International course

Wetlands, integrated water resources management and food security

WAGENINGEN
UNIVERSITY & RESEARCH

Promoting the value of wetlands for conservation, food security and climate change resilience

Wageningen, The Netherlands, 04 - 22 June 2018

Ramsar

Integrated water resources management (IWRM)

as defined by the Global Water Partnership (GWP)

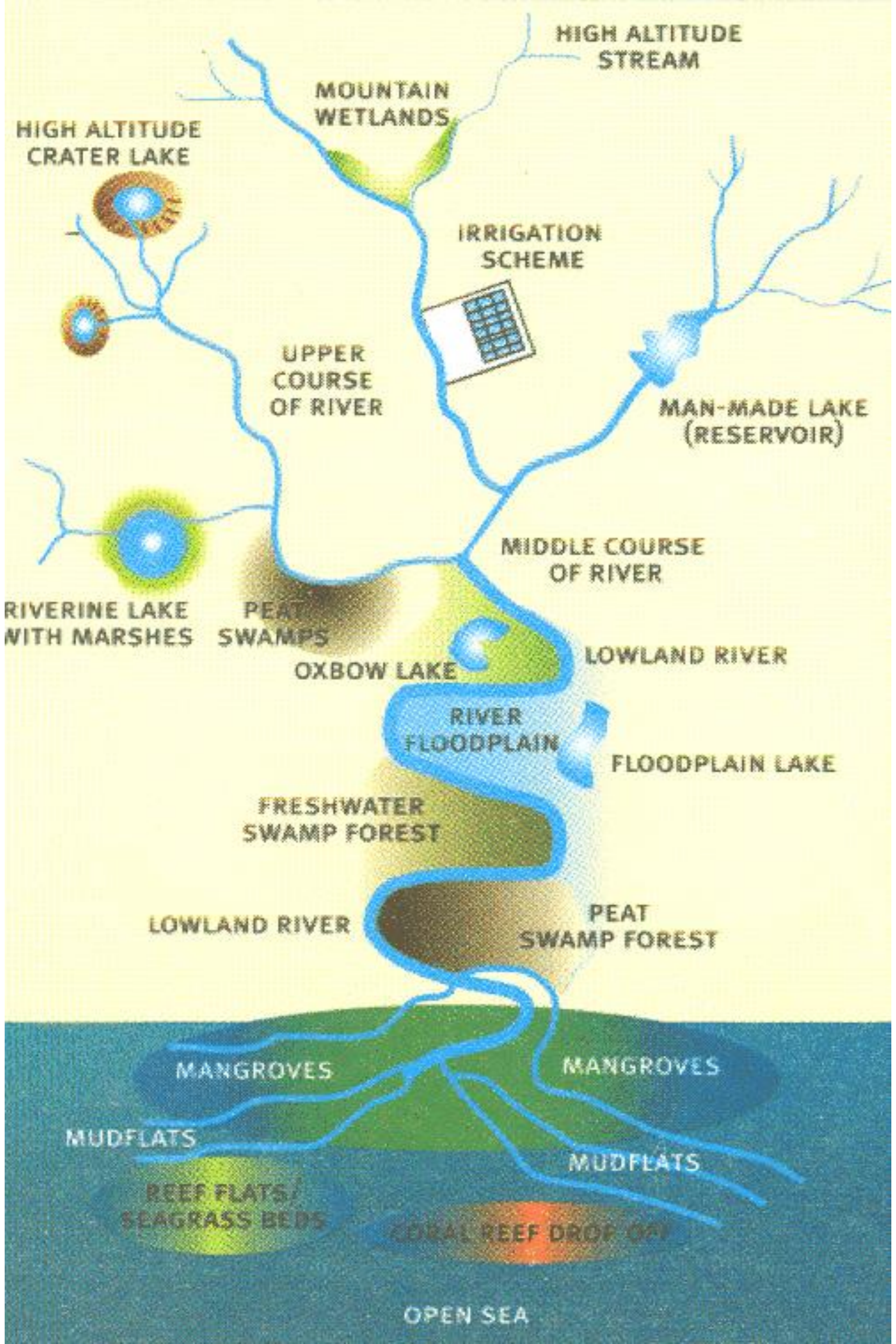
"**a process** which promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems.

In other words: IWRM aims at integrating the three E's:

Social equity: ensuring equal access for all users (particularly marginalised and poorer user groups) to an adequate quantity and quality of water necessary to sustain human well-being.
Economic efficiency: bringing the greatest benefit to the greatest number of users possible with the available financial and water resources.
Ecological sustainability: requiring that (aquatic) ecosystems are acknowledged as users and that adequate allocation is made to sustain their natural functioning.

Schematic presentation of IWRM

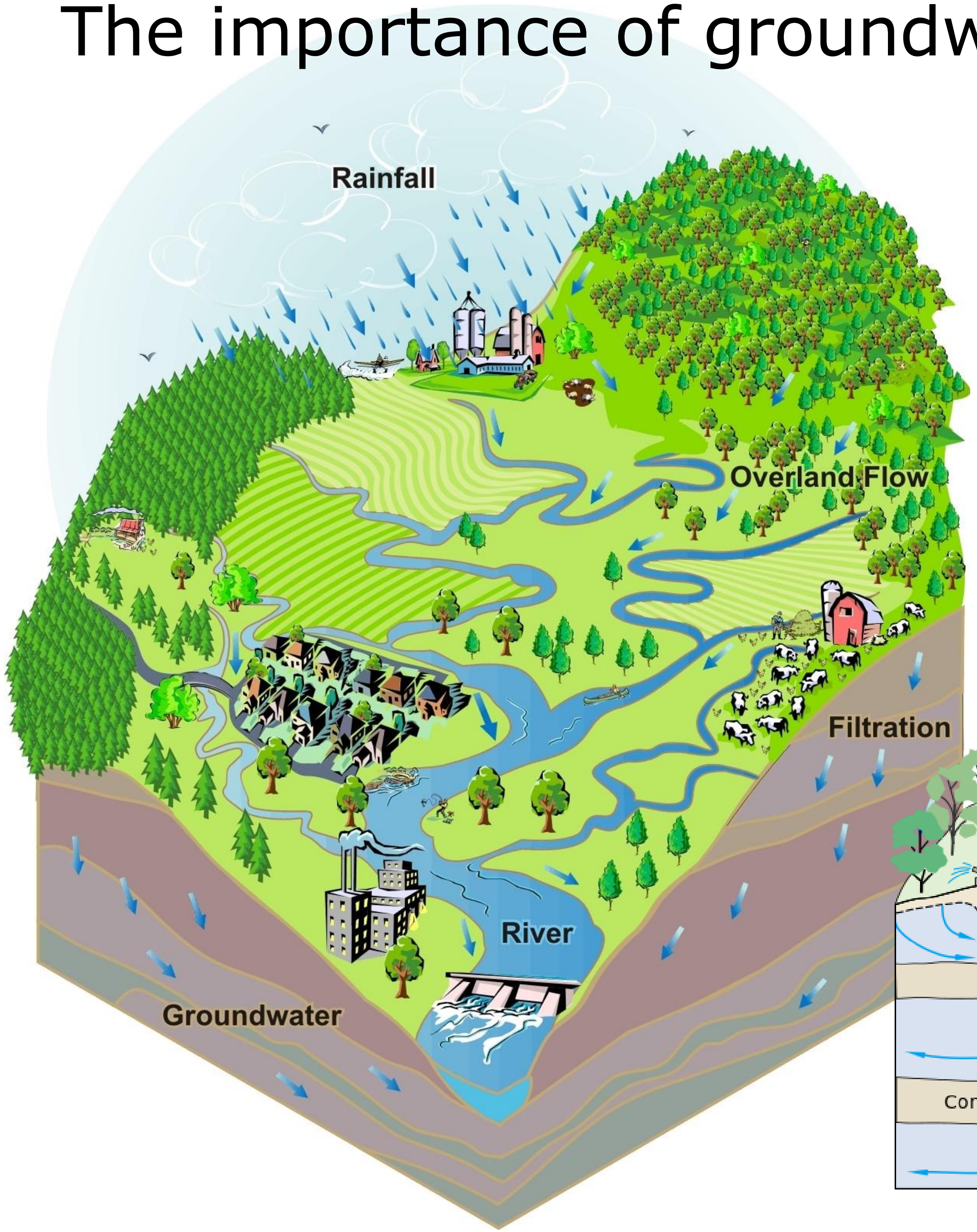
See also: http://www.gwp.org/en/ToolBox/ABOUT/



