An Environmental Research Abstract

Headlines Himalaya

For the 663rd – 664th issues of Headlines Himalaya, we reviewed researches from four sources and selected 11 researches from five countries. We selected four researches from Nepal and seven researches from other Himalayan countries (India, China, Bhutan and Pakistan).

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SOIL MANAGEMENT PRACTICES IN COMMERCIAL VEGETABLE FARMING IN CHANGING SOCIOECONOMIC CONTEXT IN MAKAWANPUR, NEPAL

Sushmita Dahal and Bikram Manandhar

With the rapid urbanization and population growth, the demand for vegetables is increasing day by day resulting in increased cultivation area and production at the expenses of soil fertility. This study aims to assess soil management practices adopted by commercial vegetable farmers in changing socioeconomic contexts in Bhundrung village, Makawanpur. Participatory rural appraisal tools; Household Questionnaire survey, Focus group discussion, Key informant interview and expert consultation were used for data collection. Most farmers use farmyard manure (FYM) and chemical fertilizer (urea, potash and di-ammonium phosphate) for maintaining soil fertility. Application of farmyard manure is decreasing, due to large farm size but less number of livestock. It has resulted in the scenario of injudicious supply of chemical fertilizers with hope of increment in production. Lack of knowledge on dose, handling and disposal of fertilizer and pesticides threatened degradation of soil and water quality in and outside the farm. In the changing socioeconomic context, farmers practice joint decision making in laborious activities like nursery bed preparation, field preparation, manure mixing, intercultural operation whereas in technology and direct money related activities were decided by male members. This study recommends there is a need for effective extension services for sustainable soil fertility management, finance and market access for economic benefits and gender friendly environment and technology for commercial vegetable farming.

DIVERSITY OF BIRDS RECORDED AT DIFFERENT ALTITUDES IN CENTRAL NEPAL HIMALAYAS

Anuj Ghimire, Maan B. Rokaya, Binu Timsina, Karolína Bílá, Uttam B. Shrestha, Mukesh K. Chalise, Pavel Kindlmann

Factors determining the spatial distribution of bird species along altitudinal gradients have been important in their ecological and biogeographical research. Here, have used the data on bird species recorded in Manang, central Nepal Himalayas and attempt to determine the drivers of bird species diversity. We also carried out indicator species analysis to observe if any bird species are associated with different altitudinal ranges and land use gradients. We recorded 1331 individuals belonging to 82 species of both resident and itinerant birds. In our study, altitude was the major factor determining species richness and abundance. Position of study localities is main factor determining bird community composition. Diversity of bird species were mainly found in habitats that were far human settlements, having high annual mean temperature and more roughness. Species diversity was high during July-August compared to September-October and in north-facing slopes, and also in shrub and tree covered areas than grassland and places with mostly snow and grassland. Indicator species analysis showed only 21 species were significantly associated with altitudinal gradients, mostly below 3000 m a.s.l. and only eight bird species were associated with two land use gradients (grassland and snow-glacier). In conclusion, position of sampled localities, altitude, aspect, land use types and different climatic factors were important determinants of bird diversity along altitudinal gradients in Manang. To protect bird diversity in Manang, we need to protect habitats that are located mainly in low altitudes for most of the bird species. However, high altitude habitats with snow and glaciers are also important for few bird species. Thus, a large area with heterogeneous habitats is important for bird species management and conservation.

INVESTIGATING THE NEXUS OF GROUNDWATER LEVELS, RAINFALL AND LAND-USE IN THE KATHMANDU VALLEY, NEPAL

Rajaram Prajapati, Surabhi Upadhyay, Rocky Talchabhadel, Bhesh Raj Thapa, Brandon Ertis, Priya Silwal, Jeffrey C. Davids

