Cluster group meeting "Water in the Landscape", 8 February 2018

Anna Tengberg started the meeting by a short recap from previous cluster group meetings and the plan for upcoming meetings and themes. She also provided a short summary about the SIWI project "Integrated Water and Landscape Governance in Ethiopia", which is currently in its inception phase.

John Matthews, Alliance for Global Water Adaptation (AGWA): Anchoring resilience in the landscape: the role of ecosystems in human adaptation

Climate and ecosystems have been described as "the invisible water utilities". We need to consider ecosystems and water which are difficult to see, and how we adapt to these invisible utilities.

Earlier, the view of ecosystems was based on conservation, and how to keep them unchanged. Ecosystems are sensitive, and if the targets we have are based on how the situation was before, it becomes difficult to design management interventions. Uncertainty is central, so how do we cope with that? How do we define goals and targets under deep uncertainty?

What do we want from ecosystems? We need robust and flexible solutions. There is currently a shift from ecosystem services to adaptation services and we need to integrate this thinking within water management systems. How do we value ecosystems? There are economic ways to value ecosystems, but it is very difficult. There is thus a need qualitative valuation not based on quantitative economic frameworks.

Can we blend ecological and engineering definitions of resilience? We need to consider decision-scaling - how to think about climate risks. Collaborative Risk Informed Decision Scaling (CRIDA) is a way of combining the different perspectives. An example was given from Mexico where the biggest problem is ecological drought, and where the CRIDA method has been used. An example from the private sector included the use of a "Water Climate Bond Standard".

Linking water and climate in integrated policies is important, for example the UNFCCC and the SDGs and integrating ecosystem considerations within climate finance, through the NDCs. Bottom up approaches and methods in this area are quite new. There is an online platform available for these methodologies, "Knowledge platform for Bottom-up Approaches to Resilient Water management".

Anita Bergstedt, County Administration Västra Götaland, Nature Department: Natural Flood Management- Natural Water Retention Measures.

Västra Götaland has developed a tool for communities to help adapt to climate change. Communities need to think about how they should tackle climate change using natural measures, such as natural water retention measures so prevent flooding. The cost is lower than for hard engineering measures and they give multiple positive outcomes for biodiversity etc.

Many questions need to be asked, for example: How much water can you manage in urban areas? How often will this amount be exceeded? Which volumes are too much? Where can water be stored? Where does the water come from? What does the landscape look like? Where do you find information about the landscape? Which partners do you need to involve getting the job done? In short, we need to think in another way in order to adapt to new circumstances, also with regard to new knowledge. We can no longer rely on knowledge from the past, when our future is uncertain - we need new knowledge for this generation.

Examples of natural flood management measures include: enhanced soil infiltration, river bank buffer strips, trees for infiltration and slowing down of water flows, measures in ditches, and dams. You can usually put these measures in place at a low cost and they are quite easy to implement. However, there are also bigger projects that need some more investment and bigger effort, such as restoring lakes and flood plains, which can be very efficient in reducing floods.

The development of the tool has benefitted from international cooperation. The European Commission has described 53 Natural Water Retention Measures, but Västra Götaland selected just a few of them for further analysis. There has also been collaboration with the UK that has conducted more research on how to work with this. Our aim is to get this information out to community leaders in Sweden, as earlier solutions have been very focused on engineering and "grey" solutions and there is a need to try other alternatives.

Questions and comments:
Who should be responsible for granting land for these measures? Does the responsibility also lie on private individuals and actors? How will it be feasible to implement these measures when there is also a pressing need for farmland? We need to use the water in a more efficient way. For example, in the UK smaller communities and farmland are often "sacrificed" to avoid larger damage in big cities. How do we deal with these conflicts of interests? These "green" solutions, based on ecosystem services are often too small to really make a difference in event of a big flooding.

Emelie Karlsson, SMHI: MicroWeather – a new technology for measuring precipitation
The weather affects everything and it is becoming more and more important to be able to predict extreme weather events and effects on agricultural production and food security.

The MicroWeather tool is based on telephone masts sending microwave links, which are attenuated by rain. Microwave links are the backbone of mobile phone networks. The technology has been developed during the last 10 years and tried out in Holland and Israel. SMHI is conducting a Swedish pilot in Gothenburg since 2015.

Improved rainfall monitoring with real time mapping enables monitoring of intensity of the rain, not only the amount. There are pros and cons with all systems, some monitors better in certain places. Improved observation data leads to improved forecasts and warnings, and less damage and release of pollution from sewage systems.

There are about 4 million links globally. Many low-income countries do not have any other infrastructure to measure weather-related data, which is a good reason to make use of the growing market for mobile phones. Measuring the weather has no negative impact on the network and the microwave links are many and frequent in cities.

An algorithm has been developed to derive precipitation from the microwave links. The rainfall causes disruptions in the links, from which the data is calculated. The data need some corrections otherwise the rainfall is overestimated. During peak rainfall intensity the mobile network provide better ability to capture peak intensities compared to radar, as the data has a better temporal and spatial resolution. For the pilot project in Gothenburg, there are updates on the SMHI website.

Potential users are meteorological agencies, municipalities, insurance companies, energy providers, media and especially developing countries for which the microwave links provide an affordable leap-frog technology for weather measurements.

Questions and comments:

Are there any limitations with the technology? Mobile networks are not evenly distributed everywhere, such as in the mountains for example, which are also places where it is very important to be able to collect data on weather as it affects water flows. In rich countries where there is already infrastructure for measuring weather data, this is more of a complement to already existing technology, but in developing countries it could be the only data available. How does the topography affect the signals? Since the signals go between the masts, longer distances between them result in more problems.

Markus Petzén, DHI: A Study of Water Balance in a Changing Climate

Markus presented two case studies of water balance modelling, one from Blekinge, Sweden and another one from Kenya. The method includes mapping and evaluating catchment data to develop the water balance model using the MIKE Hydro Basin software. The second step is to verify the model and assess the public and industrial water demand. What are the dams and regulated lakes that can have an impact on the water flow? What is the water demand for irrigation in agriculture? Many users do not have official permits to withdraw water for their activities. Based on the above information the water balance model using MIKE HYDRO Basin is developed.

Water-shortage risk analysis in today’s climate and in a changing climate involves calculating future flows and the number of times it falls below a critical threshold, and the risks of the reservoir running out of water. There is also a need to identify the water-use priorities and prioritised users, and to consider regulations for withdrawal upstream as it affects the access to water downstream.

In Kenya the same methodology has been used to gain better knowledge and prepare a modelling tool to predict different water-balance scenarios. The project was carried out together with Kenyan authorities.

Questions and comments:
Does the model take into account environmental flows? Is there any requirement for minimum water flow? The method is used globally, for example in Australia. DHI developed the method and it is not open source.

Concluding discussion

- We have to address the **conflict of how we value different ecosystem services or measures**. We tend to focus on the costs of flooding and find ways to prevent that from happening, but what about the possibility that we extinguish biotopes in watersheds while doing so? What should we value most? What trade-offs are we willing to make? We should not value everything in monetary terms.
- There is also a **conflict between food security and the need to hold water** using water retention measures to reduce floods. How do we balance the different interests? It is a knowledge intensive process, requiring capacity in data analysis and modelling, and in bringing different stakeholders together to negotiate acceptable solutions.
- How do we move towards **solutions that are not only based on infrastructure** that keep the water on one side of the wall, and the people on the other side, with many casualties when it breaks, but solutions that allow areas to be flooded and adopted to extreme weather events? We need to change our way of thinking to minimise damages.
- There is a need to **create livelihoods and incomes in rural areas** as well, not only to create conservation areas. There are many social aspects that needs to be taken into consideration. The importance of finding production systems that are profitable and long term, in order for it to be appealing to local citizens, as well as companies and industries. Otherwise climate change adaptation will not be sustainable.

- It can be difficult to **find solutions to different interests upstream and downstream**. We must have a dialogue across borders, both on national, regional and local level. WHO- HYCOS is a project with six countries sharing real time data and an example of transboundary cooperation. Different issues have different relevance due to size of watershed. In the Nile, for example, it is mostly about geopolitical interests, other issues become secondary.
- The MicroWeather tool can be very useful for governments especially for measuring rainfall that moves across international borders. **We need to find ways of linking the different methodologies available**, such as those presented today, and identify who will be responsible for that?
- There is a need to **work with governance and transboundary issues** not only for actual watersheds or rivers on the ground, but also for so called 'aerial rivers' created by evapotranspiration in the atmosphere, and across different continents.

The next meeting will be held in March during week 11 or 12.

The Cluster Group
Water in the Landscape

Impacts of Climate Change

Anna Tengberg
SWH/SIWI

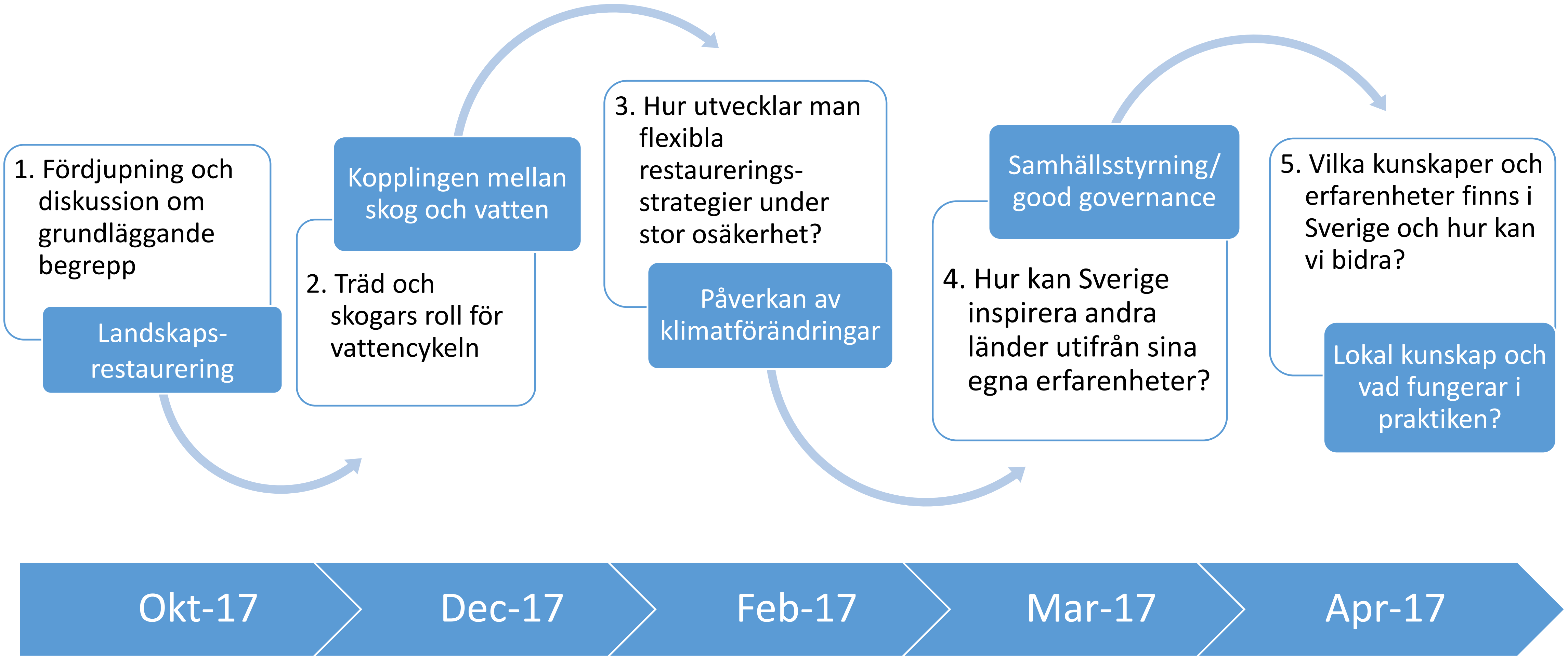
SIWI

SWH Cluster Group:
Sustainable use of water for productive and multifunctional landscapes

