Headlines Himalaya

For the 703rd - 704th issues of Headlines Himalaya, we reviewed researches from nine sources and selected 11 researches from four countries. We selected five researches from Nepal and six researches from other Himalayan countries (India, China, and Bhutan).

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GREATER ONE - HORNED RHINO (*RHINOCEROS UNICORNIS*) MORTALITY PATTERNS IN NEPAL

Shivish Bhandari, Binaya Adhikari, Kedar Baral, and Suresh C. Subedi

Nepal's lowland regions provide a rich habitat for greater one-horned rhino (*Rhinoceros unicornis*) populations. However, rhinos are facing human-caused and natural threats such as habitat loss and several other forms of anthropogenic pressure that cause mortality of greater one-horned rhinos (hereafter rhino) in Nepal. Understanding these patterns of mortality can provide important information for rhino conservation. In this study, we answered three important questions to aid in rhino conservation in Nepal:1)what was the pattern of rhino mortality (increased, decreased, or no change) during 2008–2018 in Nepal? 2) Does the pattern of rhino mortality vary by season, age, and gender? And, 3) what are the major causes of rhino mortality in Nepal? We collected rhino mortality data along with age, gender, and cause of death in the period between 2008 and 2018 in Nepal from secondary sources. We found that a total of 232 cases of rhino mortalities were observed during the 11-year period. Mortality of the rhino was associated with age and cause but not with gender and season. Among the nine categories of the causes of mortality, self-fighting, natural, tiger attacks, and poaching contributed about 80 % of total mortality. Mortality due to poaching of rhinos has decreased in recent years, while mortality due to self-fighting and tiger attacks have increased. We concluded that mortality causes associated with limited space and food, and tiger population growth are increasing in recent years. Therefore, habitat expansion, translocation to new suitable habitats, and multispecies conservation policy would contribute to long-term rhino conservation in Nepal.

For Further Reading: https://doi.org/10.1016/j.gecco.2022.e02189

ECOLOGICAL FACTORS DETERMINING BARKING DEER DISTRIBUTION AND HABITAT USE IN THE MID-HILLS OF NEPAL

Bijaya Neupane, Bijaya Dhami, Shreyashi Bista, Bipana Maiya Sadadev, Siddhartha Regmi, Sami Shrestha, Bikram Shrestha, Iva Traxmandlová, Sona Varachova, and Pavel Kindlmann

Barking deer is found in dense tropical and subtropical forests of Asia. It is listed as "least concerned" by the International Union of Conservation of Nature and as "vulnerable" in Nepal, where it is also protected. Due to the habitat loss and fragmentation by human activities, barking deer abundance is decreasing, which may even ultimately lead to its extinction. This in turn might negatively affect local ecosystem such as the abundance of the endangered common leopard, for which barking deer is the main prey species in the mid-hills of Nepal. We therefore need to know factors affecting barking deer abundance and its habitat preferences. To determine these factors, we recorded barking deer either by direct sighting or by any evidence of its indirect presence observed through transect surveys in January and February, 2019. To analyze habitat preference, the presence of barking deer was set to 1 if the barking deer or any sign of its presence were observed "used plots," or to 0 if the barking deer or any sign of its presence were not observed ("habitat availability plot"). We measured main four ecological

drivers such as forest management regime, microclimate, disturbance and food resources, which include 11 habitat characteristics in spots where barking deer was present, and in randomly selected spots. We found that elevation, slope, distance from settlement, presence of tree species, depth of leaf litter and percentage cover of leaf litter were most significantly affecting its presence. These results can serve as guidelines for local authorities to prevent decline in abundance of barking deer.

