

Status of "Wetland ecology" education and research at the Department of Environmental Science, Institute of Agriculture and Animal Science of the Tribhuvan University, Nepal

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Introduction

Wetlands are considered as the most productive ecosystems and cradles of biodiversity harboring a wide variety of flora and fauna. They maintain and provide a variety of environmental services to the human beings including fish and wildlife habitats, flood protection, erosion control and water quality maintenance (Tiner, 1989). Despite their value, wetlands have suffered from widespread destruction due to misuses and abuses (CP, 2005). Wetlands are threatened by population growth, increased exploitation of biological resources, timber harvest, pollution of various forms, development activities and other forms of mismanagement (Kerr *et al.*, 2002). So, wetlands need to be preserved and utilized wisely for the livelihood enhancement. To implement this task, countries need a sufficient number of experts and technical staff who are qualified and enthusiastic to work in the field of wetland conservation. So, the role of universities become crucial to launch academic programs for producing man power that can understand wetland ecology and their services and influence and make policy for wetland conservation and management. Because of their widespread distribution and biological, chemical, and physical complexity, wetlands are excellent "living laboratories" for teaching (Baldwin, 2007).

Wetland education is not only important for students of environmental science but equally important for the students studying agriculture and other applied natural and social sciences focusing on the concepts of biodiversity and interrelatedness using comparative study of chemical, physical, social and biological aspects (Wetland International, 2006). Like in developed and underdeveloped countries, Nepal has also introduced environmental education in school, college and university systems as a subject or a separate program. Besides academic programs, there are many examples of informal or non-formal education that played a vital role to educate the people in large. In this regard, the Enviro-edu Entertainment (Wetlands Quizzes and Wetlands Tambola) is the one that helped educate the society on environment and wetland issues (Suri, 2008). It is proved that the more the public is aware of the facts about wetlands and their vital role in the ecosystem, the more wetland preservation and restoration can be done. Raising awareness about the importance of wetlands and understanding the unique role and function of wetlands will assist in the protection, conservation and sustainable management of wetlands. One of the other requirements is to provide a unique learning experience that is interesting, interactive, and fun.

Wetland science emerged as a distinct discipline in the 1980s and in order to provide confirmation of the quality of education and experience of persons involved in regulatory, management, restoration/construction, and research involving wetland resources the professional certification began at mid 1900s (Wilcox, 2007). Tribhuvan University is the pioneer university in Nepal that is offering Bachelor, Masters, M. Phil. and Ph.D. programs in many disciplines including environmental science. This university is offering Master Degree in Biodiversity and Environmental Management at the Central Department of Botany, Kirtipur and Master of Science in Agriculture majoring Conservation Ecology at the Institute of Agriculture and Anima Science (IAAS), Rampur. M.Sc. Ag in Conservation Ecology offers Wetland Ecology course. IAAS needs teaching resources, qualified teachers and facilities for research to generate knowledge to utilize for teaching this course. It is therefore attempted to know the status of education and research in wetlands at the IAAS. Specifically, this papers highlights on the learning approaches, term papers submitted by the students, research project conducted and papers published by the faculty members of the Department of Environmental Science at IAAS.

Methodology

This study was based on a number of documents such as term papers, research reports, proceeding papers, scientific articles, abstract, field visit reports collected from the faculties and students Department of Environmental Science of IAAS. Students enrolled in “wetland ecology” were also surveyed to know their opinion on the course syllabus, existing teaching approaches, field visits, reading resources, list of the books to be purchased, limitation of teaching and research, and suggestions/feedback for improvement to improve wetland education and research.

Results and Discussion

Wetland Ecology course syllabus

IAAS has introduced a course "Wetland Ecology" with course Code COE 706 and 2+0 credit hours (Box 1). This course has 5 units that help students learn concepts and types of wetland to wetland conservation and management. In order to make it relevant and comprehensive in Nepalese context, it should be revised consulting with different stakeholders and wetland experts.

