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"Towards Ensuring Water Security for Bhutan's Future"



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NATIONAL WATER SYMPOSIUM

"Towards Ensuring Water Security for Bhutan's Future"

Organized by:

National Environment Commission Secretariat
&
Ugyen Wangchuck Institute for Conservation and Environmental Research
Department of Forests and Park Services

Ariya Hotel, Thimphu
10th - 12th May, 2017

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Symposium Participants with the Honourable Chief Guest His Excellency Lyonchhen Dasho Tshering Tobgay

1. *Acknowledgement*

The National Water Symposium was organized with the generous support of USAID through the WWF Conservation and Adaptation in Asia's High Mountain Landscapes and Communities Project and WWF Living Himalayas Initiatives. The organizers are very grateful to these donors for their financial support.

We are immensely grateful to His Excellency Lyonchhen Dasho Tshering Tobgay for gracing the opening session of the symposium. Our gratitude to Honorable Ministers Lyonpo Yeshey Dorji, Ministry of Agriculture and Forests and Lyonpo Leki Dorji, Ministry of Economic Affairs for their gracious presence. We are thankful to Special Advisor to NECS, Dasho Paljor J. Dorji and Honorable Secretary, Dasho Chencho Norbu, NECS for chairing the concluding session of the Symposium.

Finally, we would like sincerely acknowledge all our session chairs and presenters for their time and contribution to the successful conduct of the three day symposium. We would also like to thank all the participants, representatives from the media houses and stakeholders for their active participation during the symposium.

2. The Context

About 1.2 billion people today live in areas of water scarcity and another 1.6 billion people live in countries that lack the necessary infrastructure to take water from rivers or aquifers. Almost two out of every 10 people do not have access to safe drinking water. Some of the mighty rivers that used to flow magnificently to the oceans have now become trickles during the dry seasons. Underground water tables have been dangerously depleted. The supply of water is limited but the demand keeps growing even as climate change is expected to bring a 20 percent increase in global water scarcity.

In Bhutan, we are fortunate to be blessed with rich water resources and the highest per capita of water availability in our region at 109,000 cubic meters. Even so, localized pollution and sporadic seasonal scarcity of water in some parts of the country is a national concern. Our mountain ecosystem is becoming more vulnerable to the increasing threats from climate change. While most people think of low-lying islands sinking under the sea as an impact of climate change, mountainous countries like Bhutan are equally at risk with the effects of climate change already visible to us. Our glaciers, the source of our clean rivers, are melting rapidly and we are deeply concerned over the increasing possibilities of disastrous flash floods downstream. The retreating glaciers will also adversely affect the hydropower projects that presently drive much of the economic growth in our country and provide most of the government revenue for development activities. This is an era of change, glaciers becoming to glacier lakes, glacier lakes turning into floods and GLOFs. While the Government is doing its best to garner resources to prepare to tackle this challenge, it is now the role of the different institutions to collaborate and work efficiently and strive towards a common goal. Keeping this in mind, in 2011, the first ever Bhutan National Water Seminar was held to assess the knowledge and resource gaps and also the institutional linkages within Bhutan. All the stakeholders agreed that such seminar could be organized as an annual event. But due to lack of funds, it could not continue and it is almost 5 years now since the first seminar. Many things might have changed and we would like to take stock of all these development in terms of water resources management in Bhutan. More aptly we would like to assess how adequately we have been addressing the water issues in the 11th FYP and identify synergies and identify areas of cooperation in terms of water resources management and development among different sectors in the 12FYP.

3. *Objectives of the Symposium*

- Bring together water resources professionals and agencies with water resources mandates for proper coordination and efficient management
- Stock take information of the state of knowledge on water resources in Bhutan
- Identify priority areas of cooperation for water resources management and development in the 12th FYP
- Determine research areas for sustainable water resources management

4. *Expected Outputs*

- Generated information on management and development of water resources
- Identified priority areas of cooperation on water resources management and development in 12th FYP
- Identified priority research areas for water resource management
- Guide research institutions on prioritizing and streamlining research plans on water resources
- Synergies among various stakeholders identified and an action plan for integrated cross sectoral efforts for water resources in Bhutan developed.

5. The Symposium: Inaugural Session

Key Note Address: His Excellency Lyonchhen Dasho Tshering Tobgay



His Excellency Lyonchhen Dasho Tshering Tobgay graced the opening session of the National Water Symposium. His Excellency congratulated the National Environment Commission Secretariat and Ugyen Wangchuck Institute for Conservation and Environmental Research for organizing this very important workshop. He said, everybody knows how important water is and experts believe that if there be any war in future, it will be on 'Water'.

Ocean constitutes major percentage of the total water, but freshwater resources are more important to inhabitants. Among more than 200 countries in the world, Greenland has maximum fresh water followed by Iceland, Guyana, Suriname, Papua New Guinea and Bhutan ranks at top six. Bhutan's per capita water availability is one of the highest compared to neighboring countries Nepal, India and Bangladesh. This makes Bhutan the richest in freshwater resources in the region.

However, His Excellency said, our people do not have access to 24x7 drinking water supply. In Thimphu itself, there are more than 17 streams but residence in Thimphu do not have 24x7 drinking water supply. On the other hand, government has made huge budget allocation, but the services are not improving, which means there must be something wrong somewhere. Therefore, this is the right forum to discuss, thrash out issues/challenges and come up with strategies and action plans towards achieving the goal of safe drinking water supply for all and sustainable management of water resources.

Since 64 percent of the Bhutanese population live in rural areas, sustainable supply of water for irrigation cannot be ignored. His Excellency also said that if we are to harness sustainable revenue from hydropower plants, sustainable management of water resources and its ecosystem services is crucial.

Hon'ble Lyonchen mentioned that water is identified as one of the flagship program in the 12th FYP and one of the key objective is to achieve 24x7 safe drinking water supply in both urban and rural areas. The forum should discuss on issues, strategies and recommend for incorporation in the flagship program.

His Excellency also shared his concern on the multiple institutional set ups and its engagement in management of water resources, leading to weak coordination and implementation. Therefore, the need to study carefully the existing institutions and recommend how best it could be improved and strengthened was emphasized.

Lastly, His Excellency congratulated all the participants for coming together for this symposium and asked to submit recommendations to the government.

6. Symposium Technical Sessions

Opening Remarks:

Mr. Chencho Norbu, Hon'ble Secretary, National Environment Commission Secretariat



The Hon'ble secretary, NECS, opened the technical session by linking water resources management to Sustainable Development Goal (SDG) 6 on water and sanitation. The secretary pointed out that water resources management program is one of the key programs in 12th FYP with NECS being the overall coordinating agency. Dasho highlighted on water being a common subject of interests among various organizations and he urged the participants to consider discussion on the mandates of various institutions and to look into kind of support and resources required to fulfill the mandates. Dasho cautioned the participants to not look at water as a standalone sector, which lead to duplication in mandates and resources within the stakeholders. Upon making the reference to the international water experts' forum - Dasho urged the meeting to look at water as an instrument to connect and forge partnerships for a common consensus. "While we are working hard on water issues, these works are not being systematically documented and reported, since there are numerous implementing agencies with different mandates" remarked Dasho.

Dasho informed the meeting on the National Integrated Water Resources Management (NIWRM) plan, which was drafted in accordance to the Water Act 2011. NIWRM is expected to help in managing water holistically with inclusion of all key stakeholders; including our local leaders and communities. He mentioned that the NECS is putting in extra efforts to educate and expose our local leaders on water issues since water management is coupled with customary practices which are existent and often very sensitive. Dasho stated that in-order to achieve the vision of 24x7 supply of potable and affordable water to all citizens as stated by H.E Prime Minister of Bhutan in his keynote address will be possible only through this inclusive participation from grass root level. Dasho concluded the opening note by reiterating the need to look at water as a collective issue and to work collaboratively. Dasho encouraged the participants to share their views and field experiences and to keep a record of the discussion which could be synthesized on the final day for onward submission to the Government.

Overview of the Symposium



Dr. Norbu Wangdi of the Ugyen Wangchuck Institute for Conservation and Environmental Research, gave a brief overview of the symposium. He talked on the objectives and expected output from the symposium, modality and topics that will be covered in the 3 day Symposium. The house was also informed that the symposium will cover all water related issues right from water governance and policy, snow and glaciers, economy, ecology and climate change.

7. Session I: Water Governance and Policy

Chair:
Karma Dupchu,
Hydrology Services Division, National Center for Hydrology and Meteorology (NCHM)

Talk 1	Water governance in Bhutan	Mr. Kunzang Rinzin, NECS
Talk 2	Water resources and National Integrated Water Resource Management Plan (NIWRMP)	Ms. Tenzin Wangmo, NECS
Talk 3	Local governments perspective of water resources management	Mr. Dorji Wangdi, Wangdue Dzongkhag

Talk 1 Water governance in Bhutan



Mr. Kunzang Rinzin's talk focused on various Acts; and rules and regulations: Water Act 2011 and its regulations, Waste Prevention and Management Act 2009 and its regulations. He reiterated water resources as the state property with the mandate for overall coordination entrusted to NECS. However, he also said that the actual implementation remains with the respective agencies.

He also talked on the important linkage of Water Act with the Environmental Assessment Act, whereby water related projects are regulated through issuance of an Environmental Clearance.

Talk 2 Water Resources and National Integrated Water Resource Management Plan



Ms. Tenzin Wangmo's talk covered an overview of water resources in Bhutan: legislations in place for effective water management; key issues and challenges in the water sector; and NIWRMP, 2016. NIWRMP is a framework for coordinated development; management; conservation; and efficient use of water resources in Bhutan. Bhutan water security index form important component of NIWRMP, which is incorporated in 12 FYP within the water sector.

