An Environmental Research Abstract

For the 699th - 700th issues of Headlines Himalaya, we reviewed researches from three sources and selected 13 researches from four countries. We selected four researches from Nepal and nine researches from other Himalayan Countries (India, China and Pakistan).

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Nepal-Himalaya

IDENTIFYING THE ENVIRONMENTAL AND ANTHROPOGENIC CAUSES, DISTRIBUTION, AND INTENSITY OF HUMAN RHESUS MACAQUE CONFLICT IN NEPAL

Sabina Koirala, Suraj Baral, Paul A. Garber, Hari Basnet, Hem Bahadur Katuwal, Sabita Gurung, Devi Rai, Raju Gaire Bishal Sharma, Tejab Pun, and Ming Li

Reducing conflict between humans and wildlife is considered a top conservation priority. However, increasingly human-induced disturbances across natural landscapes have escalated encounters between humans and wildlife. In Nepal, forests have been destroyed, fragmented, and developed for human settlements, agricultural production, and urban centers for decades. As a result, human-wildlife conflict, in the form of crop-raiding, livestock predation, and injuries to humans and wildlife, is common throughout the country. In particular, crop-raiding by macaques is an increasingly common form of human-wildlife conflict. Rhesus macaques (*Macaca mulatta*) have been identified as a top ten crop-raiding wildlife species in Nepal. In order to better understand the nationwide distribution and intensity of human-rhesus macaque conflict (HRMC), we conducted an extensive literature review of reported incidences of HRMC during the period 2000 to 2021 in Nepal. We also created an online survey to obtain nationwide data on the location and severity of HRMC, and modeled the set of ecological factors that affect habitat suitability for rhesus macaques. An ensemble of three different species distribution model (SDM) algorithms were used to analyze these data. We found that almost 44% of Nepal's land area contains suitable habitat for rhesus macaques, with less than 8% of all suitable habitat located in protected national parks. As humans continue to alter and fragment natural landscapes, HRMC in Nepal has intensified. At present, nearly 15% of the country's land area in which human settlements are permitted, is characterized by moderate or high rates of HRMC. We argue that prioritizing programs of forest restoration, strategic management plans designed to connect isolated forest fragments with high rhesus macaque population densities, creating government programs that compensate farmers for income lost due to crop-raiding, and educational outreach that informs local villagers of the importance of conservation and protecting biodiversity, offer the most effective solutions to reduce HRMC in Nepal.

For further reading: https://doi.org/10.1016/j.jenvman.2022.115276

CLIMATE CHANGE THREATENS STRIPED HYENA (*HYAENA HYAENA*) DISTRIBUTION IN NEPAL

Shivish Bhandari, Binaya Adhikari, Kedar Baral, Saroj Panthi, Ripu M. Kunwar, Tilak Thapamagar, Maria Psaralexi, Daya Ram Bhusal, and Dionisios Youlatos

Climate change can be expected to alter ecosystems and influence the spatial distribution of species. Understanding the effects of climate change on species distribution can help develop effective conservation protocols to tackle further biodiversity loss. Striped hyena (*Hyaena hyaena*) global populations appear to follow an overall decreasing trend as the species faces numerous threats. Hyena presence location data was collected, and we utilized a Maxent species distribution model to predict current and future distribution patterns in Nepal. We used two distinct representative concentration pathway (RCP) values (RCP 4.5 and RCP 8.5) to determine potential impacts on hyena distribution. We found that hyena current suitable habitat in Nepal extends over 22,000 km^2 and is projected to significantly decrease in both (RCP 4.5 and RCP 8.5) scenarios. In terms of habitat reduction, we further showed that RCP 8.5 was more adverse than RCP 4.5. We found that the Chure hills and the Terai regions hold the largest extent of hyena habitat in Nepal. Hyena habitat reduction was comparatively lower within the protected areas. Future projections, however, portend severe consequences for the species' survival as suitable habitat areas will be drastically reduced in the next 50 years. Further research on hyena microhabitat suitability under anthropogenic and topographic variables will be useful for future conservation policies.

