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of Material Fluxes and of Resources



TECHNISCHE
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DRESDEN

ADVANCING A **NEXUS APPROACH**
TO THE SUSTAINABLE MANAGEMENT
OF **WATER, SOIL AND WASTE**



INTERNATIONAL
KICK-OFF WORKSHOP

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ADVANCING A **NEXUS APPROACH**
TO THE SUSTAINABLE MANAGEMENT
OF **WATER, SOIL AND WASTE**

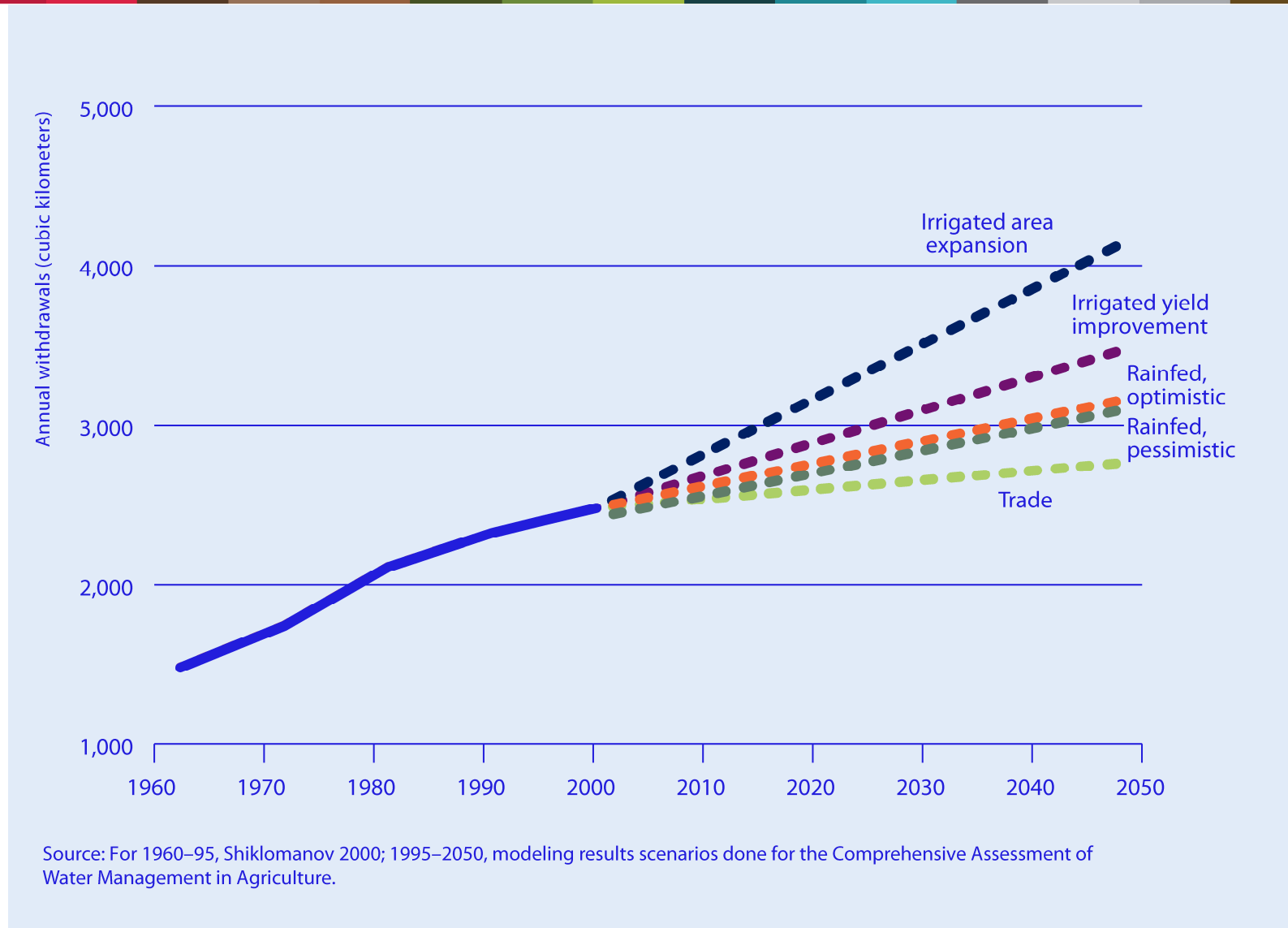
Integrated management of water resources demand and supply in irrigated agriculture - challenges and potentials