- To promote water in the international conversation on landscape approaches and restoration
- Strengthening / expanding Swedish and International networks on water-related natural resource management

SIWI SWEDISH WATER HOUSE

Teman hösten 2017/våren 2018



Developments since last meeting

Proposed an event at the World Water Week:

Working with the flow? Multifunctional landscapes in a changing climate

- Focus on challenges and opportunities in restoring degraded landscapes in drylands in Sub-Saharan Africa.
- Convenors
  - SIWI Swedish Water House
  - SLU
  - SIANI
  - Focali
  - CGIAR Research Program on Forests, Trees and Agroforestry (FTA)
  - Gothenburg University

Integrated Water and Landscape Governance Project in Ethiopia

IWRM Capacity Building

- National multi-stakeholder IWRM dialogues
- Capacity of mandated institutions on IWRM is developed

Capacity Building for Multifunctional and Resilient **Landscapes**

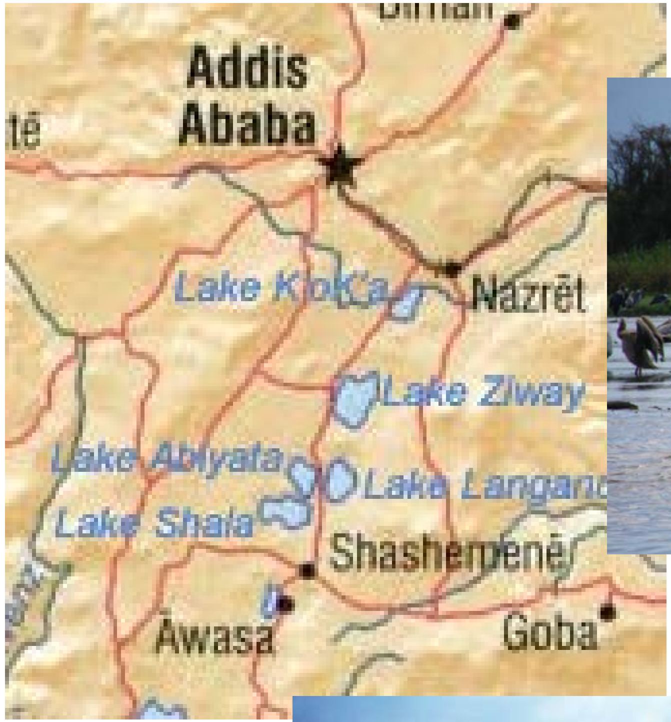
- Stakeholder dialogues initiated on restoration and sustainable use of multifunctional landscapes
- Capacity building and training programs on land-use/water interactions
- Local restoration and management initiatives launched

Textile Sector Dialogue and Capacity Building

- Build capacity of ETIDI regarding efficiency, water and pollution prevention
- Build capacity of ministries, agencies and universities to do risk assessments
- Build capacity of factories to understand the negative impacts of industrial effluents

Geographical Scope: Rift Valley

- Will work with the **Rift Valley River Basin Authority**
- Will focus on **Lake Awassa Catchment,** including the **Hawassa Industrial Park**.



Conclusions from last meeting: Forest & Water

- The cluster group welcomed the new participants from the food sector
- The relationship between forest and water depends on the context
- Need to widen the geographical perspective from watersheds to whole continents and cross-regional perspectives
- It is sometimes better to focus on trees than forests
- Look at diversification of species and use of local varieties
- Existing conceptual frameworks for water and forests need to be updated
- The Swedish resource base could provide inputs to FAO's Working Group on Dryland Forests and Agrosilvopastoral Systems
- When identifying opportunities for restoration,we should not only focus on degradation, but try to identify opportunities instead.
- Stronger focus on stakeholders and the end-users.

SIWI

Today's Programme

9.30-9.40	Welcome and opening of the meeting	**Anna Tengberg**, SIWI/SWH
9.40-11.10	Key Notes:	
9.40-10.00	Anchoring resilience in the landscape: the role of ecosystems in human adaptation	**John Matthews**, AGWA (via video link)
10.00-10.20	Study of Water Balance – examples from Sweden and Kenya	**Markus Petzén**, DHI
10.20-10.40	Tool for Natural Flood Management	**Anita Bergstedt**, Länstyrelsen Västra Götalands Län
10.40-11.00	MicroWeather – a new technology for measuring precipitation	**Emelie Karlsson,** SMHI
11.00-12.00	Coffee break and group discussions	
12.00-12.20	Presentation of group discussions	Group rapporteurs
12.20-12.30	Conclusions and next meeting	**Anna Tengberg,** SIWI/SWH

SIWI

Introduction of Participants

Today's questions for discussion

1. What are the main water-related adaptation challenges at the landscape level?

2. How could the different tools presented help addressing these challenges and how applicable are they in different climates and socio-economic contexts?

3. Other adaptation tools that should be considered?

SIWI

Next meeting

- Theme – Good Goverance
- Speakers – ICA, ….European Landscape Convention?, International Land and Forest Tenure Facility?, …
- Date

Water in the Landscape

Engage in our network @ swedishwaterhouse.se

Thank you!

SIWI SWEDISH WATER HOUSE

Natural Flood Management
Natural Water Retention Measures

Anita Bergstedt

Nature Department

County administration of Västra Götaland

LÄNSSTYRELSEN
VÄSTRA GÖTALANDS LÄN
County Administrative Board

Tool for communities

- A help to adapt to climate change
- River flooding will occur more often
- Higher flood peaks with longer duration are expected
- How does the community want to tackle present and future flooding of urban areas?
- There are sustainable measures available, which give positive effects on biodiversity in the landscape, in the streams and in the sea
- Lower cost than hard

engeneering

LÄNSSTYRELSEN
VÄSTRA GÖTALANDS LÄN
County Administrative Board

A lot of questions need to be asked

- **Our tool will help to ask the right questions**
- ***Then you need to find the answers…***
- **How much water can you manage in the urban area?**
- **How often will this amount be exceeded?**
- **Which volumes are too much?**
- **How much more water do you need to slow down or store in the catchment for how long, in order to avoid flooding?**

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VÄSTRA GÖTALANDS LÄN
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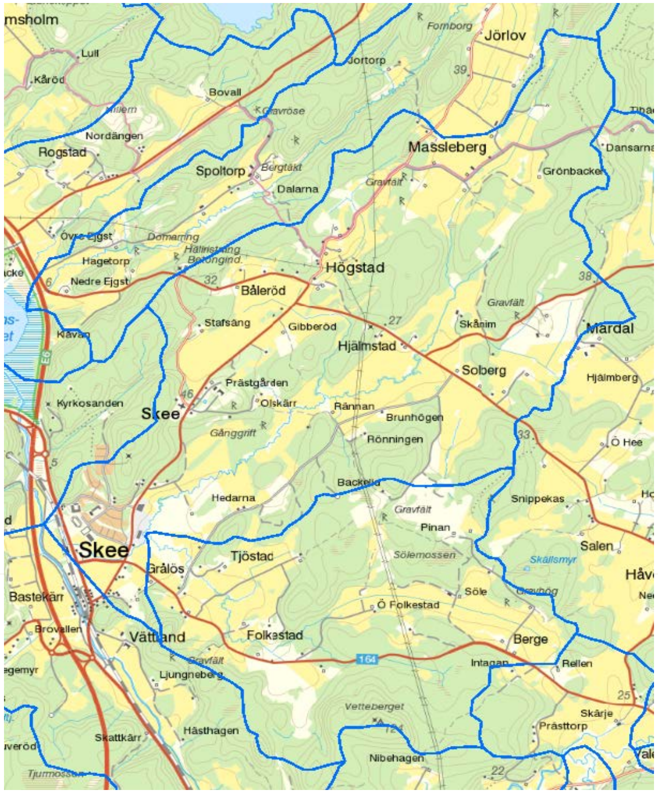
Where can water be stored?

- How do you find suitable locations for water storage?
- Where do you find information about water in the landscape?
- Which partners do you need to involve to get the job done?