<p>Box 1. Course details of wetland ecology course code COE 706; Cr hr 2+0</p> <ul style="list-style-type: none"> • Concepts, scope and types of wetlands. • Origin, feature, biology, geochemistry, physics, values, functions and productivity of wetlands. • Limnology, river systems, hydro-development, water pollution and eutrophication. • Wetland flora, fauna, and agriculture in Nepal and south Asia. • Conservation and management of wetlands: World conventions on wetlands, legal aspects of wetland conservation, institutions and capability in wetland management; Awareness and community involvement in wetland management.
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Teaching and learning approaches

Lecture methods

Instructors use lecture as the principal method of teaching “wetland ecology” at IAAS, Rampur. As this course syllabus is new to IAAS, course-in-charge uses books and reports mostly published by IUCN and ICIMOD. To complete this course, students have to identify thematic

area/topic for writing their term papers with the help of course-in-charge. They also have to present their term papers in the given time and also take written examination. The term papers and their exam carry out 50 marks, 25 for each part.

Term Papers

The term paper is a library research paper on a topic approved by the instructor. It presents students' analysis and interpretation of the data and ideas found in a survey of the literature relevant to the topic of the term paper. Thus, the purpose of writing term papers is to develop ability to organize ideas effectively and express them clearly. Till date twenty-seven term papers are written by the students who are enrolled in the course Wetland Ecology (Fig. 1). It is clear from the table that this course is preferred by the students of Conservation Ecology (22 students), Aquaculture (2 students), Agronomy (2 students) and Plant Pathology (1 student). The topics of term papers submitted by the different batches were repeated (Appendix 1). All the term papers and PowerPoints were compiled for the teaching purpose.

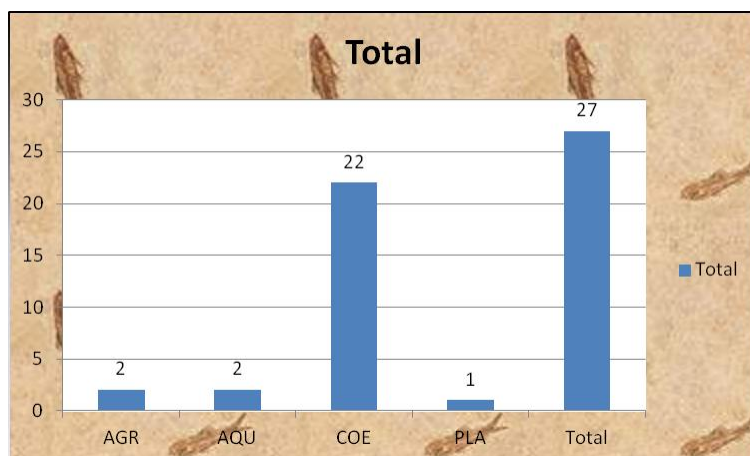


Figure 1. Total number of term papers submitted by the students of AGR (agronomy), AQU (Aquaculture), COE (Conservation Ecology), and PLA (Plant pathology) disciplines.

Field Visits

Field visits or trips are important to enrich knowledge and develop ability to think critically. Research has shown that field trips/visits can be remembered long after a visit (Falk and Dierking, 1997; Wolins, 1992), can influence career choice (Salmi, 2003; Cosmos Corporation, 1998), can increase interest and engagement in science regardless of prior interest in a topic (Bonderup Dohan, 2011) and result in affective gains such as more positive feelings towards a topic (Csikszentmihalyi and Hermanson, 1995). Their importance is supported by professional organizations such as National Science Teachers Association which asserts field trips can "deepen and enhance" classroom study (NSTA, 1999) and National Research Council who assert a quality science curriculum in one that extends beyond the walls of the classroom (National Research Council, 1996). The course-in-charge organizes field visits to different wetlands to observe wetland flora and fauna and to understand conservation and management practices of the same. An educational tour was organized on 6-7 November 2011 for faculties and students to

learn about community biodiversity management principles and practices in Kaski district of Nepal. In this tour, faculties and students got opportunity to visit Rupatal and discussed with the cooperatives of Rupatal Reconstruction and Fisheries Cooperative Limited about wetland conservation and management and learned on the spot about the conservation approaches and benefit sharing and local fishes, floras and birds conserved in that area.

Thesis Research

To build research capacity of master degree students, UGC supported Rampur Ghol Project has provision of supporting research grant to four students. Two students from IAAS (Radha Gurung and Rajesh Nepal) and one each from Central Department of Environmental Science (Birendra Gautam) and Golden Gate International College (Bam Bahadur Oli) were awarded research grants. Another student from IAAS (Subodh Khanal) got research grant from LIBIRD, Pokhara to study the impact of climate change on ecosystem services of Beeshazar Lake and associated wetland area of Chitwan, Nepal.

