Abstracts of Papers
Presented at the
Second Regional Dialouge
State of Ecology of the Tibetan Plateau

State of Ecology, and Ecology of the State on the Tibetan Plateau

Gabriel Lafitte

Abstract:

China's latest blueprint for the future development of the Tibetan Plateau emphasises the fragility of Tibetan ecology. This frames the policy debate, leading to ever-firmer 'red lines" drawn around the best pasture lands of the plateau, as areas of permanent grazing bans, removal of pastoralists and official prohibition of extractive and other heavy industries inside the red lines.

Ecology has become a prime justification for depopulating rural Tibet, turning skilled livestock and land managers into unskilled fringe dwellers on the urban edge of the world's factory market economy. The fragility of Tibetan ecology, especially in Qinghai, in upper reaches of the Yellow, Yangtze and Mekong rivers, has become so naturalised, as a well-known fact, that policy makers take it for granted as the key fact of planning for the future.

Does China –or the global scientific community- know the Tibetan Plateau well enough to establish "fragility" as the defining characteristic of the lush alpine meadows of Amdo, in Qinghai province? Does China understand the dynamics and drivers of a grazed, curated, inhabited landscape that, on archaeological evidence, has been managed sustainably for 9000 years? Does China have a more intimate knowledge of the boundary between sustainable and unsustainable land management practices, than the nomads?

These are obvious questions to ask of the naturalised "fact" of Tibetan fragility. Further questions arise. What is China's definition of a grassland that is not endangered, overgrazed, degrading and fragile? Is all grazing defined as a degradation of the grassland? Is there a contradiction between grass and animals? Is "fragility" a code word for redefining the Tibetan grasslands purely as a provider of downstream water and environmental services for lowland China? Is the future of the nomads to be paid to do nothing, to protect those environmental services?

The same 2012 master plan that decrees the most productive pastures of Qinghai to be fragile also calls for "improved granularity", or greater knowledge of actual, local circumstances, so central planners in distant Beijing may know what to do. (China Council for International Cooperation on Environment and Development: Policy Research Report on Environment and Development Regional Balance and Green Development 2012).

But does the state, used to judging Tibet from afar, and from satellites in the sky, actually know that the Prohibited Grazing Main Functional Zone that comprises 40% of the area of Qinghai is "fragile"? Do we need an ecology of the state, to track the origins of this sinocentric mythos of Tibetan fragility?

Action and Reaction:
The Human Interface of Ecological Change in the Tibetan Plateau

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Abstract:
Even decades of discussion about global warming, pollution and excessive resource exploitation have apparently not convinced world leaders to take decisive steps to halt all this. The reasons may be that the places where people feel the consequences most are generally the least populated, or amongst the least powerful. Their fragile ecosystems didn't allow for massive exploitation, and thus made only a limited number of highly adaptive people live there. It is a tragic irony of the fate that those who caused the least are susceptible to suffer most from the impacts of the global climate change. Due to their relatively small number, they are not in the position to fight the causes on their own. What they do is to adapt to changes they experience.

Simultaneously, some of their governments, like China, attempt to mitigate immediate effects, to draw on measures to limit causing further change and to restitute, where possible, the former, or conserve at least the current state of affairs.
Due to the complexity of the interrelations between people and their actions, the climate, the biosphere and even "global markets", reactions to singular problems identified as "causers" of ecological deterioration have their own consequences, both positive and negative, on the environment. Sometimes, these seem to be unpredictable, although a detailed analysis of the dynamics at the "human interface" could help to assess possible (local) impacts by an interdisciplinary approach towards identifying the interrelations between ecology, economy, demography, social, political and cultural contexts. Here, at the "human interface" of the ecological change in the Tibetan Plateau, I focus on local stakeholders impacted by that change, who react to it and eventually also add to such changes, deliberately or involuntarily.

The analysis is thus based on the complex conditions of their livelihoods, focusing on how ecological change and related policies influence people's access to resources. This means that we discuss ecological change from a perspective of political ecology—by studying the complex interaction between political, economic and social factors and environmental issues and changes. Using this approach to look at the state of ecology of the Tibetan Plateau means to focus on the (local) human interface: originally local people acted in order to conserve what they used.

Traditionally, they are closer to the understanding of "healthy conditions" of the local environment than distant policy-makers' interventions. If their behaviour shows signs of disregard towards such conservation, we may have to interpret this as a (partial or complete) reaction to internal and external influences, with those latter restricting access to basic resources of local livelihood options. In order to unfold respective dynamics in Tibetan areas, I attempt in my paper to
1 summarize perceived ecological change(s),

2 roundup given explanations and description of causes,
3 unfold the perspective of local stakeholders on what they consider the most urgent problems,
4 highlight state measures taken to halt ecological change in the Tibetan Plateau,
5 discuss effects of those measures, and
6 brief my own perception of current (and future) ecological problems, of countermeasures and interventions, and the identification of major factors for or against ecological change in Tibetan areas.

Analysis on the policy of Ecological Incentive and Subsidy for grassland ecological conservation in the Tibetan Autonomous Region

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Abstract

Through the investigation of Gerze County in Ngari Prefecture in the Tibetan Autonomous Region(TAR), this paper aims to explore the policy of Ecological Incentive and Subsidy for grassland ecological conservation implemented by the Chinese government, including its relations with the ecological reconstruction and the problems that have ensued. Located in the northern part of Qiangtang Prairi, Gerze is the largest County in Ngari Prefecture with more than 7.8 million acres pasture, among which 6.2 million acres are usable and 3.4 million acres lack water source. In recent decades, due to increased population and various other reasons, local herdsmen have overgrazed the pasture, which leads to the serious degradation, desertification and salinization of the grassland. Since 2009, when neighboring Coqin County was chosen as a pilot for the national Ecological Incentive and Subsidy Policy, Gerze has also started to adopt this policy and brought it into full implementation in 2010. Its purpose is to solve the problem of overgrazing. But like other policies carried out in Gerze, its implementation is faced with many challenges. First, it is difficult to define the types and scopes of the incentives and subsidies, which have become a major source of complaints of the local herdsmen. Second, the local herdsmen are also concerned about the fairness of assigning rewards and subsidies. Third, the high cost of implementing and supervising the policy reduces its effects. Fourth, the fact that the herdsmen are not willing to reduce livestock population makes it difficult for the policy to achieve actual results. The author thinks it's necessary to revise and improve the current Ecological Incentive and Subsidy Policy.

