An Environmental Research Abstract

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For the 639th-640th issues of Headlines Himalaya, we reviewed journal articles from nine sources and selected 19 researches from five countries. We selected six researches from Nepal and 13 researches from other Himalayan countries (India, China, Bhutan and Pakistan).

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EVALUATION OF PARAMETER SENSITIVITY FOR GROUNDWATER POTENTIAL MAPPING IN THE MOUNTAINOUS REGION OF NEPAL HIMALAYA

Dinesh Pathak, Rupendra Maharjan, Neelam Maharjan, Surendra Raj Shrestha, and Purushottam Timilsina

Groundwater for Sustainable Development 13: 100562

Groundwater potential (GWP) mapping of an area is the initial stage of assessing groundwater for further investigation leading towards exploitation of the resources to meet the water demand for various sectors. Groundwater availability is explicitly important especially in the mountainous area in the Himalayan region. In practice, different combinations of parameters are used to prepare GWP map, however, the sensitivity of parameters are poorly assessed. This paper aims to evaluate the sensitivity of parameter for delineating groundwater potential using GIS and remote sensing. Multi-Criteria Decision Analysis (MCDA) technique is used to prepare groundwater potential map of Khadadevi-Manthali area, Ramechhap district, of Bagmati Province, Nepal. Nine influencing parameters are considered in the present analysis, which were integrated through assigning normalized weight to the thematic layers and their classes using Analytical Hierarchical Process (AHP). Further, groundwater potential maps have been prepared for 7 different cases using different combination of parameters and for each case, the results were successively validated with 21 springs and 3 tube wells spatially distributed within the study area. The results show that the GWP maps prepared using the lineament and hydro-geomorphic maps yield better result. The ROC/AUC Curve (Receiver operating characteristic curve/Area under curve) for GWP map prepared using 9 parameters shows 72.4% prediction accuracy. Thus, we conclude that lineament and hydro-geomorphology of an area are most influencing factors in delineating GWP zones in mountainous area of Himalayan region and the nine parameters considered in the present study can be applied in also other areas of the region for preparing GWP map.

For further reading: https://doi.org/10.1016/j.gsd.2021.100562

ROLE OF LANDSLIDES ON THE VOLUME BALANCE OF THE NEPAL 2015 EARTHQUAKE SEQUENCE

A. Valagussa, P. Frattini, E. Valbuzzi, and G. B. Crosta

Scientific Reports 11: 1-12

The 7.8 M_w earthquake that struck Nepal on April 25th, 2015 triggered over 21,000 landslides over an area of more than 25,000 km^2. These landslides contributed to mass wasting, partially compensating the tectonic uplift by the earthquake. In this paper we quantify the volume balance resulting from the 2015 earthquake uplift (or subsidence) and landslide erosion. Starting from a new complete earthquake-induced landslide inventory, we calculated landslide volume by adopting different strategies for low-mobility and high-mobility landslides, considering also the potential supply of sediments to the drainage network. The results show that the contribution of earthquake-induced landslides to erosion is about one order of magnitude smaller than the vertical coseismic displacement. We found landslide volume values, due to the 2015 Nepal earthquake, ranging between 251 (− 15/ + 16) Mm^3 up to 1503 (− 183/ + 210) Mm^3 based on the adopted method, and a volume due to coseismic vertical displacement of 2134 (± 1269) Mm^3 for the whole area. The volume balance of the 2015 Nepal earthquake is strongly dominated by tectonic displacement. We show that these estimates depend on several uncertainties. We identified and quantified uncertainties related to: (1) the choice of empirical volume-area scaling relationships and their parameters; (2) the completeness and quality of landslide inventory through comparison with available inventories; (3) the approach adopted for the assessment of elongated landslide volume; (4) the InSAR displacement data.

