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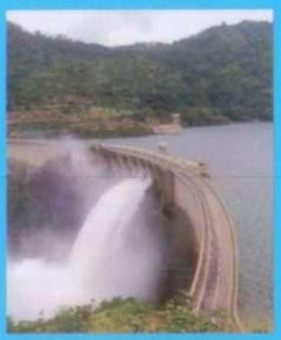
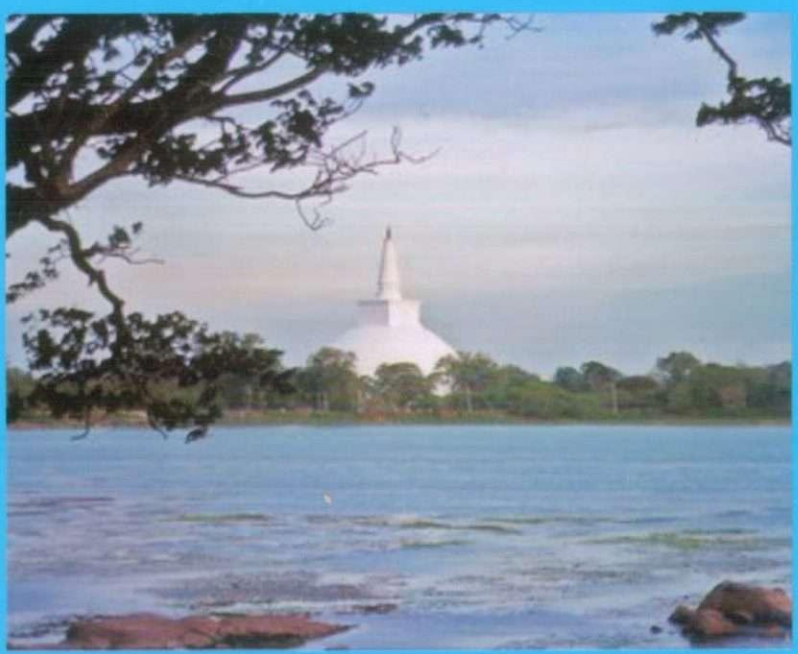
Report

National Forum on Water Research

'Identifcation of Gaps and Priorities'





16th and 17th of September 2010
Colombo, Sri Lanka

National Science Foundation, Sri Lanka

Sponsored by

Dam Safety and Water Resources Planning Project (DSWRPP) of the Ministry of Irrigation and Water Resources Management, Sri Lanka

UNESCO Internatioanl Hydrological Programme (IHP), New Delhi

REPORT

National Forum on Water Research

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Compiled by

K. D. W. Nandalal

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Dam Safety and Water Resources Planning Project
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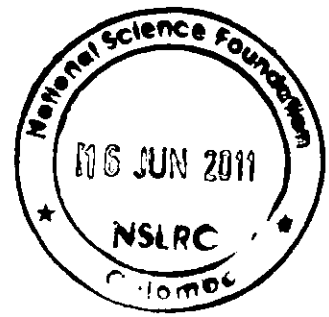

The National Forum on Water Research 'Identification of Gaps and Priorities' organized by the National Science Foundation was held at Hotel Galadari in Colombo on 16 and 17 September 2010. The forum commenced on 16 September at 0915 h with traditional lightening of the oil lamp followed by the national anthem.

CAPTER 01

Inaugural Session

The chief guest of the event was Hon. Minister Tissa Vitharana, Minister of Technology and Research while the guest of honour was Hon. Minister Nimal Siripala de Silva, Minister of Irrigation and Water Management. The chairperson of the NSF, Prof. Sirimali Fernando, the director of the NSF, Dr. Sarath Abayawardana, the Chairman of the National Committee on Hydrology, Prof. N.T.S. Wijesekera, Regional Programme Specialist of UNESCO IHP Programme, Dr. Bhanu Neupane and the two ministers addressed the gathering during the inaugural session. Dr. David Molden, Deputy Director General (Research), International Water Management Institute (IWMI) delivered the key note address during the same session.

At the outset, the Chairperson of the NSF, Prof. Sirimali Fernando, delivered the welcome address. She said that the forum has been organized at the opportune time since the country is trying to focus on research required for our societal development. She stated that though the NSF has been funding research for the past 40 years, as the main research funding organization in the country, only a few have been successful as NSF has been funding ad-hoc research without having a very clear focus. As the NSF has a responsibility towards the societal development and the resources are limited, it has initiated a programme called "National Thematic Research Programme." Under the programme, four main themes, viz. Food Security, Energy Security, Water Security and Climate Change, have been identified to direct research funding and the forum is to address the issue of water security. Prof.Fernando stated that the NSF is planning to embark on a large-scale research project to ensure that Sri Lanka will be secured in water and the purpose of this forum is to come up with a comprehensive research proposal to address the needs and issues for water security.

Prof. N.T.S. Wijesekera, Chairman of the National Committee on Hydrology, explained the mandate of the committee, which is to address the national vision on the country's water resources. He stated that the committee identified that there is a strong need to carry out a situation analysis of water research in the country prior to embarking upon a very timely focused target of concentrated water resources research to safeguard our water resources. In the country, there are many organizations involved in water research with financial support either from the government, from the NSF or from other donors. However, it can be noted that there had been only a very limited effort to identify the status on the adequacy of coverage of research on water. This forum is targeted to obtain a holistic view of various components in water resources research. He stated that the committee identified ten contributory areas on which papers are presented by invited speakers followed by discussions and requested all the participants to contribute positively to identify priority water research areas and mission oriented research projects for future.