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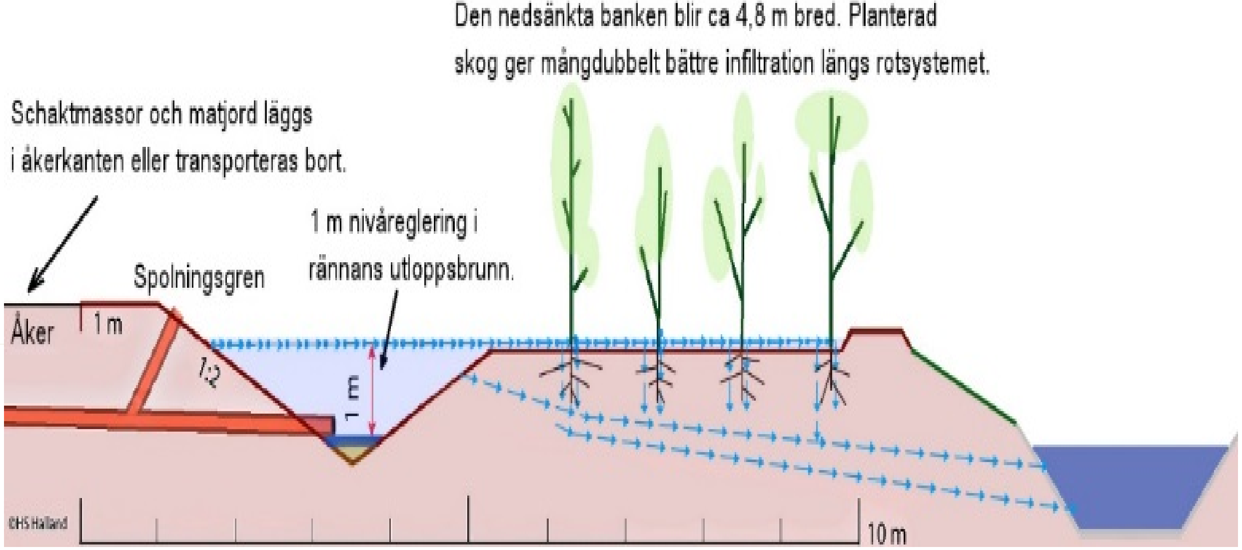
Natural Flood Management

- Increasing soil infiltration
- Evaporation
- Slowing water
- Storing water
- Interrupting surface flows

Categories of NFM features

- Soil management
- River bank buffer strips
- Trees for infiltration and slowing water
- Measures in ditches
- Dams
- Controlled flooding; directing high flows out of streams
- Big projects



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Soil management

- No till agriculture
- Spring tillage
- Controlled traffic farming
- Green cover
- soil structure liming

Gains

- Increasing soil infiltration
- Less surface runoff
- Ground water build up
- Less sediment and nutrition in streams and rivers

River bank buffer strips

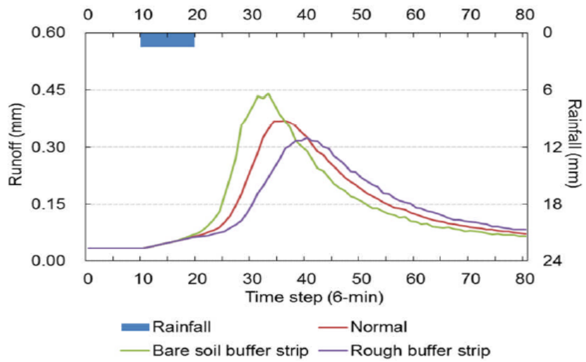

Figure 2.5. Hydrographs of the riparian buffer strip scenarios (10 % area) under a 15 mm rainfall event.

Gains

- Slowing high flows
- Increasing soil infiltration
- Enhanced biodiversity
- Less sediment and nutrition in streams and rivers

LÄNSSTYRELSEN
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County Administrative Board

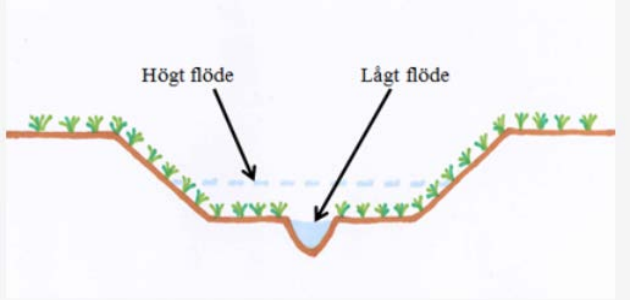
Trees for infiltration and slowing water flows

- Hedgerows
- Targeted tree planting
- More trees in the catchment
- Forestry without clear cuts

Gains

- Increasing soil infiltration
- Evapotranspiration
- Slowing water
- Interrupting surface flows
- Higher biodiversity

Measures in ditches



- Open up underground drainage
- Careful maintenance of ditches
- Two-step ditches
- Remeandering of ditches
- Block forest ditches

Gains

- Increasing soil infiltration
- Slowing water
- Storing water
- Higher biodiversity
- Less sediment and nutrition in the rivers

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Dams

- Create wetlands
- Dams for catching phosphorus
- Dams in previous waterways
- Catching surface runoff
- Barriers holding high flows back in ditches

Gains

- Increasing soil infiltration
- Evaporation
- Slowing water
- Storing water
- Interrupting surface flows
- Higher biodiversity
- Less erosion, sediments and nutrition in streams and rivers

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Controlled flooding; directing high flows out of streams

- Woody debris i streams
- Open up the outside of a meander

Gains

- Increasing soil infiltration
- Slowing water
- Storing water
- Less erosion, sediments and nutrition in streams and rivers
- Higher biodiversity

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Big projects

- Restoring lakes
- Restoring floodplains

Gains

- Increasing soil infiltration
- Evaporation
- Slowing water
- Storing water
- Higher biodiversity
- Less sediments and nutrition in waterways

International cooperation?

- The European Commission has described 53 Natural Water Retention Measures
- In England measures has been undertaken in several catchments in cooperation between different universitys, the Environment Agency and local organisations
- Our tool will point the minds of community leaders in Sweden in the right direction and help them get started
- There should be positive effects in developing countrys handling flooding problems this way (low costs, enrichment of the environment)
- These measures should help to control small and medium size flooding, probably not the worst scenarios

Read more

- http://nwrm.eu/sites/default/files/documents-docs/53-nwrm-illustrated.pdf
- http://www.yorkshiredales.org.uk/__data/assets/pdf_file/0003/1010991/11301_flood_management_guide_WEBx.pdf

SMHI ERICSSON

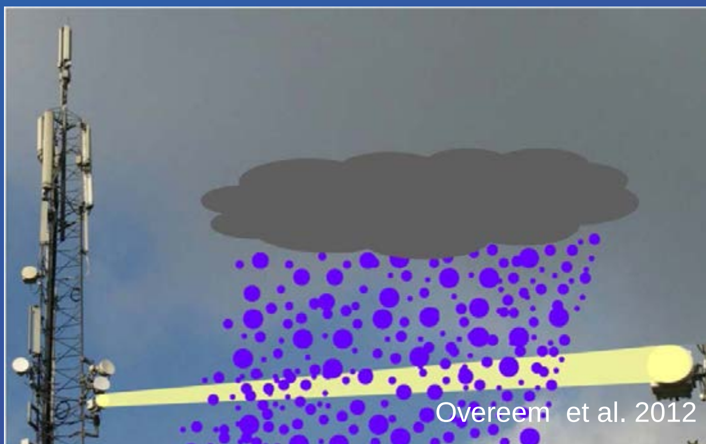
MicroWeather - Use the hidden asset in the microwave network to measure rain!

Weather affects everything

- Industries: hydropower, insurance, agriculture, telecom, aviation, construction, transporation, tourism etc.
- Global challenge of changing climate
  - More extreme events in many places (e.g. intense rainfall and flooding, landslides etc.).
  - Knock-on effects on agricultural production and food security
- Big global initiatives to adress this challenge and find workable solutions, esp. in developing communities with highest vulnerability (Paris agreement, COP process)
- Better accuracy can improve water management, hydro-power operations, insurance business etc.

The microweather concept

Microwave links sense rain!



MW link signal attenuated by rain → Calculate rainfall from path loss data collected from existing networks

Resolution
Accuracy
Cost

Additional revenue flow for operators

Sweden:

12 radars, 600 gauges

50 000 Microwave radios

4 million
Microwave links globally

Collect weather data as part of existing infrastructure

What is MicroWeather?


Photo: Jafet Andersson

- Microwave links (MWL) backbone of mobile phone networks
- MWL signal attenuated by rain
- Collect signal strength data from operational telecom networks to calculate rainfall
- Tested during last 10 years in Israel, Holland,…,
- Swedish pilot in Gothenburg since May 2015

Concept & first test | **Gothenburg Pilot** | **Expansion**

2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019

SMHI

ERICSSON

FutureCityFlow

MEMO

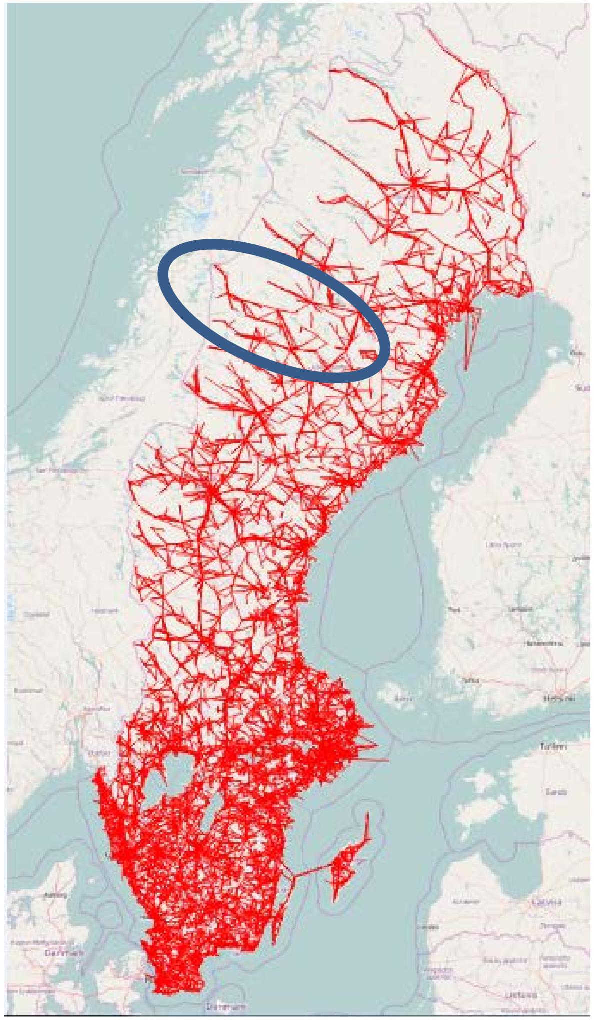
Potential uses

Meteorology

- Improved rainfall monitoring: operational, cost, coverage, temporal resolution, spatial resolution, near surface, peak rainfall/cloudbursts.
- Real-time mapping with fusion of radar, stations and links → improved error correction & redundancy
- Nowcasting (short propagation)
- Evaluate & improve forecast models
- Fusion with forecast models