Sacred Mountain versus Mining

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Abstract:

An ancient painting representing a beautiful God dressed in pure white, holding a crystal sword in one hand and a spear in the other depicts the famous folklore mountain deity Yarlha Shampo. Mount Yarlha Shampo is the abbot of this worldly God whose name and stories are narrated in the ancient Tonghua manuscript, in a 13th century Tibetan history as well as in numerous Tibetan folklore stories.

According to the Bon religion's beliefs, the Yarlha Shampo deity or Mount Yarlha Shampo is one of the nine worldly mountain deities came into existence with the Tibetan plateau's formation as protectors of the land. The mountain peaks in which these deities are believed to reside have been revered as Sacred Mountains by the Tibetans since ancient times; notwithstanding their change in religious affiliation from indigenous Bon to later Bon and finally to Buddhism. These powerful mountain deities have numerous children, siblings and ministers in the form of nearby sacred peaks and valleys, to protect the land and its inhabitants from drought, disease, famine and war.

This exceptionally rich and unique relationship between worldly gods, nature and humans has helped the Tibetan plateau survive for thousands of years despite its fragile ecosystem and historically dense population. Recent studies have also demonstrated that sacred areas often play a major role in environmental conservation. Scientists have found greater biodiversity and richer vegetation in sacred mountains such as the Mt. Khawa Karpo in eastern Tibet than elsewhere.

But in recent years, lack of Tibetan perspective in development models of current Tibet under Chinese rule, the threat to sacred mountains have never been greater with mining activities happening on many sacred mountains of Tibetan Plateau. This lack of respect for the people and understanding of the land has left local Tibetans gasping in despair.

This is a very dangerous approach as it is a well known fact among the Tibetans that the great mineral treasures present in those mountains are necessary to sustain a healthy ecosystem on the plateau. Where, for a non-Tibetan, it might only make sense to mine these great treasures, for a Tibetan these hidden treasures are like long term investment from which one receives continuous good fortune in the form of timely rain, healthy calves, good grass, fresh streams, bumper harvest, successful business and a happy community.

Thus, I will try to highlight the importance of the sacred mountains from a Tibetan perspective as well as their role in environmental conservation from a researcher's point of view, and give you a holistic view on the reasons behind the recent numerous protests against the mining activities on the sacred mountains of the Tibetan areas.

Changing nature of natural hazards – Manifestation of climate change in Karakoram Himalayas in last few Decades

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Abstract

Climate change in NW Himalayas in last three decades has led to an overall rise in air temperature, uneven distribution of precipitation causing extreme heavy precipitation events, decrease in snow cover, and increase in incidences of floods, cloud bursts, landslides, rockfall and avalanches. In the perspective of Karakoram Himalayas, it appears that extreme rainfall events, which hitherto were not known in this area, have started occurring with alarming frequency. Predominance of periglacial climate characterised by sub-zero temperatures for longer durations and scanty precipitation in Karakoram Himalayas makes the occurrence of an earthflow or a mudflow a very uncommon phenomenon. But one such mass wasting event of gigantic proportion was observed over the Siachen Glacier area in Karakorum Himalaya during the field studies of the region in October, 2011. This unique event is being reported for the first time from this area. This paper presents the results of subsequent field investigations and analyses of the data collected to establish time and date of occurrence of the event and causative factors thereof.

Analyses of multi-date remote sensing data (LANDSAT ETM imageries), precipitation data of TRMM (Tropical Rainfall Measurement Mission) and the seismic data recorded by nearby seismic stations indicate the time of occurrence of the event as 16 September 2010 at 2:51 GMT (7:21 AM IST). Persistent rainfall amounting to about 20 mm in preceding two days and enhanced melting of snow due to rise in temperature translated in generation of significant amount of runoff and seepage of water in the loose soil. Resultant instability in the scree-filled slope caused a massive earthflow on 16 September 2010. Identical events of much larger magnitude attributed to extreme precipitation events have also been reported from Leh on 05 August 2010, Tyakshi on 6th August 2010 and Gayari in POK on 07 April 2012 which have claimed many lives.

Precipitation Chemistry over the Central Himalayas, Nepal in Comparison with the Tibetan Plateau

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Abstract:
Precipitation chemistry is important to assess atmospheric environment and its impacts on ecosystem and human health. For the first time, chemical composition in precipitation were investigated from April 2011 to September 2012 at four sites Kathmandu, Dhunche, Dimsa and Gosainkunda characterized as an urban, semi-urban and remote sites in Nepal. The result showed that HCO_3^- is the dominant anion and NH_4^+ is the dominant cation at four sites. Anthropogenic ions SO_4^{2+}, NO_3^- and NH_4^+ have shown the decreasing concentrations trend from urban to rural sites. The significant contribution of Na^+ and Cl^- by sea salt is evident by close linear correlations and similar Cl/Na ratio with seawater ratio which is an influence of the monsoonal air masses from Indian Ocean. Seasonal variations showed higher concentrations during non-monsoon seasons due to limited precipitation amount than during monsoon. In general, the results of this study suggest that the precipitation chemistry is influenced by natural, anthropogenic and marine sources in Nepalese Himalayas. In our study, majority of ions in precipitation accounted for HCO_3^- and Ca^{2+} which is similar to the findings in Lhasa and Nam Co, Tibet. The concentrations of NO_3^-, SO_4^{2-}, and NH_4^+ in Kathmandu were higher than in Tibetan regions but comparable with other high altitude sites in Nepal. The concentrations of Na^+ and Cl^- in high elevation sites from this study were very similar to the Tibetan regions. Thus this study can provide the valuable database on atmospheric chemistry in the mountain regions.

Biodiversity and Regional Significance of Himalayan High Altitude Wetlands

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Abstract

Himalayan high altitude wetlands are crucial for biodiversity and sustainable economic growth not only locally but also at the river basin and regional levels. In addition they regulate micro-climates and have immense livelihood, cultural and spiritual significance for the communities living amongst them. Yet despite their importance, they are under increasing threats from climate change, tourism and unsustainable exploitation not only of the wetlands themselves but also of the catchments draining into them. And there is a risk that these threats could lead to negative knock-on effects right down the rivers systems that they supply.