Student's Publication

Utsala Shrestha of the Department of Environmental Science of IAAS wrote a term paper entitled "Community participation in wetland conservation" and published it in the Journal of Agriculture and Environment, a journal published by the Ministry of Agriculture and Cooperatives, Singh Durbar, Kathmandu (Shrestha, 2011). Although this is only one example, it has paved a way to other students giving very good message to write and publish papers based on their term papers. Two students of batch 2011-2012 are writing review papers based on their term papers.



Figure 2. A discussion with board members of Rupatal Reconstruction and Fisheries Cooperative Limited during field visit.



Figure 3. Chief warden of Chitwan National Park presenting paper in Wetland Education Seminar 2012.

Seminars on Wetlands

IAAS and Small Earth Nepal jointly organized a Wetland Day Seminar on February 2, 2010 at NMDP/NARC Rampur. Two papers, one each by a faculty and a student, were presented on wetland education at IAAS. All the faculties and students of the Department of Environmental Science (IAAS) had participated in the event. After two years, Wetland Education Seminar was organized on August 31, 2012 at the PG Seminar Hall, IAAS, Rampur and 6 students of the same department and Jhamak Bahadur Karki, Chief Warden of Chitwan National Park presented

their papers. This seminar created opportunity to learn from Chief Warden who was responsible to wetland studies and policy formulation. Chief warden also expressed the importance of seminar to share new knowledge and development in the wetland science in Nepal (Figs 2 & 3).

Writing Workshop

A workshop was organized from 15-17 Baisakh 2070 to train postgraduate students, young faculties and researchers of different organizations. Participants were asked to write papers based on their term papers or field research and to submit their papers in the format of the Journal of Wetlands Ecology. Students and young researchers submitted their manuscripts and discussed during workshop. Two post-graduate students and two faculties of the Department of Environmental Science of IAAS also participated in the workshop. This type of writing workshop was very important to build capacity in technical writing. The student and young researchers expressed their commitment of completion of their manuscripts for publication.

Research Projects conducted by Faculties

Compared to aquaculture research, researches on wetland flora and ecology are less. A couple of research projects on wetland or its related areas have been conducted by the faculties of the Department of Environmental Science/IAAS (Table 1).

Table 1. List of the projects on wetlands or related areas conducted by the faculties of Department of Environmental Science, IAAS, Rampur, Chitwan.

SN	Project titles	Researchers	Project duration	Funded by
1	Wetland Study Project	PI: D. R. Dangol	Ongoing	UGC
2	Baseline Study of Rampur Ghol	PI: D. R. Dangol	2010	IHP/UNESCO
3	Weeds of Nepal project	Prof. Dr. W. Holzner, D. R. Dangol	1995-1997	Oesterreichische Akademie der Wissenschaften, Wien, Austria
4	Aquatic plant resources of Beesh Hazar Tal area, Tikauli Forest, Chitwan	D. R. Dangol	1996	IUCN-Nepal
5	Inventory of wetlands of Terai in Nepal	B. B. Bhandari (ed.)	1996	IUCN-Nepal
6	Study of Ghodaghodi tal	S. B. Gurung	1996	IUCN-Nepal
7	Beeshhazar tal ethnobotany	S. B. Gurung	1996	IUCN-Nepal
8	Studies on plant communities of natural & man-engineered ecosystems in the Chitwan valley, Nepal	D. R. Dangol, S. B. Gurung & A. Bhandary	1993-1994	NEMP-IUCN, Nepal
9	Study of rice field weeds of Bara district, Nepal	D. R. Dangol & I. Bhattarai	1989-1990	IAAS Research Committee
10	Preliminary survey of major field weeds & farmer's weed management practices in Chitwan, Nepal	D. R. Dangol & S. B. Gurung	1987-1988	RONAST
11	Survey of weeds in crop area in Rampur & its vicinity, Chitwan, Nepal	D. R. Dangol, S. B. Gurung, I. Bhattarai, & N. K. Chaudhary	1986-1987	IAAS Research Committee
12	Survey of flora of IAAS, Rampur, Chitwan, Nepal	D. R. Dangol, S. B. Gurung, I Bhattarai, & A. K. Srivastava	1985-1986	IAAS Research Committee

Most of the research projects were conducted before the design and implementation of the course "Wetland Ecology". Recently, one research project was completed and generated basic information on water, vegetation, etc (SEN, 2010). To generate more data, another project was launched in November 2011 with the support from University Grant Commission to investigate biological diversity, limnological information and socio-economic data on Rampur Ghol of Chitwan district, Nepal.

