

Year one report for UNESCO-IHP:
Ecohydrology task-force for education and capacity-building

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1.0 INTRODUCTION and OBJECTIVE

1.1 Background and Objectives of the Task Force

The Education and Capacity Building Task-Force (ECB TF) was officially launched in June 2006 at the first meeting of task forces in Faro, Portugal. The vision of the ECBTF is to ensure that the industry standard for the management and development of water resources worldwide will include the principles of ecohydrology. This means that ecohydrology would be developed, applied and promoted as a recognizable banner for sustainable Integrated Water Resources Management.

At this first meeting, members of the ECB TF determined both long-term, (next biennium), and short-term, (this biennium), goals and strategies. They are as follows:

Long-term vision and strategies:

The long-term vision of the ECB TF is to see the principles of ecohydrology (using the relationships between hydrological processes and biotic dynamics) included as an industry standard for the management and development of water resources worldwide within the context of Integrated Water Resources Management (IWRM).

The long-term strategy of the task force is to develop, apply and promote ecohydrology as a recognizable banner for sustainable IWRM.

Short-term workplans for this biennium 2006 – 2007:

The ECB TF recognized that there are significant resources already developed for Ecohydrology. The short-term goal was to synthesize existing efforts and materials related to the development, application and promotion of Ecohydrology, conduct a gap analysis and list of priorities, explore partnerships and increase access to existing information.

1.2 Objective of Report

In line with the objectives of this Task Force as established in Faro, this report outlines the progress made towards the short-term goals for this biennium (2006-2007). The work consisted of three focused projects:

i. Partner Identification and Questionnaire

Several organizations and individuals have expertise and have expressed an interest in education and capacity-building related to ecohydrology. These individuals/groups were identified with the assistance of UNESCO and were contacted to determine their existing activities, interest, and perceived needs related to the output of this Task Force in the form of the questionnaire. A summary of the responses to the questionnaire are found in section 2. The questionnaire responses are presented in Appendix 1. Please note that this is not an exhaustive partner list and our focus was largely on existing partners within UNESCO IHP and membership associated with the different Task Forces. This work serves only as a starting point for partner identification.

ii. Synthesis of Existing Materials

Guidelines and manuals on ecohydrology already exist. In addition, several courses (e.g., coastal zone ecohydrology) are already offered and publications for specific research activities are available, and, many courses deal with aspects of ecohydrology yet are not identified as such. These materials/activities were synthesized in a bibliographic form and is presented in Appendix II. The results and summary of this synthesis are presented in section 3.

iii. Gap Analysis and Needs Assessment

Based on a review of existing materials, a gap analysis was conducted to identify needs and priorities related to education and capacity-building. The results of the gap analysis are presented in section 4.

2. Synthesis of Existing Partners and Partner Survey

2.1 Introduction and Context

Individuals and groups were identified by UNESCO to assist in focused targeting of partners related to ecohydrology. The list included internal and external partners e.g. representatives from UNESCO-IHE, UNESCO regional offices, UNEP-IETC, DIVERSITAS Freshwater BIODIVERSITY network and GWSP. In addition all members of the Scientific Advisory Committee and the various Task Forces were included.

It was recognised that the target audience for the questionnaire was not all-inclusive, with a predominant focus on existing partners and players within UNESCO IHP and members of the Scientific Advisory Committee and various task-force members.

2.2 Survey

The survey was prepared in response to comments and suggestions from the first meeting of Task Force members (Faro, Portugal) and the first meeting of the SAC (Paris, France). These comments/suggestions were:

1) There are already a number of people/organisations involved in ecohydrology activities. Therefore the survey offered an opportunity to obtain information about those activities, the methods used and how successful these methods were. (Questions 1-4)

2) It was identified in the first meeting of task forces that UNESCO-IHP would act as a central clearing house, or hub, for ecohydrology activities and information. Specifically, the ecohydrology website would be developed to provide up-to-date information on current ecohydrology activities globally. Questions were included within the survey to obtain information on current activities and how access to information and resources on a regional and global basis were currently rated. (Question 7)

3) At the first SAC meeting in Paris (September, 2006), concerns were raised regarding the scope of the ECB TF activities and whether the development of a course would be the best method for ECB. Questions were included within the survey to establish opinions regarding methods for ECB (Questions 5, 6 and 8)

4) Another priority issue raised at the first SAC meeting in Paris was in reference to the definition and outline of core principles for ecohydrology. Specifically, ecohydrology needs to be defined in relation to IWRM and hydro-ecology. A question was included within the survey to obtain opinions from a wider audience (Question 9).

In response to these four comments, the questionnaire was developed specifically for obtaining partner input and to determine existing activities, interests and perceived needs related to the output of the ECB TF. The questionnaire is presented in Appendix I.

2.3 Results and Summary

The responses received were predominantly from organisations that are actively running projects that utilise ecohydrology (EH) principles. From the ten questions answered the following four points are highlighted:

- 1) Practical demonstrations, on-site field courses, use of case studies and videos would be the most successful/useful method for E/CB. The development of on-site training was rated the most useful E/CB method, followed closely by video and short-course development. The development of a masters and/or undergraduate course was voted the least valuable at this stage or phase of ecohydrology orientation/education.
- 2) The definition of EH is not clear and requires clarification, this is an important point and is closely related to points 3 and 4. This statement is not surprising considering the breadth of activities that were associated under the ecohydrology banner. Integrated water resource management, biodiversity assessment, sustainable development, natural resource management were terms associated with ecohydrology activities. In addition, activities spanned freshwater to coastal applications, ecological to socio-economic systems, and involved community, post-graduate, and operational levels of application and practice.
- 3) There is regional variability with regards to EH activities, however most regions scored a marginal to poor rating. It was pointed out that a lot of activities may be occurring that are EH related, but are not considered EH activities because of the lack of definition i.e. activities defined as IWRM instead of EH.
- 4) Dissemination of knowledge regarding EH activities is required. This may relate to point 3, i.e. there may be EH activities occurring but they are not defined as such and are not promoted well either regionally or globally. It was suggested that updates with regards to EH activities should be sent via E-mail i.e. EH newsletter. It was also suggested that an EH journal be created to promote and disseminate current EH activities globally.

There are currently two journals already dedicated to ecohydrology (Ecohydrology and Hydrobiology, launched in 2001, and, Ecohydrology, set for release next year). The responses received regarding the lack of an ecohydrology journal, highlights the importance of promotion, or rather how important the development of a central hub of information regarding ecohydrology is. As UNESCO-IHP is to act as a central clearing house or hub for ecohydrology, the suggestions from this survey highlighted the key points regarding the development of the website i.e. that it needs to be all encompassing, with information on journals, books, courses, organizations, regional experts, recent publications and projects etc. Development of a “home-base” for information exchange related to ecohydrology would also serve to promote and sustain a definition of ecohydrology and associated core fundamental principles.

3. Synthesis of Existing Materials

3.1 Introduction and Context

At the Faro meeting it was suggested that extensive documentation related to ecohydrology already exists and any limitations were more associated with accessibility to this information and integration of it. The questionnaire results support this statement; there may be existing materials but they are not well publicized or accessible. A web-based search was conducted to obtain information on journals, books, short courses, undergraduate and graduate courses in ecohydrology or courses that had ecohydrology components e.g. integrated water resource management, hydro-ecology.

3.2 Method and Bibliography

Current information (UNESCO brochures, training manuals and partner lists) were used to obtain information on organisations already involved in projects with UNESCO-IHP. Web searches were also conducted using search terms: Ecohydrology, Integrated Water Resource Management, education, course, training, hydroecology, hydrogeology, limnology and hydrology.

The full synthesis report is presented in Appendix II and contains summaries of ecohydrology activities, broken down by category within the table of contents. Within each category, a description of the activity is given alongside the location. Full details of each course/activity within these categories can be obtained by accessing the hyperlinks within the table of contents.

3.3 Summary

Summer, Short-courses and Workshops:

Ten courses were globally available i.e. not restricted to local applications, however travel was required. These courses covered a range of levels from basic to expert/graduate level. Two on-line courses were offered and these were open to managers/decision makers and undergraduate students. Twelve local courses (only open to local students or managers) were found. It is important to note here that there may be other local, and even global, courses available but the information was simply not available on the internet.

On-line courses seem to be the most useful as they limit travel costs, however this also limits accessibility to those who do not have access to a computer. The global and local courses offered encompassed a wide range of education levels and target audiences. The content of these courses was variable depending on the target audience and area of interest/research. Their content should be assessed for consistency i.e. that the core principles and guidelines for ecohydrology are represented in the course content e.g. social sciences. This could be a future task for the ECBTF, with the assistance of ERCE, and should be a priority for those courses linked with UNESCO-IHP, -IHE, -ROSTE, -MAB, as well as with UNEP and UNU.

Undergraduate/Graduate Level:

The majority of undergraduate and graduate degree courses (semester duration) are offered in North America, with two offered in Europe and one offered in Israel. However the masters degree programs have good global distribution with many having links to, or at least mentions of, UNESCO-IHP and/or the eco-hydrology demonstration sites. Again, it must be mentioned here that this information was derived from a web-based search and, as such, there may be other undergraduate or graduate courses or programs that are run but the information was not available on the web.

The degree programs and courses are more specialised towards specific research areas than the short-courses. Their content is influenced by the research priorities of the department and/or professors involved and this has led to fairly varied content between universities and countries.

Other material

Two journals dedicated to Ecohydrology were identified. A number of books dedicated to the science of Ecohydrology were also identified. These books were often mentioned as reading material or recommended reading for a number of the university-level courses.

A video (Mara - Africa's river of destiny), highlighting the work being conducted at the Serengeti – Mara demonstration site, was also identified. However, information on its availability could not be established before this report was finished.

It is recommended that this information be added to the website in the form of teaching/reference material.

4. Gap Analysis

4.1 Survey Responses

There were three key points identified by the survey. The first was the lack of definition for ecohydrology and how it relates to integrated water resource management and hydroecology. This ultimately leads to confusion and misunderstanding of the core principles of ecohydrology. The second point was the lack of a central organisation that disseminates information on ecohydrology e.g. current reading material, courses available, a database of regional experts, projects, and, conferences/workshops solely or partly inclusive of ecohydrology activities. The third point was that ecohydrology has an audience but a process for education and capacity building to build this audience was largely in its infancy. This presents an exciting opportunity to focus the concept and principles of ecohydrology, develop short-term and long-term strategies to educate and build capacity, and to promote the concept of ecohydrology in more of a process-driven fashion.

The development of the UNESCO-IHP website is required for it to become the central clearing house or hub for ecohydrology activities. The website should include journal and book listings, courses, organizations, regional experts, recent publications and projects. In addition, the development of a more inclusive partner list to establish a network of people involved in ecohydrology should also be conducted. The establishment of a network would help to improve communication regarding current activities and developments in the science of ecohydrology, on a global basis.