Some of the key issues and challenges reflected were:

- poor water storage capacity;
- water availability vs. accessibility in the villages due to the biophysical condition of the settlements and high investment cost;
- emerging water quality issues due to increased urbanisation and inadequate waste management system;
- changing water course due to increasing activities along river and buffer zones; and
- lack of multi-sectoral coordination.

Talk 3 Local Governments' perspective of Water Resources Management



Mr. Dorji Wangdi, presented on the water resources management and challenges at Dzongkhag level along with possible solutions. He highlighted on not having a dedicated sector in Dzongkhags looking after water resources management leading to following issues:

- water supply activities not implemented holistically - focus is on the supply side and often water source protection including minimum environmental flow is neglected
- misinterpretation of the statement "water resources as state property" in the community - some communities even claim water sources in private areas as having rights to extract
- issues among households, communities and gewogs on water sharing are on rise due to water shortages
- relocation of RWSS is on rise due to drying of water sources
- livestock rearing not regulated
- requirement to implement buffer zones width (100 ft/30 m) difficult sometimes - difficult to implement buffer rules in private lands and Water Act does not have provision to substitute land too
- no clear provision on international water management coordination in the Water Act 2011
- design of the infrastructure development pursued by central agencies where water efficiency is overlooked. For example, toilet design issued by the Ministry of Health (MoH) require adequate water for flushing toilets than the conventional types and many places lacks access to adequate supply of water
- public and the local leaders not fully aware of Acts and regulations and
- Sometimes court judgments are based on old agreement and not necessarily follow the provision of the Act. eg. Matalungchhu court case in Wangdue

Mr. Dorji Wangdi also presented on some of the solutions and experiences at the Dzongkhag level for proper water management as follows:

- appoint a focal person for water management in Dzongkhags;
- encourage institution of Payment for Environmental Services (PES)
- rainwater harvesting should be piloted to see its sustainability
- regulate and control impermeable surfaces in urban settlements to maintain and improve groundwater recharge
- undertake water resource mapping in all gewogs and
- create awareness and advocacy to the local leaders on relevant Acts and Regulations

Q & A Session

1. Mr. Ugyen Lhendup, BTFEC shared that indigenous knowledge on water resources management is important and needs to be included in the overall water resources management plans. This, according to him will encourage local community participation in water resources management and for this to materialize, Dzongkhags must provide support and assistance.

Kunzang Rinzin, Legal Services, NECS said as per the Act, customary practices should be respected provided it is fair and equitable. If there is case of customary practices of water sharing, the court should consider this provisions in making decisions.

2. Thinley Namgyel, NECS, asked whether or not there are observations in Dzongkhags on what actually is causing the water sources to dry up. He also sought clarity on courts interpretation of water sharing in the judicial system. "How are equity sharing considered by the court"?
Mr. Dorji Wangdi, Wangdue Dzongkhag, cited water conflict case of Phangyul in Wangdue Dzongkhag where the court pronounced a judgment based on terms of old agreement (1980s). He said that most people are blaming climate change for water sources drying up, however their understanding of the subject may be re-visited.

Tenzin Wangmo, NEC, informed that court generally asks for a technical report on water availability for any water related cases. With regards to drying up of water sources; though no scientific studies were undertaken, during the site visit to Paro, it was observed that the construction of farm road coupled by rampant illegal logging seems to have affected the water sources.

3. Jigme Phuntsho, Ministry of Work and Human Settlement (MoWHS), commented that the "monitoring of Acts and regulation by the apex body is weak and also there is a need to sensitize our rural people on the Acts and Regulations".

Kunzang Rinzin, NECS responded that a numerous awareness and campaigns on the Acts and Regulations on the national media and regional workshops are carried out. Thus, people seem to be aware of the Act and Regulations to certain extent. However, the acceptance level and behavioral change in public is must for effective implementation of these Acts and Regulations.

4. Ugyen Lhendup, BTFEC commented that the issue of acute shortage of drinking water are mostly caused by human activities, grazing and forest fire. According to him issuing of permits to fell trees by Department of Forests and Park Services (DoFPS) within watershed areas is aggravating the problem.

5. Ms. Sonam Choden, WWF- Bhutan highlighted on the need to maintain at least one river as wild and untouched by developmental activities for future reference studies and conservation purposes.

6. Ms. Sonam Choden, Watershed Management Division, raised concerns on contaminated water storage tanks in the cities. "Water Regulation requires timely cleaning of the water storage tanks but it's not being implemented" said Ms. Sonam.

Ms. Tenzin Wangmo, NECS, responded that the responsibility of maintaining clean water till meter point lies with the Thromde and beyond that lies with the building owners as per the Water Regulation. The contamination of water in the storage tank will be taken care when the MoH, as a surveillance body, starts monitoring drinking water quality from the tap-point in the households. Thromde undertakes water treatment with the objective to make it potable, however, treated water are used for other household purposes such as flushing toilets, washing, cooking, etc as the building doesn't have two separate water pipes. If Thromde is able to provide 24X7 water supply, the storage tanks may not be necessary and segregating water for consumption from other uses may help in improving the quality of drinking water.

Ms. Dechen Yangden, informed that MoWHS is revising the Bhutan Building Rules and fitting for cleaning up of storage tanks is incorporated.
Mr. Sonam Dorji, Mawongpa Water Solutions, informed that they provide water storage tanks cleanup services. Currently, they rely on the provisions of the Regulations to encourage house

owners to clean tanks periodically. He said that factors such as procurement of low quality GI pipes, workmanship/skills, lack of research and development add to the existing challenge in terms of providing safe drinking water.

7. Mr. Karma Dupchu, National Center for Hydrology and Meteorology (NCHM) opined that policy and regulatory functions of NECS needs segregation and NECS should focus only on policy functions.

8. Ms. Shristi Sharma, representative from Clean Bhutan asked on the different parameters considered in monitoring effluent discharges from the industries and its frequency.

9. Mr. Tshewang Dendup from Sherubtse College enquired on water quality standards and different parameters monitored and asked the parameters monitor.

Tshewang Lhamo, NECS, informed that there is a long list of water quality parameters under the industrial effluent discharge standards 2010, which industries must comply with. However, the type of parameter monitored depends on the type of industry and the effluent that they are likely to discharged from their manufacturing process. As of now, compliance monitoring of industries is conducted at least once a year by NECS. However, NECS is currently seeking collaboration from relevant agencies to conduct regular monitoring in the future. In terms of drinking water, she said that the parameters are clearly shown in the Bhutan Drinking Water Quality Standards, 2016. She informed that the Bhutan Drinking Water Quality Standard, 2016 will come into effect from July, 2017 and that clear roles and responsibilities of relevant agencies are also spelt out in the standard.

10. Mr. Bholanath Bhattarai from Gross National Happiness Commission (GNHC) expressed views on implementation of existing policies, Acts, Regulation, plans and programs. He informed that GNHC has requested all local government and agencies to submit any implementation issues that they might have.

Chair's Summary

At the end of the session, chair summarized the discussion points by highlighting the important issues that came up during the question and answers session. Some of the main points were:

- water mandates with multiple agencies and weak coordination;
- drying up of water sources and measures needed to address;
- increasing number of developmental activities and stress on water resources;
- poor enforcement of legislations and policies;
- inadequate awareness on the laws and policies:
- implementation issues and challenges at Dzongkhag level; and
- water quality: How can we ensure it ? What can we do about it?

8. Session 2: Water and Ecology

Chair:
Mr. Ugyen Lhendup,
Bhutan Trust Fund for Environmental Conservation

Talk 1	Watershed management & wetland conservation in Bhutan	Ms. Sonam Choden, WMD, DoFPS
Talk 2	Freshwater macroinvertebrates biodiversity in Bhutan	Mr. Jigme Wangchuk, UWICER, DoFPS
Talk 3	Brief account on freshwater biodiversity of Bhutan	Mr. Ugyen Dorji, CNR, Royal University of Bhutan
Talk 4	Fishery resources of Bhutan: threats and opportunities.	Mr. Gopal Prasad Khanal, NRCR&LF
Talk 5	Study on minimum environmental flow for hydropower projects of Bhutan	Mr. Tenzin Khorlo, NECS

Talk 1 Watershed management & wetland conservation in Bhutan



Ms. Sonam Choden presented an overview of the chronology of the Watershed Management Division (WMD) under the DoFPS. She also highlighted mandates of WMD and informed the meeting on WMD serving as the focal for climate and water for DoFPS. She also presented an overview of the ongoing project and activities that WMD is implementing for Climate change adaptation and water resource management in Bhutan.

According to her, per capita of water for the country will be higher than current figure if fresh water in the wetland and other areas are accounted. Thus she feels the need for a nationwide wetland and freshwater assessment.

Ms. Sonam also highlighted the following challenges:

- increasingly there is problem of plenty and problem of scanty due to impact from climate change
- many agencies involved in water related projects leading to:
    - weak coordination
    - common resource conundrum: rights and responsibility
- weak science in mountain hydrology often leading to un-informed decision making processes;
- inadequate hydro meteorological stations;
- limited enabling authority for implementing integrated watershed management plan;
- areas outside protected areas are considered as no man's land, thus need more attention in terms of water resources management;
- difficulties in wetland conservation
    - knowledge gaps
    - wetlands benefits misunderstood

- scarce database on wetlands

Ms. Sonam Choden summarized the presentation, highlighting following opportunities in the 12th FYP:

- enhanced coordination;
- comprehensive valuation of water resources;
- enhanced public-private partnerships;
- explore the cumulative effects (climate change –food security and energy nexus);
- effective implementation of the policies in place;
- integration of right approaches to wetlands conservation and implementation of the watershed management plans.