For further reading: https://doi.org/10.1007/s13364-022-00638-2

HOUSEHOLD CONFLICTS WITH SNOW LEOPARD CONSERVATION AND IMPACTS FROM SNOW LEOPARDS IN THE EVEREST AND ANNAPURNA REGIONS OF NEPAL

Jonathan H. Hanson

Impacts on households from large carnivores are frequently reported in the conservation literature, but conflicts between households and large carnivore conservation are not. Employing a human-wildlife coexistence framework that distinguishes between human-wildlife impacts on one hand, and human-conservation conflicts on the other, this paper presents data from Annapurna Conservation Area and Sagarmatha (Everest) National Park, Nepal, each with different models of conservation governance. Using systematic sampling, quantitative information from 705 households was collected via questionnaires, while 70 semi-structured interviews were conducted with key informants for cross-methods triangulation. 7.7% of households reported conflicts with snow leopard conservation in the previous 12 months, primarily due to damage to livelihoods; these were significantly higher in the Annapurna region. 373 livestock were reported lost by households to snow leopards in the previous 12 months, representing 3.4% of total livestock owned and US$ 132,450 in financial value. Livestock losses were significantly lower in the Everest area. In linear regression models, total household livestock losses to all sources best explained conflicts with snow leopard conservation and household livestock losses to snow leopards but the models for the former dependent variable had very low explanatory power. Conservation in general, and large carnivore conservation in particular, should distinguish carefully between impacts caused by coexistence with these species and conflicts with conservation actors and over the methods and interventions used to conserve carnivores, especially where these negatively impact local livelihoods. In addition, livestock husbandry standards are highlighted again as an important factor in the success of carnivore conservation programmes.

For further reading: https://doi.org/10.1007/s00267-022-01653-4

THE WAY FORWARD FOR COMMUNITY FORESTRY IN NEPAL: ANALYSIS OF PERFORMANCE AGAINST NATIONAL FORESTRY GOALS

Kamal Acharya, Nicolae Talpă, Aureliu Florin Hălălișan, and Bogdan Popa

Covering 45% of Nepal's national territory, forests play a key role in maintaining the daily life of most rural communities. Community forestry is a participatory forest management approach for managing state-owned forests by local communities. By assessing the link between national level forestry goals and the community forestry outcomes, this study aims to measure the performance of community forestry towards achieving sustainable forest management goals. The 3L causative benchmark model was used, with some adaptations to fit the national context of Nepal. Data were collected through semi-structured interviews, a questionnaire survey, as well as using secondary sources such as policy documents, governmental and non-governmental reports, and scientific papers. Results reveal that community forestry is oriented towards achieving sustainable forest management goals, but there are aspects where further improvement is needed: forest product diversification, marketing and business, and planning and management of the non-marketable forest ecosystem services. Community forestry's role in managing the conflicting interests between stakeholders and promotion of the forestry sector in society is judged to be beneficial. There is an envisaged positive pathway to enhance the performance of community forestry through strong forest tenure rights, community friendly policies and regulations, and proper technical and business support from forest authorities.

For further reading: https://doi.org/10.3390/f13050726

India-Himalaya

CLIMATIC TRENDS OF VARIABLE TEMPERATE ENVIRONMENT: A COMPLETE TIME SERIES ANALYSIS DURING 1980–2020

Bilal Ahmad Lone, Sameera Qayoom, Aijaz Nazir, Shafat Ahmad Ahanger, Umer Basu, Tauseef Ahmad Bhat, Zahoor Ahmad Dar, Muntazir Mushtaq, Ayman El Sabagh, Walid Soufan, Muhammad Habib ur Rahman, and Rasha Fathallah El-Agamy