4.2 Synthesis of Current Material

As initially suspected, there are many courses covering aspects of ecohydrology that target a wide range of educational levels but in the context of site-specific, institutional-specific, and context-specific applications. Three needed elements for effective education and capacity building fall-out:

- 1) Instructional communication of a definition and fundamental core principles associated with ecohydrology (Core Theory);
- 2) Flexibility to adapt educational materials to suit different audiences and applications (Audience and Application Suitability); and
- 3) Hands-on practice using case studies that involve some level of user-directed decision making, videos, and/or demo-site visitation (Application or Practice).

The following table provides a summary of the gaps identified with corresponding needs for both the survey and synthesis of current information. An additional section entitled 'organisation' has also been added to account for comments made relating to the accessibility of information.

	Gaps Identified	Needs Identified
Survey	<ul style="list-style-type: none"> • Lack of definition for EH and how it relates to IWRM and hydro-ecology • Lack of communication regarding EH activities on a global and regional basis 	<ul style="list-style-type: none"> • Paper defining EH required that separates IWRM, hydro-ecology and ecohydrology • Ecohydrology newsletter or development of an ecohydrology society to improve communication within the scientific community globally • Identification of an organisation that can become the central hub for EH activities and information i.e. UNESCO
Courses	<ul style="list-style-type: none"> • No common structure, central framework or guideline • Customized course for specific area/project • Many courses contain EH information but not identified as EH • Lack of social science material or focus in courses entitled Ecohydrology 	<ul style="list-style-type: none"> • Development of a framework that includes common core principles and definition of EH and how it relates to IWRM (as above) • Development of core modules that can be adapted for level and/or area of education. • Addition of EH core principles and definition to UNESCO's EH website • Promote the inclusion of social sciences into current EH courses.
Organisations	<ul style="list-style-type: none"> • Contacts identified that were not included in partner list • Lack of central/leading organisation to act as a forum for communication, information and/or discussion 	<ul style="list-style-type: none"> • Development of membership e.g. Society of Ecohydrology, similar to Society of Toxicology or Societas Internationalis Limnologiae • Addition of bibliography and web links to UNESCO's EH website as well as information on conferences and projects on-going.

APPENDIX I: Ecohydrology questionnaire responses – Jan 2007

1) Please indicate whether you, or your organisation, are directly involved in Ecohydrology activities including project development and/or project implementation? If yes, please provide a brief (less than 200 words) description

The Nature Conservancy – involved in ecohydrology activities both project development and implementation in many parts of the USA and Latin America, via our Sustainable Waters Program. They work on many aspects of ecohydrology although we do not refer to the activities as such e.g. land use management for water quality; floodplain restoration, setting environmental flows for dam operation.

Tanzania National Parks – UNESCO-IHP Demo site on Mara River and Serengeti Plain, Kenya and Tanzania. The project links the concept of Ecohydrology principles in the use of water to various initiatives taking place within the Mara River Basin. Dry season water flows and uses, as well as creation of wetlands for improved water quality

University of Vienna – Biosphere Reserve “Lobau” Demo Site activities. Focus on preserving, or enhancing, the existing biodiversity in the Biosphere Reserve (BR). The BR has become a species refuge for still-water species over the last 130 years of regulated river conditions, it is an indispensable centre for adapted species, which lost their original habitats outside today’s flood plain. A long-needed final concept for flood protection in the urban agglomeration of Vienna and the ecology-based wish to re-establish run-off patterns in the flood plain which are closer to the former non-regulated situation of the Danube River are kind of outbalanced by endangering the species refuges existing there today. The Ecohydrology Approach should be the way of integrating not only technical solutions, or ecological solutions constrained by priorities on only a few rheophilic species, but also integrating aspects of conservation as well creation of new habitats for the species in refuge. This task will be taken on through the DemoSite.

University of Algarve – Coordination of Coastal EH Task-force, coordination of European Working Group on Coastal EH, Coordination of the Guadiana EH demosite.

Fundaco Universidade – Parana floodplain demosite, Brazil. Creation of a biosphere reserve to prevent decline in biodiversity within the unique subtropical river floodplain. The floodplain is located in the last stretch of the Parana River inside Brazilian territory free of dams and the enhancement of the knowledge on the functioning of this ecosystem in relation to water level could improve economic activities and maintain biodiversity. Main issues are the impacts of upstream dams in water quantity. It is expected to determine the threshold level that inundates the plain; the influence of water quantity on floodplain nutrient loads and other water parameters; the response of the biotic assemblages to water quantity changes; model response of biotic assemblages to water quantity changes; propose management of water quantity in order to maintain floodplain biodiversity. Main socio-economic issues are those related to the use and occupation of the plain. Sand extraction was intensive in the main channel of the Parana River. With the creation of the protected areas, a series of restrictions came along. Then, locals used to

APPENDIX I: Ecohydrology questionnaire responses – Jan 2007

put fire in the vegetation to crop Pfaffia (Brazilian ginseng; this species is the first to grow). Also, there were intensive use for agriculture, ranching (cattle) and fisheries (recreational and professional and subsistence) and hunting. Cities located close to the area present very poor population.

The Mountain Institute - Andes program, Peru is a group specializing in the social dimensions of natural resource management in mountain areas. TMI is involved in the promotion of ecohydrology approaches in Peru through a partnership with Universidad Cayetano Heredia research group of hydrology experts and with the NGO Urpichallay. We are currently working in the Rio Santa watershed in Central Peru promoting a water management network that involves local community groups to government and private companies. TMI is working within the context of this network to promote the Ecohydrology approach. This will be done through multiple types of activities (from research to training local groups, science fairs, etc.). TMI has been actively involved in the interphase of natural resource/water management activities but only recently it is beginning to formally package its activities in terms of the ecohydrology paradigm. Although working with formal research groups at universities in Peru, their main field of action is with rural mountain communities and their needs.

Al Balqa Applied University, Jordan – Dr Yasin Al-Zu'bi recently finished his research regarding the eco-hydrology of Azraq Basin in Jordan, this research was funded by UNESCO/ Amman Office. This research mentioned key water resource elements that need research and application to sustainable management. The question addressed by this research was, how to incorporate these multiple variables; agricultural crops, industries, ecosystem benefits, and the impact of climate change, into a model that will result in a useful prioritization of water use for management in the Azraq Basin.

UNESCO-IHE Institute for Water Education (Chiung-Ting Chang) – Through the WTICH project

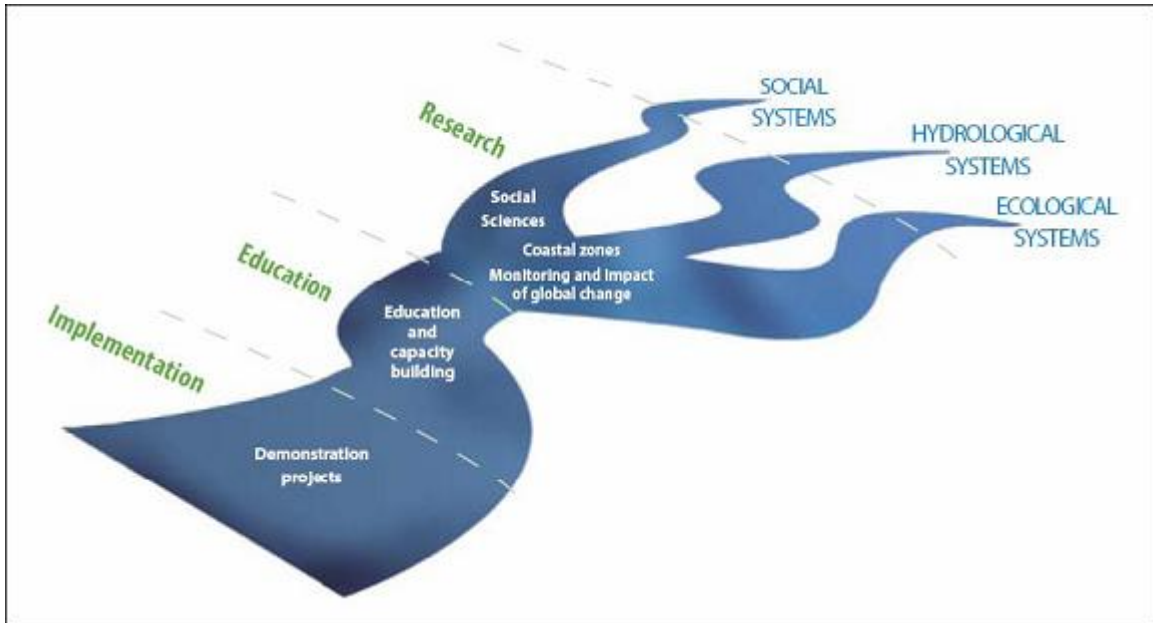
UNEP-IETC - Between the years 2000 and 2004 IETC was strongly involved in the implementation of the Ecohydrology Programme through the application of Phytotechnologies, the implementation of the Pilica River Case Study in Poland and various publications.

UNESCO Windhoek Cluster Office, Namibia - UNESCO's Ecohydrology Programme (EP) is a scientific programme to understand and elucidate the dynamic relationships between hydrological, social and ecological systems; to consider how these act upon each other, and to seek new ways to balance human and environmental needs for water resources. The aims of the programme are:

- to advance the integration of social, ecological and hydrological research; and
- to generate outcomes that will enable the development of effective policies and practices.

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The following Scheme shows the approach taken by the EP



APPENDIX I: Ecohydrology questionnaire responses – Jan 2007

2. Are you involved in any educational or capacity building (E/CB) activities that involve ecohydrology or any of its components? Please provide details. If not, please go straight to Q5.

The Nature Conservancy - The Sustainable Waters Program has several training packages on environmental flows methodologies, assessment etc. They have a number of new products in development presently, including a series of on-line training modules. All of their existing products can be found on their website (<http://www.nature.org/initiatives/freshwater/>), but some of them take a bit of searching to locate.

Tanzania National Parks - Already there are some institutions that deal with education and capacity building in the Basin. They link with them to make sure the ecohydrology concept is well understood for guidance when working with people in the Basin. The institutions working with various stakeholders in the Basin have various expertise that they use to drive the message home to communities living in the Basin or depend on the Basin's resources for their livelihood.

University of Vienna – not yet

University of Algarve – Elaboration of a students guide for EH (under UNESCO-BRESCE support)

Fundaco Universidade – Parana floodplain demosite, Brazil. They are involved in education, but the activities of ecohydrology were not considered yet. First they need to spread the information to their education fellows.