Talk 2 Freshwater Macroinvertebrate biodiversity in Bhutan



Mr. Jigme Wangchuk began his talk by highlighting the role of macroinvertebrates for assessing health of environment and water quality. It serves for decomposition of organic matter, nutrition recycling, water purification and food sources for trophic levels. Aquatic macroinvertebrates are least explored in Bhutan with only few studies undertaken since the 1970's and that too in few groups viz. dragonflies and damselflies. There are 411 species under 70 families as per the recorded species and published papers.

He brought up some issues and challenges:

- lack of technical expertise for species identification. Most species identified only upto family level or order level;
- religious sentiments of the Bhutanese researchers while collecting specimen for identification; and
- Inadequate funds for aquatic biodiversity research.
- Key for identification not available and the one developed through the HKH- assess key is incomplete.

According to him following supports may be required to strengthen the aquatic biodiversity research in Bhutan:

- having a specific funding window for aquatic biodiversity research;
- capacity building in the field of aquatic biodiversity;
- develop standard sampling protocols for nationwide assessment;
- develop central data repository for aquatic biodiversity data and specimen.

Talk 3 Brief account on freshwater biodiversity of Bhutan



Mr Ugyen Dorji presented an overview of activities on aquatic biodiversity implemented by College of Natural Resources (CNR). More specifically, he presented on the status of fish diversity in Bhutan lead by Dr. D B Gurung, CNR.

As per the latest report of Gurung and Thoni (2015), a total of 109 species of fish from 64 Genera and 24 families are recorded in Bhutan. Mr. Ugyen reiterated the significance of macroinvertebrates as indicators of water quality since they are very sensitive to water pollution. Mr. Ugyen further stated the lack of information on aquatic plants and remarked on the adverse impacts of dams on fishes and how inappropriate fish ladders.

He concluded by highlighting some of the challenges for fish conservation in Bhutan as follows:

- construction of dams without proper minimum environmental flow;
- fish migration hindered;
- fish ladder and e-flow - the efficacy of the fish ladder in Kurichhu project is also doubtful;
- illegal fishing.

Talk 4 Fishery resources of Bhutan: threats and opportunities



Mr. Gopal Prasad Khanal presented on the diverse fishery resources in Bhutan, such as culture and capture fisheries; and indigenous and exotic fishes. He said, as per the studies carried out and recorded, there are 104 fish species of which 93 are indigenous and 11 exotic. Golden Mahseer is globally endangered and it is totally protected in Bhutan. He also highlighted on the threats and some of the factors posing the threats including construction of hydropower dams, soil and debris from the construction of roads and mining activities, illegal fishing, habitat degradation due to extraction of sand and boulders.

He informed that introduction of exotic fish species in the 1930s played a huge role in the survival of native fish species in Bhutan: competition for food and other resources. He expressed on the need to have a mechanism to regulate introduction of exotic species to help conserve native fish species. The need to create awareness on existing laws and consider consequences from act of "Tshethar" was emphasized.

Talk 5 Study on minimum environmental flow for hydropower projects of Bhutan



Mr. Tenzin Khorlo, NECS, presented on environmental flow (E-flow) project through which an E-flow for certain hydropower dams in Bhutan are being set up. E-flow project aims to develop guidelines for assessment, determination and monitoring of minimum environmental flow for rivers. The project is undertaken in one wild river, one hydropower project under construction, one under operation and one hydropower project planned for development. He pointed out that E-flow for watercourses is a mandatory requirement under the Water Act 2011.

He said that E-flow for hydropower is very crucial owing to a very high potential in Bhutan. It is very crucial to mitigate impacts and maintain the current state status of the biodiversity in the dewatered stretch. Mr. Tenzin showed a video clip taken using drones during the lean winter month (February) of backwater flow of Chhukha dam and downstream of the dam with hardly any water in the river. He appointed out that about 9-10 km of dewatered stretch in Chukha is almost dry in winter and this is not good for ecosystem.

Q & A Session

1. Tenzin Khorlo, NECS asked the presenter from CNR how he came with the number 0.5 to 1 cubic meter per second as minimum environmental flow.

Mr. Ugyen Dorji, CNR responded that it is for macroinvertebrates and not for fishes.

2. Sonam Dorji, Mawongpa water solutions enquired on what would be E-flow figure from NECS. He also asked if there is any plan to address the effluents from automobile workshops in Olakha.

Tenzin Khorlo, NECS informed that the E flow figure will be published once it is determined.

Tenzin Wangmo, NECS responded that the issue of Olakha automobile workshop has been going back and forth among agencies. NECS has written to the Thromde to monitor and address the issue since Thromde is the competent authority for issuing environmental clearance for automobile workshops.

3. Sonam Choden, WMD, commented that most streams are tapped for domestic use and asked if there is any project in pipeline with NECS in terms of looking for E-flow for streams.

Tenzin Khorlo, NECS, informed that E-flow guidelines will help and facilitate in determining E-flow for streams, however, as per the Water Regulation the default figure of the minimum environmental flow is 30% of the lean flow, unless the proponent is in a position to scientifically provide the minimum flow.

Mr. Kinley Dorji, River Guides of Panbang, expressed his observation on weak implementation of policies. He also pointed out that our rules prohibits harvesting of golden masher, however it is being harvested in India, which warrants coordination beyond national boundary. Our communities are being deprived of their livelihood sources while communities on the other side of the border is enjoying this resources.

Mr. Gopal Prasad Khanal, NRCR & LF informed that the golden mahseer is endangered as per FNCA 1995, FNCR 2006, FNCRR 2017. Awareness and advocacy programs have been conducted on the importance of conservation of this species. However, there is still need for more efforts from DoFPS to protect them. He expressed that the question pertains to a transboundary issue which is very difficult to sort out and it requires commitment from policy makers of neighbouring countries which may require discussions at different forums.

Sonam Choden, WWF-Bhutan, informed that the fish ladder in Kurichhu project is not properly designed for the golden mahseer. Some of the experts commented that it is not the right design for species like Mahseer but for Salmon. She opined that hatchery breeding and conservation should be the last resort. She also added that there is no proper guidelines and monitoring on release of species through 'Tshethar' practices.

4. Sonam Choden, WMD made reference to the Annual Forestry Conference where the issue of fish ladder was discussed at length and concluded that the fish ladder does not work. She questioned on why agencies are encouraging fish ladder despite the fact that it is not working.

Tenzin Khorlo, NECS informed the meeting that so far only two hydropower projects has fish ladder. He pointed out that unavailability of data is one of the causes and there is need for efficacy studies.

Mr. Gopal Prasad Khanal from NRCR&LF, said that import of any animal for "Tshethar" is banned as per livestock rules & regulation. However this is commonly practiced near the border areas.

Hatcheries built in India in olden days were mostly focused on quantity of fingerlings produced

without much interest on quality and genetic affairs. Now with advancement of technology there is breed and release technique of hatchery which may work for our rivers and solve most issues.

Chair's Summary

At the end of the session, session chair summarized as follows:

- watershed management plan is not a development plan;.
- Thimphu watershed management plan, which is under preparation may be referred as an example: to replicate in other parts of the country;
- rich freshwater biodiversity opens lot of opportunities for new species discovery;
- tshethar activity needs to be carefully dealt with;
- E-flow is an important process and it needs to be considered in future hydropower projects

9. Session 3: Climate, Cryosphere, Water and Disaster

Chair:
Karma C Neydrup
National Environment Commission Secretariat

Talk 1	Weather and climate observation and information	Mr. Tayba Buddha Tamang, NCHM
Talk 2	Cryosphere monitoring and information in Bhutan	Mr. Phuntsho Tshering, NCHM
Talk 3	Hydrological observations and flood early warning systems in Bhutan	Mr. Karma Drupchu, NCHM
Talk 4	Application of environmental isotopes as a tracer in hydrological studies	Mr. Tshewang Dendup, Sherubtse College
Talk 5	Climate change and adaptation in Bhutan	Ms. Sonam Lhaden Khandu, NECS
Talk 6	Overview of climate and water resource studies at UWICER	Mr. Dawa Yoezer, UWICER

Talk 1 Weather, climate observation and information



Mr. Tayba Buddha from NCHM gave a brief presentation on the organizational development of the NCHM. He informed that there are 20 Class 'A' agro-met stations and 64 Class 'C' climatology manual weather stations and 80 automatic weather stations; recording real time data from across the country.

As per Mr. Tayba, weather monitoring is done 24X7 and the information is shared via media on a daily basis. NCHM also provides seasonal climate information. These information are disseminated at the regional level through South Asian Climate Outlook Forum (SASCOF) and at national level through National Climate Outlook Forum (NCOF).

Mr. Tayba also informed that NCHM provides weather information services. The Himawari satellite installed with support of JICA gives real time update of the weather pattern of the world through satellite images. Mr. Tayba substantiated his statement by stating that in 2016, the center accurately predicted snowfall for the country.

Mr. Tayba concluded by sharing an information on Bhutan Climate Bank which was published in 2016.

Talk 2 Cryosphere Monitoring and Information in Bhutan



Mr. Phuntsho from NCHM gave a brief background on the institution of cryosphere services division within the newly established NCHM, which was a merger of two divisions within the Ministry of Economic Affairs: Glaciology and Snow; and Glacier Division. He highlighted that the division was formed considering the importance of cryosphere in Bhutan.

Mr. Phuntsho informed that Bhutan is home to more than 2600 glacial lakes with 25 of it categorized as potentially dangerous lakes. Currently, the division is conducting the field validation for the potentially dangerous glacial lakes. He said that glaciers in Bhutan are known to be summer accumulation type, which are highly sensitive to climate change.

