Water and Environment Centre

Sana'a University
Republic of Yemen

Course:

Integrated Watershed Management

Date: December 2008

COURSE OUTLINE

Contents
Watershed Management is the process of guiding and organizing land and other resource usage in a watershed, ensuring the sustenance of the environment. In this process, it is important to recognize the interrelationships between land use, soil-water and slope of terrain. The unifying focus in watershed management is in how various human activities affect the relationship between water and other natural resources. Integrated Watershed Management provides a basis for actions concerning the development and conservation of the natural resources.

During the course hydrological processes of the watershed will be studied, including a workshop on watershed modelling and calculation exercises. Monitoring and information needed for an integrated watershed management plan will be discussed. The socio-economics and the institutional system will be a part of the second half of the course, including user functions, the existing legal framework and an environmental impact assessment of the watershed system. A separate chapter will be spend on agriculture in watershed management, as this plays an important role for water conservation. All subjects contain student assignments, and the course will end with selected case studies and an excursion.

IGWM in the broader context
All watersheds contain many kinds of natural resources - soil, water, forest, rangeland, wildlife, minerals, etc. In developing and managing a watershed, the use of some natural resources will be complementary while others will be competitive. For instance, logging may affect water resources and recreation. Changing intensive land use to less intensive ones may benefit soil and water resources. The key is to use these resources as efficiently and perpetually as possible, with minimum disturbance to the watershed as a whole. Although in many cases, watershed managers may not be the decision-makers on resource uses, their task is to plan and carry out practices which will encourage those uses which are complementary and suggest preventive and protective measures for those uses which could impair the watershed.

Within the watershed, an integrated water management approach will be used. The course will link several of the disciplines from the first semester, such as the different water uses and engineering courses. Within this approach, the concept of participation will be important. Assessing an environmental impact assessment is a part of the integrated watershed management course, but it will be discussed more in detail in the Environmental Impact Assessment course.

Objectives
The students should:

- Know what the Integrated Watershed Management (IWM) 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 IWM issues;

- Know which information is needed in IWM and how to obtain this information by monitoring and research programs;
- Be able to analyse the upstream actions and downstream effects.

TABLE OF CONTENTS

Block 1:

Introduction to IWSM

1 INTRODUCTION

Compulsory literature:
Chapter 1 of the book:
Isobel W. Heathcote. "Integrated Watershed Management: Principles and Practice."

Negenman, T., 2000. "Evolution of Water Resources Management in Yemen." ILRI Workshop. Groundwater management: Sharing responsibility for an open acces resource.

Recommended literature:
Downs, Peter W., Kenneth J. Gregory and Andrew Brookes. 1991. "How integrated is river basin management?" *Environmental Management* 15(3): 299-309.

Teclaff, Ludwik A. 1996. "Evolution of the river basin concept in national and international water law." *Natural Resources Journal* 36(2): 359–391.

2 PRINCIPLES OF IWSM CONCEPTS

Compulsory literature:

German, Laura, Hussein Mansoor and Getachew Alemu, 2006. "Participatory Integrated Watershed Management." *Evolution of Concepts and Methods*. African Highlands Initiative, Working papers # 11, 2006.

Wilkinson, J.C., 1983. "Traditional Concepts of Territory in South East Arabia." The Geographic Journal, Vol. 149, No. 3, pages 301-315, 1983.

Recommended literature:

IWMI. "Water Accounting for Integrated Water Resources Management." *Tools and Concepts for Improved Water Management*. International Water Management Institute.

Block 2:

Hydrological Processes and Patterns of the Watershed

3 INTRODUCTION TO HYDROLOGICAL PROCESSES OF THE WATERSHED

Compulsory literature:
The book:
Peter E. Black. "Watershed hydrology (2nd edition)."

At least the first 2 chapters of the book:
Philip B. Bedient. "Hydrology and Floodplain Analysis (4th edition)."

Recommended literature:
No literature has been found!

