An aerial photograph of a river basin. The foreground is a dry, brownish field with a fence line. The middle ground is dominated by large, rectangular green agricultural fields, likely irrigated. In the background, there are rolling hills and a river winding through the landscape under a hazy sky.

Designing future irrigation landscapes in Seyhan and Euphrates River Basin in Turkey

Takanori Nagano
Graduate School of Agricultural Science
Kobe University

RIHN-Initiative meeting
RIHN
November 14 2011

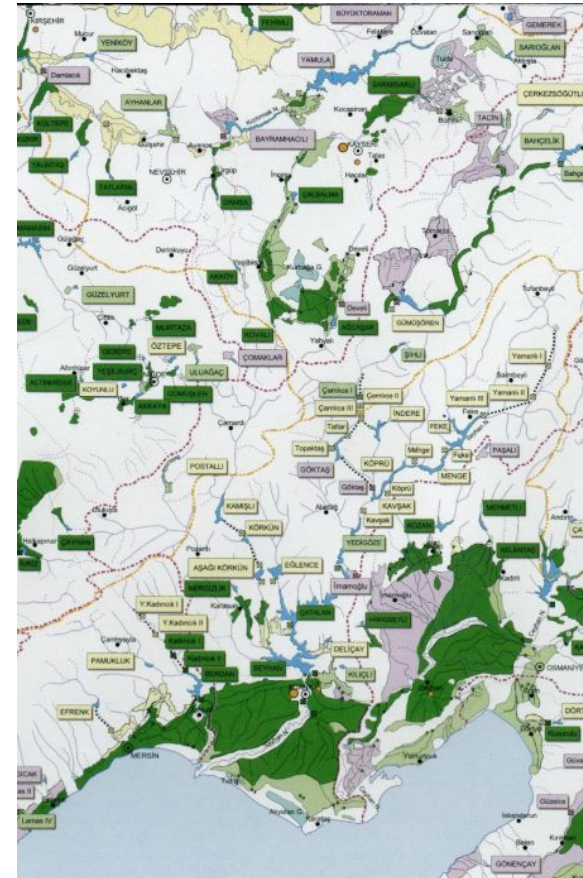
Water resource development in Turkey

Rapid conversion of forest/pasture into farmland after WW2 with introduction of machinery.

Poor land management resulted in nation-wide severe erosion.

The government changed its agricultural strategy to intensive farming in the coastal area. Rapid water resource development initiated in 1960s.

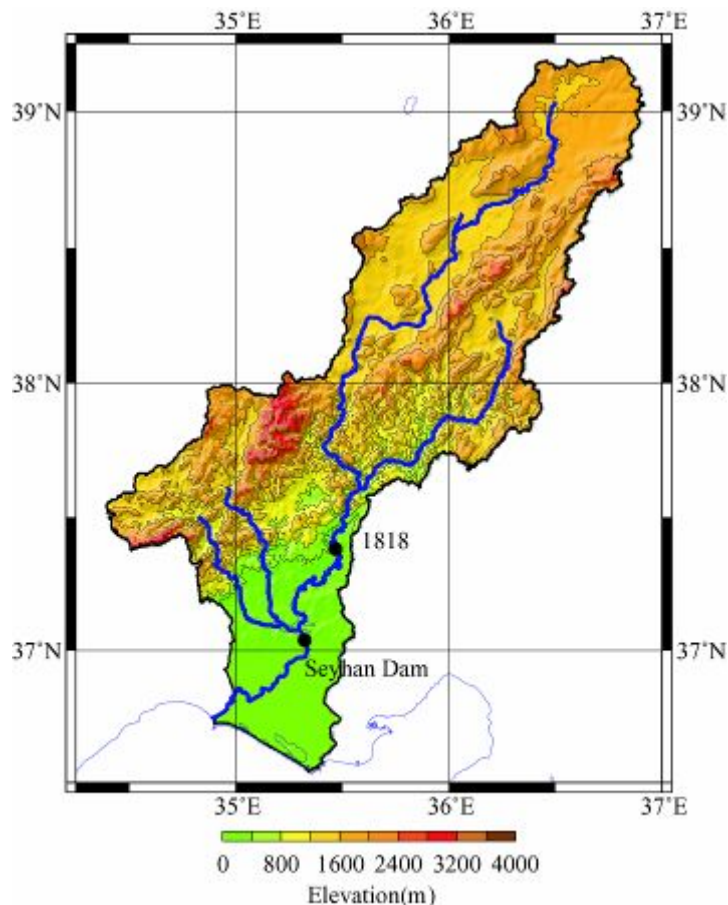
Turkey is relatively water-rich in the Middle East. Large development projects are still going on.



The map of water resource planning around Seyhan and Ceyhan River made by DSI

Case study area 1

Seyhan River Basin



- Seyhan River originates in Central Anatolia and flows into Mediterranean Sea. Total basin area is around 25,000km².
- Most of the upper basin is sparsely populated and undeveloped. The outflow is stored in two big reservoirs in the middle reach of the river and used for irrigation in the delta on the coast.
- Recently dam constructions and related irrigation projects are rapidly increasing in the branches of the river.