Since, glacier mass balance is an indication of the health of glaciers, he informed the house that the division is currently undertaking studies on glacier mass balance at Gangju la, Metatshota and Thana glaciers. He said geodetic and direct methods are used in the assessment of the glacial mass balance. The center has plans to pursue studies on cryosphere in terms of water balance and also monitor snowfall trends in Bhutan.

Talk 3 Hydrological Observations and Flood Early Warning Systems in Bhutan



Mr. Karma Dupchu, NCHM presented an overview of hydrological observation networks of Bhutan. He highlighted that most of the existing hydrological stations are located on big rivers and are concentrated in the western and central region of the country. He said that there is a need for expanding the existing network as there are some rivers and streams which are highly populated with settlements and utilized for socio-economic benefits by the inhabitants. He informed that as Bhutan is prone to floods and landslides and having early warning systems in place is paramount. However, it is not a single agency's responsibility but requires the commitment from many stakeholders including the community. He also informed that the first early warning system was established in Wangdue Dzongkhag along the Punatsangchhu and at present there are four early warning system installed and data is transmitted every hour to the center. Further, he said that NCHM have two database in place, which are HYDATA- National Hydrological Database, SEDAT- Sediment database.

Talk 4 Application of Environmental Isotopes as a Tracer in Hydrological Studies



Mr. Tshewang Dendup from Sherubtse College gave an introduction on isotopes and showcased the application of stable isotopes and mixing models to determine the sources of water. He said that isotopes are used in the hydrology to trace water sources through 2-component mixing model. He informed that such models can be used to conduct catchment research to determine the source of water; precipitation, glaciers or ground water. He also informed that Sherubtse College has a state of the art laboratory for isotope analysis. However, it is proving to be very expensive to keep the lab running with the lack of dedicated funds. They look forward to establishing strong collaboration with other agencies working in the areas of water resources management and climate change and really look forward to contribute to the common goal of ensuring water security in Bhutan.

Talk 5 Climate Change Adaptation in Bhutan



Ms. Sonam Lhaden Khandu presented on the climate change and adaptation activities in Bhutan. She mentioned that Bhutan is vulnerable to climate change due to factors such as our rugged fragile mountain, landlocked, least developed country, heavy dependence on climate sensitive sectors such as agriculture, hydropower, etc. Further, she stressed, for Himalayan countries such as Bhutan, erratic weather patterns, fast receding glaciers, and the risk of Glacial Lake Outburst Floods (GLOFs) have now become stark reality.

Ms. Sonam also presented on the institutional arrangements to address climate change issues. She informed that a high level national climate change committee is constituted under coordination of the NECS. The committee comprises of members from relevant agencies and is supported by a national taskforce for climate change.

Ms. Sonam also reported that NECS was also responsible for reporting to the UNFCCC as Bhutan has ratified the convention. NECS has already completed the second phase of reporting [2nd National Communication].

Besides that NECS is also the main project coordinator for the implementation of the National Adaptation Programme of Action (NAPA) project supported by the Least Developed Countries' fund within the framework of UNFCCC climate finance mechanisms. She also informed the house that Paris Agreement is yet to be ratified by the parliament and if ratified, then we would have some more obligatory reporting in GHG inventory, Carbon Neutrality etc.

Talk 6 Overview of Climate and Water Resource Studies at UWICER



Mr. Dawa Yoezer presented an overview of climate and water resource studies conducted by UWICER. Some of the studies conducted by UWICER in the past included study on aquatic biodiversity, documentation of socio-cultural significance of high altitude wetlands, inventory of high altitude wetlands, loss and damage associated with the changing rainfall patterns in Punakha Dzongkhag, compilations of tshachu and menchhu in Bhutan. Some of the ongoing activities are enhancing community livelihood and resilience to climate change adaptation through promotion of climate smart villages (pilot in Shawa and Nimshong gewog in Lhuntse); assessing water use pattern and scarcity in Kengkhar and Gangzur Geogs. Besides that awareness campaigns on sustainable cordyceps collection, waste management and water source protection in the alpine regions are also carried out.

Mr. Dawa also highlighted that inadequate financial resources and HR capacity was a major hindrance for effective delivery of research and services in water sector. There is a need for more funding window and capacity building programs in water resources.
Institutional collaboration is also an issue and there is need for strengthening coordination and collaboration among the relevant agencies.

Q & A Session

1. Mr. Gopal Prasad Khanal, NRCR & LF, Mr. Pema Dorji, DGPC asked if there are any information on rate of retreat of ice in Bhutan. He also asked about the duration that snow and glaciers take to melt.

Mr. Tayba and Mr. Phuntsho Tshering, from NCHM responded by saying that they cannot provide concrete answers to the exact number of years it takes for snow and glaciers to melt as only limited number of studies have been carried out.

2. Mr. Ugyen Dorji, from CNR asked about the kind of statistical tool that is being used by NCHM to forecast weather.

Mr. Tayba from NCHM said that NCHM uses dynamical model and does not use statistical tools to forecast weather. He informed that global model is downscaled into regional model and used as reference for forecasting. He also said that there are various models which are available online for forecasting.

3. Ms. Sonam Choden from WMD sought clarifications on the high altitude wetland assessment undertaken by UWICER. She pointed out on many studies which were conducted by International Center for Integrated Mountain Development (ICIMOD), Department of Geology and Mines (DGM) and National Soil Service Center (NSSC), however she pointed out on the information being scattered. She also asked if the high altitude wetland mapping report of 2016 was published.

Mr. Dawa Yoezer, UWICER, explained that conducting wetland assessment was very difficult task. The study covered the lakes and not marshes and peat bogs. The assessment was based on satellite imageries (Google Earth Images). In 2016, previous study was reassessed which was also based on Google Earth but with improved resolutions. He said that the report is in a finalization process with

GIS and statistical information and field validation underway.

4. Mr. Passang, Department of Hydropower and Power Systems (DHPS), commented that there are multiple sectors conducting similar studies resulting in different results. This he said is not only wasteful but often duplicates the same work. Therefore, he reiterated the need for a common entity to undertake such research and studies. Further, he said that hydropower investigations & planning are multi-disciplinary with lots of diverse studies & assessments to be undertaken. Therefore, he informed that there are lots of opportunities for engagement in hydropower investigations & planning. Ministry of Economic Affairs (MoEA) can outsource catchment studies to Sherubtse College in future if they have potential to conduct such studies.
Mr. Tshewang Dhendup from Sherubtse College informed that the college has state of art laboratory facility but are at an early stage of catchment research. However, he said that the college has plans to improve and conduct more water related and catchment research in the future. He said samples are collected on a monthly basis to get snapshot of the catchment.

5. Mr Jigme Phuntsho from MoWHS asked if NCHM has a system of sharing extreme weather forecasts to relevant authorities in advance. He also requested NECS to involve central agencies besides local authorities in preparation of national adaptation plans to avoid duplication of work.

Mr. Tayba, NCHM, informed the house that weather forecasts are shared through public media such as facebook, BBS, and other social media to the public and through official correspondences to the higher authority.

Chair's Summary

At the end of the session, chair reflected on following points:

- resources are scattered coupled with weak coordination and human capacity;
- weak coordination among agencies are observed during the presentation and such symposium forms a platform to create awareness, align and streamline activities in the future.

10. Session 4: Water and Livelihood

Chair:
Dr. Phuntsho Thinley,
Ugyen Wangchuck Institute for Conservation and Environmental Research

Talk 1	Rural drinking water supply and quality	Mr Karma, MoH
Talk 2	Urban water supply	Ms. Dechen Yangden. MoWHS
Talk 3	Water for irrigation	Mr. Kelzang Tenzin DoA, MoAF
Talk 4	Water for community and its livelihood	Mr. Kinley Dorji, River Guides of Pangbang
Talk 5	Rainwater harvesting; Opportunities for rural Bhutan	Mr. Jamyang Phuntsho, Tarayana Foundation

Talk 1 Rural Drinking Water Supply and Quality



Mr. Karma, MoH presented on the background of Rural Water Supply Schemes (RWSS), key achievements in the 11th FYP, priorities in the 12th FYP and issues and challenges faced by Public Health Engineering Division (PHED).

Some of the key achievements of PHED presented were:

- completion of pilot projects on springshed development, which resulted in increased water source yield;
- initiation of Water Safety Plans (WSP) following core 7 steps of WSP in 20 dzongkhags with engagement of communities;
- development of database (RWS MIS) for efficient collection of data and information; and
- introduction of four stages pumping station in Zobel, Pemagatshel and water source mapping in Gangtey, Wangdue.

He highlighted some of the programmes planned for 12th FYP:

- development of small scale water treatment system;
- water source mapping in more Gewogs;
- scale up springshed development project;
- explore alternative technologies; and
- community ownership.

Mr. Karma said that following were the issues and challenges faced by PHED:

- Decline of community ownership of Water Safety Plans
- no dedicated RWS engineer in the Dzongkhags;
- drying up of spring sources;
- rationing of water supply - unequal distribution;
- reaching the unreached (no source in some places);
- human resources - only 3 people in PHED.

Talk 2 Urban Water Supply



Ms. Dechen Yangden presented the key achievements of Water & Sanitation Division (WSD) during the 11th FYP, the key issues and challenges faced by WSD and their priorities for the 12th FYP.

The key achievements presented were:

- Prepared water and wastewater master plan (Mapping of watershed management and the resources in Thimphu);
- implemented water safety plan (simple tool to ensure safety from the source till the tap point);
- water and sanitation scenario for Thimphu Thromde assessed;
- developed action plan to be implemented by Thimphu Thromde;
- developed Water and Sanitation Information Systems (WASIS) for storing water information and data generated by Thromde and municipalities;
- conducted inventory of urban water and sanitation infrastructure; and
- provided water quality testing kits for pH, turbidity and chlorine to all municipalities.

