Integrated Water Management

Week 1:

Introduction

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Civil Engineering and Geosciences
Technical University Delft

IWM Fall 2013

Week 1: Introduction

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Outline

- IWM vis-à-vis other disciplines
- Inventory of topics covered by IWM engineer (cases)
- Expectations and philosophy
- Course outline
- Team work / Extreme programming

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Teams & logistics

- Five to six groups
- Rhine & Volta

- Computer lab

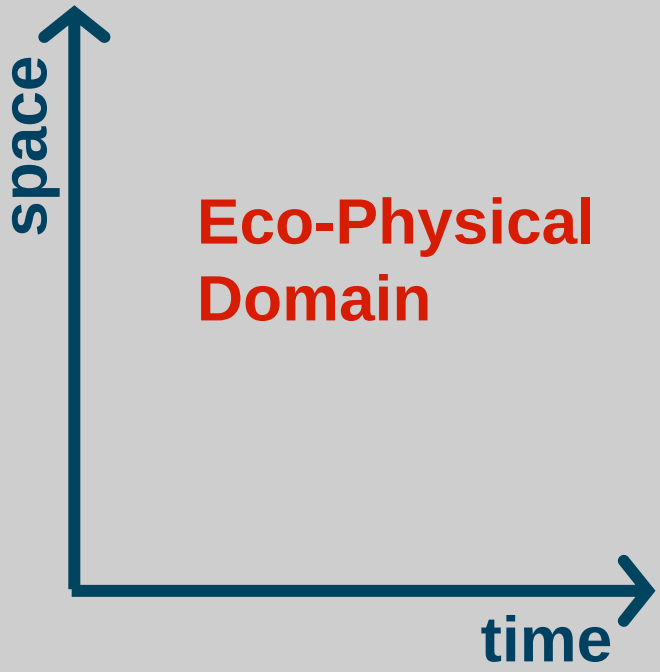
IWM vis-à-vis other disciplines

- Physical environment:
  - Hydraulics
  - Hydrology
  - Sanitation engineering, biochemistry
  - Ecology, aquatic biology
  - …

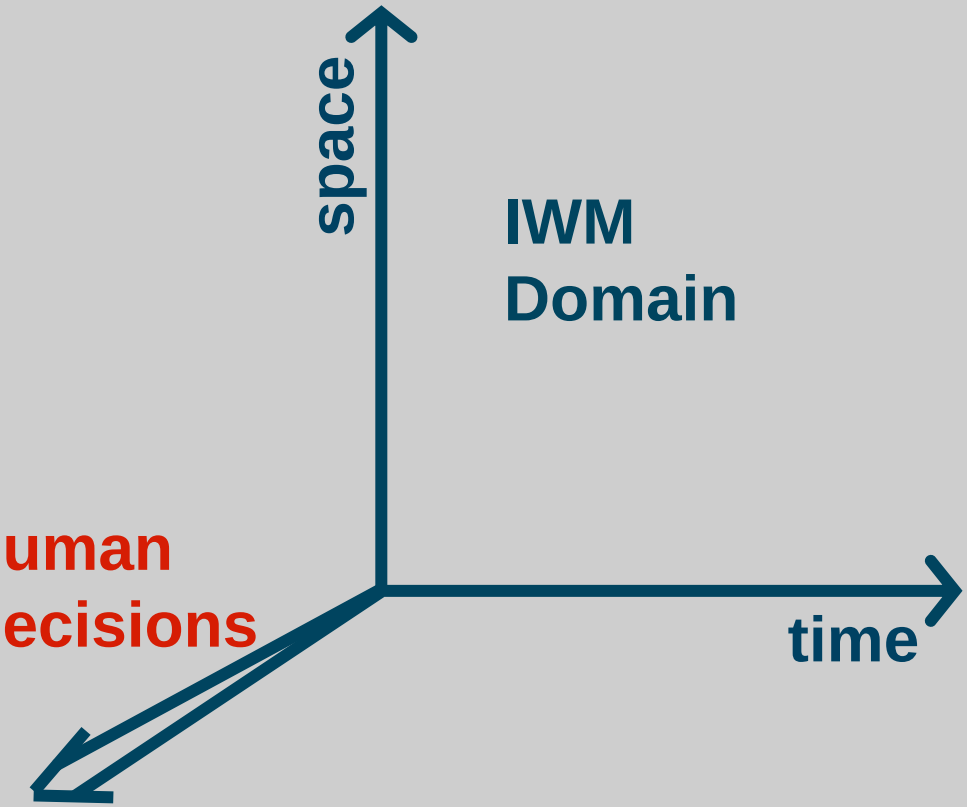
IWM vis-à-vis other disciplines

- Mathematics/tools:
  - System Analysis, Dynamical Modeling
  - Computer Science, Numerics
  - GIS, Remote Sensing
  - …

IWM vis-à-vis other disciplines



IWM vis-à-vis other disciplines



IWM vis-à-vis other disciplines

- Social environment:
  - Law

“tussen droom en daad staan wetten in de weg en praktische bezwaren”

Elsschot

IWM vis-à-vis other disciplines

- Social environment:
  - Law
  - Economy
  - Public administration
  - Anthropology
  - …

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Courses by Water Resources Management:

- **CT4450: Integrated Water Management Introduction and River Basin Management**
- CT4460: Polders and Flood Control
- CT5510: Urban Water Management
- CT4410: Irrigation and Drainage
- CT5490: Operational Water Management
- CT5401: Spatial Tools in Water Resources
- CT5500: Water Law and Organization
- CT5560: CT in Developing Countries

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Courses by Water Resources Management:

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} **Regional**

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- **CT5560: CT in Developing Countries** } **Service**

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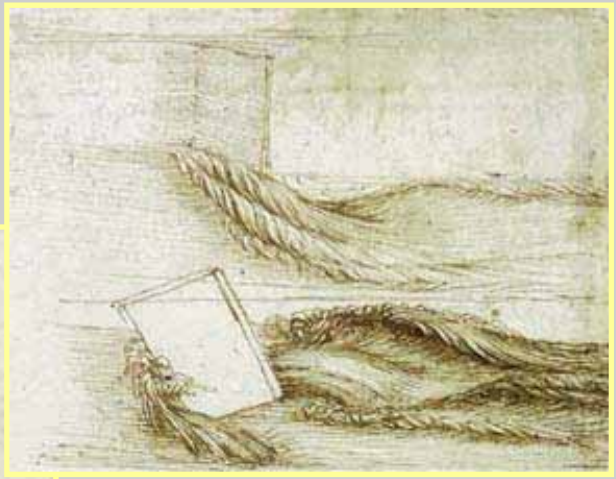
Inventory of skills...



Do we have to be Leonardo's to be IWM engineers?

Inventory of skills:

- Project involvement IWM Engineers:
  - Sacramento River (Salmon & temperature)
  - New York City Watershed (Cryptosporidium)
  - Irrigation development West Africa (Malaria)
  - …
  - (YOUR PROJECTS HERE!)

Inventory of skills: Case 1 Sacramento River

- Many issues:
  - Power supply
  - Irrigation
  - Delta wetland
  - Forestry
  - Salmon