For further reading: https://doi.org/10.1038/s41598-021-83037-y

FACTORS THAT INFLUENCE THE PLANT USE KNOWLEDGE IN THE MIDDLE MOUNTAINS OF NEPAL

Durga Kutal, Ripu M. Kunwar, Kedar Baral, Prabhat Sapkota, Hari P. Sharma, and Bhagawat Rimal

PLoS ONE 16: e0246390

An account of total of 58 plant species including 57 genera and 43 families was reported as useful in ethnomedicine from semi-structured questionnaire survey to the 76 participants of Kaski and Baitadi districts, Nepal. Fieldwork and participatory meetings were carried out between September 2017 and January 2018. A total of 419 emic use reports including 150 from Kaski and 269 from Baitadi were reported from 58 ethnomedicinal plant species. Each species was reported for 2–43 use reports and each participant recorded 1–12 use reports. About 25% (n = 104) use reports were associated with the treatment of digestive system disorders followed by 83 for general complaints. Of the species assessed, 53 species had IASc value < 0.25 and only five species had > 0.25. Species *Swertia chirayita*, *Paris polyphylla*, *Bergenia ciliata*, *Valeriana jatamansi* and *Centella asiatica* with > 0.25 IASc were found to be highly consented; however they were incongruent between the sample groups and sites. Divergent plant use knowledge specific to each sample district and group was corresponding to the heterogeneity of socio-economy and culture of the sites. Gender, ethnicity, household economy and food availability of the respondents were leading factors affecting the plant use knowledge. Despite the sites were relatively homogenous in eco-physiography, they possessed the distinct plant use knowledge, hinted that the socio-economic factors are more explanatory in plant use knowledge.

For further reading: https://doi.org/10.1371/journal.pone.0246390

STATUS OF SPRINGS IN MOUNTAIN WATERSHED OF WESTERN NEPAL

Sanot Adhikari, Anup Gurung, Raju Chauhan, Deepak Rijal, Bhawani S. Dongol, Dibit Aryal, and Rocky Talchabhadel

Water Policy 23: 142-156

The study, conducted in western hilly areas of Nepal, inventoried and mapped over 4,222 springs from five different watersheds. The study showed that more than 50% of the spring sources were found under natural conditions, i.e., open spring whereas 15% of them were of pond type. Similarly, the other 15% spring was recorded as a concrete structure or tank while 1% was determined to be a well. Attempts were made to identify if a change in water discharge from springs relates to rainfall patterns. The inter-annual variability analysis shows a significant fluctuation suggesting variation in water discharge across spring sources. The lowest amount of yearly rainfall received in the river basin is governed by decreasing water flow from the springs in the upper and mid-hills of Nepal. Besides, the intra-annual variation (i.e., seasonal and concentrative nature of rainfall only during monsoon) leads to shortage of drinking water and other domestic purposes (e.g., cooking, cleaning) during the dry months of the year. This study, based on the estimation of discharge flow in these springs, revealed that about 70% were decreasing and, in particular, the flow over the recent ten years decreased significantly.

For further reading: https://doi.org/10.2166/wp.2020.187

THREE DECADES OF LANDSLIDE ACTIVITY IN WESTERN NEPAL: NEW INSIGHTS INTO TRENDS AND CLIMATE DRIVERS

A. Muñoz-Torrero Manchado, S. Allen, J. A. Ballesteros-Cánovas, A. Dhakal, M. R. Dhital, and M. Stoffel

Landslides 2021: 1-15

In recent decades, landslide disasters in the Himalayas, as in other mountain regions, are widely reported to have increased. While some studies have suggested a link to increasing heavy rainfall under a warmer climate, others pointed to anthropogenic influences on slope stability, and increasing exposure of people and assets located in harm's way. A lack of sufficiently high-resolution regional landslide inventories, both spatially and temporally, has prevented any robust consensus so far. Focusing on Far-Western Nepal, we draw on remote sensing techniques to create a regional inventory of 26,350 single landslide events, of which 8778 date to the period 1992–2018. These events serve as a basis for the analyses of landslide frequency relationships and trends in relation to precipitation and temperature datasets. Results show a strong correlation between the annual number of shallow landslides and the accumulated monsoon precipitation (r = 0.74). Furthermore, warm and dry monsoons followed by especially rainy monsoons produce the highest incidence of shallow landslides (r = 0.77). However, we find strong spatial variability in the strength of these relationships, which is linked to recent demographic development in the region. This highlights the role of anthropogenic drivers, and in particular road cutting and land-use change, in amplifying the seasonal monsoon influence on slope stability. In parallel, the absence of any long-term trends in landslide activity, despite widely reported increase in landslide disasters, points strongly to increasing exposure of people and infrastructure as the main driver of landslide disasters in this region of Nepal. By contrast, no climate change signal is evident from the data.