Key issues and challenges presented were:

- weak coordination among the agencies;
- MoH and MoWHS responsible for supply of drinking water in rural and urban areas respectively. As a result, peri-urban population left unattended;
- lack of reliable on water resources and even water supply systems.
- drying up of water sources;
- conflicting water users (drinking water reflected as priority in the act, however people of Bondey are not allowing drinking water to the Tshongdu public at Paro);
- Poor demand management
- lack of awareness on water source conservation and consumption.

Further, she presented the priorities in the 12th FYP:

- improve adequate, safe and sustainable urban water services;
- ensure adequate supply of water to urban population;
- manage non- revenue water, improve demand management, regulation of water tariff, etc.

Talk 3 Water for Irrigation



Mr. Kelzang Tenzin, Department of Agriculture, presented on the water and land resource available in the country and the institutional arrangements in terms of managing water for irrigation. He informed that the national irrigation policy was developed in 1992 and revised in 2012. Apart from that, the national irrigation master plan was prepared in 2016. As per the master plan, by 2032 there should be an increase in total irrigable from 64,000 acres to 145,00 acres which would lead to 75 % food self-sufficiency. He also presented some of the existing technologies that were being assessed for implementation.

Mr. Kelzang Tenzin pointed out the following issues and challenges faced by the irrigation sector:

- There is need to build storage reservoir but due to small scale farming, such investment are economically not viable, thereby limiting production.
- fragmented land holdings;
- lack of manpower;
- Limited information to explore bore wells in Southern Dzongkhags.

In the way forward, he said that the following support is required:

- Strengthen the manpower of Irrigation Division.
- Encourage Research and Development on water resources.
- Borewell in southern dzongkhags.
- Replace the existing irrigation canals with high efficiency irrigation system.
- Explore the groundwater in Southern Dzongkhag.
- Land development.

Talk 4 Water for community and livelihood



Mr. Kinley Dorji said that the River Guides of Panbang (RGP) is the first community based ecotourism established in the country. RGP is a group venture business which was formed by young school dropouts in Panbang. It was formally established in 2012 as a rafting company. He informed that, their business plan has provision to share 5% of their total profit to Royal Manas National Park and 20 % to the communities of Panbang.

He showcased various services provided by them which include kayaking and kayak clinics, river campaigns, river expeditions (longest one being four days rafting from Kengkhar in Mongar to Panbang), rafting from Panbang to Manas which provides good opportunity to see floral and faunal diversity, Manas jungle camp (luxury tent with twin beds and western toilets), mountain biking, fly fishing with trained eco guides.

Mr. Kinley highlighted on the following issues and challenges:

- RGP targeted Indian tourists but not having immigration office in the area does not enable them for night halt;
- lack of ecotourism initiatives from RMNP Park Management; and
- impacts of climate change.

Talk 5 Rainwater harvesting



Mr. Jamyang Phuntsho informed that Tarayana Foundation is currently working in 36 villages of 4 selected Dzongkhags to solve the problem of water scarcity through NAPA II project. He said that 31 water user groups have been formed benefitting 1096 households.

In particular, he said that following activities are being carried out as per the project:

- encourage and adopt traditional methods of water harvesting;
- resource mapping to identify cluster of households or settlements;
- conducted 570 households baseline survey for water resource mapping in the East;
- formed water user committees to carry out minor maintenance and operation;
- plantation of native plant species for slope stabilization;
- identify water friendly plants and removal of alien plant species;
- construction of reservoir tanks and water source fencing;
- restoration of defunct water taps and installation of underground pipelines; and
- training on water filtration techniques with indigenous methods such as using bamboos
- conducted forest fire prevention and control in collaboration with Forestry extension staff.

Q & A Session

1. Mr. Sonam Dorji, Mawongpa Water Solutions, commented that the government agencies should start building their own capacity and capacity of the private sector instead of relying on external technical assistance. The involvement of private sector will ensure quality, operation and

maintenance of the infrastructure development in water sector. Also the advantage of private sector involvement ensures continuous improvement of the system.
2. Ms. Sonam Lhaden Khandu, NECS asked the logic behind promotion of flushable toilet system despite increasing concerns of not having sufficient water for drinking in rural areas.

Mr. Karma, MoH replied that there is a need to calculate daily demand and supply of water. Further, he clarified that it is not compulsory to have flushable toilets although it is a requirement in order to fulfill the UN SDG goals.

Ms. Shristi Sharma, Clean Bhutan, said that there are numerous technologies which use less water like urine diverting toilets, ecological sanitations, etc. which should be explored by the government.

Mr. Karma, MoH informed that there are a lot of options provided to public and the choice depends on the user's economic condition.

Ms. Sonam Choden, WMD, pointed out the shortcomings in the Public Private Partnership (PPP) model. She informed that some villagers were required by health workers to compulsorily install flushed toilets in their houses. She said that tourists are also raising issues with Tourism Council of Bhutan (TCB) constructing toilets near water sources. With regards to upscaling of springshed management by the DoA, she informed that such activities provide only temporary solution which agencies need to be mindful of. She reminded that planting right species of plants/trees is the right solution and not just planting any trees.

3. Mr. Tenzin Khorlo, NECS asked on the safety of drinking water that is supplied to houses. He also suggested RGP to improve marketing strategies to local people.

Ms. Dechen Yangden, MoWHS said that the water supplied by Thromdes undergoes vigorous treatment (rapid sand filter, compact treatment plant) and water is tested before supplying to consumers. She viewed people's unawareness and unwillingness could be a reason for not drinking water straight from taps.

Mr. Kinley Dorji, RGP informed that they have special rates for locals to encourage local tourism.

Chair's Summary
At the end of the session, the chair summarized the following:

- there has been tremendous progress made in terms of water utility and water harvesting. However, water security still remains a grey area. More deliberation need to happen on measures to ensure water security;
- ecosystem services, structures and functions which are poised to provide critical ecosystem services are not looked at. There is a need to harmonize our thoughts and views on how to harmonize productive ecosystem services;
- key issues and challenges in water resources management are common and it requires further in depth deliberations and discussions.

11. Session 5: Water, Energy and Economy

Chair:
Ms. Dechen Yangden,
Ministry of Works and Human Settlement

Talk 1	Hydropower development in Bhutan	Mr. Passang, DHPS
Talk 2	Hydropower energy	Mr. Pema Dorji, DGPC
Talk 3	The Economics of Ecosystem and Biodiversity (TEEB) study in Bhutan	Mr. Sangay Wangchuk, UWICER
Talk4	Natural capital valuation in Chamkhar chhu sub-basin	Mrs. Nagdrel Lhamo, WWF-Bhutan
Talk 5	Bhutan water risk scenarios and opportunities	Mrs. Sonam Choden, WWF-Bhutan
Talk 6	Issues, challenges and opportunities of water supply system: Mawongpa Water Solutions	Mr. Sonam Dorji, Mawongpa Water Solutions

Talk 1 Hydropower Development in Bhutan



Mr. Passang presented on the hydropower development in Bhutan. He said that hydropower is declared as the first jewel and Bhutan has huge potential for harnessing hydropower. As of now 1,606 MW have been installed, which is 6.76% of the total techno-economically feasible hydropower capacity and 3,658MW (15%) is under construction.

He explained on different planning cycles adopted in coming up with a hydropower plant. He said that hydropower provides significant benefits such as providing clean and renewable energy, establishment of schools, colleges, hospitals in project sites, fuel the growth of industry and private sectors and plough back mechanism in the social sector.

Challenges and issues presented were:

- high transportation cost;
- import of electricity from India in lean season; and
- limited human capacity both within the Ministry and private firms.

He outlined the future plans as follows:

- revise power system master plan 2003;
- undertake Detailed Project Report (DPR), Pre-feasibility Report (PFR) and reconnaissance studies; and
- Construction Development Corporation Limited (CDCL) to carry out tunneling in Kholongchhu.

Talk 2 Hydropower energy



Mr. Pema Dorji, provided information on the roles of DGPC, informed the meeting on the hydropower stations under operation, their subsidiary companies, and issues and challenges faced by DGPC.

He said that DGPC was established with the objectives to pool resources, maintain existing hydropower projects, promote and develop new hydropower projects, take lead role in accelerating hydropower development and provide energy security. He informed that the plants under operation are Chukha, Tala, Basochhu, and Kurichhu.

He said that DGPC is trying to evolve and become a competent public sector company to carry out DPR for hydropower projects in future to minimize outsourcing.

Following are the issues and challenges raised:

- environmental and social concerns such as maintaining e-flow during lean season as there is minimal flow in rivers and applicability of fish ladder.
- waste/pollution in water bodies resulting in higher maintenance costs;
- sedimentation and siltation resulting in reduction of reservoir capacity and machine life.

Talk 3 The Economics of Ecosystem and Biodiversity (TEEB) study in Bhutan



Mr. Sangay Wangchuk, informed that TEEB is a process to value the ecosystem services which started in 2013 with funding from UNEP. He said that a stakeholder workshop was conducted in 2014 which identified hydropower as a topic to study with the objective to inform sustainable hydropower policy and renewable energy policies of Bhutan.

He informed that TEEB Bhutan selected eight hydropower sites [3 commissioned; 2 under construction and 3 planned for construction] after generating three different scenarios [business as usual; dam construction without up-stream land management; and dam construction with upstream land management]. The study used system dynamics model to derive mathematical models and also used InVEST modeling tool to undertake biophysical and valuation modelling for 2010 and 2030. He informed that the results from the model indicated a decrease in forest cover in the future even with no hydropower damming since the population is going to increase thereby increasing demand for forest resources.