Globally, groundwater resources play a crucial role in supporting livelihoods and sustaining human health. Groundwater recharge is mainly influenced by the spatial distribution of rainfall patterns across groundwater basins and the heterogeneous distribution of geology, soil, and topographical characteristics. This study evaluates the implications of variations in rainfall and land-use on groundwater level fluctuations in the Kathmandu Valley, Nepal. We selected and analyzed data from thirty-five monitoring wells observed by citizen scientists from July 2017 to June 2019. Over two years, groundwater levels varied spatially from −0.11m (negative sign denotes a groundwater level higher than the ground surface) to 11.5m, with a mean of 4.24m and a standard deviation of 2.29m. Our results indicated a strong positive correlation between rainfall and groundwater levels, as the fluctuation was influenced by the rainfall of that area. The seasonal fluctuations in groundwater level showed the direct influence of monsoonal rainfall. In areas with agricultural land use, 80% of the analysed wells showed a strong and statistically significant correlation between rainfall and groundwater levels. In contrast, higher groundwater extraction rate and surface sealing limited groundwater recharge in built land uses; therefore wells across non-agricultural land-uses showed a weak correlation in most of the cases. In the northern groundwater district, we found areas with highly permeable sand and gravel have nearly constant groundwater levels (shallow in agricultural land-use and deep in built land-use) year-round and act as potential recharge zones for the aquifer. The areas with less permeable but highly porous clay and silt in agricultural land use show greater seasonal groundwater fluctuations. Our study highlights the ability of citizens to generate meaningful hydrogeologic datasets, and the importance of rainfall and land use planning to groundwater recharge. Understanding these complex relationships must form the basis for the sustainable management of the rapidly declining groundwater resources of the Kathmandu Valley.

COUPLING LANDSCAPE-SCALE DIAGNOSTICS SURVEYS, ON-FARM EXPERIMENTS, AND SIMULATION TO IDENTIFY ENTRY POINTS FOR SUSTAINABLY CLOSING RICE YIELD GAPS IN NEPAL

Krishna Prasad Devkota, Mina Devkota, Gokul Prasad Paudel, and Andrew James McDonald

Rice is the primary staple food crop in Nepal, contributing 20% of the agricultural gross domestic product and more than 50% of the total calories in the national diet. Nevertheless, the productivity of rice (3.36 t ha^{-1}) is the lowest in South Asia region. The objective of this study was to employ a mixed-methods approach to characterize and decompose yield gaps (YGs) in the context of identifying sustainable intensification pathways for rice production in Nepal. Methodologies include: a) landscape-scale crop diagnostic survey on crop management, field attributes, and productivity outcomes combined with gridded soil and daily weather data to decompose rice yield gaps into constituent factors with machine learning diagnostics; b) with survey data, computation of key performance

indicators to identify factors associated with productivity, profitability, and resource use efficiencies; c) complementary multi-location on-farm experiments (2011–2017) evaluating new agronomic management practices; and d) dynamic simulation (ORYZA3) to derive estimates of rice yield potential. Analysis of survey data suggests an exploitable YG of 2.57 t ha^{-1} (40%) and the total YG of 4.85 t ha^{-1} (55%) indicating substantial scope for increasing rice yields in Nepal. Frequency of irrigation, amount of late-season rainfall, soil type, amount of early-season rainfall, presence of water stress,, soil PH, and nitrogen (N) and phosphorus (P) Fertilizers rate the principal determinants of productivity outcomes in descending ranked order. Efficiency metrics suggest rice farmers in the study region make good use of fertilizer inputs, but since application rates are very low (e.g. most farmers apply <20 kg P ha^{-1}) unsustainable mining of soil nutrients is likely common. Farmers in the top 10% of the yield distribution had lower greenhouse gas emission intensities (−43%), increased water productivity (+66%), and higher use efficiencies of N and P fertilizers (+28% and +20%, respectively), suggesting that yield intensification can be achieved without trade-offs with key environmental performance indicators. On-farm experiments conducted over several seasons support insights from surveys by demonstrating that major gains in rice yield (1.86 t ha^{-1}) and profitability (US$ 243 ha^{-1}) are achievable through the adoption of good agronomic practices. Through a mixed methods approach, our results suggest that adoption of integrated 'good agronomic practices' can close YGs and improve food security outcomes associated with the rice-based agricultural systems of Nepal while simultaneously preserving or enhancing key sustainability and livelihood objectives.

Further Reading: https://doi.org/10.1016/j.agsy.2021.103182

India-Himalaya

BIOMASS AND SOIL CARBON STOCKS IN RELATION TO THE STRUCTURE AND COMPOSITION OF CHIR PINE DOMINATED FORESTS IN THE LESSER HIMALAYAN FOOTHILLS OF KASHMIR

