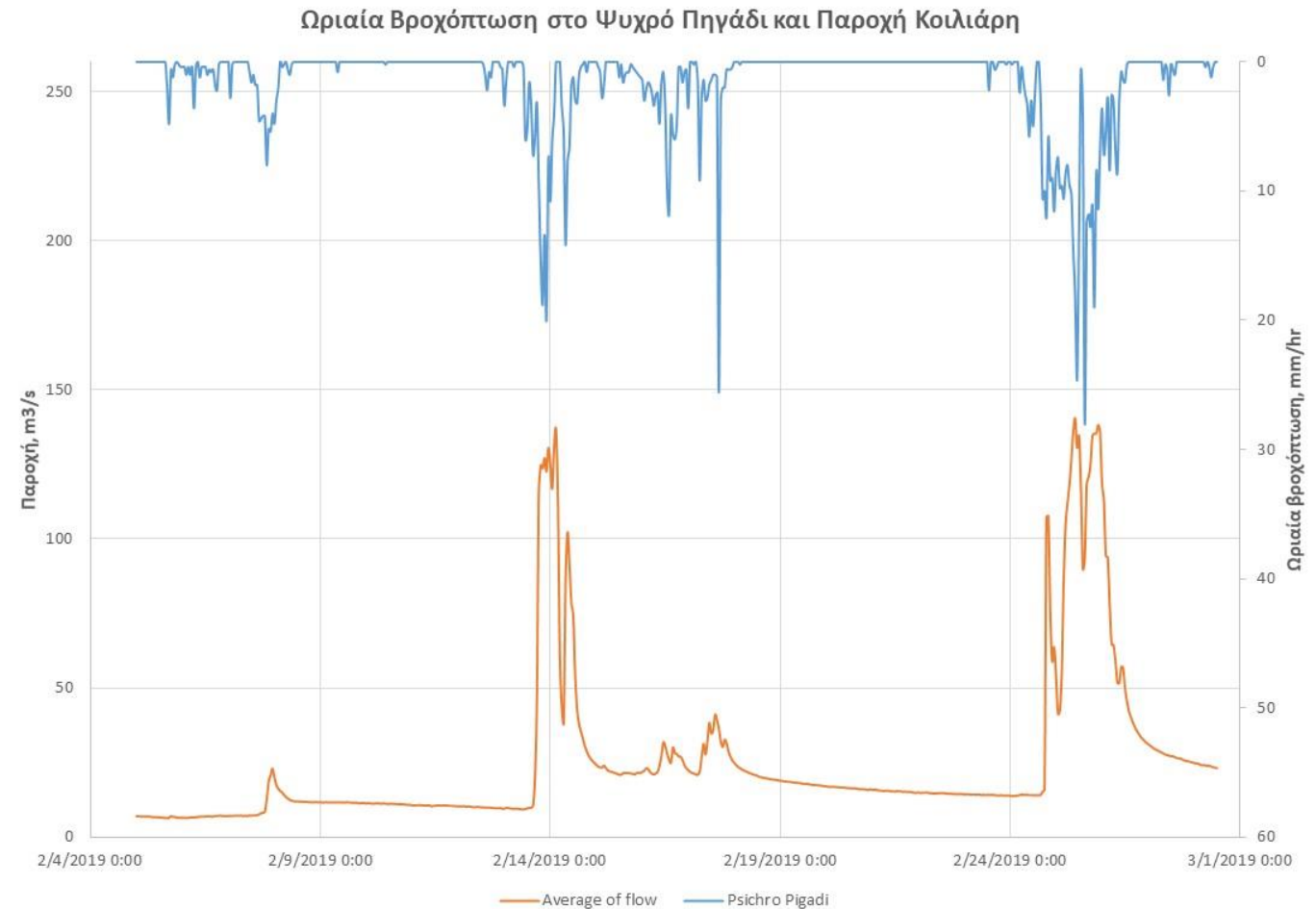
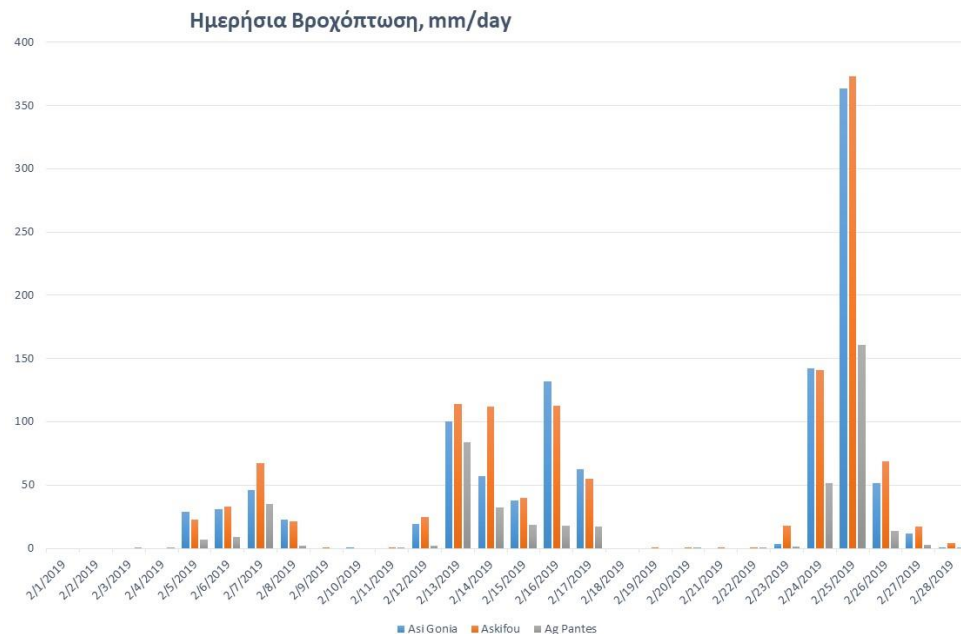