Inventory of skills: Case 1 Sacramento River

California

Inventory of skills: Case 1 Sacramento River

California

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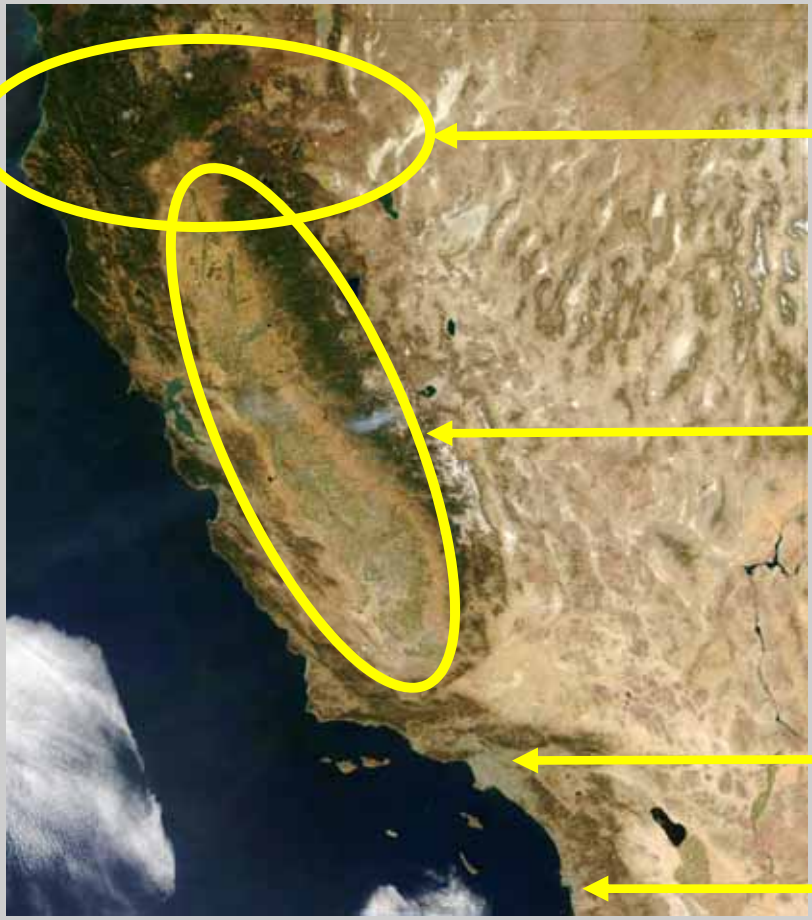
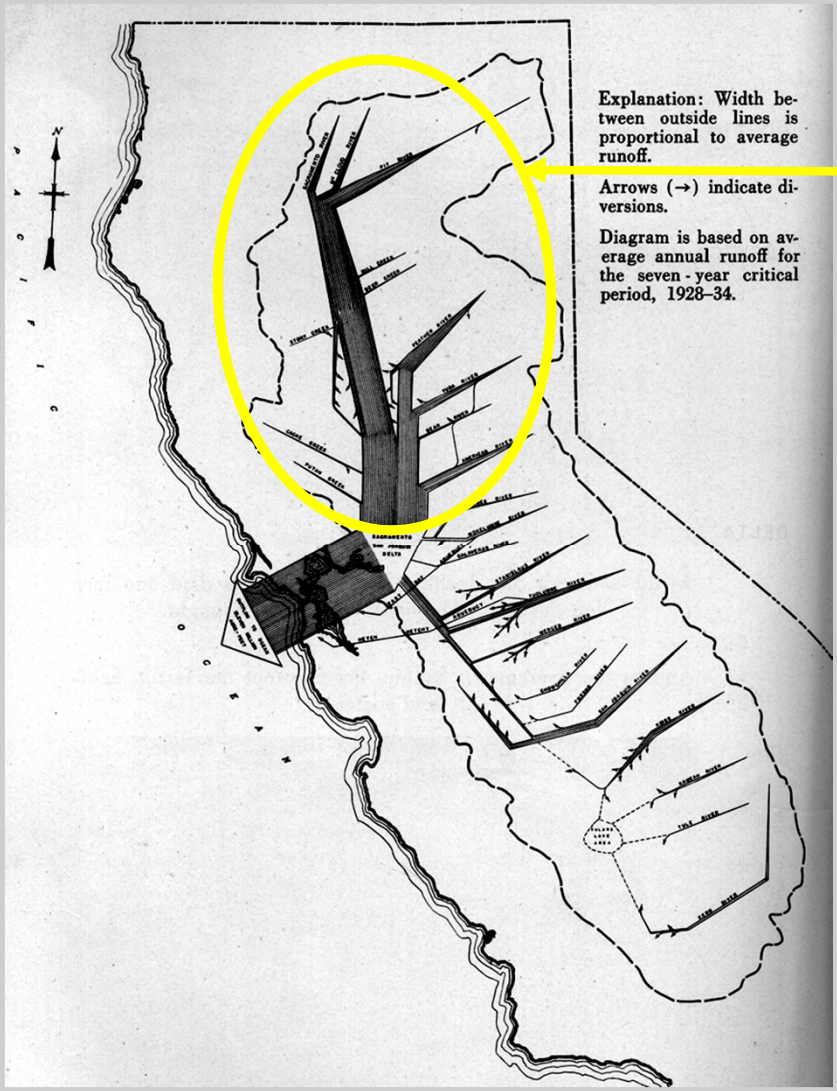
Inventory of skills: Case 1 Sacramento River



California

Inventory of skills: Case 1 Sacramento River

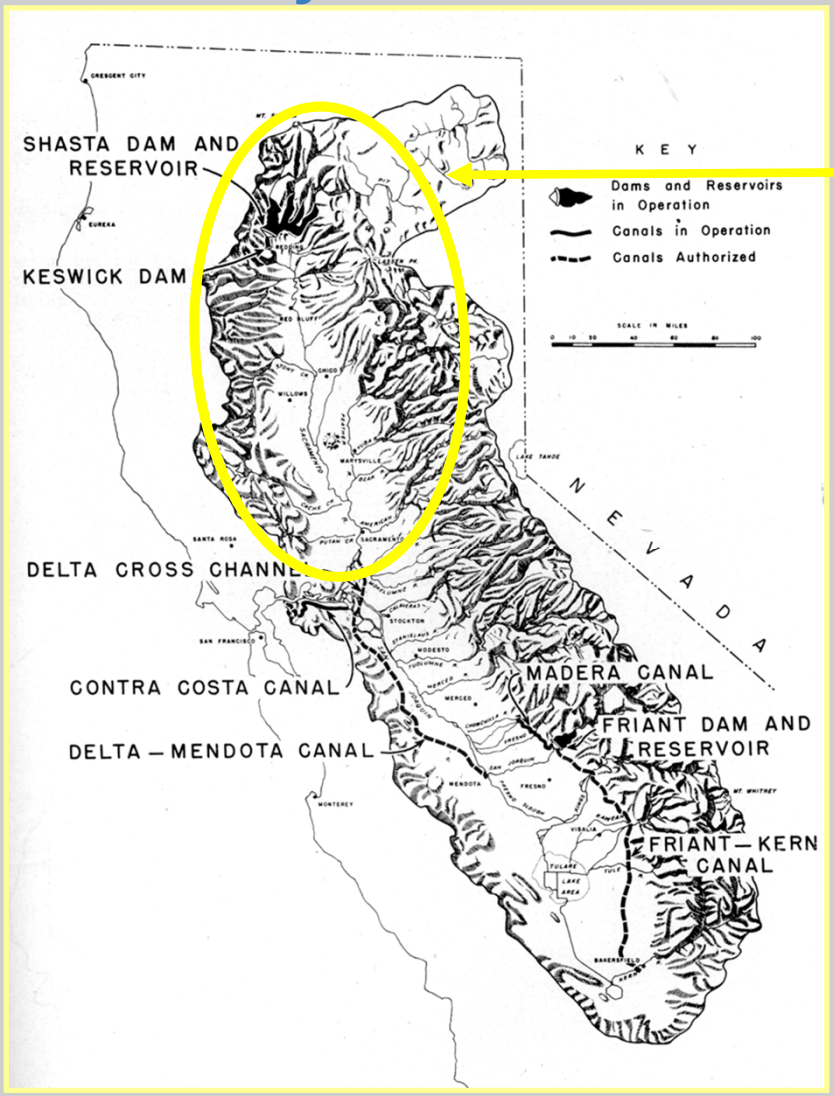


Sacramento

California

Source: www.meishu163.net

Inventory of skills: Case 1 Sacramento River



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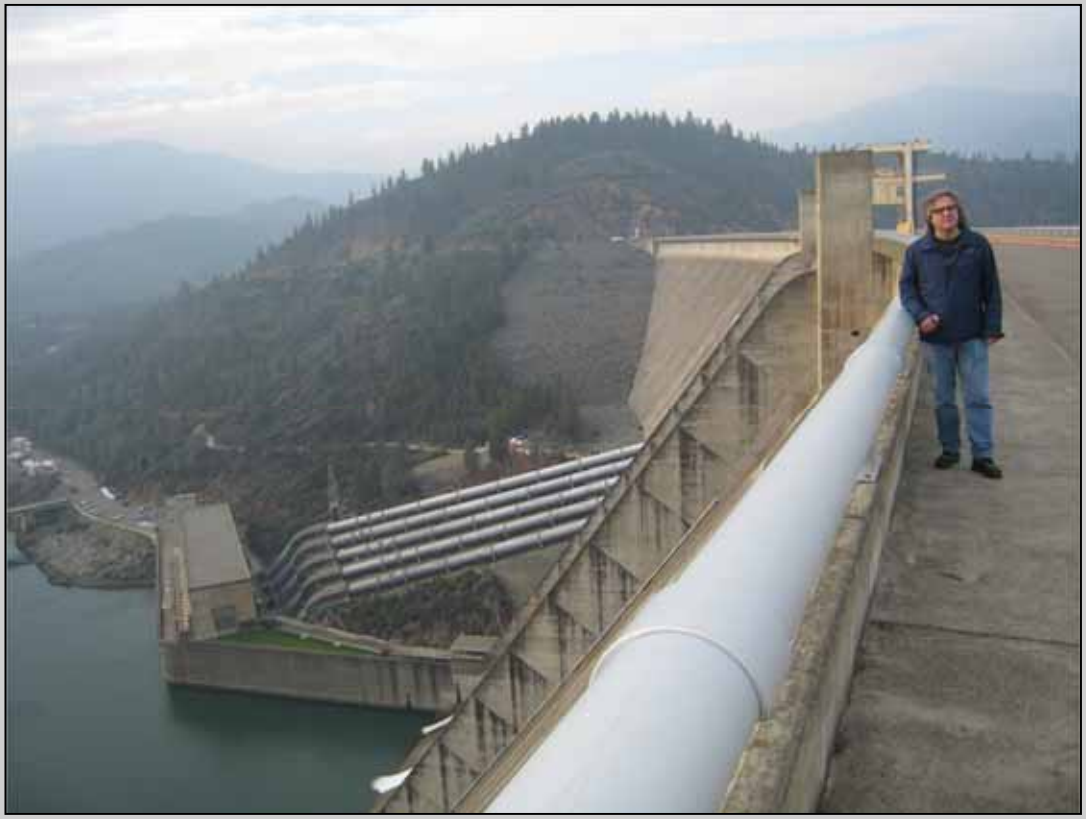
Sacramento