Raja Waqar Ahmed Khan, Hamanyun Shaheen, and Shahzad Naseer Awan

Carbon Management 12: 1-9

Quantification of carbon stocks is critical to evaluate the potential of an ecosystem to mitigate the impact of global climate change in the REDD + scenario. Present research project was designed to gauge the sequestered carbon in Chir Pine (*Pinus roxburghii*) dominated forests in the foothills of the western Himalayan region of Kashmir which constitute a significant regional carbon pool. The study outcomes revealed an average carbon stock value of 94.3 Mg/ha from which 68 Mg/ha was shared by soil organic carbon (SOC); whereas average biomass carbon share was 26.3 Mg/ha. *P. roxburghii* was the most noteworthy species containing an average carbon stock value of 5.93 Mg/ha followed by *Quercus incana* (3.59 Mg/ha) and *Olea cuspidata* (2.26 Mg/ha). Average forest biomass was chronicled as 52.5 Mg/ha from which tree biomass was 49.34 Mg/ha. Shrub and herb biomass contributed 1.95 and 0.53 Mg/ha correspondingly whereas the Leaf litter and deadwood necromass produced an average of 0.67 Mg/ha. Ordination analysis revealed that the forest carbon stocks were significantly influenced by the species composition, structural attributes as well as anthropogenic disturbances. Current study has resulted in generating a standard baseline dataset of the regional carbon stocks with diverse implications for sustainable carbon management in REDD + perspective.

Further Reading: https://doi.org/10.1080/17583004.2021.1966511

CHANGES IN THE FLOOD PLAINS AND WATER QUALITY ALONG THE HIMALAYAN RIVERS AFTER THE CHAMOLI DISASTER OF 7 FEBRUARY 2021

Sansar Raj Meena, Kushanav Bhuyan, Akshansha Chauhan, and Ramesh P. Singh

The Himalayan regions are vulnerable to all kinds of natural hazards. On 7 February 2021, a deadly disaster occurred near the Tapovan, in Uttarakhand, Himalayas. During the event, large volume of debris along with broken glacial fragments flooded the Rishi Ganga River and washed away the nearby hydropower plants (Rishi Ganga and Tapovan), which was revealed from detailed analysis of multi spectral and bi-temporal satellite data. We present the impact of the Chamoli disaster on the flood plains and water quality of Himalayan rivers, Rishi Ganga near Tapovan, Alaknanda near Srinagar and Ganga near Haridwar and Bijnor. We used four locations along four sections of Himalayan rivers and have analysed various indices, modified normalized difference water index, normalized difference chlorophyll index, and normalized difference turbidity index, to study the changes in water quality and flood plains. On comparison of the spectral and backscattering coefficients derived from Sentinel-2 optical and Sentinel-1 synthetic aperture radar data, changes in the water quality and flood plains of the rivers were found.

China Himalaya

CAN TRUST MOTIVATE FARMERS TO PURCHASE NATURAL DISASTER INSURANCE? EVIDENCE FROM EARTHQUAKE-STRICKEN AREAS OF SICHUAN, CHINA

Xueling Bao, Fengwan Zhang, Xin Deng, and Dingde Xu

Natural disasters cause great losses of property and life in many areas of China. However, rural residents do not always insure themselves against these losses. Measuring the correlation between trust and farmers' behavior related to the purchasing of natural disaster insurance is of great significance to the implementation of natural disaster insurance pilot programs and insurance systems in China. This article analyzes data from a survey of 327 households in four districts and counties of Sichuan Province, China, that were affected by the Wenchuan and Lushan earthquakes. According to the relevant theories of trust, trust was divided into three dimensions: authority trust, collective trust, and relationship trust. Then a technology acceptance model was built, and PLS-SEM was used to comprehensively analyze the correlation between different dimensions of trust and farmers' insurance purchase behavior. The results show that (1) only relationship trust was directly and significantly positively correlated with insurance purchasing behavior. Although there was no direct significant correlation between authoritative trust or collective trust and buying behavior, relationship trust was found to indirectly affect buying behavior. (2) Younger farmers and those with higher incomes are more likely to buy disaster insurance if they live in a disaster-threat zone, have experienced disasters, and are risk averse. We then discuss the correlations between farmers' trust and natural disaster insurance purchasing in areas threatened by earthquake disasters. This provides a policy inspiration for the promotion of disaster insurance and the construction of insurance systems in China.