High altitude wetlands, which include lakes, marshes, seeps, peat bogs etc, in the Himalayas have several characteristics that make them unique in terms of their biodiversity value. The plants and animals that occur in and around them are often endemic and highly adapted to their locations. Many of these wetlands play vital role in the hydrological regime of some of the world's largest and most important rivers: namely the Ganges, Brahmaputra, Indus, Yangtze, Yellow, and Mekong. Each of these rivers are of immense economic importance in terms of hydropower, transport, irrigation and fisheries etc; while some, such as the Ganges are also of great cultural or religious significance.

In addition to their hydrological importance at the basin level, these wetlands and the ecosystems that they support are also critically important from a biodiversity conservation perspective, especially in the arid trans-Himalayas. Typically in fact, these high altitude wetlands are characterized by unique biodiversity not found anywhere else on this globe. They also have profound social, economic and cultural values at the local level where many lakes in particular are considered sacred both locally and nationally.

Several species of mammals are found in the region, e.g. the Blue Sheep (*Pseudois nayaur*), Ladakh Urial (*Ovis orientalis vignii*), Tibetan Argali (*Ovis ammon hodgsoni*), Tibetan Wild Ass (*Equus kiang king*), Himalayan Marmot (*Marmota himalayana*), Red Fox (*Vulpes vulres*), Tibetan Gazelle (*Procarpa picticaudata*), Snow Leopard (*Uncia uncia*), Lynx (*Lynx isabellina*), Wild Dog (*Cuon alpinus laniger*), Tibetan Wolf (*Canis lupus chanko*), Tibetan antelope (*Pantholops hodgsoni*), and Wild Yak (*Bos grunniens*).

The flora of the region falls under the Alpine and High Alpine zones and is dominated by annual and prennial herbs. The vegetative growth commences at the break of summer when

melting snow provides abundant moisture to the alpine plants. Some of the widely used medicinal plants of the region are *Podophyllum hexandrum*, *Aconitum violaceum*, *Picrorhiza kurrooa*, *Rheum spiciforme*, *Hyoscyamus niger*, *Capparis spinosa*, *Delphinium brunonianum*, *Ephedra gerardiana*, *Hippophae rhamnoides*, *Inula racemosa*, etc.

The present paper presents a general overview of the biodiversity of the high altitude landscapes specially wetlands. The paper also highlights the significance of Himalayan high altitude wetlands as sources of major rivers originating from the region. The various conservation issues related to the Himalayan high altitude wetlands and wildlife species will also be discussed.

Indigenous knowledge, livelihood options and habitat conservation vis-à-vis development and growth in the Himalayas and the Tibetan Plateau

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Abstract:
As the paradox of extraordinary natural resources and yet an under-developed Tibetan Plateau- Himalayan region continues to remain unresolved, irreversible damage to the fragile ecology looms large due to unparalleled infrastructure initiatives. Current growth and developmental path appears unsustainable, as irreparable habitat loss is taking place in a manner that has threatened habitat-based, culturally diverse indigenous livelihoods. While natural resources alone, in the absence of blending of traditional knowledge, rather wisdom, with appropriate low impact technology supported by required institutional mechanism and a holistic vision, is unlikely to nurture a productive economy, unplanned infrastructure may be last nail in the coffin. In the backdrop of average per capita income lower in Northeast India by one third than the country average, all sectors reflect: (a) federal government rather than regional interest in decision-making; (b) weak, complex and inadequate institutional arrangements for profitable and ecologically pragmatic local enterprises; (c) fragmented, insulated and largely un-documented, and hence incomplete and partly inaccessible indigenous knowledge base; and (d) growing disillusionment by local communities with current economic initiatives due to adequacy-deficit and credibility-deficit of past initiatives to deliver. This can possibly be changed with a targeted thrust on ecologically sensitive local governments, communities and indigenous grass root stakeholders. Key among the much overdue changes are (a) collective cooperation in ecosystem based livelihood security; (b) increased conservation responsibility by the different responsible groups, agencies, individuals; and (c) decentralization of decision making to adequately accommodate habitat based

livelihoods. This last pristine frontier of the planet must seek livelihood options that are in sync with sustainable regenerative cycles of its habitats and disown other options. This process must include mechanisms for equitably sharing the benefits and focus more upon locally profitable ecosystem centric livelihood activities that can have immediate sustainable impact on food-water-energy security at the community level. Institutions must be able to create and manage an environment of incentives and disincentives that encourage initiatives consistent with sound habitat protection objectives, and discourage initiatives that direct benefits to exclusive small groups while inflicting social and environmental damage and consequent resource insecurity to the community at large.

Is mass tourism in mountainous regions a boon or a bane?

Claude Arpi

This study does not pretend to be a scientific or even academic paper.
It is just question laid in front of the participants of this round-table; it is opened for disagreement and discussion.
It is presented with the only hope that it can triggered a debate and more importantly, initiate serious and honest researches on the pro- and the con- of mass tourism in a environmentally-fragile region; more than any other regions, the Tibetan plateau and the Himalaya are prone to the often-unpredictable effects of the climate change.
During the recent National People's Congress held in Beijing, Lobsang Gyaltsen, Chairman of the Tibet Autonomous Region (TAR) and a deputy to the National People's Congress (NPC) declared: "Dense forest, extensive grassland, clean water, blue sky and clear air are not only Tibet's largest wealth, but also the biggest contribution Tibet has provided to China and even to all mankind".
One can only agree with him.
Lobsang Gyaltsen further stressed that Tibet is for China, an important ecological safety barrier. Probably referring to the fact that 11 of the major Asian rivers have their sources on the Tibetan plateau, Gyaltsen called the region, the 'Asian water-tower', the 'last pure land of the world'; he spoke of the importance of Tibet's ecological and strategic position.
The TAR's Chairman continued: "Feasible measures should be taken to protect the environment of Tibet. At present, Tibet remains as one of the best areas in ecological environment in the world."
He added that his government has always attached a great importance to environment protection, and swore that the TAR "has never introduced enterprises and projects with high energy consumption, high pollution and high emissions." One can question: how long will this last if the current policies continue.
The same issue of 'feasible measures to protect the environment' apply to the Indian Himalaya, particularly Ladakh, Uttarakhand, Himachal Pradesh and Sikkim.
Has anybody study the capacity of these high mountainous regions, to absorb millions and millions of visitors every year?
There is no doubt that more tourists means, more infrastructure, more constructions, more hotels and less water, more solid waste, etc.
In China, the Fifth Work Forum on Tibet held in Beijing in 2010 decided to transform Tibet into an important international tourism destination.