For Further Reading: https://doi.org/10.3389/fevo.2022.894369

ECOSYSTEM-BASED ADAPTATION FOR INCREASED AGRICULTURAL PRODUCTIVITY BY SMALLHOLDER FARMERS IN NEPAL

Kiran Bhusal, Erica Udas, and Laxmi Dutt Bhatta

The impacts of climate change are evident in the agriculture sector globally. These impacts are more severe and pronounced in a mountainous country like Nepal due to the high reliance on agro-economy and subsistence-based livelihoods by smallholder farmers that increase vulnerability and risks. Several ecosystem-based adaptation measures have proved to build the adaptive capacity of both agro-ecosystems and smallholder farmers by offering simple and affordable technologies however, these are yet to be prioritized by policy and programs for scaling. In this paper, we provide science-based evidence to traditionally used practices, such as *jholmal* (locally prepared bio-fertilizer and pesticides) and straw mulching by comparing their efficacy in terms of yield and reduction in disease pest infestation. The study was conducted in Kavre district of Nepal during 2017 and 2018 using participatory on-farm field trials for *jholmal* and straw mulching designed separately with Randomized Complete Block Design for selected vegetable crops like bitter gourd and tomato. The application of *jholmal* showed significant increase in bitter gourd yield both at the foothill and hilltop sites compared to the farmer's business usual practice (in 2017 and 2018, bitter gourd yield increased by 30.5% and 31.1% in foothill, while 26.6% and 28.7% in hilltops respectively). Further, a significant reduction on fruit infestation was observed in *jholmal* treated plots. Similarly, there was increase in tomato yield when straw mulch was used compared to the non-mulched trials (in 2017 and 2018, tomato yield increased by 16.5% and 20.3% respectively). These findings suggest that traditionally used practices have scientific basis and offer simple, affordable and climate friendly practices to improve the health of agro-ecosystem while supporting smallholder farmers to adapt to adverse impacts of climate change and build socio-ecological resilience. These practices can be also customized depending on the local context for wider adoption and scaling across Nepal and elsewhere as ecosystem-based adaptation measures for smallholder farmers.

For Further Reading: https://doi.org/10.1371/journal.pone.0269586

ASSESSMENT OF THE STATUS OF ROOFTOP GARDEN, ITS DIVERSITY, AND DETERMINANTS OF URBAN GREEN ROOFS IN NEPAL

Sara Rawal and Sandesh Thapa

In recent days, the practice of adopting rooftop garden can be seen in urban areas of developing countries, but a successful adoption of well-equipped green roofs is still lacking and is limited to open farms. To fulfill the gaps in urban agriculture in determining diversity status and socioeconomic factors affecting the adoption of RTG, this study was conducted. The survey was conducted from February 3 to April 6, 2021, where a total of 116

respondents were selected randomly from Morang and Sunsari districts. The rooftop adopters had 30.5% and 33.2% of the roofs under farming in Morang and Sunsari, respectively, having the size of the roof of rooftop adopters significantly larger than nonadopters. A binary logit model was used to determine the factor affecting the adoption of RTG where age, gender, schooling year, training, and farming experience have a significant effect on the adoption of RTG. Locally available material was given preference under farming and nutritionally important 50 species were reported with tests of the daily food requirement of the respondents. The diversity indices suggest that ornamental plant diversity is more followed by vegetables. Though, adopters are continuing the garden but have reported that lack of proper policy and ineffective management makes it difficult to protect the life of roof. Concludingly, respondents and other willing people must be provided with training, financial support, and proper extension services as lack of training and extension services are the major problems reported in the study area. Proper policy of rooftop garden is lacking in study area though it is under study in Kathmandu; thus, policy makers and research institution should focus on promoting the rooftop in study area and provide more reliable package for roof protection and garden continuation.

