An Environmental Research Abstract

Headlines Himalaya

December 1 – December 15 (2020) No. 629 - 630 Editorial Team: Meena Sharma and Pratistha Shrestha

For the 629th – 630th issues of Headlines Himalaya, we reviewed researches from five sources and selected eight researches from four countries. We selected two researches from Nepal and six researches from other Himalayan countries (India, China and Bhutan). The overall coverage of this issue is Biodiversity, wildlife, water management, climate change, agriculture and environment.

Headlines Himalaya, a weekly e-News is an attempt to keep our global readers abreast with the happenings in the Himalaya. Please share it with your colleagues and friends. Also, subscription is free. Enjoy!

NEW STATE STRUCTURE AND AGRICULTURE GOVERNANCE: A CASE OF SERVICE DELIVERY TO LOCAL FARMERS IN THE EASTERN GANGETIC PLAINS OF NEPAL

Hari Dahal, Madhav Karki, Tamara Jackson, and Dinesh Panday

Agronomy 10: 1874

Under the new constitution adopted in 2015, Nepal embraced the federal structure of government comprising seven provincial and 753 local governments, each with their own legislative, judicial, and executive powers. Nepal's agriculture sector provides livelihoods to about 60% of the population. However, its bottlenecks are rooted in poor implementation of agricultural policies and plans, low levels of investment, uncertain political commitment and weak governance, especially a lack of an effective service delivery mechanism to farmers. This study analyzed the impacts of federalism on the institutional arrangements and governance of the agriculture sector through both review of literature and field-level information gathering, particularly focusing on extension service delivery to farmers in Province 2. The findings highlight the impacts of federalism on agricultural governance mainly in functional overlapping, resource allocation, priority setting, coordination, human resource management, and extension service delivery. The lack of coordination and collaboration between the three tiers of government and the line agencies results in less-effective extension service delivery, especially in providing integrated, specialized technical services to farmers which is the main responsibility of local governments. Lack of poor understanding of governance, institutionalization, and human resources management is found to be one of the most serious problems with the provincial and local governments. The consequences are that despite a huge potential to improve service delivery leading to increased production and a market surplus, the province remains food-deficient and lacks food and nutrition security. The study recommends a strong political commitment, better policy and institutional coordination and coherence, and good governance in all tiers of government by providing demand-driven agricultural services leading to higher cropping intensity and productivity potential for which it is well recognized.

For further reading: https://doi.org/10.3390/agronomy10121874

ANALYZING THE RELATIONSHIP, DISTRIBUTION OF TREE SPECIES DIVERSITY, AND ABOVE-GROUND BIOMASS ON THE CHITWAN-ANNAPURNA LANDSCAPE IN NEPAL

Shiva Pokhrel and Chungla Sherpa

International Journal of Forestry Research 2020: 2789753

Forests provide numerous ecosystem goods and services. Their roles are considered as important for both climate mitigation and adaptation program. In Nepal, there are significant forest resources which are distributed in different regions; however, the studies on the spatial tree species distribution and the above-ground biomass and their relationship at the landscape level have not been well studied.)is study aims to analyze the relationship, distribution of tree species diversity, and above-ground biomass at a landscape level. The data used for this study were obtained from the Forest Research and Training Center of Nepal, International Centre for Integrated

Mountain Development (ICIMOD), and Worldwide Wildlife Fund (WWF-Nepal).)e landscape has a mean of 191.89 tons ha^{-1} of the above-ground biomass. The highest amount of the above-ground biomass measured was 650 tons ha^{-1} with 96 individual trees, and the least was 3.428 tons ha^{-1}. The measured mean height of the tree was 11.77 m, and diameter at breast height (DBH) was 18.59 cm. In the case of the spatial distribution of the above-ground biomass, plots distributed at the middle altitude range greater than 900 meters above sea level (m. a. s. l) to 3000 meters above sea level taking more amount of the above-ground biomass (AGB). Similarly, the highest plot-level Shannon diversity index (H') was 2.75 with an average of 0.96 at the middle altitude region followed by the lower region with an average of 0.89 and least 0.87 at a higher elevation. Above-ground biomass (R^2=0.48) and tree height (R^2=0.506) significantly increased with increasing elevation up to a certain level increased of elevation. Diameter at breast height (DBH) showed significance (R^2=0.364) but small increase with increasing elevation, while the relationship among tree species diversity index, above-ground biomass, and elevation showed a weak and very weak positive relationship with R2=0.018 and R^2=0.002, respectively. Based on the overall results, it is concluded that elevation has some level of influence on the forest tree diversity and above-ground biomass. The finding of this study could be useful for landscape-level resource management and planning under various changes.

