

KATHMANDU UNIVERSITY

**RESEARCH THRUST AREAS IN:
GROUND WATER RESOURCE MANAGEMENT**

Dr. Sanjay Nath Khanal, Head, DESE

Dr. V. Krishna Murthy, Chair Professor

Department of Environmental Science and Engineering

KATHMANDU UNIVERSITY, Dhulikhel, Nepal. <http://www.ku.edu.np>

Meeting on Nov. 8th, 2005.

**GROUNDWATER GOVERNANCE IN ASIA – CAPACITY BUILDING THROUGH RESEARCH
IN THE INDOGANGETIC AND YELLOW RIVE BASIN**

ACADEMIC PROGRAMS

- **Ph.D. in Environmental Science**
- **M. Sc. in Environmental Science**
- **M. S. by Research in Environmental Science**
- **B. Sc. Environmental Science**
- **B. Tech. In Environmental Engineering**
[From 2005]

ACADEMIC COLLABORATION

- **HMG- Ministry of Environment, Science & Technology; Dept. of Hydrology & Meteorology**
- **N.G.O.s & I.N.G.O.s (WWF, ICIMOD, IUCN, Filters for Families)**
- **Foreign Universities:
USA, Austria, Norway, Germany, China, Japan,
India.**

Research and Development

Besides intra-mural projects and U.G. & P.G. student research projects, the department is currently running more than 10 funded research projects (extra-mural)

Departmental Facilities

- **Environmental Science Laboratory**
- **Microbiology Laboratory**
- **Disaster Management and Sustainable Development Center**
- **Mechanical Engineering Laboratory**
- **Waste Water Treatment Plant**
- **Environmental Meteorological Stations**
- **Central Instrumentation Laboratory**

Departmental Facilities

AQUATIC ECOLOGY CENTRE

- **Equipped to conduct Water Resource, Aquatic Ecology, Research Studies**
- **Sophisticated Instruments:
AAS, GC, HPLC, Flame Photometer,
Spectrophotometer & range of water / soil
sampling & analytical devices**

Departmental Facilities

HUMAN RESOURCE: FACULTY

- **5 faculties with Ph.D.; 7 with M.Sc. degree**
- **Expatriates :**
 - 3 foreign faculty members; visiting and carrying out teaching and research**
 - 4 national visiting faculties – teaching and research & faculties from other departments**

GROUNDWATER GOVERNANCE IN ASIA – CAPACITY
BUILDING THROUGH RESEARCH IN THE INDOGANGETIC
AND YELLOW RIVE BASIN – PROJECT

KU Participation

GROUNDWATER GOVERNANCE IN ASIA – CAPACITY BUILDING THROUGH RESEARCH IN THE INDOGANGETIC AND YELLOW RIVE BASIN - PROJECT

KU PARTICIPATION – RESOURCE AND STRTENGTHS:

- **CURRICULUM DEVELOPMENT**
- **TRAINING**
- **RESEARCH**

KU

CURRICULUM DEVELOPMENT

**KU has in-house capacity for the
CURRICULUM DEVELOPMENT**

CURRICULUM DEVELOPMENT PROCESS IN KU

- **Need analysis – for contextual, market relevance**
- **Meta-analysis – compilation of similar content, pedagogy, credit equivalence**
- **Draft curriculum frame work development**
- **Subject expert interaction- Brainstorming**
- **Subject Committee Meeting – for value addition and formal approval (internal, external subject experts)**
- **Academic Council -Ratification**
- **Curricula for all the courses in KU as of now has been designed by in-house resource**

**Ample scope for Continuous improvement
and upgrading, merging, deletions and
introduction of new courses**

CURRICULUM DEVELOPMENT

**Water Resource Related curriculum in
M.Sc., B.Sc., & B.Tech. levels**

M.Sc.

MESE 517: Principles of water resource management

MESC 502: Natural resource conservation & development

MESN 604: Advances in Aquatic Ecology

MESC 509: Environmental Pollution Science

MESP 601: Pollution monitoring and analytical techniques

MESP 603: Environmental Epidemiology

CURRICULUM DEVELOPMENT

**Water Resource Related curriculum in
M.Sc., B.Sc., & B.Tech. levels**

B.Sc. & B.Tech (Env. Engg.)