Land use in Seyhan River Basin

Rain-fed farmland



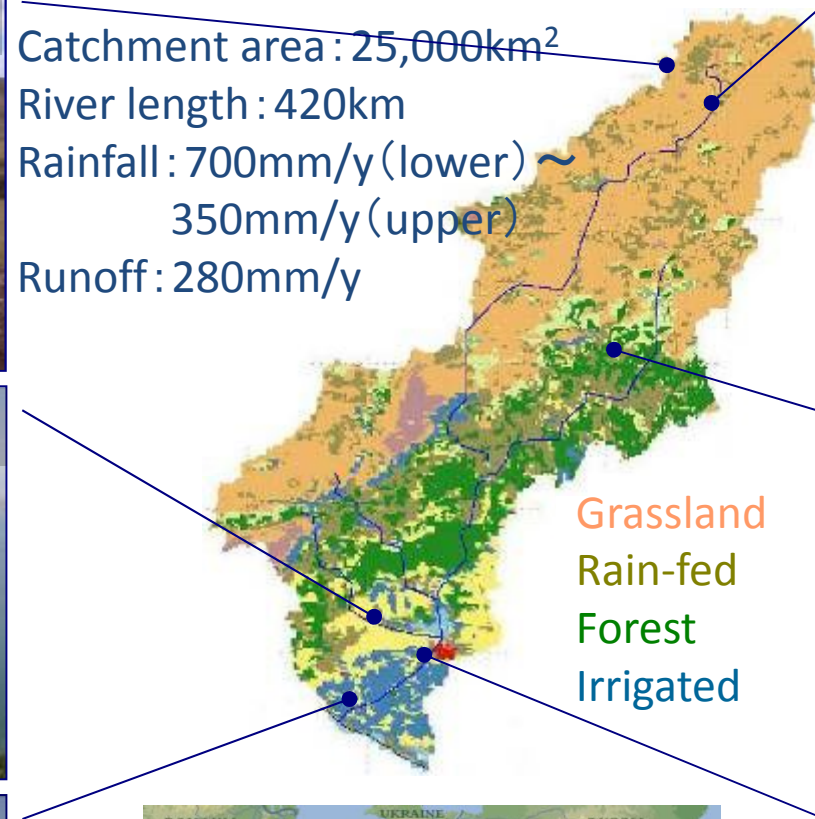
Large reservoir



Irrigated farmland



Catchment area: 25,000km²
River length: 420km
Rainfall: 700mm/y (lower) ~
350mm/y (upper)
Runoff: 280mm/y

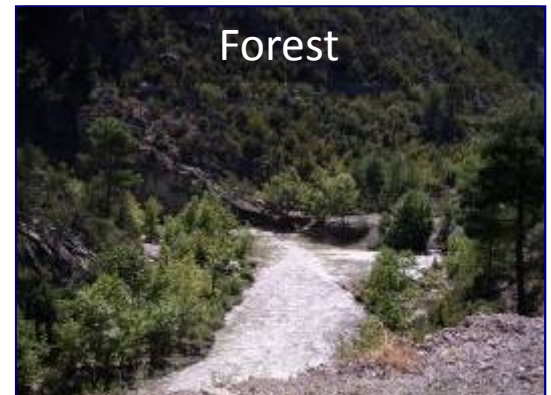


Grassland
Rain-fed
Forest
Irrigated

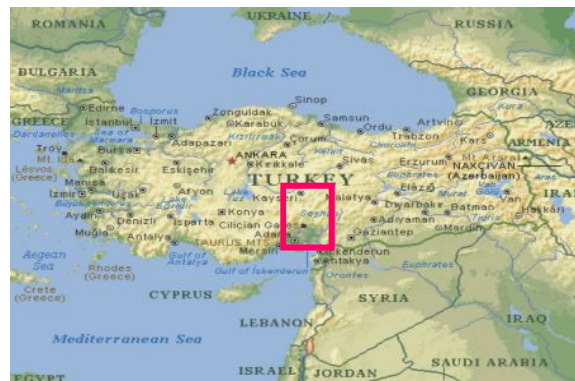
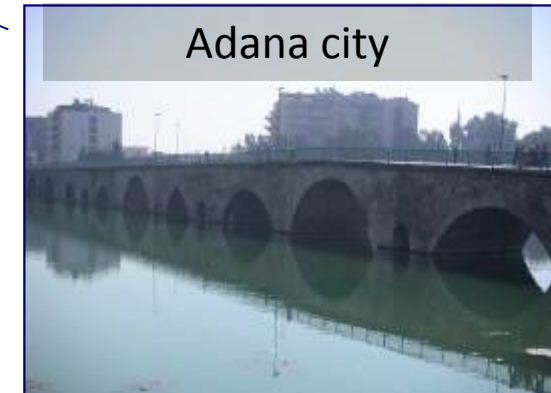
Mountains