For further reading: https://doi.org/10.1007/s10346-021-01632-6

WILL CLIMATE CHANGE IMPACT DISTRIBUTION OF BATS IN NEPAL HIMALAYAS? A CASE STUDY OF FIVE SPECIES

Sanjan Thapa, Suraj Baral, Yifeng Hu, Zhenglanyi Huang, Yang Yue, Maheshwar Dhakal, Shant Raj Jnawali, Nakul Chettri, Paul A. Racey, Wenhua Yu, and Yi Wu

Global Ecology and Conservation 26: e01483

Nepal Himalayas combine Oriental and Sino-Japanese zoogeographic realms as well as those of the eastern and western Himalayas. Physiography coupled with the diverse local climates has enriched the biodiversity of the Nepal Himalayas. The order Chiroptera constitutes more than 25% of the mammalian fauna and forms the most

speciose group of mammals in Nepal, where bats are recorded within a wide range of elevations from 64m to 4154m. Climate variation in the past has been observed and projected change has been predicted, and an evaluation of the climate change impact on biodiversity and habitats has been initiated. However, there has been no study to assess the impact of climate change on bats in the Himalayan range including Nepal. Through Species Distribution Modelling (SDM), we describe the present distribution range for five common chiropteran species and assess how these might changes in future climate scenarios. We projected the occurrence of bats against 19 environmental variables for different climate scenarios; present, Representative Concentration Pathways (RCPs) 4.5 and 8.5 for 2050 and 2070 deploying maximum entropy modeling (MaxEnt). We prepared predicted distribution range maps and estimated area using Arc GIS 10.7.1. Among 10 uncorrelated bioclimatic variables, six contribute to the SDM. Annual precipitation (bio12) is a common variable for all five species. Two species shows wider present distribution ranges compared to other three. The range is predicted to shift towards northern latitudes and higher elevations. The range is predicted to shift towards northern latitudes and higher elevations, although there is variation between species. Since the larger part of the current potential distribution range lies outside protected areas, a landscape level conservation approach prioritizing bat conservation is needed. Future surveys should target ground truthing in the western region of the country.

For further reading: https://doi.org/10.1016/j.gecco.2021.e01483

India-Himalaya

IDENTIFICATION OF ACTIVE FAULT TOPOGRAPHY ALONG THE KISHTWAR FAULT, JAMMU AND KASHMIR, NORTHWEST HIMALAYA, INDIA

S. K. Pandita, Ahsan Ul Haq, G. M. Bhat, Yudhbir Singh, and Arjun Singh

Environmental Earth Sciences 80: 140

Kishtwar region of Jammu and Kashmir, India has been investigated to identify the traces of active faults preserved in the topography of the area. The objectives were achieved by geomorphic mapping with the help of satellite imageries (Cartosat-1 with 2.5 m resolution), detailed geological field investigations, shallow sub-surface geophysical mapping and the optical luminescence dating. Active tectonic landforms mapped in this study include Kishtwar rhombohedral basin, fault scarps, drainage offset, deformed recent sediments, uplifted lacustrine sediments and faulted river terraces. The evidence of active extensional topography reported here is from the compressional tectonic regime of NW Himalaya and is represented by the ~ 10 km long and 2–3 km wide Quaternary basin, interpreted as a tectonic graben. The basin is vaulted by normal faults, where master fault and the antithetic fault show continuous and en echelon behaviour respectively. The presence of normal fault system bounding the basin/graben, lead to hypothesize that the releasing bend of Kishtwar strike-slip fault is responsible for their origin. Detailed field investigation along these faults led to highlight their active nature and future prospects for palaeoseismic investigations. The active nature of these faults is supported by dip-slip movement, fault scarp, fault rupture and displacement in the Holocene and recent sediments. The spatial distribution of these features has been confirmed with the help of Ground Penetrating Radar (GPR) survey. Optically Stimulated Luminescence (OSL) dating of the deformed units demonstrate that the displacement along the Kishtwar fault has occurred between 16.35 ± 2.13 to 13.14 ± 0.91 ka and 13.14 ± 0.91 to 7.89 ± 0.71 ka.