- ENVS 207: Natural resources management**
- ENVS 332: Environmental geology and geomorphology**
- ENVS 335: Hydrology and water resources**
- ENVS 432: Water and waste water management**
- ENVS 412: Water quality assessment (Elective)**
- ENVS 415: Aquatic Ecology (Elective)**
- ENVS 435: Watershed management (Elective)**

KATHMANDU UNIVERSITY

TRAINING

TRAININGS are conducted through course manuals, lectures, interactive sessions, field exercises and laboratory work.

TRAINING RESOURCES IN KU

- **Modular Courses, custom-built short-term training courses, workshops, seminars, conferences are regular features of academics in KU**
- **National, International experts are invited and intensive training for both faculties (Faculty Capacity Development) as well as for students/participants are conducted**
- **Summer-courses, vacation periods, holidays and beyond regular class-work periods are utilized for conducting training sessions**

KATHMANDU UNIVERSITY

TRAINING ORGANIZED BY KU: EXAMPLES

Training field	Target Group
Curriculum development on Environmental sustainable Development	Teachers at collegiate level
Water quality monitoring	University teachers, Researchers, Govt. officials
Environmental Mathematical Modeling	Faculties of SOS
Pesticide Residue Analysis	Govt. officials and faculty of SOS (Planned)

KATHMANDU UNIVERSITY

RESEARCH

GROUND WATER RESOURCE MANAGEMENT

KATHMANDU UNIVERSITY

RESEARCH AREAS IN:

GROUND WATER RESOURCE MANAGEMENT

Themes:

- 1. Agricultural Water Management (2003-04)**
- 2. Water, Health and Environment (on going - 2004-05..)**
- 3. Ground Water Management (ongoing - 2005.)**
- 4. Sustainable land & Water Management (Planned from 2006)**
- 5. Water Resources Institution and Policies (Planned from 2006)**

KATHMANDU UNIVERSITY

RESEARCH : GROUND WATER RESOURCE MGT.

Themes and Techniques

Themes	Techniques
Agricultural Water Management	<ul style="list-style-type: none">• Soil Bio-mechanical approach (surface and subsurface water-soil interactions)• Organic farming; drip irrigation techniques• Rain water harvesting techniques
Water, Health and Environment	<ul style="list-style-type: none">- Env'tal. trans-media distribution of Arsenic- Aquifers and soil strata relationships- Physico-chemical, geological assays- Phyto-remediation (ferns, herbs)-small, medium scale water treatment (family & community levels)- Microbiological remediation- Epidemiological approach

Continued...

KATHMANDU UNIVERSITY

RESEARCH : GROUND WATER RESOURCE MGT.

Themes and Techniques

THEMES	TECHNIQUES
Ground Water Management	<ul style="list-style-type: none">- Geological approach- Trans-boundary basin settings
Sustainable land & Water Management	<ul style="list-style-type: none">- Remote sensing and geo-physical approaches- Aquifer profiling, Regional and National scale
Water Resources Institution and Policies	<ul style="list-style-type: none">-Research centric prioritization of water for agriculture- Short & long term policy issues- Protect (sustain), optimize and administering of water resource

KATHMANDU UNIVERSITY

GROUND WATER RESOURCE MANAGEMENT - RESEARCH

Theme-1: Agricultural Water Management (2003-04)

PROJECT / EXPERIMENT	Results
Influence of drip irrigation method on performance and yields of cucumber and tomato (www.ku.edu.np/kuset)	<ul style="list-style-type: none">• Field plot expt. with randomised complete block design• Higher yields from surface drip irrigation treatment• soil water moisture status and water delivery rate could be chief determinants
Future plans	<ul style="list-style-type: none">- Trials with different vegetable crops- Assessment of soil mechanics w.r.t. to water- Organic farming without usage of pesticides
Project status	Initiated in 2004; Ongoing

Continued...

