

Hydronomics 2050

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From

IWRM: Integrated Water Resources Management

towards

RBAM: River Basin Asset Management

Denmark Technical University 1965

Denmark Polytechnical Institute



Mike Abbott
Computational Hydrology

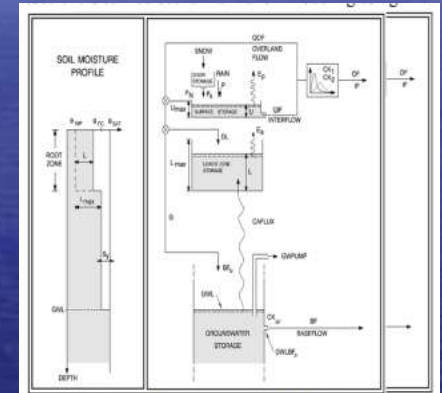
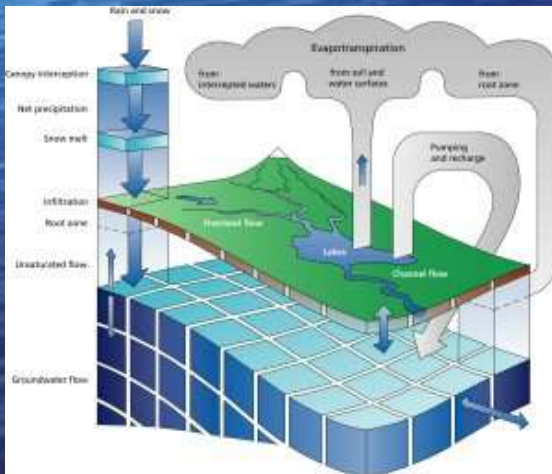


Figure 2: Processes of NAM Model

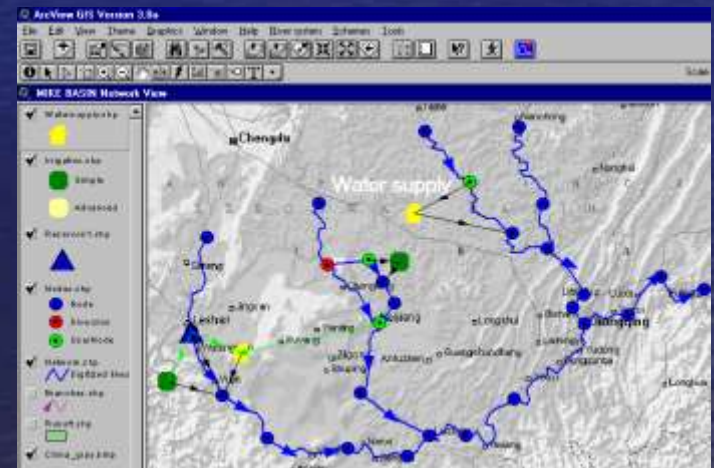
GIER
CPU 4 Kb

NAM model



Mike SHE

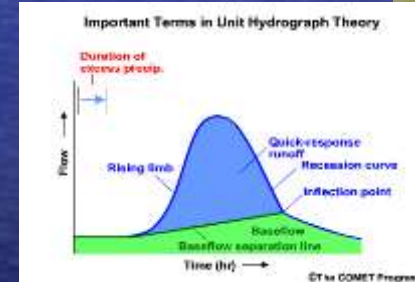
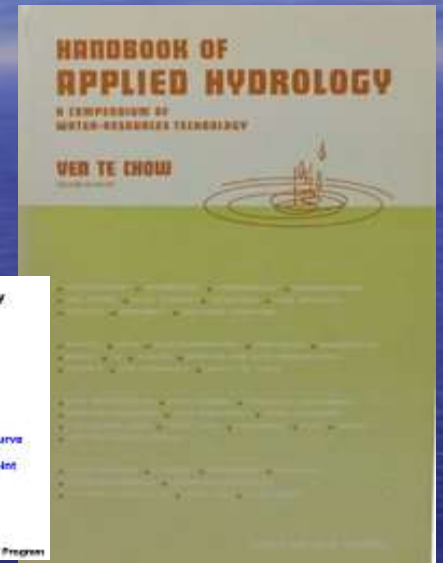
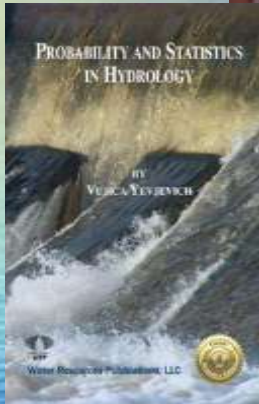
Khao Yai pilot