Director of the NSF, Dr. Sarath Abayawardana, stated that though the country receives a large amount of rainfall its temporal and spatial distribution does not match with the demand. Solving this problem

is a huge task and addressing it needs looking at water and how it is managed in different perspectives; (i) resource perspective, (ii) use perspective, (iii) access perspective and (iv) supply/demand management. These are interrelated and this interrelation is another big issue. He stressed the importance of having a good framework of research in this area to find solutions. Research in the country at present are very much aligned to researcher's specialty sometimes resulting in duplication, which could be prevented by bringing them together. Dr.Abeywardana stated that the proposed "National Thematic Research Programme" is a broad process to identify mission oriented research activity based on national needs through a structured process with end products that can be harnessed readily in tackling on ground issues and contribute to national development. It will enrich the multidisciplinary collaborative research in the country, which is totally absent today. Sequence of events planned is; (i) review literature to find out what has been done in the country so far and synthesize that, (ii) identify priorities through stakeholder consultation, (iii) identify mission oriented, well defined projects, and (iv) solicit proposals for the identified projects. Finally, the workshop will enable to identify not only gaps and priorities but also identify very specific projects to address water security issues in the country.

Dr. Bhanu Neupane, Regional Programme Specialist, UNESCO IHP Programme, addressed the forum, next. He commenced his speech by stressing the importance of saving the precious resource, water, since it is essential to sustain life on the earth. Though at the turn of the century all agreed upon millennium development goals on water and sanitation, in spite of all the efforts by the UN system, water related problems continue to increase. It is the major reason for having the forum, i.e., to demonstrate the awareness, commit to take action and to seek a way forward through identifying research needs. He was in the opinion that science and technology are not sufficient in solving problems and stressed the value of getting all stakeholders in the process, as their willingness to assist in water research related work would be very useful.

Key Note address "Water Security for Sri Lanka" was delivered by Dr. David Molden, Deputy Director General (Research), International Water Management Institute (IWMI). He commenced his presentation with a brief description on IWMI, which is one of the 15 international research centres concerned with agriculture. He presented the global picture of water scarcity and security and related it to Sri Lankan conditions. He identified the key drivers for change in water security as; population and diet, urbanization, energy, and climate change & shifting patterns of water availability. On average, one litre of water produces one calorie and thus increase in population needs more calories and more water in future. Though Sri Lanka is self sufficient with rice at present, with population increase demand for rice will continue to rise and more water will be needed for agriculture. Further, the expected climate change will vary availability of water both spatially and temporarily making farming more vulnerable. Water security is having sufficient quantity and acceptable quality of water

for various uses such as drinking and irrigation. Since water storage is important for water security, revitalizing old system of tanks, which were developed over hundreds of years before, will be important. In addition, looking for groundwater for agriculture and wetland systems, as buffers against flood, will be important. Along with the changing world, the institutions that manage water need to undergo changes. Thus keeping water security will remain a significant challenge since many drivers change future leading to considerable uncertainties about the future of water for a country like Sri Lanka, which uses water mainly for agriculture. He concluded his presentation stating that science and good research will underpin the kind of knowledge and decisions that need to be made in the future to handle this very difficult complex water problem.

Hon. Minister Nimal Siripala de Silva, Minister of Irrigation and Water Management, started his speech by thanking the organizers for giving him the opportunity to address the forum and said that he would talk from political perspective. He stated that water management is not anything alien to Sri Lanka and it has a very proud history and heritage. If water security in the country is taken, preservation of water sources, wetlands, catchment areas, etc., is important since they are already polluted as people are living in those lands and doing agricultural work. However, removing people from all these places is a critical issue in the country and a challenge, which human researchers have to look into. It is important to understand minds of people, needs of people and human behavior to make the researches useful and the researches that had been carried out have not made a significant impact on lives of people in the country. He said that the country does not need very deep-rooted research now but needs research to cater to our domestic problems and pointed out that otherwise research will be redundant to the people and to the country. He stressed the need to have research to find immediate solutions for the problems such as quality of agricultural and drinking water, unrealistic use of inorganic fertilizer, water-borne diseases, etc. He expressed his hope for researchers to focus on these areas, too.

Hon. Minister Tissa Vitharana, Minister of Technology and Research, stated that the forum is focusing on one of the important issues confronting all living things on this planet, water security, and there are many issues that we need to properly target our research efforts. Though Sri Lanka will not have a shortage, the neighbouring countries in South Asia will increasingly face with severe water shortages in future. He continued to say that world wars have been fought on oil, but next world war will be fought on water. Though a scientist is used get involved in one particular research area irrespective of the final outcome, his/her research efforts should be targeted to provide maximum beneficial impact to the people. For example, there are many people without safe drinking water or proper sanitation and research in those issues need priority. Water needs for agriculture, fisheries and livestock should be given due recognition. Research on water management practices in rice agriculture to minimize the utilization of water, high use of chemicals in agriculture as fertilizers and

pesticides applicable under our conditions should be promoted. Chemical inputs that pollute both surface and groundwater should not be allowed. The minister said that all living things have a right for water, food and ecosystem. However, for natural reasons and human interventions ecosystem has been changed and therefore, these changes should be managed to have a sustainable change. He concluded his speech by requesting to avoid multiplicity of activities and to prioritize research to ensure that water is available, usable and beneficial for our future generations.

The inaugural session ended with vote of thanks by Ms.Rohini Wijeratne of the Research Division, NSF.

The forum comprised four technical sessions. First three sessions were held on 16th September while the last session was held on 17th September. Invited speakers presented review papers on ten different themes in these four sessions. Discussions were held at the end of the presentations during each session.

CAPTER 02

Technical Sessions

Technical Session 1: Water in Society

Prof. Kapila Goonasekera chaired the first technical session. Experts made three presentations titled (a) Water for food, fibre, livestock and aquatic production, (b) Water for basic needs and health and (c) Water and environment during, the session. A discussion was held at the end of the three presentations.