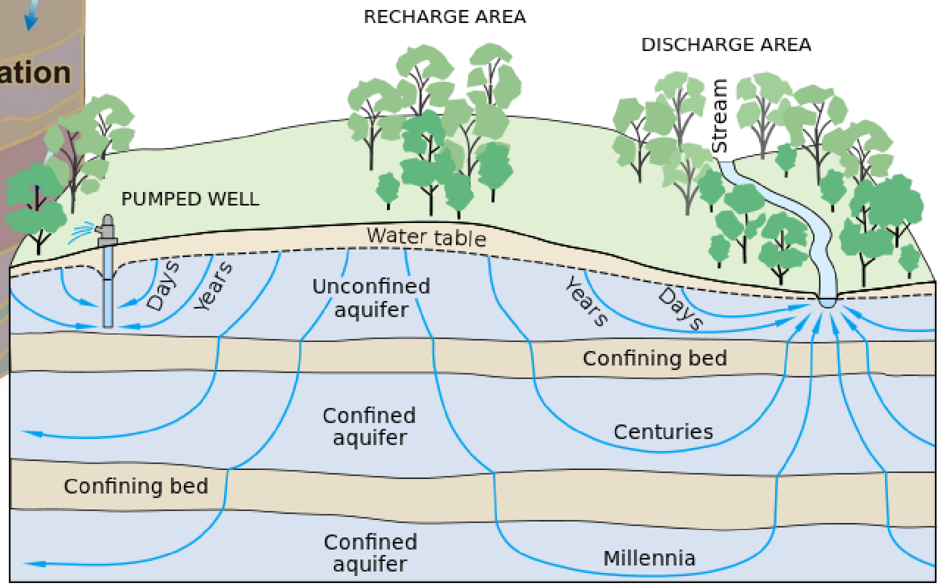
Various types of wetlands in river basins

Wetlands play a crucial role in managing the river discharge patterns and in managing and controlling the water quality of rivers.

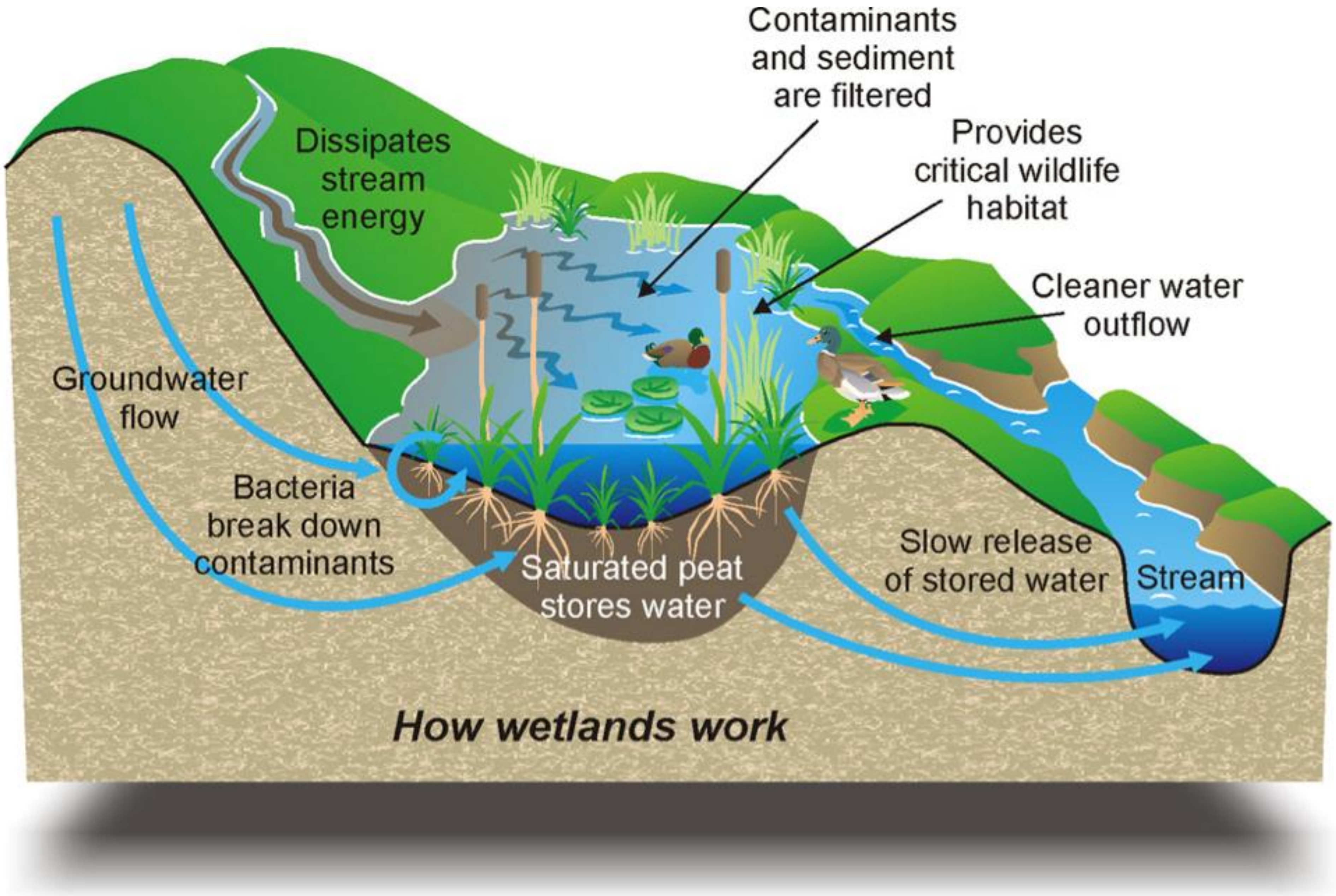
The importance of groundwater and land use



Managing River Basins also implies Managing Groundwater



Regulating service of wetlands

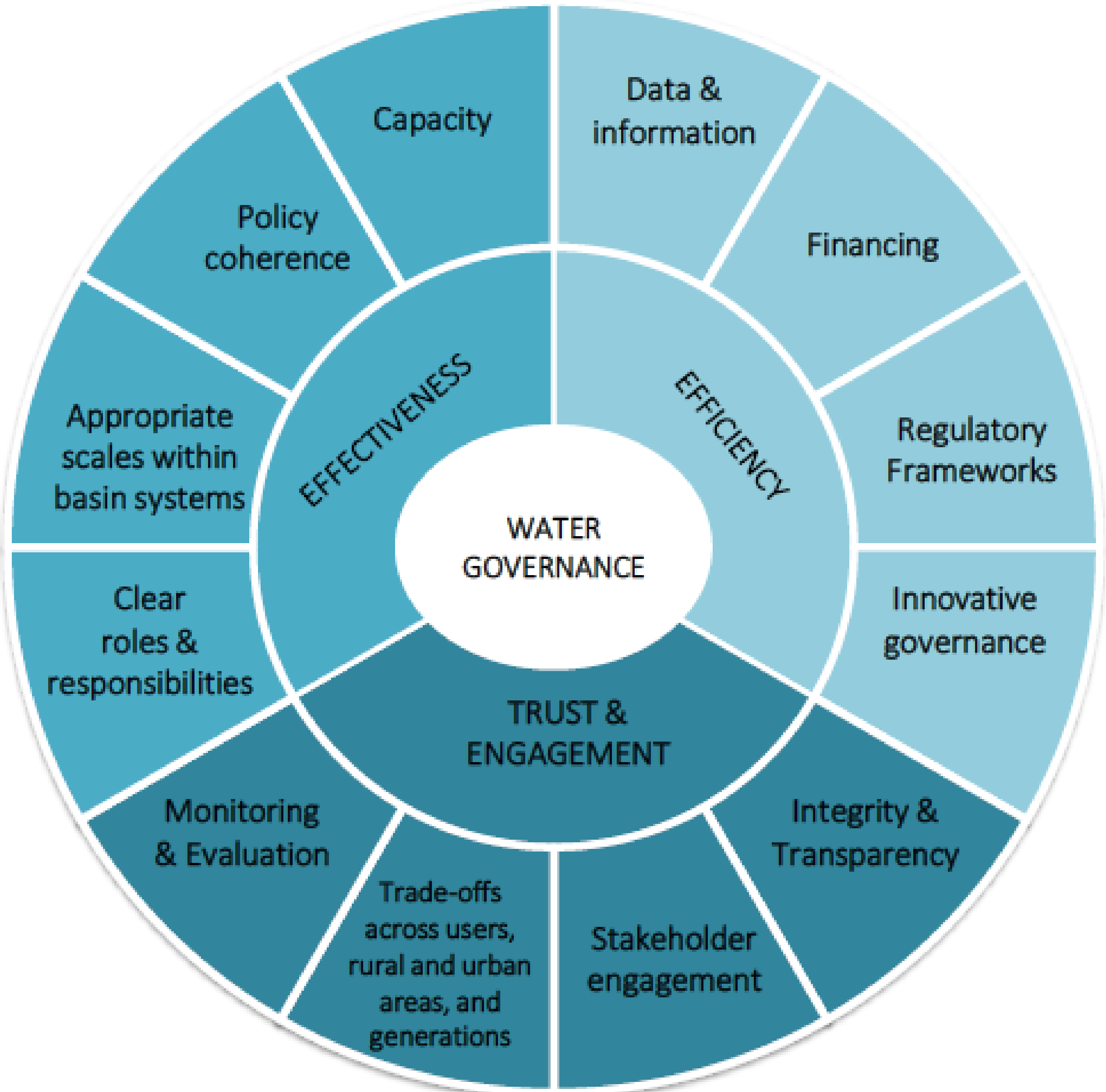


What is Water Governance

- **Water governance** can be described as a range of political, social, economic and administrative systems that are in place to develop and manage water resources and to organise the delivery of water services, at different levels of society (Global Water Partnership (2002)

- **Water governance** is the set of rules, practices, and processes (formal and informal) through which decisions for the management of water resources and services are taken and implemented, stakeholders articulate their interest and decision-makers are held accountable (OECD, 2015a).