Hydrology

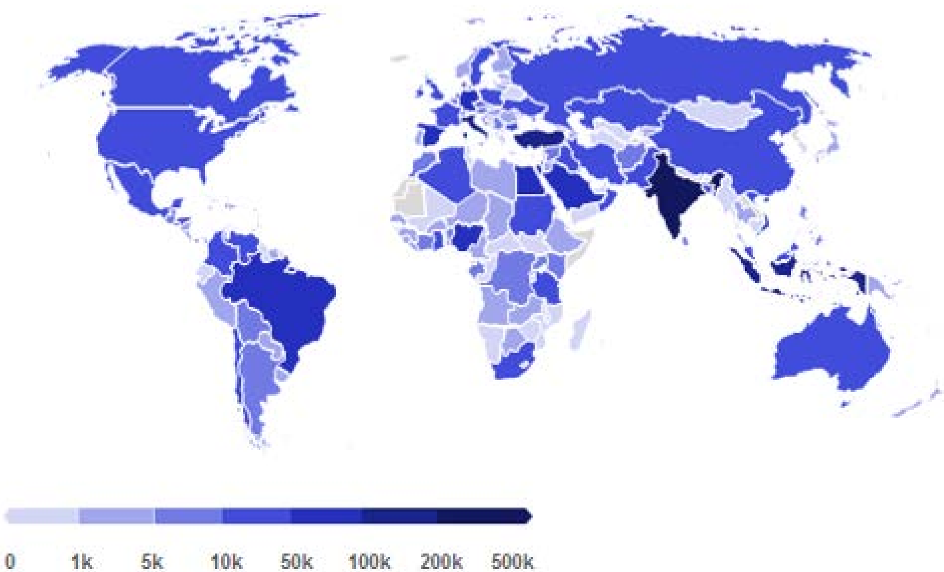
- Forecasting: better monitoring of recent rainfall → better forecasts → better warnings → less damage & release of pollution from sewage treatment plants
- Construction (e.g. sewer pipe dimensioning)
- Post-event evaluation: insurance claims
- Peak rainfall is critical!

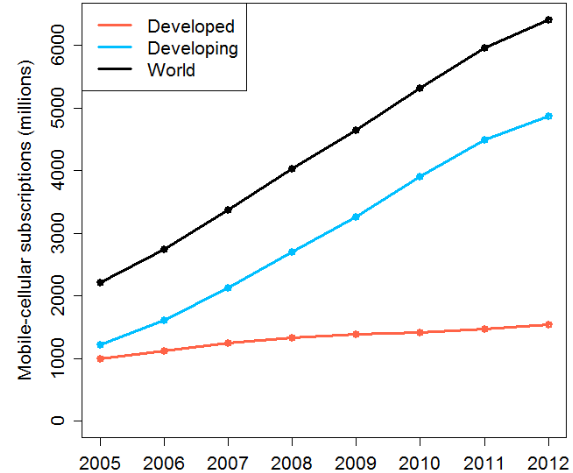


Swedish microwave link coverage: 20 000 links (vs. 600 SMHI daily stations). Source: (PTS), 2016

Global potential

Ericsson MW links sold per country
Global total: 4 million links



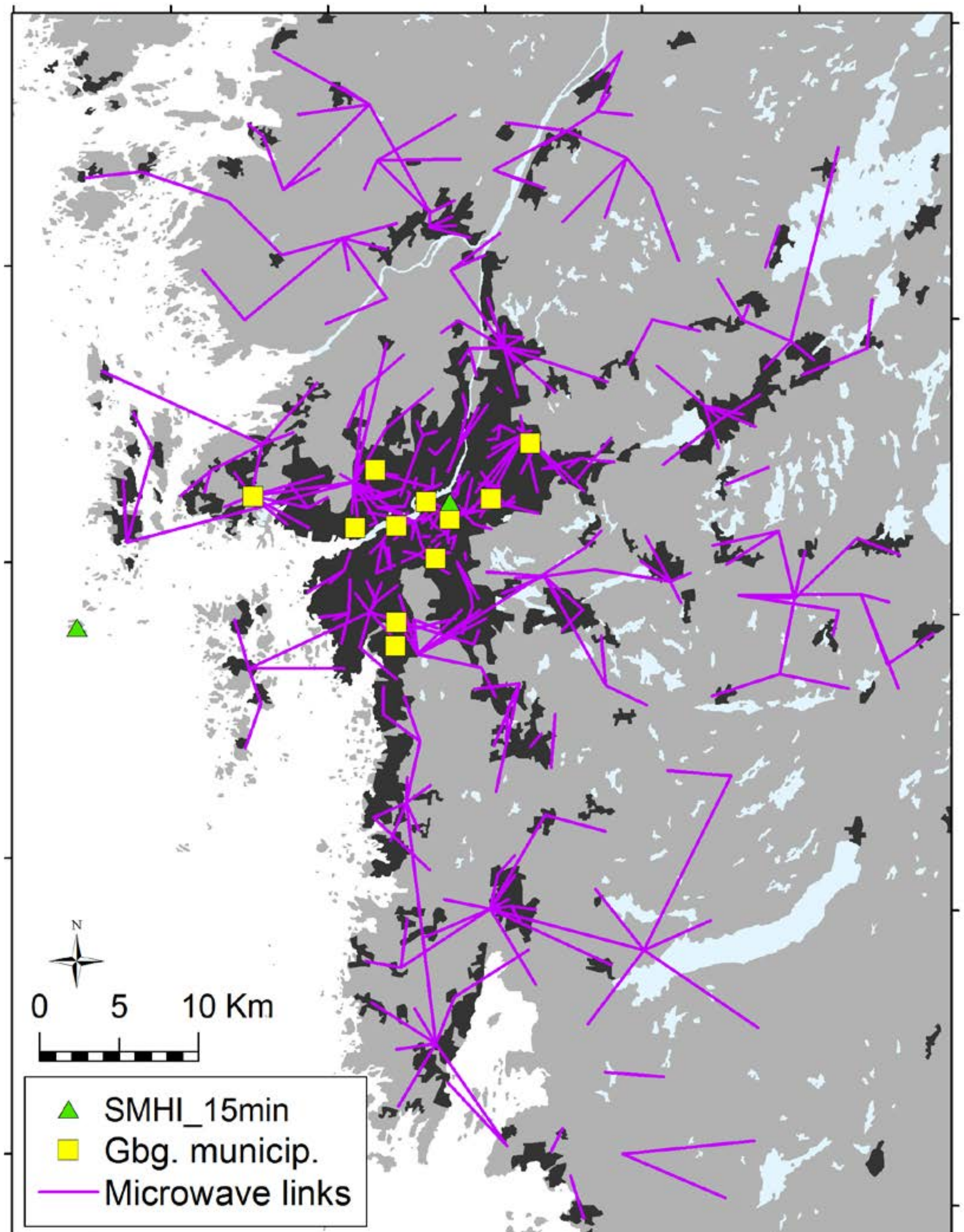


ITU mobile subscriptions

Flooding in West Africa

- Developing countries:
  - Operational data (no radar, non-operational stations) → enables forecasting
  - Capacity development (Agenda 2030)

Datasets



Microwave links (MWL):

- 364 microwave hops
- 10-sec TX & RX sampling → 6.3 million measurements per day.
- MINI-LINK TN
- Frequency range 15-38 GHz
- Coverage area ~50x80 km
- No negative impact on network performance or operations

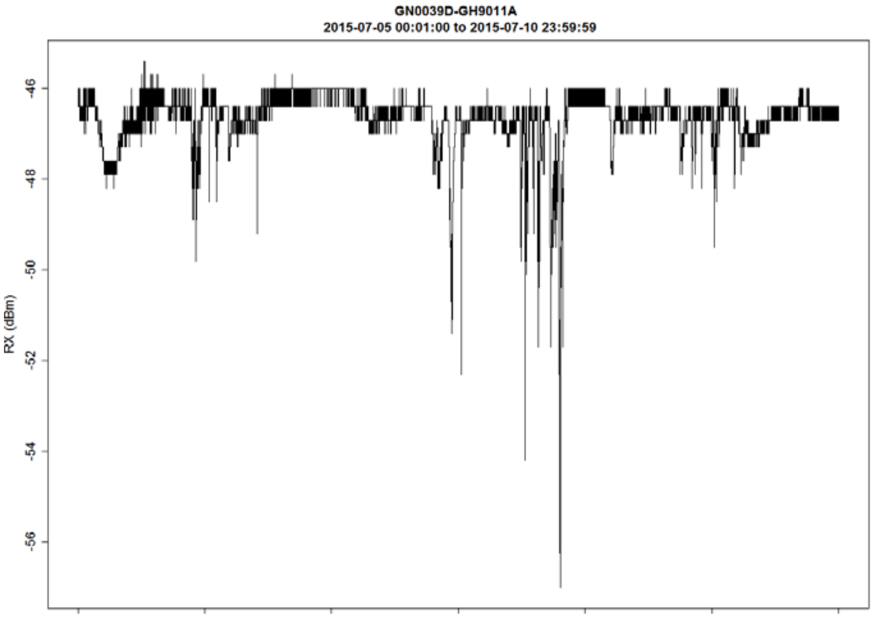
Stations:

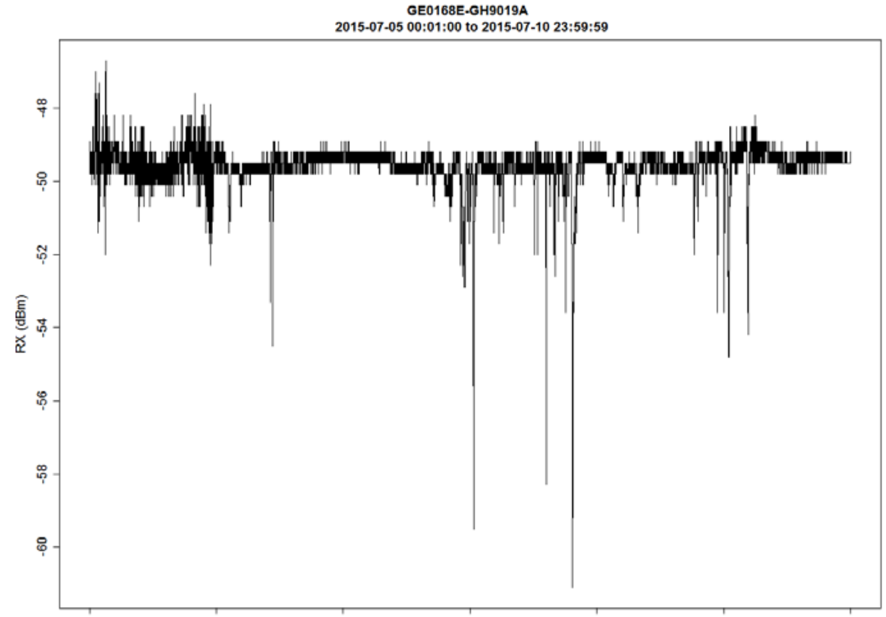
- 1 @ 15-min (SMHI)
- 10 @ 1-min (municipality)