Forest



Adana city

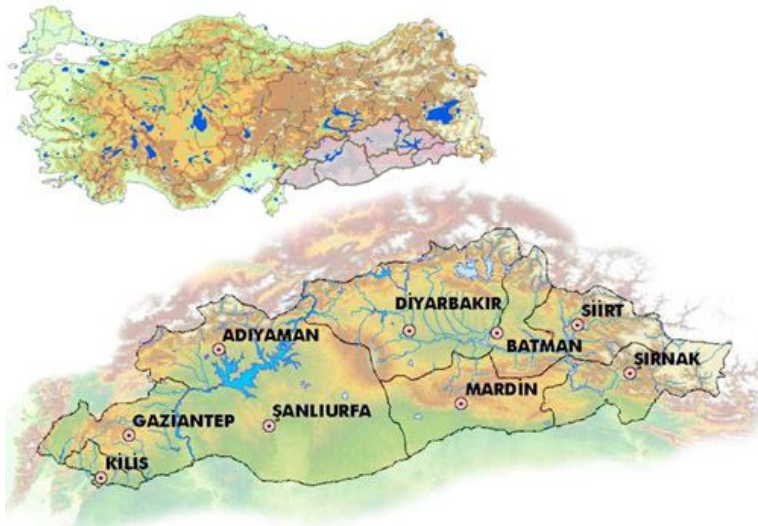


Case study area 2

GAP (Euphrates River Basin)



Situation of Euphrates River



GAP in the eastern Turkey

- Euphrates River originates in Eastern highlands in Turkey and flows through Syria and Iraq. Hydrological basin in Turkish territory is 104,000 km².
- GAP (Southeastern Anatolia Project) is a multi-sector integrated regional development project. It aims to construct 22 reservoirs, 19 power plants and to irrigate 17 million ha of farmland by 2015.
- Irrigation started 20 years ago and there are already some adverse effects associated with irrigation becoming clear.

What are the problems in Seyhan River Basin and in Euphrates River Basin in terms of IWRM?

- Excessive use of irrigation water
- **Water quality** deterioration due to excessive fertilizer use.
- This area is likely to be severely impacted by **climate change**.
- Water resource developments and **land use** changes are accelerating.
- The sense of inequality is growing among people living in non-irrigated area in the upper basin.

What do we need to implement?

Monitoring tool to assess hot spots for the IWRM (low productivity, source of pollution, etc)

Hydrological models to run on different land use and climate scenarios to assist integrated water resource management in the basin.

Farmland models to quantify non-point effluent load due to agricultural activities.

Opportunities for stakeholders to gather and discuss.

Project outcomes should be effectively disseminated at three conventions of United Nations