Overview of OECD Principles on Water Governance



Wetlands as Natural Climate Buffers

Some NWRMs can be linked with one of the NCB types…

Natural Water Retention Measures (NWRM)

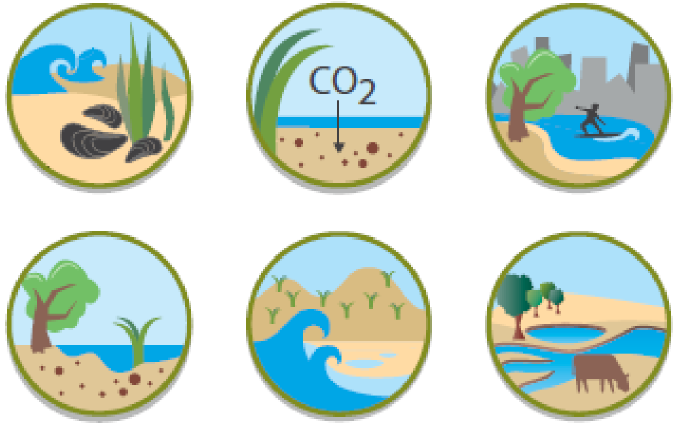
I. Direct modification in ecosystems:

- Rivers and connected wetlands,
- Lakes and connected wetlands,
- Aquifers

II. Change & adaption in land-use & water management practices:

- Agriculture
- Forestry and pastures
- Urban development

Natural Climate Buffer (NCB) approach



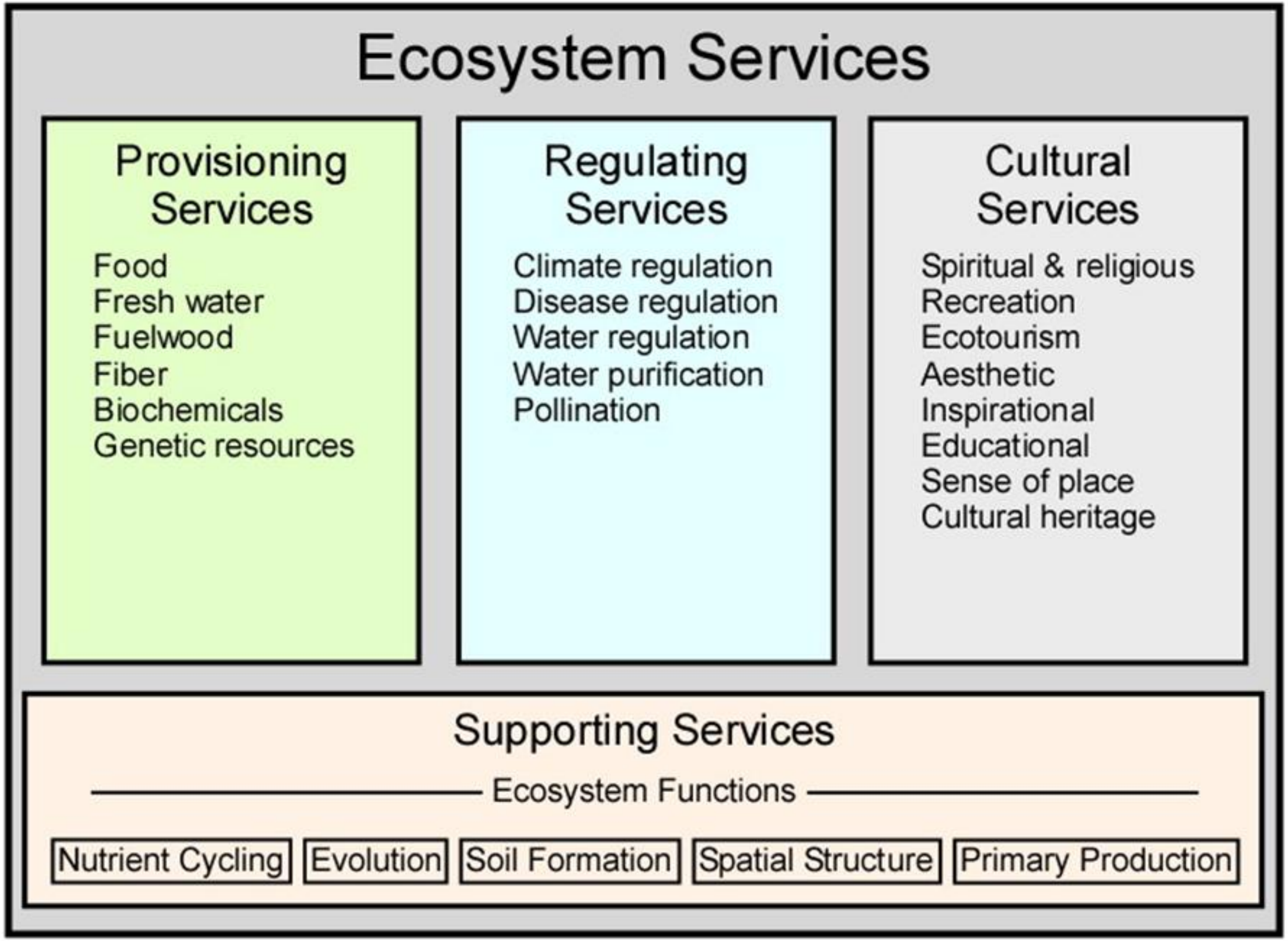
… while NCBs can be seen as an informative way to illustrate the NbS focused on climate change as a societal challenge.

Nature-based Solution (NbS) concept

- ER – Ecological Restoration
- EE – Ecological Engineering
- FLR – Forest Landscape Restoration
- GI – Green Infrastructure
- NI – Natural Infrastructure
- EbMgt – Ecosystem-based Management
- EbA – Ecosystem-based Adaptation
- EbM – Ecosystem-based Mitigation
- Eco-DRR – Ecosystem-based Disaster Risk Reduction
- CAS – Climate Adaptation Services
- AbC – Area-based Conservation

Wetlands and the Sustainable Development Goals

No	SDG 6 global indicators (short title)	Custodian (v25Apr16)
6.1.1	Safely managed drinking water services	WHO UNICEF
6.2.1	Safely managed sanitation services	WHO UNICEF
6.3.1	Wastewater safely treated*	WHO UN-Habitat UN-DESA
6.3.2	Good ambient water quality*	UNEP
6.4.1	Water use efficiency*	FAO
6.4.2	Level of water stress	FAO
6.5.1	Integrated water resources management	UNEP
6.5.2	Transboundary basin area with an operational arrangement for water cooperation*	UNECE UNESCO
6.6.1	Water-related ecosystems*	UNEP
6.a.1	Water- and sanitation-related official development assistance that is part of a government coordinated spending plan	WHO UNEP OECD
6.b.1	Participation of local communities in water and sanitation management	WHO UNEP OECD