When Lobsang Gyaltsen says that Tibet should create high-quality tourism products ‘to promote the integrative development of tourism, culture and ecology’, have all the environmental studies been made?

When ‘tourism' becomes a 'product' to be marketed and sold, does it not automatically come under the laws of the 'market'? Everyone knows that the ‘laws of the market’ are usually not environment-friendly, most of the large cities in China have recently been experiencing this.

Every year, to feed and take care of 15 million tourists on a Roof of the World requires a lot of energy, water, food; etc. It directly or indirectly means more pollution.

We are told that it should soon will be quicker (and more convenient) to reach several places on the plateau; for example the Lhasa-Shigatse railway line connecting Lhasa to Shigatse, the second largest Tibetan town will be opened in September and by the end of the year, the construction of a new line between Lhasa and Nyingchi, near the Indian border of Arunachal Pradesh, should start.

Will this help preserve the pristine environment of the plateau?

It was interesting that the head of the Tibetan local government stated during the NPC: "We will never develop economy at the cost of environment."

But in Tibet, as in the Himalayan regions, political leaders first see the huge revenues pouring into the coffers of their respective States/regions. Who has looked at the collaterals of bringing 15 million visitors on the Roof of the World, 20 million in Uttarakhand, 1,40,00 in Ladakh or 1 million in Sikkim?

Hong Wei, a Tibetan delegate who is deputy head of the regional tourism bureau told *China Tibet Online* in Beijing: "Tibet is protecting its environment with a no-nonsense manner; we will never develop our economy at the cost of the environment", while another delegate added “Tibet's goal is to be a world class tourist destination. We are still far from that. If the environment in Tibet is damaged, its attraction will be greatly harmed."

The issue needs to be debated: are both (developing tourism and keeping the purity of the environment) compatible?

Many believe that mass tourism is the best (and the quickest) way to destroy the environment of an area as it demands large amounts of energy and generates big quantity of solid waste. At the same time, it can’t be denied that it brings revenues to the local economy and communities.

Where is the solution?

Is it feasible to limit the numbers of yearly visitors to protect the environment in mountainous regions?

It is perhaps high time to think about these issues and start scientific researches on this topic.

We can add: and why not initiate ‘joint’ researches between scientists of China, India, Bhutan and Nepal on the relation between mass tourism and climate changes?

International water law and China's Role as an Investor both upstream and downstream in hydropower

Grace Mang,
International Rivers

As China begins its biggest dam building spree and emerges as a significant force in the global hydropower industry, all eyes will turn to China to play the role of a responsible global actor. The Chinese government has in the past few years adopted a number of best practice policies to support its own hydropower development plans including basin level hydropower assessment and cumulative impact assessments. These policies and regulations form the backbone of environmental and social protection efforts as China seeks to approve and commence construction on 50 large dams on China's major rivers including the Jinsha (Upper Yangtze), Dadu, Lancang (Mekong) and Yarlong Tsangpo (Bramaputra rivers) during the life of the current 12th Five Year Plan (2011-2015). At the same time, the Chinese government's own "going out" policy has supported the Chinese dam building industry to emerge as giants in the global hydropower industry. To date, International Rivers is aware of over 300 projects in more than 70 countries with Chinese companies, primarily State-Owned Enterprises and, or the support of Chinese banks.

For better or worse, unwarranted or not, much attention will focus on China's dam building and its transboundary impacts, as well as the performance of its state-owned dam building companies who are being encouraged to "go abroad." The world's biggest dam builder, Sinohydro Corporation has responded to increased attention and scrutiny by committing to international standards (such as the World Bank's safeguard standards) and developing its own policy incorporating international best practice. Sinohydro's own desire to follow international best practice on when building overseas dam projects with transboundary impacts are relevant. Sinohydro has withdrawn from at least two overseas dam projects due to the concerns raised by downstream countries that would have been negatively impacted. My presentation will also touch on the international legal context for hydropower development of Transboundary Rivers. There is increasing support for the precautionary principle in decisions by the International Court of Justice regarding transnational environmental impacts, which may be relevant to the planning of cascade hydropower developments on Transboundary Rivers. Further more, there is a growing body of soft international law with respect to protocols and principles that may have implications for hydropower development with transboundary impacts. Finally, I will briefly explore the principles of state responsibility and harm, and their relevance.

Asia's Water Tower in Danger

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Abstract:
Rapid glacier melt on the Tibetan Plateau due to global warming is causing lakes to overflow and flood pastures. Stretching over an area of around 40,000 square kilometres, the Tibetan Plateau's glaciers account for over a third of High Asia's ice cover**.** Recent studies have quantified the glacier ice loss at 16 gigatonnes a year in around 80% of the Tibetan glaciers. That is around 6% of the total loss in mass of all the glaciers on Earth. Some glaciers in the central and north-western part of the Tibetan Plateau have grown in mass, but glaciers in the monsoon-influenced southern and eastern part of the plateau have melted significantly. Overall, the entire region has suffered a loss in mass. A large proportion of the melt – around two gigatonnes a year – flows into lakes without an outlet on the plateau, causing them to burst their banks.

This threat is exacerbated by the intensification of mining in Tibet. Today all the environmental services Tibetans traditionally protected are threatened. Extensive land use is changing to intensification, concentrating capital, technology and labour in enclaves designated for resource extraction, feedlot animal production or tourist gratification. Mining is rapidly turning the Tibetan Plateau from a cost centre into a profit centre focused on the 80 million tonnes of extractable copper, and 2,000 tonnes of gold proven by Chinese geological teams. At today's gold and copper prices, the sale of Tibetan copper will generate revenues of $617 billion, of which only half need be spent as the cost of production, and gold a further $106 billion. Meanwhile China's industrial centres are moving inland from the coast, taking advantage of lower labour costs, plentiful hydroelectricity from Tibet, less stringent environmental law enforcement and proximity to fresh Tibetan sources of raw materials. Chongqing and Chengdu have boomed as manufacturing hubs.