The Mountain Institute - Andes program, Peru - No

Al Balqa Applied University, Jordan - Yes, their faculty are involved in both educational and capacity building activities. They teach many courses related to ecohydrology for both B.Sc and M.Sc students and conduct research related to water and biota. As well, every year their faculty hold a training workshop for the employees of different agencies involved in water resources management including; Ministry of water and irrigation, Ministry of Environment and Ministry of Agriculture. This Year the Training workshop was about Capacity Building for water resources management.

UNESCO-IHE Institute for Water Education (Chiung-Ting Chang) – Wetland restoration, water accounting (both at early stages of development)

UNEP-IETC - Yes, in the application of Phytotechnologies

UNESCO Windhoek Cluster Office, Namibia - Yes. A project was initiated early in 2007 in order to link the indigenous knowledge on natural resources management with

APPENDIX I: Ecohydrology questionnaire responses – Jan 2007

common practices at the Kavango area which covers Angola, Botswana and Namibia. A workshop was held where community representatives from the 3 countries shared knowledge and practices and a best practices booklet will be published later in 2007 (October) to disseminate the results to a wider audience

APPENDIX I: Ecohydrology questionnaire responses – Jan 2007

3. In your experience, which E/CB methods outlined in Q 2. have been the most successful, and why?

Tanzania National Parks – Most of the initiatives have just started. At this stage it will be difficult to provide such an assessment. More time is needed. The ecohydrology concept is still new and it will take time to sink in people's way of thinking for success to be ascertained.

Al Balqa Applied University, Jordan - Capacity building by using mathematical models, Decision Support System (DSS) and case studies in the field of IWRM have been the most successful methods. This conclusion based on the questionnaire filled by the trainee, also the education method almost oriented for the people who haven't any experience, while the capacity building for management of water resources and the ecosystem in general are oriented for the people who have a good back ground about ecohydrology or any of its components.

APPENDIX I: Ecohydrology questionnaire responses – Jan 2007

4. *Please provide a brief description and availability of any E/CB material you have produced in conjunction with the above mentioned activities, e.g. CD, manual, on-line courses, video etc.*

The Nature Conservancy – please see website
<http://www.nature.org/initiatives/freshwater/>

Tanzania National Parks - Nothing so far except that various workshops have been conducted with various stakeholders working in the Basin. The purpose of the workshops has been to identify the stakeholders' initiatives in the Basin and what they do. Also in so doing finding ways and means of linking the activities without having conflict of interest so that common goals can be agreed upon and move forward together. A mechanism is also being sought through East African Community to negotiate with respective national governments to come to agreement on how best to use the river sustainably applying
ECOLOGY PRINCIPLES

Al Balqa Applied University, Jordan - Last year the Faculty of Agricultural Technology held several activities relevant to Eco-hydrology in collaboration with the UNESCO, such as "Water Crises Management", Integrated Water Resources Management in Wadis using Decision Support Systems" and "Integrated Management for Water Resources using Mathematical Models". They have produced manual for training on issues related to ecohydrology such as; Application of decision support system (case study), rainfall-runoff relationships, integrated water resources management and water harvesting.

UNEP-IETC - 1. Guidelines for the Integrated Management of the watershed - Phytotechnology and Ecohydrology (Hard Copy and CD ROM);

2. Integrated Watershed Management -Ecohydrology and Phytotechnology -Manual- (Hard Copy and CD ROM)

UNESCO Windhoek Cluster Office, Namibia - The booklet will be available later this year, attached is the proceedings from the workshop

APPENDIX I: Ecohydrology questionnaire responses – Jan 2007

5. *What methods would you like to see incorporated into future E/CB activities for Ecohydrology? Please provide reasoning.*

The Nature Conservancy - Many of the demonstration sites, in my view, do not incorporate some important concepts of ecohydrology. For example, there is much attention to what happens on land, but little to what is happening in the actual river/estuary. Environmental flows needed to sustain the system, for instance, are not tackled in all the demo sites. Another area that seems to be lacking is any attention to freshwater biodiversity - other than aspects that can be directly linked to land use activities. For example, invasive species are, in many instances threatening the functioning of a system, but this issues is rarely addressed in any of the ecohydrology projects.

Tanzania National Parks - Define what Ecohydrology is. Its importance to the environment, advantages associated with its use. Link it with water supply, needs for people, biodiversity (flora and fauna), show that without biodiversity no continuous flow and if water and biodiversity are abused there will be no recharge. This should be followed by awareness creation on use of ecohydrology principles.

University of Vienna - Production of information material and courses on the concept of EH, based on examples relevant for local/regional solution strategies, placed within the Demo Site Framework. This should be distributed to schools (written material) and to universities and other organisations, involved in teaching especially young scientists and student going to be school teachers. Distribution via media (TV series?) could be another aspect. Respective material can be quite easily (?) produced.

Luis Chichara (University of Algarve) - Practical field courses in different ecosystems dealing with different problems. Training activities should be structured in a way to provide gradual help to students rationalization about the EH approach and contributing to their own understanding and development of proposals of the most adequate solutions for the water problems they are trying to solve.

Fundaco Universidade – Parana floodplain demosite, Brazil.

- Scientific materials about ecohydrology: in our native language: to better increase the knowledge of our personel;
- Seminars on ecohydrology: to improve knowledge of our personel;
- Folders (or videos) with examples: to show our team what is done in other places.

The Mountain Institute - Andes program, Peru

(*) Use of demonstration sites with a capacity to serve both as teaching and training grounds for future replication (it is necessary to demonstrate to specific stakeholders the impact of ecohydrology approaches, e.g. to groups proposing dam construction as the only solution to water shortages, demonstrate the complementary advantage of proper range management for the hydrological cycle, etc.)

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(*) Participatory Action research applied to the field of ecohydrology (in countries like Peru and most of Latin America government extension services collapsed in the 1980s and have not been replaced, therefore supporting community capacities (including the potential role of the school system) to participate in the validation of ecohydrology technologies may be critical).

Al Balqa Applied University, Jordan - Development of on-site training projects, Demonstration Project Areas, for example to monitor the most important wetland sites, taking into consideration the topographic data, hydro-chemical and hydro-geological data, geographic location, altitude, the nature of this wetland if it is a dam, river, pool... etc., the water quality, the surrounding activities, the chemical and the biological characteristics, the land productivity, determining if there is any threat on this wetland and its environmental impact and putting the required solutions to conserve such wetlands. This monitoring process may carry periodically (every 3 months). During the field trips water samples will be subjected to chemical and biological analyses. This type of training will strongly support the concept of eco-hydrology among the people who work in the field of biology and hydrology, this type of project according to my experience is more helpful than teaching courses.

UNEP-IETC - Homogenous programmes in terms of syllabus and information, tailored to specific audience and dynamic in nature.

Interactive capacity building tools i.e. e-learning. This tool has high visual content, keeps the student concentrated and it can be continuously update by means of modules.

UNESCO Windhoek Cluster Office, Namibia - Hard copy and audiovisual material that address issues at various levels of education (from University to grassroots level)

APPENDIX I: Ecohydrology questionnaire responses – Jan 2007

6. *What methods would you not like to see incorporated into future E/CB activities?
Please provide reasoning.*

Fundaco Universidade – Parana floodplain demosite, Brazil. – Guidelines on what should be done, because adaptations (or complete alterations) for every project are necessary

UNEP-IETC - Ad-hoc programmes resulting in confusing messages and poor training results.

APPENDIX I: Ecohydrology questionnaire responses – Jan 2007

7. *On a scale of 1-10 (1 = low, 10 = high), at present, how would you rate:*

a. *the quality of current E/CB activities for Ecohydrology globally*

Median value = **7**

(All results = 1,8,7,3,7)

b. *the quality of current E/CB activities for Ecohydrology in your region (please specify region)*

East Africa = 1

Namibia (Southern Africa) = 5

Vienna (Europe) = 1

Europe = 9

S America = 1

Peru = 2

West Asia = 4

c. *the availability of up to date information regarding current activities of Ecohydrology*

Median value = **3.5**

(All results = 1,4,5,3,2,5)

Additional comments:

The Nature Conservancy – This question is hard to answer, as what is included in "ecohydrology" is quite broad, and usually referred to in many other ways within the integrated watershed management context. So, while there are many activities globally, the majority of them would not identify themselves with ecohydrology per se, but with the more traditional integrated river basin management approach or framework.

APPENDIX I: Ecohydrology questionnaire responses – Jan 2007

8. *Please rank the following E/CB method options in order of preference (where 1=most valuable and 5=least valuable method)*

Result shown in bold = median value, all results listed in brackets

4_ Masters Level Course in Ecohydrology (3, 5, 4, 2, 3, 4, 5)

2_ Short-course (1 week) in Ecohydrology for practitioners/consultants etc (3, 1, 2, 1, 4, 2, 5)

1_ Development of on-site training projects (Demonstration Project Areas) incorporating all disciplines involved in Ecohydrology i.e. Ecologists, Hydrologists, Social Scientists (1, 1, 5, 1, 5, 1, 1)

3_ Ecohydrology module for incorporation into current undergraduate courses in hydrology and ecology (3, 1, 1, 4, 5, 3, 2)

2_ Production of Ecohydrology video promoting case studies and concepts (4, 1, 3, 2, 2, 2)

Additional comments:

University of Algarve – All the options are important but not simultaneously. I think that if you are interested in starting to disseminate the concept, short courses is the best. In areas where there is already a reasonable knowledge a think that “moving” to EH modules and master courses is the next step

UNESCO Windhoek Cluster Office, Namibia - There is tremendous potential for research and training with the development of on-site training projects incorporating all disciplines involved in Ecohydrology. The development of an ecohydrology module for incorporation into an undergraduate course and the production of a video is a good idea.

APPENDIX I: Ecohydrology questionnaire responses – Jan 2007

9. *How would you define the field of “Ecohydrology” as it pertains to you?*

The Nature Conservancy – I am still trying to understand the differences between ecohydrology and integrated river basin management, environmental flows and other similar concepts

Tanzania National Parks - It is the sustainable use of water resources that take into account the servicing of flora and fauna in such a way that there is constant supply of water and biodiversity sustenance. This process allows water quality and quantity to be maintained and protection of environmental destruction to be avoided.

University of Vienna - The science of spanning the gap between hydrology, as the technical solution for water management problems, and ecology, as the solution model that integrates social sciences and even economics within its scope of application.

University of Algarve - An integrated way to try to solve water problems at low costs and in a sustainable ecologic way

Fundaco Universidade – Parana floodplain demosite, Brazil. - Ecohydrology is a new concept that has potential to guide enquires in our projects. Its principles allow us to focus, in another view, on how the control of water level promoted by dams located upstream from the upper Paraná River floodplain influences nutrients cycling and the structure and composition of several assemblages.

The Mountain Institute - Andes program, Peru - I would define ecohydrology as an ecosystemic approach to the sustainable management of hydrological resources and processes that include both nature and human objectives.