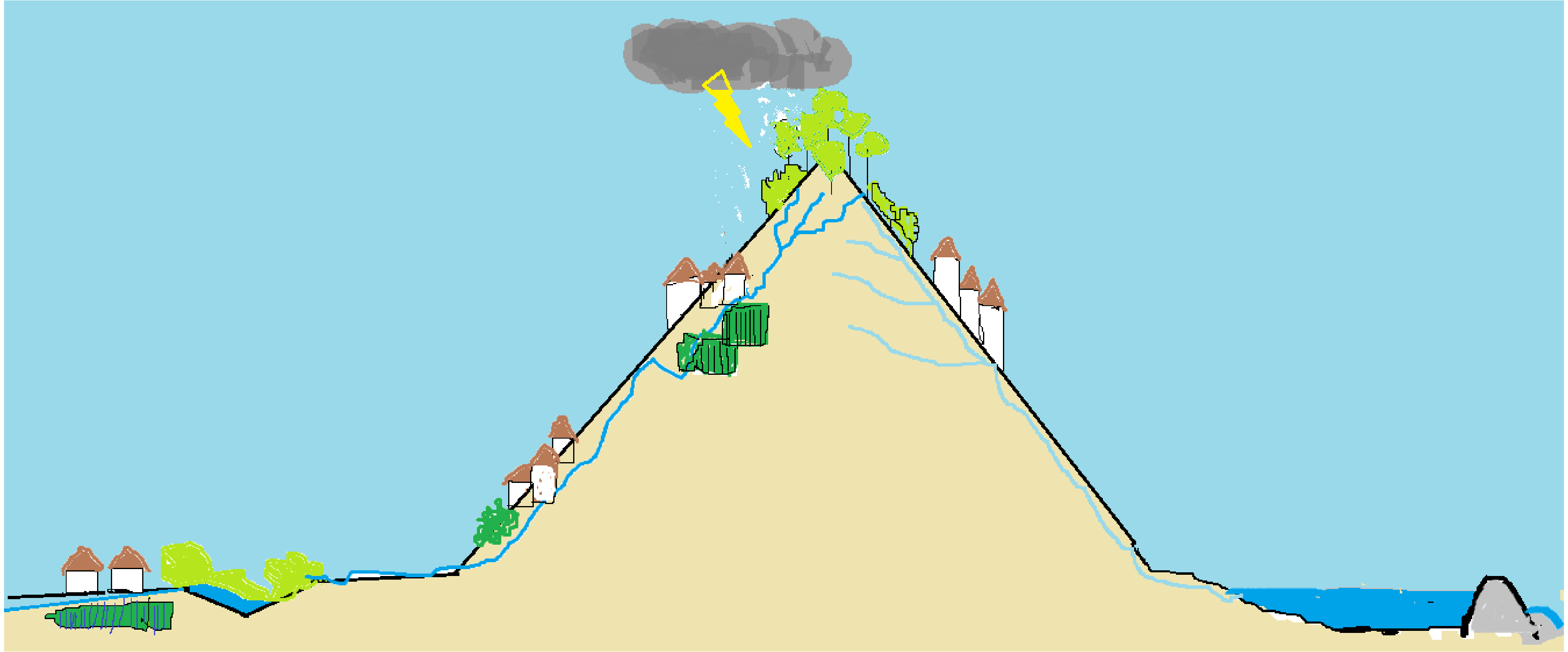


Modified, with additions, from the Millennium Assessment

Ecology becomes Economy (PES)

- The good news: if demand exceeds supply **economic value** is created;
- Demand for ecosystem services is booming and supply is shrinking: economic value becomes tangible and prices should rocket!
- This is great news for resource owners and managers: it can change the **conservation economy** and can support local communities!

PES: Who pays for the water?
And who gets the money?



Exercise 1

- In your groups, brainstorm briefly about the different ecosystem services existing in your case

-> You have 10 minutes

Key Dimensions of Food Security

- ***Availability*** of sufficient food , i.e. the overall ability of the agricultural system to meet food demand
- ***Stability*** which relates to individuals at high risk of temporarily or permanently losing their access to the resources needed to consume adequate food. An important cause of unstable access is climate variability.
- ***Access*** which covers access by individuals to adequate resources (entitlements) to acquire appropriate foods for nutritious diet. A key element is purchasing power of consumers and the evolution of real incomes and food prices.
- ***Utilization***, which encompasses all food safety and quality aspects of nutrition.

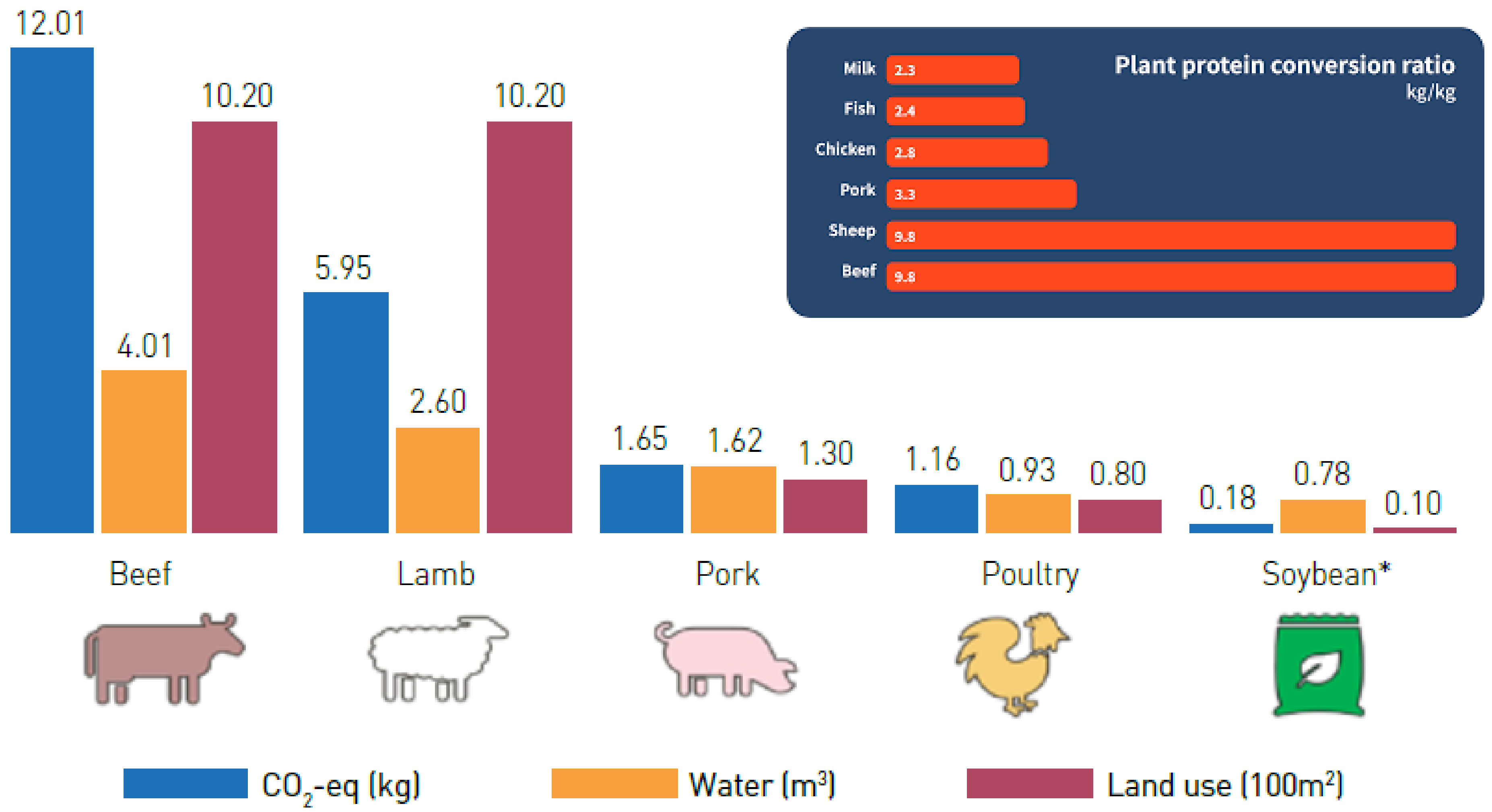
Schmidhuber 2007

Trends in Food Production

- India: Food production; 50 million tonnes per year in the 1950s; over 250 million tonnes per year in 2010.
- India: Availability per person per year has only grown from 145 kg in 1950s to about 190 kg in 2010.
- The averages over such a large population is misleading; many externalities such as poverty and gender issues limit access to food.
- Mostly unseen are the impacts of agriculture and fertiliser and chemical use on soil health and water quality
- Big impact on water availability; the area under irrigation has grown from under 20 per cent in the 1950s to just over 50 per cent at present.