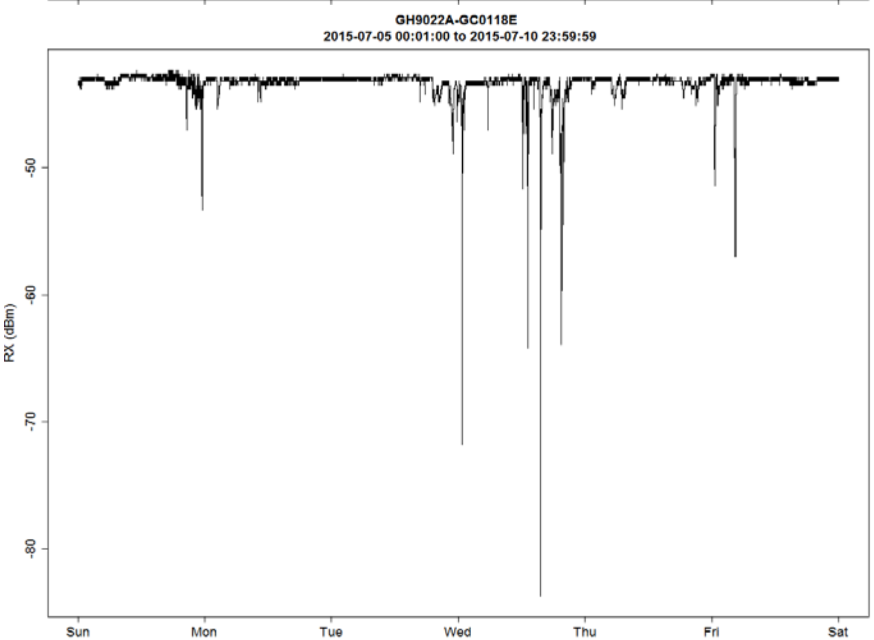
Radar:

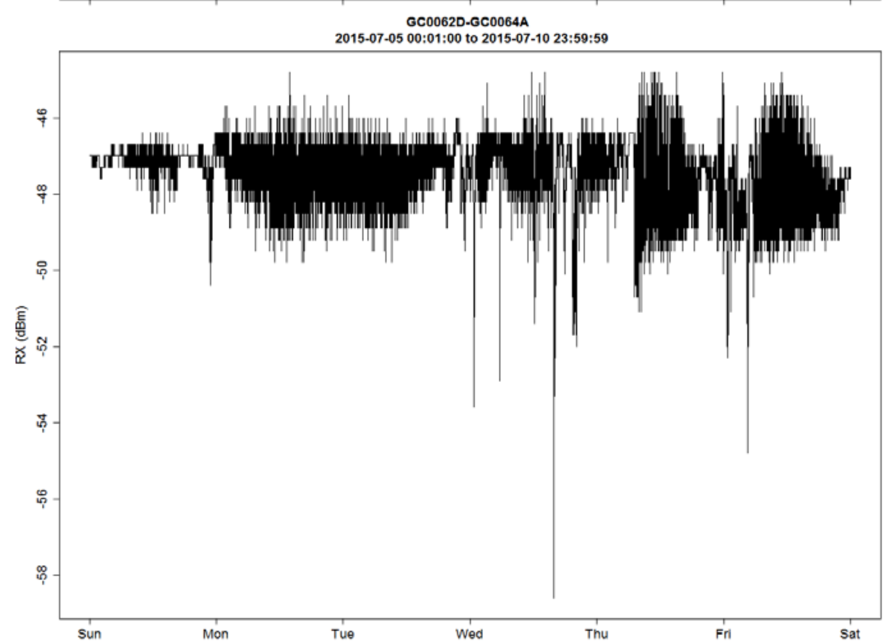
- $4 km^2$ @ 15-min & 1.2 km elevation (SMHI)

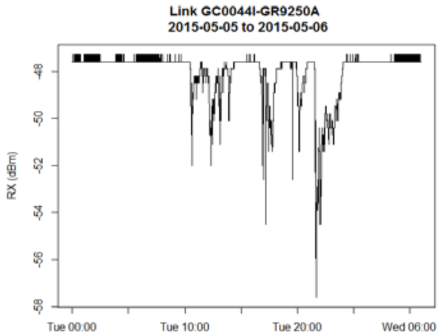
Raw data examples











Algorithm to derive precipitation

RX & TX: path loss

Filter doubious data

Time averaging

Attenuation

A_{ml}

Wet/dry classification

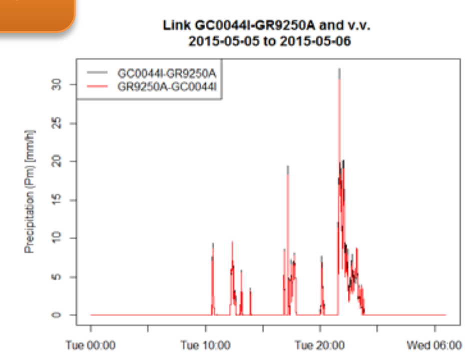
Baseline

Corrections (wet-antenna)

Attenuation → precipitation f(freq,pol,len)

Bias correction

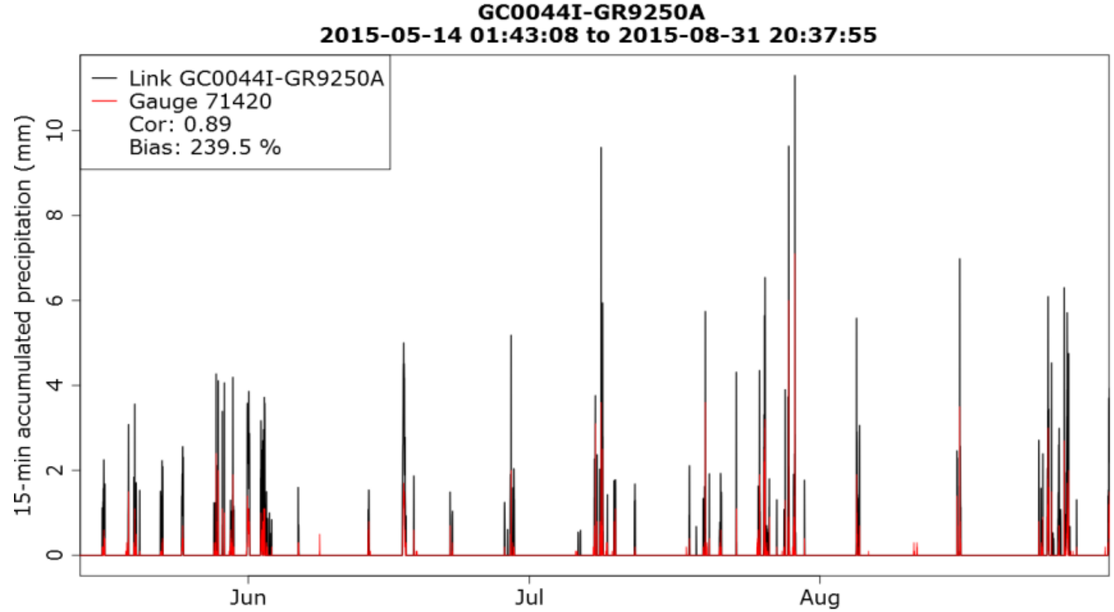
P_m

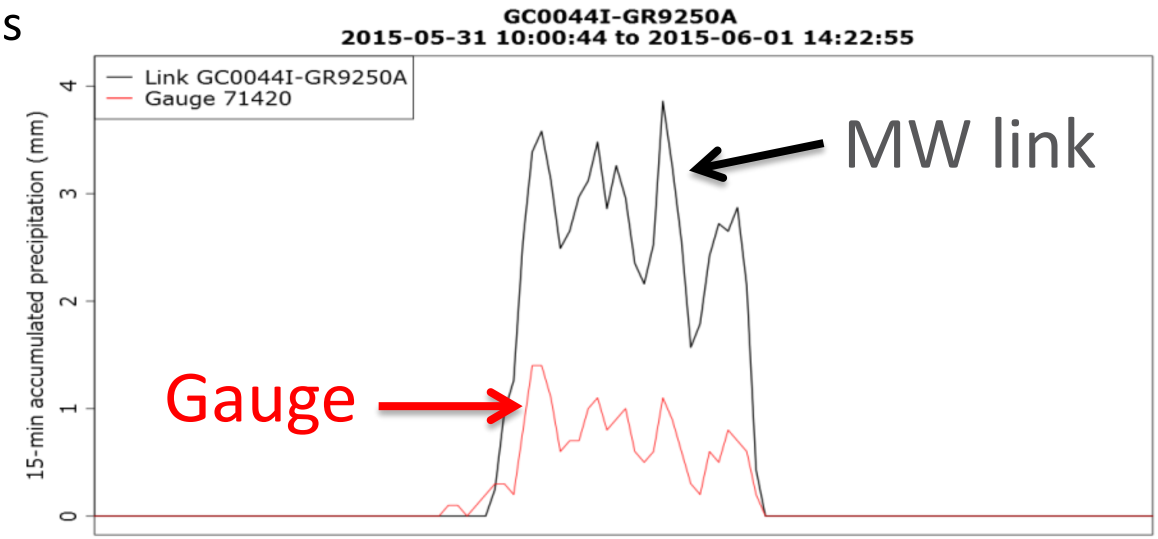


P_m = path-average rainfall intensity

Rainfall evaluation for 1 gauge

- Performance **without any error corrections**
- 15-min accumulated rainfall: Göteborg A gauge vs. links 14 May to 31 August
- Excellent correlation = capture temporal dynamics well
- Magnitudes substantially overestimated