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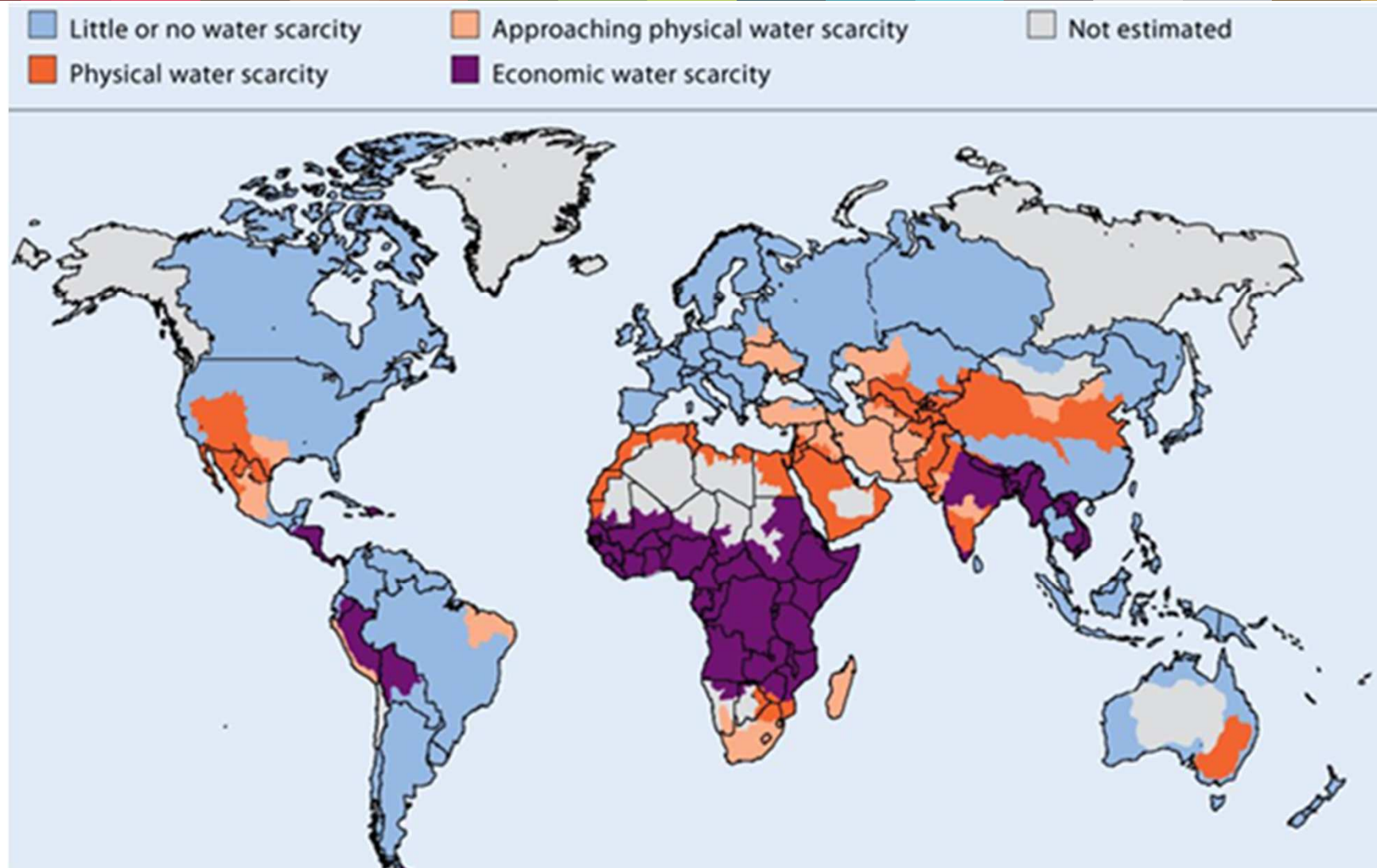