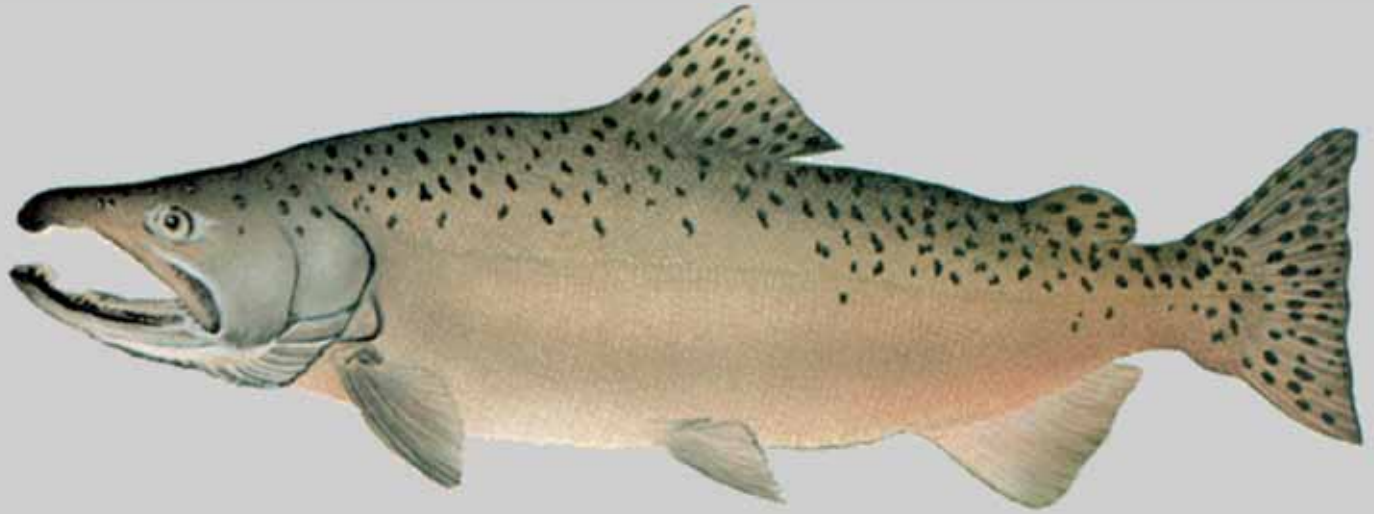
California

Inventory of skills: Case 1 Sacramento River



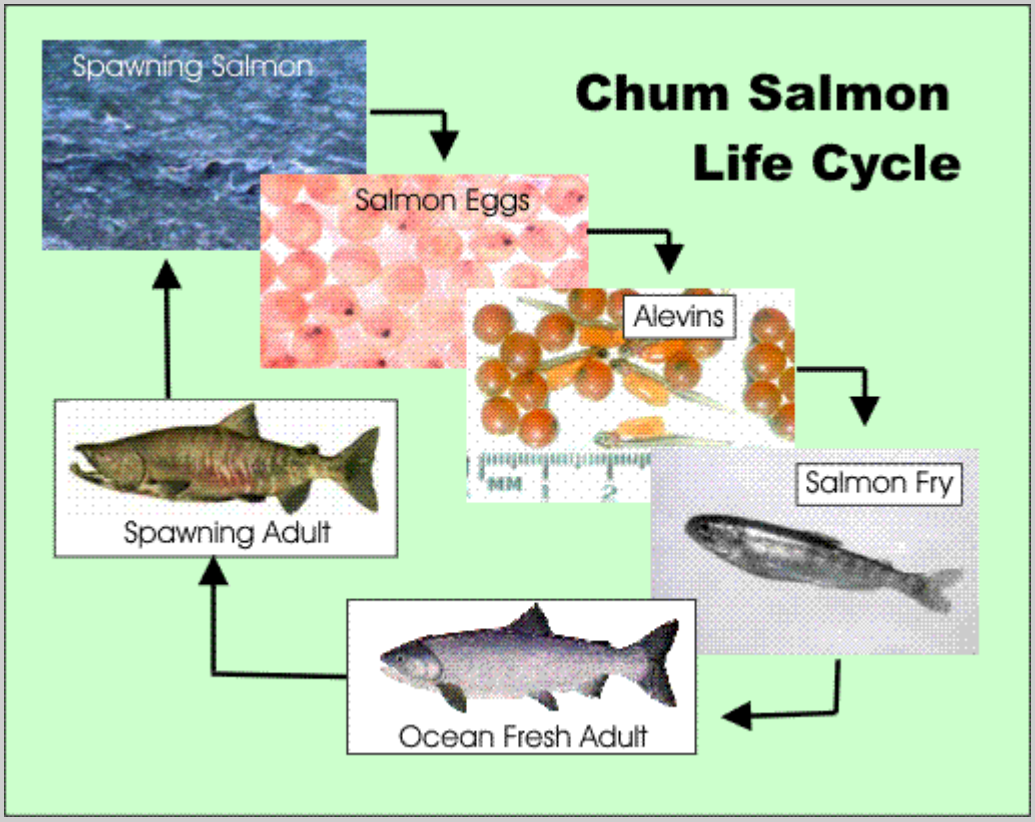
Shasta dam: 200 m, 539 MW, Central Valley

Inventory of skills: Case 1 Sacramento River



Source: www.psmfc.org

Inventory of skills: Case 1 Sacramento River



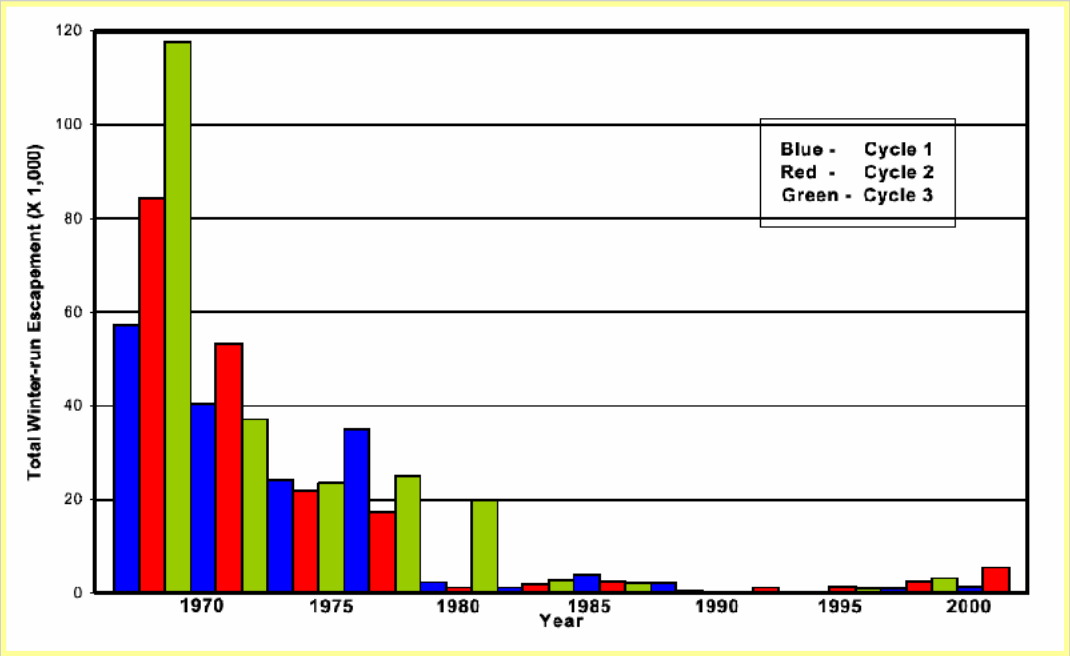
Anadromous

Inventory of skills: Case 1 Sacramento River

- Dams and irrigation development
  - Blockage of spawning rushes
  - Diversion of fry into turbines and diversion channels
  - Mixing of water from different rivers (“smell”)
  - Loss of spawning grounds
  - Temperature

Inventory of skills: Case 1 Sacramento River

In Sacramento < 5% original number!



Winter-Run Chinook

http://www.dfg.ca.gov/nafwb/pubs/2002/2002_03_chinook_wr_00_01.pdf

Inventory of skills: Case 1 Sacramento River

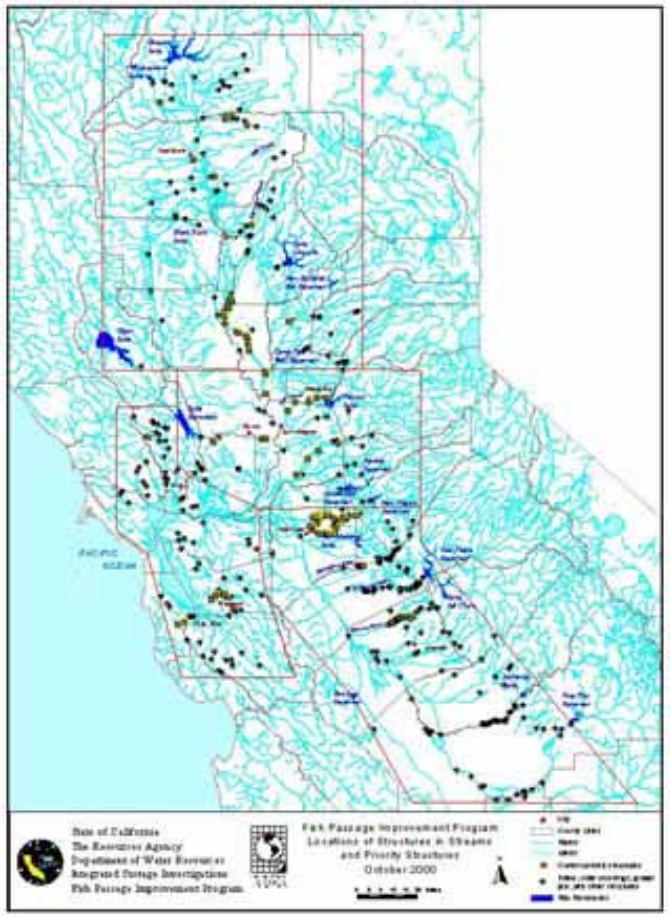
- Engineering solutions
  - Fish ladders
  - Spawning channels
  - Fish grating
  - Release management
  - …

Fish ladder

Source: August 28, 2005 by Garrett Fitzgerald

Inventory of skills: Case 1 Sacramento River

- Typical IWM
  - Stakeholders
  - Conflicting interests
  - Large array of measures
  - Demand/supply
  - GIS
  - …



Inventory of skills: Case 1 Sacramento River

Temperature

Inventory of skills: Case 1 Sacramento River

Temperature

- Shasta normally provides energy at peak-demand
- Low flows downstream
- Temperature rise
- 1992 Chinook endangered species
- 1987-1996: Emergency releases (w/o power)
- $63 million losses in energy production / year
- Better mousetrap

Inventory of skills: Case 1 Sacramento River

Shasta TCD ($80 million)

Inventory of skills: Case 1 Sacramento River

Shasta TCD ($80 million)

Inventory of skills: Case 1 Sacramento River

Source: commons.wikimedia.org

Shasta TCD ($80 million)

Inventory of skills: Case 1 Sacramento River

- Skills
  -
  -
  -
  -
  -
  - ???