Water for food, fibre, livestock and aquatic production

Mr. D. V. S. de Gamage

FAO National Consultant

Mr.Gamage has reviewed research papers written by Veterinary Research Institute and universities in search of research on utilization of water for food production and food security but has found none. However, in aquaculture there have been many publications on water. With the projected per capita income of US$ 4000 by 2016 there will be a great demand for non-serial based food items (i.e., fruits, vegetables, milk, eggs, fish and meat) and increased access to pipe borne water. He said that the country is ahead of most of the Millennium Development Goals except malnutrition and quite a sizable population of children is either wasted, stunted or underweight and most of the pregnant mothers are either anemic or undernourished. The malnutrition is observed to be linked to water. With the increase in income of people and tourist industry demand for non-serial food will increase and therefore, methods to enhance production of such food are needed. Dietary energy consumption is an indicator to measure of living condition of a society. Nutritional anchor for the Official Poverty Line in Sri Lanka is 2030 calories per day. Daily average dietary energy consumption per person in Sri Lanka is 2118 cal. Though that is good, there is a big difference between poor and non-poor and about 50% of the population is below 2030 cal level. Mr.Gamage stated that it is necessary to increase non-serial food production at least by 30% and it needs a lot of water. Though water is required to produce whatever produced in the country, water footprint of our nation has not been studied yet and therefore, research in that area is very much needed. Further, he identified research studies on virtual water and virtual water trade, pollution due to high use of inorganic chemicals in cultivations, use of water for increased animal based and crop based food production, use of water to reduce post harvest losses are needed in the country.

Water for basic needs and health

Mr. S. Sumanaweera

Assistant General Manager (R&D), National Water Supply and Drainage Board

Mr. Sumanaweera said that water is useful but while using water it gets polluted. For the betterment of people the environment has to be protected and water is a part of it. He reminded that the

millennium development goals in which environmental sustainability is one of the goals. In par with it, NWS&DB has declared seven goals under its corporate plan. He said that water supply coverage at present is 80% and planning for 85% coverage by 2015 and finally 100% by 2025. Similarly, at present sewerage cover is 85.7% and planning to have 90% by 2015. Quantity-wise only 2% of the river water discharging into sea is used for drinking purpose. Though it is a very small amount sometimes there are drinking water scarcities due to changes in climate and catchment characteristics. The country needs to enhance storm water management by having wetland protection plans, better land use management, and flood control storages. Mr.Sumanaweera mentioned that NWS&DB has a water quality surveillance mechanism conducted along with Department of Health. He presented the trend of water borne diseases in Sri Lanka and went on talking about geochemistry and health. With respect to urban wastewater management, the Colombo sewerage collection system (80% of Colombo) is the largest in Sri Lanka. However, it has no treatment and sewerage is discharged into sea through two outfalls. He said that the country has no a hazard waste management system. There are a few new wastewater treatment plants on the pipeline, but more research in this area to identify the most suitable method is needed.

Water and environment

Prof. N. Ratnayake

Professor of Civil Engineering, University of Moratuwa

Prof.Ratnayake commencing her presentation on "water and environment" stated that freshwater ecosystem covers about 0.8% of the earth's surface and contains less than 0.01% of all water. Though it is a very small quantity, it contains about 41% of the fish species. Freshwater-based ecosystems can be divided into several ecosystems; streams and rivers, lakes and ponds, freshwater wetlands and coastal wetlands. She went on to describe different parameters that influence ecosystems and the importance of River Continuum Concept, which looks at a river as a whole or as a continuum where the physical parameters of the water body govern the things that are happening within the ecosystem. She said that wetland ecosystems, which have extensively being used by people, are under stress due to siltation and encroachment, land filling, overexploitation of wetland products, pollution loads beyond their carrying capacities and altered flow regimes. Changes in temperature and rainfall have aggravated the situation. Prof. Ratnayake said that scientific and methodical data gathering and record keeping is very important in this area. Studies on development of indicators or indices to assess ecological condition and suggest plausible causes of ecosystem degradation of water bodies is identified as necessary, in order to plan proper monitoring and management systems before the stresses on the water bodies become excessive. She suggested developing methodologies for the use of the River Continuum Concept in establishing the status of water bodies and impact assessments. Pollution is caused by point sources and non-point sources. Though there is legislation to prevent

point source pollution such as EPL (Environmental Protection License) for industries, there is no such a system for non-point pollution. Thus research to devise methodologies for the prevention of pollution using a holistic approach, instead of isolated actions, is important. Water conservation, which is aimed at reduction of fresh water consumption and recycling of wastewater, thereby reducing cost of water supply for domestic, industrial and irrigation purposes is worth studying. Closing the water cycle in high water use industries, development of wastewater treatment technologies for removal of certain substances that prevent the maximum reuse of wastewater, benchmarking for high water consuming industries were also brought up as research gaps in this area.

Discussion:

The following issues were brought forward during the discussion.

- Since water is a basic right of people, pricing water has to be done very carefully. Also, it may not be possible to cost water that is used for drinking purpose. Its political sensitivity was also discussed.
- Possibility to increase the quantity of water used for aquaculture production. Quality of water should also be given due consideration.
- Problem of having heavy metal pollution, algal toxins and pesticides in water. Non-availability of data to compare with the WHO or any other standard limits. Importance of developing low cost methods, such as bio-indicators and other simple methods to test water quality.
- Since 96% of irrigation water is diverted for rice cultivation, importance of giving due recognition for the rice ecosystem.
- Studies on virtual water and water footprint.
- Wasteful use of water by the famers in paddy cultivation.
- Contamination of water sources with e-coli and fecal contamination. However, people use this water and may be they are immune to such water.
- Microbiological contamination of groundwater.
- Importance to assess the usage of water by different types of animals such as low input, indigenous types.
- Do pollution control as a whole and thereby protecting water quality.
- Importance of paying attention to protect sources by controlling pollution through proper implementation of a water safety plan.
- Possibility to conserve water in aquifers.
- Agriculture pollution due to use of fertilizer and pesticides.