KQ 1. Increased future pressure on water resources by irrigated agriculture?





KQ 1. Increased future pressure on water resources by irrigated agriculture?





KQ 2. Is there integrated management of water supply and demand ?

Measures

Improvement of water availability

- first choice if no economic constraints
- technical solutions
 - Dams, pumps, pipes
 - Groundwater recharge
 - Rainwater harvesting
 - desalinization

Case of Oman

Improvement of water availability

- 32 groundwater recharge dams and 67 surface storage dams have been built in the last 20 years





KQ 2. Is there integrated management of water supply and demand ?

Improved water demand management

- making the most of available water
- **minimizing water use**
- **maximizing the outputs per unit of water (productivity)**

Case of Oman

Water demand management

- balanced in the historical falaj system
- more than 100% groundwater withdrawals of actual renewable fresh water resources in the coastal area
- “Common pool problem” (Kinzelbach, 2003)





KQ 2. Is there integrated management of water supply and demand ?

Water demand reduction policies

- Volumetric charging
- Limited water allocation (quotas)
- cropping restrictions
- ...

Measures

Supporting policies

- Increasing irrigation efficiency by optimal irrigation scheduling and control, irrigation methods (drip)
- Increasing water productivity
- Farmer education and capacity develop.
- Water metering





KQ 2. Is there integrated management of water supply and demand ?

Integrated planning

Water infrastructure

- Design of
 - Dams (Volume?)
 - Well field (Capacity?)
 - Pipes (Structure?)

Options for water demand management

- Water prices?
- Water quotas?
- Irrigation efficiency?
- Water productivity?
- Irrigation equipment subsidies?
- Communication of BMP's?



KQ 2. Is there integrated management of water supply and demand ?

Integrated operation over time

Water infrastructure

- Operation of
 - Dams (releases?)
 - Well field (abstraction?)
 - Surface water (abstraction?)

Options for water demand management

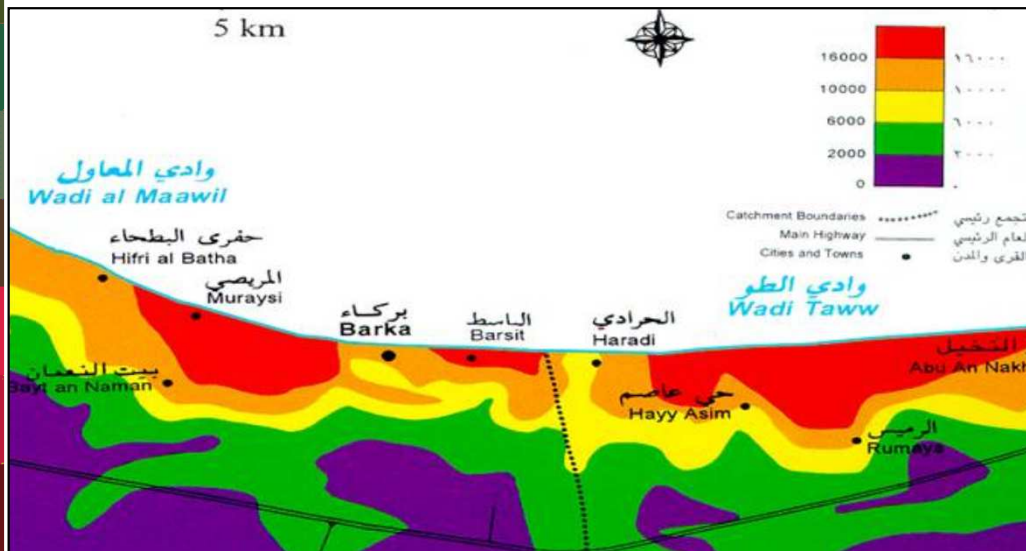
- Cropping pattern?
- Irrigation scheduling?
- Service and support?