Inventory of skills: Case 2 NYC Watershed

Source: affordablehousinginstitute.org

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Inventory of skills: Case 2 NYC Watershed

1842

Source: affordablehousinginstitute.org

Week 1: Introduction

Inventory of skills: Case 2 NYC Watershed

1900-1970:
> 150 km!

1842

Source: affordablehousinginstitute.org

Week 1: Introduction

Inventory of skills: Case 2 NYC Watershed

1900-1970:
> 150 km

Pristine water!

1842

Source: affordablehousinginstitute.org

Inventory of skills: Case 2 NYC Watershed

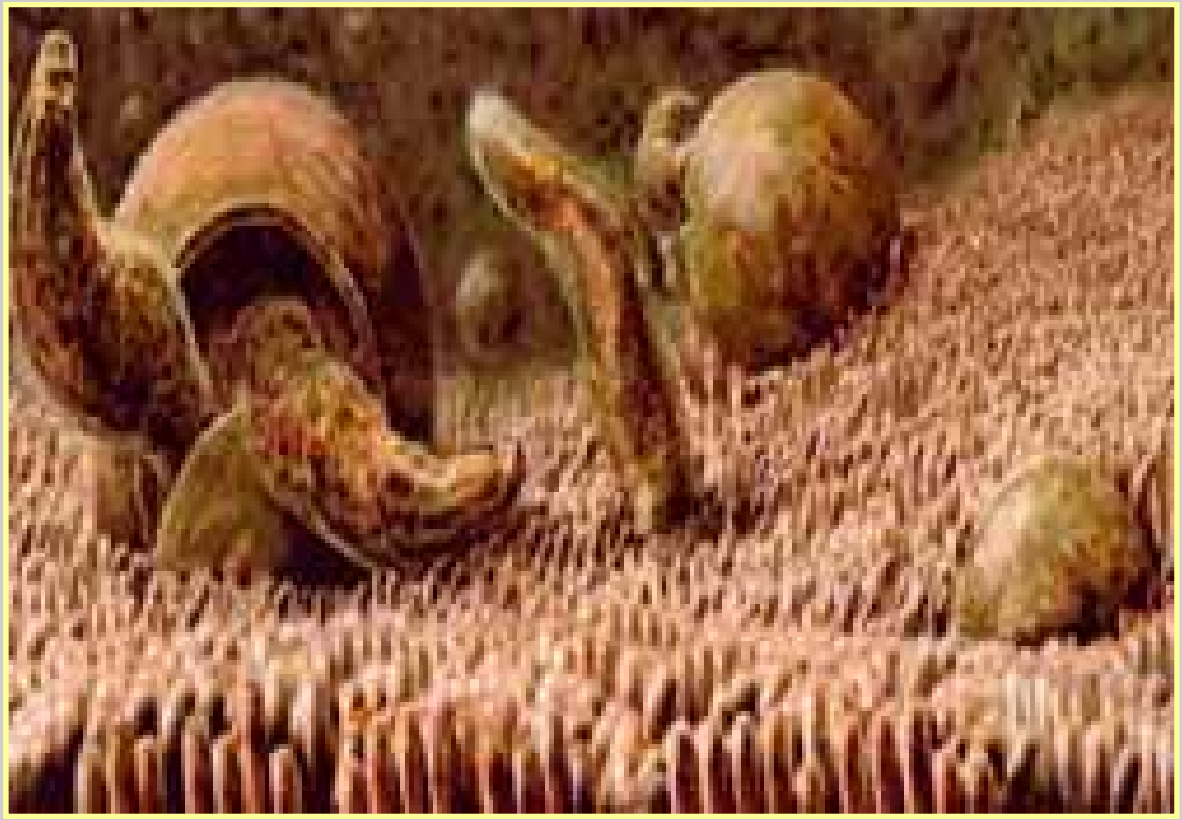
- Early nineties: EPA regulations filtration
- Building this for NYC costs $3-8 billion
- Running it $ 300 million per year
- Plea for waiver almost granted

Inventory of skills: Case 2 NYC Watershed

- 1993 Cryptosporidium outbreak in Milwaukee
  - 406,000 people sick
  - 4000 hospitalized
  - >50 died

Inventory of skills: Case 2 NYC Watershed

- 1993 Cryptosporidium outbreak in Milwaukee



Cryptosporidium parvae

Inventory of skills: Case 2 NYC Watershed

- 1993 Cryptosporidium outbreak in Milwaukee
  - Poorly understood
  - Difficult to detect
  - Digestive tract of human, ruminants, … feces
  - Change in disinfectant, pH, flocculant?
  - Cows, snow, runoff?

Inventory of skills: Case 2 NYC Watershed

- EPA does not waive NYC's filtration obligation
  - NYC stalls, studies
  - IWM plans
  - Population non-cooperative at first

Inventory of skills: Case 2 NYC Watershed

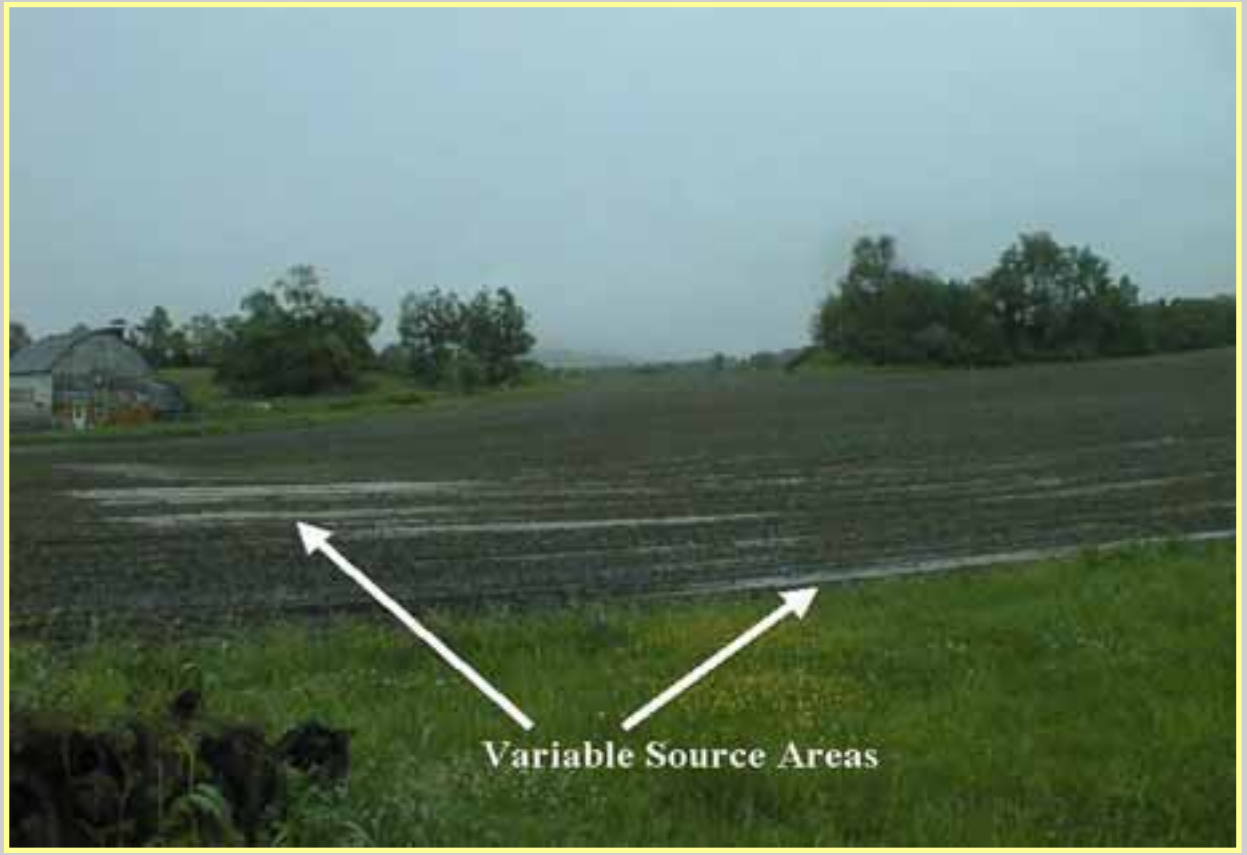
- Solutions
  - Buy all land….

Inventory of skills: Case 2 NYC Watershed

- Solutions
  - Buy all land….
  - Best Management Practices
    - Cows, paper, staples

Inventory of skills: Case 2 NYC Watershed

- Solutions
  - Watch sensitive areas!



Inventory of skills: Case 2 NYC Watershed

- Solutions
  - Watch sensitive areas!