Technical Session 2: Water Resources and Disaster Management

In the second technical session, which was chaired by Dr. A. M. Mubarak, three experts presented papers. The titles of the presentations were (a) Surface water resources and climate change, (b) Groundwater resources and (c) Water related disaster management. These presentations were followed by a discussion.

Surface water resources and climate change

Prof. N.T.S. Wijesekara

Professor of Civil Engineering, University of Moratuwa

Prof.Wijesekara identified and assessed the research that had been conducted on surface water and climate change of Sri Lanka by reviewing about 100 papers. These included papers that could be accessed on line, journal publications and SLAAS abstracts. Surface water research has been carried out in the areas, water resources, floods, streamflow, rainfall, water quality, surface water storage systems, water policy and strategy, and climate change. The review revealed the lack of any indication on quality of research output except very qualitative statements, lack of describing data collection methods or sources and methods used for selection of models and methods, lack of studies on water resources quantifications and inconsistencies in the use of terminology. Many water quality studies were just reporting water quality status or measurements. Research on reservoir assessments, reservoir storage, reservoir releases are on very coarse time scales of monthly resolution. In water policy area publications are inadequate in quantitative research. Published works on water policy show the strong desire for developing a better water policy for the nation, but they were based on various concepts. There is very limited work in most of the specific areas in the subject of surface water resource and shows a strong need to consolidate the research results. Prof.Wijesekara stated that it is important for implementing agencies to identify signals given by ongoing research and then lead concentrated efforts for more case studies to arrive at guidelines for practice and design. It is important to take a macro view of government role in surface water research, looked at from a point of view of problem solving or advancement of fundamental knowledge and whether the research has a national significance. He suggested research to be done on climate change effects on small reservoir systems in Sri Lanka benefiting the poor farmers in the dry zone.

Groundwater resources

Prof. K. D. W. Nandalal

Professor of Civil Engineering, University of Peradeniya

Prof.Nandalal stated that groundwater is used for drinking water supply, irrigated agriculture and

industrial sector in Sri Lanka and demand for it is steadily increasing as it is regarded as a stable source. Generally, groundwater is a highly valuable resource providing good quality water. However, once groundwater has become polluted, it can be usually a very long, complex and expensive task to restore the quality. Groundwater may become polluted by specific point sources and diffuse pollution sources. He said that groundwater resources are extensively used in the dry zone of the country though depletion of deep confined aquifers is observed due to poorly planned tube well schemes. Saline intrusion is a very special case of groundwater pollution. Leaching of agrochemicals from intensively cultivated soil is responsible for elevated concentrations of chloride, nitrate and potassium. Excessive fluoride in drinking water is recognized as a serious health and social concern. It is believed that the increase in water and food borne diseases in parts of the country is associated with the bacterial pollution of wells and shallow groundwater. Generally, the extent of contamination, both in terms of occurrences, levels and types, is little documented and known in Sri Lanka. He stated that understanding the causes for quality deterioration, integrated management of surface water and groundwater, an institution for management and regulation of groundwater, stakeholder participation in management are several unaddressed issues with respect to groundwater use. Though many government agencies have involved in groundwater development none is responsible for management of groundwater resources of the country. Most studies that have been carried out by organizations in the country are of a localized and fragmented nature with relatively little reporting. Though a significant body of data (quantitative and qualitative aspects) has been gathered by individual organizations as well as by various scientists over the past 30 years a central, comprehensive and coordinated database does not exist. Integrated and distributed groundwater modeling in the country is lacking. Public awareness programmes or community level participatory programmes conducted on groundwater are also scarce resulting in a considerable gap between the scientific community and water users.

Water related disaster management

Mr. P. P. Ghanapala

Additional General Manager Technical, SLLRDC

Mr.Ghanapala states that about 90% of hazard events, 70% of casualties and 75% of economic losses are related to hydro-meteorological hazards. He described the different types of water related disasters; floods, droughts, tsunamis and landslides. He talked about impact of climate change on these different types of disasters such as sea level rise, a change in of hydro-meteorological extremes such as frequency, severity and location of droughts, floods, tropical cyclones, etc. He said that management of disasters, preparedness and adaptation as the key things to improve the sustainability of communities and nations against disasters. The management and adaptation measures for floods, droughts, tsunamis, etc. were presented next. The presentation included many different international

and national agencies involved in disaster management. Mr.Ghnapala identified rainfall and flood forecasting systems for Sri Lanka, rainfall harvesting, protection of water quality in water sources, effects of seawater intrusion into ecosystems, population migration into the urban cities as research areas to be focused.

Discussion:

The following issues were brought forward during the discussion.

- Collecting river flow data and rainfall data by government authorities and making them available for researchers.
- Importance of developing a database of reports of research projects carried out in the country by various institutions.
- Possibility of treating already abandoned wells.
- Availability of data collected by different institutions for various research works and their reluctance to release such data for other users.
- Some institutions do many researches but do not expose them sufficiently.
- Raise the concern given to recurring droughts.
- Having water quality measurement network systems.
- Providing an economic incentive for preserving water by not using fertilizers and pesticides.
- Use of shallow groundwater in agriculture mainly in dry zone.
- Networking all the laboratories in the country to bring down the cost of water quality testing and to have a good database.

Technical Session 3: Water for Development

Mr P. Dias chaired the third technical session. A paper titled "Water for industry and energy generation" was presented in the session. A discussion on the presented paper and research area followed the presentation.