Al Balqa Applied University, Jordan - The use of ecosystem properties as a management tool by using biota to control hydrological processes and, vice versa, by using hydrology to regulate biota.

UNEP-IETC - A concept which integrates the use of ecosystem services towards the preservation and/or restoration of degraded aquatic or semi-aquatic ecosystems. It based on the application of environmental and hydrological sciences, technological applications (Phytotechnologies) coupled with socio-economic components.

UNESCO Windhoek Cluster Office, Namibia - It is a holistic manner to view issues that cannot be resolved by looking only at the eco or hydro side of things

APPENDIX I: Ecohydrology questionnaire responses – Jan 2007

10. Please provide any additional comments/suggestions you have regarding the activities of the Education and Capacity Building Task Force.

The Nature Conservancy – a clarification of what distinguishes ecohydrology from all the other water management approaches would be helpful

Tanzania National Parks - Initiatives are needed to popularize the Ecohydrology Concept so that it is well understood globally for sustainable management of water resources and biodiversity in general.

University of Vienna - At present: none.

Luis Chichara (University of Algarve) - I think that the ECBTF could provide support for the elaboration of EH courses in different levels and help in the preparation of the proposals for funding. Ex. We have now in Europe the EDULINK that represents an opportunity for organizing a shared course in EH – in my case, coastal – with ACP countries. If I can have your support on this it would be extremely good and I think we could use this first approach as a “training” for other courses.

Fundaco Universidade – Parana floodplain demosite, Brazil. - It should be sent by e-mail all activities developed. This may help us identifying potential activities to be incorporated in our project.

The Mountain Institute - Andes program, Peru - I personally would like to see a strong component of participatory/extension service activities products to improve likelihood of impacts of the educational materials at the local level.

Al Balqa Applied University, Jordan - I suggest that ECBTF to think seriously to have a journal specialize in articles related to eco-hydrology.

UNEP-IETC - It is important to consider that the application of Ecohydrology does not only depend on engineers, hydrologists, ecologists, biologists, sociologists, etc. but very much on decision makers. In light of this there is an imperative need to also produce information packages and training materials specifically tailor for this audience.

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Books

Balancing water for humans and nature

Author/s: Malin Falkenmark and Johan Rockstrom
Publisher: Earthscan: James & James

Description: This work exposes how water flow links nature and society through water's many parallel functions as the "blood stream" of both the natural environment and the embedded human environment - and the resulting conflicts that arise. The authors argue that a sustainable future depends fundamentally on our ability to manage these trade-offs. They advocate an ecological approach to land/water/environmental problems and argue for viewing precipitation as the gross water resource. Distinguishing between terrestrial aquatic ecosystems, they show how an ecological approach can be expressed in water-related trade-offs, incorporating criteria for long-term resilience. Based on per capita needs for an acceptable nutritional diet, the authors analyse the amounts of water needed for global food production by 2050 and identify potential sources. Drawing on small-scale experiences in Africa and Asia, they also cover the vulnerability of the semi-arid tropics, disentangling it into green and blue water scarcity components.

Web-site:

<http://shop.earthscan.co.uk/ProductDetails/mcs/productID/29/groupID/6/categoryID/21/v/969406b3-6072-4266-bfc8-79019c634afd>

Dryland Ecohydrology

Author/s: Paolo D'Odorico, Amilcare Porporato (Eds.)
Publisher: Springer Publishers

Description: Ecohydrology emerges as a new field of research aiming at furthering our understanding of the earth system through the study of the interactions between the water cycle and vegetation. By combining the analysis of biotic and abiotic components of terrestrial ecosystems, this volume provides a synthesis of material on arid and semiarid landscapes, which is currently spread in a number of books and journal articles. The focus on water-limited ecosystems is motivated by their high sensitivity to daily, seasonal, and decadal perturbations in water availability, and by the ecologic, climatic, and economic significance of most of the drylands around the world.

Web-site: http://www.springer.com/west/home/environment/ecology?SGWID=4-10002-22-94256241-0&teaserId=67835&CENTER_ID=276999

Ecohydrology of Water-controlled Ecosystems

Author/s: Ignacio Rodríguez-Iturbe and Amilcare Porporato

Publisher: Cambridge University Press

Description: Ecohydrology of Water-controlled Ecosystems addresses the connections between the hydrologic cycle and plant ecosystems, with special emphasis on arid and semi-arid climates. This important topic is treated by building suitable mathematical models of the physics involved and then applying them to study the ecosystem structure and its response to rainfall and climate

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forcing in different parts of the world, including savannas, grasslands and forests. It investigates the vegetation response to water stress (drought), the hydrologic control on cycles of soil nutrients, and the dynamics of plant competition for water. The book also offers insights into processes closely related to soil moisture dynamics, such as soil-atmosphere interaction and soil gas emissions. This book will appeal to advanced students and researchers from a large range of disciplines, including environmental science, hydrology, ecology, earth science, civil and environmental engineering, agriculture and atmospheric science.

Web-site: <http://www.cambridge.org/catalogue/catalogue.asp?isbn=9780521036740>

Ecohydrology: Darwinian Expression of Vegetation

Author: Peter S. Eagleson

Publisher: Cambridge University Press

Description: This volume is devoted to the derivation and application of simplified bioclimatic boundary conditions at vegetated land surfaces using natural selection of vegetation characteristics driven by productivity maximization. It investigates the internal control of forest growth by the vertical fluxes of light, CO₂, water vapor, and heat within the canopy, as well as the external control offered by the balances of thermal energy and water. Through these means it seeks to determine how the physical characteristics and productivity of forest communities are related to the climates and soils in which they are found. Ecohydrology bridges the fields of hydrology and ecology and proposes new unifying principles derived from the concept of natural selection. It also has potential application in determining the response of vegetation to slow variations in climate and will provide fascinating reading for graduate-level students and research scientists working in ecohydrology, hydroclimatology, forest ecology, and surface water hydrology.

Web-site: <http://www.cambridge.org/catalogue/catalogue.asp?isbn=9780511007446>

Ecohydrology: Processes, Models and Case Studies

Author: D. Harper, M. Zalewski, S. E. Jorgensen and N. Pacini

Publisher: Oxford University Press

Description: Unavailable

Web-site:

<http://www.us.oup.com/us/catalog/general/subject/LifeSciences/Ecology/?view=usa&ci=9781845930028>

Ecohydrology: Vegetation Function, Water and Resource Management

Author: Derek Eamus, Tom Hatton, Peter Cook, Christine Colvin

Publisher: CSIRO Land and Water

Description: *Ecohydrology: Vegetation Function, Water and Resource Management* describes and provides a synthesis of the different disciplines required to understand the sustainable management of water in the environment in order to tackle issues such as dryland salinity and

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environmental water allocation. It will provide in the one volume the fundamentals of plant ecophysiology, hydrology and ecohydrology as they relate to this topic.

Web-site: <http://www.publish.csiro.au/pid/5233.htm>

Estuarine Ecohydrology

Author: Eric Wolanski

Publisher: Elsevier Publishing

Description: Focuses on the principal components of an estuary and presents theories, models, and real-world solutions to serve as a toolkit for designing a management plan for the ecologically sustainable development of an estuary

Web-site: http://www.elsevier.com/wps/find/bookdescription.cws_home/712546/description

The Ecohydrology of South American Rivers and Wetlands

Author: Michael E. McClain (ed.)

Publisher: International Association of Hydrological Services (IAHS)

Description: An overview of ecohydrological processes operating in South America's most important aquatic systems.

Web-site: <http://www.cig.ensmp.fr/~iahs/bluebooks/SP6.pdf>

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Conference Proceedings

2nd Asia Pacific Training Workshop on Ecohydrology

Date: July 2003

Editors: P.E. Hehanussa, G.S. Haryani and H. Pawitan

Location: Cibinong-Indonesia

Description: Integrating Ecohydrology and Phytotechnology into Workplans of Government, Private and Multinational Companies. Ecohydrology is a concept which aim is to create a new interdisciplinary background for assessment of sustainable management of fresh water resources. It integrates biological and hydrological factors toward enhancement of resistance and resilience of fresh water ecosystems against anthropogenic stress. This document collects 29 research papers on subjects related to this new concept presented during the workshop held in Cibinong (Indonesia) in July 2003.

Web-site: http://www.unesco.or.id/activities/science/water_sci/publications.php

Ecohydrology of High Mountain Areas

Date: March 1996

Editors: Chalise, S.R., Herrmann, A., Khanal, N.R., Lang, H., Molnar, L., Pokhrel, A.P.

Location: Kathmandu, Nepal

Description: To focus on the ecohydrological problems in the high mountain areas with special reference to the Hindu Kush-Himalaya system, the Kathmandu-based International Centre for Integrated Mountain Development (ICDVIOD) organized an International Conference on Ecohydrology of High Mountain Areas in March 1996 with support from the German IHP/OHP Committee. This special volume contains papers presented at the Conference. The majority of papers in the volume focus on operation and interaction of the physical system, biosphere and humans in the most vulnerable high mountain region of the world. Part A deals with the regional issues in high mountain ecohydrology. The authors touched some of the important problems like the effects of altitude on ecohydrological processes. In these regions, variation and form of precipitation are of key importance for understanding hydrological processes. Similarly, the effect of global warming on flows in the proglacial rivers is significant as all the HKH rivers originate from the snow and glacial ice melt. Part B of the volume contains papers on network design, instrumentation, data collection and processing methodology and modelling.

Web-site: http://www.cig.ensmp.fr/~iahs/hsj/440/hysj_44_06_0997.pdf

Ecohydrology: Proceedings of the International Workshop on Ecohydrology

Date: 2001

Editors: V. Subramanian and AL. Ramanathan

Location: New Delhi, India

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Description: Ecohydrology connects the two key elements that are the focus of all environmental problems, namely ecosystems and water. The hydrological problems in diverse ecosystems are being focussed in many countries due to enhanced stress on water both with respect to quantity and quality. Hence, there is an urgent need to integrate ecological approaches for better understanding of surface and subsurface hydrological processes. With this view in mind, several experts were invited to contribute to this book to reflect the inherent diversity in the subject matter. Ecosystems from temperate regions in Sweden, Japan as well as the Himalayas, river and ground water domains in the South Asian region, lakes and coastal environment and pollution of water bodies in diverse regions have all been covered in this book. Contributors represent eight countries namely India, Nepal, Bangladesh, Sri Lanka, Kenya, Japan, Sweden and England.

All invited articles have been suitably edited for easy reading. It is intended as a standard reference for ecologists, hydrologists, geochemists and those interested in current issues in environmental sciences particularly problems related to water or the aquatic environment.

