An Environmental Research Abstract

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For the 729th-730th issues of Headlines Himalaya, we reviewed research papers from four sources and selected nine research papers from four countries. We selected three papers from Nepal and six from other Himalayan Countries (India, China, and Pakistan).

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Nepal-Himalaya

ETHNOBOTANY IN ANNAPURNA CONSERVATION AREA (ACA), NEPAL: A REVIEW

Ashish Poudel, Shila Gurung, and Jyoti Bhandari

Ethnobotany Research and Applications 24: 39

Background: Nepal is considered as a biodiversity hotspot with a multi-dimensional social system accompanied by vast amounts of plants and traditional knowledge regarding ethnobotanical practices. There are number of ethnic groups in Nepal whose culture is enriched by ethnobotanical knowledge that has been passed down over generations. Also, ethnobotanical knowledge is diverse in different regions of Nepal. The ethnobotany of Nepal and related archaic knowledge are of great importance to the advancement of local, national and global human society. In this study, we analyze ethnobotany in five districts within Annapurna Conservation Area, Nepal's largest protected area. Information was extracted from relevant publications from the year 1995 to 2021 from electronic databases following the PRISMA framework. Those extracted data from thirty-two publications were analyzed systematically. This study revealed that the temporal research trend has varied significantly and that the number of research in the accessible areas were relatively higher. Despite the high occurrence of research focusing on ethnomedicinal uses, other ethnobotanical research focusing on Non-timber forest products, wild edible foods are still lacking. Priority should be given to relatively unexplored research topics and lesser explored areas such as wild edible foods and non- timber forest products, and pharmacognosy in the future, so that the research gap will be addressed which ultimately brings out the real potentiality of the ethnobotanical sector of Annapurna Conservation Area.

For further reading: http://dx.doi.org/10.32859/era.24.39.1-14

BREEDING HABITAT AND FACTORS AFFECTING THE CLIFF SELECTION BY EGYPTIAN VULTURES IN CENTRAL-WEST NEPAL

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Journal of Raptor Research 57: 1-11

The Egyptian Vulture (*Neophron percnopterus*) is a resident species in Nepal, and breeds in the lower mountains in the southern plains of Nepal. Nest-site availability is an important factor that determines the population growth of vultures; however, such information is lacking in South Asia. We here describe the characteristics and spatial distribution patterns of Egyptian Vultures' nest sites in the foothills of the Himalayan Mountains in central-west Nepal, and the factors that influence their nest-site selection. From 2012 through 2018, we surveyed all the known and potential nesting cliffs of the Egyptian Vulture located in the Pokhara Valley and its periphery during the nest building and nestling-rearing periods. In addition, we used generalized linear models to analyze the influence of landscape configuration, topography, and human disturbance factors on nest-site selection. We found a total of 21 occupied nests in a sampled area of 346 km^2. Nests were not uniformly distributed, and the nearest neighbor distance between nests averaged 8.8 ± 6.1 km. Nests were located at an elevation of 523–1644 masl on cliffs with a mean height of 20.1 ± 12.2 m; 76% were in caves and 24% were on open ledges. Our models suggested that cliff height, anthropogenic trophic resources, and altitudinal variation around the cliff were the main determinants of the nesting cliff selection. Selection of small cliffs closer to food sources could minimize energy expenditure during food delivery and interspecific competition for nesting sites. The high altitudinal variation around the nest sites suggest that Egyptian Vultures preferred heterogeneous habitat, which might also be relatively difficult for humans to access and use easily.