4 HYDROLOGICAL PROCESSES AND PATTERNS IN WATERSHEDS IN YEMEN

Compulsory literature:
Arcadis Euroconsult, 2006. "Hydrological Studies." Yemen SMRI, hydrological studies, 2006.

Recommended literature:
No literature has been found!

5 ECOSYSTEM FUNCTIONS AND RELATED GOODS AND SERVICES IN THE WATERSHEDS IN YEMEN

Compulsory literature:
Varisco, Daniel Martin, 1983. "Sayl and Ghayl: The Ecology of Water Allocation in Yemen." Human Ecology, Vol. 11, No. 4, 1983.

Recommended literature:
No literature has been found!

6 USER FUNCTIONS AND LAND USE PATTERNS IN YEMEN'S WATERSHEDS

Compulsory literature:
No literature has been found!

Recommended literature:
No literature has been found!

Block 3:

The Role of the Government in IWSM

7 IWSM AND POLITICS

Compulsory literature:

Manea, Elham M.,1995. "Yemen, the tribe and the state."

Barham, Elizabeth. 2001. "Ecological boundaries as community boundaries: The politics of watersheds." *Society and Natural Resources* 14(3): 181-191.

Recommended literature:

Bakker, Karen. 1999. "The politics of hydropower: Developing the Mekong." *Political Geography* 18 (2): 209-232.

Wengert, Norman. 1957. "The politics of river basin development." *Law and Contemporary Problems* 22(2): 258-275.

Blomquist, William and Edella Schlager. 2005. "Political pitfalls of integrated watershed management." *Society and Natural Resources* 18(2): 101-117.

8 RELEVANT LAWS AND REGULATIONS, CONTROL MECHANISMS AND THEIR STRENGTS AND WEAKNESSES

Compulsory literature:

Mehari, Abraham, Frank van Steenbergen and Bart Schultz, 2007. "Water Rights and Rules, and Management in Spate Irrigation Systems in Eritrea, Yemen and Pakistan." CAB International, 2007.

Ministry of Legal Affairs, Republic of Yemen, 2002. "Law No. 32 for the Year 2002 Concerning Water."

National Water Resources Authority. "National Water Strategy." Republic of Yemen, Ministries Council, NWRA.

Taher, Taha Mohammed and Sharafuddin A. Salleh. "Traditional Applications and Conflicts of Water Rights in Wadi Zabib and the Impact on Newly Developed Irrigation Systems." Water and Environment Center (WEC), Sana'a University.

Bahamish, A. Awadh, 2004. "Legal Survey of Existing Traditional Water Rights in the Spate Irrigation Systems in Wadi Zabib and Wadi Tuban." Ministry of Agriculture and Irrigation, Republic of Yemen, 2004.

Recommended literature:

Lichtenthäler, G. and A.R. Turton. "Water Demand Management, Natural Resource Reconstruction and Traditional Value Systems: A Case Study From Yemen." Water Issues Study Group, School of Oriental and African Studies (SOAS), University of London, Occasional Paper No. 4.

Block 4:

Management Options and tools to Solve IWSM Issues

9 SOCIAL MANAGEMENT OPTIONS AND TOOLS TO SOLVE IWSM ISSUES

Compulsory literature:

Moench, Markus, 2002. "Water and the potential for social instability: Livelihoods, migration and the building of society." Natural Resources Forum 26, pages 195-204, 2002.

Mohieldeen, Yasier, 1999. "Responses to water scarcity: Social adaptive capacity and the role of environmental information." *A case study from Ta'iz, Yemen*. Water Issues Study Group, School of Oriental and African Studies (SOAS), Occasional Paper No. 23, 1999.

Garcia, Conchita, Nada Al-Syed Hassan and Carin Vijfhuizen. "Women and Water Rigths in Wadi Tuban, Yemen."

Recommended literature:

Taher, Taha Mohammed and M. Tahir. "Rainwater Harvesting: A Community Based Managed System (The Process)." Water and Environment Centre, Civil Engineering Department, University of Sana'a.