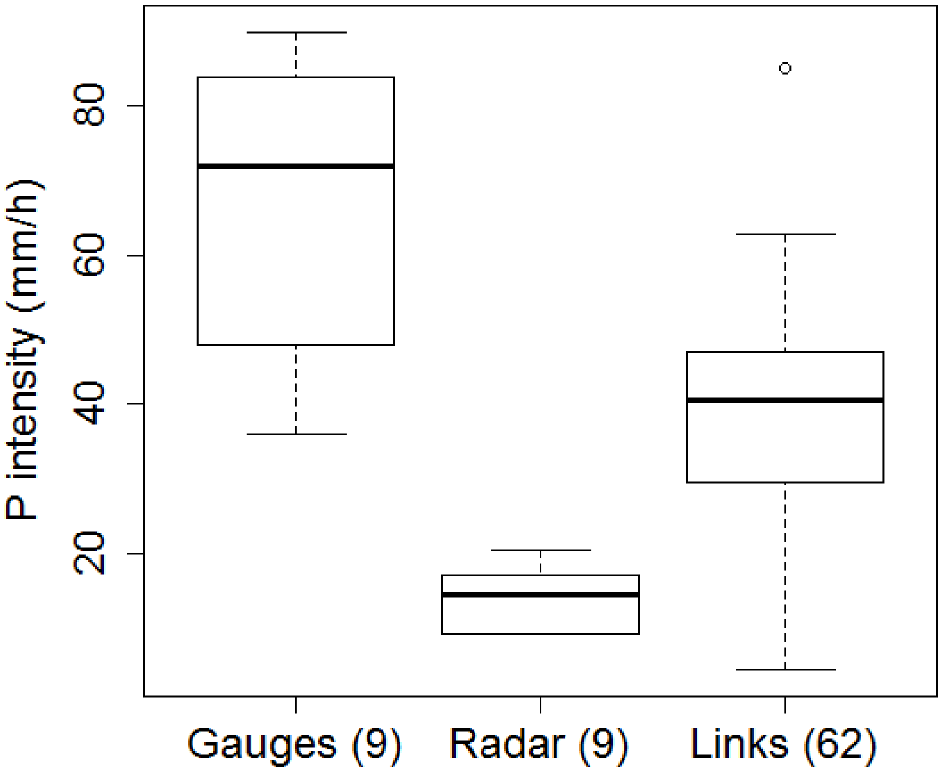


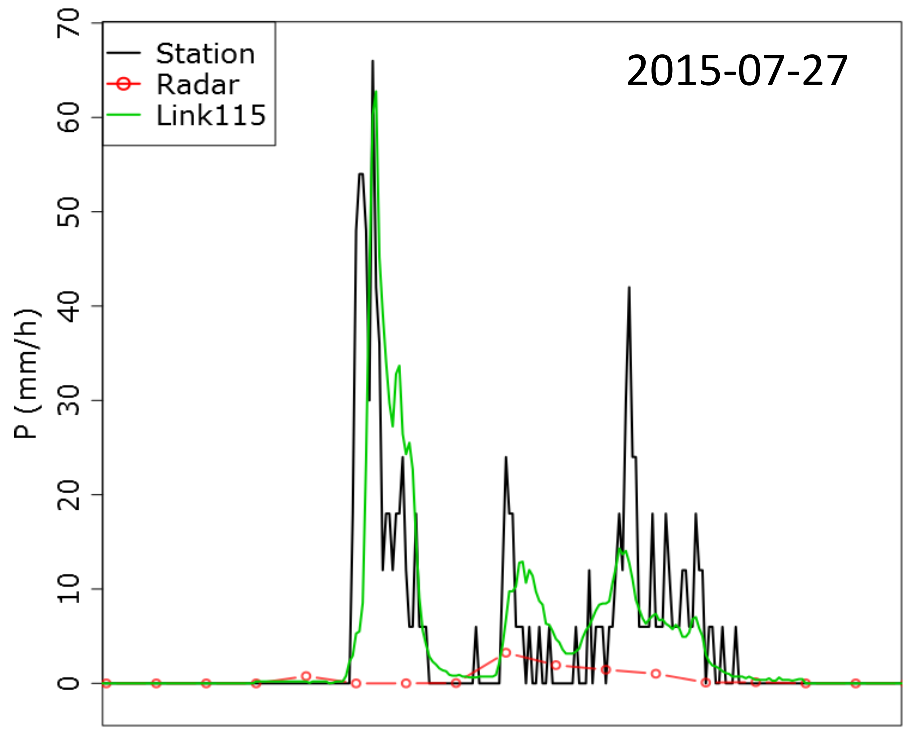


What would we expect from nearby stations?

Station	Distance from Göteborg A (71420)	Correlation with Göteborg A (-)	Cumulative bias against Göteborg A (%)
Drakegatan	1km	0.79	-23
Lilla Bommen	1.5km	0.81	-9
Torpagatan	2.6km	0.83	+6

Results: peak rainfall intensities





Comparison

- 9 gauges (1-min)
- 9 nearest radar pixels (15-min)
- 62 links within 500m of the stations (1-min)
- Maximum rainfall intensity for July 2015

Results

- Mobile network provide better ability to capture **peak intensities** compared with radar (cloudburst)
- Better also at capturing **quick rainfall events**

Overall performance vs. 10 local gauges

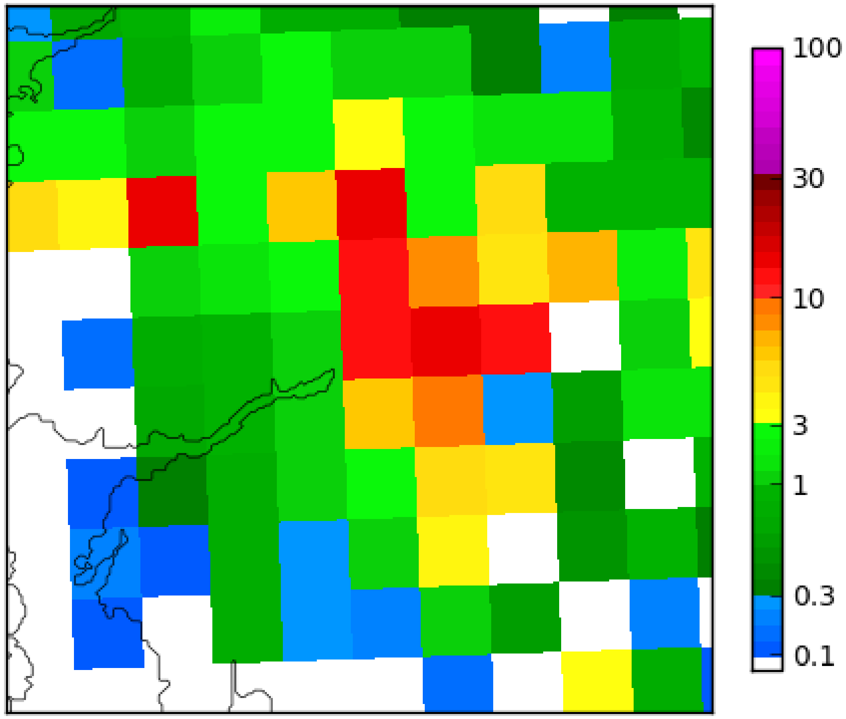
Mean performance criteria	Correlation	Bias
Mobile network	0.82	+ 31 %
Radar	0.57	- 20 %
Nearby gauges (independent)	0.80	- 10 %

- 15-min accumulated P
- Excelent correlation = very good representation of temporal variability
- Over-estimation of magnitudes requires bias correction (SMHI algorithm)

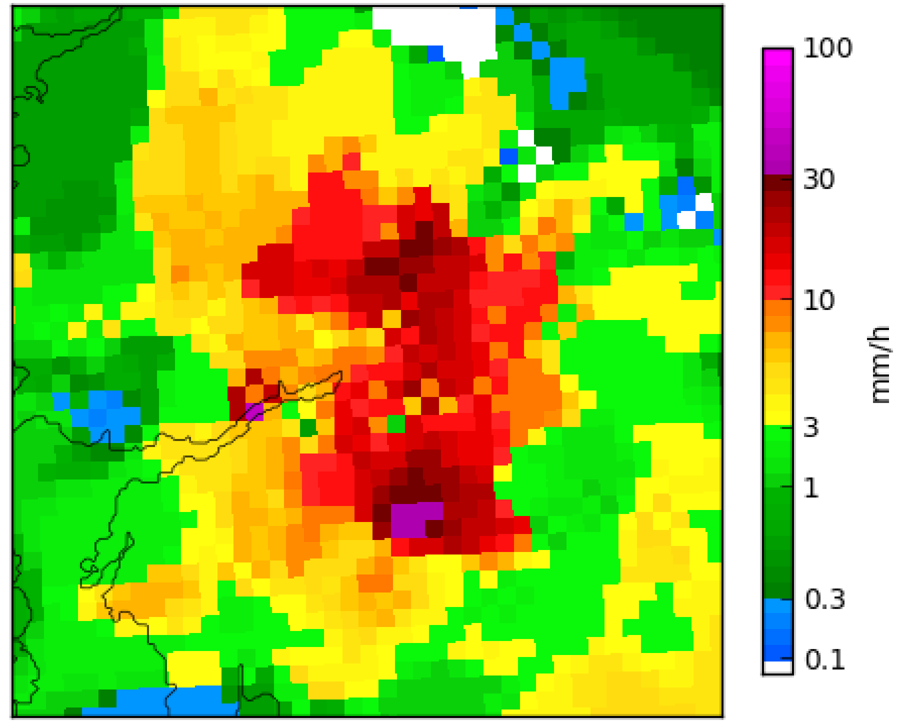
Real-time mapping at higher resolution

2015-07-08 00:45 UTC

Radar



Microwave links



	Radar	Microwave links
Temporal resolution	15-min	1-min
Spatial resolution	4 km^2	0.25 km^2
Vertical sampling	1.2 km	25 m

http://www.smhi.se/en/services/professional-services/micro-weather-example-from-2016-04-28

Summary comparison with other techniques

- Microwave backhaul links provide accurate, high resolution rainfall measurement.
- Microwave requires no additional CAPEX and lower OPEX than traditional tools.

	Rain gauge	Weather radar	Microwave link
Time resolution	Down to 15 min	5–15 min	10 s–1 min
Space resolution	~2 dm^2	~1 km^2	100–1,000 m
Coverage area	~2 dm^2	~200 km radius	100–1,000 m
Accuracy on ground level	Very good	Limited, measures at ≥500 m height	Good, measures at 10s of meters above ground level
Cost	New installation CAPEX SEK 150,000 OPEX SEK 90,000/year	New installation CAPEX SEK 25 million OPEX SEK 725,000/year	Additional cost for collecting data from an existing network of 1,000 links: CAPEX SEK 135,000 OPEX SEK 100,000/year

Value

SMHI

- Improved services
  - Higher resolution & accuracy
  - Measurement where there is none
- Potential users
  - Meteorological agencies (now-casting maps)
  - Municipalities (floods)
  - Insurance companies (extremes)
  - Energy (hydro-power inflows)
  - Media (current weather)
  - Developing countries: technical institutions & financers
  - Etc.

MicroWeather in Africa?