Variable source area

Inventory of skills: Case 2 NYC Watershed

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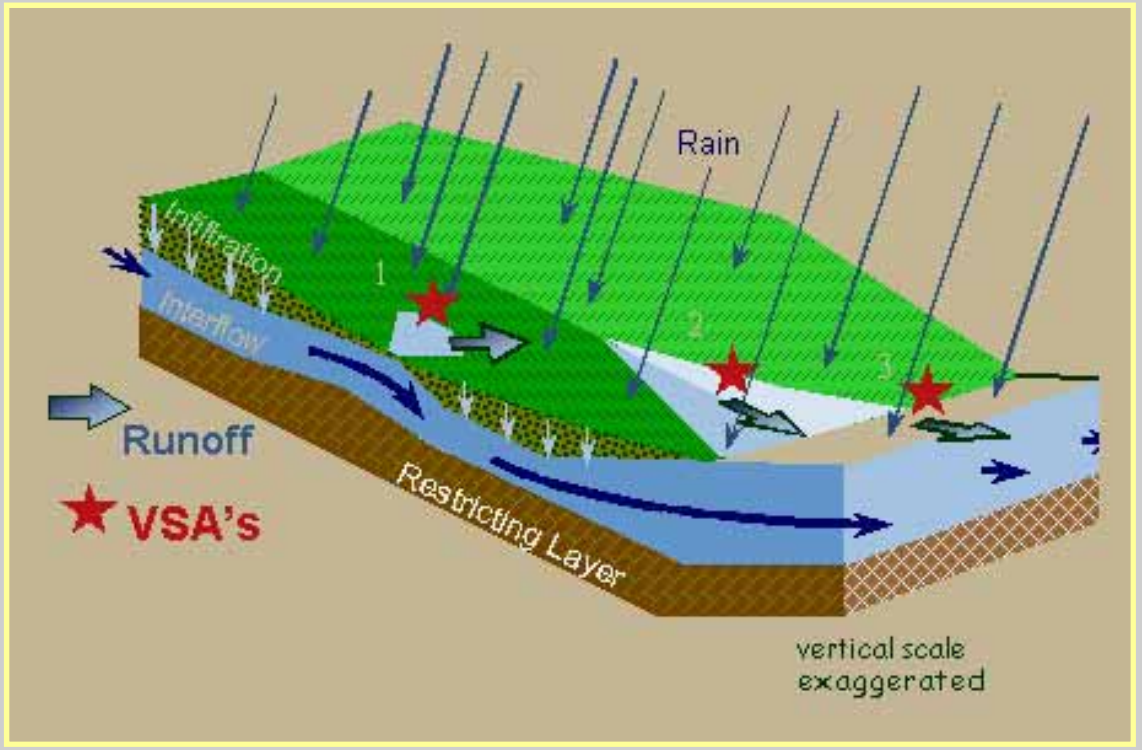
  - Watch sensitive areas!



Variable source area

Inventory of skills: Case 2 NYC Watershed

- Solutions
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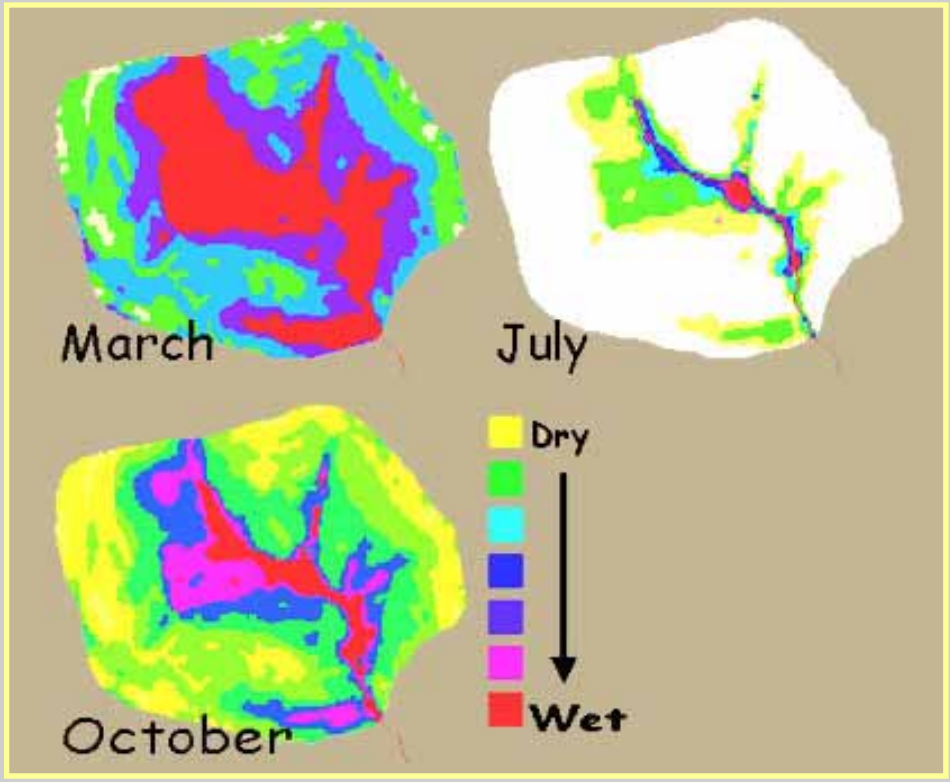


Variable source area

Inventory of skills: Case 2 NYC Watershed

- Solutions IWRM:
  - Monitoring
  - Manure management
  - Phosphorus management
  - Land acquisition
  - Wastewater treatment
  - Buffer zones
  - Best Management Practices
  - 1997 MoAgreement, Watershed Partnership
  - Studies….

Inventory of skills: Case 2 NYC Watershed

- Skills
  -
  -
  -
  -
  -
  - ???

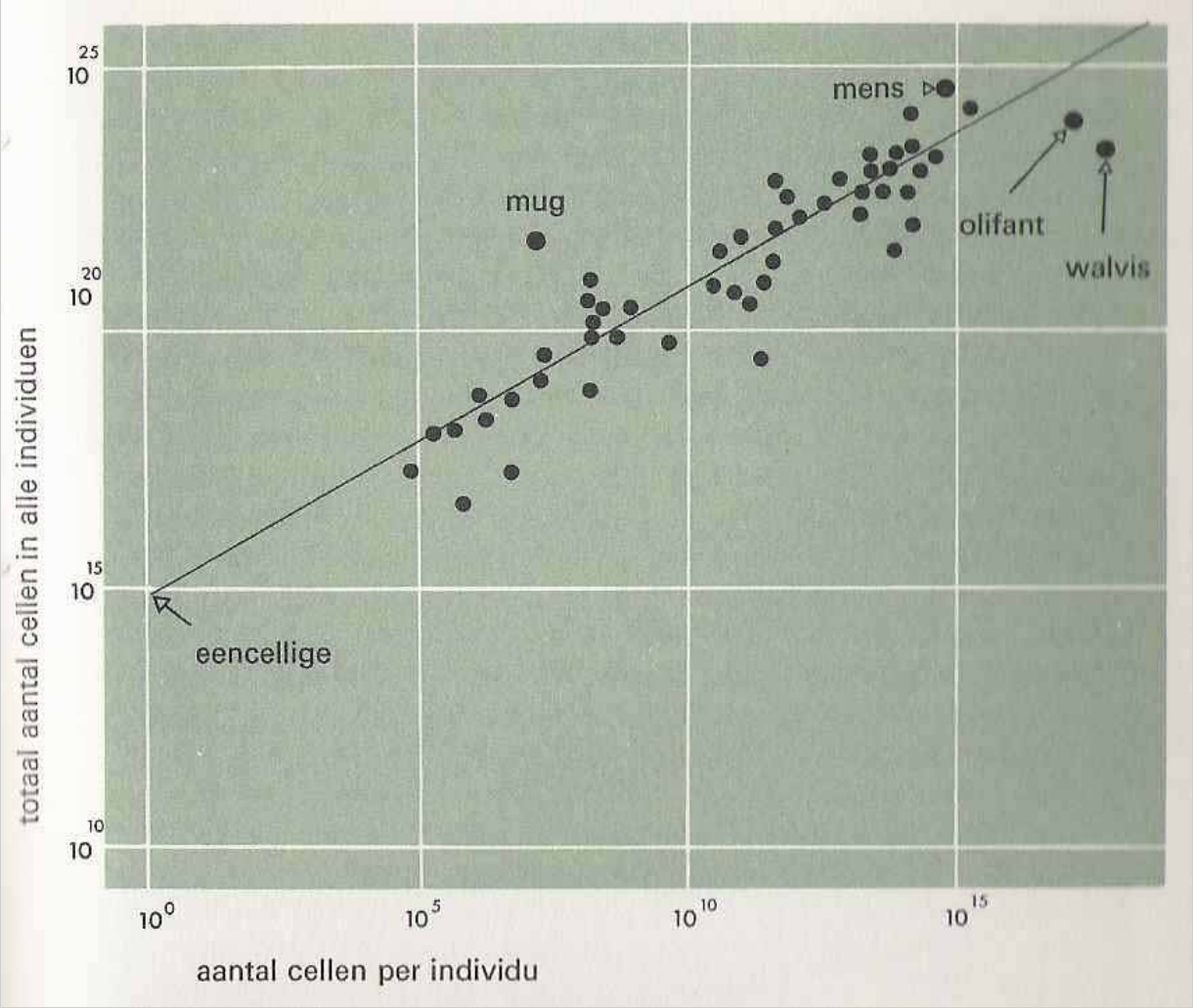
Inventory of skills: Case 3 Malaria and Irrigation