The western Himalayan region is susceptible to minor climate changes because of its fragile ecology, which might threaten the valley's prestigious ecosystems and socio-economic components. The Himalayas's local climate and weather are vulnerable to and interlinked with world-scale climatic changes since the region's hydrology is predominantly dominated by snow and glaciers. The Himalayas, notably the Jammu and Kashmir region in the western Himalayas, has clearly shown distinct and robust evidence of climate change. This study used observed data to examine the climatic variability and trends of change in precipitation and temperature for the Kashmir valley between 1980 and 2020. Gulmarg, Pahalgam, Kokernag, Qazigund, Kupwara, and Srinagar (Shalimar) meteorological stations in the Kashmir valley were studied in detail for long- and short-term as well as localized fluctuations in temperature and precipitation. The annual temperature and precipitation fluctuations were calculated using Sen's slope approach, and the sloping trend was determined using linear regression. The research showed statistically insignificant growing trends in maximum and minimum temperatures throughout the Kashmir valley. The average annual temperature in the Kashmir valley increased by 1.55 °C during the last 41 years (from 1980 to 2020), with a higher rise in maximum and minimum temperature by 2.00 and 1.10 °C, respectively. However, precipitation showed a non-significant decreasing trend concerning time series analysis over 1980 to

2020 in Kashmir valley. Results of annual average maximum temperature at all the stations revealed that Pahalgam (2.2 °C), Kokernag (1.8 °C), and Kupwara (1.8 °C) displayed a steep upsurge and statistically significant trends; however, annual average minimum temperature followed an increasing trend from 1980 to 2020 at all the stations except Shalimar. However, non-significant declining trends in precipitation were recorded at all the locations in Kashmir valley. This changing pattern of temperature and precipitation could have significant environmental consequences, affecting the western Himalayan region's food security and ecological sustainability.

For further reading: https://doi.org/10.3390/atmos13050749

HYDROGEOCHEMICAL AND STABLE ISOTOPIC EVIDENCE TO DIFFERENT WATER ORIGINS OF KARST SPRINGS IN THE WESTERN HIMALAYAS, INDIA

Rouf Ahmad Shah, Ghulam Jeelani, Jairam Singh Yadav, and Santosh Kumar Rai

Karst aquifers provide tremendous benefits to the people in the Indian subcontinent, but their studies are limited due to scanty observational data. This study examines the ionic and stable isotopic composition of water samples (n = 233 collected between 2012 and 2014) from karst springs in the western Himalayas to determine geogenic and anthropogenic solute sources and karst aquifers recharge. A principal component analysis suggests that karst springs acquire Ca^{2+}, Mg^{2+}, HCO_3^-, Na^+, K^+, and SO_4^- through natural processes, including carbonate and silicate dissolution. With a pollution index of 38%, about 50–88% of the NO_3^-, F^- and Cl^- contributing to karst springs have an anthropogenic origin. Karst springs are under-saturated with respect to calcite and dolomite, have higher pCO2, and electrical conductivity is inversely related to discharge, suggesting potential of recharging waters to dissolve the host rocks along flow paths. The springs display a distinct seasonal pattern in isotope characteristics with lower values from March to May and from August to October, reflecting the recharge from the snowmelt. Occasional higher isotopic values in February, June, and July suggest episodic rainfall events. The lower values of slope (6.9 ± 0.4) and intercept (9.8 ± 1.4) along with higher d-excess (> 16‰) of the karst springs provide strong evidence of winter snow as the primary source of recharge. Based on the karst index, the karst springs were classified as moderately to well karstified in the Liddar and Bringi catchments while slightly karstified in the Kuthar catchment. The study increases the understanding of karst aquifer sensitivity, which is necessary for implementing water supply protection schemes within the region.

For more reading: https://doi.org/10.1007/s12665-022-10397-7

GENETIC DIVERSITY AND POPULATION STRUCTURE OF THE NORTHERN RED MUNTJAC (*MUNTIACUS VAGINALIS*) IN INDIAN HIMALAYAN REGION

Vinaya Kumar Singh, Bheem Dutt Joshi, Abhishek Singh, Sujeet Kumar Singh, Kailash Chandra, Lalit Kumar Sharma, and Mukesh Thakur