Mike BASIN

Colorado State University 1970

Edmund Schultz



Vujica Yevdevich

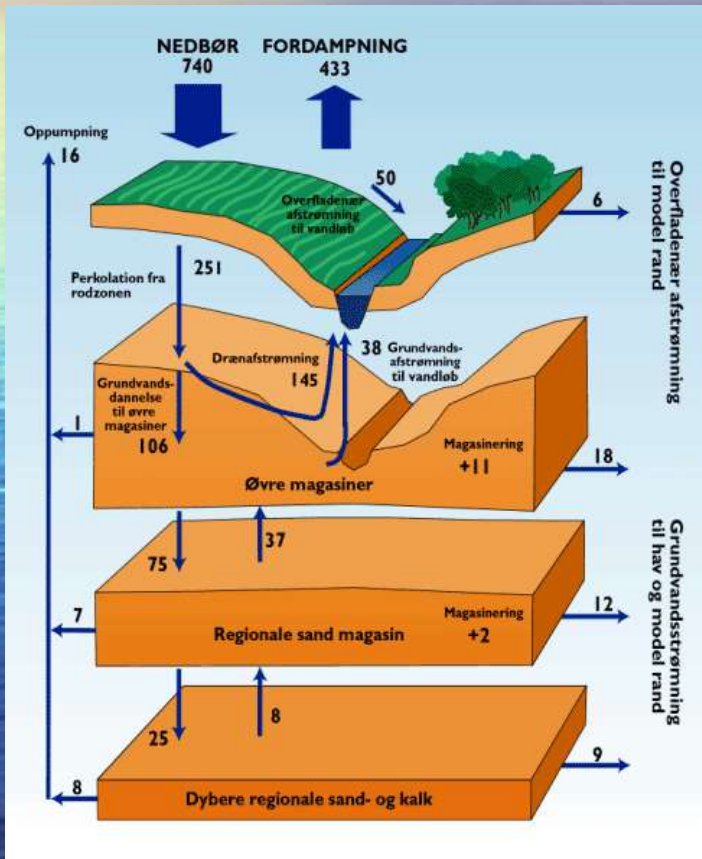
1468 pages !!!!



Dave Dawdy

Impact of groundwater development 1970'ies

The Susaa model 1979



The DK model 2003

GEMS www.gems.dk

Vandforbrugets påvirkning på vandmiljøet Vandløbspåvirkning i dag

Største begrænsninger for økologisk kvalitet i danske vandløb:

- Dårlige fysiske forhold
 - Manglende variation
- Mængden af vand
 - Ændret vandføringsregime
- Barrierer
 - Forringet forbindelse
- Kvalitet af vand
 - Forringet vandkvalitet




IBM System/360
CPU: 256 Kb

Developing waterbox tools takes time: 20-25 years

AIT 1984-86

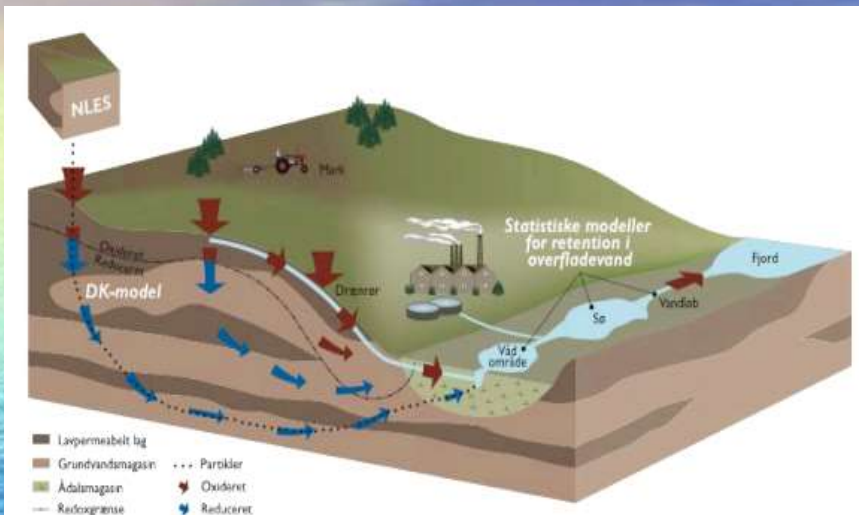


Rick Pama and me in interaction

The outcome

Impact of Agricultural Pollution in 80'ies

NPO Research Program (5 years)

