An Environmental Research Abstract

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For the 683rd – 684th issues of Headlines Himalaya, we reviewed researches from three sources and selected eight researches from four countries. We selected three researches from Nepal and five researches from other Himalayan countries (India, China, and Pakistan).

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Nepal-Himalaya

INVESTIGATING MAJOR CAUSES OF EXTREME FLOODS USING GLOBAL DATASETS: A CASE OF NEPAL, USA AND THAILAND

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Progress in Disaster Science 13: 100212

In recent years, the damages caused by flooding has been severe globally, and several research studies indicated extreme precipitations and changes in land-use plays a crucial role. The hydrological and climate impact studies in data-scarce regions are relatively challenging, and several global dataset products have aided in overcoming them. However, their accuracy and reliability vary from climatic regions to the topography of the land surface. Therefore, this study employed global dataset products for precipitation and land use to identify the major flood driver in tropical, subtropical, and temperate regions where severe flooding had occurred in the past decade. The study evaluated the performances of the PERSIANN-CDR, PERSIANN-CCS and PERSIANN precipitation products, and ESACCI-LC land□use product to develop a statistical relationship among the land-use and extreme precipitation variables using the Multiple Linear Regression technique. The result shows that the PERSIANN-CDR estimates were more accurate than others in the selected study basins. The statistical model showed that the combined contribution of both land-use and precipitation to the flood (R^2) are 73.9%, 66.7% and 37.4%, for the Mun River Basin (MRB), Thailand, the Bagmati River Basin (BRB), Nepal and the Missouri Little Sioux (MLSB) Basin, USA, respectively. Moreover, it correlated with the flood (R) by 85.9%, 81.7% and 61.1% in the MRB, BRB, and MLSB, respectively. Additionally, the results indicated that the major cause of flooding in MRB and BRB is likely to be the changes in precipitation, while land-use change is likely to be the major cause in the MLSB. The result from the study shall be useful for the researchers, practitioners, and decision-makers in determining the applicability of a suitable precipitation product in data-scarce regions, visualise the major cause of flooding and plan the flood risk management strategies accordingly by minimising the exposure and maximising the resiliency for possible future events.

For Further Reading: http://dx.doi.org/10.1016/j.pdisas.2021.100212

FLOOD ASSESSMENT AND IDENTIFICATION OF EMERGENCY EVACUATION ROUTES IN SETI RIVER BASIN, NEPAL

Bhabana Thapa, Teiji Watanabe, and Dhananjay Regmi

Land 11: 82

Sudden floods frequently occur in the Himalayas under changing climates. Rapid glacial melt has resulted in the formation of glacial lakes and associated hazards. This research aimed to (1) identify flood-prone houses, (2) determine pedestrian emergency evacuation routes, and (3) analyze their relationships to socioeconomic status in the Seti River Basin. Detailed hazard maps were created using field survey results from unmanned aerial vehicle photogrammetry and the Hydrologic Engineering Center River Analysis System. Questionnaire, focus-group, and key□informant surveys helped identify the socioeconomic situation. Inundation maps revealed that most residents are exposed to future flooding hazards without proper evacuation routes. Highly impoverished and immigrant households were at the highest risk in terms of income inequality and migration rate ($p < 0.001$) and were located on the riverside. The locations of 455 laborers' houses were significantly correlated with inundation hazards ($p < 0.001$). Governmental and associated agencies must develop adequate plans to relocate low-income households. Group discussions revealed the need for stronger adaptive capacity-building strategies for future risk management. Pokhara requires better systematic and scientific land-use planning strategies to address this issue efficiently. A similar approach that combines flood modeling, proper evacuation route access, and socioeconomic survey is suggested for this river basin.