Despite showing high resilience and adaptation to various types of habitats including human-dominated landscape, barking deer have experienced considerable threats due to habitat loss, poaching, and competition for resources with other deer species. In the present study, we examined the population genetic parameters of barking deer from the Indian Himalayan Region, (IHR) using mitochondrial and nuclear markers and performed comparative

analysis with the barking deer sequences retrieved from China, Thailand, Vietnam, and India (Central and Northeast region). We observed relatively high genetic diversity (Hd = 0.904 ± 0.038 and π = 0.0165 ± 0.005) at mitochondrial Cyt b gene and a moderate genetic variability at 11 nuclear microsatellites (Ho = 0.587 ± 0.072, He = 0.731 ± 0.046). The Bayesian-based population structure analysis revealed the presence of two different populations corresponding to the western and central-eastern Himalayas. The present study has generated a baseline population genetic account of barking deer that may be used in population monitoring of barking deer across IHR using non-invasive genetic sampling.

For more reading: https://doi.org/10.1007/s42991-022-00254-2

CHARACTERISATION AND ASSESSMENT OF A FLASH FLOOD IN THE HIMALAYA: UNDERSTANDING THE SIGNIFICANCE OF HIGH MAGNITUDE EVENTS IN SEDIMENT MOBILISATION

Arkaprabha Sarkar and Vimal Singh

Journal of the Geological Society of India 98: 678-686

An increase in the frequency of high magnitude events (climatological, geomorphic and meteorological) has been observed in the recent times. The observation has been closely linked to anthropogenic activities and climate change. The events have been studied on the basis of their trends, frequency, geographical distribution and impacts. A flash flood from 2018 in a small catchment in Uttarakhand, North West Himalayas is reported here. The event has been characterized based on the possible causes and observed effects. The runoff generation tendency of major sub-catchments within the study area was assessed and the area was mapped based on sediment connectivity. The hydrological characteristic of the event was calculated using Manning's equations. The event generated a peak discharge of 9953 m^3/s flowing at 15 m/s with a stream power of 6.4 MW. Based on the hydrological assessment, the thresholds of bedload movement, sediment transport and redistribution was analysed. The peak flow had a capacity of mobilizing boulders of 6m diameter. Putting together the field and modelled data, the difference in the nature of the of the topography was analysed that caused only a particular sub-catchment to respond to the same climatic forcing significantly more than the others and also highlighted the significance of such high magnitude stochastic events in controlling the rates of long term geomorphic processes that shape the landscape.

For more reading: https://doi.org/10.1007/s12594-022-2044-8

China Himalaya

HETEROGENEITY IN AGRICULTURAL HOUSEHOLDS AND TRANSITION PATHS IN SOUTHERN TIBET

Jing Zhang, Colin Brown, Scott Waldron, Lava Yadav, and De-qing Zhuoga

Journal of Mountain Science 19: 1386-1403

Smallholder livelihoods in agricultural areas in Tibet Autonomous Region, China (Tibet for short) have traditionally been based on subsistence mixed crop-livestock systems. Like many parts of China and the developing world, rural Tibet is undergoing rapid change in agricultural development, boosted by links with the off-farm sector. However, the agricultural transition process in Tibet has not been linear, is affected by policies particular to the region, and

varies significantly for different categories of rural actors. This paper analyses heterogeneity of household types in agricultural areas of southern Tibet and how household structures and characteristics result in different agricultural development pathways. Data is drawn from a stratified random survey of 144 households in three townships in southern Tibet and analysed through three methods: cluster analysis, bio-economic modelling, and analysis of household perceptions and attitudes to change. The analysis allows for the identification of three key household types — semi-subsistence, pluriactive and semi-commercial — organised along a continuum of intensification, commercialisation, specialisation and productivity. The study demonstrates the diversity of household farming systems in Tibet which in turn highlights the need for disaggregated analysis and tailored development policies and strategies. However, the analysis also reveals commonalities in development paths between groups, where all farm types are more interested in pursuing income and livelihood goals through an increase in productivity than through an increase in scale. Farmers in all systems choose to retain agriculture as a base from which to pursue livelihood strategies, especially through off-farm activities. Accounting for this household heterogeneity is important on several levels. First, it provides more granular detail on the process of development in rural areas of Tibet that has been very difficult to access in English literature especially in recent years. Second, the characteristics of the case study in agricultural areas of Tibet — especially the mixed agricultural-pastoral systems, high levels of seasonality, heavy state investment and increased integration with the other regions of China — may contribute to the broader agricultural development study. Third, policymakers in the central and local governments may be interested in how the household heterogeneity may affect — or be affected by — policies to increase agricultural productivity, intensify systems, change the composition of crop-livestock systems, promote rural-urban transformation and pursue environmental objectives, especially grassland degradation.