KQ 5. Do we have data for monitoring and assessment of actual water supply and demand ?

Water availability

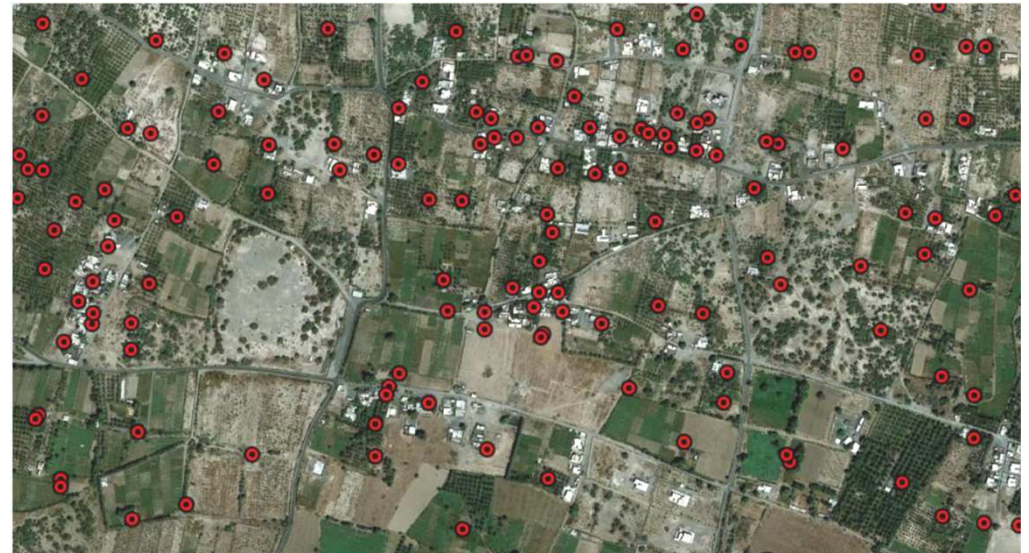
- Quantity and quality is uncertain



Case of Oman

Agricultural water demand

- Problems to estimate actual abstraction (quantity, quality)
- Problems to estimate actual water application (no water metering)
- Problems to estimate water productivity





KQ 5. Do we have data for monitoring and assessment of actual water supply and demand ?