For Further Reading: https://doi.org/10.1155/2022/6744042

WHAT AFFECTS FARMERS IN CHOOSING BETTER AGROFORESTRY PRACTICE AS A STRATEGY OF CLIMATE CHANGE ADAPTATION? AN EXPERIENCE FROM THE MID-HILLS OF NEPAL

Deepa Paudel, Krishna Raj Tiwari, Nani Raut, Roshan Man Bajracharya, Suman Bhattarai, Bishal K. Sitaula, and Shivaraj Thapa

Determinants for choosing climate change adaptation strategies and selecting improved agroforestry practices have rarely been explored, while numerous studies have been conducted on climate change and agroforestry. This paper discusses; local understanding of climate change, climatic impacts, and factors that affect farmers' choices of adaptation strategies, and agroforestry practices. We focused on three districts located in the mid-hills of Nepal, where farmers were adopting agroforestry practices in two forms; traditional and improved practices. We followed three techniques of social survey; household survey (n = 420), focus group discussions (n = 6), and key informant interviews (n = 24). Almost all farmers of the study areas were experiencing climatic challenges, but only 59.29% of them accepted that the challenges are induced by climate change and, likewise, 55.24% have adopted climate change adaptation measures. Diversifying crop production, shifting farming practices, changing occupation, and emigration were local adaptation strategies. Livelihood improvement, income generation, and food production were the primary motives for adopting agroforestry practices in the study area. Agroforestry as an adaptation measure to climate change was considered secondary by most farmers. Statistical analysis using a logit model revealed that age, education, and habit of growing commercial species significantly influenced farmers adopting climate change adaptation strategies. Likewise, age, education, gender, habit of growing commercial species, and income from tree products significantly influenced the choice of improved agroforestry practices as a better option. Though agroforestry was widely considered a strategy to combat climate change, only some farmers accepted it due to their awareness level. Therefore, education programs such as training, farmer field schools, door-to-door visits, etc., should be intensified to sensitize farmers about climate change and encourage them to adopt improved agroforestry practices. The findings of the study could reinforce local, national, and international allied agencies to design operative actions in the days to come.

For Further Reading: https://doi.org/10.1016/j.heliyon.2022.e09695

EVALUATION OF OBSERVED AND FUTURE CLIMATE CHANGE PROJECTION FOR UTTARAKHAND, INDIA, USING CORDEX-SA

Neetu Tyagi, Tripti Jayal, Mukesh Singh, Vipan Mandwal, Atul Saini, Nirbhav, Netrananda Sahu, and Sridhara Nayak

The climate change scenarios, especially global warming, have raised significant concerns, and the Himalayan regions such as Uttarakhand are highly vulnerable to such climatic shifts. Considering 10 Coordinated Regional Climate Downscaling Experiments in South Asia (CORDEX-SA), experiments with 3 regional climate models (RCMs), driven by 13 global climate models, historical estimates and future projections are analyzed from the mid-century (MC) i.e., from 2021–2050 to the end of the century (EC) i.e., from 2070–2099 to characterize annual and seasonal variations in precipitation and temperature. The analysis shows a decrease in the annual average precipitation by 5.92% at MC and an increase of 5.97% at EC for the Representative Climate Pathway (RCP) 4.5, while precipitation may likely increase from 2.83% to 15.89% towards MC and EC in the RCP 8.5. The maximum temperature may likely increase from 0.42 °C to 3.07 °C from MC to EC in the RCP 4.5 and from 0.83 °C to 5.49 °C in the RCP 8.5. In addition, the minimum temperature may increase from 0.80 °C to 3.25 °C from MC to EC in the RCP 4.5 and from 0.30 °C to 5.86 °C from MC to EC in the RCP 8.5. Notably, a decrease in the pre-monsoon precipitation at EC and a higher increase in the maximum temperature during the monsoon season are observed. An increase in the maximum temperature along with precipitation may lead to an increase in the frequency of the monsoon season's extreme rainfall events.