- Most African countries have no weather radar. Many have maybe one or two at most.
- There is significant and sustained growth in the telecom industry in Africa
- Microwave link provides an affordable leap frog technology for rainfall measurements in these environment.
- Information on rainfall is essential for agricultural productivity and food security
- Will strengthen Early Warning capabilities

Gothenburg 2015-07-08
Heavy rainfall

movie.mp4

CORVALLIS, OREGON, USA & STOCKHOLM, SWEDEN •
JOHOMA@ALLIANCE4WATER.ORG • 8 FEBRUARY 2018

ANCHORING RESILIENCE IN THE LANDSCAPE

THE ROLE OF ECOSYSTEMS IN HUMAN ADAPTATION

AGWA: ALLIANCE FOR GLOBAL WATER ADAPTATION

- ~1100 global water and climate professionals, >7 years old
- Co-chaired by World Bank, SIWI
- Strong emphasis on best practices + global policy program
- Target audience: "Luis's engineer"

http://alliance4water.org

http://AGWAGuide.org

Pat Mulroy,
Brookings Institution

climate & ecosystems:
the “invisible water utilities”

How do we respond when these utilities are evolving with climate impacts?

the new era of sustainability has not yet (fully) appeared

- Can we conserve “conservation”?

  If our goals are judged against better conditions in the past, we risk keeping ecosystems embedded in climate conditions that no longer exist.

- How do we define goals and targets under deep uncertainty?

  Predicting water conditions is difficult with climate change. Predicting species and biophysical processes responses is even harder.

- Have economic valuations of ecosystems been successful?

  So far, applying quantitative ecosystem services valuations have not been widely used despite 25 years of effort. These approaches are even more challenged in the context of *future* values.

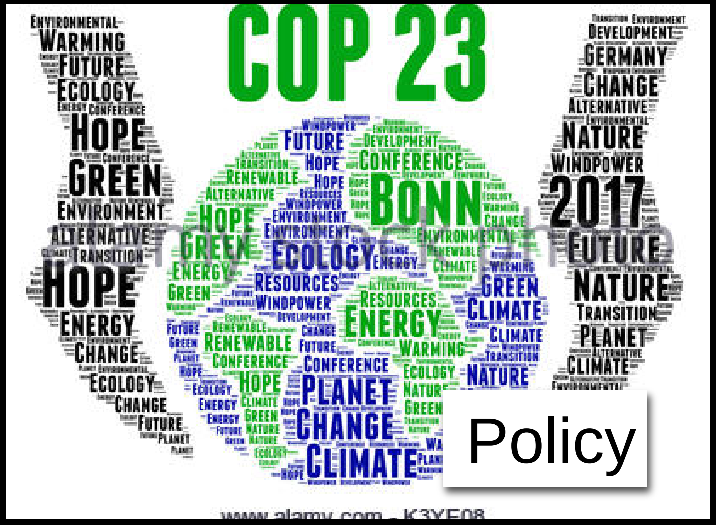
Water management in a time of climate change requires some fundamental shifts. Climate adaptation and resource management cannot remain separate.

What do we want from ecosystems?

- Robust and flexible solutions: A shift from “ecosystem services” to “adaptation services”
- Integration within water management systems
- Qualitative valuation, not based on quantitative economic frameworks

Elena Lopez
iCatalyst

the rise of “nature-based solutions”



Three stories of emerging approaches

CAN WE BLEND ECOLOGICAL AND ENGINEERING DEFINITIONS OF RESILIENCE?

Four workshops at the National Socio-Environmental Synthesis Center (SESYNC)

June 2013 through October 2014

Poff & Matthews co-PIs

Poff, Brown, et al., Sustainable Water Management Under Future Uncertainty with Eco-Engineering Decision Scaling (EEDS). 2016. Nature Climate Change

Engineering principles for "resilience":

- Efficiency
- Reliability
- Robustness
- Reduce vulnerability

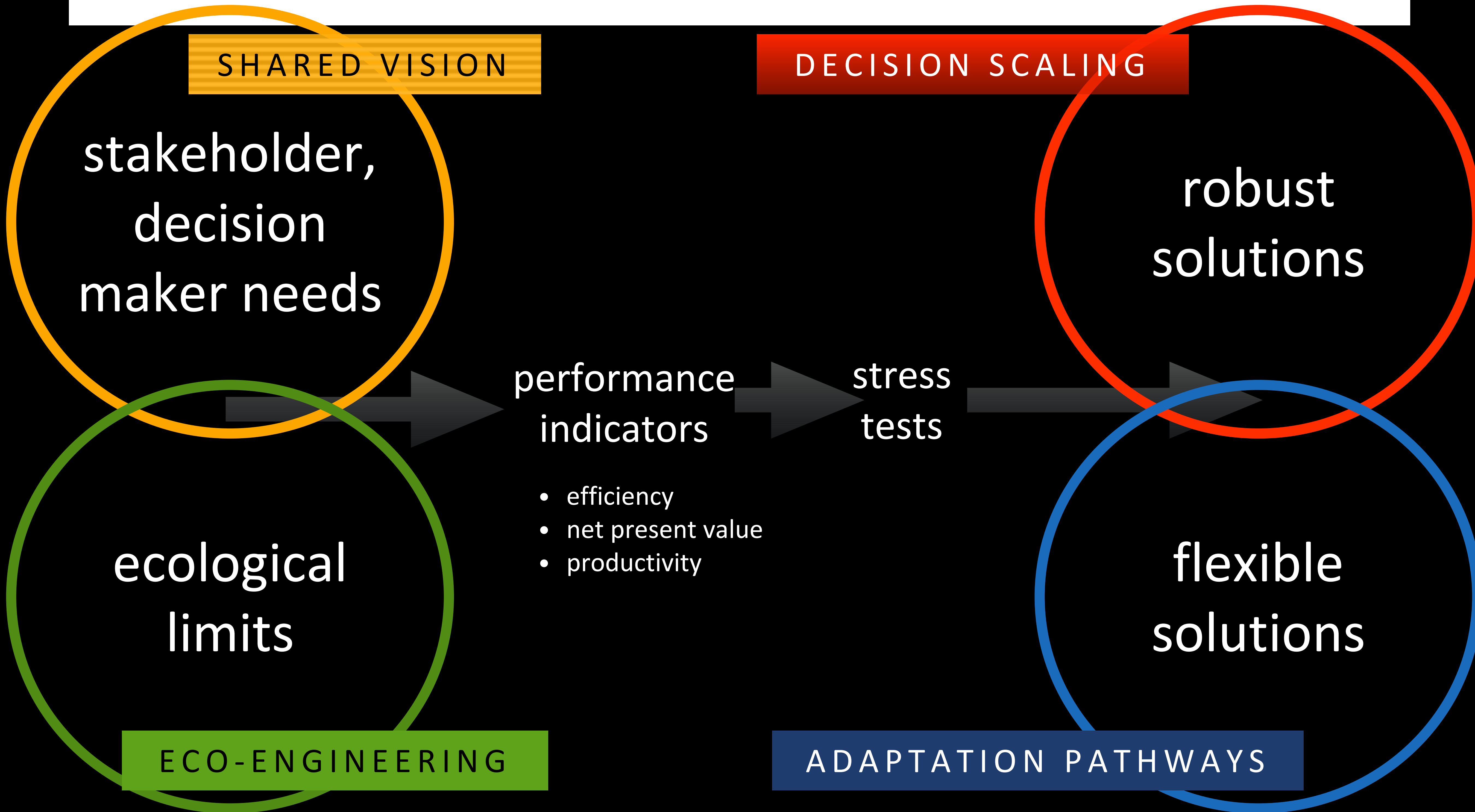
Ecological principles for "resilience":

- Variability
- Connectivity
- Heterogeneity
- Reduce non-climate stressors

system-level performance indicators

SESYNC
NATIONAL
SOCIO-ENVIRONMENTAL
SYNTHESIS CENTER

CRIDA: COLLABORATIVE RISK-INFORMED DECISION ANALYSIS

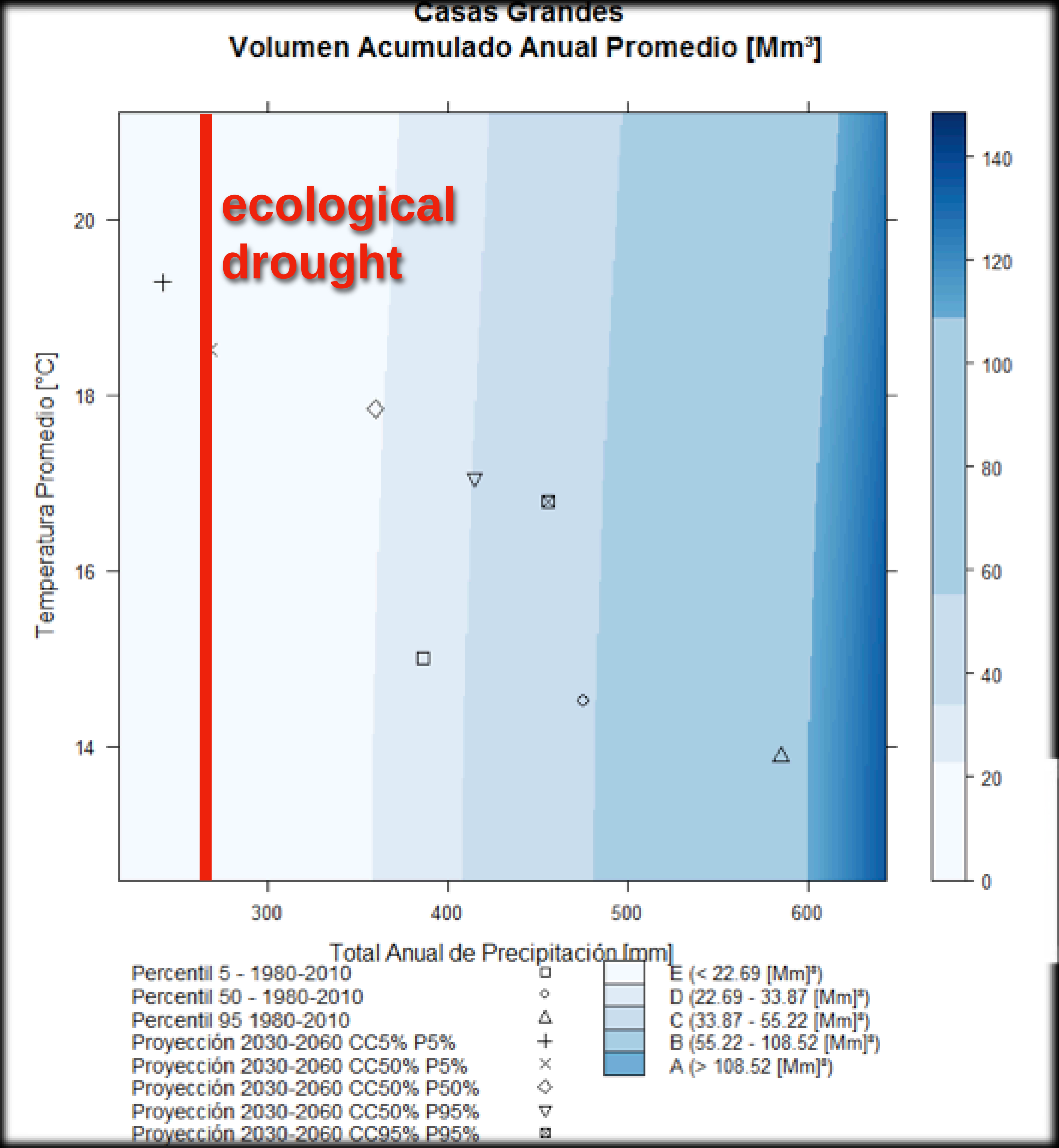


http://AGWAguide.org/

publishing March 2018

MEXICO'S WATER RESERVES AND "ADAPTATION SERVICES"