Talk 4 Natural Capital Valuation in Chamkharchhu sub-basin



Mrs. Nagdrel Lhamo presented the study on natural capital valuation of Chamkhar chhu sub basin undertaken by WWF Bhutan Program in collaboration with agencies. She said that it is important to know the economic value of natural capital in order to understand and appreciate ecosystem services. She said, the information generated can be utilized in the GNH model for accounting value for the environment. She informed that they used InVEST (Integrated Valuation of Ecosystem Services and Tradeoffs) modeling tool which is freely available.

The study was to assess the extent of sediments and erosion from different land cover. The site was selected as there are many hydropower projects planned along the river basin. She said the study was taken up with the aim to improve soil and land management practices upstream of hydropower projects.

Talk 5 Bhutan Water Risk Scenarios and Opportunities



Ms. Sonam Choden, WWF presented the Bhutan water risk scenarios and opportunities study carried out by the NECS and WWF. She said that the study was carried out to provide sound understanding of current and future ecological and biophysical scenarios and opportunities for future development.

She informed that during the study, three plausible scenarios were developed - hydro Bhutan, brand Bhutan and green Bhutan after discussion with relevant stakeholders. She said that for each of the scenarios, there are future trade-offs in assurance of water supply/ reliability/access, downstream protection, watershed integrity and stability, disaster management, and spatial overlays/conflicts. The report recommends the following:

- Spatial planning- taking deliberate but conscious and strategic planning and direction of varied development in different regions;
- Management instrument- integrated water related decision support tools and approaches in wider economic planning;
- Strengthen partnership - among key stakeholders, researchers and private individuals.

Talk 6 Mawongpa Water Solutions: Issues, Challenges and Opportunities



Mr. Sonam Dorji, presented on the various machineries and equipment supplied by his firm. He informed that Mawongpa Water Solutions is a service provider which supplies reliable and safe equipment for water storage and provides rental services for filtration and maintenance of water storage tanks.

Mr. Sonam informed on the water dispenser facility which can be used for storage of water in schools to enhance safe drinking water. He said that the availability of such facility would in the long run help cater better health services for our younger generation as these facilities are claimed to be healthier than the current system used in our community. However, it was realised that there is no conducive policy for promotion of such services at the moment.

Q & A Session

1. Mr. Jigme Wangchuk from UWICER enquired on the lifespan of hydropower dams. He informed that a machine established in France called TOKAMAK can generate 500MW of power and if it comes in the market it may affect the hydropower market.

2. Mr. Dawa Yoezer from UWICER asked the time period and cost of decommissioning Hydropower Dams.

3. Mr. Gopal Prasad Khanal from NRCR&LF asked whether the hydropower agencies revive the natural state of the river system after decommissioning of hydropower dams. He asked if the agencies keep funds for decommissioning of dams. He further enquired if there are fish friendly turbine that could be constructed in Bhutan.

Mr. Passang from DHPS replied that as of now decommissioning of dams has not happened however it should be considered.

4. Ms. Sonam Choden from WMD informed that decommissioning of dams are more expensive than construction of dams. She said that the spring water may have dried due to construction of tunnels for hydropower dams. She said that the Sherubtse College, UWICER and CNR should carry out research to find out if such activities is the cause for sources drying up. She asked DGPC if they have a strategy for ploughing back funds for environmental restoration.

Dr. Phuntsho Thinley, UWICER, said that ecological restoration is not as simple as stated, and it requires a reference point. He said that should current hydropower plans materialize, it will leave no reference point as all rivers will be tapped for hydropower development. He informed that in order to study and monitor ecological changes taking place in river, there is a need for keeping one undisturbed river system. He said that the hydropower agencies provide funds for plantation to the DoFPS as a plough back mechanism, however such activities are not monitored and evaluated. He said it is important to identify correct species while carrying out plantation. Further he highlighted that research is very important but at the moment there is no political commitment as politicians demand answers in a short period.

Mr. Pema Dorji, DGPC, informed that they record data as part of the EIA process and reporting. He said EIA should be one of the reference point.

Mr. Tenzin Khorlo, NECS, asked the way forward from TEEB study. He said there are many water bottling plants coming up and its impact on hydropower in future have not been studied.

Mr. Sangay Wangchuk, informed that they involved the during the system dynamics model development, officials from National Statistical Bureau were engaged with the possibility to include the findings in indicator of green accounting. He also said that the DGPC was quite positive to take on board the results from the economic valuation for holistic planning and during preparation of EIA and DPR reports.

Mr. Passang from DHPS said that as part of the EIA and DPR, detail studies are carried out from the social, environmental and economical point of view. He informed that the import of energy during lean season is compensated in the form of energy in summer when there is excess production. He said that the damming of all rivers in Bhutan for hydropower is a speculation and it is not going to happen as people have speculated. He also said that there are many reviews underway to incorporate all the changes that are taking place and a strategic road map preparation is planned.

Chair's Summary

- Hydropower is a sector that contributes to the revenue of the country and it is inspiring to learn that CDCL and private companies are evolving in terms of capacity to take up the projects in the future;

- DGPC have many projects completed and many going to come up. The challenges of E-flow and waste management is really a hurdle for the company. The awareness campaign on the waste management in the communities is inspiring;
- TEEB as a process for evaluating ecosystem services and hope it will help to evaluate country's ecosystem services and enhance the management of the resources;
- valuation of ecosystem services significant for planning projects that are related to natural resources and InVEST tool will help plan these projects more effectively; and
- changing from sector specific planning to more holistic and integrative plan involving all the sectors in the system. The report on the water risk scenarios and opportunities can help enhance in planning the project related to water.

12. Session 6: Group Work and Plenary

Chair:
Chencho Norbu, Secretary,
National Environment Commission Secretariat

Ms. Tenzin Wangmo, NECS gave a brief outline on Day 3 agenda. She informed the meeting that the participants will work in groups to discuss on issues and challenges in water resources management, research needs and intervention areas (for the 12th FYP and beyond), institutional collaborations and action plan and other pertinent issues.

The participants were divided into three groups and discussed on the following topics:

- Issues and challenges in water resources management
- Research needs and intervention areas (for the 12th FYP)
- Institutional collaborations and action plan

Plenary group presentation and Discussions

Group I presentation	Ms. Sonam Choden, WMD
Group II presentation	Mr. Dorji Wangdi, Wangdue Dzongkhag
Group III presentation	Mr. Sonam Dorji, Mawongpa Water Solution
Summary and closing remarks	Hon'ble Secretary, NECS and Dasho Paljor J Dorji, Special Advisor to NECS

Presentation: Group I

Following are the issues presented:

- Weak institutional coordination: The group pointed out that there is no centralized agency on the water resources management in the country. More so, the current institutional set up is weak with numerous agencies with multiple mandates;
- No comprehensive water resource mapping (water bodies) which covers lakes, marshes, mountain types, wetlands- maps of sources of rural water supply;
- No proper dissemination of research results to relevant stakeholders. Science-policy

interface is very weak;
- No centralized data repository on water resources leading to poor data management;
- Inefficient demand management by the concerned authority resulting in commercialization of water resources especially in urban areas;
- Weak implementation of Acts and Policies;
- Poor aquatic biodiversity studies;
- Watershed areas for drinking, industries, agriculture and energy is not clearly demarcated;
- Water demand, water budgeting and critical watersheds not assessed;
- No baseline data on groundwater;
- Weak planning and implementation of RWSS. Existing policies are adequate but implementation and planning is weak;
- Inadequate financial and human resources;
- Lack of platform for information sharing;
- No clear mandates on roles and responsibilities in conducting research, approval processes and reporting systems. Lack of specific repository system, forums and opportunities to present research results.

The Group also pointed out the following research needs:

- Wetland valuation and functions.
- Wetland mapping.
- Water resources assessment.
- Baseline fishery ecology studies on lake and rivers.
- Effectiveness of Rural Water Supply System (RWSS) and Urban Water Supply System (UWSS).
- Assessment of drinking water quality.
- Assessment of ambient water quality.
- Fish ladder efficacy.
- Investigation on water source drying up.
- Institutional set up including human resource adequacy and coordination among the relevant agencies.

The group proposed the following recommendations:

- Water symposium be coordinated annually.
- Alignment of activities in the 12 FYPs.
- Standardization of water quality testing laboratories.
- Strengthen enforcement and implementation of Water Act 2011 and Regulations.
- Institute a centralized data management system.

Discussions

Mr. Sangay Wangchuk, UWICER, argued that research results are accessible but it is upto the audience to refer them. He expressed that it may be incorrect to point that the results are not being shared and disseminated while these documents are being published, in particular the studies done by UWICER.

Secretary, NECS suggested using policy briefs for technical reports being mindful of target audience to ensure that the message is sent across clearly.

Jigme Phuntsho, MOWHS informed that the environmental clearance requirement for abstraction

of groundwater in the southern belt may be relaxed since it is extracted in anyway by the people across the border.

Secretary, NECS, informed the house that establishment of borewell will be encouraged should the proposal come from the community and requirements to obtain environmental clearance has also been simplified.

Presentation: Group II

Roles of agencies working on water was presented and following issues were covered:

- Contradiction in policies e.g; water sanitation and watershed management;
- Lack of clear roles & responsibilities of field officers of different agencies.

Following were the research needs that were identified:

- Water and livelihood.
- Water sources drying up.
- Household water use and management.