Web-site: <https://www.vedamsbooks.com/no29358.htm>

Appendix II: Bibliography of existing materials

Journals

Ecohydrology

Publisher: John Wiley & Sons

Launched: 2008

Editors: Keith RJ Smettem (Editor-in-chief; Australia), David Breshears (USA), Han Dolman (The Netherlands), James Waddington (Canada)

Description: *Ecohydrology* is an international journal publishing original scientific and review papers that aim to improve understanding of processes at the interface between ecology and hydrology and associated applications related to environmental management. *Ecohydrology* seeks to increase interdisciplinary insights by placing particular emphasis on interactions and associated feedbacks in both space and time between ecological systems and the hydrological cycle. Research contributions are solicited from disciplines focusing on the physical, ecological, biological, biogeochemical, geomorphological, drainage basin, mathematical and methodological aspects of ecohydrology. Research in both terrestrial and aquatic systems is of interest provided it explicitly links ecological systems and the hydrologic cycle; research such as aquatic ecological, channel engineering, or ecological or hydrological modelling is less appropriate for the journal unless it specifically addresses the criteria above. Manuscripts describing individual case studies are of interest in cases where broader insights are discussed beyond site- and species-specific results.

Web-site: <http://www3.interscience.wiley.com/cgi-bin/jabout/114209870/ProductInformation.html>

Ecohydrology and hydrobiology

Publisher: European Research Centre for Ecohydrology

Launched: 2001

Editors: Maciej Zalewski (Poland), David M. Harper (UK), Richard D. Robarts (Canada)

Description: The International Journal ECOHYDROLOGY & HYDROBIOLOGY publishes papers concerned with ecology and hydrology of rivers, reservoirs and lakes with special emphasis on the functional interrelations between hydrology and biota from a molecular to the catchment scale.

Web-site: <http://www.journal.ecohydro.pl/>

Estuarine Coastal and Shelf Science

Publisher: Elsevier

Launched: October 2007

Description: A special section of Estuarine Coastal and Shelf Science (volume 70, issues 1-2, October 2007) was dedicated to "Applying the Ecohydrology approach to the Guadiana estuary and coastal areas: lessons learned from dam impacted ecosystems".

Web-site:

http://www.elsevier.com/wps/find/journaldescription.cws_home/622823/description#description

Appendix II: Bibliography of existing materials

Short Courses

Advanced course on Ecohydrology and Coastal management

Organisation: University of Algarve, Portugal

Length: 7 days

Target group: This course was open to MSc and PhD students, and for young scientists from all around the World.

Objectives:

- Explain the Ecohydrology concept and the advantage of applying this tool for water management;
- Extend the use of Ecohydrology concept and tools from catchment to coastal area studies;
- Integrate Ecohydrology under the Global changes in water availability scenario;
- Introduce the use of analytical methods for individual analysis as short-term indicators of ecosystem changes in Ecohydrology studies;
- Include a social-economic dimension in the Ecohydrology studies, i.e. link health of ecosystems with social and economy variables of human populations, allowing the sustainable use of ecosystems;
- Implement the use of Ecohydrology tools to management and restoration of aquatic systems and,
- Contribute to the development of a network of scientists with common interest in ecohydrology and coastal areas that can collaborate in the implementation of studies, projects and definition of environmental policies regarding common interests in the above-mentioned areas.

Web site: http://portal.unesco.org/en/ev.php-URL_ID=11156&URL_DO=DO_PRINTPAGE&URL_SECTION=201.html

Advanced Study Course on Ecohydrology

Organisation: UNESCO IHP, ROSTE

Length: 13 days

Target Group: Young scientists of different specialisations from around the world

Objectives:

- To improve the understanding of basin scale processes by integration of hydrological and biological factors toward enhancement of resistance and resilience of freshwater ecosystems against anthropogenic stress;
- To develop cost effective methods of water and nutrients cycles restoration in river basin scale by using ecosystem properties as a management tool.

Web site: <http://unesdoc.unesco.org/images/0012/001204/120465Eo.pdf>

Ecohydrology and Coastal Management: from Catchment to Coastal Areas

Organisation: UNESCO ROSTE, University of Algarve

Length: 8 days

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Target group: The Course was open to MSc and PhD students, and for young scientists from all around the World (22 participants in total, from Brazil, Germany, India, Ireland, Italy, Papua New Guinea, Poland, Portugal, Romania, Spain, Tanzania, Thailand, Turkey, Ukraine, Venezuela).

Objectives:

- Explain the Ecohydrology concept and the advantage of applying this tool for water management;
- Extend the use of Ecohydrology concept and tools from catchments areas to coastal areas studies;
- Integrate Ecohydrology under the Global changes in water availability scenario;
- Introduce the use of analytical methods for individual analysis as short-term indicators of ecosystem changes in Ecohydrology studies;
- Include a social-economic dimension in the Ecohydrology studies, i.e. link health of ecosystems with social and economy variables of human populations, allowing the sustainable use of ecosystems;
- Implement the use of Ecohydrology tools to management and restoration of aquatic systems
- Contribute to the development of a network of scientists with common interest in ecohydrology and coastal areas that can collaborate in the implementation of studies, projects and definition of environmental policies regarding common interests in the above-mentioned areas.

Web site:

http://portal.unesco.org/unesco/ev.php?URL_ID=11156&URL_DO=DO_TOPIC&URL_SECTION=201&reload=1176316149

Ecohydrological approaches to wetlands, Czech Republic

Organisation: UNESCO MAB, IHP

Length: 5 days

Objectives:

- Management of wetlands as stabilizing components of catchments
- Control of hydrological processes as a management tool
- Steering of biogeochemical cycles in wetlands
- Role of wetlands and wetland vegetation in regional water cycling
- Integrated Water Resources Management with respect to wetlands
- Ecohydrological monitoring of water bodies in the context of the EU Water Framework Directive
- Services and livelihood provided by wetland ecosystems
- International cooperation in the field of conservation and wise use of wetlands

Target group:

- wetland, land and water resource managers
- landscape planners
- personnel employed in state administration responsible for the protection of nature, environment and sustainable use of wetlands and shallow water bodies, and other relevant stakeholders.

Web site: http://www.ramsar.org/wn/w.n.czech_training2006.htm

Appendix II: Bibliography of existing materials

Integrated River Basin Management

Organisation: UNESCO-IHE

Length: 4 months

Objectives:

- Understanding interactions between development, water and environment at the river basin scale
- Understanding the importance of holistic approaches in river basin research and management
- Being aware of the latest concepts, international trends and practices of Integrated River Basin Management
- Learning a critical attitude towards use and implementation of IRBM concepts in specific river basins

Target Group: The course is designed for professionals actively involved in or planning to be involved in the different aspects of river basin management. They may be working at river basin organisations, regional or national governments involved in the different aspects of IRBM, non-governmental organisations, companies or universities and do not have the time to take a course that lasts several weeks abroad.

Web site: <http://www.unesco-ihe.org/education/downloads/DLC/Online%20IRBM%20course.pdf>

Integrated Water Resource Management

Organisation: Al-Balqa' Applied University, Jordan

Length: 5 days

Target Group: None defined, open application

Objectives:

1. Principles of Integrated Water Resources Management.
2. Data required to build Decision Support System (DSS) and how to rank the priorities.
3. Development of DSS to be applicable for technical and non-technical people.
4. Monitoring and update data in order to modify the DSS.

Web site: <http://wh.bau.edu.jo/firstcourse.doc>

Integrated Water Resource Management

Organisation: United Nations University

Length: 250 hours – on-line

Target group: The program is intended as a specialized, undergraduate-level program for individuals, usually with undergraduate degrees, but with little or no previous training in the IWRM-related aspects of environmental engineering, natural science and social science. Other individuals may take the course as part of a self-directed learning experience.

Objectives:

- Introduction to Integrated Water Resources Management
- Water Transfer
- The Terrestrial Ecosystem and the Impacts of Land Use Changes
- The Aquatic Ecosystem
- Aquatic Ecosystem Health and Impact Assessment

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- Water Use
- Wastewater
- Governance and Community Based Approaches:
- Organizational Infrastructure and Management:
- Applying Integrated Water Resources Management:

Web site: <http://www.inweh.unu.edu/inweh/Training/WVLC.htm>

Monitoring of processes and application of Ecohydrology and Phytotechnologies for Integrated Water Resource Management

Organisation: University of Lodz, Poland

Length: 4 days

Objectives:

Present techniques of monitoring of ecohydrological and phytotechnological processes. Demonstrate possibilities of ecohydrology & phytotechnologies application for Integrated Watershed Management.

Target group: Young scientists, decision-makers and stakeholders

Web site: http://www.biol.uni.lodz.pl/demosite/pilica/Download/Programme_of_the_Course.doc

Ecohydrology: Education for Schools

Organisation: University of Lodz, UNESCO and UNEP

Length: 1 day

Target Group: Young scientists from local schools: Two schools from the area has been involved: the Primary School in Komorniki: 25 students trained; the Technical Higher School in Wolborz; 26 students trained

Objectives:

1. Presentation of Ecohydrology and Phytotechnologies approach.
2. Ecological education.
3. Ecological awareness rising

Web site: <http://www.biol.uni.lodz.pl/demosite/pilica/en/main/implementation/training.html>

Phytotechnology for wetland management

Organisation: UNEP-IETC, Egypt

Length: 10 days

Target Group: Decision makers and community representatives

Objectives:

- To build capacity of Iraqi decision makers and community representatives on aspects of marshland management, including: policy and institutional aspects, technical subjects, and analytical tools.

Web site: http://marshlands.unep.or.jp/default.asp?site=marshlands&page_id=FC67B302-4665-4FCB-9067-31FDD34A602E

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Post-graduate training course on Environmental Hydrology for arid and semi-arid systems

Organisation: Hydraulics Research Institute, Egypt
Length: 6-8 weeks

Target group: Pre-requisites required, BSc in hydrology related field, or, candidates with professional experience in hydrology.

Objectives: To provide basic knowledge in applying physical and mathematical models for tackling problems in operational and environmental hydrology

1. To offer a clear explanation of operational and environmental hydrology in arid and semi-arid regions.
2. To explain the nature and uses of numerical techniques and their application in groundwater management
3. To present examples of actual problems and work out solutions

Web site: <http://www.nbcbn.com/Shortcourse1.html>

Watershed and River-basin management

Organisation: UNESCO-IHE
Length: 3 weeks

Target group: Top and mid-level decision-makers, technical experts and professional trainers and researchers with a background in water management, environmental management or watershed management.

Objectives: This course provides a theoretical background and develops practical skills of participants for the management of watersheds - taking into account developmental, food, environmental and institutional aspects and placing this in the context of Integral River Basin Management.