United Nations, 2005. "IWRM and Social Equity: Poverty, Participation and Gender." *Module on Cross Cutting Issues. Workshop on Training of Trainers on the Application of IWRM Guidelines in the Arab Region*. Economic and Social Commission for Western Asia, United Nations, 2005.

10 TECHNOLOGICAL MANAGEMENT OPTIONS AND TOOLS TO SOLVE IWSM ISSUES

Compulsory literature:

Alderwish, Ahmed and Mohamed Al-Eryani, 1999. "An approach for assessing the vulnerability of the water resources of Yemen to climate change." Climate research, Vol. 12, pages 85-89. Sana'a University, Yemen, 1999.

Recommended literature:

Atroosh, Khader, Mohamed Alnaboos and Abdul Azeez Haider, 2003. "Assessment of the Utilisation of Water Dams and Reservoirs in the Highlands of Yemen." Ministry of Agriculture and Irrigation, Republic of Yemen, 2003.

11 ECONOMIC MANAGEMENT OPTIONS AND TOOLS TO SOLVE IWSM ISSUES

Compulsory literature:
Ministry of Water and Environment, Republic of Yemen, 2005. "National Water Strategy and Investment Program, 2005-2009."

Recommended literature:
No literature has been found!

12 INSTITUTIONAL MANAGEMENT OPTIONS AND TOOLS TO SOLVE IWSM ISSUES

Compulsory literature:

Chevalking, Simon J., 2007. "A technical-institutional analysis of small dams in the Sana'a basin, Yemen."

Ministry of Water and Environment and Ministry of Agriculture and Irrigation, 2004. "National Water Strategy and Investment Program (NWSSIP)."

Ward, Christopher, Satoru Ueda and Alexander McPhail, 2000. "Water Resources Management in Yemen." Contribution to the CDR Yemen, 2000.

Recommended literature:

No literature has been found!

13 INFORMATION NEEDED IN IWSM: HOW TO OBTAIN THIS INFORMATION BY MONITORING AND RESEARCH PROGRAMS?

Compulsory literature:
Leung, Keith C.K., 1999. "Monitoring Qat with earth observation data and geographic information system techniques in the region of Jabal Sabir, Ta'izz, The Republic of Yemen." Occasional Paper No. 24. Water Issues Study Group, School of Oriental and African Studies (SOAS), 1999.

Recommended literature:
No literature has been found!

14 AGRICULTURE IN WATERSHED MANAGEMENT

Compulsory literature:
No literature has been found!

Recommended literature:
No literature has been found!

15 ANALYSES OF UPSTREAM ACTION AND DOWNSTREAM EFFECTS

Compulsory literature:
No literature has been found!

Recommended literature:
No literature has been found!

Block 5:

IGWM Aspects

16 THE WAY TOWARDS IWSM: MULTISTAKEHOLDER PLATFORMS

Compulsory literature:

Arcadis Euroconsult, 2004. "Irrigation Improvement Project." *Main Technical Assistence Package for IIP. Manual on Participatory Planning and Design*. Ministry of Agriculture and Irrigation, Republic of Yemen, Working Paper 29, 2004.

Arcadis Euroconsult, 2003. "Irrigation Improvement Project." *Main Technical Assistence Package for IIP. Water User Association Contracting. Manual of Procedures*. Ministry of Agriculture and Irrigation, Republic of Yemen, Working Paper 21, 2003.

Ladd, Brent. "What skills and information do watershed groups require for effective watershed planning and restoration? *A summary of recent research*. Skills and Information for Succesfull Watershed Restoration, Indiana Watershed Leadership Program, Purdue University.

Recommended literature:

Edmunds, David and Eva Wollenberg. 2001. "A strategic approach to multistakeholder negotiations." *Development and Change* 32(2): 231-253.

Griffin, C.B. 1999. "Watershed councils: An emerging form of public participation in natural resource management." *Journal of the American Water Resources Association* 35(3): 505-518.

17 PLANNING AND MANAGEMENT

Compulsory literature:

Buller, Henry. 1996. "Towards sustainable water management: Catchment planning in France and Britain." *Land Use Policy* 13(4): 289-302.