UNFCCC

UN Framework Convention on Climate Change

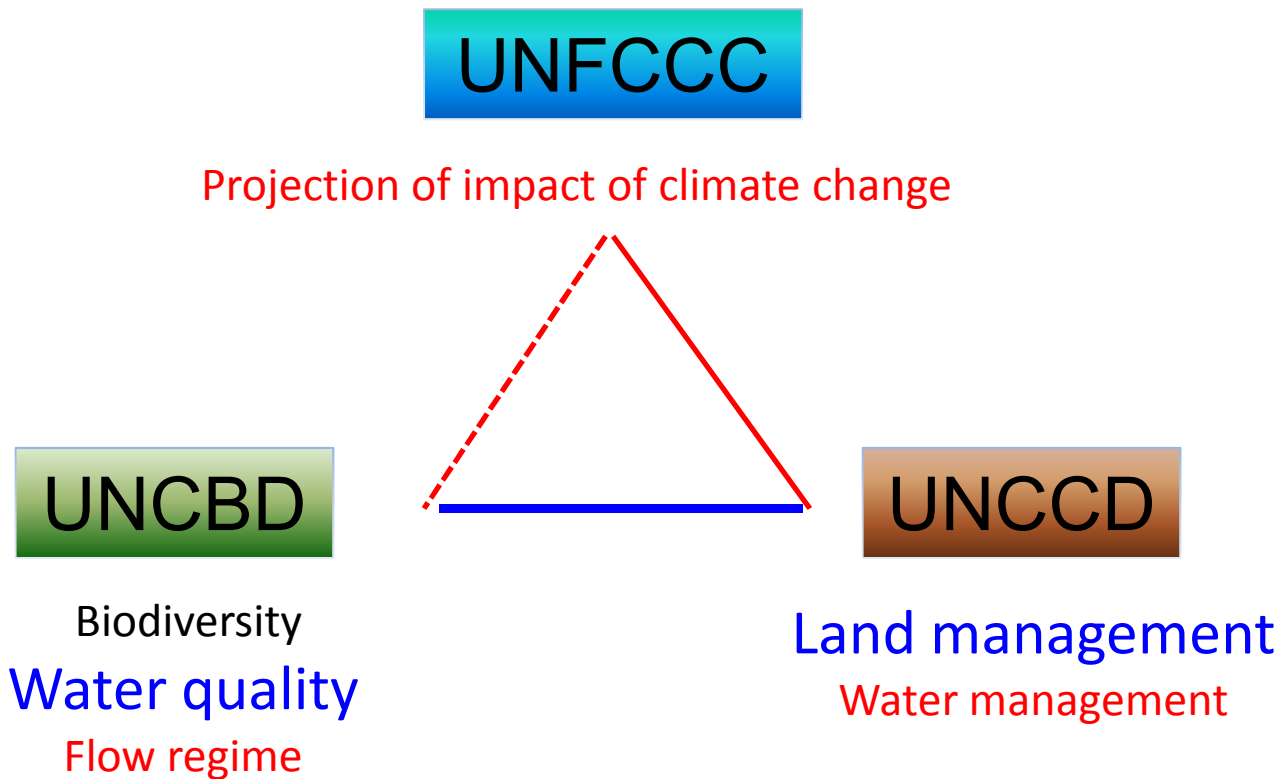
UNCBD

UN Conventions on Biological diversity

UNCCD

UN Conventions to Combat Desertification

Scientific challenges: creating links between three conventions in terms of the IWRM



We need to incorporate water quality issues which is very critical for basin water resource management

Collaborators

- Three universities in the eastern Turkey: Çukurova, Harran, Adiyaman.
- GAP administration, State Hydraulic Works (DSI).
- RIHN, Kobe University, Doshisha University, Ryukoku University.

Proposed activity for the scientific part of Turkish case studies

Modeling of irrigation district and hydrological basin with
focuses on

1. Projections on climate change
2. Changes in land-use, scenarios
3. Monitoring of hazards (salinity, excessive nitrates etc.)
4. Water quality
5. Basin level water management (upstream-downstream agreement)
6. Land quality, sustainable land management
7. Change in institutions
8. Tools for better management (thematic maps, etc.)

Proposed study area: Seyhan Basin and Euphrates Basin

	Seyhan	Euphrates
Basin modeling	Complete	Initiated
Irrigation modeling	Complete	Initiated
Water quality monitoring	Ongoing	Initiated
Salinity problem	Improving	Worsening
Situation of irrigation	Downstream	Middle reach

1. Projections on climate change

Latest climate scenarios are obtainable from collaborators in Japan.

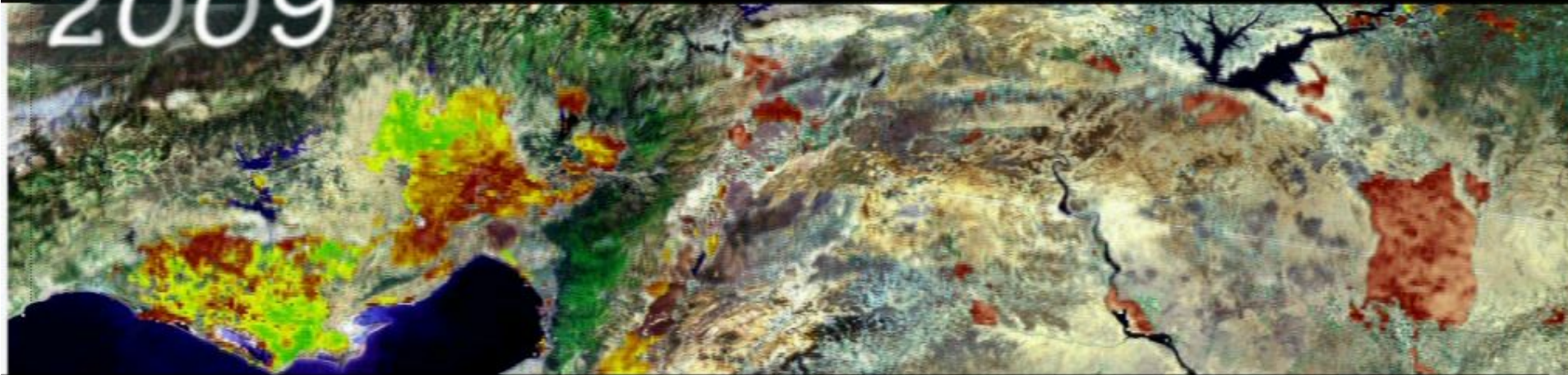
Access to high-resolution grid precipitation products.

2. Changes in land-use, scenarios

Land cover changes are detected for every year from 2000 by use of time-series MODIS imagery.

Scenarios will be generated based on dialogues between researchers and stakeholders.