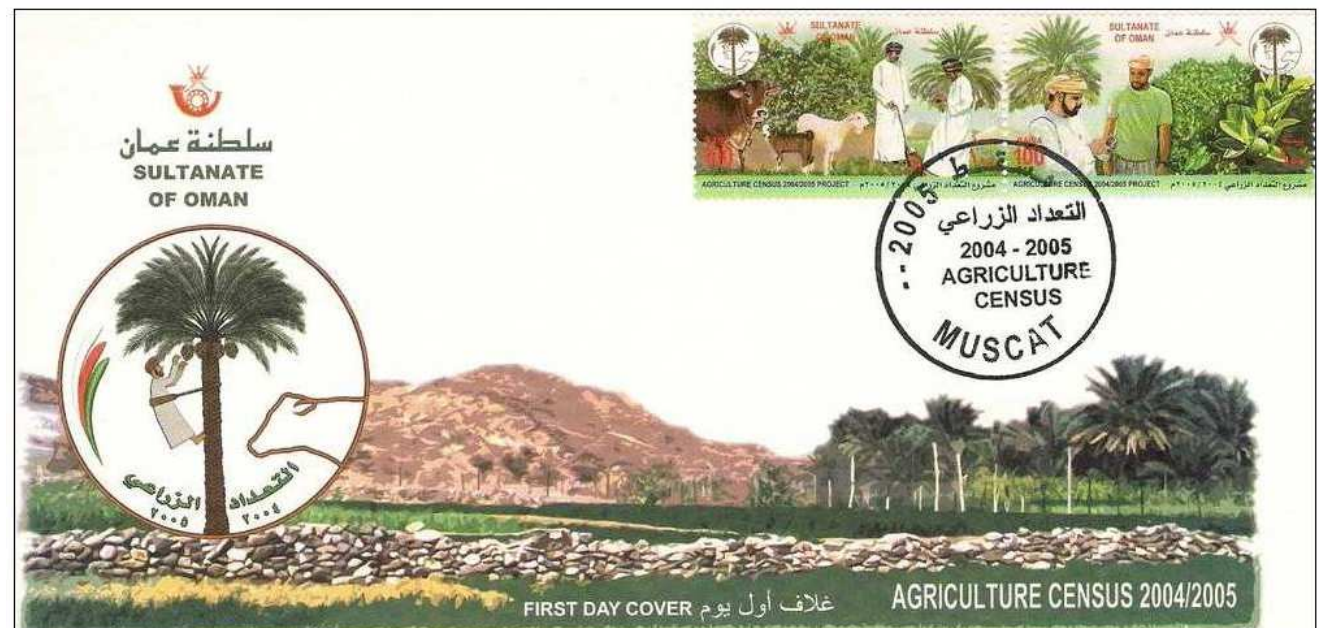
Case of Oman

MRMWR

- National Well Inventory Project
- Water metering campaign
- Estimations of safe yield

MAF

- Agriculture Census
- vegetation cover from satellite imagery
- estimations of crop water use (FAO 33)





KQ 5. Do we have data for monitoring and assessment of actual water supply and demand ?

Case of Oman

MRMWR

- National Well Inventory Project (1990's)
- Water metering campaign
- Estimations of safe yield

MAF

- Agriculture Census
- vegetation cover from satellite imagery
- estimations of crop water use (FAO 33)

No link (spatial reference, ...) of collected data or no link at all between MRMWR and MAF

Challenges:

- Integration of monitored data
- Integrated planning of monitoring programmes
- Remote sensing (actual evapo-transpiration, soil moisture)