Web site: http://www.unesco-ihe.org/vmp/articles/Short-Courses/SHO-MAI_WSM.html

The concept of Ecohydrology as a tool of Integrated Water Resources Management of the Iraqi Marshlands

Organisation: UNESCO Baghdad
Length: Unknown – in development

Target group: Hydrologists, environmental managers, ministries for water resources, agriculture and environment

Description: As the Iraqi marshlands are unique in scale and natural conditions in the Middle East, there is no comparable example to learn experiences from in the region. The development of training workshops was proposed to increase awareness of ecohydrology. The objective of the project was to introduce the ecohydrological approach for IWRM in on-going activities in the Arab states, which would encourage Iraqi participation. The training workshops will aim to develop a unique approach to Iraq's diverse natural condition (the twin rivers flow from the mountainous

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north via the central desert to the marsh areas in the south) and, will be developed by Iraqi scientists and researchers.

Integrated Management of Water Resources

Organisation: UNESCO Montevideo

Length: 5 days

Target group: professionals, researchers, decision makers

Description: The course on Integrated Management of Water Resources took place in Guatemala, in the framework of the UNESCO Chair on Water Resources (Universidad de San Carlos de Guatemala). The course was designed to improve the management of land-water-habitat interactions by introducing eco-hydrological principles into integrated water resources management through the development of an eco-system approach.

Web-site: none available

Appendix II: Bibliography of existing materials

Summer Courses

Managing transition to adaptive river basin management

Organisation: Global Water Systems Project
Length: 10 days

Target group:

The summer school will include the participation of approximately 25 young academics, primarily PhD candidates, as well as several post-doctoral researchers and Master's level students, who are involved in interdisciplinary studies and/or research oriented towards addressing water management issues.

Objectives:

- 1 The complexity of the transitions process in moving towards adaptive management in river basins
- 2 Socio-economic and institutional barriers to change in the context of water resources management
- 3 The importance of learning processes in facilitating change
- 4 Insights into what societal transitions are
- 5 How to analyse transitions (multi-level/multi-phase)
- 6 How transitions management can contribute to more effective river basin management (including transitions management theory and strategies)
- 7 The role of the European Water Framework Directive in water management and transitions management

Web site: <http://www.gwsp.org/>

Ecohydrology

Organisation: Vrije Universiteit
Length: 5 days

Target group: The course is at graduate level, aimed at PhD students and professionals who want to obtain knowledge of the current state of the field of ecohydrology. MSc students are also welcome to participate

Objectives:

To provide a state of the art course of ecohydrology, including the relationship between hydrology and landscape ecology, soil-plant-atmosphere interactions, as well as large scale biogeochemical modeling. Ecohydrological studies of several ecosystems will be discussed in greater detail.

Course outline:

Day 1: Ecohydrology; abiotic environment and vegetation response

Day 2: Processes in Ecohydrology. Role of vegetation in the water balance.

Day 3: Large Scale processes. Feedback between vegetation and climate, mesoscale eco-hydrological modeling.

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Day 4: Ecohydrology of coniferous and broadleaved forests in the Netherlands. Ecology of water limited systems

Day 5: Ecohydrology and green house gas emission of Amazonian lowland rainforest.
Ecohydrology of montane cloud forests

Web site: <http://www.hydrology.vu/ecohydro/>

International wetlands management

Organisation: Kenya Wildlife Service Training Institute, Kenya

Length: 6 weeks

Target group: Wetland managers

Objectives:

Ramsar Convention endorsed programme and is designed based on the Ramsar Management Guidelines. It provides knowledge and skills necessary in Management of Wetland Sites - both protected and unprotected. It takes participants through the process of developing wetland management plans using bio-diversity data, stakeholders' analysis information, legal/institutional framework and other communication variables. The course consists of a mixture of lectures, workshops, field practicals as well as interactive learning.

Web site: <http://www.kws.org/kwsti-wetlands.html>

Ecosystems Hydrology Intensive Course

Organisation: University of Miami, Universidade de Brasilia

Length: 2 weeks

Target group: University of Miami and Universidad de Brasilia undergraduate and graduate students

Description: An intensive short course in ecosystems hydrology taught jointly between the University of Miami and the Universidade de Brasilia in Brazil. In this course, students spend two weeks working on hands-on field experiments in the Everglades and Cerrado ecosystems, focusing on the following educational components/skill building: familiarity with ecohydrological instrumentation, data acquisition, interpretation of measured results and comparison with model simulations, write-up of technical reports and papers.

Web site: http://www.rsmas.miami.edu/groups/biocomplexity/index_files/page0020.htm

Appendix II: Bibliography of existing materials

Workshops

Regional approaches to reservoir development and management in the La Plata river basin.

Organisation: Universidad Nacional de La Plata, Argentina
Length: 7 days

Target group: The meeting was meant for experts from the five countries of the La Plata River Basin

Objectives:

(i) set the arena for an open and multisectorial debate on sustainable development of reservoirs;
(ii) host foundation activities of the La Plata River Basin Environmental Research and Management Network (RIGA), which is one of the most relevant activities stemming from the recommendations of the previous I and II International Workshops, and in doing so,
(iii) provide continuity and follow up to the previous regional meetings successfully held in 1991 and 1994.

Web site:

http://www.unesco.org/water/wwap/events/4th_la_plata_workshop/pdf/3rd_workshop.pdf

Eco-hydrology and Sustainable Development in Deltas, Estuaries and Lagoons

Organisation: UNESCO Venice
Length: 3 days

Target group: Hydrologists, young researchers, local communities, institutions for scientific research, basins stakeholders and managers, academic institutions, ministries for water resources, agriculture and environment, biosphere reserves

Description: A regional workshop organized in Tulcea (Danube Delta), Romania, dedicated to "Eco-hydrology and Sustainable Development in Deltas, Estuaries and Lagoons". A meeting of the UNESCO Working Group on Estuarine and Coastal Eco-hydrology as a side event of the Workshop was also held. Progress in the application of the ecohydrological Coastal Model in Guadiana Estuary and the Kastelo Bay in Croatia were reviewed. The Workshop was successful in stimulating the Danube Delta Biosphere Reserve authorities and scientists to undertake the experimentation of this model in the Danube Delta.

Web-site: http://portal.unesco.org/en/ev.php-URL_ID=35473&URL_DO=DO_TOPIC&URL_SECTION=201.html

Appendix II: Bibliography of existing materials

Workshop on Eco-hydrological Approaches for Water Management

Organisation: UNESCO – Amman office
Length: 3 days

Target Group: Hydrologist and Watershed Management specialists at the Ministry of Water and Irrigation and Ministry of Environment

Description: This training course aimed to provide participants with a broader, interdisciplinary view on various aspects of Integrated Water Management, with special emphasis on practical use of understanding relationships between hydrology and biota and their use in order to control environment quality. According to the presented approach, for sustainable management of water resources quality and stabilization of hydrological cycle, it is necessary to harmonize technological and ecological measures.

The aims of this course were to:

1. *Present basic theory for ecohydrology and phytotechnology concepts and introduce basic definitions essential for understanding in order to apply ecohydrological and phytotechnological measures.*
2. *Present an overview of methods for assessment of potential issues in watersheds, focusing a reader's attention on possible variations and interpretations of results from the point of view of ecohydrology and phytotechnology.*
3. *Present practical suggestions and recommendations for application of ecohydrology and phytotechnology in IWM.*

Web-site: none available

Ecohydrology in the Arab Region “Perspective and Challenges”

Organisation: UNESCO Office in Cairo
Length: 3 days

Target Group: Managers, decision-makers, consultants, stake-holders

Description: This workshop aimed to assist capacity building of the region to use the concept of ecohydrology as a tool for environmental assessment, monitoring, and management in drylands; and to have information gained to bear influence on decision making processes. The objectives of the workshop were to explore the challenges and opportunities for the promotion of the ecohydrology concept in the region; and to assist in the capacity building of participating institution and individuals to introduce and use advance information system to deal with problems of ecosystem management and planning. In addition, the workshop was to foster the exchange of experiences and strengthen cooperation among participating countries. The workshop was planned to be as interactive as possible with participants strongly encouraged to identify case studies and best practice pertaining to the following themes:

1. Integrated water resources management to achieve a balance between ecosystem needs and human water consumption in drylands region
2. Development of ecohydrology pilot and research area for the Arab region
3. Involvement of the public in the planning/management process.

Web-site: none available

Appendix II: Bibliography of existing materials

Linking Indigenous Knowledge and Modern Science

Organisation: UNESCO office in Namibia

Length: 3 days

Target Group: Ministry representatives, NGOs, community members, local farmers

Description: This workshop was hosted by The Namibia Nature Foundation through the Every River Has Its People project. The main objective of this workshop was to integrate Indigenous Knowledge and Modern/Scientific Knowledge in order to arrive at a holistic approach for Integrated Water and other Natural Resource Management across the Okavango River Basin. Key priority issues identified in the basin were:

- Water resource use and management (water quality and pollution).
- Wildlife management.
- Crop production and management.
- Rangelands and livestock management.
- Fire use and management.
- Fish harvesting and management.
- Forestry products and forestry management.

Web-site: none available

Appendix II: Bibliography of existing materials

Undergraduate courses/activities

University Research Projects at the Desert Research Foundation of Namibia

Organisation: Desert Research Foundation of Namibia

Length: 6-8 weeks

Description:

The Desert Research Foundation (DRFN) of Namibia is an internationally known and respected Namibian research organization, with activities ranging from basic ecological research to community needs assessment, environmental education, and policy formulation. The Foundation's mission is to create further awareness and understanding of dryland environments around the globe, and to develop the capacity, skills, and knowledge to manage them appropriately. The Foundation takes an interdisciplinary approach to this challenge, integrating ecological, economic, and social considerations. DRFN currently has joint undergraduate project opportunities at Grinnell University, Stockholm University and Worcester Polytechnic Institute.

Web site: <http://www.drfn.org.na/volunteer.htm>

Ecohydrology – California State University

Organisation: California State University, USA

Length: Semester

Description: The study of linkages between hydrologic processes and ecosystem functions; field methods for data gathering; hydrologic transport of nutrients and pollutants through ecosystems; case studies of problems in ecohydrology

Lecturer: Professor David Brown

Web site: <http://www.csuchico.edu/sustainablefuture/academicPrograms/nsci/>

Ecohydrology – Texas A&M

Organisation: Texas A&M University, USA

Length: Semester Course

Description: Undergraduate course on Ecohydrology of semi-arid landscapes

Lecturer: Professor Bradford Wilcox

Web site: <http://rangeland.tamu.edu/people/wilcox/RLEM%20689/RLEM%20689.html>

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Ecohydrology – University of New Hampshire

Organisation: University of New Hampshire, USA

Length: Semester

Description: Introduction to eco-hydrological concepts in terrestrial and riverine systems. Topics include the historical practices, resource management impacts, hydrologic variability, and the relationships among water and ecology, vegetation, biology, geomorphology, and water quality.