For further reading: https://doi.org/10.3356/JRR-21-59

MALARIA TRANSMISSION IN NEPAL UNDER CLIMATE CHANGE: ANTICIPATED SHIFTS IN EXTENT AND SEASON, AND COMPARISON WITH RISK DEFINITIONS FOR INTERVENTION

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Malaria Journal 21: 390

Background: Climate and climate change affect the spatial pattern and seasonality of malaria risk. Season lengths and spatial extents of mapped current and future malaria transmission suitability predictions for Nepal were assessed for a combination of malaria vector and parasites: *Anopheles stephensi* and *Plasmodium falciparum* (ASPF) and *An. stephensi* and *Plasmodium vivax* (ASPV) and compared with observed estimates of malaria risk in Nepal. Thermal bounds of malaria transmission suitability for baseline (1960–1990) and future climate projections (RCP 4.5 and RCP 8.5 in 2030 and 2050) were extracted from global climate models and mapped for Nepal. Season length and spatial extent of suitability between baseline and future climate scenarios for ASPF and ASPV were compared using the Warren's I metric. Official 2010 DoHS risk districts (DRDs) and 2021 DoHS risk wards (DRWs), and spatiotemporal incidence trend clusters (ITCs) were overlaid on suitability season length and extent maps to assess agreement, and potential mismatches. Shifts in season length and extent of malaria transmission suitability in Nepal are anticipated under both RCP 4.5 and RCP 8.5 scenarios in 2030 and 2050, compared to baseline climate. The changes are broadly consistent across both future climate scenarios for ASPF and ASPV. There will be emergence of suitability and increasing length of season for both ASPF and ASPV and decreasing length of season for ASPV by 2050. The emergence of suitability will occur in low and no-risk DRDs and outside of high and moderate-risk DRWs, season length increase will occur across all DRD categories, and outside of high and moderate-risk DRWs. The high and moderate-risk DRWs of 2021 fall into ITCs with decreasing trend. The study identified areas of Nepal where malaria transmission suitability will emerge, disappear, increase, and decrease in the future. However, most of these areas are anticipated outside of the government's current and previously designated high and moderate-risk areas, and thus outside the focus of vector control interventions. Public health officials could use these anticipated changing areas of malaria risk to inform vector control interventions for eliminating malaria from the country, and to prevent malaria resurgence.
For further reading: https://doi.org/10.1186/s12936-022-04417-x

India-Himalaya

ADAPTATION STRATEGIES FOR OPTIMUM SOWING OF WHEAT VARIETIES AND VALIDATION THROUGH CERES-WHEAT MODEL IN CHANGING CLIMATIC CONDITIONS UNDER SHIVALIK RANGE OF N-W HIMALAYAS

Vikas Gupta and Meenakshi Gupta

Bangladesh Journal of Botany 51: 759-765

Experiments were conducted at Research Farm of Agromet Research Centre, SKUAST-Jammu, during *rabi* 2015-16 and 2016-17, and comprised of 3 varieties, 3 sowing environments and 3 N-levels laid out in split-split plot design. The growth and development of wheat crop was also validated through CERES-Wheat model. Earlier sown wheat took more days for physiological maturity as compared to normal and late sown crop. WH-1105 variety took maximum days for physiological maturity and followed by HD-2967 and RSP- 561. Higher dose of nitrogen took more calendar days for physiological maturity as compared to lower doses of nitrogen. WH 1105 variety recorded significantly superior grain and biological yield as compared to HD 2967 and RSP 561. The coefficient of

determination (R2) between validation of observed and simulated days to anthesis and maturity was 0.79 and 0.76, respectively. The values obtained for R2 during validation of CERES-wheat model for grain yield of wheat was 0.78. Maximum temperature during reproductive stage showed distinct effect on grain yield of crop.

For further reading: https://doi.org/10.3329/bjb.v51i4.63495

China Himalaya

EFFECTS OF EXTREME RAINFALL FREQUENCY ON SOIL ORGANIC CARBON FRACTIONS AND CARBON POOL IN A WET MEADOW ON THE QINGHAI-TIBET PLATEAU

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Ecological Indicators 146: 109853