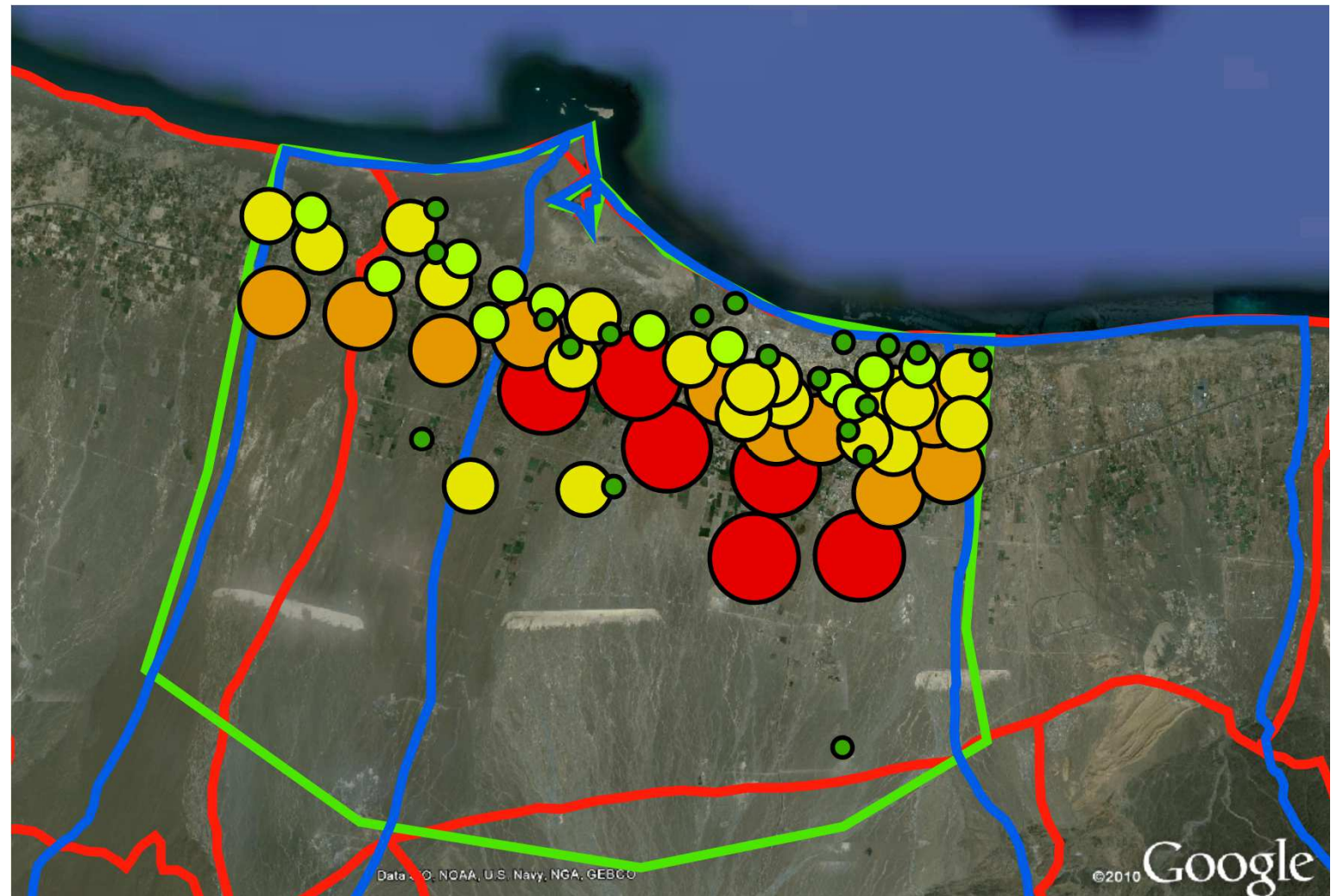
First steps:

- Implementation of IWRM office with staff from MRMWR and MAF
- Integrated assessment of water productivity



KQ 5. Do we have data for monitoring and assessment of actual water supply and demand ?

Agricultural water demand of different agricultural subzones



Estimates based on data
of the „National Well
Inventory“ (1993-95)



KQ 4. Do we have the models for integrated assessment of measures of water supply and demand ?

Integrated (predictive) modeling

of water availability needs

- Hydrological modeling
- Reservoir system modeling
- Groundwater modeling
- Modeling of distribution systems
- Climate modeling ...

-
- at a large spatial scale and a large time scale

of water demand needs

- modeling of irrigation systems
- modeling of crop response (incl. stresses)
- modeling of the economic response
- modeling of the farmers response to measures (rational, irrational)

-
- at a small spatial scale and small time steps
 - at regional scale and larger time scale



KQ 4. Do we have the models for integrated assessment of measures of water supply and demand ?