Water for industry and energy generation

Prof. R. Shanthini

Professor of Civil Engineering, University of Peradeniya

Prof.Shanthini's presentation covered a few Sri Lankan and international research works in the areas of industrial water pollution, prevention and control, and hydropower generation potential. She said that most of the work done in industrial pollution area is on BOD and COD. She took Brewery industry as an example to show how a research study has helped the industry to put the process wastes to beneficial use. Colour and other toxic chemicals are issues in textile industry and burnt bricks were

found to be a good absorbent of them. Normally, synthetic wastewater is used for research work and therefore the research outputs are not most of the time applicable to complex industry effluents. Applicability of water hyacinth in treating water effluents from textile industry has been tested. Research is reported in the use/applicability of anaerobic treatment in natural rubber processing industry effluent treatment. For desiccated coconut industry use of Up-flow Anaerobic Floating Filter (UAFF) system has been researched. Research is needed to determine how these systems are working and whether they are successful to adopt. Research work is progressing on treating wastewater effluents from rice mills. Up-flow Anaerobic Floating Filter, wetlands with common cattail, use of paddy husk charcoal as adsorbent are being researched. Research work reported on electro-chemical industry are Electrodialysis treatment of black liquor from pulp mill, Electrodialysis treatment of photographic effluent, Electrocoagulation treatment of oily wastewaters and all these processes give electricity. Microbial fuel cell treatment, which produces electricity, is an interesting work reported in the international arena. Prof.Shanthini said that some research work done on hydropower is reported in literature and presented a few examples. She concluded her presentation by stating that in Sri Lanka, we think about research and development only, but we have to adopt the concept, research, development, demonstration and deployment (RDD&D), which is practiced in the west.

Discussion:

The following issues were brought forward during the discussion.

- Applicability of aerobic and anaerobic methods to treat water in pesticide industry.
- Pollution of water and treating the pollution.
- Non-availability of records/data on total amount of wastewater produced by industries, hospital waste, and domestic waste in Sri Lanka.
- Economic treatment methods that can be used by industries.
- Role of CEA in issuing environmental clearance for various projects and industries after a EIA.
- Pollution of groundwater by pesticides which come with very high COD.
- Urban pollution due to non-point sources.

Special Presentation

The second day of the forum commenced with a special invited presentation on the "Dam safety and water resources planning project" currently in progress in the country. It was made by the director of the project, Eng.S.Elakanda.

Dam safety and water resources planning project

Eng. S. Elakanda

Project Director, Dam safety and water resources planning project,

Ministry of Water Resources and Irrigation

Eng.Elakanda presented "Dam safety and water resources planning project", which is implemented at present to improve development and management of water resources in the country, to reduce water-induced hazards and to enhance the effectiveness of water related investments. There are 80 large dams and under the project, 32 most high-risk dams are selected to rehabilitate while others will be provided with basic safety facilities. Further, the existing hydro-meteorological information system in the country will be upgraded to improve the programme of data collection and their maintenance. It includes the development of a data sharing policy. A national water use master plan is also planned to be developed by integrating the master plans of different water related institutes in the country. Mr.Elakanda identified main issues faced in water sector as sectoral decision-making, absence of any strategic planning framework, ad-hoc site-specific developments by different agencies without any holistic approach, insufficient coverage of environmental and social aspects and very low stakeholder consultation.

Technical Session 4: Caring for Water

Dr. S. Herath chaired the fourth technical session, which included three presentations titled (a) Water, education and knowledgebase, (b) Water data and information system and (c) Water governance. A discussion was held at the end of the three presentations.

Water, education and knowledgebase

Prof. H. D. Gunawardhana

Professor of Chemistry, University of Colombo

Prof. Gunawardhana started the presentation with mentioning about the importance of water, water cycle and water management history in the country. He said that enhancing the research culture in the country should be started at the school level by training students specially at the advanced level through chemistry and physics, the subjects majority of the science students offer. Inclusion of lessons on water quality to the chemistry syllabus and getting students involved in the collection of water quality parameter data would give them the opportunity to appreciate the importance of water quality in the country and to enhance their analytical minds. He said that calcium and magnesium in a normal soil system can be replaced by sodium and because of that replacement there can be swelling of soil particles and loss of soil permeability. This has happened in many places in the country and as a

result, a huge area of irrigation lands is lost or abandoned. Educating the students about such situations, water quality in our irrigation tanks, CEA gazetted water quality standards, etc., would be very useful and timely. He concluded with stressing the danger of increasing the quantity without paying attention to quality as dangerous and pointed out that it is happening in education, too.

Water data and information system

Prof. N. T. S. Wijesekara

Professor of Civil Engineering, University of Moratuwa

Prof. Wijesekara stated that the use of data of correct temporal and spatial resolution and desired quality is primary for making sound decisions on the sustainable management of water resources in the country. However, the high resource demand makes it extremely expensive for a data and information system to capture, process and store all water related data at very fine spatial and temporal resolutions. He said that based on eighty peer reviewed publications data and information related statements were extracted for the conceptualization of water data and information system status in the country and summarized the data on three sub topics: data collection, data and information processing and management, data and information dissemination. According to the observations there is significant but scattered water data and information in the country though those are not properly used. Design and management of data collection programmes are not satisfactory. Lack of central agency with a mandate to record, collect and quality control the water data collections was also identified. A central archiving institute to which the public has access should collect documentation related to all research projects and projects using state or foreign assistance. National data collection programmes do not contain stakeholder-based approach for the dissemination of data. It is important to convert data to information either to use for day-to-day activities or the furtherance of science. These can be for in-house or external agency purposes or for development activities. There are very limited publications on data, data summaries and related information. There is a strong need to provide information on water projects and research studies to stakeholder community. Enabling access to such information would facilitate stakeholders to have a better rational assessment of the area of interest, avoid duplication, enhance existing knowledge and contribute significantly to national interest. Efforts taken by data processing and management agencies in this regard could not be identified in the review. It is very important to initiate studies to capture stakeholder requirements with respect to data processing and management.