Publications

Faculties were involved in projects on wetland research and reported their research findings in the form of reports and research papers in the proceedings and journals (Table 2).

Table 2. List of reports, journal articles and proceeding papers published by the faculties of the Department of Environmental Science, IAAS, Chitwan, Nepal.

Type & titles of publications	Authors
Reports	
• 1997. "A report on the "Weeds of Nepal Project". Submitted to Kommission fuer Entwicklungsfragen, Oesterreichische Akademie der Wissenschaften, Wien, Austria (September, 1997). 157 p.	Dangol, D.R.
• 1996. "Aquatic resources of Beeshazar Tal of Chitwan". A report submitted to IUCN- Nepal.	Dangol, D.R.
• 1995. "Studies on plant communities of natural and man-engineered ecosystems in the Chitwan valley, Nepal". Pp. 116-162. A final report submitted to NEMP-IUCN, Nepal.	Dangol, D.R., S.B. Gurung & A. Bhandary.
• 1993. "Study on the weeds of Terai rice fields in Nepal". Pp 94-100. In: F. P. Neupane (ed.), <i>IAAS Research Reports</i> (1985-1991), Inst. Agric. Anim. Sci., Rampur, Chitwan.	Dangol, D.R. & I.D. Bhattarai.
• 1993. "Survey of weeds in crop area in Rampur and its vicinity, Chitwan, Nepal". Pp. 9-17. In: F. P. Neupane (ed.), <i>IAAS Research Reports</i> (1985-1991), Inst. Agric. Anim. Sci., Rampur, Chitwan, Nepal.	Dangol, D.R., S.B. Gurung, I. Bhattarai & N.K. Chaudhary.
• 1986. "Survey of flora of IAAS, Rampur, Chitwan, Nepal". Submitted to the Research Committee, IAAS, Rampur.	Dangol, D.R., S.B. Gurung, I. Bhattarai & A.K. Srivastava
Proceeding papers	
• 2000. "Preliminary study on plant communities of forest ecosystems in Chitwan, central Nepal". pp. 1571-1578. <i>3rd Natn. Conf.Sci.&Techn., Proc. Vol II</i> , March 8-11, 1999, NAST, Kathmandu, Nepal.	Gurung, S.B., D.R. Dangol & A. Bhandary
Journal/newsletters papers	
• 2010. "Species composition, dominance, richness, life form and local uses of rice field weeds in the Chitwan valley, Nepal". <i>Nepalese Journal of Agricultural Sciences</i> 10: 152-164.	Dangol, D.R.
• 2000-2001. "Aquatic plant resources and their uses: observation from Beeshazar Lake, Chitwan". <i>J. Inst.Agric. & Animal Sci.</i> 21-22: 119-133.	Dangol, D.R.
• 1998-1999. "An inventory of plant biodiversity of Rampur, Chitwan, Nepal". <i>Journal of Institute of Agriculture and Animal Science.</i> 19-20:27-40.	Dangol, D.R.
• 1991. "Ricefield weeds in Chitwan valley, Nepal". <i>IRRN</i> 16(3):27-28.	Dangol, D.R.
• 1991. "Transplanted rice field weeds in Gorkha district, Nepal". <i>Geobios new Report.</i> 10:179-182.	Dangol, D.R.
• 1991. "Enumeration of weeds of ricefields of Bara district, Nepal". <i>Newsletter of Himalayan Botany.</i> 11:9-15.	Dangol, D.R. & I. Bhattarai.
• 1986. "Lowland rice weeds at the agronomy farm of IAAS, Rampur, Chitwan, Nepal". <i>J. Inst. Agric. & Animal Sci.</i> 7:1-11.	Dangol, D.R., S.B. Gurung & I. Bhattarai.