For further readings: https://doi.org/10.1155/2020/2789753

India-Himalaya

STRONG DAY-TO-DAY VARIABILITY OF THE ASIAN TROPOPAUSE AEROSOL LAYER (ATAL) IN AUGUST 2016 AT THE HIMALAYAN FOOTHILLS

Sreeharsha Hanumanthu, Bärbel Vogel, Rolf Müller, Simone Brunamonti, Suvarna Fadnavis, Dan Li, Peter Ölsner, Manish Naja, Bhupendra Bahadur Singh, Kunchala Ravi Kumar, Sunil Sonbawne, Hannu Jauhiainen, Holger Vömel, Beiping Luo, Teresa Jorge, Frank G. Wienhold, Ruud Dirkson, and Thomas Peter

Atmospheric Chemistry and Physics 20: 14273–14302

The South Asian summer monsoon is associated with a large-scale anticyclonic circulation in the upper troposphere and lower stratosphere (UTLS), which confines the air mass inside. During boreal summer, the confinement of this air mass leads to an accumulation of aerosol between about 13 and 18 km (360 and 440 K potential temperature); this accumulation of aerosol constitutes the Asian Tropopause Aerosol Layer (ATAL). We present balloon-borne aerosol backscatter measurements of the ATAL performed by the Compact Optical Backscatter Aerosol Detector (COBALD) instrument in Nainital in northern India in August 2016, and compare these with COBALD measurements in the post-monsoon time in November 2016. The measurements demonstrate a strong variability of the ATAL's altitude, vertical extent, aerosol backscatter intensity and cirrus cloud occurrence frequency. Such a variability cannot be deduced from climatological means of the ATAL as they are derived from satellite measurements. To explain this observed variability we performed a Lagrangian back-trajectory analysis using the Chemical Lagrangian Model of the Stratosphere (CLaMS). We identify the transport pathways as well as the source regions of air parcels contributing to the ATAL over Nainital in August 2016. Our analysis reveals a

variety of factors contributing to the observed day-to-day variability of the ATAL: continental convection, tropical cyclones (maritime convection), dynamics of the anticyclone and stratospheric intrusions. Thus, the air in the ATAL is a mixture of air masses coming from different atmospheric altitude layers. In addition, contributions from the model boundary layer originate in different geographic source regions. The location of the strongest updraft along the backward trajectories reveals a cluster of strong upward transport at the southern edge of the Himalayan foothills. From the top of the convective outflow level (about 13 km; 360 K) the air parcels ascend slowly to ATAL altitudes within a large-scale upward spiral driven by the diabatic heating in the anticyclonic flow of the South Asian summer monsoon at UTLS altitudes. Cases with a strong ATAL typically show boundary layer contributions from the Tibetan Plateau, the foothills of the Himalayas and other continental regions below the Asian monsoon. Weaker ATAL cases show higher contributions from the maritime boundary layer, often related to tropical cyclones, indicating a mixing of clean maritime and polluted continental air. On the one hand increasing anthropogenic emissions in the future are expected due to the strong growth of Asian economies; on the other hand the implementation of new emission control measures (in particular in China) has reduced the anthropogenic emissions of some pollutants contributing to the ATAL substantially. It needs to be monitored in the future whether the thickness and intensity of the ATAL will further increase, which will likely impact the surface climate.