- Malaria

Source: http://virusdaarte.net

Inventory of skills: Case 3 Malaria and Irrigation

- Malaria



Inventory of skills: Case 3 Malaria and Irrigation

- Malaria:
  - 100-200 million cases per year
  - Kills 2 million people per year (mainly children in Africa)

Source: tpeblog.wordpress.com

Inventory of skills: Case 3 Malaria and Irrigation

- Malaria: Complicated disease

Source: www.abc.net.au

Source: chsweb.lr.k12.nj.us

Inventory of skills: Case 3 Malaria and Irrigation

- Malaria:
  - Clear shallow water larvae
  - Mosquito has to bite infected person
  - Mosquito has to bite uninfected person (ten days)
  - Person non-resistant

Inventory of skills: Case 3 Malaria and Irrigation

- Malaria:
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Irrigation = Malaria

Inventory of skills: Case 3 Malaria and Irrigation

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Inventory of skills: Case 3 Malaria and Irrigation

FAIR PROJECTS

10. Migration: Lowering barriers to migration for skilled workers
11. Malnutrition: Improving infant and child nutrition
12. Malnutrition: Reducing the prevalence of low birth-weight
13. Diseases: Scaled-up basic health services

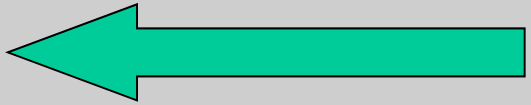
BAD PROJECTS

14. Migration: Guest-worker programs for the unskilled
15. Climate: Optimal carbon tax
16. Climate: The Kyoto Protocol
17. Climate: Value-at-risk carbon tax

Inventory of skills: Case 3 Malaria and Irrigation

VERY GOOD PROJECTS

1. Diseases: Control of HIV/AIDS
2. Malnutrition: Providing micronutrients
3. Subsidies and Trade Barriers: Trade liberalization
4. Diseases: Control of Malaria



GOOD PROJECTS

5. Malnutrition: Development of new agricultural technologies
6. Water and Sanitation: Small-scale water technology for livelihoods
7. Water and Sanitation: Community-managed water supply
8. Water and Sanitation: Research on water for food production
9. Governance and Corruption: Lower cost of starting a new business

Inventory of skills: Case 3 Malaria and Irrigation

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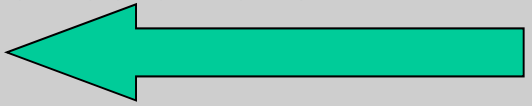

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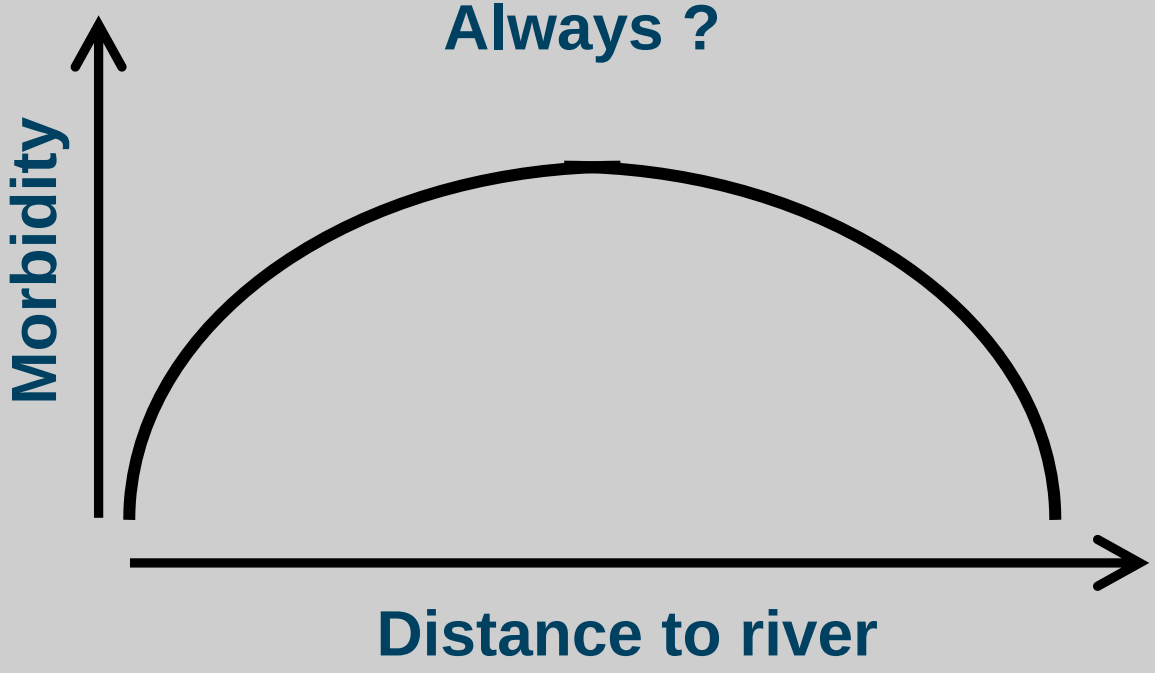
Inventory of skills: Case 3 Malaria and Irrigation

Irrigation = Malaria ?
Always ?



Inventory of skills: Case 3 Malaria and Irrigation

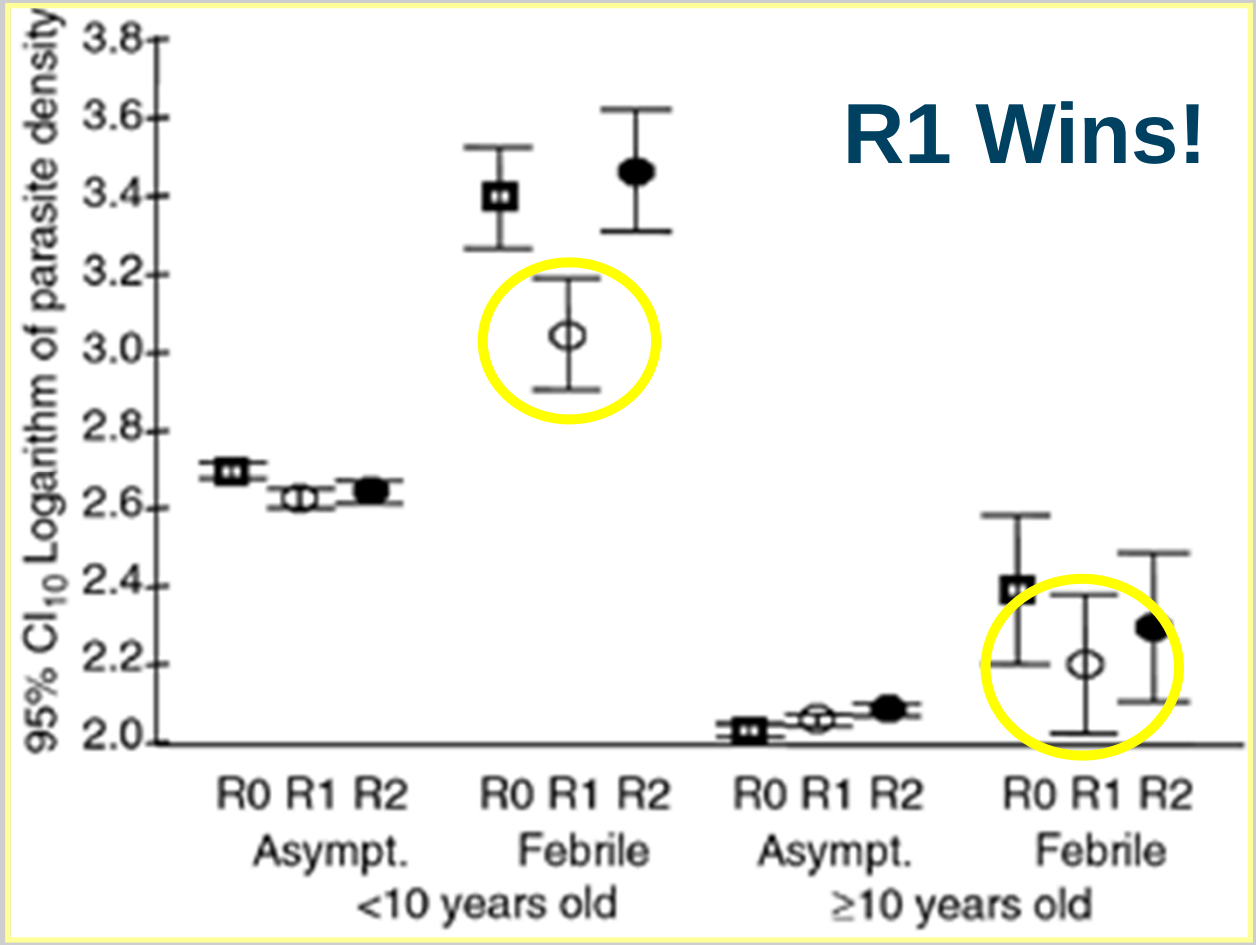
- Major study in Cote d'Ivoire & Mali
  - Sahel, savanna, forest
  - Environmental characterization
  - Socio-economic characterization
  - Large number of people checked
  - Compare:

R0: Village without irrigated rice

R1: Village with one season irrigated rice

R2: Village with two seasons irigated rice

Inventory of skills: Case 3 Malaria and Irrigation



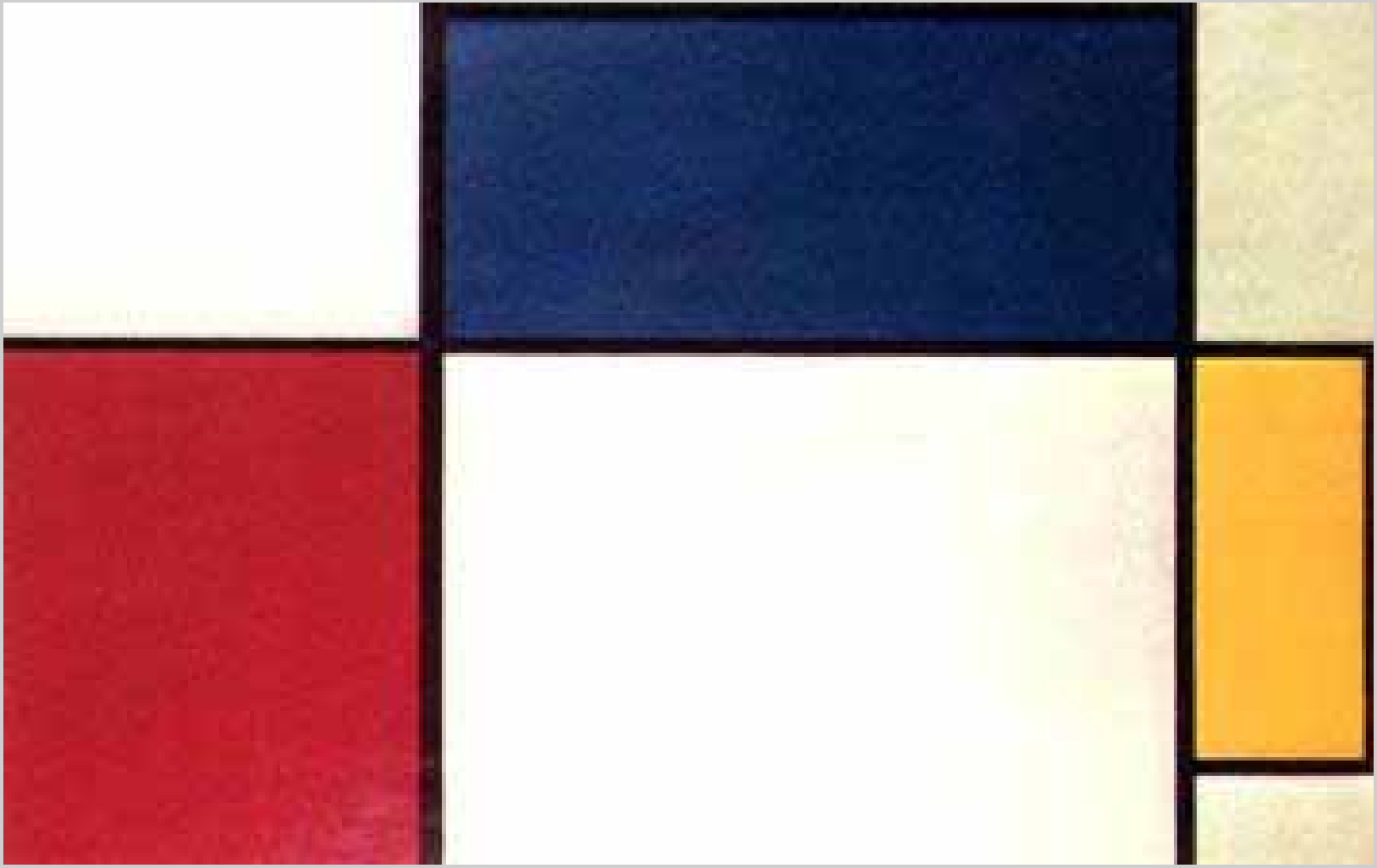
Inventory of skills: Case 3 Malaria and Irrigation

- When asked to design water development without negative health impacts:
  - Understand disease
  - Understand vectors & transmission
  - Understand health care
  - Understand role of water: positive & negative
  - Get help, big time!

Inventory of skills:

- …
- …
- …
- …
- …
- …

Week 1: Introduction



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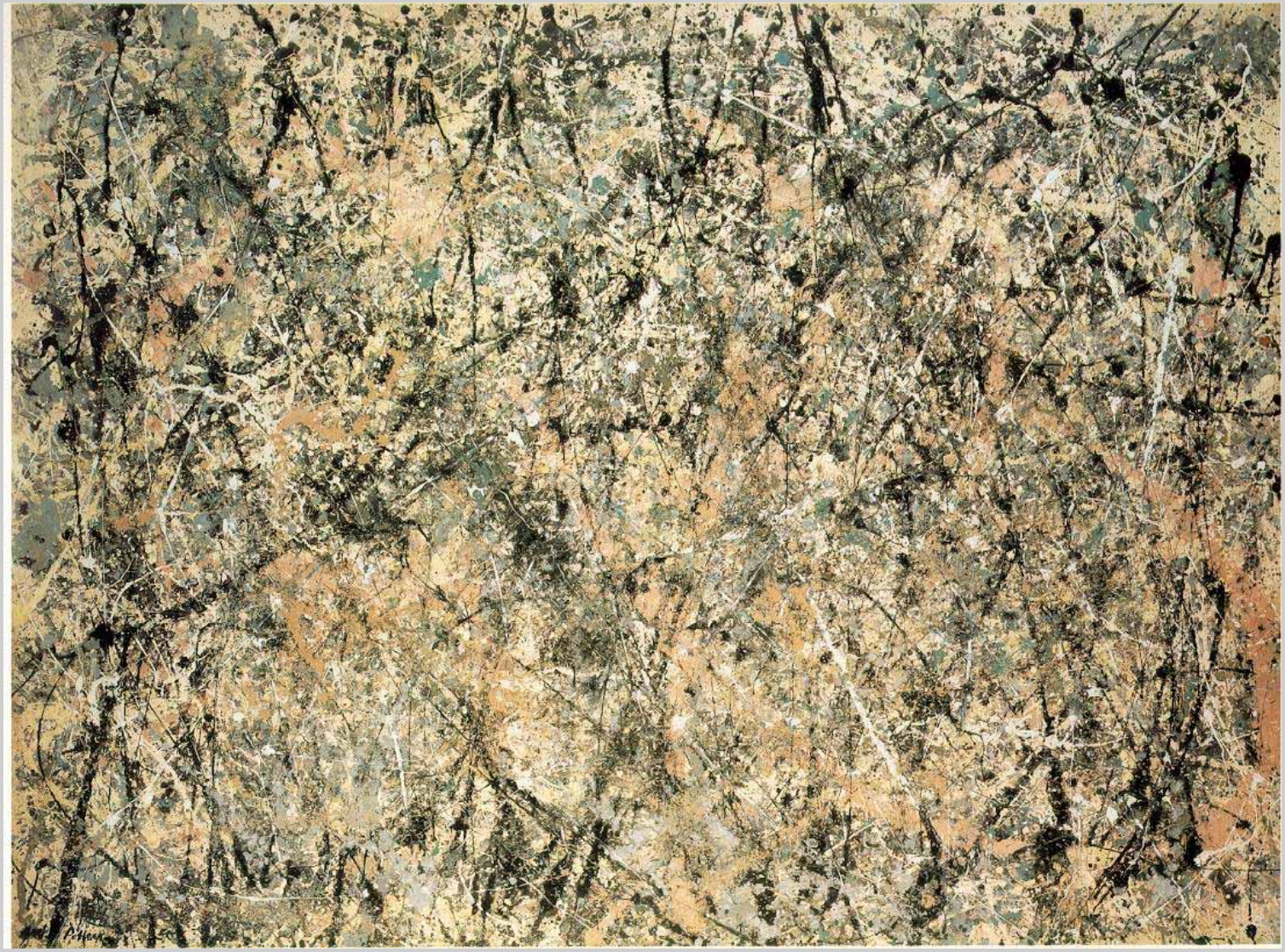
Week 1: Introduction



Source: Jackson Pollock, Lavender Mist: Number One; 1950

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Inventory of skills: YOUR CASES

- …
- …
- …
- …
- …
- …

Week 1: Introduction

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Inventory of skills:

- Micro-biology
- Ichthyology
- Aquatic biology
- Epidemiology
- Medical entomology
- …
- …
- + hydraulics, hydrology, math, com-sci, law, ….