The Environmental Impact of Animal Protein

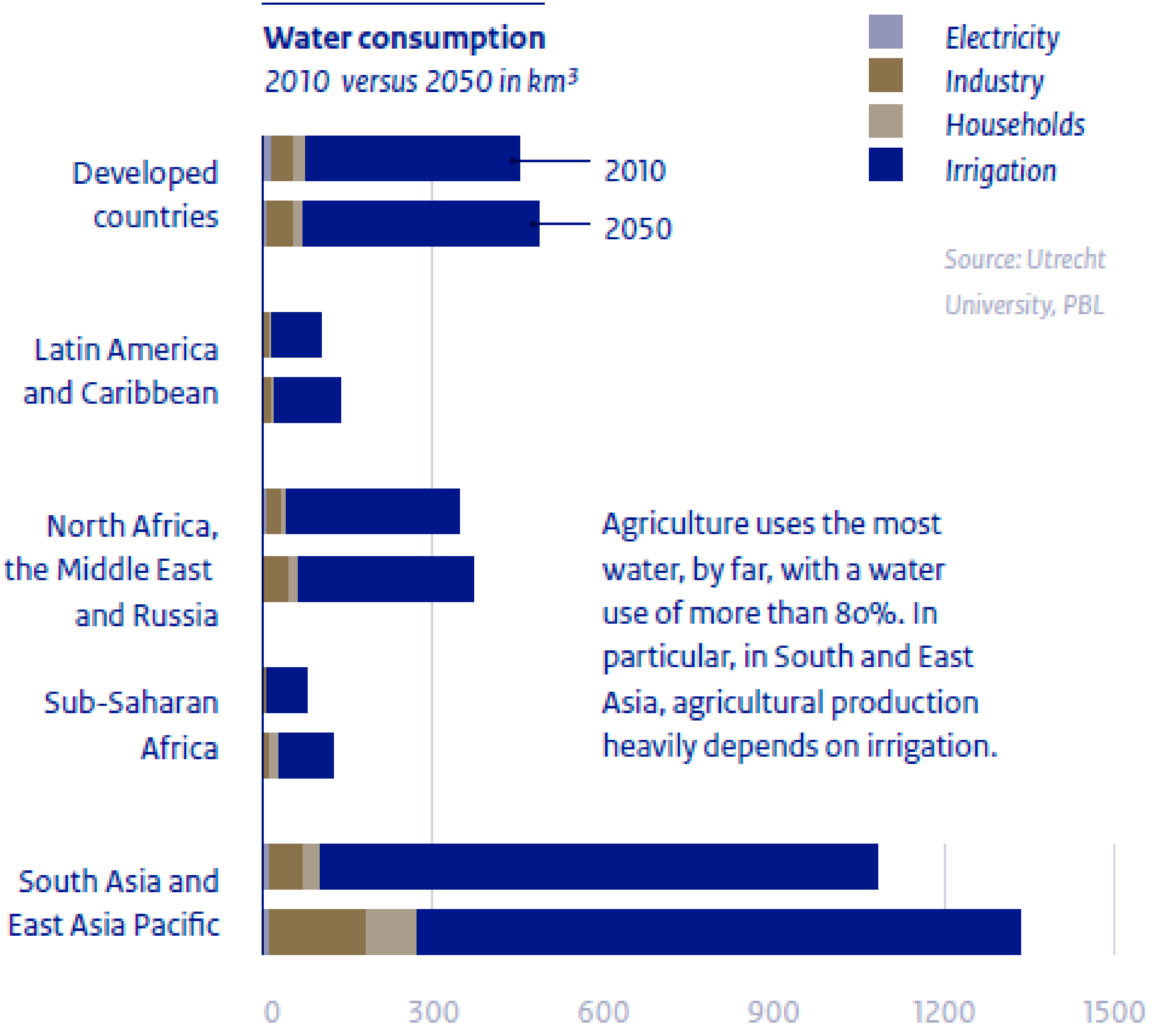
Per kg protein



*Soybean produced under sustainable conditions

Sources: OECD-FAO Agricultural Outlook 2017–2026; FAO, Tackling climate change through livestock 2013; Mekonnen & Hoekstra (2011 & 2012); Clark & Tilman (2017); USDA (2017)

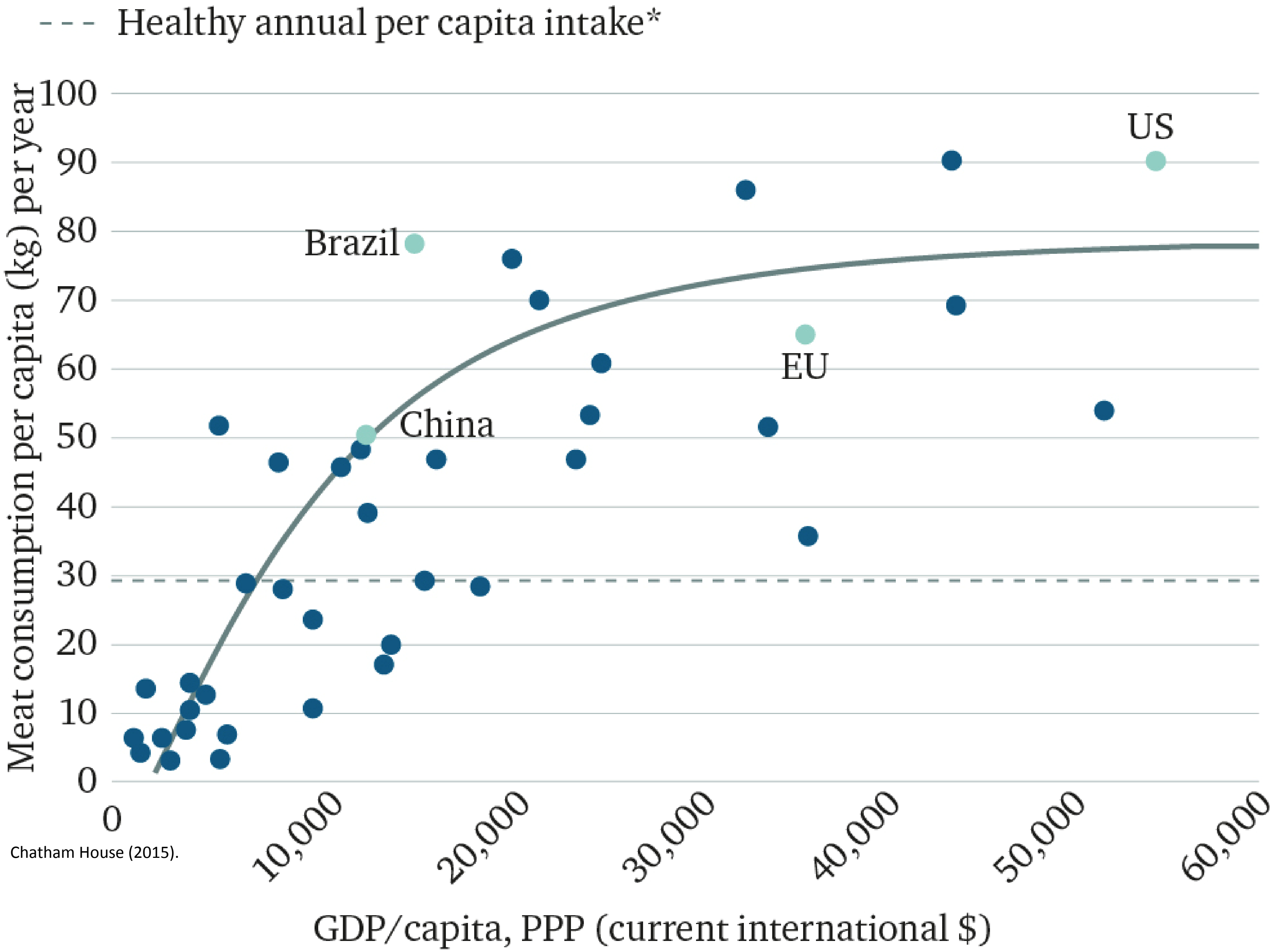
Between now and 2050, global water consumption is expected to increase by 25%, due to the growing number of households, the growth in industrial production and agricultural expansion and intensification.
Growing water demand and —in some regions— declining precipitation will increase the pressure on the available water resources, resulting in high levels of water stress in many regions.