Lecturer: Professor Jennifer Jacobs

Web site: <http://www.undergradcat.unh.edu/0607/ug-cie-0607.htm>

Ecohydrology – University of Buffalo

Organisation: University of Buffalo, USA

Length: Semester

Description: This course deals with hydrologic and ecological mechanisms underlying climate-soil-vegetation dynamics and land-water dynamics. The evolution of terrestrial ecosystems depends on the need of vegetation for inputs of light, water, and nutrients. These inputs are variable in time and space, and how they are assimilated depends on plant characteristics and ecosystem structure.

Thus, vegetation plays an active role as both cause and effect of the space-time dynamics of soil water and climate. Specific topics will include preferred states in spatial distribution of soil moisture, hydraulic limits to plant water use, ecological optimality, vegetation-hydrology linkages at catchment scales, carbon and nutrient cycling, and vegetation competition.

Lecturer: Professor Scott Mackay

Web site: <http://water.geog.buffalo.edu/mackay/instruction/geo561/index.html>

Ecohydrology Reading Group – New Mexico Institute of Mining and Technology

Organisation: New Mexico IMT, USA

Length: Semester

Description : Discussion of a series of articles and chapters on ecohydrology theory, field studies, and numerical simulations with a focus on semi-arid landscapes. Topics include: Ecohydrology Theory, Ecohydrology Research In Semi-Arid Landscapes, Ecohydrology Modeling and Remote Sensing, Additional Readings or Editorial Commentaries,

Lecturer: Professor Enrique Vivoni

Web-site : <http://www.ees.nmt.edu/vivoni/ecohydro/ecohydrology.html>

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Ecological Engineering

Organisation: Oregon State University
Length: Semester

Description: Ecohydrology would be an elective course under the proposed Ecological Engineering undergraduate program. Topics covered include wetlands, watershed management and riparian restoration.

Lecturer: none – this is a proposed course

Web-site: http://bee.oregonstate.edu/Presentations/EcoEngineering_summary.ppt

Introduction to global environmental systems

Organisation: University of Saskatchewan, Canada
Length: Semester

Description: An introduction to principles, processes and interactions in the earth's physical environment with a particular emphasis on the flow of energy and matter within global systems. Topics include global radiation and energy balances, atmospheric and oceanic processes, the hydrological cycle, earth surface process and biogeochemical cycling. Case studies are introduced to illustrate the interaction between human activity and the natural environment.

Lecturer: Professor Cherie Westbrook

Web-site: <http://homepage.usask.ca/~cjw842/index.htm>

Introduction to the hydrology and running waters ecology

Organisation: University of Vienna, Austria
Length: Semester

Description: The most important hydrologic fundamental ideas and connections are represented, described at sample applications in line with standard usage (e.g. flow measurement, determination of flow, determination of hydraulic stress parameters, discharge-determining forces ua.). Further emphasis is the discussion of the global water circulation and a representation of the most substantial longitudinal zoning models. The lecture obtains a view of the theory of hydrologic procedures and of the practice of important measuring methods of laboratory and open land.

Lecturer: Professor Johan Warringer

Web-site: <http://www.univie.ac.at/fresh/>

Natural Resources Management – University of Belize

Organisation: University of Belize
Length: 3 years

Description: The B.Sc. degree in Natural Resources Management is a multi-disciplinary program

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offering concentrations in Terrestrial/Watershed Resources Management and Marine Resources Management. During their first year in the B.Sc. programme, all students do professional NRM courses in a semester long sequence and choose their specialization stream (in Marine Resources Management or in Terrestrial Resources Management) in their second year in a modular sequence which is offered at an on-going project site. Students attend lectures, conduct field activities, working in lab settings, analyzing data and helping compile the course activities report.

Lecturer: Profs Ed Boles, Leandra Cho-Ricketts, Arlenie Perez, Philip A. Morgan

Web-site: http://www.ub.edu.bz/templeet.php/UB_root/NRM/Degree.en.html

Natural Resources Management – Bunda College of Agriculture

Organisation: University of Malawi
Length: 2 years

Description: unavailable – see website

Web site: <http://www.bunda.unima.mw/depts.htm>

Ecohydrology – Indiana University

Organisation: Indiana University, USA
Length: Semester

Description: This course is a survey of current research topics at the intersection between plant ecology and surface hydrology. We will explore scientific questions related to water movement in plants, the effect of forest management on the hydrological cycle, the dynamics of plant communities in water-limited ecosystems, and the theoretical advancement of approaches for understanding the coupled dynamics of plants, soils, and climates.

Lecturer: Professor Kelly Caylor

Web site: <http://www.indiana.edu/~ecohydro/ecohydro/>

Water Resources – Griffith University

Organisation: Griffith University, Australia
Length: 3 years

Description: This BSc degree will equip students with the skills to provide leadership in finding and implementing solutions to local, regional and national water resource issues. The program provides a foundation across the biological, chemical, physical and social sciences to build an understanding of the whole water cycle, from the catchment to the coast, and from water source to household taps. Local, state and federal government agencies, engineering and environmental consultancies, and a range of industries are all undergoing a rapid expansion in the water area to respond to the growing importance of water as an issue within Australia and internationally. Students will graduate from this program with the knowledge and skills required to meet the growing need for water professionals across a wide range of field, including water resource

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management, aquatic ecosystem conservation and restoration, and monitoring and improving water quality.

Lecturer: Lead Professor Christine Fellows

Web site: http://www17.griffith.edu.au/cis/p_cat/admission.asp?ProgCode=1316&Type=overview

Watershed Ecohydrology

Organisation: McMaster University, Canada

Length: Semester

Description: Offered at the senior undergraduate level, the goal of this course is to improve upon skills necessary for future academic or workplace success. Students will be introduced to the critical reading and interpretation of literature through the use of case-studies to introduce lecture material. These case studies will also provide the opportunity to investigate research design and this skill will be put into practice through hands-on field laboratories. Finally, communication skills will be improved as students are required to discuss literature in class and to present a seminar reviewing a relevant research topic.

Lecturer: Professor James Michael Waddington

Web-site:

<http://www.science.mcmaster.ca/geo/undergraduate/courses/fourthyear/geo4b03/index.html>

Application of Ecohydrology concepts in the Azraq Basin

Organisation: UNESCO Amman and Al-Balqa Applied University

Length: Unknown

Description: Three student research assistants conducted research in application of ecohydrology concepts in the Azraq Basin. The research project focused on the application of eco-hydrology concepts integrated model in light of the ever growing need for water, analysis of supply of groundwater resources in Jordan and bridging the gap between the water supply and demand. This research identified variables relevant to Azraq Basin in order to suggest and recommend actions to demonstrate the use of ecosystem properties as a management tool by using biota to control hydrological processes for Sustainable Management for Water Resource Management. Findings of the research project were used for policy making at the political level. Report published by the IHP National Committee. Awareness on eco-hydrology generated in eco-hydrology at the institutional level.

Web-site: none available

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Graduate level courses/activities

Ecohydrology

Organisation: Universidad Nacional de La Plata, Argentina

Length: 2 Years

Description: Primer año: Introducción a la Hidrometeorología, Ecología de medios acuáticos continentales, Fundamentos de Hidrología de superficie, Fundamentos de Hidrología subterránea

Segundo año: Química ambiental, Hidrología de superficie avanzada, Geohidrología ambiental, Métodos y técnicas de diagnóstico y gestión ambiental

Web-site: <http://www.ing.unlp.edu.ar/ecohidrologia>

Ecohydrology

Organisation: Vrije Universiteit, Denmark

Length: 2 Years

Description: International Hydrology Master's programme offers specializing in ecohydrology. Students will acquire a solid understanding of the complex interactions between climate, soils, vegetation / land cover and hydrological functioning; based on insights into the underlying processes students will be in a better position to make rational decisions on land cover changes, be it as a resource manager, consultant or scientific adviser. As part of their studies they will learn to operate a host of scientific equipment during field practicals and other field-orientated activities that will enable them to quantify hydrological variables and processes. In addition, students will learn to use eco-hydrological models of varying complexity that may be applied to predict the hydrological consequences of land-cover change or climate change.

Web-site: <http://www.hydrology.vu/programme/ecohydrology.html>

Ecohydrology

Organisation: University of Southern Florida, USA

Length: Semester

Description: The objectives of this course are to examine the roles vegetation play in the hydrologic cycle, and to examine the roles hydrological processes play in controlling ecosystem structure and function. In the first part of the course, they follow water from atmospheric vapor, to condensation and rainfall, to surface water and groundwater flow, to plant uptake and flow through plant tissues, and to flow back to the atmosphere via evapotranspiration. In the second part of the course, they explore the biogeochemistry of submerged soils; biological adaptations to life in submerged soils; gradient analysis and catenas; the special ecohydrological case of rivers; and the effects of vegetation change on hydrological processes.

Lecturer: Professor Mark Cable Rains

Web-site <http://shell.cas.usf.edu/%7Emrains/ecohydrology.html>

Appendix II: Bibliography of existing materials

Environmental Engineering and Water Resources (EEWR)

Organisation: Princeton University, USA

Length: 3-6 years

Description: The goal of the EEWR program is to train outstanding engineers and scientists and to conduct advanced research in areas that are vital to national and international needs in the areas of environmental engineering and water resources. Because environmental problems are by nature interdisciplinary, the EEWR program includes strong interactions between faculty from a number of engineering and science departments and programs, including the Princeton Environmental Institute (PEI), Geosciences, Chemical Engineering, Chemistry, Ecology and Evolutionary Biology, Atmospheric and Oceanic Sciences, the Woodrow Wilson School, and affiliated faculty from NOAA's Geophysical Fluid Dynamics Laboratory. Research within the EEWR program focuses on environmental problems in areas such as groundwater contamination and remediation, ecohydrology, land surface - atmosphere interactions including energy and moisture fluxes and their relationship to large-scale climate modeling, remote sensing of environmental variables such as soil moisture and rainfall intensity, the urban environment and biogeochemistry of contaminated waters. To provide the sound background necessary for conducting significant research and carrying out applications in the area of environmental engineering and water resources, advanced analytical, numerical, and statistical methods are combined with elements of environmental fluid mechanics, geochemistry, hydroclimatology, hydrogeology, hydrology, and water quality.

Web-site http://cee.princeton.edu/Information/e71/environmental_engine.html

Graduate students involved in demo site project

Organisation: University of Vienna, Austria

Length: 2-6 years

Description: The department of Limnology and hydro-botany concentrates its research on the functional aspects of the ecological integrity of river-floodplain systems, on both aut- and synecological aspects with regard to life history strategies, feeding ecology, bioenergetics and taxonomy, and on the significance of microbial processes for material and energy fluxes. In addition, stream ecology (hydraulic stress, biofilm, hyporheos, carbon flux) and the development of restoration and conservation concepts for large rivers are a main field of work. The Department also covers research in tropical lakes and reservoirs, esp. on the role of fishes in ecosystem processes and on the significance of limnology for local socioeconomics. Graduate research projects also include work with the Danube River, Labau Floodplain demonstration project.