For Further reading: https://doi.org/10.1007/s12665-021-09427-7

ANALYSIS OF PRECIPITATION VARIABILITY OVER SATLUJ BASIN, HIMACHAL PRADESH, INDIA: 1901–2013

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Journal of Water and Climate Change 12: 127–135

Himachal Pradesh is a mountainous state in the Indian Himalayas, which spreads over an area of 55,000 km2. The state has a unique geography, which influences the climatic variability of the state. In the present study, Satluj Basin has been considered as a study area. This basin experiences frequent floods, erratic distribution of rainfall and climatic variabilities, which causes extensive damage over the basin. Precipitation is one of the most crucial meteorological variables which determines the impact of climate change in the Himalayan landmass. For spatial and temporal variation of precipitation, long-term precipitation data of 113 years (1901–2013) was utilized. Further, non-parametric, i.e. Mann–Kendall (MK) and modified Mann–Kendall (MMK) tests, were performed to check possible trends and Sen's slope estimator (SSE) test was used for determining the change in magnitude over the basin at 95% level of significance. The entire analysis was performed on a monthly, annual and seasonal (pre-monsoon, monsoon, post-monsoon and winter) basis. In this study, it was noticed that both positive and negative trends are detected in monthly and seasonal time series. It was also noticed that similar results have been estimated in MK, MMK and Sen's slope estimator tests during 1901–2013.

For Further reading: https://doi.org/10.2166/wcc.2020.136

SPATIO-TEMPORAL CHARACTERIZATION OF LANDSCAPE FIRE IN RELATION TO ANTHROPOGENIC ACTIVITY AND CLIMATIC VARIABILITY OVER THE WESTERN HIMALAYA, INDIA

Somnath Bar, Bikash Ranjan Parida, Gareth Roberts, Arvind Chandra Pandey, Prasenjit Acharya and Jadunandan Dash

GIScience and Remote Sensing 2021: 1-19

The frequent occurrence of a forest fire can be detrimental to the functioning of ecologically fragile regions such as the Western Himalaya. This study assesses the spatio-temporal variability and trends of fire occurrence in forests, shrubland, and grassland in relation to anthropogenic activities and climate oscillations over Uttarakhand and Himachal Pradesh; the most fire-affected states in the Western Himalaya. The Pre-monsoon (March to June) temporal distribution of fire occurrence is bimodal with the first and second fire peaks occurring in the last week of April and late May/early June, respectively. The length of fire season was found to have reduced by ~ 10 days in 2010s compared to 2000s with the increasing burned area concentration over a shorter period (~110 days). The Mann-Kendall Tau (τ) and Sen's-slope suggested an increasing trend (τ = 0.3, Sen's slope = 46.78 km^2 $year^{-1}$, p = 0.02) of burn area over Uttarakhand where most fire activity occurs. The Getis-Ords (Gi*) statistic was derived by using Fire Radiative Power (FRP) data to infer the spatial distribution of hot and cold clusters which were found to be greatest (Gi* = 1–10) in evergreen needleleaf forest which also accounted for a marginally higher mean per-pixel FRP than other land cover types. Analyses of the role of climatic variables on fire activity revealed moderate positive and negative correspondence between the burned area and average maximum-temperature (R = 0.57, p = 0.01) and total precipitation (R = – 0.53, p = 0.02), respectively. Assessment of the variation of fire activity with global climatic oscillation indices found the Niño-3.4 index to have the strongest, albeit modest, relationship (R = 0.51) with burned area anomalies. This study highlights the increase in fire intensity in the fragile forests of the Western Himalayan region and the requirement for further research into the role of climate and anthropogenic activities on fire occurrence in order to best preserve regional biodiversity and develop an effective forest management strategy.

For further reading: https://doi.org/10.1080/15481603.2021.1879495

CLIMATE CHANGE OBSERVATIONS OF INDIGENOUS COMMUNITIES IN THE INDIAN HIMALAYA

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Weather, Climate and Society 13: 245-257

Mountains are important global sites for monitoring biological and socioecological responses to climate change, and the Himalaya has some of the world's most rapid and visible signs of climate change. The increased frequency and severity of climate anomalies in the region are expected to significantly affect livelihoods of indigenous communities in the region. This study documents the perceptions of indigenous communities of climate change in the western Himalaya of India. The study highlights the power of knowledge and understanding available to indigenous people as they observe and respond to climate change impacts. We conducted a field-based study in 14 villages that represent diverse socioecological features along an altitudinal range of 1000–3800 m MSL in the western Himalaya. Among the sampled population, most of the respondents (>95%) agreed that climate is changing. However, people residing at low- and high-altitude villages differ significantly in their perception, with more people at high altitudes believing in an overall warming trend. Instrumental temperature and rainfall from nearby meteorological stations also supported the perception of local inhabitants. The climate change perceptions in the region were largely determined by sociodemographic variables such as age, gender, and income as well as altitude. A logistic regression, which exhibited significant association of sociodemographic characteristics with climate change perceptions, further supported these findings. The study concluded that the climate change observations of local communities can be usefully utilized to develop adaptation strategies and mitigation planning in the Himalayan region.