The frequent occurrence of extreme rainfall events may greatly affect soil organic carbon (SOC) fractions and carbon (C) pool of wet meadow in the Qinghai-Tibet Plateau (QTP). However, it remains unclear how SOC fractions will change under different extreme rainfall frequency. Therefore, we set five extreme rainfall frequency treatments in the QTP wet meadow: CK (control plots), DF1 (once a week), DF2 (once every-two weeks), DF3 (once every-three weeks), DF4 (once every-four weeks), all treatments received ambient rainfall. We found that soil particulate organic carbon (POC) content increased with the increasing of extreme rainfall frequency in 0–40 cm layer. Extreme rainfall frequency significantly decreased dissolved organic carbon (DOC) content in 0–10 cm layer. DF2, DF3 and DF4 significantly decreased the soil easily oxidizable carbon (EOC) content, DF2 significantly increased and DF4 significantly decreased SOC content in 0–10 cm layer. Soil organic carbon storage (SOCS) decreased with the increase of extreme rainfall frequency, the lowest value in DF1 treatment (85.61 $mg \cdot hm^{-2}$) and the highest value in DF4 treatment (139.92 $mg \cdot hm^{-2}$). The EOC/SOC and DOC/SOC values at 20–40 cm were greater than those at 0–10 cm under each treatment, and the proportion of SOC fractions in the surface layer (0–10 cm) was more sensitive to the extreme rainfall frequency, while in the deep soil layer (10–20, 20–40 cm) was relatively stable. Redundancy analysis (RDA) showed that soil bulk density (BD) (Explanation = 31.8 %), total phosphorus (TP) (Explanation = 12.8 %), NH_4^+-N (Explanation = 8.8 %) were important environmental factors affecting the SOC fractions content under extreme rainfall frequency. Our study suggests that the increase of extreme rainfall frequency in the future will lead to significant differences in the content of SOC fractions and will reduce the SOCS by affecting soil physicochemical properties, and this may have a serious impact on the C sequestration function and C pool stability of QTP wet meadow soil.

For further reading: https://doi.org/10.1016/j.ecolind.2022.109853

THE IMPACTS OF LAND USE SPATIAL FORM CHANGES ON CARBON EMISSIONS IN QINGHAI–TIBET PLATEAU FROM 2000 TO 2020: A CASE STUDY OF THE LHASA METROPOLITAN AREA

Meimei Wang, Dezhen Kong, Jinhuang Mao, Weijing Ma, and Ramamoorthy Ayyamperumal

Land 12: 122

The ecological contribution of the Qinghai–Tibet Plateau has received considerable attention as a result of the increased focus on global climate change and the continuous growth of carbon emissions in all countries. In this study, we proposed a method and measured the carbon emissions from land use in the Lhasa metropolitan area from 2000 to 2020, based on image interpretation data, by exploiting corrected carbon emission factors in

different land types from the Qinghai–Tibet Plateau. We studied the impact of construction land form on carbon emissions using the spatial lag model (SLM) and the spatial error model (SEM), and the results show that the Lhasa metropolitan area's carbon emissions showed an overall increasing trend from 2000 to 2020, with the characteristics of "slow acceleration–slight deceleration–acceleration", with a deceleration period from 2005 to 2015. As a result, the construction land has a relatively low capacity, but it constitutes about 90% of all emissions; moreover, carbon emissions from cultivated land cover about 9%. The rate of spatial expansion of carbon emissions from land use is significantly slower in the Lhasa metropolitan area, yet the spatial expansion of carbon emissions has a clear direction and increases in the north and west of Lhasa. The carbon emissions from land use in the Lhasa metropolitan area is characterized by "one core, many points, and multiple belts" in spatial distribution. The changing of spatial forms of construction land has a significant impact on carbon emissions. Finally, we depicted the impact logic of land use pattern on carbon emissions and provided policy and management recommendations that were both feasible and reasonable.

For further reading: https://doi.org/10.3390/land12010122

CONTINUOUS MASS LOSS ACCELERATION OF QIANGYONG GLACIER, SOUTHERN TIBETAN PLATEAU, SINCE THE MID-1880S INFERRED FROM GLACIOLACUSTRINE SEDIMENTS

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Quaternary Science Reviews 301: 107937