2009



1999



(NDVI)



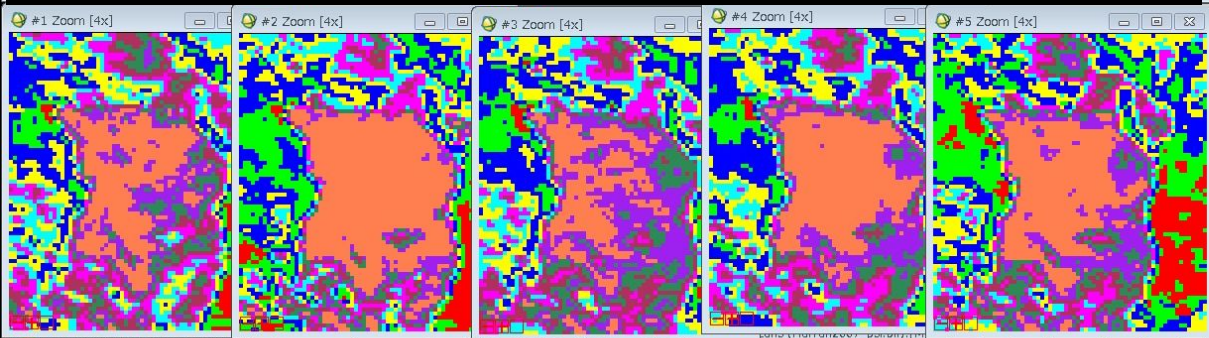
1 2 3 4 5 6 7 8 9 10 11 12

Month

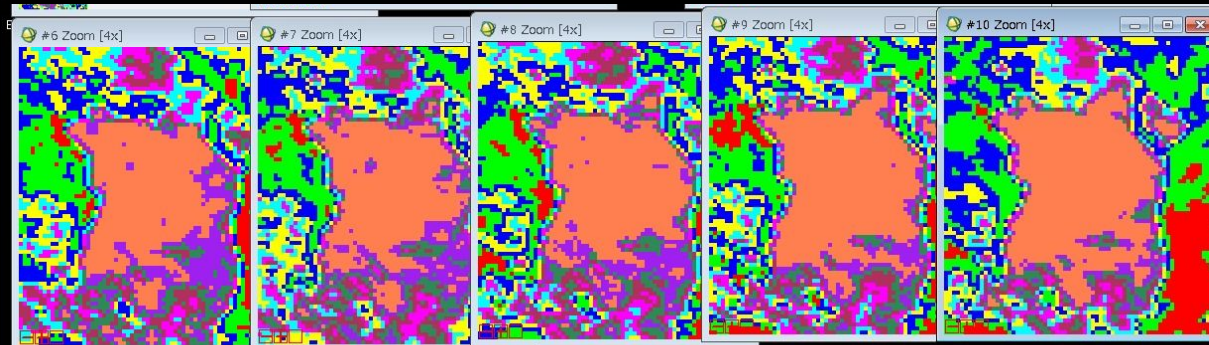


Time-series productivity analysis using the SPOT datasets: Harran Plain, Turkey

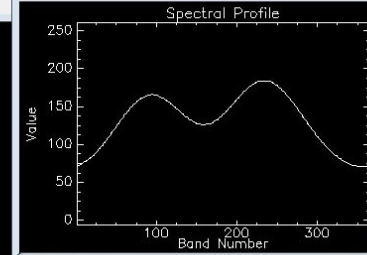
1999 2000 2001 2002 2003



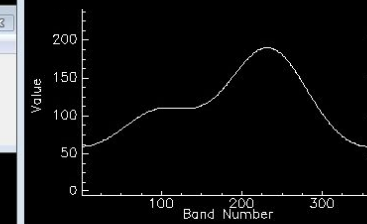
2004 2005 2006 2007 2008



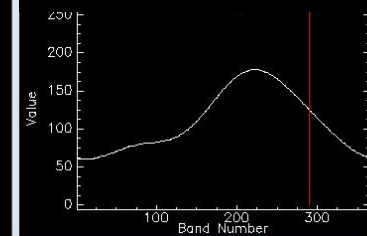
Two crops



One crop



Low productivity



3. Monitoring of hazards (salinity, excessive nitrates etc.)
4. Water quality

In-field monitoring of salt and nutrient dynamics.

Hyperspectral remote sensing using VNIR sensors for detection of salinity and nitrate hazards.