Further reading: https://doi.org/10.1175/WCAS-D-20-0077.1

LANDSLIDE PROBABILITY MAPPING BY CONSIDERING FUZZY NUMERICAL RISK FACTOR (FNRF) AND LANDSCAPE CHANGE FOR ROAD CORRIDOR OF UTTARAKHAND, INDIA

Ujjwal Sur, Prafull Singh, Praveen Kumar Rai, and Jay Krishna Thakur

Environment, Development and Sustainability 2021: 68

Landslide poses severe threats to the natural landscape of the Lesser Himalayas and the lives and economy of the communities residing in that mountainous topography. This study aims to investigate whether the landscape change has any impact on landslide occurrences in the Kalsi-Chakrata road corridor by detailed investigation through correlation of the landslide susceptibility zones and the landscape change, and finally to demarcate the hotspot villages where influence of landscape on landslide occurrence may be more in future. The rational of this work is to delineate the areas with higher landslide susceptibility using the ensemble model of GIS-based multi-criteria decision making through fuzzy landslide numerical risk factor model along the Kalsi-Chakrata road corridor of Uttarakhand where no previous detailed investigation was carried out applying any contemporary statistical techniques. The approach includes the correlation of the landslide conditioning factors in the study area with the changes in land use and land cover (LULC) over the past decade to understand whether frequent landslides have any link with the physical and hydro-meteorological or, infrastructure, and socioeconomic activities. It was performed through LULC change detection and landslide susceptibility mapping (LSM), and spatial overlay analysis to establish statistical correlation between the said parameters. The LULC change detection was performed using the object-oriented classification of satellite images acquired in 2010 and 2019. The inventory of the past landslides was formed by visual interpretation of high-resolution satellite images supported by an intensive field survey of each landslide area. To assess the landslide susceptibility zones for 2010 and 2019 scenarios, the geo-environmental or conditioning factors such as slope, rainfall, lithology, normalized differential vegetation index (NDVI), proximity to road and land use and land cover (LULC) were considered, and the fuzzy LNRF technique was applied. The results indicated that the LULC in the study area was primarily transformed from forest cover and sparse vegetation to open areas and arable land, which is increased by 6.7% in a decade. The increase in built-up areas and agricultural land by 2.3% indicates increasing human interference that is continuously transforming the natural landscape. The landslide susceptibility map of 2019 shows that about 25% of the total area falls under high and very high susceptibility classes. The result shows that 80% of the high landslide susceptible class is contained by LULC classes of open areas, scrubland, and sparse vegetation, which point out the profound impact of landscape

change that aggravate landslide occurrence in that area. The result acclaims that specific LULC classes, such as open areas, barren-rocky lands, are more prone to landslides in this Lesser Himalayan road corridor, and the LULC-LSM correlation can be instrumental for landslide probability assessment concerning the changing landscape. The fuzzy LNRF model applied has 89.6% prediction accuracy at 95% confidence level which is highly satisfactory. The present study of the connection of LULC change with the landslide probability and identification of the most fragile landscape at the village level has been instrumental in delineation of landslide susceptible areas, and such studies may help the decision-makers adopt appropriate mitigation measures in those villages where the landscape changes have mainly resulted in increased landslide occurrences and formulate strategic plans to promote ecologically sustainable development of the mountainous communities in India's Lesser Himalayas.

For further reading: https://doi.org/10.1007/s10668-021-01226-1

China Himalaya

CHINESE CATERPILLAR FUNGUS (OPHIOCORDYCEPS SINENSIS) IN CHINA: CURRENT DISTRIBUTION, TRADING, AND FUTURES UNDER CLIMATE CHANGE AND OVEREXPLOITATION

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Science of The Total Environment 755: 142548