Integrated simulation based optimal management

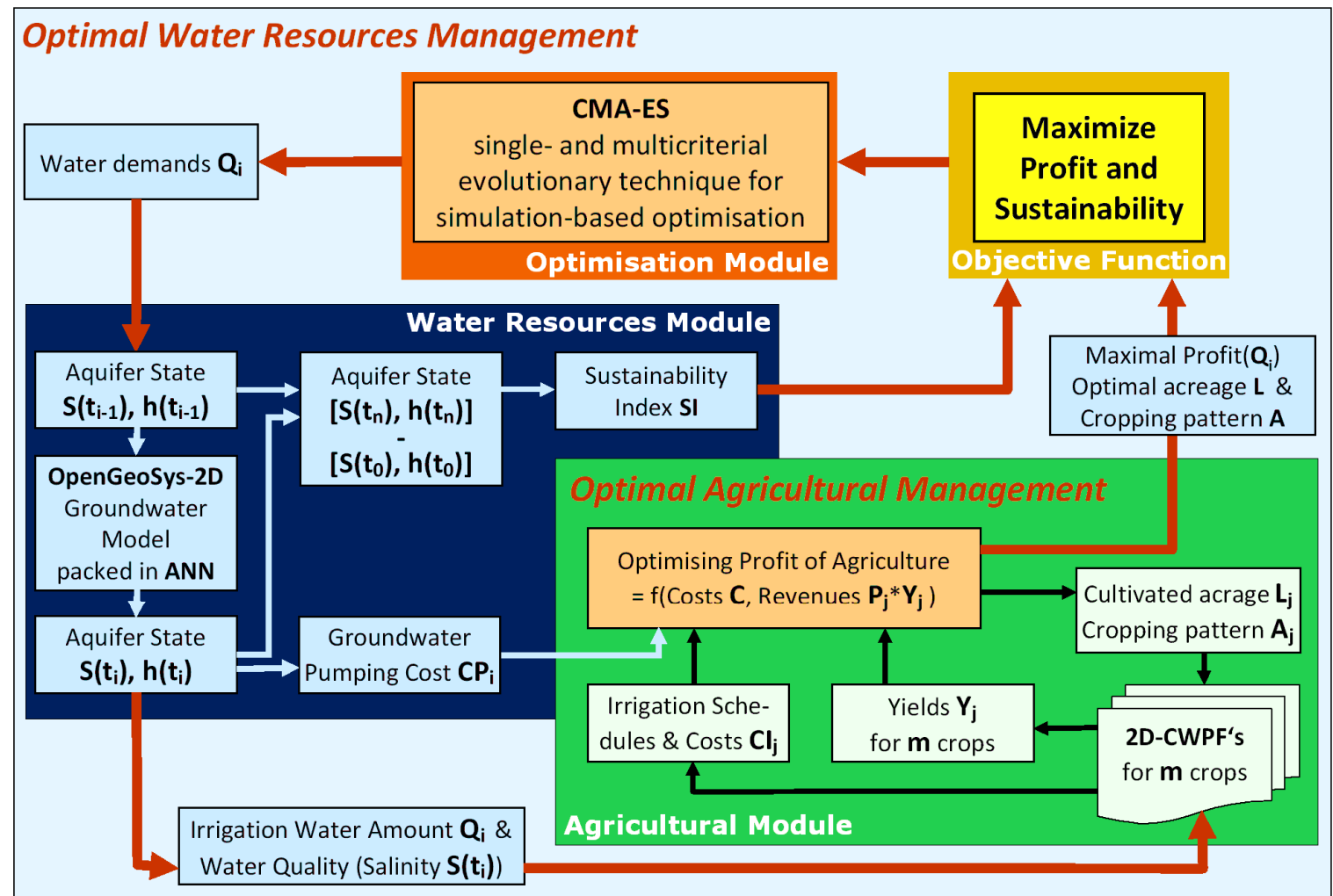
What is best (productivity, sustainability, employment, welfare, economic effectiveness)

- on the short term?
- on the long term?

Challenges (KQ 7.)

- complexity
- uncertainty (climate, ...)
- non-linearity
- water quality
- integration of other resources/sectors

-----NEXUS-----





KQ 4. Do we have the models for integrated assessment of measures of water supply and demand ?

Validation and Implementation of (simulated) best managing practise

Principles:

- Sustainable Water Supplies
- Shared Responsibilities
- Self Governance
- Link between water users and water managers
- Sound Science
- Adaptive Management
- Informed Public