For Further Reading: https://doi.org/10.3390/land11010082

LIQUEFACTION HAZARD ASSESSMENT AND GROUND FAILURE PROBABILITY ANALYSIS IN THE KATHMANDU VALLEY OF NEPAL

Mandip Subedi and Indra Prasad Acharya

Geoenvironmental Disasters 9: 1

During the 2015 Gorkha Earthquake (M_w7.8), extensive soil liquefaction was observed across the Kathmandu Valley. As a densely populated urban settlement, the assessment of liquefaction potential of the valley is crucial especially for ensuring the safety of engineering structures. In this study, we use borehole data including SPT-N values of 410 locations in the valley to assess the susceptibility, hazard, and risk of liquefaction of the valley soil considering three likely-to-recur scenario earthquakes. Some of the existing and frequently used analysis and computation methods are employed for the assessments, and the obtained results are presented in the form of liquefaction hazard maps indicating factor of safety, liquefaction potential index, and probability of ground failure (P_G). The assessment results reveal that most of the areas have medium to very high liquefaction susceptibility, and that the central and southern parts of the valley are more susceptible to liquefaction and are at greater risk of liquefaction damage than the northern parts. The assessment outcomes are validated with the field manifestations during the 2015 Gorkha Earthquake. The target SPT-N values ($N_{improved}$) at potentially liquefiable areas are determined using back analysis to ascertain no liquefaction during the aforesaid three scenario earthquakes.

For Further Reading: https://doi.org/10.1186/s40677-021-00203-0

India-Himalaya

ASSESSING SEASONAL VARIATION OF DIFFUSIVE NITROUS OXIDE EMISSION FROM FRESHWATER WETLAND IN KEIBUL LAMJAO NATIONAL PARK, MANIPUR NORTHEAST INDIA

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Atmosphere Environment: X 13: 100147

Nitrous oxide (N_2O) is an important atmospheric trace gas that contributes to the present global warning and is responsible for the destruction of stratospheric ozone. The emission of N_2O from the natural freshwater wetland to the atmosphere is poorly understood. We investigated N_2O flux using the static chamber method and their controlling factor in the freshwater wetland of Keibul Lamjao National Park (KLNP), Manipur. The overall mean N_2O flux from the park was 0.10 ± 0.04 μg m^{-2} d^{-1}. Nitrous oxide emission showed evident seasonal changes, the highest flux occurring in the summer (with a mean value of 0.14 ± 0.02 μg m^{-2} d^{-1}), while the lowest flux appeared in the winter (0.05 ± 0.01 μg m^{-2} d^{-1}). There were significant seasonal variations of N2O emission. The NH_4^+ – N and NO_3^- – N have a significantly positive correlation with N2O flux ($p < 0.001$). By comparing the slopes of the regression equations obtained between the emission of nitrous oxide and the content of NO_3^- – N and NH_4^+ – N in water, we found that N_2O flux were predominantly by $NH4^+$ – N. The results imply that nitrification played a crucial role in N_2O emissions from the wetland park. Additionally, the decay of submerged macrophytes in the lake contributes to N_2O flux, particularly during the summer.

For Further Reading: https://doi.org/10.1016/j.aeaoa.2022.100147

SPATIAL PATTERNS OF FERTILIZER USE AND IMBALANCES: EVIDENCE FROM RICE CULTIVATION IN INDIA

Kaushik Bora

Environmental Challenges 7: 100452

Fertilizer use immensely contributes to sustaining higher crop productivity and ensuring food security around the globe. However, the over-application of nitrogenous fertilizers resulted in negative environmental externalities. Thus, assessing imbalances in chemical fertilizer use is vital for environmental sustainability. This paper studies the pattern of imbalances in chemical fertilizer application as an indicator of environmental sustainability. Using district-level data for India, this study finds within-State heterogeneity in the fertilizer application. Spatial patterns for divergences from recommended norms in rice cultivation show the existence of districts with both excessive and deficit fertilizer applications. Many districts in the Indo-Gangetic plains use unsustainably excess fertilizer. Similarly, our results indicate large surpluses of nitrogen from partial nitrogen balance assessment in the region. The assessment of sustainability indicators helps identify regions for policy intervention targeting nutrient balance in the soil.