Inventory of skills

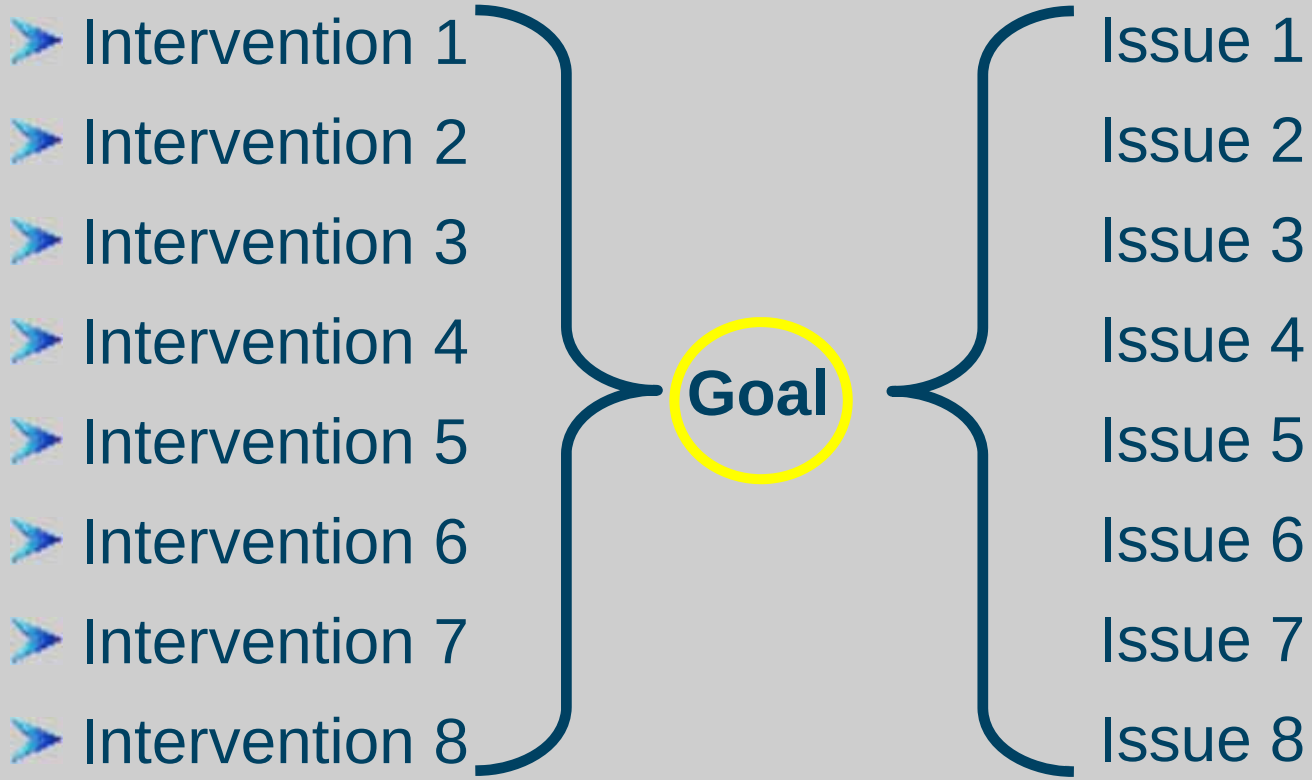
Integration

- Intervention 1
- Intervention 2
- Intervention 3
- Intervention 4
- Intervention 5
- Intervention 6
- Intervention 7
- Intervention 8

→ **Goal**

Inventory of skills

Integration



Inventory of skills

Integration

- Intervention 1
- Intervention 2
- Intervention 3
- Intervention 4
- Intervention 5
- Intervention 6
- Intervention 7
- Intervention 8

Goal

- Issue 1
- Issue 2
- Issue 3
- Issue 4
- Issue 5
- Issue 6
- Issue 7
- Issue 8

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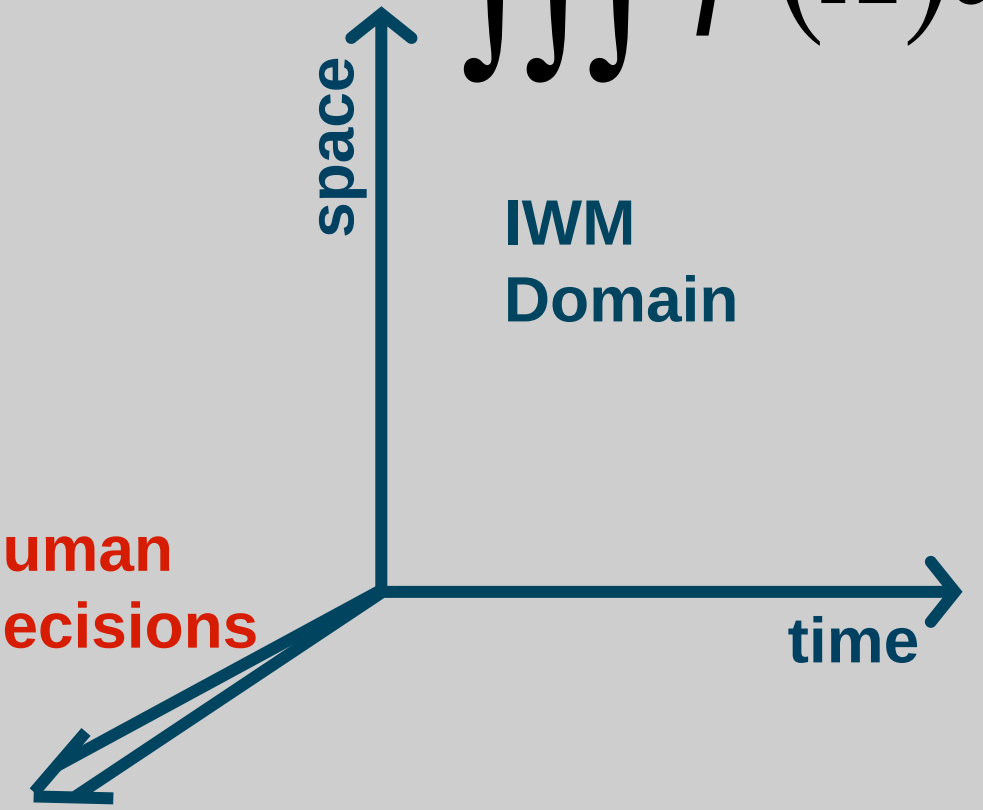

Inventory of skills

In practice:

- Integration will be need-driven

Inventory of skills

In practice:

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- You will work in (small) inter-disciplinary teams in problem-oriented fashion

Inventory of skills

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- Integration will be need-driven
- You will work in (small) inter-disciplinary teams in problem-oriented fashion
- You will apply your basic skills (hydraulics, hydrology, math, com-sci,…) to real-world problems

Inventory of skills

In practice:

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- You have to know how to listen to other disciplines

Inventory of skills

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- You have to explain the possibilities and limitations engineering approaches

Inventory of skills

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- You have to explain the possibilities and limitations engineering approaches
- Understand motivation of clients

Inventory of skills

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- You have to know how to listen to other disciplines
- You have to explain the possibilities and limitations engineering approaches
- Understand motivation of clients

Course philosophy

- How would you go about learning/teaching these skills
  - Micro-biology
  - Ichtology
  - Aquatic biology
  - Epidemiology
  - Medical entomology
  - Mythbusters
  - …
  - + hydraulics, hydrology, math, com-sci, law, ….

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Course philosophy

- Mimic praxis: Put to work in small teams
- Exposure through cases (Rhine & Volta)
- Extreme programming:
  - Work in teams
  - Just start!
- Tools:
  - Law
  - Optimization
  - Time series analysis
  - …
- End with theoretical framework

Week 1: Introduction

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Course outline

Wednesday (all day…)

- 9h00-10h30: Lectures
- 10h45-12h00: Interactive/reading
- 13h45-17h30: Lab CT 1.97
- Reader: Read **before** lecture:

Week 1: Introduction

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Course outline

- Grade 80% based on group work (model presentation)
  - Website
  - Group presentation
  - Written report & model

Classes:	28 hrs
Reader:	21 hrs
Labs:	14 hrs

You can spend 57 hrs on report!
€30,000

Week 1: Introduction

Course Outline

Day		Subject	Teacher
4-9	Morning	Introduction course and IWRM	Van de Giesen
		Challenges Volta and Rhine, climate change	Van de Giesen/ Mostert
	Afternoon	Computer lab WEAP: WEAP River	Van de Giesen
11-9	Morning	Scenarios and tools	Van de Giesen
	Afternoon	Computer lab WEAP: Rhine & Volta	Van de Giesen
18-9	Morning	Role-play transboundary water management	Mostert
	Afternoon	Computer lab WEAP: Rhine & Volta	Van de Giesen
25-9	Morning	Water, food and energy (Discussion)	Van de Giesen/ Mostert
		Computer lab WEAP: Rhine & Volta	
	Afternoon		Mostert
2-10	Morning	Mid-term presentations	Mostert/van de Giesen
	Afternoon	Computer lab: actor analysis Rhine & Volta	Mostert
9-10	Morning	IWRM revisited	Van de Giesen
		Discussion progress	Mostert/Van de Giesen
	Afternoon	Work on Rhine & Volta	
16-10		No lecture. Work on draft report	
23-10	Morning	Draft final report ready. Presentation	Van de Giesen/ Mostert
4-11		Before 9.00 am: Handing in final report and indication of everybody's contribution to it.	

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Course Outline

Day		Subject	Teacher
5-9	Morning	Introduction course and IWRM	Van de Giesen
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26-9	Morning	Water, food and energy (Discussion)	Van de Giesen/ Mostert
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3-10	Morning	Governance and stakeholders: case study from The Netherlands	Mostert
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10-10	Morning	IWRM revisited	Van de Giesen
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17-10		No lecture. Work on draft report	
24-10	Morning	Draft final report ready. Presentation	Van de Giesen/ Mostert
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1: Introduction

IWM Fall 2013

Week 1: Introduction

TU Delft

Course Outline

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1: Introduction

2: Scenarios & Tools

IWM Fall 2013

Week 1: Introduction

TU Delft

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1: Introduction

2: Scenarios & Tools

3: Institutions

IWM Fall 2013

Week 1: Introduction

TU Delft

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1: Introduction

2: Scenarios & Tools

3: Institutions

4: Water, food, energy

IWM Fall 2013

Week 1: Introduction

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1: Introduction

2: Scenarios & Tools

3: Institutions

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5: Mid-term

IWM Fall 2013

Week 1: Introduction

TU Delft

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1: Introduction

2: Scenarios & Tools

3: Institutions

4: Water, food, energy

5: Mid-term

6: IWRM re-visited

IWM Fall 2013

Week 1: Introduction

TU Delft

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1: Introduction

2: Scenarios & Tools

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7: Presentations

IWM Fall 2013

Week 1: Introduction

TU Delft

IWM Fall 2013

Course Output

- Group presentation & report
- Concerns your case (Volta or Rhine)
- Concerns your client
  - Stakeholder analysis
  - Model scenarios (WEAP, Qual2K)
- Divide work but
  …. group output!
- Graduate course
- *“Additional information CT4450.pdf”*