Water governance

Prof. D. C. H. Senarath

Emeritus Professor of Civil Engineering, University of Moratuwa

Prof.Wijesekera, presenting the paper "Water governance" of Prof.Senerath, said that it plays a key role in efficient utilization of the available water to alleviate water shortages in different sectors. Management of water has many implications in several areas such as politics, social harmony, health, food security, power generation, poverty and economic development apart from the technological issues. Integrated Water Resources Management (IWRM) is regarded as a basis for water governance. Demand for water is continuously increasing with population and urbanization while the development of surface water schemes has almost reached limits, the potential for groundwater is limited and the change in weather patterns gives rise to more frequent floods and droughts. Thus, there is an urgent need for efficient management of the available water resources to meet the demands of all the sectors. However, there are many controversies in the areas such as management principles and strategies, economics, social issues and politics for the implementation of effective management. Therefore, much study, research and education are needed in these areas for successful water management. Having realized the risk of water shortages in terms of quantity and quality in the future years, the Government of Sri Lanka embarked on the development of a comprehensive water resources policy and its formulation and approval process was carried out from year 1996 to year 2000. Though the Cabinet of Ministers approved it in the year 2000 there has been no further development beyond that stage. Presently there is no effective management of water resources in a comprehensive sense and the different sectors and institutions connected with water resources function independently largely. The government departments and statutory bodies that handle subjects related to water resources come under different ministries and they have their own priorities mainly of a political nature and therefore, balancing these priorities particularly when the subjects of ministries keep changing from time to time is a challenge. Promoting community participation in water resource management is also proposed as important. He suggested modifying the already formulated Water Resources Policy or formulating a new policy learning from the studies that have been done and the political and social realities at present.

Discussion:

The following issues were brought forward during the discussion.

- Non availability of data on use of water from the time water is given to stakeholders.
- Use of schools as laboratories for testing water quality.
- Recycling of water to purify non-usable water.
- Reviewing the water policy developed in the year 2000 since a policy has to be reviewed periodically.
- Having a small booklet with the information on data availability and from where to obtain such data.
- To archive reports and data resulting from state funded and foreign funded projects.

CAPTER 03

Breakout Sessions

At the end of the fourth session, all the participants discussed gaps in water research to identify research priorities in four groups. The discussions, which were steered by Prof. N. T. S. Wijesekera, were held under four themes; (a) Water environment and disasters, (b) Water for food, (c) Water sanitation, basic needs and health, and (d) Nature of resource. At the end of the discussions among the group members, each group made a presentation on their findings. Those presentations were followed by discussions during which all the participants were able to contribute to the themes. The research issues and gaps identified during discussions at the breakout sessions are as given below. They include some issues identified during the technical sessions, too.

Group 1: Water environment and disasters

Water is a basic right of people and therefore pricing it has to be done carefully. Whether to put a value for water is a debating question since its social value is considered important. Economic pricing of water, which is a sensitive political issue, has to be scientifically studied by professionals to provide necessary recommendations to convince politicians and public the importance of the proper management of water at present since it will be a scarce resource in the near future. The water policy put forward in the year2000 needs to be reviewed now in 2010 since a policy needs to be reviewed every 3 years.

Recent surveys reveal that surface water sources used for drinking purpose are considerably polluted and therefore, attention needs to be paid to protect them. Thus, studies on controlling pollution of water sources and implementation of water safety plans, taking at least one river basin, would be very important since pollution of water sources is continuously increasing. Further, the development of nanotechnology based, both decentralized and centralized water treatment systems to remove common pollutants (fluoride, iron, Mn, nitrates etc.) is identified as important.

Pollution of surface water and groundwater due to heavy metals, algal toxins, fertilizers and pesticides is observed in the country. Development of methods for preventing pollution due to these reasons and treating already polluted waters is important. Application of indigenous methods for these purposes should also be studied. Investigation of mechanisms (economic instruments) that could be used to provide incentives for using organic fertilizers instead of agro chemicals in agriculture is required.

Landslides, floods and droughts are the three main disasters experienced in Sri Lanka and floods and landslides are studied and attended to, but droughts are not given due recognition. Usually, droughts affect a large area and government spends a huge amount on drought relief work.

Therefore, studies on recurring droughts in the country with respect to their occurrence, severity, social impact, adaptation and mitigation strategies etc., should be given due recognition. Use of multiple disaster assessments in regional planning should be investigated.

Assessing present status of wetlands in the country and identifying sources and causes for their degradation are important. Socio-economic impacts on wetland degradation should be given due recognition. Wetland health could be assessed based on indices developed for that purpose. Methods should be developed to restore degraded wetlands and applicability of bio control methods in mitigation of wetland pollution should be investigated. A study should look at impact of climate change on wetlands.

Environmental flows or minimum amount of water to be maintained is an area need to be looked at.

Group 2: Water for food

Rice fields need to be considered as ecosystems since about 96% of diverted irrigation water is used for rice cultivation. Rice uses a lot of water and more than 50% of that goes to weed management. Studies indicate that rice can be grown in saturated soil if weed can be prevented and thereby reduce waste of water. Methods to minimize use of water for irrigated rice cultivation are necessary to have more water diverted to satisfy requirements of other sectors. Impact of factors such as suitability of land, technologies adopted and paddy varieties, etc., may be investigated.

Total economic value of aquaculture and livestock is not estimated and water requirement for livestock and aquaculture have not been considered. Further, assessment of water use by low input, indigenous type animals, who give about two and half to three litres of milk by drinking very little water is needed since about 80% of cattle in Sri Lanka are of this type.

Development of an appropriate cropping system integrated with animal husbandry to conserve soil and water while adapting to climate change is necessary in the country. It is necessary to consider the integration of large and small-scale agriculture, home garden, etc., with animal husbandry.