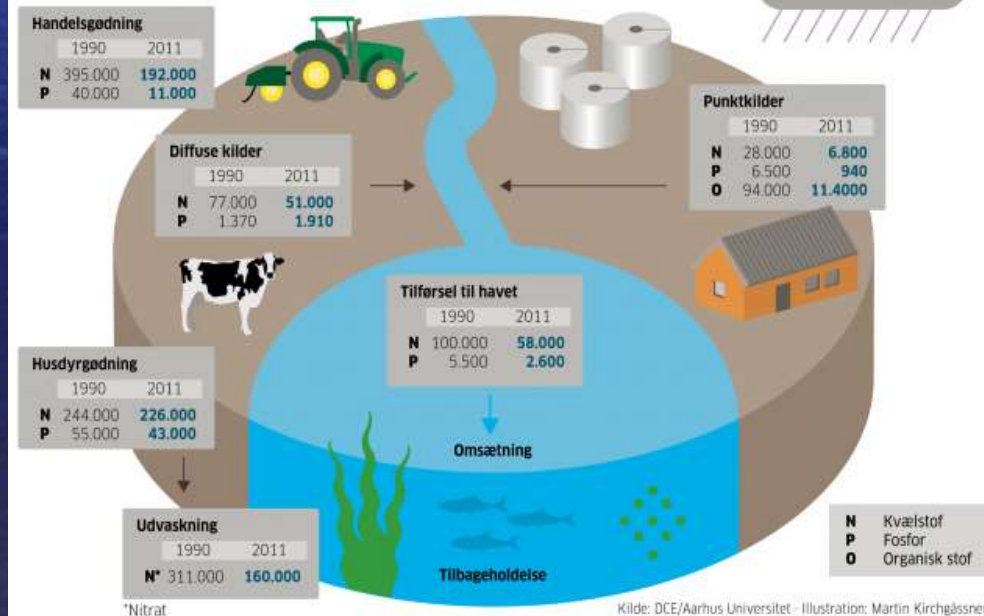


Plans take time

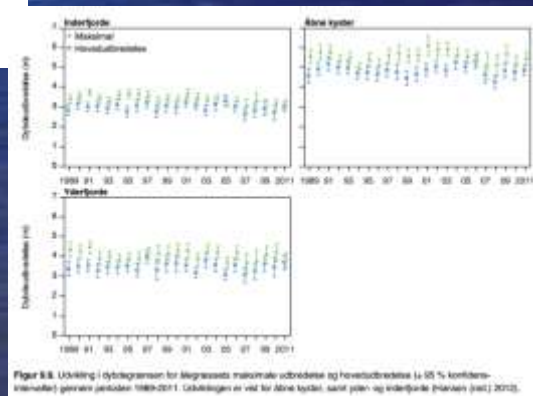
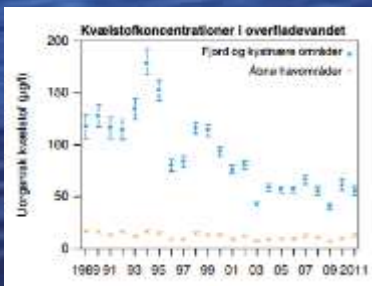
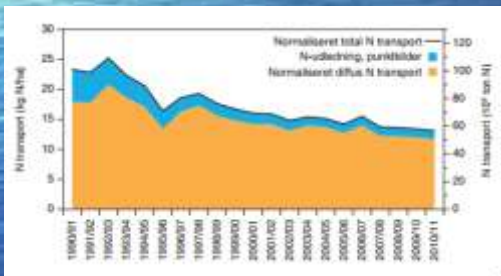
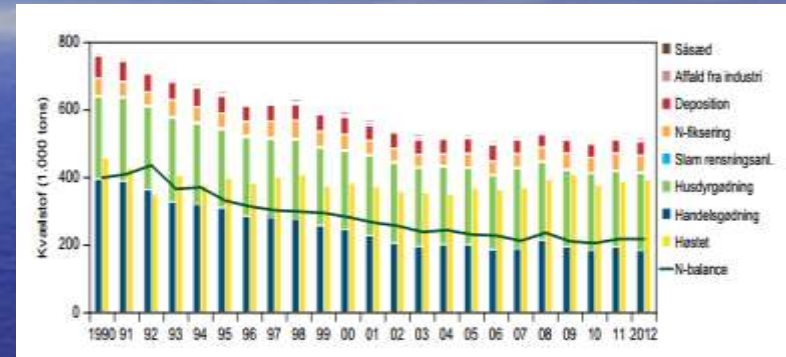
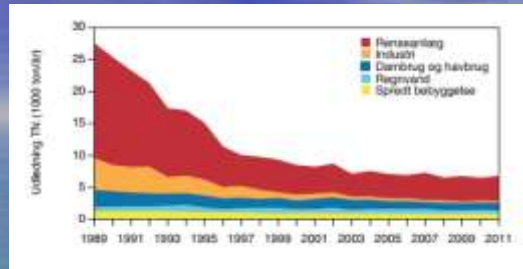
Aquatic Environment Plans (25 years)

ATMOSFÆRISK DEPOSITION

Illustrationen viser de reduktioner, der er sket i belastningen af vandmiljøet med kvælstof, fosfor og organisk stof fra landbrugets udledninger og spildevandet, siden vandmiljøplanerne blev startet i 1990.