Geologically, Tibet is a young land, still rising. The rock is often loose, vulnerable to earthquakes and landslides blocking rivers, then giving way in sudden outbursts. Toxic heavy metals occur naturally in Tibetan rivers, so mining, which generates huge waste dumps close to major rivers, must be able to keep tailings waste dams from leaching into the river below. Given the flagrant violations of environmental regulations Tibetans have witnessed, there's little reason to believe the new miners will ensure the safety of their wastes for decades and centuries after mining has exhausted the ore deposits.
The Himalayas are not the natural barrier many Indians imagine. Rivers cut through them, monsoon clouds float through, and people have always crossed. South Asia will be affected in many ways, as mining spreads across Tibet, especially in the many areas being depopulated by the grazing ban policy, supposedly to grow more grass, which in practice lets in more miners, without any locals left to resist. India is downstream of Tibet, and is awakening to the strong connection between damming of Tibetan rivers and mining, which is a major user of hydropower for ore concentrators and smelters. The new large scale intensive mines now about to go into full operation, at Shetongmon, Gyama and Yulong, will generate so much wealth that they have the

potential to integrate Tibet into the global economy. The new mines establish long-term enclaves of high profitability that attract new waves of immigrants, all further intensifying land use. The soil of Tibet cannot sustain intensive use. The Tibetan Plateau can accommodate extensive land use, mobile pastoralism that moves on well before overgrazing and land degradation start. Because of the long and intensely cold winter, once degradation starts to destroy the hardy native vegetation, it is extremely hard to stop. Because of accelerating degradation, social exclusion of nomads from their pastures, temporary grazing bans becoming irreversible, the loss of land tenure and food security in Tibet, all that will be left will be a depopulated, desertifying grassland, with pockets of intensive production centred on cities, mines and the highways that connect them. That's an alarming prospect, not only for Tibet, but for all the billion people across Asia who drink Tibetan water every day.

Four areas of water resilience to meet water challenges of South Asia

Dr Mats Eriksson, Stockholm International Water Institute

Mankind is facing fundamental development challenges on a global scale, at a speed and of a magnitude never experienced before. Most of these challenges are directly or indirectly water-related and include for example managing risks of extreme water events such as floods, flash floods, water stress and drought; rapid decrease of freshwater habitats and aquatic biodiversity impacting fisheries and other local livelihoods. Furthermore, they unlock huge uncertainties of whether we will be able to meet increasing water demands for food production and the production of other goods and services. We thus urgently need to focus more efforts on building and maintaining water resilience. While *resilience* encompasses all stress factors that a society needs to be prepared for, *water resilience* refers to the stress factors that are related to water, often too much or too little water, in time and space.

Achieving water resilience will require that future challenges are met through multiple strategies and approaches. I have singled out four areas that are crucial for governments to support in order to strengthen resilience on local, national and sometimes regional level in the light of drivers of change occurring at all levels, from global to local.

a) ***The first*** is to ensure a sustainable utilization of ecosystems and their services. Thus the interface between the biosphere and society needs careful attention;
b) ***The second*** is to ensure that interventions for increased resilience are tailor-made to local conditions, being built on local situations, knowledge and experience;
c) ***The third*** is to look for opportunities to broaden the support for livelihoods in order to make income generating activities less dependent on only one (potentially vulnerable) sector or resource;
d) ***The fourth*** is to acknowledge the increased interactions between rural and urban areas and facilitate processes that enhance water resilience in this perspective.

Human resources are key to improved resilience and we need to enhance the capacity of people to more actively become part of the solutions rather than part of the problems. Of fundamental importance is that increased social-ecological resilience will build on enhanced understanding of biophysical and social systems undergoing rapid change and how they are interconnected. Safeguarding continued ecosystem services while supporting socio-economic

development is crucial. Social capacity is needed to deal with these changes and scientific knowledge combined with government support must be translated into practical solutions. Finally, these two actors also need to build a partnership with the private sector in order to find workable solutions towards increased water resilience.

Coordination of water resources development and ecological protection in the arid Qaidam Basin, North Qinghai-Tibet Plateau

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Qaidam Basin is an arid basin on the north Tibetan Plateau, located in between 35°00′-39°20′N latitude, 90°16′-99°16′E longitude. With 800km in length from west to east and 300km in width from south to north, it extends from northwest to southeast. The average annual precipitation of the area is less than 200 mm per year, less than 50mm in most of the bottom area. The plain area contributes almost no runoff to the river system in the basin. Be extremely dependent on precipitation in mountain area, Qaidam Basin faces severe water scarcity.

Qaidam basin is rich of natural resources, such as potassium in salt lake, oil and natural gas, nonferrous metals, coal and vast land. The development of all these resources needs a precondition of water resources supply.

Under natural conditions, water is used by natural ecological system, such as rivers, lakes, natural oases, swamps, as well as desert. Now economic development needs to divert water for human use. In arid regions, human water resources utilization will certainly damage natural ecological system because less water left for the use of natural system. It's very important to coordinate the water use distribution between human being and natural system. How to realize this?

In the process of water resources development planning of Qaidam basin, we firstly identify what are the important ecological items and their scope and standards to be protected in terms of water supply, and then estimate how much water should be kept for their use, ie., define ecological water requirement. What can be developed by human being is only the part of total water resource left after guaranteeing ecological water requirement. And further, the human part of usable water resources are rationally distributed between sub-regions and sectors.