Public Consultation – NBS Co-design



The Event that catalyzed consensus - February 2019 Floods

	12-17/2/2019	24-27/2/2019
Ασή Γωνιά	408	569
Ασκήφου	458	604.2
Αγιοι Πάντες	172.2	229.4
Ψυχρό Πηγάδι	346.6	433



February 2019 Floods



February 2019 Floods



Phase 4 – Implementation

1. Obtain **approvals** from various Departments of the Decentralized Administration of Crete - The Department of Environment and Spatial Planning will forward the request and the recommendation to the Regional Council for final approval. Upon approval, the procurement details with the estimated cost will be prepared for the tender.
2. Securing **funding** (around EUR 3 to 3.5 million) - The project can be included in the funding of the structural funds, or obtain national funding
3. Continuous **assessment** and evaluation of the NBS – Use Key Performance Indicators (KPIs)

Key performance indicators per NBS challenge to be solved for Koiliaris CZO			
NBS challenge	Indicators	Current Impact	Expected Impact
Climate mitigation and adaptation	Carbon storage and sequestration in vegetation and soil	Low density agricultural vegetation, limited riparian forest and 1-2% org soil carbon	40 m length high density riparian forest, soil carbon to increase to 3-4% at maturity.
Water management	Reduction of flood risk	None	50-year flood or maximum hourly flow of 127 m³/s
	Areas (ha) exposed to flooding	56	31
Participatory planning and governance	Number of meetings held with citizens to explain the progress of the project	2 meeting during the design phase and 1 with municipality	To be determined
	Numbers of persons involved in the activities carried out under the project	50 people per meeting	To be determined
	Number of public officials who have been involved in the execution of activities in the execution of the project	Mayor, Municipality Council, Deputy Governor of Chania, Regional officials	Mayor, Municipality Council, Deputy Governor of Chania, Regional officials
Public health & well-being	Increase in walking and cycling in and around areas of interventions	Minimum	High
Potential of economic opportunities and green jobs	New businesses attracted	Minimum	High

Benefits and Co-Benefits

- Protection of the river in a sustainable way
- Improvement of river and riparian biodiversity
- High ecological value recreational area
- Improvement of quality of life and social cohesion
- Collaboration of tourism and agricultural sectors with the potential of new job creation
- Creation of riparian forest by reclaiming agricultural land – it is the reference point for agricultural development of unique and high quality agricultural products – marketing tool

Final Thoughts.....

A significant social barrier was the acceptance of local stakeholders and farmers to reclaim agricultural area and restore the riparian forest. We have been able to effectively overcome these barriers because of our relation with the local stakeholders over the past 15 years and our ability to fuse the vision of the riparian forest restoration to all levels of stakeholders.

This vision “drove” the project and created the necessary consensus to achieve its objectives which was to convert privately owned, prime agricultural land to riparian forest.

The development of a global vision for agricultural development of the area and its linking with the river and riparian forest restoration act as a driver to overcome the barriers and enhance the social acceptability of the project.



Gracie Mille