FEEDING SITES PROMOTING WILDLIFE-RELATED TOURISM MIGHT HIGHLY EXPOSE THE ENDANGERED YUNNAN SNUB-NOSED MONKEY (*RHINOPITHECUS BIETI*) TO PARASITE TRANSMISSION

Eve Afonso, Rong Fu, Amaël Dupaix, Anne-Claude Goydadin, ZhongHua Yu, Cécile Callou, Petra Villette, Patrick Giraudoux, and Li Li

An increasing number of studies have found that the implementation of feeding sites for wildlife-related tourism can affect animal health, behaviour and reproduction. Feeding sites can favour high densities, home range overlap, greater sedentary behaviour and increased interspecific contacts, all of which might promote parasite transmission. In the Yunnan snub-nosed monkey (*Rhinopithecus bieti*), human interventions via provisioning monkeys at specific feeding sites have led to the sub-structuring of a group into genetically differentiated sub-groups. The fed subgroup is located near human hamlets and interacts with domesticated animals. Using high-throughput sequencing, we investigated *Entamoeba* species diversity in a local host assemblage strongly influenced by provisioning for wildlife-related tourism. We identified 13 *Entamoeba* species or lineages in faeces of Yunnan snub-nosed monkeys, humans and domesticated animals (including pigs, cattle, and domestic chicken). In Yunnan snub-nosed monkeys, *Entamoeba* prevalence and OTU richness were higher in the fed than in the wild subgroup. *Entamoeba polecki* was found in monkeys, pigs and humans, suggesting that this parasite might circulate between the wild and domestic components of this local social–ecological system. The highest proportion of faeces positive for *Entamoeba* in monkeys geographically coincided with the presence of livestock and humans. These elements suggest that feeding sites might indirectly play a role on parasite transmission in the Yunnan snub-nosed monkey. The implementation of such sites should carefully consider the risk of creating hotspots of disease transmission, which should be prevented by maintaining a buffer zone between monkeys and livestock/humans. Regular screenings for pathogens in fed subgroup are necessary to monitor transmission risk in order to balance the economic development of human communities dependent on wildlife-related tourism, and the conservation of the endangered Yunnan snub-nosed monkey.

Further Reading: https://doi.org/10.1038/s41598-021-95166-5

Bhutan-Himalaya

MEASURING LANDSLIDE VULNERABILITY STATUS OF CHUKHA, BHUTAN USING DEEP LEARNING ALGORITHMS

Sunil Saha, Raju Sarkar, Jagabandhu Roy, Tusar Kanti Hembram, Saroj Acharya, Gautam Thapa, and Dowchu Drukpa

Landslides are major natural hazards that have a wide impact on human life, property, and natural environment. This study is intended to provide an improved framework for the assessment of landslide vulnerability mapping (LVM) in Chukha Dzongkhags (district) of Bhutan. Both physical (22 nos.) and social (9 nos.) conditioning factors were considered to model vulnerability using deep learning neural network (DLNN), artificial neural network (ANN) and convolution neural network (CNN) approaches. Selection of the factors was conceded by the collinearity test and information gain ratio. Using Google Earth images, official data, and field inquiry a total of 350 (present and historical) landslides were recorded and training and validation sets were prepared following the 70:30 ratio. Nine

LVMs were produced i.e. a landslide susceptibility (LS), one social vulnerability (SV) and a relative vulnerability (RLV) map for each model. The performance of the models was evaluated by area under curve (AUC) of receiver operating characteristics (ROC), relative landslide density index (R-index) and different statistical measures. The combined vulnerability map of social and physical factors using CNN (CNN-RLV) had the highest goodness-of-fit and excellent performance (AUC = 0.921, 0.928) followed by DLNN and ANN models. This approach of combined physical and social factors creates an appropriate and more accurate LVM that may—support landslide prediction and management.

Further reading: https://doi.org/10.1038/s41598-021-95978-5

Pakistan- Himalaya

PHYTOCHEMICAL AND PHARMACOLOGICAL USES OF MEDICINAL PLANTS TO TREAT CANCER: A CASE STUDY FROM KHYBER PAKHTUNKHWA, NORTH PAKISTAN

Asif Khan, Sajid Ali, Waheed Murad, Khizar Hayat, Shumaila Siraj, Muhammad Jawad, Rashid Abbas Khan, Jalal Uddin, Ahmed Al-Harrasi, and Ajmal Khan