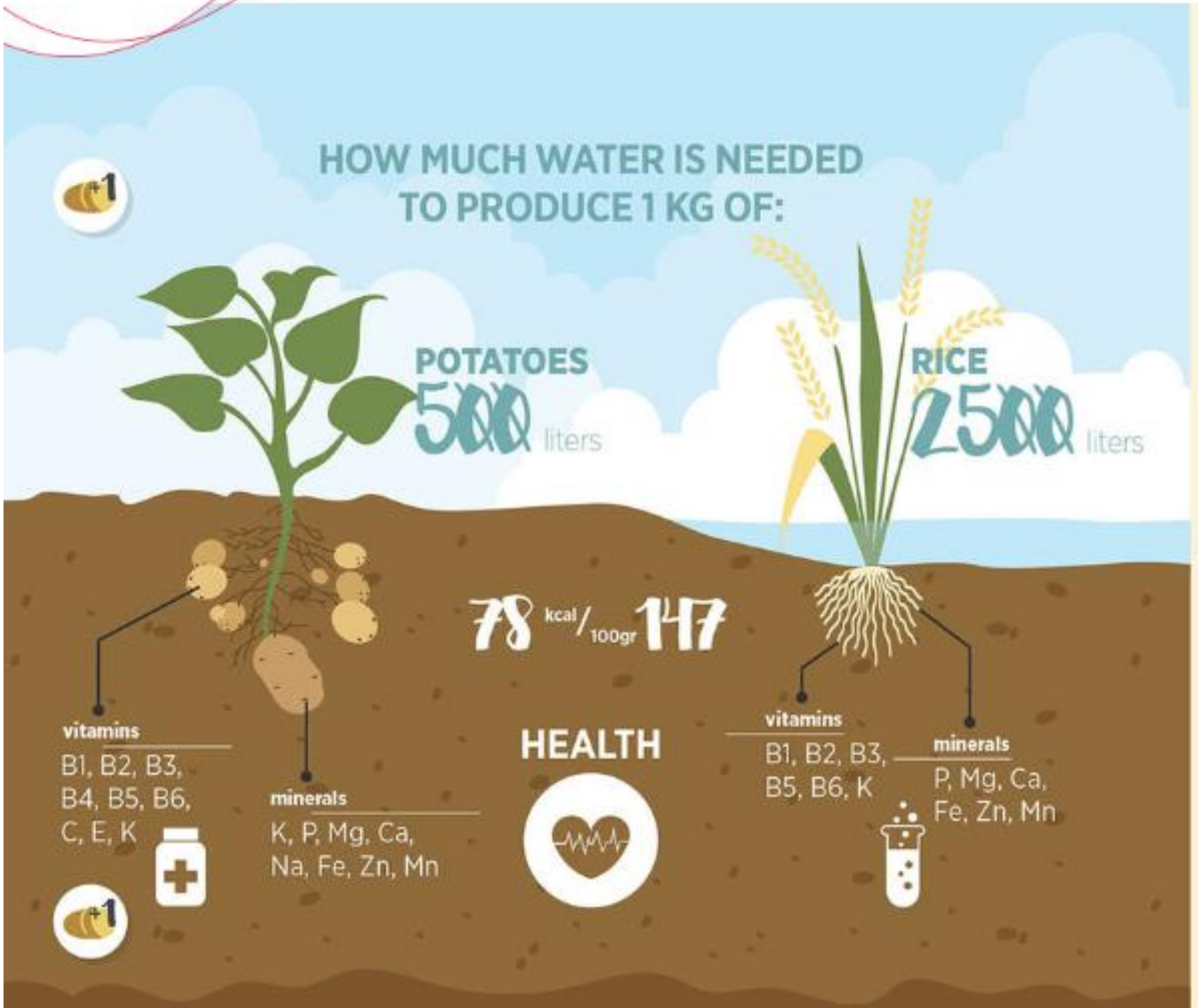
Agriculture uses the most water, by far, with a water use of more than 80%. In particular, in South and East Asia, agricultural production heavily depends on irrigation.

Challenges

Climate change, which brings higher average temperatures and changing precipitation patterns, combined with increasing competition for water resources, may result in substantial increases in the number of people living under severe water stress.



Chatham House (2015).



HOW MUCH WATER IS NEEDED
TO PRODUCE 1 KG OF:
POTATOES
500 liters
RICE
2500 liters
78 kcal/100gr 147
vitamins
B1, B2, B3,
B4, B5, B6,
C, E, K
minerals
K, P, Mg, Ca,
Na, Fe, Zn, Mn
HEALTH
vitamins
B1, B2, B3,
B5, B6, K
minerals
P, Mg, Ca,
Fe, Zn, Mn

Water demand trends

- Each person requires 2-4 litres of water per day, but it takes 2,000 – 5,000 litres of water to produce one person's daily food.

- By 2050 the world's water will have to support the farming systems that will feed an extra 2 billion people.

- The Intergovernmental Panel on Climate Change (IPCC) predicts yields from rain-dependent agriculture could decrease by 50% by 2020.

Exercise 2

- Individual reflection: how does my daily diet contribute to (over)exploitation of natural resources?

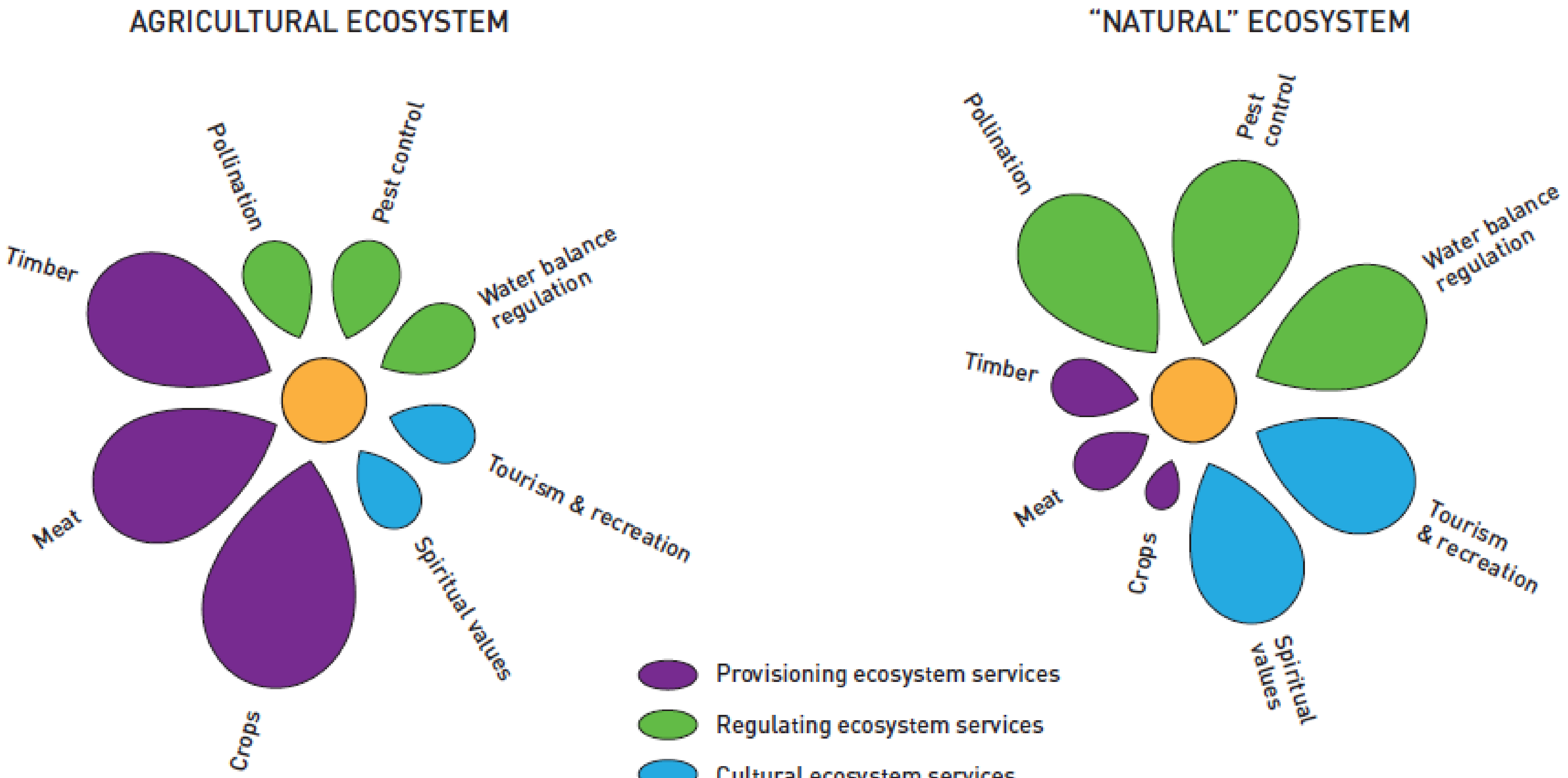
-> You have 3 minutes

Changing freshwater availability based on satellite image analyses

https://www.youtube.com/watch?v=MaxBOvQ2a_o

Impact of Agriculture on other Ecosystem Services

Figure 3: Agriculture generally increases provisioning ecosystem services at the expense of regulating and cultural services.