Chinese caterpillar fungus (*Ophiocordyceps sinensis)* is a precious traditional medicine which is mostly distributed on the Qinghai-Tibetan Plateau (QTP). Due to its medicinal values, it has become one of the most valuable biological commodities and widely traded in recent years worldwide. However, its habitat has changed profoundly in recent years under global warming as well as anthropogenic pressures, resulting in a sharp decline in its wild population in recent years. Based on the occurrence samples, this paper estimates the potential distribution of caterpillar fungus using MaxEnt model. The model simulates potential geographical distribution of the species under current climate conditions, and examines future distributions under different climatic change scenarios (i.e., RCP 2.6, RCP 4.5, RCP 6.0 and RCP 8.5 have been modelled in 2050s and 2070s, respectively). For examining the impacts of climate change in future, the integrated effects of climatic impact, trading, and overexploitation had been analyzed in detailed routes. The results show that: 1) The distribution patterns of caterpillar fungus under scenario RCP 2.6 have been predicted without obvious changes. However, range shift has been observed with significant shrinks across all classes of suitable areas in Tianshan, Kunlun Mountains, and the southwestern QTP in 2050s and 2070s under RCP 4.5, RCP 6.0 and RCP 8.5 scenarios, respectively. 2) The exports were decreasing drastically in recent years. Guangzhou and Hongkong are two international super import and consumption centres of caterpillar fungus in the world. 3) Both ecological and economic sustainable utilization of the caterpillar fungus has been threatened by the combined pressures of climate change and overexploitation. A strict but effective regulation and protection system, even a systematic management plan not just on the collectors but the whole explore process are urgently needed and has to be issued in the QTP.

Further reading: https://doi.org/10.1016/j.scitotenv.2020.142548

ASSESSING SUITABILITY OF HUMAN SETTLEMENTS IN HIGH-ALTITUDE AREA USING A COMPREHENSIVE INDEX METHOD: A CASE STUDY OF TIBET, CHINA

Yanpeng Ding, Bin Shi, Guijin Su, Qianqian Li, Jing Meng, Yongjian Jiang, Yi Qin, Lingwen Dai, and Shuai Song

Sustainability 13: 1485

With the steady advancement of the United Nations Sustainable Development Goals (SDGs), how to build a sustainable environment for human settlements has become a hot topic of research for scholars from various

countries. Rational space utilization and resource allocation are the keys to enhancing human well-being and achieving sustainable human settlements. A comprehensive human settlement environment evaluation system, which includes 14 indicators from the natural environment, infrastructure, and public services, was established in this study. The results showed that the habitat suitability area only accounted for 1.61% (2.05% after removing the nature reserve) and all centered on cities and radiated to the surrounding areas. A belt-like suitability distribution pattern of "Yi Jiang Liang He" (i.e., Brahmaputra, Lhasa, and Nianchu Rivers) is formed, and a point-like suitability distribution pattern of the Chamdo Karub District, Nagqu Seni District, and Ngari Shiquanhe Town are formed. The results of the driving factor analysis indicate that the level of public health development in infrastructure and various indicators in public services are the main factors influencing human settlement. There is not much difference in the natural environment in the populated regions, so the suitability of the natural environment is not a significant driving factor. In addition, the reliability of the assessment results was verified by a questionnaire survey of residents in the three regions, and the subjective satisfaction of the residents agreed with the ranking results of the objective evaluation. The evaluation results of this study provide theoretical and directional guidance for the improvement of human settlements on the Qinghai–Tibet Plateau. It will be a useful tool for evaluating human settlements in the region and has a reference significance for the formulation of macro-policy in high-altitude regions.

For Further reading: https://doi.org/10.3390/su13031485

CONTRIBUTION OF SOUTH ASIAN BIOMASS BURNING TO BLACK CARBON OVER THE TIBETAN PLATEAU AND ITS CLIMATIC IMPACT

Junhua Yang, Zhenming Ji, Shichang Kang, and Lekhendra Tripathee

Environmental Pollution 270: 116195

This study used a regional climate-chemistry transport model, WRF-Chem v3.9.1, to evaluate the impact of South Asian biomass burning on black carbon (BC) over the Tibetan Plateau (TP) and its climatic effects for an entire year. The simulation, which was validated by comparing surface meteorological parameters and BC concentration against in-situ observations over South Asia and the TP, provided a perspective on the seasonal variations and regional spatial patterns of BC concentration. Using a sensitivity simulation where BC emissions from biomass burning were removed from South Asia, this study found South Asian biomass burning emissions contributed up to 90% of BC mass over the TP during the pre-monsoon season, specifically emissions from western India for the simulated year. The emissions led to reduced surface radiative forcing, causing the temperature to decrease accordingly. However, column cloud water was increased. This study suggested that the biomass burning emissions from South Asia have significant impact on atmospheric BC over the TP, especially during the pre-monsoon season. Therefore, reducing biomass burning emissions from South Asia is potentially important for alleviating the effects of BC on climatic and environmental conditions over the TP and surrounding regions.