Cancer is the top death causing disease in the world, due to its occurrence through various mechanism and form.Medicinal plants have been extensively used for the purifications and isolations of phytochemicals for the treatment and prevention of cancer. Consequently, this research was designed to document the traditional practices of anti-cancer plants and its phytochemical essay across the districts of KP, Pakistan. Semi-structured interviews were conducted in 24 districts from the informants mostly the traditional herbalists (key informants). The information were compared with the publish data using various authentic search engines including, Google, ResearchGate, Google Scholar and NCBI. One hundred and fifty-four (154) anti-cancer plants were recognized belonging to 69 families among all, *Lamiaceae* (13 sp.), *Asteraceae* (12 sp.) and *Solanaceae* (9 sp.) were the preferred families. The local inhabitants in the area typically prepare ethnomedicinal recipes from leaves (33.70%) and whole plants (23.37%) in the form of decoction and powder (24.67%), respectively. Herbs stayed the most preferred life form (61.68%) followed by shrub (21.4%). Similarly, breast (29.22%) and lung cancer (14.83%) was the common disease type. Literature study also authorize that, the medicinal plants of the research area were rich in phytochemical like quercetin, coumarine, kaempferol, apigenin, colchicine, alliin, rutin, lupeol, allicin, berbarine, lutolin, vanilic acid, urocilic acid and solamargine have revealed significant activates concerning the cancer diseases, that replicating the efficacy of these plants as medicines. The Khyber Pakhtunkhwa is rural area and the local inhabitants have very strong traditional knowledge about the medicinal plants for different diseases like cancer. The medicinal plants for significant ranked disorder might be pharmacologically and phtyochemicaly explored to demonstrate their efficacy. Moreover, the local flora especially medicinal plants facing overgrazing, overexploitation and inappropriate way of collection, however, proper management strategies like reforestation, controlled grazing, proper permission from concerned department and rangeland strategies among others may be assumed to enhance the proper usage of medicinal plants.

Further Reading: https://doi.org/10.1016/j.jep.2021.114437

IMPACT OF LAND USE/LAND COVER CHANGES ON WATER QUALITY AND HUMAN HEALTH IN DISTRICT PESHAWAR PAKISTAN

Waqas Ahmad, Javed Iqbal, Muhammad Jamal Nasir, Burhan Ahmad, Muhammad Tasleem Khan, Shahid Nawaz Khan, and Syed Adnan

The quality and quantity of groundwater resources are affected by landuse/landcover (LULC) dynamics, particularly the increasing urbanization coupled with high household wastewater discharge and decreasing open lands. This study evaluates temporal changes of groundwater quality for 2012 and 2019, its relation to landuse/landcover, and its impact on Peshawar's residents (study area), Pakistan. A total of 105 and 112 groundwater samples were collected from tube wells in 2012 and 2019. Samples were then analyzed for seven standard water quality parameters (i.e., pH, electric conductivity (EC), turbidity, chloride, calcium, magnesium, and nitrate). Patient data for waterborne diseases were also collected for the years 2012 and 2019 to relate the impact of groundwater quality on human health. Landsat satellite images were classified for the years 2012 and 2019 to observe landuse/landcover dynamics concerning groundwater quality. Results manifested a decrease in groundwater quality for the year 2019 compared to 2012 and were more highlighted in highly populated areas. The nitrate concentration level was found high in the vicinity of agricultural areas due to the excessive use of nitrogenous fertilizers and pesticides, and thus the methemoglobinemia patients ratio increased by 14% (48–62% for the year 2012 and 2019, respectively). Besides, Urinary Tract Infections, Peptic Ulcer, and Dental Caries diseases increased due to the high calcium and magnesium concentration. The overall results indicate that anthropogenic activities were the main driver of Spatio-temporal variability in groundwater quality of the study area. The study could help district health administration understand groundwater quality trends, make appropriate site-specific policies, and formulate future health regulations.

Further Reading: https://doi.org/10.1038/s41598-021-96075-3

Highlight of the Issue

CLIMATE CHANGE: EXTREME FLOODS IN EUROPE AND ASIA ARE MADE MORE LIKELY BY HUMANS

Climate change has been the talk of the decade and we are experiencing extreme event every now and then. Scientists have said that the heavy rainfall behind deadly flooding in Europe in July was associated more likely to climate change. The deadly flood in Germany, Belgium and elsewhere in Europe in July, 2021 was a unprecedented to weather forecast and local authorities.

Similar flooding events could be observed in developing countries like India and Nepal which affected indigenous communities and their livelihoods. The Melamchi-Sindhupalchowk flood in Nepal was devastating and it affected human lives and properties severely. If such events occur, the main question arises: are human societies still not resilient to weather extremes? IF not, we need to work in developing climate resilient infrastructure to reduce causalities and make the vulnerable communities able to withstand against these extreme devastating events.

Further Reading:

https://www.bbc.com/news/science-environment-58309900?utm_campaign=later-linkinbio-bbcnews&utm_content=later-19989671&utm_medium=social&utm_source=linkin.bio