The group proposed the following recommendations:

- Institutional collaboration: Research institutions need a forum to avoid duplication, stock take information, link to policy development and decision making.
- Regulatory bodies to complement each other and not compartmentalize.
- Stakeholder consultation for review of policies, coordination, identify issues and challenges and identify solutions
- Research sharing forum
- Scale up water safety plan (WSP)
- Enforce Water Act
- Encourage formation and strengthen water users associations
- Assessment of project related to water
- Clear procedure for decision making and reporting
- Expanding PES in the rural areas
- Encourage and introduce best management practices in watershed areas
- Establish clear procedure for decision making and reporting
- Encourage PES in watershed areas so that when developmental activities come up, communities in that area can be compensated.
- Identification of reference rivers for ecological studies
- Support and encourage research on water
- encourage formation of CSOs on water
- Strengthen institutional coordination
- National repository on water.

Discussions

Policy contradiction: as per the WSP, fencing in water sources are allowed, however WMD's policy does not allow fencing of water sources to allow access of the resources to wildlife.

WMD: fencing is not healthy practice for the management of the water resources and it deprives the use by wildlife. The concretization of water sources are not environmentally friendly.

Sherub UWICER: Water holes can be left unfenced for wildlife where as sources used by the people can be fenced, thus it is a workable situation.

Chair: Asked group 2 to substantiate more examples on the unclear legislation and also pointed out that the research needs are more generic and need to down scale to the activities.

Regulatory bodies to complement each other: despite the Acts and regulation specifying the same, authorities in the ground seemed to act differently and not complementary to each other causing difficulties to the common people.

NECS: Water act reflects comprehensive description on the competent agencies that will implement the activities. However water being crosscutting activity the lapses are foreseen. The mechanism of coordination and reporting from different agencies should be streamlined.

Presentation: Group III

Following are the issues presented:

- Weak planning
- Weak public procurement policies: bidding for the low price and getting low quality material
- Poor infrastructures: low quality used in the present market and health of public is a concern
- Too much dependent on findings and technology from other countries
- Electricity tariff: high tariff not allowing rural farmers to use pumping facility for water usages.
- Poor ownership of end users- dependent on government

Following are the research needs identified:

- Catchment research
- Mechanisms to fund catchment and water related issues should be promoted by HP companies
- Hydropower companies should have provision to fund upstream catchment research activities
- Comprehensive baseline studies on aquatic biodiversity
- Studies on groundwater availability in southern region
- Farm road and its impact on water resources
- Analytical studies not just economy but for social and environment as well

The group proposed the following recommendations:

- Bhutan water commission
- Institutional collaboration
- Formulate mechanism for institutional interaction.
- Pilot PPP model and explore ways to engage private participation when it comes to long term problem solving.
- Provide incentives and subsidies

- Capacity building and resource pooling
- Institutional collaboration: Agencies should be proactive in taking up the activities and linkages between agencies.

11.6 Discussions

Data sharing- NCHM are sharing the hydromet data to the client on the request based on the requisition form (soft and hard) as necessary.

Dasho Secretary commended UWICER on the impressive study done on upper Chamkharchhu and urged the UWICER to share the study result with other agencies.

11.7 Chair's Summary

- Weak coordination among stakeholders;
- Weak enforcement of Act but this requires detailed study and analysis to identify provisions that are not working and why;
- Research being weak and poor dissemination of research results. No common forum to share;
- Information management and data sharing
- Water quality testing facilities at various agencies. Therefore, important to have an inventory on these facilities.
- Identifying institutes- first carefully examine the mandates and roles for existing institution and assess the need for establishing a new institution. Have a good argument by analyzing the current scenario. Each agencies are being fulfilled as mandated under the Act, the issues faced, conduct a careful assessment and come up with recommendations.

13. Closing Remarks:

Dasho Paljor J. Dorji, Special Advisor National Environment Commission

Dasho expressed his regret for not being able to attend the proceedings of the symposium despite his great interest in water and water resources management. Dasho shared his personal experiences on the transformation of the mighty Teesta river in Sikkim into a long dirty sewerage stretch. "The river now flows like a lame duck and has totally lost its charisma" Dasho stressed. He attributed this changes to mainly hydropower plants and numerous other developmental activities along the river.



Dasho introduced the wilderness of Bhutan's rivers depicted through the documentary called 'Powers of River' which was shot in the Drangmechhu in eastern Bhutan. Dasho insisted everyone to watch the documentary and compare it with that of Teesta and ensure our rivers not to become like that of once mighty Teesta. Dasho highlighted the importance of proper utilization of water resources for everyone's benefit but also cautioned that we must not kill the river which contains life in itself.
Dasho asked the members of the house to mature into good decision makers and plead to maintain at least one river systems as a free flowing river in the interest of our natural history and diversity. He highlighted the richness of biodiversity along Chamkharchu and expressed his regret in losing the battle for keeping this river undisturbed. Dasho expressed his wish to protect Drangmechhu

and for better economic benefit of its users such as downstream communities. Dasho concluded by thanking the house for coming together and expressed his wishes for furthering the expertise in the field of water resources management and conservation.

14. Resolutions of the Symposium

1. Recognizing weak institutional collaboration with regard to water resources management, the house resolved that NECS will immediately coordinate to bring together all the key stakeholders. The forum should assess the mandates and roles of various agencies to avoid duplication in resources, strengthen coordination and to assess the need for establishing a new institution to solely deal with water resource management.

Action Point: NECS to coordinate stakeholders meeting by December 2017.

2. The House unanimously acknowledged the comprehensive provisions in the Water Act 2011 and Regulation, 2014. However, the enforcement and implementation of these provisions is weak owing to weak coordination, limited capacity and resources.

Action Point: NECS to include this during the Stakeholders' meeting under Resolution 1.

3. The Competent authorities/agencies including research and academic institutes, should submit annual report to the NECS on the enforcement, implementation and monitoring of the Water Act of Bhutan, 2011 and its Regulations including issues and challenges confronted by them. This is also in accordance with Section 65 of the Water Act, 2011 and Section 21 of the Water Regulation, 2014.

Action Point: NECS to communicate to Competent Authorities/Agencies including research and academic institutions by June 2017.

4. The House noted that while the Water Act has come into force in 2011, there are still ambiguities in the interpretation of the provisions and issue of inadequate awareness among agencies and public. In keeping with this, the House agreed to require more rigorous and continuity in awareness and sensitization programs on the Water Act, 2011 and Water Regulation 2014 by concerned agencies.

Action Point: NECS should coordinate with concerned agencies.

5. Research in the areas of water resources and climate is still in its infancy in Bhutan and there is a need to strengthen research in terms of water and aquatic biodiversity. The House identified the following areas of research:

- Water sources drying up;
- study on aquatic biodiversity;
- water resources assessment;
- farm road construction and its impact on water resources;
- study on groundwater;
- effectiveness of RWSS and UWSS;

Action Point: NECS to coordinate with research institutes to explore funds for research and avoid duplication of work.

6. The House noted on various activities on water resources and aquatic biodiversity carried out with information and efforts scattered among agencies. This require institution of a central data repository system at national level to strengthen information management and sharing among users.

Action Plan: NECS should carry out an assessment and identify relevant agency to form central data repository.

7. Water quality testing and laboratory facilities are available with various agencies. The House felt the need to have a centralized and standardized laboratory. Towards this, an inventory of existing facilities shall be conducted immediately.

Action Point: UWICER in consultation with NECS to carry out the inventory.

8. The House recommended the need for institutionalizing and strengthening the Payment for Environmental Services schemes at local and national level.

Action Point: Watershed Management Division, Department of Forests and Park Services to explore additional funding opportunities and mechanisms for upscaling the PES schemes from international and within Bhutan mainly from Hydropower sector.

9. Currently in Bhutan the quality of water supply infrastructures and workmanship is not paid much attention and is compromised greatly. In order to ensure safe and reliable drinking water to the households, and discharge of wastewater into water bodies, the house resolved the need for improving the standards of the water pipes, storage, and distribution system and workmanship skills.

Action Point: MoWHS should coordinate with Bhutan Standards Bureau.

10. The House commended the first water symposium for providing a platform to share information, experiences, lessons learnt, issues faced and explore collaborative actions in water resources management. Further, the House recommended the symposium be held on an annual basis.

Action Point: NECS to coordinate the symposium annually in collaboration with relevant agencies.