For Further reading: https://doi.org/10.1016/j.envpol.2020.116195

Bhutan-Himalaya

VULNERABILITY OF MAMMAL COMMUNITIES TO THE COMBINED IMPACTS OF ANTHROPIC LAND-USE AND CLIMATE CHANGE IN THE HIMALAYAN CONSERVATION LANDSCAPE OF BHUTAN

Ugyen Penjor, Sonam Wangdi, Tandin Tandin and David W. Macdonald

Ecological Indicators 121: 107085

Human land-use and climate change drive biodiversity loss, precipitating the extinction crisis. The fragility of the Himalayas makes species in this landscape vulnerable to land-use and climate change. We aim to quantify the response of terrestrial mammal community to land-use and climate scenarios in the Bhutan Himalaya. Using large-scale camera-trap dataset, we examine the effects of anthropic land-use and climate variables on the terrestrial mammal assemblage using Bayesian multi-species occupancy model. Most of the terrestrial mammals in our sample displayed a strong negative relationship with anthropic land-use variables (agriculture, roads and settlement). Further, the occurrence of most species decreased with likely projections for climate variables, illustrating threats to conservation if the current trend in global warming continues. Notably, we found that biodiversity conservation in this landscape can be achieved by protecting extensive forest cover. Our findings emphasize the importance of reconciling land-use management and mammal conservation in the face of climate change and provide vital information which can be used to optimize future conservation and development plans.

Further reading: https://doi.org/10.1016/j.ecolind.2020.107085

A CRITICAL REVIEW OF WATER RESOURCES AND THEIR MANAGEMENT IN BHUTAN

Muhammad Atiq Ur Rehman Tariq, Kelden Wangchuk, and Nitin Muttil

Hydrology 8: 31

Bhutan is a small yet water-abundant country. The country suffers from frequent flooding and is lately experiencing a growing risk of localized droughts due to inappropriate water resource management and climate change. Such a situation calls for much more efficient use and management of water in Bhutan. This paper undertakes an extensive analysis of the country's water resources for better planning and management of the available water resources. Bhutan can be divided into three zones, the Southern Foothills, the Central Inner Himalayas, and the Higher Himalayas. The top four leading industries of Bhutan are related to water, either directly or indirectly. The country at present is at a very early stage of development. The government has prioritized water resources management over recent years. Water for hydropower in Bhutan has been in focus as compared to that allocated for irrigation, industries, and environmental demand. The demand for water in Bhutan has also increased in the last decade due to population increase, changes in lifestyle, and economic advancements through tourism and hydropower projects. Climate variation, deteriorating water quality, frequent floods, and increasing urbanization threaten the sustainability of water resources. Water accessibility issues for settlements due to the country's harsh geographical landscape is leading towards localized water scarcity. Serious attention to rainwater harvesting and groundwater recharge is required to address localized water scarcity issues.

Further reading: https://doi.org/10.3390/hydrology8010031

Pakistan- Himalaya

AIR POLLUTION AND CHILD HEALTH: THE IMPACT OF BRICK KILN POLLUTION ON CHILDREN'S COGNITIVE ABILITIES AND PHYSICAL HEALTH IN PAKISTAN

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Environment, Development and Sustainability 2021: 45

This study explores the adverse impact of air pollution, caused by emissions from brick kilns, on the children's cognitive ability and physical health. A survey of children between the age of 5 and 12 years was conducted in the

Peshawar district of KP province of Pakistan. The concentrations of particulate matters (PM_{10} and $PM_{2.5}$) were found to be higher in areas within 3 km radius of brick kilns (treatment group) compared to those that are outside of this defined radius (comparison group). By employing propensity score matching method, the study found that exposure to brick kiln pollution has significant negative effect on children's cognitive ability and physical health. These results advocate that, in addition to increasing the direct health cost, brick kiln pollution also has adverse long-term welfare consequences through indirect and unobservable effects.