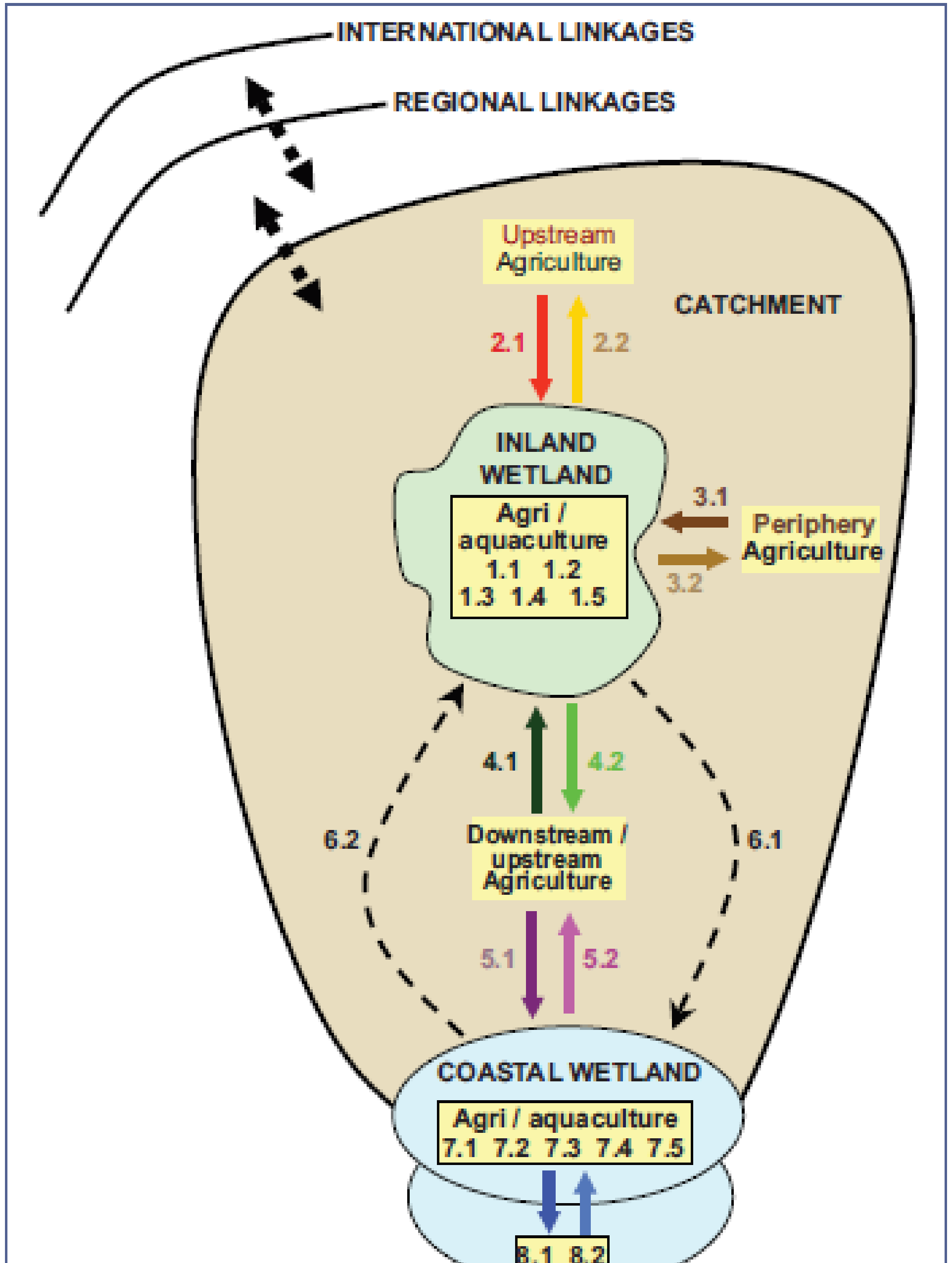
Source: L.J. Gordon et. al. Agricultural Water management 97 (2010): 512-519

FIGURE 3

Conceptual model of agriculture–wetland interactions

Key:

1. Wetland agriculture (*in situ*) interactions
   - 1.1 Complete transformation of wetland ecosystem to agricultural use
   - 1.2 Partial transformation of wetland ecosystem to agricultural use
   - 1.3 Agricultural use of wetlands without transformation of ecosystem (e.g. limited/ sustainable ecoagriculture).
   - 1.4 Enhancement of wetlands / creation of additional wetlands (often used for agriculture)
   - 1.5 Reversion to natural wetland
2. Upstream agricultural activity (external) interactions (from distant catchment)
   - 2.1 Upstream agricultural activity influencing wetland ecosystem and wetland agriculture downstream
   - 2.2 Wetland ecosystem influencing upstream agricultural activity
3. Periphery agricultural activity (external) interactions (from local catchment)
   - 3.1 Periphery agricultural activity influencing wetland ecosystem (e.g. irrigation water, fringe drainage)
   - 3.2 Wetland ecosystem influencing periphery agricultural activity (e.g. flooding)



Exercise 4

- In your groups, analyse the agriculture-wetlands interactions exisiting in your river basin/case