It is necessary to develop operational policies for tanks and reservoirs giving attention to aquaculture in addition to other purposes such as irrigation and hydropower generation with the aim to improve the quantity and quality of aquaculture products for value added exports. Concern on causes that affect water quality in tanks and reservoirs and development of methods to improve

the quality is very vital for aquaculture enhancement.

Development of low-cost testing methods and upgrading the existing laboratories will be useful to gather necessary data to understand the present water quality situation in the country. Cost involved in data collection can be brought down by networking all the laboratories in the country. Besides, it will provide a good database. The data collected can be made reliable by adopting the laboratory accreditation system prevailing in the country.

The total amount of wastewater and pollutants produced by industries, hospitals, etc., and amount of domestic waste in the country have to be discovered and economic treatment methods that could be used for them should be developed.

Determination of water footprint and virtual water in different foods is an area that needs attention.

Group 3: Water sanitation, Basic needs and Health

Prevention of pollution of ground water sources by individual sanitary systems is necessary. Already available technologies to limit pollution of groundwater are not popular among people. Thus understanding the reasons for reluctance to use new sanitation technologies is necessary for making them user-friendly. Sanitation in estate sector in the upper watershed areas, which could lead to downstream users facing contamination, is worth looking at.

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Recent surveys reveal that surface water sources used for drinking purpose are considerably polluted and therefore, attention needs to be paid to protect them. Thus, studies on controlling pollution of water sources and implementation of water safety plans, taking at least one river basin, would be very important since pollution of water sources is continuously increasing. Further, the development of nanotechnology based, both decentralized and centralized water treatment systems to remove common pollutants (fluoride, iron, Mn, nitrates etc.) is identified as important.

Urban water bodies continue to be polluted mainly by non-point sources. Identification of various

sources that pollute these water bodies and development of management methods to prevent pollution is an area worth looking at. Impact of improper management of sewage and waste in urban areas on water should be investigated.

It is understood that in the country there are many data collected by diverse agencies. Information on type of data available and from where to access data should be made available to researchers. A system should be developed to archive data and reports resulting from state funded and foreign funded projects. Since data is the key for any water study, the diverse agencies involved in collecting data should be encouraged to share them with others who need such data.

In a disaster situation, water demand as well as consumption may change. It will affect human health and that itself will affect the water source. Identification of ways to minimize impact on health during disaster situations as well as to prevent pollution of water sources during a disaster is necessary.

A national water quality-monitoring programme is necessary for the country to have base level information on water quality. It is understood that there are many sophisticated instruments in the country, which are underutilized. Conducting a nationwide monitoring programme using these unutilized facilities is proposed.

Developing simple tools (test kits) for testing identified key water quality parameters by the school students with the objective of improving their knowledge on water and environment can be useful.

Data available on the use of water from the time water is given to stakeholders is very little. A lot of water is found to be wasted by them. Efforts should be made to gather more data on the use of water by various stakeholders and do more research to find methods to minimize waste of water.

Development of methods to recycle water to purify non-usable water is very important.

Students should be made aware of the importance of water and water quality since early stages of their schooling, such as from grade six, and they should be taught actual theoretical applications at advanced level classes to develop knowledge further in those areas. Thus, students at that level could be used to collect water quality data using school laboratories.

Usually toxins take a long time to damage human body and attempts made to understand reasons after health problems are faced is not proper. Therefore, mapping water quality parameters including heavy metals can be very useful to understand relationship between water and disease

distribution in the country.

Group 4: Nature of resource

Standards and regulations on water quality for diverse water uses need to be developed for Sri Lanka. These standards are very important to establish baseline water quality and designated water quality levels. Thus research on water quality standards, such as type of standards and level of standards to be used, etc., is needed.

Rectification of polluted groundwater and surface water catchments using bio remediation combined with indigenous knowledge on forestry is necessary.

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Large quantity of water can be conserved in aquifers and therefore understanding aquifer behavior to know yield and recharge capabilities of them is useful. Legislation to monitor and protect groundwater is very urgently required. Agencies involved in groundwater extraction collect data such as the depth of the well, diameter of the casing, chemical parameters and pumping yield at the time of construction of a tube well and therefore, they have a good database. Further, aquifer systems in the country need to be studied to understand aquifer connectivity, aquifer behavior, their physical parameters, quantification, etc.

Preparation of basin wise detailed water budgets and estimation of water usages are important. That will help to understand the temporal and spatial variability of both surface and groundwater. It will further useful to know about occurrence of floods and droughts. Inclusion of water quality, in addition to quantity will be useful. This study can be extended to look at optimum management of water for various uses based on the concept of conjunctive use.

CHAPTER 04

Research Areas

Proposed Research Areas

1. Methods to minimize use of water in irrigated rice cultivation
2. Development of a cropping pattern integrated with animal husbandry to conserve soil and water while adapting to climate change
3. Economic pricing of water
4. Methods to prevent and treat pollution of surface water and groundwater due to agricultural and industrial activities
5. Pollution of urban water bodies
6. Development of low-cost water quality testing methods
7. Development of water quality standards and regulations for different sectors
8. Hydrological hazards and their mitigation
9. Mapping water quality based on a national water quality monitoring programme
10. Identify sources and causes for degradation of wetlands
11. Enhancement of quantity and quality of aquaculture products
12. Study on basin level water resources availability considering both quantity and quality aspects
13. Climate change effects on small reservoir systems
14. Estimation of environmental flows in water courses
15. Study on water footprint, virtual water and diverse water use

ANNEX 01

Programme

PROGRAMME

National Forum on Water Research 'Identification of Gaps and Priorities'