They submitted 7 reports to the donors, published one paper in the proceedings and 7 papers in journals/newsletters. These publications are important assets for teaching units (such as plant communities of wetland agriculture and resource utilization of wetlands) of the course of Wetland Ecology in IAAS. These documents should be made available to the course-in-charge to teach wetland.

Appendix 1. Title of term papers written by students with year of submission

SN	Title of term papers	Students	Batch	Submission
1	Wetlands: An overview in Nepalese context	Archana Karna	R-2005-COE	Nov 2006
2	River systems in Nepal	Pramod Rijal	R-2006-AQU	Nov 2007
3	Wetland fauna of Nepal	Ravi Lal Sharma	R-2006-AQU	Nov 2007
4	Wetland agriculture in Nepal	Nima Acharya	R-2007-COE	Nov 2007
5	Community participation in wetland conservation	Utsala Shrestha	R-2007-COE	Nov 2007
6	Wetland management	Kabita Kharel	R-2007-COE	Nov 2007
7	Water pollution	Gitendra Sapkota	R-2007-COE	Nov 2007
8	Wetland education and public awareness	Ananta Subedi	R-2007-COE	Nov 2007
9	Wetland flora of Nepal	Ananda Katwal	R-2007-COE	Nov 2007
10	Types of wetlands and their ecosystems in Nepal	Bhimsen Chaulagain	R-2009-COE	June 2010
11	Wetland status and threats in Nepalese threats	Drona Budhathoki	R-2009-COE	June 2010
12	Importance and uses of wetlands in Nepal	Bhim Chaulagain	R-2009-PLP	June 2010
13	Wetland conservation and management: A case study of Ghodaghodi lake	Krishna Dhital	R-2009-AGR	June 2010
14	Wetland flora and their density	Madhav Dhakal	R-2009-AGR	June 2010
15	Pollution in relation to wetland degradation of Nepal	Subodh Khanal	R-2011-COE	July 2011
16	Conservation and management of wetlands	Rajesh Nepal	R-2011-COE	July 2011
17	Watershed management and wetlands conservation in Nepal	Madhavi Parajuli	R-2011-COE	July 2011
18	Wetland education: Need, scope and ways	Sunil Dhungana	R-2011-COE	July 2011
19	Agriculture and wetland interrelation	Manasarobar Bhattarai	R-2011-COE	July 2011
20	Wetlands of Nepal, their threats and management	Kiran Maskey	R-2010-COE	Feb 2012
21	Wetland resources and their sustainable management	Radha Gurung	R-2010-COE	Feb 2012
22	Concept, origin, feature, biology, geochemistry, and physics of wetlands	Pratima Poudel	R-2012-COE	August 2012
23	Wetland flora of South Asia	Pushpanjali Rimal	R-2012-COE	August 2012
24	Productivity of wetlands	Daya Muni Brajacharya	R-2012-COE	August 2012
25	Institutions and their capability in wetland conservation and management	Khem Prasad Oli	R-2012-COE	September 2012
26	Wetland fauna of South Asia	Uttam Sharma	R-2012-COE	September 2012
27	Wetland agriculture of South Asia	Pratima Poudel	R-2012-COE	September 2012

Faculty and Students' Opinions on Wetland Education and Research IAAS needs to draw its attention on various educational and research activities:

- Prepare and publish national database on wetland literature
- Organize joint events (seminars, symposium, conferences, and workshop) on wetland to provide forum for sharing teaching experiences and research findings of wetlands.
- Organize guest lectures, seminars, field visits for students and teachers in wetland.

- Develop educational materials on wetland ecology.
- Revise course curriculum to update the content of the course
- Build capacity of faculties and students on teaching and research of wetland science.
- Develop collaborative research proposals on wetland to raise research fund
- Establish and strengthen links, network and partnerships for collaboration and cooperation to advance wetland education and research.
- Create opportunities for faculties and students to share educational experiences and research findings in seminars, workshops and symposiums on wetlands with scientific communities.
- Write and publish scientific papers and prepare database on wetland to share research findings with the different stakeholders.
- Establish Center for Wetland Research to conduct research on wetland science in Nepal.

Conclusions

Teaching “Wetland Ecology” has developed human resources and educational materials. Research based teaching wetland science is effective to generate qualified human resources. The research projects add value and quality to wetland education and help to enhance participation of faculty, staff and students in wetland learning. We recommend research-based education system to bring excellence in academia.

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