National Monitoring Program 1988-now



Figur 8.8. Udvikling i dybdeprofilen for årgangens maksimale udledning og koncentrationerne i 95 % konfidensterværdier gennem perioden 1989-2011. Gennemsnit af vand for åbne fjorde, søer, jule- og søerfjorde (Hansen *et al.* 2012).

20 years response time

Courtcase 2015

VMP II 1998

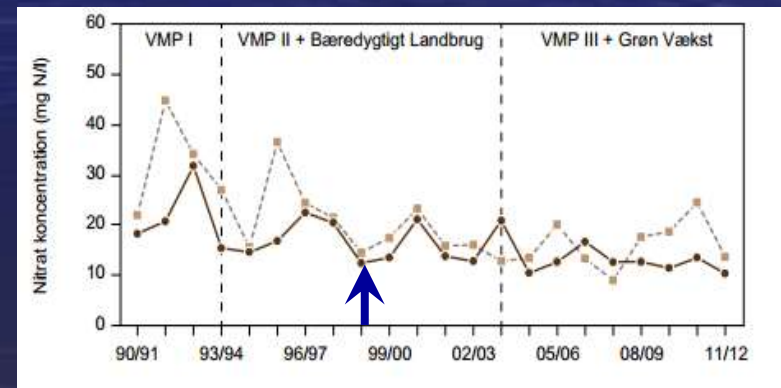
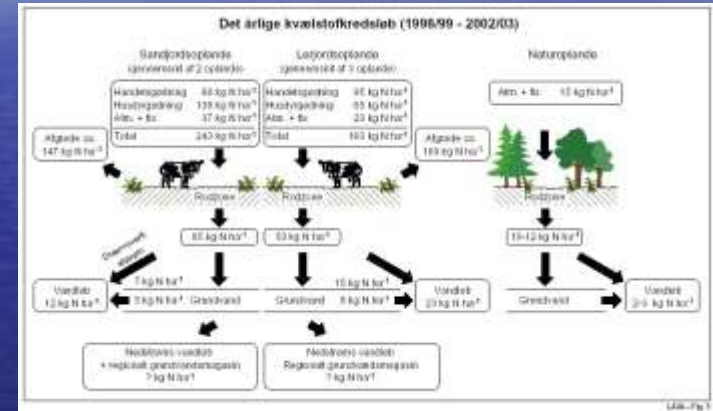
- 20% Reduction of optimal fertilizer application
- Reduction of protein content
- Reduction in harvested **value**: 400 mio USD/year

No significant emission effect

Court reject farmers request

3000 farmer families bankrupt

LOOP Data



United Nations 2000's Water and Environment

Pollution Control
(1970'ies)



Nature conservation (1980'ies)



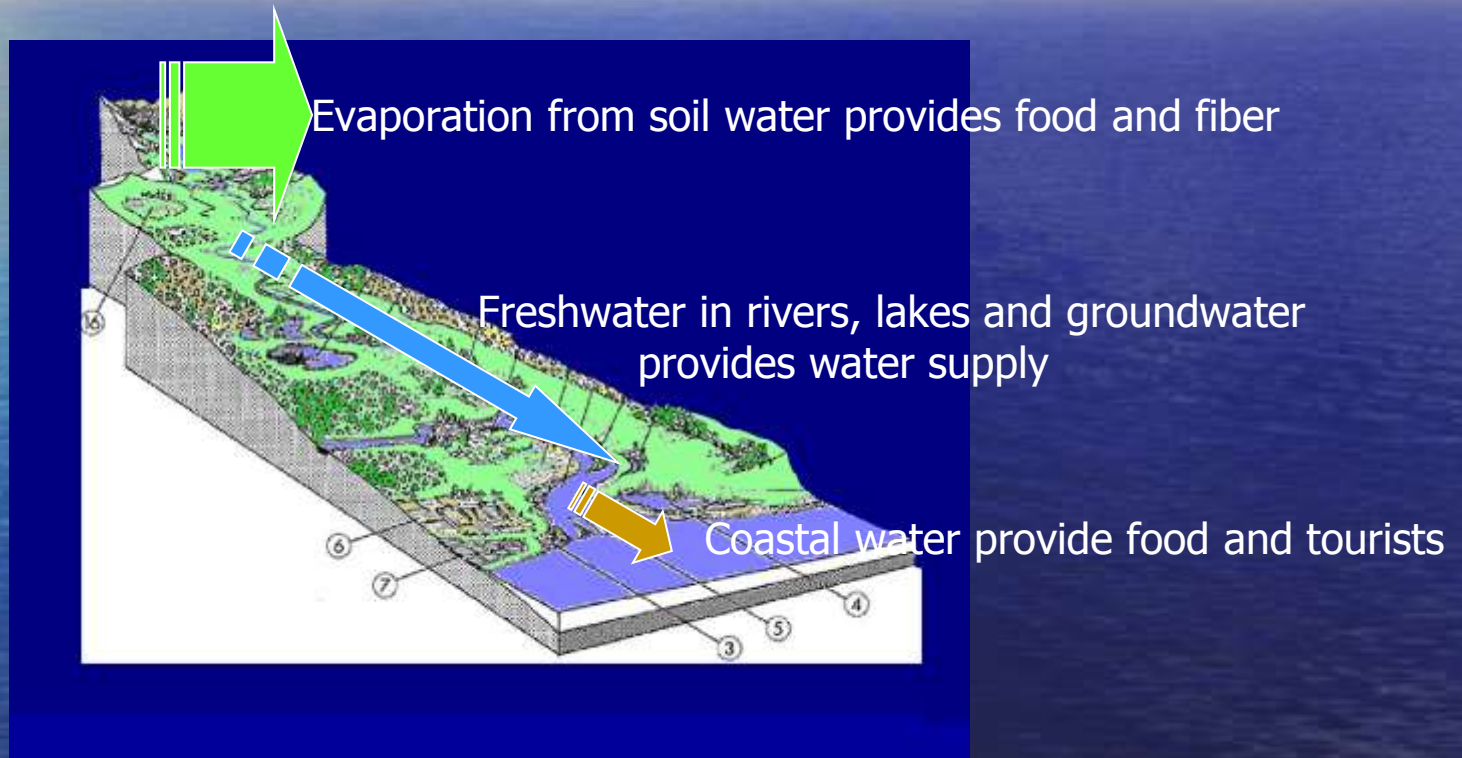
Ecosystems as Development Assets: Goods and Services