16th and 17th of September 2010

Hotel Galadari, Colombo

Inaugural Ceremony

09.00 a.m. – 09.15 a.m. **Registration**

09.15 a.m. – 10.55 a.m. **Inaugural Ceremony**
Lighting the Oil Lamp
National Anthem

09.30 a.m. – 09.35 a.m. **Welcome Address**
Prof. Sirimali Fernando
Chairperson, NSF

09.35 a.m. – 09.45 a.m. **Introduction to the National Forum on Water Research**
Prof. Sohan Wijesekera
Chairman, National Committee on Hydrology

09.45 a.m. – 09.55 a.m. **National Thematic Research Programme on Water Security**
Dr Sarath Abayawardana
Director, NSF

09.55 a.m. – 10.00 a.m. **Address by the UNESCO Representative**
Dr Bhanu Neupane
Regional Programme Specialist, UNESCO IHP Programme

10.00 a.m. – 10.30 a.m. **Key Note Address - Water Security for Sri Lanka**
Dr David Molden
Deputy Director General Research, IWMI

10.30 a.m. – 10.40 a.m. **Address by the Guest of Honour**
Honourable Nimal Siripala De Silva
Minister of Irrigation and Water Resources Management

10.40 a.m. – 10.50 a.m. **Address by the Chief Guest**
Honourable Prof. Tissa Vitarana
Minister of Technology and Research

10.50 a.m. – 10.55 a.m. **Vote of Thanks**
Ms. Rohini Wijayaratne
Head/Research Division, NSF

10.55 a.m. – 11.30 a.m. **Refreshments**

DAY 01 – 16th September 2010

Technical Session 1 : Water in Society

Chairperson : **Prof. Kapila Goonasekera**

11.30 a.m. – 11.50 a.m. **Water for food, fibre, livestock and aquatic production**
Mr. Sunil Gamage
FAO National Consultant – Dairy Cattle and Buffalo Improvement Project
Former Deputy Director (Research) Veterinary Research Institute

11.50 a.m. – 12.10 p.m. **Water for basic needs and health**
Mr. S. Sumanaweera
Assistant General Manager R&D, National Water Supply and Drainage Board

12.10 p.m. – 12.30 p.m. **Water and environment**
Prof. Neranjanie Ratnayake
Professor of Civil Engineering,, University of Moratuwa

12.30 p.m. – 01.30 p.m. **Discussion**
Lead Rapporteur : **Prof. K. D. W. Nandalal**
Rapporteur : **Ms. Manjula Amarasinghe**

1.30 p.m. **Lunch**

Technical Session 2 : Water Resources and Disaster Management

Chairperson : **Dr A. M. Mubarak**

2.15 p.m. – 2.35 p.m. **Surface water resources and climate change**
Prof. Sohan Wijesekara
Professor of Civil Engineering, University of Moratuwa

2.35 p.m. – 2.55 p.m. **Groundwater resources**
Prof. K. D. W. Nandalal
Professor of Civil Engineering, University of Peradeniya

2.55 p.m. – 3.15 p.m. **Water related disaster management**
Mr. P. P. Ghnanapala
Additional General Manager Technical, SLLRDC

3.15 p.m. – 4.00 p.m. **Discussion**
Lead Rapporteur : **Mr. K.A.U.S. Imbulana**

Technical Session 3 : Water for Development

Chairperson : **Mr Priyalal Dias**

4.00 p.m. – 4.20 p.m. **Water for industry and energy generation**
Prof. R. Shanthini
Professor of Chemical and Process Engineering, University of Peradeniya

4.20 a.m. – 4.45 p.m. **Discussion**
Lead Rapporteur : **Prof. K. D. W. Nandalal**
Rapporteur : **Dr Gowry Moorthy**

4.45 p.m. – 5.00 p.m. **Tea**

DAY 02 – 17th September 2010

Technical Session 4 : Caring for Water

Chairperson : **Dr Subangi Herath**

9.00 a.m. – 9.20 a.m. **Water, education and knowledgebase**
Prof. H.D. Gunawardhana
Professor of Chemistry, University of Colombo

9.20 a.m. – 9.40 a.m. **Water data and information system**
Prof. Sohan Wijesekara
Professor of Civil Engineering, University of Moratuwa

9.40 a.m. – 10.00 a.m. **Water governance**
Prof. D. C. H. Senarath
Emeritus Professor of Civil Engineering, University of Moratuwa

10.00 a.m. – 10.15 a.m. **Tea**

10.15 a.m. – 11.00 a.m. **Discussion**
Lead Rapporteur : **Prof. K. D. W. Nandalal**
Rapporteur : **Dr Inoka Sandanayake**

Concluding Session : Priority Water Research

Chairperson : **Mr. K. A. U. S. Imbulana**

11.00 p.m. – 1.30 p.m. ***Discussion I : Water Research for Water Security***

Identification of gaps and priorities

Lead discussant : **Prof. Sohan Wijesekara**
Professor of Civil Engineering, University of Moratuwa

Lead Rapporteur : **Prof. K. D. W. Nandalal**
Rapporteur : **Dr Sachie Panawala**

1.30 p.m. – 2.00 p.m. **Lunch**

Concluding Session : Cont.....

2.00 p.m. – 4.00 p.m. ***Discussion II : Identification of Priority Mission Oriented Research Projects***

Identification of priority research projects

Lead discussant : **Dr Sarath Abayawardana**
Director, NSF

Lead Rapporteur : **Prof. K. D. W. Nandalal**
Rapporteur : **Dr Sachie Panawala**

3.30 p.m. – 4.00 p.m. **Tea**

4.00 a.m. – 4.30 p.m. **Closing Remarks and Reflections of the Forum**
Prof. Sohan Wijesekera
Professor of Civil Engineering, University of Moratuwa

ANNEX 02

Photo Gallery

Presentations and Discussions

Group work