Water Resource Management in the Himalayan Region: An Eco-hydrological approach

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Water is most essential for life on earth and river valleys are cradles of human civilization. The Himalayas and Tibetan Plateau not only are sources of some of the largest rivers in the world, but also support populations that far exceed continental populations of Europe or Africa, thus giving it pre-eminence among the glaciated regions of the world. However, very little is known about the health of these glaciers so that even the IPCC had to retract from its AR4 report, a controversial statement that most of Himalayan glaciers will disappear by 2035. However, the little scientific data that has been analyzed for a few of these Himalayan glacier catchments does not support such bleak posturing. The sources of water in Himalayas feeding the major foothill regions where most of the people live are of the utmost importance to water resource management. To know how the Himalayan water resources affect local populations, we need to look at this challenge from a sustainability perspective, including what is going to happen to rivers like the Indus and the Brahmaputra in the next 20 years. While satellite data analysis can give a relatively broad basin level picture of what has happened in the last 20-30 years, we also need to have catchment level projections of water resource availability in the coming decades based on sound field data that compliments the broader understanding of the impacts of climate change on the water resource availability in the region. A few questions are pertinent to the eco-hydrological assessment of the region: First, how sensitive are the Himalayan glaciers to climate and other environmental factors? We have been trying to answer this question through the ongoing mass balance program on Chhota Shigri Glacier from 2002, which now boasts of the longest mass balance record available for any glacier in the Indian Himalayas, by utilizing geodetic as well as glaciological methods and correlating this with the available climate data. The second question relates to the potential impacts of changes in climate and glaciers on the timing and volume of river flows in the region and the likely implications for water supplies and extreme climatic events such as floods. This requires long-term hydrological data from Himalayan river basins to be analyzed. However, as these data are classified, the procurement is extremely time consuming and often hindered by insurmountable obstacles. Another issue is the rudimentary nature of water management systems in place to help adapt to changes in regional hydrological systems. How might these systems be strengthened? Himachal Pradesh for example, has a first level GIS based integrated water resource framework developed for the state that can serve as a first cut common base for the involved line departments like Irrigation and Public Health, Forest, Horticulture, Hydro electricity, Industries, Rural Development etc. As the availability of data improves with time, the framework will become more effective. However glaring gaps in data is an issue that needs to be addressed with modeling techniques and use of proxies on a large scale. It is hoped that eco-hydrological assessments of the various sub-regions in the Himalayan region will go a long way in resolving conflicts that stem from water scarcity in view of climate change induced changes in water security.

Vivideath: Mapping Chinese Rivers On the Wane- A multimedia project for water crisis in CHINA

Dr. Zhou Lei
Dr. in anthropology and founder of Oriental Danology Institute (ODI)

To Chinese, *Shanshui*, mountain and water, or landscape is deeply embedded in their spiritual system, manifesting dialectical, hermeneutical and soteriological values. Ever since 1949, China is witnessing the death and eco-degradation of rivers at a mind-boggling rate, which according to recent governmental survey, the number of rivers dwindled to 22,909 from over 500,000 (figures in 1950s).

This project intends to pontificate the consequences of dead rivers from hermeneutical, ontological and **art advocacy** perspectives, through presenting a few portfolios of historical values, and activated here as a holistic ritual for the diseased river. We therefore, can consider the dreadful prospectus confronting us, when China and the other related parts of world keep on its disastrous trajectory.

Book of Dead Rivers <死水经注>. Owning to manqué and dearth of river family (I treat the death of rivers as loss of river kinship and tribes, human's indispensible companions), the famed Book of Rivers {also known as Commentary to Rivers Classics}, ironically, is a metaphysical reference and guidance for the souls of dead rivers. Through writing, chanting, narrating, memorizing the lines of Book of Rivers, the dead rivers can be somehow resuscitated and reclaiming their rippling radiance. And the entire process of scribing Book of Rivers is a ritualized and spiritual rhizome, enabling us to reconnect the dead soul of rivers to their physical and socio-geographical specificities.

Rural Electrification through Renewable energy in Ladakh region

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Access to reliable and affordable energy is a key enabler for sustainable development of an area. Energy impacts on people for the economic growth, food security, education and health. Dependence on fast depleting and expensive fossil limits economic development, degrades local natural resources. A Plan for Renewable Energy deployment to electrify and meet other energy requirements in Laddakh region was launched in 2010 by Ministry of New and Renewable Energy, Govt of

India with the support of Leh and Kargil renewable development agencies. The objective of the plan has been to minimize use of diesel in the region and increase the availability of electricity as Diesel generating (DG) sets provide only limited electricity for few hours and wherever possible the DG sets be replaced / supplemented with small hydro units. The region has the highest solar radiation intensity and has been using solar energy especially for heating for long time. Thus a large scale use of solar water heating systems, solar cooking and space heating has been also planned. Use of conservation techniques for housing and agriculture as well as improving livelihood have been other objectives of the plan.

AHEC, IIT Roorkee prepared a master plan for rural electrification through small / micro hydro projects using local and mini grid in 2009. Detailed data for 240 villages in Ladakh and Kargil districts, their status of electrification and plan for meeting their power requirement through small hydro projects was developed. All basic information regarding potential sites for small / micro hydro projects, villages, existing DG sets, distribution transformers etc were gathered and integrated were also highlighted. Energy use pattern in different institutions, civil as well as defense, were analysed. TERI prepared other master plan for use of solar energy in the villages and for the villages not having hydro source and or were of very small population.

SHP plants, SPV plants and home lighting systems for remote villages and few civil and defense establishments for meeting day load, SPV power plants in institutions / health centers etc. Solar thermal systems for water heating, cooking, space heating and Green Houses for vegetable production have been installed in both districts. Plan is expected to be completed by December 2015. A budget of INR 4.73 Billion is provided for this plan.

The Ladakh Renewable Energy Development Agency (LREDA) and Kargil Renewable Energy Development Agency (KREDA) are implementing the various components of the plan in their respective districts. In Kargil 11 nos of small hydro (13.2 MW) covering Suru, Zanskar and Drass valley, 98 no of SPV plants have been installed so far. In Leh district 22 small hydro (11.8 MW), 50 nos of pico hydro, 110 no SPV plants have been installed/under installation for villages and various establishments. This efforts is leading to large saving of diesel and a step towards sustainable development of eco-sensitive area.

Damming for Electricity: New Challenges Embroil Yalongzangpo Rivers

Yang Yong,
Chief Scientist of Heng Duan Mountain Research Centre

In his speech, Yang addresses the unique ecological value of Yanglongzangpo watersheds and disturbing damming movements in their inception, which tend to create pernicious effects on China and downstream countries.