For further reading: https://doi.org/10.5194/acp-20-14273-2020

China Himalaya

TEMPORAL–SPATIAL DISTRIBUTION OF RISKY SITES FOR FEEDING CATTLE IN CHINA BASED ON TEMPERATURE/HUMIDITY INDEX

Ting Wang, Rongzhen Zhong**,** and Daowei Zhou

Agriculture 10: 571

This study identifies risk areas for cattle husbandry based on temperature and a relative humidity index (THI) derived from climate data (1987 to 2016) at 839 meteorological stations in China using geostatistics (ordinary and indicator kriging) in the geographical information system (GIS). In general, monthly mean THI values were the highest in July and the lowest in January for all regions. The correlation analysis showed that there were negative relationships between THI values and latitude or elevation for the whole year ($p < 0.01$). The THI values were higher at low latitudes in coastal areas and at high latitudes in arid areas in summer. The healthy risk for cattle production varied depending on the time of the year and region. The study shows that cattle production is suitable throughout the whole year in the Qinghai-Tibet Plateau; from October to April for most areas, except the southern coastal areas; in May and September in Northeast China, North China, and parts of Northwest China; in June in Heilongjiang and Inner Mongolia. The information obtained in this study can provide a regional distribution of risk for the cattle industry in China.

For further reading: https://doi.org/10.3390/agriculture10110571

GEOLOGICAL HERITAGE VULNERABILITY EVALUATION INDEX SYSTEM FOR THE BAMEI STONE FOREST ON THE TIBETAN PLATEAU

Yuan Yin, Zhongquan Li, Xiaoqin Li, Dong Peng, Qizhong Wang, Shuang Yang, and Fang Lai

Geoheritage 12: 93

As a nonrenewable resource, geological heritage landscapes are formed in the process of geological processes. The fragility of the landscape is mainly determined by the external dynamic geological factors. The study of the Bamei stone forest, a unique metamorphic stone forest found in the Xianshuihe fault zone on the southeastern margin of the Tibetan Plateau, shows that the internal dynamic geological processes are also of great significance to its landscape vulnerability. Based on the implications of the formation of geological heritage landscapes and the landscape changes identified in the field investigations, in this study, we constructed an evaluation index system of the vulnerability of geological heritage landscapes based on a multifactor weighted evaluation. We included the geological background and human factors in the first level of the index; the five aspects of landscape genesis, geographical environment, climate conditions, economic activities, and protection activities in the second level of the index; and 14 other factors, such as tectonics, rock mass structures, rock types, geomorphical characteristics, vegetation, soil, hydrology, rainfall, temperature, wind force, infrastructure, land use, ideology, and protection measures, in the third level of the index. Using the analytic hierarchy process (AHP) to determine the index weights, the vulnerability of the metamorphic stone forest was evaluated scientifically, and the vulnerability levels and the trends of its strengths and weaknesses were determined. These results provide a feasible reference for the vulnerability evaluation of geological heritage landscapes. This index system has better systematism and comparability compared with the main qualitative research and sensory cognition in the recognition of geological heritage landscape vulnerability.

For further reading: https://doi.org/10.1007/s12371-020-00520-0

EFFECTS OF FREEZING–THAWING CYCLE ON THE DAILY EVAPOTRANSPIRATION OF ALPINE MEADOW SOIL IN QINGHAI–TIBET PLATEAU

Xin Liu, Yibo Wang, Wenjing Yang, Mingxia Lv, and Haipeng Zhao

Environmental Earth Sciences 79: 533

The study of the diurnal response mechanism of the actual evapotranspiration (ETa) to the environment in the permafrost regions of the Qinghai–Tibet Plateau (QTP) using the LYS30 micro-evaporation instrument found that there are different feedbacks to the ETa under freezing and thawing cycles. The ETa process during the winter cooling period (WC) and the spring warming period (SW) is snow and ice sublimation and is mainly affected by the vapour pressure deficit (VPD). In the summer thawing period (ST), ETa can reach the maximum value when all meteorological elements reach a certain range of change at the same time, while ETa will decrease when the meteorological elements are not qualified. During the autumn freezing period (AF), the amount of condensate reached a maximum at 7:00, and due to the sudden change in meteorological elements at 9:00, the ETa increased rapidly at a rate higher than the condensation rate that occurred between 7:00 and 9:00. We also found that in different stages of freezing and thawing, the two physical processes of condensation and evaporation alternated in 1 day, with the process of evaporation occurring during the day and the condensation process occurring during the

night. The diurnal response mechanism of the ETa to the environment in the permafrost regions of the QTP is expected to reveal the mechanism of soil hydrological processes and will provide a theoretical and scientific basis for water balance analysis and ecological environment protection in permafrost regions.