KATHMANDU UNIVERSITY

GROUND WATER RESOURCE MANAGEMENT - RESEARCH

Theme-1: Agricultural Water Management (2003-04)

PROJECT / EXPERIMENT	Results
Water-soil biomechanical interactions with respect to agricultural intensification and its impact on environment	<ul style="list-style-type: none">• Negative impact on nutrient conservation in soils of mid-hills• Soil erosion on a disturbing scale• Soil-water interaction not conducive to the agricultural production
Project status	Initiated in 2003; Ongoing

KATHMANDU UNIVERSITY

GROUND WATER RESOURCE MANAGEMENT - RESEARCH

Theme-2: Water, Health and Environment

PROJECT / EXPERIMENT	Results
Deforestation Effects on Arsenic Distribution in Soils and Aquifers of Endemic Tarai Region of Nepal	<ul style="list-style-type: none">• Case-control (jungle-non jungle plant, soil, well-water arsenic assays in Chandranigahapur, Rautahat, Nepal• Higher arsenic levels in sediments and water of non-jungle wells• Water Level Change through Time in Jungle & Non-jungle Wells- jungle aquifers respond more quickly to increase in water from precipitation
Future plans	<ul style="list-style-type: none">- Impact on wet lands-Bio-geological variants with aquifers and inter-relationships- Soil characteristics (Scanning Electron Microscopic, X-Ray Fluorescence analyses)
Project status	Initiated in 2004; Ongoing

Continued...

KATHMANDU UNIVERSITY

GROUND WATER RESOURCE MANAGEMENT - RESEARCH

Theme-2: Water, Health and Environment

PROJECT / EXPERIMENT	Results
Using Nature to Remove Arsenic Project	<ul style="list-style-type: none">• Case-control Endemic vs. non-endemic areas of Tarai• Ethnic plants show tolerance to arsenic in soil and water
Future plans	<ul style="list-style-type: none">- Ferns as phyto-remediation trials – controlled experiments-- Microbiological tolerance studies- Extending Bio-sand filter technique to community level
Project status	Initiated in 2004; Ongoing

Continued...

KATHMANDU UNIVERSITY

GROUND WATER RESOURCE MANAGEMENT - RESEARCH

Theme-2: Water, Health and Environment

PROJECT / EXPERIMENT	Objectives
Estimation of Quantitative and Qualitative Water Budget for Landfills and Dumps Using Lysimeter: A Case Study in Kathmandu Valley, Nepal	<ul style="list-style-type: none">• To estimate water budget in landfill on quantitative and qualitative basis• To check system response with different climatic conditions• To determine method of operation of landfill in developing countries• To recommend state of art technologies in treatment of landfill leachate
Future plans	- Impact studies of leachate toxics and ground water quality
Project status	Initiated in 2005; Ongoing

KATHMANDU UNIVERSITY

GROUND WATER RESOURCE MANAGEMENT - RESEARCH

Theme-2: Water, Health and Environment

PROJECT / EXPERIMENT	Objectives
River Quality Assessment and Monitoring in Hindu-Kush Region	<ul style="list-style-type: none">• To assess the rivers and classify them according the different quality through biological indicators• To study the impact of human impairments• To develop policy of classification of rivers of the region• To develop water quality system for the HK region
Future plans	- Monitor and assess river quality for major rivers of Asia
Project status	Initiated in 2005; Ongoing

Continued...

KATHMANDU UNIVERSITY

GROUND WATER RESOURCE MANAGEMENT - RESEARCH

Theme-4: Sustainable land & Water Management (Planned)

PROJECT / EXPERIMENT	Objectives
Appraisal and integration of intricacies of environmental processes and human resource use and management	<ul style="list-style-type: none">• Identify resource mgt. Boundaries (artificial constructs)• Integrate local, traditional and scientific knowledge systems• Resource profiling studies

KATHMANDU UNIVERSITY

GROUND WATER RESOURCE MANAGEMENT - RESEARCH

Theme-5: Water Resources Institution and Policies (Planned)

PROJECT / EXPERIMENT	Objectives
Ground water as common property; sharing among stakeholders through institutional policies for usage	<ul style="list-style-type: none">• Identify legitimate stakeholders• Establish secure property-rights for user groups• Co-ordination of institutions and resource to be managed• Foster adaptive management• Recognize institutional building as long-term, multi-level, interdisciplinary issue

Thank You