For Further Reading: https://doi.org/10.3390/atmos13060947

IMPROVEMENTS IN SO$_2$ POLLUTION IN INDIA: ROLE OF TECHNOLOGY AND ENVIRONMENTAL REGULATIONS

Jayanarayanan Kuttippurath, Vikas Kumar Patel, Mansi Pathak, and Ajay Singh

India relies heavily on coal-based thermal power plants to meet its energy demands. Sulphur dioxide (SO$_2$) emitted from these plants and industries is a major air pollutant. Analysis of spatial and temporal changes in SO$_2$ using accurate and continuous observations is required to formulate mitigation strategies to curb the increasing air pollution in India. Here, we present the temporal changes in SO$_2$ concentrations over India in the past four decades (1980–2020). Our analysis shows that the Central and East India, and Indo-Gangetic Plain (IGP) are the hotspots of SO$_2$, as these regions house a cluster of thermal power plants, petroleum refineries, steel manufacturing units, and cement Industries. Thermal power plants (51%), and manufacturing and construction industries (29%) are the main sources of anthropogenic SO$_2$ in India. Its concentration over India is higher in winter (December–February) and lower in pre-monsoon (March–May) seasons. The temporal analyses reveal that SO$_2$ concentrations in India increased between 1980 and 2010 due to high coal burning and lack of novel technology to contain the emissions during the period. However, SO$_2$ shows a decreasing trend in recent decade (2010–2020) because of the environmental regulations and implementation of effective control technologies such as the fuel gas desulphurisation (FGD) and scrubber. Since 2010, India's renewable energy production has also been increased

substantially when India adopted a sustainable development policy. Therefore, the shift in energy production from conventional coal to renewable sources, solid environmental regulation, better inventory, and effective technology would help to curb SO_2 pollution in India. Both economic growth and air pollution control can be performed hand-in-hand by adopting new technology to reduce SO2 and GHG emissions.

For Further Reading: https://doi.org/10.1007/s11356-022-21319-2

China-Himalaya

ATMOSPHERIC DRY DEPOSITION OF NITROGEN AND PHOSPHORUS IN LAKE QINGHAI, TIBET PLATEAU

Xuan Zhang, Chunye Lin, Chongyi E, and Xitao Liu

To investigate the fluxes and potential sources of the atmospheric dry deposition (ADD) of nitrogen (N) and phosphorous (P) in the Lake Qinghai area, atmospheric deposition dusts were collected monthly at the eastern coast of Lake Qinghai from October 2017 to September 2018. N and P species in the dusts were determined. Results indicated that the annual ADD flux (ADDF) of dusts was 215.64 g m^{-2} yr^{-1}, 48% of which occurred in March and April. The annual ADDF of N was 7.98 kg ha^{-1} yr^{-1}, 49% of which was water-soluble total nitrogen, including 23%, 16%, and 10% of water-soluble NH_4^+-N, NO_3^--N, and organic N, respectively. The annual ADDF of the total P was 1.72 kg ha^{-1} yr^{-1}, only 6% of which was water-soluble. The dusts as well as the N and P in the dusts primarily originated from western Inner Mongolia and northern Gansu, driven by the winter monsoon. However, relatively high concentrations of N and P in the dusts in summer might be related to the Southeast Asian monsoon from southern Gansu and northern Sichuan. Overall, the ADDF of the total N was about half of the atmospheric wet deposition flux (AWDF) of N, while the ADDF of the total P was approximately equal to the AWDF of P. However, most of the P in the dusts was not water-soluble and thus not readily bioavailable. Therefore, N and P wet deposition provides most of the readily available nutrients to phytoplankton in Lake Qinghai.

For further reading: https://doi.org/10.1016/j.apr.2022.101481

TRADITIONAL BELIEFS, CULTURE, AND LOCAL BIODIVERSITY PROTECTION: AN ETHNOGRAPHIC STUDY IN THE SHALULI MOUNTAINS REGION, SICHUAN PROVINCE, CHINA