For further reading: https://doi.org/10.1007/s12665-020-09290-y

MULTIANALYSIS CHARACTERIZATION OF MINERALOGICAL PROPERTIES OF COPPER-LEAD-ZINC MIXED ORES AND IMPLICATIONS FOR COMPREHENSIVE RECOVERY

Qian Zhang, Shuming Wen, Qicheng Feng, Song Zhang, and Wenlin Nie

Advances in Materials Science and Engineering 2020: 2804924

Copper-lead-zinc mixed ore in Tibet, China, is a complex and refractory polymetallic ore resource; thus, ascertaining its mineralogical properties is very important for comprehensive recovery of valuable elements. In this work, the mineralogical properties of this copper-lead-zinc mixed ore have been characterized in detail following a multidisciplinary approach, including chemical, phase, x-ray diffraction (XRD), electron microprobe, and mineral liberation analyses. The results show that the raw ore contained 0.53% Cu, 1.29% Pb, and 0.54% Zn; the oxidation rates of copper, lead, and zinc were 40.21%, 79.31%, and 84.83%, respectively. The Au and Ag contents in the raw ore were 0.28 g/t and 23.6 g/t, which can be comprehensively utilized along with the recovery of copper, lead, and zinc. The gangue mainly contained SiO_2, CaO, and Al_2O_3. Copper in the raw ore mainly existed in bornite, duftite, chalcopyrite, and chrysocolla; lead mainly existed in cerussite, duftite, and galena; zinc mainly existed in willemite, hemimorphite, and sphalerite. The complexity in the embedding and wrapping relationships, fine-grained dissemination, high oxidation, and considerable differences in the floatability of various minerals result in difficulties in recovering the target minerals using a single method. Based on the systematic mineralogical properties obtained, an integrated technology of “bulk flotation-oxidation roasting-hydrometallurgy” has been proposed to enrich and separate copper, lead, and zinc in the ore, providing new ideas for the comprehensive and efficient utilization of polymetallic mineral resources in Tibet.

For further reading: https://doi.org/10.1155/2020/2804924

Bhutan-Himalaya

ASSESSING THE ADEQUACY OF A PROTECTED AREA NETWORK IN CONSERVING A WIDE-RANGING APEX PREDATOR: THE CASE FOR TIGER (*PANTHERA TIGRIS*) CONSERVATION IN BHUTAN

Phuntsho Thinley, Rajanathan Rajaratnam, Stephen J. Morreale, and James P. Lassoie

Conservation Science and Practice 2020: e318

Protected area networks (PAN) are essential for conserving wide-ranging apex predators but their adequacy in species protection has rarely been assessed. Here, we assess the adequacy of Bhutan's PAN in conserving and providing connectivity to the endangered tiger (*Panthera tigris*). We determine the current extent of tiger habitat, predict new suitable habitat, identify potential corridors, and empirically estimate the range of tiger numbers that

Bhutan can spatially support. We use two spatial models with different approaches to ascertain current tiger distribution and predict new suitable tiger areas: (a) an *expert model* based on tiger ecology and (b) an *observation model* from observed tiger distribution. The *expert model* identified more suitable tiger areas (32,887 km^2) over the *observation model* (29,962 km^2), with the PAN encompassing 46% and 45% of predicted suitable areas, respectively. Vast suitable tiger habitat remains unprotected. Based on our estimates of total suitable habitats, Bhutan can spatially support 138–151 tigers compared to the current estimate of 103, thereby precluding a doubling in tiger numbers. To ensure adequate protection of tigers in Bhutan, we recommend readjusting and/or expanding existing PAN boundaries, including the designation of new corridors, protecting habitats, and conserving prey populations.

For further reading: https://doi.org/10.1111/csp2.318