- Developing water management guidelines, national-scale application of eco-engineering (EEDS)
- Partnering with Mexican National Water Commission (CONAGUA), WWF-Mexico, IADB, IHP
- Examination of water reserves scenarios, flood, and drought impact on e-flows

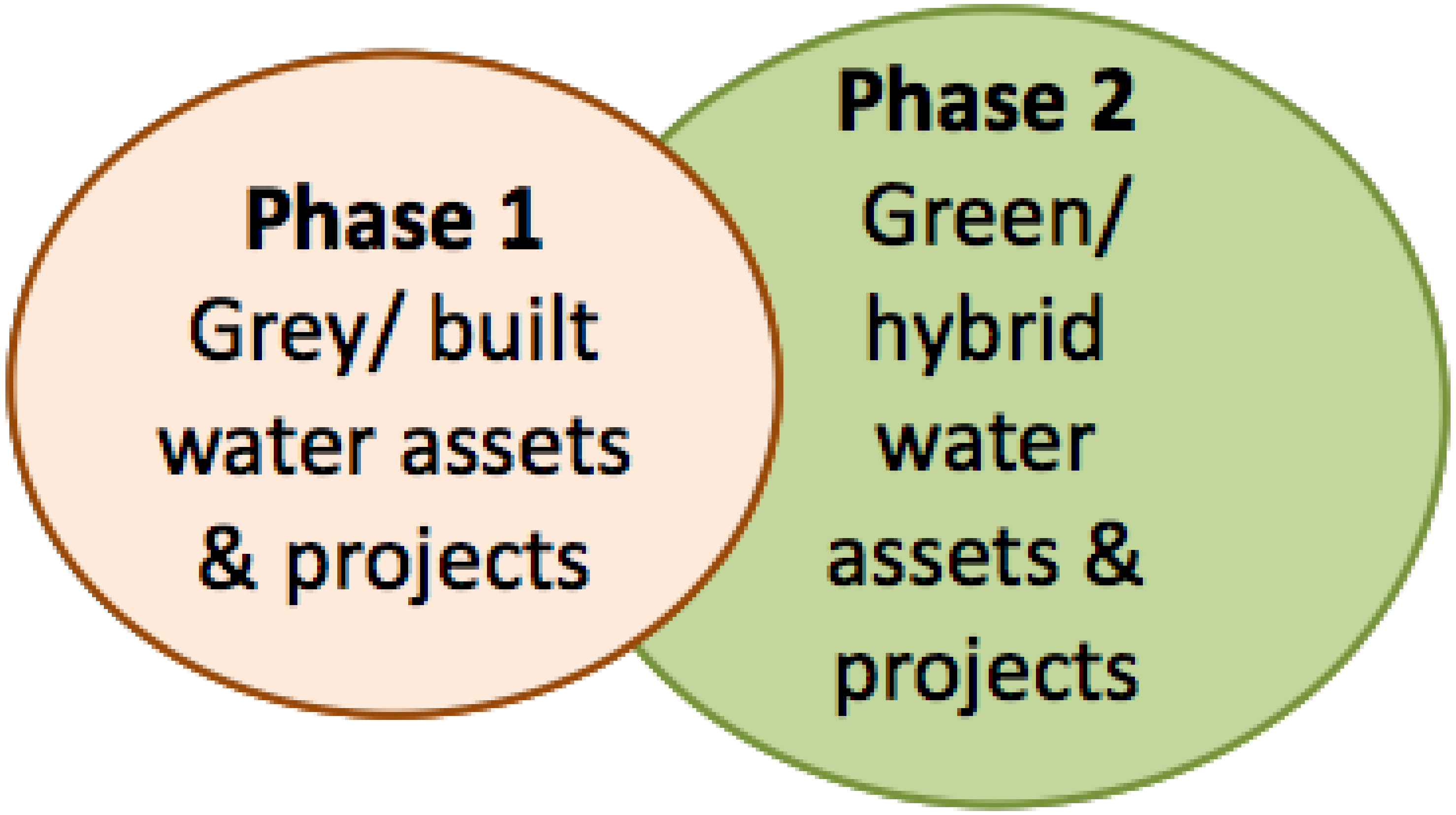


http://www.wwf.org.mx/que_hacemos/programas/programa_agua/water_reserves.cfm

WATER CLIMATE BOND STANDARD: LAUNCHED 2016

CBS Water Criteria capture eligible assets and projects relating to freshwater and waste water capture, treatment and distribution (including sewage systems, water treatment plants, flood defenses, distribution systems etc)

This includes nature-based-solutions



http://www.climatebonds.net/standard/water

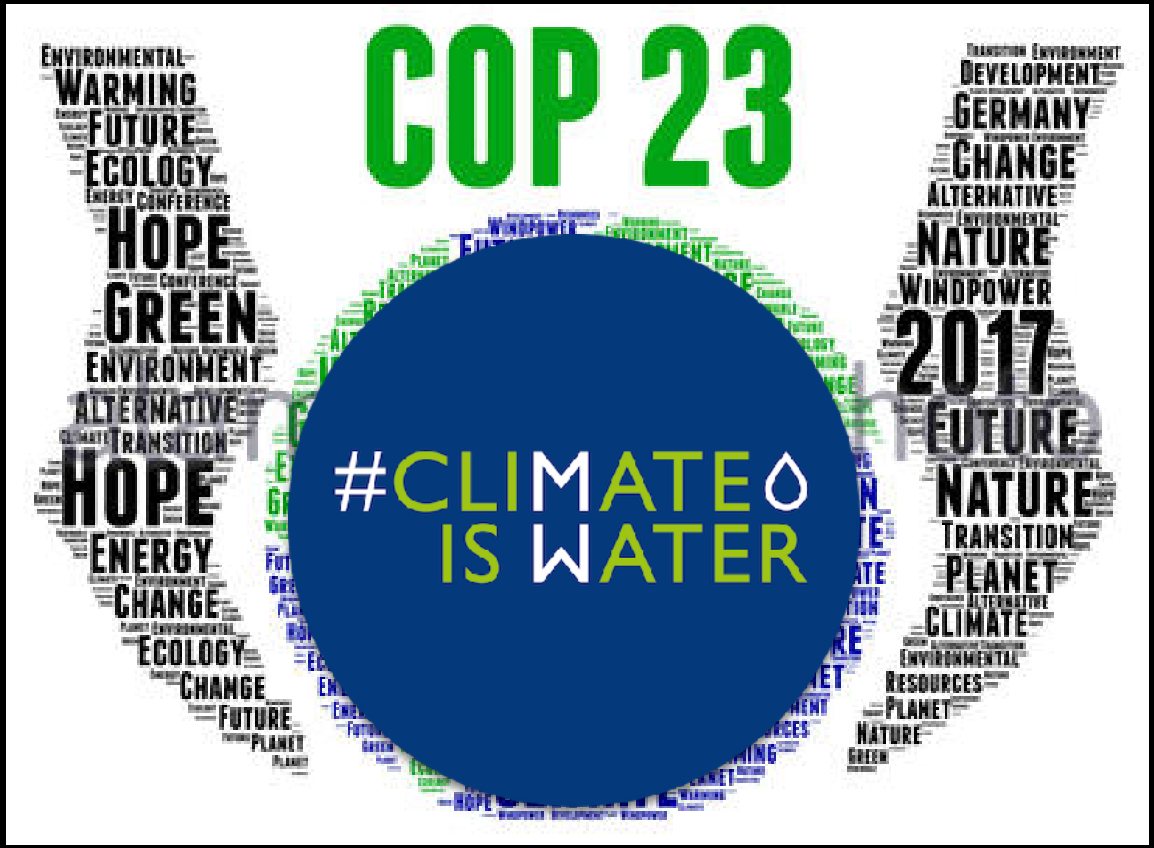
- Broadly defined as 'green' or hybrid green-grey solutions to water infrastructure
- Water NBS working group defined water infrastructure assets or projects that
  - Make use of existing ecosystems;

This work has been led by Climate Bonds Initiative, AGWA, SIWI, WRI, CDP, and Ceres but draws from >150 water experts.

To date, more than 1 billion USD have been issued against the criteria. The first resilient NBS bond issuance should come out from Cape Town in March 2018.

WATER & CLIMATE: BETTER TOGETHER AS POLICY?

- UNFCCC & SDGs are also important for integrating ecosystems within climate finance, NDCs
- AGWA's policy group is active in shaping these topics for COP24 in 2018
- alliance4water.org/policy



BUILDING A COMMUNITY OF PRACTICE FOR BOTTOM-UP APPROACHES

Yamuna River, India

Welcome to the Knowledge Platform on Bottom-up Approaches to Climate Adaptation

The time has come for a paradigm shift. The Knowledge Platform features a new generation of methodologies to assess and address climate risk and other uncertainties in water resources management. These “bottom-up approaches” work with complex stakeholder needs, build confidence for policymakers, and integrate into existing decision- making processes to achieve quantitative solutions that are both robust and flexible. The Knowledge Platform seeks to engage with researchers, practitioners, and decision makers by providing the information and resources necessary to more effectively address water management issues in the long-term.

KNOWLEDGE RESOURCES

Join AGWA, Work with AGWA
AGWA wants to work with you

AGWA newsletter: http://alliance4water.org/contact/

AGWA BUA user group: http://agwaguide.org/getinvolved/

THANKS!

john matthews • johoma@alliance4water.org

Qinghai Province, CN