Jing Wang, Barnabas C. Seyler, Ta Shi Phuntsok, Yiling Lu, and Lhakpa Tsomo

Located on the southeastern Qinghai-Tibet Plateau, the Shaluli Mountains Region (SMR) is an important conservation priority area in Southwest China's highly biodiverse Hengduan Mountains. The SMR's ecology is complex and topographically diverse, with unique composition of abundant flora and fauna. Historically and currently a majority-Tibetan region, Tibetan Buddhism has significantly affected most local people's views on the natural environment. According to Tibetan religious theories and doctrines, the Shaluli Tibetans traditionally abstain from killing wild animals, believe in reincarnation (e.g., karmic cause and effect), the equality of all living beings, and the belief that everything has spirits. To understand how these beliefs and practices influenced the SMR's ecology and biodiversity, and how modernization pressures affect them, we conducted a three-year ethnobiological field investigation in seven SMR counties and a neighbouring city. The traditional worldview in this

relatively remote region has profoundly shaped the lifestyles, customs, and behavioral norms of the local religiously-observant Tibetans. These beliefs have influenced their perspective on the natural world, having an overall positive role in the long-term protection of the local ecological environment and biodiversity. As the surrounding regions have experienced increasing development and modernization pressures that threaten this biodiversity hotspot, Shaluli's Tibetan Buddhist temples and monks have assumed an active role promoting environmental protection, forest resource stewardship, and wildlife conservation. However, we found that modernization pressures and changing socio-economic conditions have negatively influenced these traditions, resulting in greater likelihood of biological invasions and pollution of the local soil and water sources.

For further reading: https://doi.org/10.1016/j.jnc.2022.126213

THE DYNAMICS OF PAIKU CO LAKE AREA IN RESPONSE TO CLIMATE CHANGE

Zhichong Yang, Xiaoai Dai, Zekun Wang, Xiaojie Gao, Ge Qu, Weile Li, Jingzhong Li, Heng Lu, and Youlin Wang

Journal of Water and Climate Change: jwc2022083

With the drastic change in global climate, the wide distribution of natural lakes over the Qinghai-Tibet Plateau (TP) has attracted extensive attention due to their high climate sensitivity. In this paper, we investigated the dynamics of Paiku Co, the largest inland lake in the Qomolangma Natural Reserve, with the associated response to climate change in the past three decades. The methods used contain the water index method, the spatial and temporal fusion model, the statistical mono-window algorithm, and multi-variable linear regression. Lake area fluctuated greatly in 1990–2000, followed by a continuous shrinkage in 2000–2010, and stabled after that 2010–2020. We forecasted that Paiku Co would enter a slow expansion period. Conjoint analysis with climate factors showed that the area variation of Paiku Co was not significantly related to precipitation change, but negatively related to the change of air temperature and lake temperature. We found that the lake change was not dominated by a single factor but showed different climate sensitivity in each period. Especially, there was a common inflection point around 2013 that might herald the occurrence of a new trend of climate change. This article provides new ideas and solutions for the research of lakes in the Qinghai-Tibet Plateau and offers a reference for water resource management.

For further reading: https://doi.org/10.2166/wcc.2022.083

Bhutan-Himalaya

WIND VULNERABILITY AND STRENGTHENING OF BHUTANESE VERNACULAR ROOFS

Nimesh Chettri, Govinda Dhaurali, Tekindra Neopaney, Tshering Cheki, and Dipendra Gautam

Geomatics, Natural Hazards and Risk 13: 1511 - 1534

Windstorms can cause significant damage to non-engineered structure and infrastructure due to the lack of consideration of wind force in design and construction. Historical windstorm events reflect that the windstorm damage is different than most of the other dynamic forces such as earthquakes, floods, tsunamis, and landslides. Bhutan frequently observes major windstorm events that cause significant damage to structures and infrastructures. Between April 2008 and May 2021, 51 windstorm events were recorded in Bhutan. Owing to widespread damages and losses in structures and infrastructures, it is imperative to depict the windstorm

vulnerability of structures and infrastructures that would be instrumental, especially in a country such as Bhutan where windstorms are frequent and enormous losses are attributed to damage to structures and infrastructures. Based on historical windstorm observations and database, we present forensic interpretations of damage mechanisms and windstorm vulnerability analysis. Apart from this, we also present some strengthening techniques considering inherent vulnerabilities, especially for vernacular constructions in rural Bhutan.

For further reading: https://doi.org/10.1080/19475705.2022.2086830