Salinity and water level monitoring in Harran

ASD spectroradiometer



Band width: 400-2500 nm

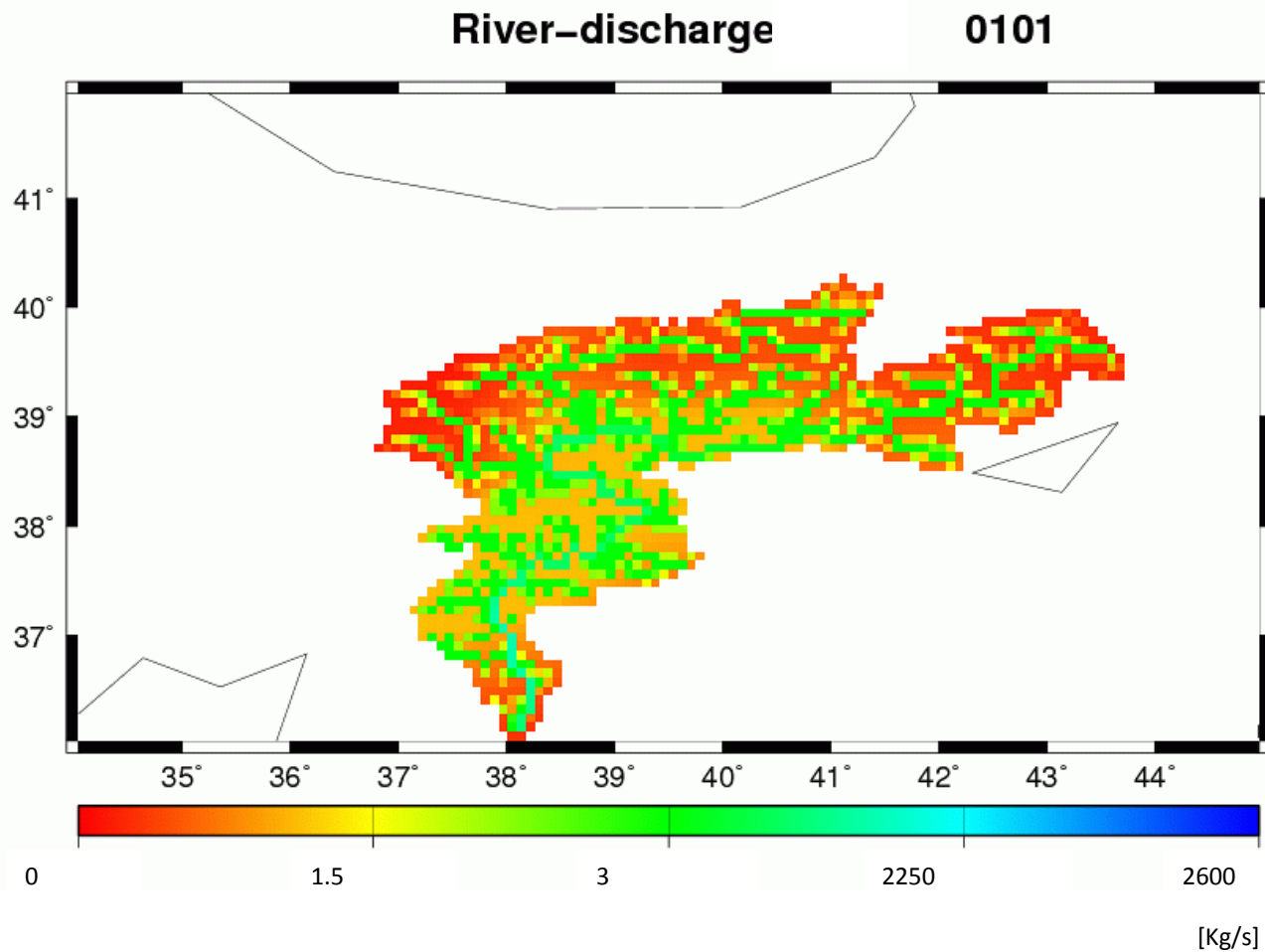
Precision: 10nm

Hyperspectral VNIR

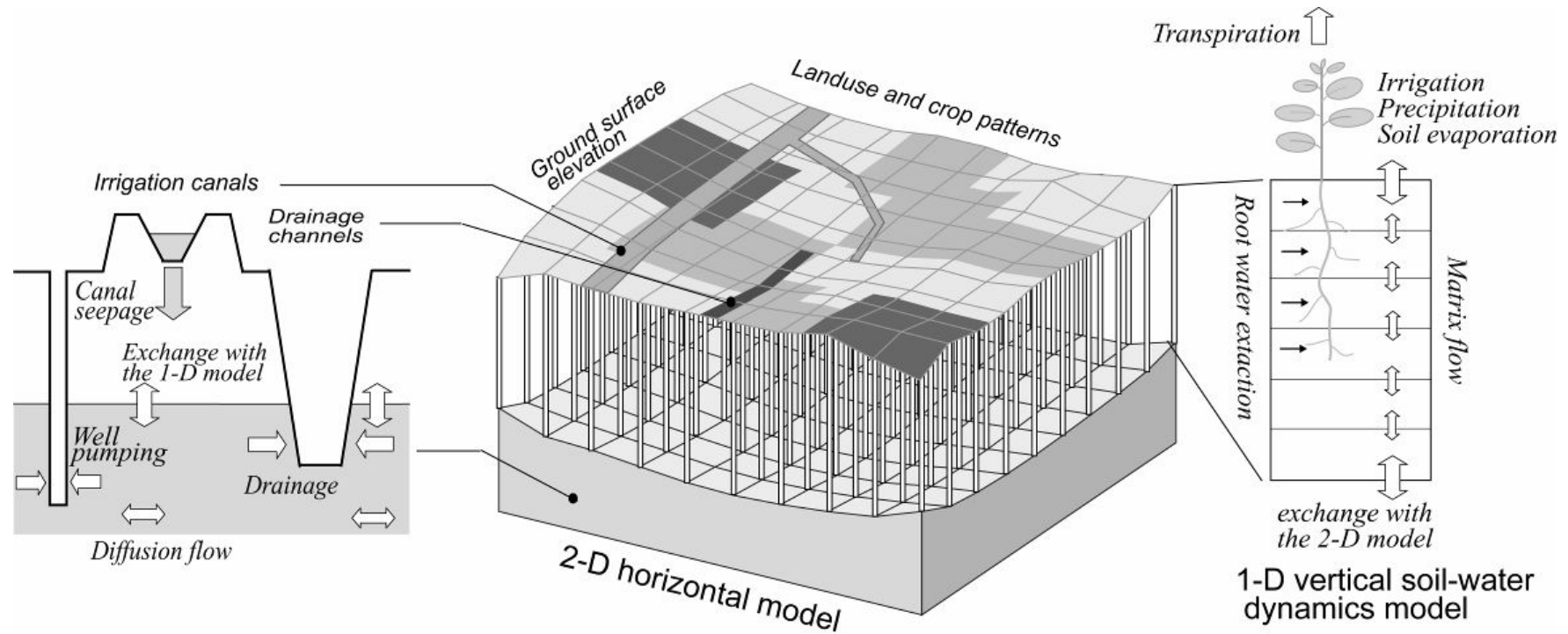
satellite: coming soon

5. Basin level water management (upstream-downstream agreement)

Global hydrological model H08 downscaled for Euphrates Basin