Source: The Economist

Ecosystem assets

Soil water, Fresh water and Coastal water



Climate, Soil, Water and living creatures (incl. Man) can not be separated

IWRM 2005

Macro Hydronomics



Fig. 4: General framework for IWRM

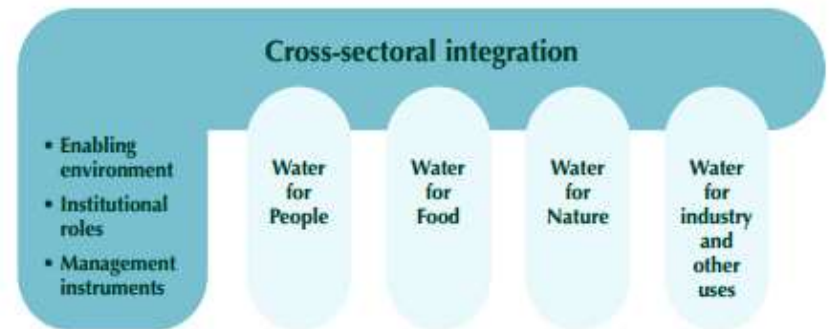


Fig. 3: IWRM and its relations to sub-sectors

The Three E's

- **Economic** efficiency
- **Social Equity**
- **Ecological** sustainability

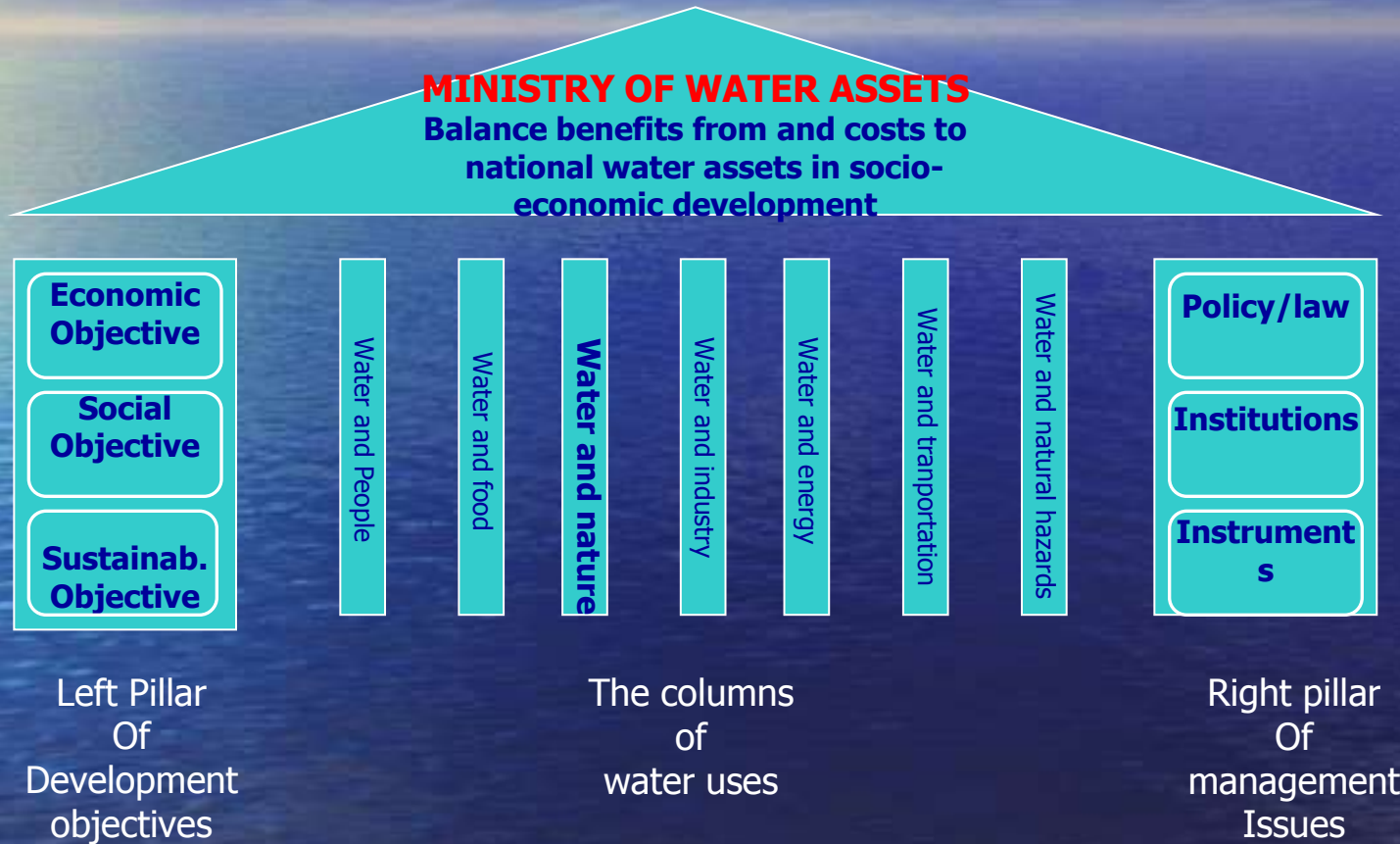
The Three Pillar's

- Enabling environment
- Institutional roles
- Management instruments

Mainstreaming Water Management

into

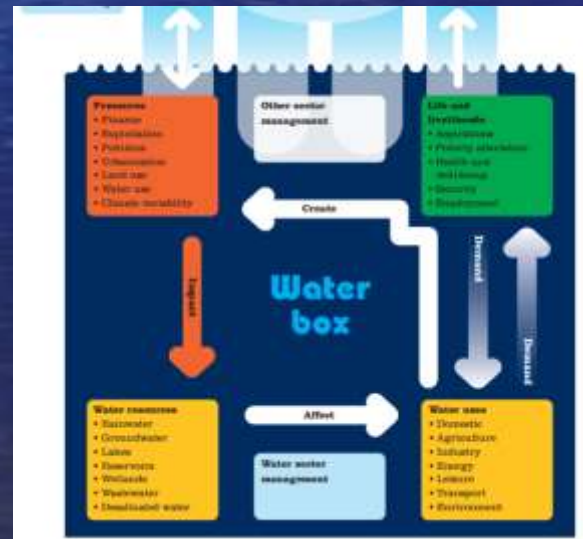
Economic, Social and Environmental Sustainability objectives



More of the same but different

World Water Development Report 2009

Water in a changing world



Bangkok Flood 2011

Integrated decision support tools for water resources management

...get the full benefit of real-time monitoring and early warning systems



...manage, organise and analyse large amounts of data

...optimise operations and planning

...make wise and robust water management decisions



Early warning and forecast systems



Chao Phraya, Thailand

The Chao Phraya River Basin.
160,000 km².

One Decision Support System to protect against devastating flooding.

“RAR highly appreciates DHI for their excellent job, especially on the close collaboration and hands on experience that made us become a good partner.”