Himalayan glaciers have been shown by satellite observations to be losing mass at accelerated rates since the mid-1970s, posing severe challenges to downstream water resource availability, ecological functioning, and glacial hazard prevention. Reconstructing long-term glacier fluctuations beyond the satellite era is consequently crucial to fully understand this acceleration. However, glacier reconstructions in the Himalayas are mainly based on discontinuous moraine chronologies, with the most recent ones marking only the timing and position of the Little Ice Age (LIA; 1250–1850 CE) maxima of Himalayan glaciers. Here, we reconstruct continuous records of the activity of Qiangyong Glacier, southern Tibetan Plateau, since the onset of the LIA (1316–2004 CE) and associated variation in precipitation, by retrieving glacier melting and advancing signals from grain size and analysing leaf wax hydrogen isotopes in the same glaciolacustrine sediments. We show that the glacier was relatively stable during the LIA, with its terminus shifting within ~100 m, depending on the combined effects of precipitation and temperature. However, it retreated by ~150 m under maximum precipitation conditions at the end of the LIA (approximately 1845–1866 CE) and, most importantly, has exhibited accelerated mass loss since the mid-1880s. Comparisons with regional and Northern Hemisphere temperatures suggest that climate warming rather than decreased precipitation since the end of the LIA plays a primary role in driving this accelerated mass loss. Our glaciolacustrine record add a continuous perspective on the variability of Himalayan glaciers, especially their mass loss status since the end of the LIA.

For further reading: https://doi.org/10.1016/j.quascirev.2022.107937

PHOTOSYNTHESIS RESPONSES OF TIBETAN FRESHWATER ALGAE *CHLORELLA VULGARIS* TO HERBICIDE GLYPHOSATE

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International Journal of Environmental Research and Public Health 20: 386

With the development of agriculture and the widespread application of agrichemicals in Tibet, herbicide residues have become a threat to the ecological safety of Tibetan water bodies. Algae, as the producers in the food chain in

water bodies, play an important role in aquatic ecosystems. Therefore, the impact of herbicides on Tibetan algae is of great significance for evaluating ecological health and the protection of Tibetan water ecosystems. In this study, we investigated the inhibitory effect of glyphosate, a herbicide, on the photosynthetic system of *Chlorella vulgaris*, Tibetan algae, by determining chlorophyll fluorescence and the activity of an antioxidant system. The results revealed that glyphosate at low concentration did not affect the photosynthetic activity of *C. vulgaris*; however, glyphosate at a high concentration significantly inhibited photosynthetic activity and reduced pigment content. Moreover, high levels of glyphosate also decreased photochemical efficiency and electron transport rate and resulted in ROS accumulation, high SOD activity, and lipid peroxidation. These results suggested that glyphosate could decrease the primary production of aquatic ecosystems and influence their performance. Therefore, reducing the herbicide levels could protect the Tibetan aquatic environment and maintain the health of ecosystems.

For further reading: https://doi.org/10.3390/ijerph20010386

Pakistan- Himalaya

IDENTIFICATION AND QUANTIFICATION OF MAJOR COMPONENTS OF WASTE DIVERSION AND THEIR RECOVERY RATES IN CURRENT WASTE MANAGEMENT SYSTEM IN PESHAWAR, PAKISTAN

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Arabian Journal of Geosciences 16: 34

Waste diversion (WD) is an integral part of modern solid waste management (SWM); however, like many developing countries, it remained ignored by the municipalities in Pakistan. Consequently, final destination of several valuable items in waste stream ends up at landfill. Most of the municipalities are not aware of waste diversion and its importance. Therefore, the study is designed to identify and evaluate potential components of WD that exist in SWM and also to assess current rate of recovery of individual component and overall WD rate. In order to identify and quantify valuable items in waste stream, MSW generation and characterization were carried out at source and landfill site as well. Quantification of individual component calculated from characterization, while rate of waste diversion is calculated by using an equation as mentioned in methodology. It is concluded that a city generates 967.33 tons/day of municipal solid waste and generation rate 0.474 kg/capita/day. Only 125.00 tons/day (13.17%) of valuable items are recovered from the waste stream, while 840 tons/day (86.81%) end up at landfill site without any treatment. The main WD components in Peshawar are reuse (13%), recycling (50.75%), RDF/mass burning (31%), and food waste using as livestock fodder (16%). Composting being important of WD is recorded 0.00% in the city. This study will assist waste management authority and will also motivate government to make policies that encourage waste diversion.

For further reading: https://doi.org/10.1007/s12517-022-11023-3