Annexure I Agenda for the Symposium

Day1: 10 May 2017

Time	***Program***	
Opening Session		
8:30	Registration of Participants	
8:45	Welcome Address by National Environment Commission	
9:00	Opening Remarks by the Hon'ble Prime Minister	
9:25	Vote of thanks by Dr.Norbu Wangdi, Ugyen Wangchuck Institute for Conservation and Environmental Research	
9:30	Photo Session	
9:40	**Tea Break**	
Technical Session		
10:30	- Introduction of participants - Opening Note by Hon'ble Secretary, National Environment Commission - Brief overview of the symposium by Dr. Norbu Wangdi, UWICER	
Session I: Water Governance and Policy-Chair : Mr. Karma Dupchu, NCHM		
11:00-11:30	Talk 1: National Water policy, water and waste Act	Legal, NECS
11:30-12:00	Talk 2: National Integrated Water Resource Management Plan	WRCD, NECS
12:00-12: 30	Talk 3: Local Governments perspective of Water Resources Management	DEO, Wangdue Dzongkhag
12: 30-13:00	Q&A Session	
13:00 -14:00	Lunch Break	
Session 2 : Water and Ecology – Chair: Mr. Ugyen Lhendup, BTFEC		
14:00-14:30	Talk 1: Watershed & Wetland Management	WMD, DoFPS
14:30-15:00	Talk 2: Freshwater macro invertebrates diversity in Bhutan	UWICER, DoFPS
15:00- 15:30	Talk 3: Documentation on Fishes of Bhutan, Golden Masher and their major threats	NRCR&LF, Haa
15:30-16:00	Talk 4: Brief account on freshwater biodiversity of Bhutan	CNR,Lobesa
16:00-16:20	**Tea Break**	
16:20-16:40	Talk 5: Study on Environmental flow	ESD, NECS
16:40- 17:00	Q&A Session	
	End of Day 1	

Day 2: 11th May 2017

Session 3 : Climate, Cryosphere, Water and Disaster – Chair: Karma C Neydrup, NECS		
09:00-09:15	Weather and climate observation and information	NCHM
09:15-09:30	Cryosphere monitoring and information	NCHM
09:30-09: 45	Hydrological observation network and information (including GLOF)	NCHM
09:45-10.05	Naturally occurring chemical tracer in hydrology	Sherubtse College
10.05-10.25	Climate change and adaptation	CCD, NECS
10.25-10:45	Overview of climate and water resource studies	UWICER, DoFPS
10:45- 11:10	Q&A Session	
11:10- 11:30	**Tea Break**	
Session 4: Water and Livelihood - Chair : Dr.Phuntsho Thinley, UWICER		
11:30-11:50	Rural Drinking Water Supply and Quality	MoH
11:50-12:10	Urban Water Supply	MoWHS
12:10-12:25	Water for Irrigation	DoA, MoAF
12: 25-12:45	Water for community and its livelihood	CY, Panbang River Guides
12.45-13:00	Rainwater harvesting	Tarayana
13: 00-13:30	Q&A Session	
13:30 -14:30	Lunch Break	
Session 5: Water, Energy and Economy – Chair: Ms.Dechen Yangden, MoWHS		
14:30-14:50	Hydropower Energy	DoHPS
14:50-15:10	Hydropower Energy	DGPC
15:10-15:30	Water Based Industries	ABI
15:30-15:50	The Economics of Ecosystem and Biodiversity	UWICER, DoFPS
15:50-16:20	**Tea Break**	
16: 20-16:40	Natural capital valuation in Chamkharchhu sub-basin	WWF-Bhutan
16:40- 17:10	Bhutan Water Risk Scenarios and opportunities	WWF-Bhutan
17:10- 17:40	Q&A Session	
End of Day 2		

Day 3: 12th May 2017

Session 6: Group Work – Chair, Hon'ble Secretary, NECS	
09:00- 11:00	Group work on following topics: • Issues and challenges in water resources management_ • Research Needs and Intervention Areas (for the 12th FYP) • Institutional Collaborations and Action Plan
11:00- 11:30	**Tea break**
11:30- 13:00	Group Presentation & Plenary Session
13:00-14:00	Lunch break
14:00-15:00	**Adoption of Resolution**
15:00-15:30	Closing Session & Vote of Thanks
	End of Day 3

Annexure II List of Participants

1. Mr. Ugyen Dorji, Lecturer, CNR
2. Mr. Bholanath Bhattarai, Sr. RO, GNHC
3. Ms. Jasoda Chuwan, Program Officer, WWF
4. Mr. Passang, Executive Engineer, DHPS, MoEA
5. Mr. Karma Dupchu, Chief, NCHM
6. Ms. Kuenga Choden Dorji, Engineer, DHPS, MoEA
7. Mr. Kelzang Tenzin, Executive Engineer, DoA, MoAF
8. Mr. Kinley Dorji, Sales and Procurement, River Guides of Panbang
9. Ms. Sonam Choden, Sr. Forestry Officer, DoFPS, MoAF
10. Mr. Chimi Rinzin, UNDP
11. Mr. Pema Dorji, Environment Officer, DGPC
12. Mr. Gopal Prasad Khanal, Sr. Livestock Officer, NRCR & LF, DoL, MoAF
13. Mr. Cheten Thinley, Forestry Officer, UWICER
14. Mr. Sherab Wangchuk, Planning officer, PPD, MoAF
15. Mr. Sonam Chophel, Communication, WWF
16. Ms. Tshering Chhoden, Executive Engineer, MoWHS
17. Dr. Karma lhazin, Director, DoPH, MoH
18. Mr. Thinley Namgyel, Chief, NECS
19. Ms. Dechen Tshomo, Kuensel Corporation Ltd.
20. Mr. Tshewang Dendup, Lecturer, Sherubtse College
21. Mr. Sonam Dorji, Founder, Mawangpa Water Solution
22. Mr. Nakphel Drukpa, Principal Engineer, Thimphu Thromde
23. Mr. Damber Kr. Ghemiray, Researcher, UWICER
24. Mr. Tenzin Rabgye, Communication, WWF
25. Mr. Kunzang Rinzin, Legal Officer, NECS
26. Ms. Dechen Yangdon, Chief, MoWHS
27. Mr. Ugyen Lhuendup, Chief, Bhutan Trust Fund,
28. Mr. Vijay Moktan, Conservation Director, WWF
29. Mr. Shacha Dorji, Specialist, DoFPS, MoAF
30. Mr. Sangay Wangchuk, Dy. Chief, UWICER
31. Ms. Shrish Sharma, Environmental Engineer, Clean Bhutan
32. Mr. Tshewang Rigzin, Engineer, NCHM,
33. Mr. Jigme Phuntsho, Executive Engineer, MoWHS
34. Ms. Nagdrel Lhamo, Program Officer, WWF
35. Ms. Sonam Choden, Project Manager, WWF
36. Mr. Dorji Wangdi, Environment officer, Wangdue Dzongkhag
37. Mr. Sonam Gyelpo, Environment Officer, Thimphu Dzongkhag
38. Mr. Tashi T. Dukpa, Program Director, Bhutan Foundation
39. Mr. Tsheten Dorji, Program Officer, RSPN
40. Ms. Passang Wangmo, NECS
41. Mr. Phuntsho Tshering, Sr. Geologist, NCHM

42. Ms. Sonam Lhaden Khandu, Dy. Chief, NECS
43. Mr. Tenzin Khorlo, Chief, NECS
44. Mr. Karma, Principal Engineer, MoH
45. Ms. Yangki, Engineer, MoH
46. Mr. Jamyang Phuntsho, Program Officer, Tarayana Foundation
47. Mr. Tayba B. Tamang, Dy. Chief, NCHM
48. Ms. Tshering Yangtsho, Program Officer, GNHC
49. Dr. Phuntsho Thinley, Principal Forestry Officer, UWICER
50. Ms. Jangchu Dema, EQST, NECS
51. Mr. Karma C. Nyedrup, Environment Specialist, NECS
52. Mr. Jigme Wangchuk, Researcher, UWICER
53. Mr. Norbu Wangdi, Dy. Chief Forestry Officer, UWICER
54. Ms. Tshewang Lhamo, Sr. Environment Officer, NECS
55. Ms. Kunzang, Dy. Chief Legal Officer, NECS
56. Ms. Tenzin Wangmo, Chief, NECS
57. Mr. Rinchen Wangchuk, Sr. Forestry Officer, UWICER
58. Ms. Kinley Wangmo, Intern, NECS
59. Mr. Jamyang Palden, Intern, NECS
60. Mr. Dawa Yoezer, Forestry Officer, UWICER
61. Mr. Sherub, Researcher, UWICER
62. Mr. Tshering Dendup, Asst. Media & Communication Officer, UWICER
63. Mr. Phuntsho Wangdi, Asst. Environment Officer, NECS

The National Environment Commission is a high level multi-sectoral body. It is an independent authority and the highest decision making and coordinating body on all the matters relating to the protection, conservation and improvement of the natural environment.The core mandate of the National Environment Commission Secretariat is to develop, review and revise environmental policies, plans and programmes, formulate environment related Laws/Acts and monitor enforcement of the same.Our pivotal goal is to mainstream environment into the country's developmental policies, plans and programmes and promote environmental awareness amongst all levels of Bhutanese society, including dissemination of environmental policies, strategies, acts, rules, regulations and standards.

We strive to institutionalize the Environmental Assessment (EA) process as an integral part of the development planning process through enforcement of EA Act 2000, adopt, review and revise environmental standards for the country, monitor ambient air and water quality, and land-use changes and inform all sections of the society. We also publish the State of Environment Reports once every 5 years and submit to the Lhengye Zhungtshog/Parliament and disseminate the findings to the general public.

We further promote and conduct environmental research, coordinate and facilitate the implementation of bilateral and multilateral environmental agreements, conventions, treaties or declarations, receive representations on environmental matters from members of the Civil Societies, develop and facilitate the implementation of the National Sustainable Development Strategy (NSDS). We also coordinate and monitor cross-sectoral issues related to water, forestry and mineral resources and waste management in the country.

The Ugyen Wangchuck Institute for Conservation and Environmental Research is a Government based research and training institute. We strive to foster better stewardship of our natural heritage – land, water, air and species therein – through rigorous science based research and transmission of cutting-edge science results to field practitioners, environmental leaders and policy makers.

Our current focus areas are defined by needs and challenges within Bhutan and outside. We recognize interlinkages between the way forestry is practiced to the dynamics of species conservation and persistence. We understand the implications of landuse practices and global climate change on water resources and energy requirements. Above all, we appreciate and seek to understand human impacts and impacts on humans by studying social patterns and economic implications of management and policy interventions.

In addition to conducting research, we provide a two-year certificate course in environment, forestry and conservation. We also offer tailor made course within the field of conservation biology, sustainable forestry and water resources for professionals working in these fields. We also offer opportunities for undergraduate students to conduct research projects as part of their Honours program.

As part of our initiative to encourage discourses and dialogue within the environmental community, we regularly organize seminars and host conferences at both national and international level.



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