-> You have 10 minutes to prepare

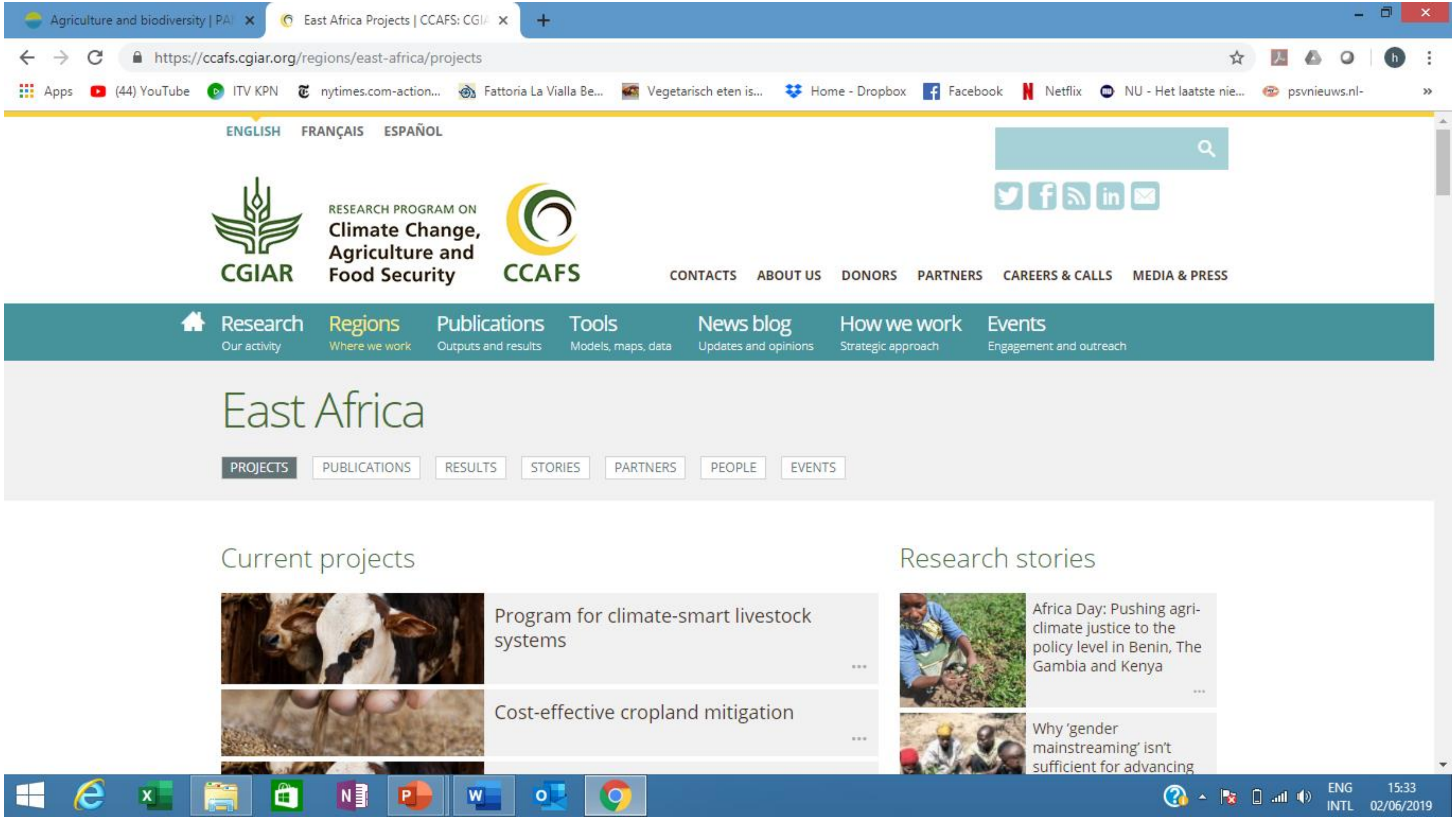
-> you have 2 minutes to present

Wetlands International in Ethiopia

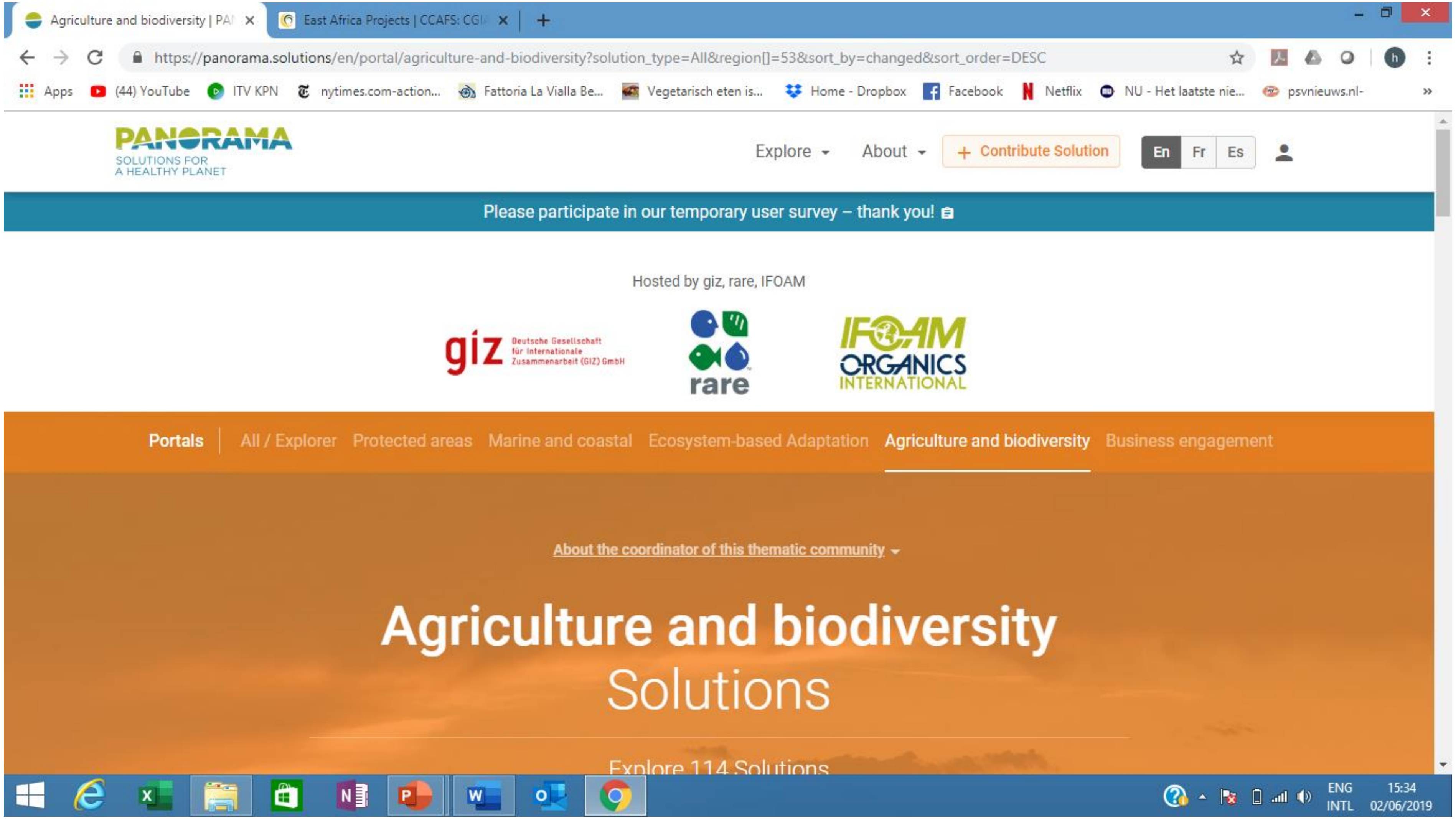
https://www.wetlands.org/video/building-ecosystem-resilience-ethiopias-somali-region/

Case Studies on Climate Smart Agriculture

https://ccafs.cgiar.org/



Case Studies in Nature Based Solutions



Food Security and Climate Change – The Dilemma

The FAO states (2004) that global meat production is responsible for 18% of greenhouse gas emissions – about the same as all of the world's cars, trains, boats and planes combined.

The world’s population is about 7.5 billion. Current estimates suggest that by 2050 it will be around 9.7 billion, with population growing most rapidly in the areas that are now the least food-secure.

SDG1: By 2030, double the agricultural productivity and incomes of small-scale food producers, in particular women, indigenous peoples, family farmers, pastoralists and fishers.

Doubling the agricultural productivity will have to take place with decreasing availability of agricultural water, much of it of lower quality, more degraded lands, much-diminished natural fisheries and with the use of fewer pesticides and less fertiliser, while at the same time reducing CO2 emissions from agriculture.

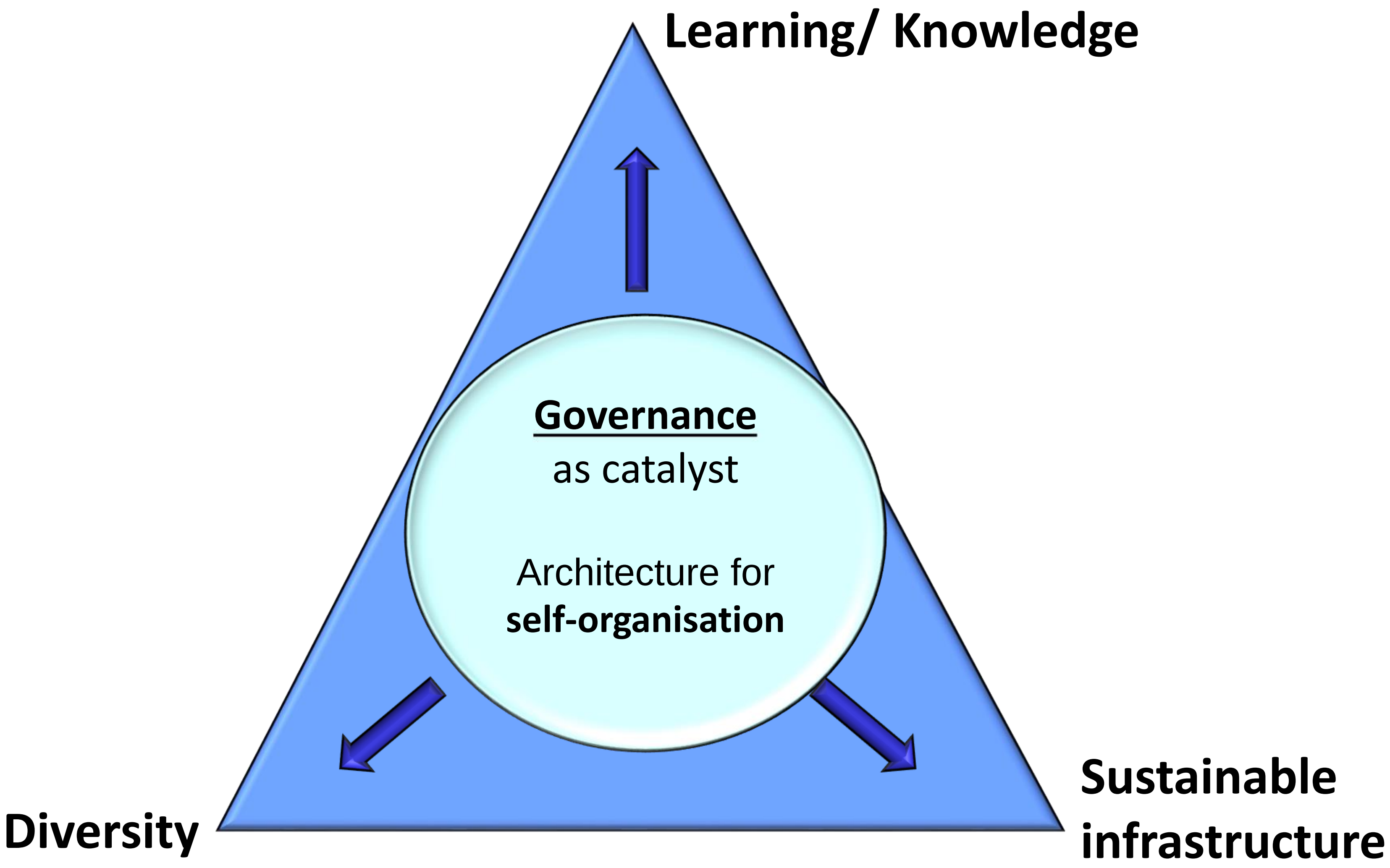
Exercise 4;

How to get out of the deadlock; increase food security with less water while reducing the climate impact and increasing environmental sustainability.

Strategies that can help to reduce hunger

- Reduce Waste – 30% of the food is wasted!
- Reduce Post Harvest Losses (PHV)
- Improve Value Chains – no transport losses
- Invest in new varieties- that use less fertlizers and water-introduce GMOs??
- Invest in IWRM – so that scarce water is fairly distributed
- Look at diets

Characteristics of Resilience



Relation between Vulnerability, Resilience and Sensitivity

Sensitivity	Resilience		
	High	Medium	Low
High			Highly vulnerable
Medium		Vulnerable	
Low	Not vulnerable		

Wetlands and Climate Change

The long-term (century-millennia), C sequestration by wetlands represent, at present, a net cooling effect

Draining wetlands decreases CO_2 uptake and increases rates of microbial decomposition and CO_2 release

The long term C accumulation and storage by wetlands is, in part, offset by CH_4 emissions from some freshwater wetlands. Freshwater wetlands represent the largest natural source of CH_4.

Soil C is also lost by peat extraction, drainage and other disturbance. The hydrologic changes can be so large that they result in massive losses of C to the atmosphere, such as occurred during the fires in tropical peatlands in Southeast Asia. Despite a decline in CH_4 emissions following wetland drainage, wetland conversion to cropland results in a significant net increase in atmospheric radiative forcing.

Recommendations for policy and management should address both the role of wetlands in climate regulation, such as conserving and sustainably managing stored carbon and the role of wetlands in provision of ecological and human climate adaptation and resilient ecosystem services.

Thank you for listening