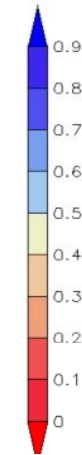
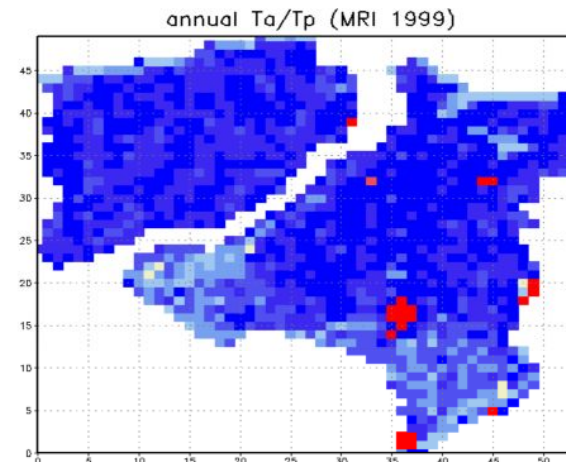
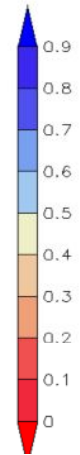
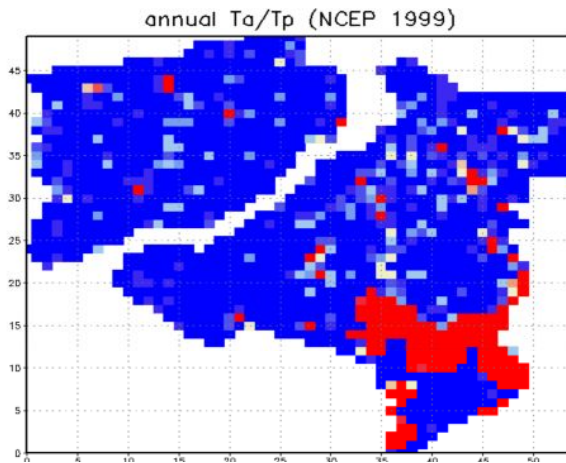
Irrigation Management Performance Assessment Model



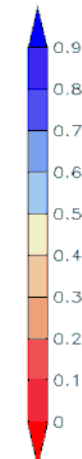
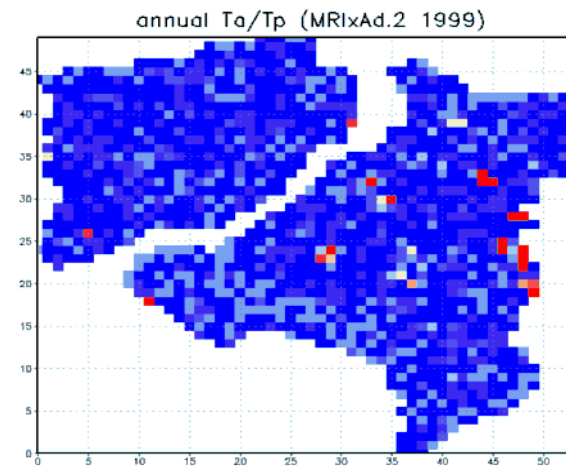
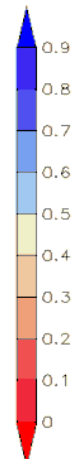
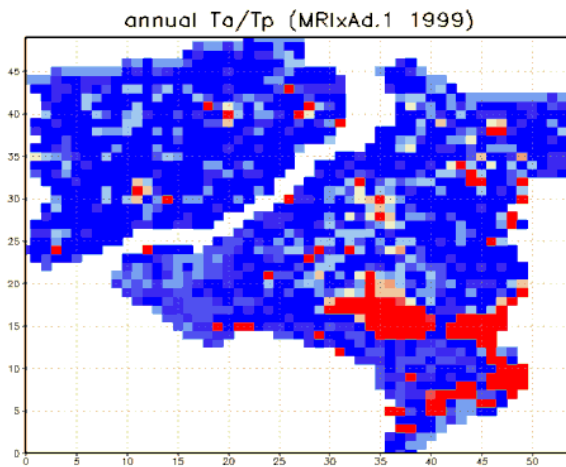
Hoshikawa et al. (2005)