For further reading: https://doi.org/10.1007/s11629-021-7154-z

IMPACTS OF ENERGY STRUCTURE ON CARBON EMISSIONS IN CHINA, 1997–2019

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International Journal of Environmental Research and Public Health 19: 5850

To mitigate climate change, reducing carbon dioxide (CO_2) emissions is of paramount importance. China, the largest global CO_2 emitter, proposes to peak carbon emissions by 2030 and become carbon neutral by 2060; transforming the energy structure represents one of the primary means of addressing carbon emissions; thus, it is essential to investigate the impacts of alternate energy sources throughout the country. Based on energy consumption and carbon emissions data from 30 provincial-level administrative regions in China (excluding Tibet, Hong Kong, Taiwan, and Macau, due to the lack of data), the study here investigated the shares of coal, petroleum, natural gas, and non-fossil energy sources (i.e., hydropower, nuclear power, wind power, solar power, and biomass power), as they relate to total, per capita, and per unit GDP CO_2 emissions via spatial regression. The results showed that: (1) The epicenters of coal and carbon emissions have shifted from the east to the central and western regions; (2) There is a significant correlation between energy structure and carbon emissions: coal has a positive effect, petroleum's effects are positive at first, and negative subsequently; while both natural gas and non-fossil energy sources have a negative impact; (3) Provincial-level carbon emissions are affected by energy structure, carbon emissions in neighboring regions, and other factors.

For further reading: https://doi.org/10.3390/ijerph19105850

CONTRASTING CHARACTERISTICS, CHANGES, AND LINKAGES OF PERMAFROST BETWEEN THE ARCTIC AND THE THIRD POLE

Xuejia Wang, Youhua Ran, Guojin Pang, Deliang Chen, Bo Su, Rui Chen, Xin Li, Hans W. Chen, Meixue Yang, Xiaohua Gou, M. Torre Jorgenson, Juha Aalto, Ren Li, Xiaoqing Peng, Tonghua Wu, Gary D. Clow, Guoning Wan, Xiaodong Wu, and Dongliang Luo

Permafrost degradation poses serious threats to both natural and human systems through its influence on ecological–hydrological processes, infrastructure stability, and the climate system. The Arctic and the Third Pole (Tibetan Plateau, TP hereafter) are the two northern regions on Earth with the most extensive permafrost areas. However, there is a lack of systematic comparisons of permafrost characteristics and its climate and eco-environment between these two regions and their susceptibility to disturbances. This study provides a comprehensive review of the climate, ecosystem characteristics, ground temperature, permafrost extent, and active-layer thickness, as well as the past and future changes in permafrost in the Arctic and the TP. The potential consequences associated with permafrost degradation are also examined. Lastly, possible connections between the two regions through land-ocean–atmosphere interactions are explored. Both regions have experienced dramatic warming in recent decades, characterized by Arctic amplification and elevation-dependent warming on the TP. Permafrost temperatures have increased more rapidly in the Arctic than on the TP, and will likely be reinforced under a future high emission scenario. Near-surface permafrost extents are projected to shrink in both regions in the coming decades, with a more dramatic decline in the TP. The active layer on the TP is thicker and has substantially deepened, and is projected to thicken more than in the Arctic. Widespread permafrost degradation increases geohazard risk and has already wielded considerable effects on the human and natural systems. Permafrost changes have also exerted a pronounced impact on the climate system through changes in permafrost carbon and land–atmosphere interactions. Future research should involve comparative studies of permafrost dynamics in both regions that integrate long-term observations, high-resolution satellite measurements, and advanced Earth System models, with emphasis on linkages between the two regions.