For further reading: https://doi.org/10.1007/s10668-021-01229-y

TEMPORAL AND SEASONAL VARIATIONS OF NOISE POLLUTION IN URBAN ZONES: A CASE STUDY IN PAKISTAN

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Environmental Science and Pollution Research 2021: 96

Noise pollution is widely recognized as an important problem and can negatively affect quality of life. This study aimed to examine the temporal and seasonal variations of noise pollution in urban zones of Peshawar, Pakistan. This city is increasingly becoming congested and traffic-related problems are common. Noise levels were assessed in four different seasons at 20 points around the city, including three different zones: commercial, residential, and silent. All the noise indices including equivalent noise level, day and night time noise level, noise climate, and noise pollution level were calculated for all zones. In winter, the Leq values ranged between 52.5 and 73.3 dBA; while in spring, summer, and autumn, it ranged between 56.2 and 88.3 dBA; 46.9 and 88.6 dBA; and 49.2 and 76.6 dBA, respectively. The level of the noise was observed highest in commercial followed by residential and the silent zones. The levels of the noise were beyond the permissible limits in some zones mentioned in the Pakistan National Environmental Quality Standards (Pak-NEQS' 2010). The seasonal variation in Leq revealed that the noise level in 70% of areas increased from winter to spring, 45% from spring to summer, 35% summer to autumn, 30% autumn to winter, 70% winter to summer, and 40% spring to autumn. Temperature, humidity, and wind speed were the main seasonal factors causing the seasonal variations and traffic was the main source of noise pollution identified in the area.

For further reading: https://doi.org/10.1007/s11356-021-12738-8

MANAGING FARM-CENTRIC RISKS IN AGRICULTURAL PRODUCTION AT THE FLOOD-PRONE LOCATIONS OF KHYBER PAKHTUNKHWA, PAKISTAN

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Natural Hazards 2021: 22

The agriculture sector in Pakistan is confronted with massive floods and other climate-induced disasters. Resultantly, the farmers are compelled to adopt several risk-management activities to cope with these risks. Therefore, the study aims to explore the risk management tools and their association with farmers' risk perception, risk-averse attitude, and other socio-economic factors. We collected data from 200 respondents from two districts in Khyber Pakhtunkhwa. The study employed a multivariate probit model to investigate the association among dependent variables (risk management tools) and explanatory variables. Findings indicated that floods and heavy rains were not the sources of risk for most of the large farmers. The majority of small farmers were risk-averse. The multivariate probit model results exposed that farmers' age, their risk perception about the heavy rains, and the size of landholding were positively associated with the adoption of assets depletion as a risk management tool. Farmers' age, education, off-farm income, and farmers' risk-averse attitude were positive, while the farming experience was negatively associated with consumption reduction. Moreover, farming experience, risk perception about the floods and heavy rains, and risk-averse attitude are positively associated with the adoption of diversification. Farmers in the study area were vulnerable, and they were relying on traditional tools of risk

management. Hence, the government is suggested extending agricultural credit and crop insurance facilities to these farmers.

For further reading: https://doi.org/10.1007/s11069-021-04610-2

Highlight of the Issue

REMEMBERING FATHER OF MODERN SCIENCE; GALILEO GALILEI

Amidst the global pandemic, an astonishing moment was achieved after years of planning and hard work. NASA'S Perseverance Rover landed safely on the surface of Mars. Her search for evidence of ancient life on Mars could help answer fundamental question: Does life ever exist on another planet? In this joyous moment, we must remember Galileo Galilei, who was born in Pisa, Italy on February 15, 1564. He was a natural philosopher, astronomer, and mathematician who made fundamental contributions to the sciences of motion, astronomy, and strength of materials and to the development of scientific method. His formulation of (circular) inertia, law of falling bodies, and parabolic trajectories marked the beginning of a fundamental change in the study of motion. He contributed to transform the natural philosophy from a verbal, qualitative account to a mathematical one through his book, "Book of Nature" written in the language of mathematics. His investigations from the telescope he invented allowed him to resolve what were seen as flaws in the heliocentric model and simultaneously discovered aspects that supported heliocentrism. His laws were not just a science theorem but a fight against existing religious belief, Aristotelianism and also a fight against the suppression of opinion of an emerging scientific minority. He became an inspiration for countless emerging researchers to pursue the freedom of scientific inquiry.

https://edition.cnn.com/2021/02/19/world/perseverance-rover-landing-joy-scn-trnd/index.html
https://plato.stanford.edu/entries/galileo/