

## 1. Inventory: Integrated Watershed Management (IWSM)

Semester 1: mainly disciplinary, used to develop a similar base of knowledge for the students.

Semester 2, week 1-8:

Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Class AA	Class AA	Class AA	Class AA	Class AA	Class AA	Class AA	Class AA
Class AA	Class AA	Class AA	Class AA	Class AA	Class AA	Class AA	Class AA
Class BB	Class BB	Class BB	Class BB	Class BB	Class BB	Class BB	Class BB

**AA = Integrated Watershed Management**

**212 hrs (26.5 hrs per week)**

BB = Water Chain Management (Boudewijn)

106 hrs

### Organization of the course:

Lectures = 86

Exercises = 76

One complete tour excursion (3 days) = 24

Workshop = 8

Self study = 18

### Objectives of the course

The students should:

- Know what the Integrated Watershed Management (IWSM) concept is about and what its important issues in Yemen are;
- Be able to identify hydrological processes and patterns in watersheds in Yemen
- Be able to identify ecosystem functions and related goods and services in the watersheds in Yemen;
- Know which user functions and land use patterns in Yemen's watershed cause pressures on the Natural system and know what the socio-economic value of those user functions are;
- Know the contents of relevant laws and regulations, control mechanisms and their strengths and weaknesses;
- Be able to identify social, technological, economic and institutional management options and tools to solve IWSM issues;
- Know which information is needed in IWSM and how to obtain this information by monitoring and research programs.
- Be able to analyse the upstream actions and downstream effects

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**External Expert:** Dr Ashraf Ghanem

**Support Lecturers:** Dr Abdulla Noman, Dr Mohammad Al hebshi, Dr Fadhl Al Nuzaily, Dr Abdulrahman Al Iryani

**Supervisor Yemen:** Dr. Taha M. Taher ([tmtahiri@y.net.ye](mailto:tmtahiri@y.net.ye)).

**Supervisor NL:** ?, not decided yet.

### Main message:

Enormous lack of scientific articles and PPP on Integrated Watershed Management issues.

Furthermore case studies need to be added (exercises: 76 hrs!). Many irrelevant PPP's.

**Articles available:**

Economic Analysis of Water Harvesting in a mountainous watershed in India (Goel *et al.*, 2004)

(*suggestion: week 6*)

Deserts and desertification in Iraq (author unknown)

Spate Irrigation (FAO, 1987, Yemen)

Article on Wadi's in Yemen (Title, year, etc. unknown, bad scan, article seems to be old, eighties?)

Flood Protection Works and Low Diversion Structures (A. Van Aarst, FAO)

Water Harvesting and Supplemental Irrigation for Improved Water Use efficiency in Dry Areas (Oweis *et al.*, IWMI, 1999)

Literature to calculate Irrigation Requirement

**Books:**

Watershed Management Field Manual, Watershed Survey and Planning (Sheng, FAO, 1990)

Hydrology (Hudson) (*suggestion: might be interesting for the whole course*)

**Other electronic documents:**

*Integrated Water Resources Management (suggestion: move to semester 1, Q. IWRM case studies):*

PPP: Introduction to Integrated Water Resources Management (Colin Mayfield, UNU-INWEH)

PPP: Leadership Concepts (Jairam Reddy, United Nations University, 2006)

PPP: Water Resources Management in Irrigated Agriculture in the Jordan Valley through participation of water user communities (Jordanian-German Development Cooperation, 2006)

PPP: The MEDA Water Programme and wastewater reuse (Gert Soer, MEDA Water, 2006)

*Spate irrigation / irrigation techniques (suggestion: move to semester 1, F. water use in agriculture):*

PPP: Typology of Spate Irrigation (WEC and Meta Meta)

PPP: Spate Irrigation: Global Trends (WEC and Meta Meta)

PPP: Spate Irrigation in Yemen (WEC and Meta Meta)

PPP: Groundwater Management in Spate Irrigation Systems (*suggestion: move to IGWM*)

PPP: Pressurized Irrigation Techniques (Phocaides, 1999)

*Water engineering, irrigation structures / distribution structures:*

PPP: Design of small dams

PPP: Small Dams and Weirs in Earth and Gabion Materials (WEC)

PPP: Command Area Distribution Structures

PPP: Field Water Distribution

PPP: Examples of Command Area Improvements (Water Resources Research Institute, Pakistan)

PPP: Basic Engineering, irrigation structures (WEC and Meta Meta)

PPP: Improved Traditional Systems, again about irrigation structures (WEC and Meta Meta)

PPP: Example of River Engineering Approach (WEC and Meta Meta)

PPP: Case Hadramawt: improved traditional engineering, especially about river intake structures (WEC and Meta Meta)

*Case studies (move to semester 1, M. Water and Public Participation):*

PPP: Case Gash: Sustainable Livelihoods Project in Sudan (Meta Meta)

Reader Contents	Course contents IWSM related to Course Guide	Electronic Data content:	What need to be added?
Reader not available	Week 1 Topic: Introduction (concept of IWSM)	PPP: Introduction Watershed Management PPP: Integrated Watershed Management, an introduction 1 (WEC) PPP: Integrated Watershed Management, an introduction 1.1 (WEC) PPP: Integrated Watershed Management, problem definition and scoping (WEC)	Topic: Important IWSM issues in Yemen Topic: Agriculture in Watershed Management
	Week 2 Topic: Hydrological Processes and Patterns in Watersheds in Yemen	PPP: Water from dry riverbeds (WEC and Meta Meta) PPP: Basic Sediment Transport and River Morphology (WEC and Meta Meta) PPP: Soil Management and moisture conservation	At least studies on the Sana'a Basin (see inventory IGWM) and other watershed studies in Yemen
	Week 3 Topic: Ecosystem functions and related goods and services in the watersheds in Yemen		
	Week 4 Topic: User functions and land use patterns in Yemen's watershed		Topic: GIS
	Week 5 Topic: Relevant laws and regulations, control mechanisms and their strengths and weaknesses	PPP: Eight tools of Watershed Protection in Developing Areas (Center for Watershed Protection)	Water regulation in Yemen
	Week 6 Topic: Social, technological, economic and institutional management options and tools to solve IWSM issues	PPP: Integrated Watershed Management, planning and management approach (WEC) PPP: Integrated Watershed Management, developing workable management options (WEC)	Case studies executed in other countries
	Week 7 Topic: Information needed in IWSM: how to obtain this information by Monitoring and Research Programs?	PPP: Modeling in GIS (Rowan, GIS Center at Stony Brook) PPP: Using GIS in Watershed Management (Schleifer, GIS Center at Upper Raritan) PPP: Monitoring	How to set up a research program?
	Week 8 Topic: Analyse upstream action and downstream effects		Topic: Effects of agricultural activities