Based on his consistent fieldwork and archival researches, Yang explores the details of Chinese damming plan and projects along Yalongzangpo watersheds, at the same time, highlighting the risks, challenges and pitfalls confronting all researchers and policy makers.

As final comments, Yang points out six contingent issues that demand imminent attention which pertains originative baseline research, potential geographical disasters assessment, preemptive measures for worst case scenarios, trans-boundary cooperation mechanism and earthquake-prone regions analysis.

Climate Change Impact on the Hydrological Regime of a Tibetan origin Trans-boundary Eastern Himalayan River Basin of India

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The water flowing in the Himalayan rivers is the combined drainage from rainfall, snowmelt and glacier-melt runoff. Various studies have pointed towards an overall consistent warming trend in the Himalayan region, including the Tibetan Plateau. As the Himalayan water system is highly dependent on snow storage, it is susceptible to suffer from the effects of global warming. The understanding of climate change in the past and during recent period has been progressing significantly through improvements and extensions of numerous datasets and

more sophisticated data analyses across the globe. However, in the rivers of eastern Himalayan region, not many scientific interventions on climate change and its impact on hydrology have been made mainly due to their trans-boundary nature, inaccessible upper basins, highly steep terrain and inadequate network of gauging stations/sites.

The present study has been carried out for the trans-boundary Subansiri sub-basin of Brahmaputra river basin. Subansiri is the largest tributary of Brahmaputra within India which originates in Tibet and the river system has its practical importance as it holds a high water resources as well as hydropower potential for India, which still remains highly under-developed. The study presents historical trends of rainfall and temperature in the basin pointing towards some statistically significant changes in temperatures. The probable impact of climate change has been analyzed using hypothetical climate scenarios to understand the behavior of total streamflow as well as snowmelt runoff under the changed climatic conditions. Based on the simulations of a daily snowmelt runoff model (SNOWMOD) using six years of data, it has been observed that total stream flow as well as snowmelt runoff increased when temperature increased. Snowmelt runoff was found to increase by about 5% and 12% for the increase of 1°C and 2°C in temperature respectively. However, not much change in snowmelt runoff was observed with changed precipitation scenarios. It has been found from this study that total stream flow changed for all the scenarios of temperature and precipitation. The observed maximum % increase in mean annual stream flow was about 6% for (T+2°C & P+10%) scenario and the minimum % decrease in mean annual stream flow observed was about 11% for (T+1°C & P-10%) scenario. Results of seasonal analysis of stream flow under the scenario of warmer climate and enhanced precipitation (T+2°C, P+10%) indicated marginal increase in annual water availability with a reduction in water availability during pre-monsoon, winter and post-monsoon seasons, but substantial increase in water availability during monsoon, thereby imposing an increased risk of floods in the already flood prone basin. The impact of a warmer climate and reduced precipitation climate scenario (T+1°C, P-10%) indicated comparatively significant reduction in annual water availability in the basin with reduction in water availability in all the four seasons. The present study aims to provide information for planning of climate change adaptation strategies for the Subansiri sub-basin of the Brahmaputra River.

Sustainability of Bhutan's Hydropower

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The total hydropower potential of Bhutan's river is estimated about 30,000 MW, the major part of which is concentrated in Wangchhu, Punatsangchhu, Mangdechhu and Drangmechhu river basins. Bhutan's socio-economic backbone is synonymous to the development of hydropower resources: 99 percent of the electricity supply is being met from hydropower generation and hydropower alone contributes 45 percent of the national revenue. Bhutan is known to be a model in the South Asian sphere for its policy in conserving the environment. However, the impacts of Climate Change are beginning to be felt in the form of fast retreating glaciers and erratic precipitation pattern that will prove to be costly for the hydropower sector, as the country continues to bank on this renewable natural resource.

With the enactment of the Water Act 2011, which advocates IWRM as its cornerstone, Bhutan is becoming more conscious to conserve its riverine ecosystem through the ecological

approach such as maintaining a strip of buffer on the banks, and making off limits any developmental activities in its vicinity, mandating the requirement of e-flow, fish passages etc.

Study of the dynamics of Chhota Shigri glacier in the western Himalaya, Himachal Pradesh, India

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Little is known about the Himalayan glaciers, although they are of particular interest in terms of future water supply, regional climate change and sea-level rise. In 2002, a long-term monitoring program was initiated on Chhota Shigri Glacier (32.28 N, 77.58 E; 15.7 km^2, 6263–4050 m a.s.l., 9 km long) located in Lahaul and Spiti Valley, Himachal Pradesh, India. This glacier lies in the monsoon–arid transition zone (western Himalaya) which is alternately influenced by Asian monsoon in summer and the mid-latitude westerlies in winter. Mass-balance and dynamic behavior of Chhota Shigri glacier, western Himalaya, India, has been investigated between 2002 and 2010 and compared to data collected in 1987–89. During the period 2002–10, the glacier experienced a negative glacier-wide mass balance of -0.67±0.40 m w.e. a^{-1}. Chhota Shigri Glacier seems similar to mid-latitude glaciers, with an ablation season limited to the summer months and a mean vertical gradient of mass balance in the ablation zone (debris-free part) of 0.7 m w.e. $(100\ m)^{-1}$, similar to those reported in the Alps. Mass balance is strongly dependent on debris cover, exposure and the shading effect of surrounding steep slopes. To find out the thickness of the glacier ice, 5 cross section obtained using Ground Penetrating Radar(GPR). The cross sections obtained from GPR measurements reveal a valley shape with maximum ice thickness greater than 250 m. The centre-line ice thickness increases from 124 m at 4400 m a.s.l. to 270 m at 4900 m a.s.l.. The volume change of Chhota Shigri Glacier between 1988 and 2010 has been determined using in-situ geodetic measurements. This glacier has experienced only a slight mass loss over the last 22 yr (-3.8 ±1.8 m w.e.). Using satellite digital elevation models (DEM) differencing and field measurements, we measure a negative mass balance (MB) between 1999 and 2011 (-4.7±1.8 m w.e.). After that the MB series of Chhota Shigri glacier has been extended back(reconstructed) to 1969 by a temperature-index model together with an accumulation model using daily records of precipitation and temperature from Bhuntar Observatory(H.P). Over the study period Chhota Shigri glacier experienced a moderate mass wastage at a rate of -0.30±0.36 m w.e. a-1. This study also suggests that winter precipitation and summer temperature are almost equally important drivers controlling the MB pattern of Chhota Shigri glacier at decadal scale.