For further reading: https://doi.org/10.1016/j.earscirev.2022.104042

MULTIFRACTAL DIMENSIONS OF SOIL PARTICLE SIZE DISTRIBUTION REVEAL THE ERODIBILITY AND FERTILITY OF ALPINE GRASSLAND SOILS IN THE NORTHERN TIBET PLATEAU

Xiangtao Wang, Lei Sun, Ningning Zhao, Wencheng Li, Xuehong Wei, and Ben Niu

Climate change and human activities have seriously degraded alpine grassland, potentially affecting soil particle size distribution (PSD) and further influencing the nutrient levels and erodibility of soil. Predicting the fertility and erodibility of alpine soil using multifractal dimensions of soil PSD could be used to enhance the management and restoration of degraded alpine grasslands. In the present study, we evaluated three types of alpine grasslands: alpine meadow (AM), alpine steppe (AS), and alpine desert steppe (ADS). Fencing and grazing management measures were conducted at sites containing each grassland type. Then, we analyzed the PSDs, erodibility, and other properties of soil in the 0–20 cm soil layer. Multifractal characterization of soil PSD was calculated using the fractal scale theory. The findings showed that grassland type significantly impacted soil nutrients and the multifractal dimensions of soil PSDs, whereas management measures affected soil erodibility significantly. The proportion of finer particles decreased as follows: AM > AS > ADS. Compared to grazing, fencing enhanced clay content and reduced the proportion of coarser particles under all three grassland types. AM had higher organic carbon and nitrogen levels than AS and ADS. Multifractal dimensions were highest for AM, with ADS having higher erodibility than AM and AS. Multifractal dimensions (except for correlation dimension) also had

significantly positive relationships with soil organic carbon and available nutrient content and soil erodibility, but had significantly negative correlations with soil pH, bulk density, and electrical conductivity. Thus, the multifractal dimensions of soil PSDs could be used to characterize the erodibility and fertility characteristics of soil in alpine regions, providing a reference for assessing vegetation restoration measures in the Northern Tibet Plateau.

For further reading: https://doi.org/10.1016/j.jenvman.2022.115145

Pakistan- Himalaya

ENERGY, EXERGY, ECONOMIC, ENVIRONMENTAL, ENERGOECONOMIC, EXERGOECONOMIC, AND ENVIROECONOMIC (7E) ANALYSES OF WIND FARMS: A CASE STUDY OF PAKISTAN

Muhammad Uzair Yousuf, Muhammad Adil Abbasi, Muhammad Kashif, and Muhammad Umair

Environmental Science and Pollution Research 29*:* 1-24

Wind energy has been seen as a viable alternative to traditional fossil fuels in recent decades. However, only a fraction of wind energy potential is exploited for Pakistan compared to the overall output due to insufficient multi-dimensional analysis. In this study, the energy, economic, environmental, energoeconomic, exergoeconomic, and enviroeconomic (7E) performance of a 50 MW wind energy system is analyzed for eight locations of Pakistan. The initial wind assessment is conducted based on the meteorological data obtained during a time period of 2016-2018. Analyses show that Sujawal has the maximum average annual speed of 7.3 m/s with an annual power density of 376 W/m^2. In comparison, the lowest findings were achieved for Peshawar having an average wind speed of 3.07 m/s with a power density of 42.63 W/m^2. From the energy, exergy, and cost assessment, it is concluded that Sujawal, Umerkot, and Sanghar are the most appropriate locations for new wind farms. The payback period in Sujawal with a lifespan of 20 years is estimated to be around 4.66 years (with GHG credit) and 7.08 years (without GHG credit). Furthermore, Sujawal is distinguished among the evaluated sites with the lowest exergoeconomic and energoeconomic parameters and the best enviroeconomic performance. The comprehensive performance assessment of the new potential sites explored in this study would be helpful in expanding the wind energy potential across the country.

For further reading: https://doi.org/10.1007/s11356-022-20576-5