Impact assessment of climate change by the IMPAM

Present management



Adaptation

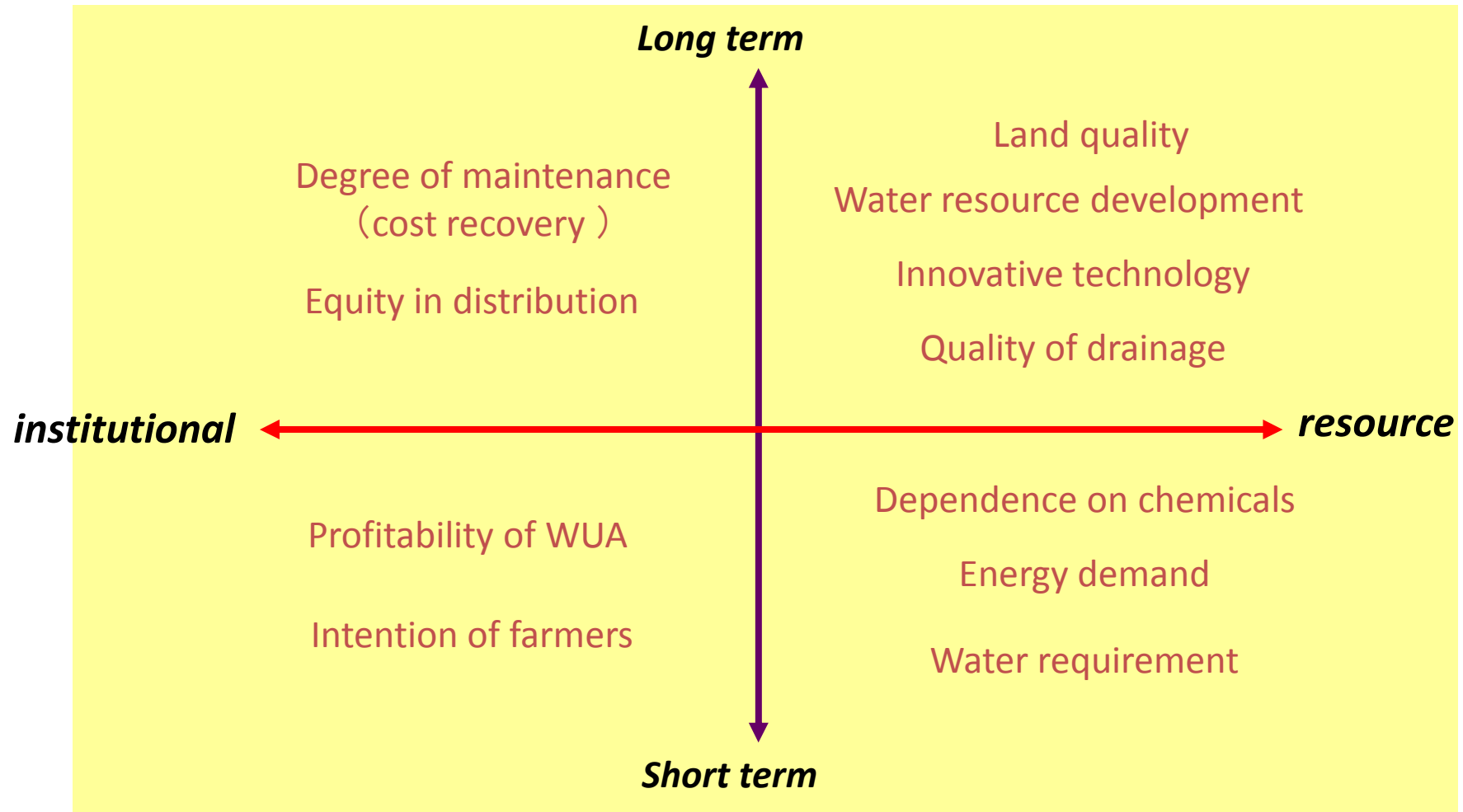


©MADS: COLA/IGES

2006-11-29-02:50

6. Land quality, sustainable land management

7. Change in institutions



Construction of database on sustainability indices of irrigated farmlands

8. Tools for better management (thematic maps, etc.)

Common database for project members for data sharing
Dialogue tools for researchers, administration and stakeholders.

Land use and land cover (LULC) map (new developing)

Satellite image collection

Hydro-meteorological data

Statistical data

Outcomes of our GAP studies

The other useful and interest data (including meta data)