Barrow, Chris J. 1998. "River basin development planning and management: A critical review." *World Development* 26(1): 171-186.

Recommended literature:

Betlem, Ilja. 1998. "River basin planning and management." In F. Nunes Correia (ed.) *Water resources management in Europe: Vol. II. Selected issues in water resources management in Europe*. (pp. 73-104). Rotterdam, The Netherlands: Balkema.

Molle, François. 2006. *Planning and managing water resources at the river-basin level: Emergence and evolution of a concept*. Comprehensive Assessment of Water Management in Agriculture Research Report 16. Colombo, Sri Lanka: IWMI.

Scott, Christopher A. and Carlos Garcés-Restrepo. 2001. "Conjunctive management of surface water and groundwater in the Middle Río Lerma Basin, Mexico." In Asit K. Biswas and Cecilia Tortajada (eds) *Integrated river basin management: The Latin American experience.* (pp. 176-198). New Delhi: Oxford University Press.

18 IWSM DEVELOPMENT

Compulsory literature:
Varisco, Daniel Martin, 1991. "The Future of Terrace Farming in Yemen: A Development Dilemma." Agriculture and Human Values, pages 166-172, 1991.

Recommended literature:

Le Marquand, David. 1989. "Developing river and lake basins for sustained economic growth and progress." *Natural Resources Forum* 13(2): 127-138.

Molden, David, R. Sakthivadivel, Madar Samad and Martin Burton. 2005. "Phases of river basin development: The need for adaptive institutions." In Mark Svendsen (ed.) *Irrigation and river basin management: Options for governance and institutions.* (pp. 19-29). Wallingford, UK: CABI Publishing.

Molle, François. 2003. *Development trajectories of river basins: A conceptual framework*. IWMI Research Report 72. Colombo, Sri Lanka: IWMI.

Molle, François, Philippus Wester and Phil Hirsch. 2007. "River basin development and management." In David Molden (ed.) *Water for food, water for life: A comprehensive assessment of water management in agriculture*. (pp. 585-625). London: Earthscan, and Colombo: International Water Management Institute.

Newson, Malcolm. 1997. *Land, water and development: Sustainable management of river basin systems*. London and New York: Routledge.

Scudder, Thayer. 1989. "The African experience with river basin development." *Natural Resources Forum* 13(2): 139-148.

Block 5:

Case Studies and Group Projects

19 CASE STUDIES

Compulsory literature:

Helmer, Richard and Ivanildo Hespanhol, 1997. "Water Pollution Control: A Guide to the Use of Water Quality Management Principles." *Case Study XIII: Sana'a, Yemen*. Published on behalf on the United Nations Environment Programme, the Water Supply and Sanitation Collaborative Council and the World Health Organization, 1997.

Farrag, A.A., A.S. Al Gabiri and A. Abdulgader. "Surface Water Pollution and its Effect on Groundwater in Taiz Water Basin."

Hovden, Eirik, 2006. "Rainwater Harvesting Cisterns and Local Water Management." A qualitative Geographical / socio anthropological case study and ethnographic description from the districts of Hajja, Mabyan and Shiris, Governorate of Hajja, Yemen." University of Bergen, 2006.

KOMEX International Ltd., 2002. "Water Resources Management Studies in the Tuban-Abyan Region."

Qahtan Yehya A.M. Al Asbahi, 2005. "Water Resources Information in Yemen." IWG-Env International Work Session on Water Statistics, Vienna, 2005.

National Water Resources Authority, 2004. "Water Resources Management Action Plan for the Ta'iz Region (Upper Wadi Rasyan)." National Water Resources Authority, Policy and Programming Sector, Republic of Yemen, Second Edition, 2004.

Recommended literature:

Varisco, Daniel Martin, 1986. "On the Meaning of Chewing: The significance of Qat (Catha Edulis) in the Yemen Arab Republic." International Journal of Middle East Studies, Vol. 18, No. 1, pages 1-13, 1986.