Dr. Piyamongkorn Srisophon, Project Leader, Hydro and Agro-informatics Institute

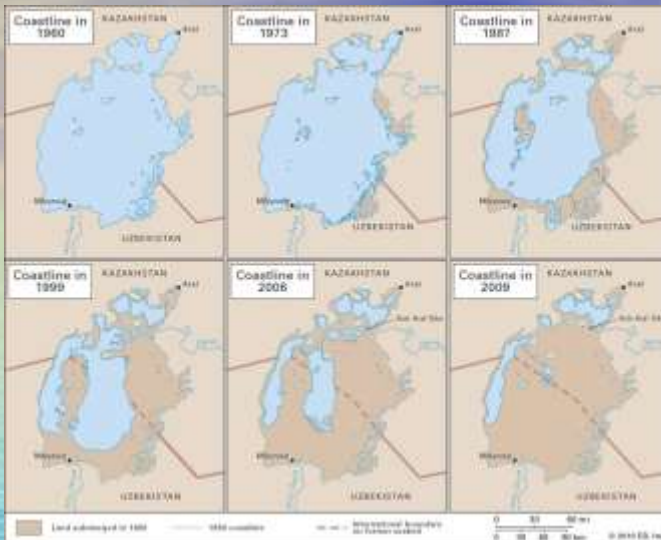


Human mistake

Mismanagement of Bhumipol and Sirikit reservoirs

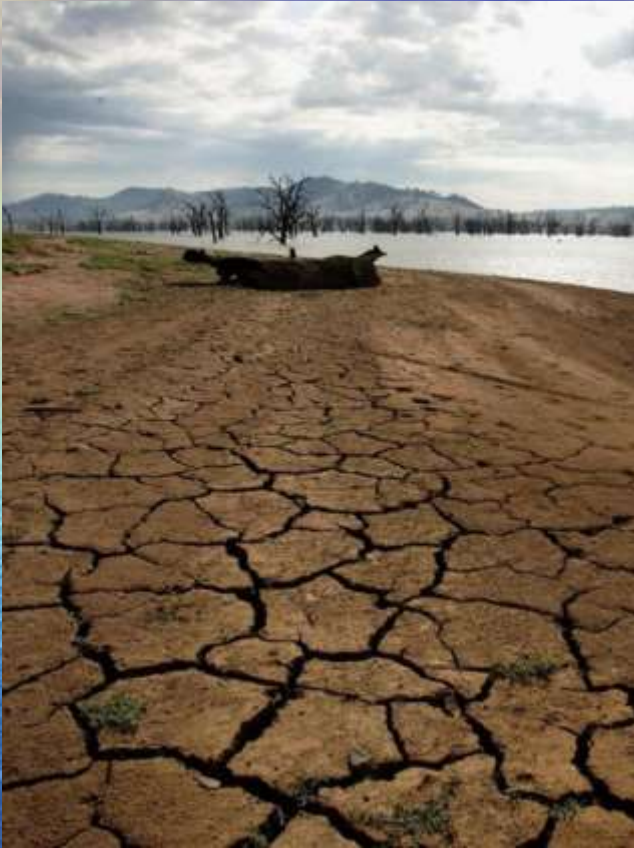
Loss: 50 billion USD

Amu-Syria Daraya basin



Murray-Darling Basin

IWRM Showcase



Colorado-San Joaquin basin



Water in a changing world

50 years of Crisis

- Iron curtain crisis: 50'ies
- Cuba crisis: 60'ies
- Oil crisis: 70'ies
- Water crisis: 80'ies
- Ecosystem crisis: 90'ies
- Climate crisis: 00'ies