For Further Reading: https://doi.org/10.1016/j.envc.2022.100452

China Himalaya

FLUX AND SPATIAL PATTERN OF PHOSPHORUS IN THE SHIGATSE SECTION OF THE YARLUNG ZANGBO RIVER, CHINA

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Ecological Indicators 135: 108552

Phosphorus (P) acts as a link between biotic and abiotic components of the ecosystem, and the phosphorus flux of a river determines the ecological diversity and biogeochemical processes in that river. The aim of our research is to provide a quantitative evaluation of land surface P losses and fluvial P fluxes in a river basin. The fluvial P flux transported in the mainstream and main tributaries from 2011 to 2013 in the Shigatse region of the Yarlung Zangbo (YLZB) River basin was simulated with the Soil and Water Assessment Tool (SWAT) model. Our study results suggested that the P loss intensity on the south bank (7.34 kg/ha) is greater than that on the north bank (2.21 kg/ha), and the fluvial P flux in the south tributaries flowing into the mainstream YLZB River is also greater (south: 8589.08 t/yr; north: 3777.61t/yr). The fluvial phosphorus transport flux for the Shigatse basin is 10,307.55 t/yr, which is lower level than that found in many other large rivers in the world. Meteorological conditions, underlying surface conditions and fluvial P retention conditions were combined to determine the spatial pattern of land surface P loss and fluvial P fluxes and their north–south differences in the study area. Our study provides new perspectives on phosphorus fluxes in data-deficient rivers in highland regions.

For Further Reading: https://doi.org/10.1016/j.ecolind.2022.108552

ECOLOGICAL RISK IN THE TIBETAN PLATEAU AND INFLUENCING URBANIZATION FACTORS

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Environmental Challenges 6: 100445

The Tibetan Plateau (also known as the Qinghai-Tibet Plateau) is an important ecological shield in China, and it is one of the most vulnerable areas of its environmental system. With increasing urbanization in the Tibetan Plateau

region, ecological pressures due to intense human activities are increasing. Studying the influence of urbanization factors on ecological risk in the Tibetan Plateau is of use in promoting the sustainable development of the region. To this end, this study constructs a comprehensive index system for evaluating ecological risk, covering the three categories of pressure, state and response. In addition, an index system of influencing urbanization factors is constructed, comprising the four categories of population, economy, society and space. Based on the panel data for 15 cities and prefectures in Qinghai Province and the Tibet Autonomous Region covering the period 2000–2015, a geographically and temporally weighted regression model (GTWR) is used to study quantitatively the ecological risk in the Tibetan Plateau and the influencing urbanization factors. The results show that, overall, the environment of the Tibetan Plateau is healthy, but there are marked regional differences. The Tibet Autonomous Region has low ecological risk, while ecological risk in the Qinghai Province is gradually increasing, making it the high-risk area of the Plateau region; there is a positive spatial correlation to ecological risk in the Tibetan Plateau, with obvious spatial clustering; Haixi, Haidong and Lhasa are the core high-risk areas, among which Haidong is a sustainable and stable high-risk area; urbanization has exacerbated ecological risk in the Tibetan Plateau, with population playing the primary role and urban population density having the greatest influence, but industrial structure and urban expansion are increasingly prominent factors.

For Further Reading: https://doi.org/10.1016/j.envc.2022.100445

Pakistan- Himalaya

CLIMATE IMPACTS ON THE AGRICULTURAL SECTOR OF PAKISTAN: RISKS AND SOLUTIONS

Areeja Syed, Taqi Raza, Talha Tufail Bhatti, and Neal S. Eashd

Environmental Challenges 6: 100433

Sixty percent of the population of Pakistan is directly or indirectly reliant upon rain-fed agriculture that depends on predictable weather patterns. Global climatic change affects our agriculture and its impacts seem to increase daily. Pakistan produces wheat, rice, cotton, sugarcane, and maize and these crops are affected by climate change. Incessant escalation in earth temperatures globally is changing precipitation patterns including a shift in our monsoon season. These conditions affect agricultural production, farm livelihoods and agribusiness infrastructure that is leading to food insecurity and malnutrition among the farming communities. The aim of this review is to highlight the climate change impacts on Pakistan's agricultural sector, current risks, and mitigation potential to insure resilient agricultural practices that provide household food security.

For Further Reading: https://doi.org/10.1016/j.envc.2021.100433