Web-site <http://www.univie.ac.at/IECB/hydrobotanik/>

Graduate students involved in demo site project

Organisation: Max-Planck Institute for Limnology, Germany

Length: 2-6 years

Description: In the frame of the IHP the working group Tropical Ecology of the Institute Max-

Appendix II: Bibliography of existing materials

Planck for Limnology performs studies in scientific cooperation with the National Institute for Amazon Research (INPA) (link: <http://www.inpa.gov.br/>) and the Mamirauá Institute for Sustainable Development (IDSM) (link: <http://www.mamiraua.org.br>). The main objective of this project is the elaboration of scientific databases on growth and regeneration patterns of commercial tree species for the development of sustainable management plans for timber resources to maintain the multiple ecosystem services and as an economic alternative for the local population in the Mamirauá Sustainable Development Reserve (MSDR) and other várzea regions in Central Amazonia.

Lecturer: Prof. Dr. Wolfgang Johannes Junk

Web-site: <http://www.mpil-ploen.mpg.de/mpiltdim.html>

Hydrodynamique et modelisation des environnements

Organisation: Ecole National d'Ingeniers de Tunis, Tunisia

Length: 3 years

Description: The objective of the Masters of Modeling in Hydraulics and Environment (MHE) is to initiate and train the students/researchers with the methods of identification, analysis, forecast and control, primarily by mathematical modeling, of the problems related to the cycle of water and its associated flows.

Web-site <http://www.enit.rnu.tn/fr/formation/masteremhe.php>

Hydrology and Water Resources programme

Organisation: UNESCO-IHE, The Netherlands

Length: 18 months

Description:

Hydrology and Water Resources programme is a specialisation module within the International Master programme in Water Science and Engineering

The specialisation modules deal with the following subjects:

- Hydrogeology enables participants to describe groundwater systems, qualitatively and quantitatively, building on their basic knowledge of the hydrological cycle and of earth science.
- Hydrology deals with the processes of land-surface and near-surface hydrology relating to evapotranspiration, soil water movement, stream flow dynamics and their interaction with groundwater.
- Water quality covers the basic chemical principles and reactions that play a role in the determination and evolution of water quality, and the various subsurface systems that transport contaminants.
- Data analysis systems deal with the processing of spatial hydrological data and with statistical data analysis, including the use of current data software, and with the ability to judge and evaluate hydrological data processing methods.

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- Tracer hydrology and flow systems analysis presents methods of analysing and assessing hydrological flow systems, with special attention to hydro-chemical and tracer hydrological approaches.

Web-site http://www.unesco-ihe.org/education/sp_hwr.htm

Interdisciplinary Course: Water Management in the Middle East

Organisation: The Arava Institute for Environmental Studies

Length: Semester

Description: This course will introduce the major issues of water management in the Middle East. Water scarcity is a reality in the Middle East and thus it is critical to explore the ways and means of sustainably managing this resource. The course will concentrate on specific case studies that illustrate the multifaceted reality of water resource management in the region. The goal of this course is to provide an interdisciplinary approach toward water management. The course includes field study trips and invited guest speakers that represent the broad spectrum of issues and professionals working in the field of water management and conservation. Field study trips to the Jordan River Watershed and the Mediterranean coastal region highlight issues ranging from recharge areas to control of urban pollution, distribution and collection systems in a region of scarcity. A group student project on community water consumption and management in the Arava will be carried out during the semester. The goal of the project is to highlight the importance of investigating how people use water and how this information can be used in management decisions on the sustainable use of water.

Lecturer: Dr Lior Asaf and Dr Clive Lipchin

Web-site

http://www.arava.org/new/academics/year_semester_program/overall_course_catalogue/interdisciplinary_course_water_management_in_the_middle_east

Sustainable Water Resource Management

Organisation: University of Leicester, UK

Length: Semester

Description: This masters level course provides scientific perspectives on water science, particularly hydrological, geomorphological and ecological. Evaluates conflicting human uses of water in the context of its maintenance as a sustainable resource

Lecturer: Professor David Harper

Web-site http://www.le.ac.uk/geography/postgraduate/msc_smnr.html

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Water Science Policy and Management

Organisation: Oxford University

Length: 1 year

Description: This masters degree programme develops knowledge and critical understanding in surface and groundwater science in temperate, tropical and semi-arid zones. It emphasizes physical, chemical and biological interactions throughout the hydrological cycle, and the role of society in altering the "natural" hydrological processes and function. It introduces the science behind both high- and low-technology engineering solutions to water supply and sanitation problems

Web-site

http://www.ouce.ox.ac.uk/~mnew/mscwspm/handbook/WSPM_Handbook_2006.pdf

Appendix II: Bibliography of existing materials

Guidelines and Training

Application of Integrated Water Resources

Organisation: UN-ESCWA

Target group: Water managers

Date: 2001

Availability: On-line (worldwide)

Description: For the Training of Trainers on the Application of IWRM Guidelines in the Arab Region, that was held in Kuwait on 14-18 May 2005, a number of interesting modules were developed. Sixteen modules are available on-line covering IWRM and social equity: poverty, participation and gender

Module 1: Concepts in IWRM

Module 2: Enabling environment and institutional roles

Module 3: Legislative and organisational frameworks

Module 4: Stakeholders and conflict resolution in IWRM

Module 5: Economic dimensions of IWRM

Module 6: Water supply, sanitation and health within IWRM consideration

Module 7: Environment and IWRM

Module 8: Balancing water supply and demand

Module 9: Water demands: modelling and management

Module 10: Valuing water resources

Module 11: Private sector participation in water management

Module 12: Groundwater and IWRM

Module 13: Agriculture and IWRM

Module 14: Management of shared water resources in the region

Module 15: Capacity building issues and needs in IWRM at the national and regional levels in the region

Module 16: Status and progress in IWRM implementation at the national level in the region

Web-site: http://www.cap-net.org/captrainingmaterialsearchdetail.php?TM_ID=154

Ecosystems and Water

Organisation: Swiss Centre of Hydrogeology

Target group: Water managers, teachers, decision makers

Date:

Availability: On-line (worldwide)

Description: The objectives are to present ecosystem considerations, appreciate their relevance to IWRM and provide examples of the approach being used to include ecosystem considerations.

Including ecosystem considerations in effective water management practices is both necessary and important to sustainable development and human wellbeing. Societal modifications to the

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landscape have impacts many of which we are only now being realized as severe and permanently adverse. How to integrate the ecosystem, water and land management practices remain a large challenge. Included on-line is a session plan for 90 minutes (50KB) a topic synthesis (250KB) and a powerpoint presentation (1MB). 1.

4. Suggest how to understand and address them.

Web-site: http://www.cap-net.org/captrainingmaterialesearchdetail.php?TM_ID=38

Integrated Water Resources Management on a basin level

Organisation: UNESCO

Target group: Trainers and Water managers

Date: 2003

Availability: on-line (worldwide)

Description: This manual is an introduction to the principles underlying the integrated water resources management concept: the focus will be on the approaches and management tools that facilitate its application, taking into account the size of the territory, whether it be national and international basins or sub-basins of local interest. Part One of the manual will introduce the basic concepts related to integrated water resources management on a basin level. Part Two of the manual is definitely training oriented. It will lead the reader and the trainer through the different steps of the proposed river basin management framework. The suggested formula is a two-week seminar that has already been applied six times in national and international river basins in Africa and Southeast Asia.

Web-site: <http://unesdoc.unesco.org/images/0013/001319/131933e.pdf>

Integrated Watershed Management – Ecohydrology and Phytotechnology

Organisation: UNEP – IETC

Target group: Water Managers and Decision makers

Date: 2004

Availability: on-line (worldwide)

Description: The present manual focuses on the methodology and practical aspects of implementing Ecohydrology and Phytotechnology concepts for integrated watershed management. It serves as a complement to the Guidelines for the Integrated Management of the Watershed, published in 2002 by UNEP-IETC and UNESCO-IHP. The guidelines present, for the first time, the general philosophy of Ecohydrology and Phytotechnology

Web-site:

http://www.unep.or.jp/ietc/Publications/Water_Sanitation/integrated_watershed_mgmt_manual/index.asp

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Introduction to Integrated Water Resources

Organisation: World Bank Institute

Target group: Water Managers, decision makers, trainees

Date:

Availability: On-line (worldwide)

Description: Introductory session of 1.5 hours to the importance of water resources management. Includes session plan (40KB); topic synthesis (40KB) and powerpoint presentation (700KB). Objectives are to define integrated water resources management within the broader context of development, appreciate the complexity of the IWRM process and examine the key elements of the IWRM process insights.

Web-site: http://www.cap-net.org/captrainingmaterialesearchdetail.php?TM_ID=33

Training and educational programmes for wetlands: conservation and sustainable use

Organisation: UNESCO office in Moscow

Target group: universities, students, NGOs, environmental groups, hydrologists, private sector, children and young people, educators, scientific community, environmental managers, media professionals, local researchers, trainers, decision makers and basins stakeholders and managers, policy makers in environmental protection and management, biosphere reserve managers

Date: On-going development

Availability: National, with global applications

Description: This project aims to foster better awareness and valuation of biodiversity resources of Lower Volga water and wetlands ecosystems and, improve understanding of the principles of sustainable development amongst local authorities and communities. Within this component, three major objectives were defined, namely:

Objective 1: to popularize widely the value of the Lower Volga water and wetlands ecosystems to different target groups. Activities would include development of action plans, training modules and methodological materials, including ecological games scenarios, for teachers.

Objective 2: to make local authorities pay attention to the environmental problems of water and wetlands ecosystems and to contribute to the sustainable development of the area. Activities would include training for decision-makers on work with the Ramsar convention on wetlands management including an eco-hydrological approach.

Objective 3: to produce education/awareness materials and establish effective dissemination mechanisms. Activities would include the creation of a series of environmental education booklets for schoolchildren, teachers and tourists.

Web-site: <http://www.unesco.ru/eng/pages/bythemes/serhio27092005142438.php>

Appendix II: Bibliography of existing materials

Videos

Mara - Africa's river of destiny

Description: The river Mara in East Africa runs through two of Africa's most important nature reserves: Masai Mara in Kenya and Serengeti National Park in Tanzania. Home to Africa's finest wildlife. Along the Mara the biggest wild herds of the world can be observed, and the river plays a crucial role in the famous migration of the wildebeest. When the animals cross the river, hungry crocodiles already lie in wait for them. The images of the crossing are breathtaking and world-famous. But few people are familiar with the rest of the Mara- its spring high up in the Mau mountains or the huge and impenetrable wilderness of the Masarua swamps in Tanzania or the delta where the Mara flows into lake Victoria --- fascinating habitats that are home to a multitude of rare animals.

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