- Financial crisis: 00'ies
- Refugee crisis: 2015

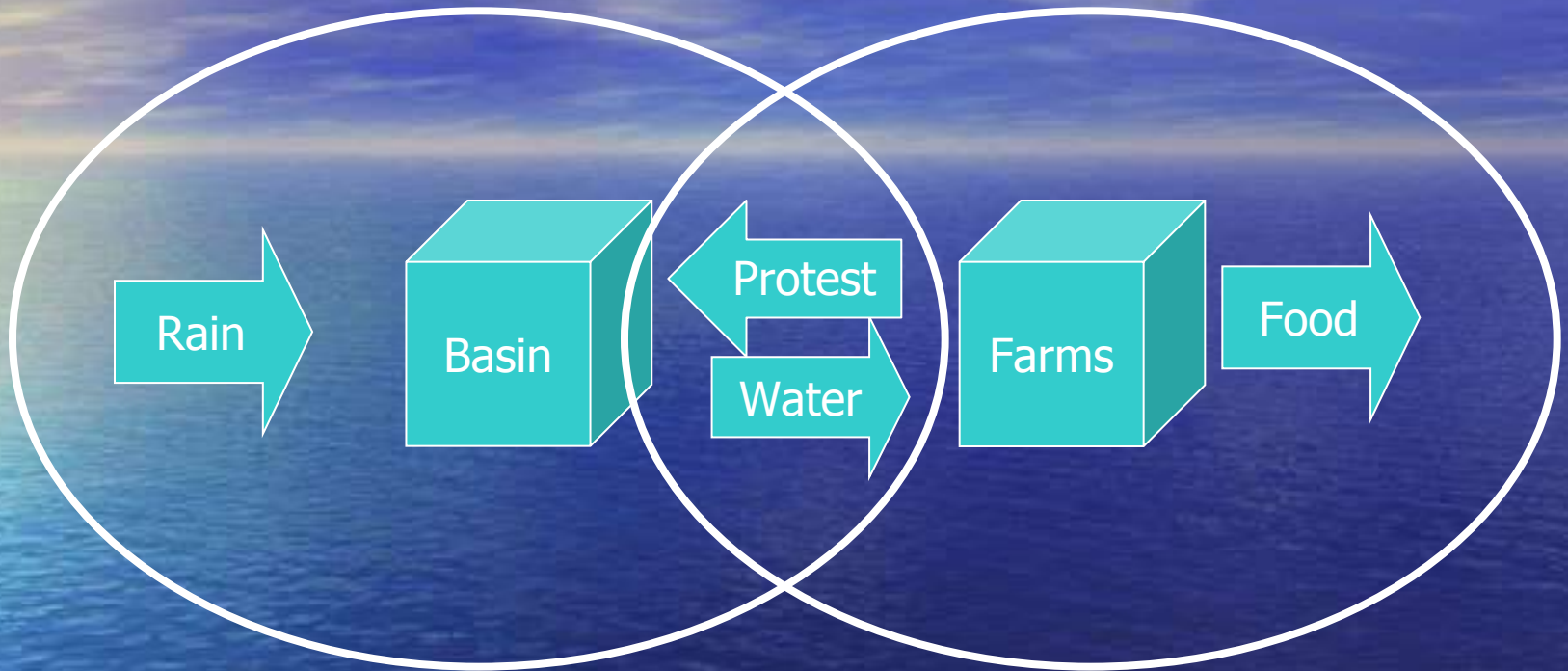
Chocks and crisis are here to stay

System vulnerability

Uncertainty and Irreversibility:
Small unexpected disturbances may have catastrophic effects



Boxes and Interactions

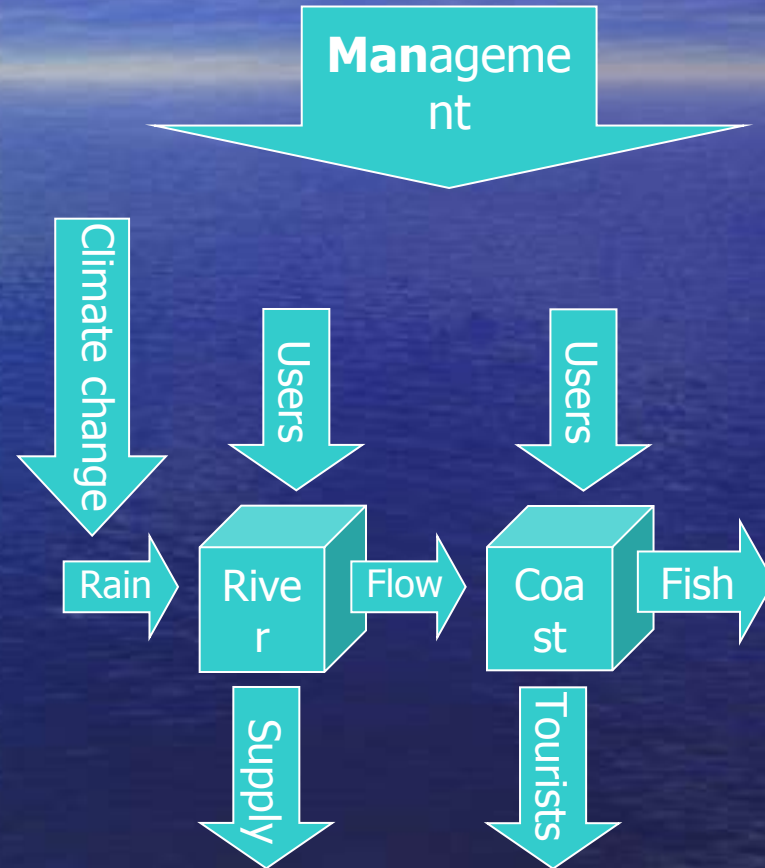


Micro Hydronomics 2050

The Econet 2050

From boxes to networks

- Focus on **problem**
- Focus on **interacting web**
- **Everything** is uncertain
- Multidisciplinary is a **MUST**
- Keep it **simple**



Water management
is
People management

2015 opportunities

In the Waterbox

- Huge and cheap computerpower
- Mobilephones with GPS
- i-Aps
- Internet of things and actions
- Robots and drones



INTERACT

In the peoplebox

- internet of words and ideas
- social networks of information and awareness
- new learning
- new economics
- new law and regulation

That's it!

With thanks to The Economist

Albert Einstein

"Two things are infinite: the universe and human stupidity.
- and I am not sure about the universe"

Conrad Hilton

"When you take shower in the bathtub, always remember to
put the curtain inside"

Dr. Mogens

"It is not enough to have a big brain and big mouth:
One needs also big ears....."



Thank you for your attention.