Kailash Sacred Landscape Conservation and Development Initiative – A Transboundary Project

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Mount Kailash (a.k.a. Mount Kailas), also referred to as *Gangrénboqí Feng* in Chinese and as *Kailása Parvata – Devnagiri* in Sanskrit (with similar names in Hindi, Nepali and other related South Asian languages) is revered as *Khang Rinpoche* among Tibetans. The landscape surroundings Mt Kailash represents a wide range of biophysical, socio-cultural and environmental conditions, and is considered among the most revered scared landscapes in the world. The spiritual and sacred values of this landscape attract tens of thousands of pilgrims every year. Ironically, the region is equally known for its vulnerability to globalization and accelerated development, as well as climate change. As a result, the rich and unique biological diversity, ecosystem goods and services, and value- based cultural heritage of this landscape are severely threatened.

The uniqueness and fragility of mountain ecosystems has attracted global attention in sustainably managing such ecosystems based on human-centered approaches. Significant efforts are being directed towards effective monitoring of structural and functional features along with gathering of evidence on changing patterns of biodiversity in these ecosystems. Among mountains of the world, the majestic Himalaya, with remarkable diversity in bio-physical and socio-cultural systems, assumes special place. It is recognized as one of the 34 global biodiversity hotspots. The importance of Himalayan region has been aptly recognized by the Government of India by way of providing for a National Mission on Sustaining the Himalayan Ecosystem (NMSHE; the only location specific mission out of 8 National Missions) under its National Action Plan on Climate Change- NAPCC. Other countries in the region are equally aware of wide ranging life support value of the Himalaya. Among others, the International Center for Integrated Mountain Development (ICIMOD ; located in Kathmandu, Nepal), an intergovernmental organization having eight Regional Member countries of Hindukush Himalayan region is engaged in various research and developmental activities in the region. This includes building regional cooperation for undertaking ecosystem management and livelihood promotion activities in identified transboundary landscapes. One such landscape is the "Kailash Sacred Landscape" which encompasses adjacent portions of the remote south –western part of the Tibetan Autonomous Region (TAR) of China and adjacent parts of north –westerns Nepal and north –eastern parts of Uttarakhand state in India. The region is endowed with highly diverse array of ecological conditions, rich and unique biodiversity components, indigenous systems of livelihood, and distinct local cultures. The sacredness and values attached with the landscape elements have provided, from times immemorial, driving force for the existence of some of the most natural sites, and time tested traditions of management and sustainable harvest of natural resources. The region being the source of the Indus, the Brahmaputra , the Karnali and the Sutlej rivers, provides transboundary ecosystem services vital to the region as well as to areas far beyond. However, on account of its geological fragility, climate sensitivity and ever increasing threats to biological diversity, the landscape is highly vulnerable. The indigenous communities and their value-based traditional systems are also undertaking rapid transformation. So is the case with

retreating glaciers and changing hydrological regimes, consequently affecting the biodiversity and socio –economic features in the region. All these issues and many more are also of much concern to large populations inhabiting downstream areas. Recognizing the global importance of this landscape, a protect entitled "Kailash Sacred Landscape Conservation and Development Initiative" (KSLCDI) has been started with the objectives to initiate and promote tranboundary biodiversity and cultural conservation, ecosystem management, sustainable development, and climate change adaptations within the region through much needed facilitation provided by ICIMOD with initial support of UNEP. The development of a Regional Cooperation Framework between the participating member countries, namely China, India and Nepal is an important step towards achievement of envisaged objectives in this somewhat long-term initiative. A total of seven such transboundary landscapes have been conceived by ICIMOD in the Hindukush Himalayan Region.
One of the major goals of KSLCDI is in respect of generation of long- term ecological, climatic, socio –cultural and biodiversity datasets within the landscape ; this would contribute substantially to address the issue of knowledge gaps, a serious impediment for undertaking and predicting impacts of changing patterns , including climate change.

The presentation would discuss various key components of this Kailash Sacred Landscape Initiative, progress made thus far from initial conception, and future plans of action.

Transboundary water governance principles and SIA Application

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Transboundary rivers flow through more than two states, thus allocation, utilization and development of shared water resources is not only a matter of a state's internal affairs, has always been an important factor in regional conflicts. Managing China's 42 international rivers affects 15 neighboring countries and 30 ethnic groups and the status of 2.2 kilometer land border. Over the past decade, the downstream states including Vietnam, Indian governments have made representation with the Chinese side due to the hydropower development of Mekong and Brahmaputra upstream. In 2010, the kick off of construction of Zangmu Hydropower Station, the first one in Tibet has caused fear from Indian and international community, even though the Chinese government announce that the dams would not affect the lower reaches of India. Based on analysis on typical global transboundary water conflicts including the Danube, Rhine, India River, Jordan, we found such typical cases reveal us that fruitful cooperation must obey fiver principles, that is success in reaching a good legal framework, governing body, integrated goals, information sharing, active participation, and cost benefit sharing mechanism. At the end of 2011, two ministries of the Chinese central government, the national development and Reform Commission and the Ministry of environmental protection jointly developed the "Interim Measures for reviewing hydropower planning report and environmental impact report", and it's the first official announcement of EIA process of hydropower planning, more importantly, a must for hydropower projects on transboundary rivers and rivers crossing provincial borders. SIA plays a function to let

decision makers know social influence before decision making consequences, including analysis, monitoring and management for policy, planning, program, and project). In 2012 and 2013, the National Development and Reform Commission issued two files that all the large projects must conduct social stability risk assessment before approval in China. Social stability risk assessment is much like SIA, but only focus on the negative impact of social influence. The evaluation mainly checks five main aspects: (one) the main risk factors of the project; (two) the project legitimacy, rationality, feasibility, controllability; (three) the project risk level; (four) the main project risk prevention and countermeasure; (five) the emergency plans and suggestions. Introduction and application of SIA process and tool in the Social stability risk assessment will play a very important role in conflict prevention in transboundary river hydropower projects in future.