An Environmental Research Abstract

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For the 627th - 628th issues of Headlines Himalaya, we reviewed journal articles 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 Pakistan).

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SMALLHOLDER FARMERS' ADAPTATION TO CLIMATE CHANGE AND ITS POTENTIAL CONTRIBUTION TO UN'S SUSTAINABLE DEVELOPMENT GOALS OF ZERO HUNGER AND NO POVERTY

Uttam Khanal, Clevo Wilson, Sanzidur Rahman, Boon L. Lee, and Viet-Ngu Hoang

Journal of Cleaner Production 281: 124999

Climate change is likely to worsen poverty, and agriculture-dependent groups and poorest countries are at the greatest risk. Farmers' have begun developing and implementing climate change adaptations. This study investigates the extent to which climate change adaptations by smallholder farmers have the potential to contribute to the UN's sustainable development goals of no poverty (SDG 1) and zero hunger (SDG 2). To this end, the study measures the impact of such adaptations on food production using farm-level survey data from Nepal. We utilize a matching technique and stochastic production frontier model to examine the productivity and efficiency of farmers. Results reveal that the group of farmers adopting adaptations exhibit higher levels of productivity and technical efficiency in food production as compared to the non-adopters. It is evident from the results that policy makers should encourage farming households in climate change adaptations, which have the potential to enhance farmers' productivity and efficiency in agriculture, thereby contributing to two of the United Nations Sustainable Development Goals (SDGs) of eradicating hunger and poverty (SDG's target indicators 2.3).

For Further Reading: https://doi.org/10.1016/j.jclepro.2020.124999

STABLE ISOTOPES OF PRECIPITATION IN NEPAL HIMALAYA HIGHLIGHT THE TOPOGRAPHIC INFLUENCE ON MOISTURE TRANSPORT

Sunil Acharya, Xiaoxin Yang, Tandong Yao, and Dibas Shrestha

Quaternary International 565: 22-30

The Nepal Himalaya is a transition zone for pollutants transport from the South Asia onto the Tibetan Plateau, with the moist convection identified as dominating the chemical composition that would be transported onto the Plateau. Yet little is known regarding the atmospheric water vapor transport over this region, and how the summer monsoon flows would interact with local topography, with traces detectable from ground sample and observations. The stable oxygen and hydrogen isotopes in precipitation ($\delta^{18}O_p$ and δD_p) are important tracers for understanding various hydrological processes. This study reports, for the first time, stable isotope data in daily precipitation at five stations along a north-south transect on the southern slope of Himalaya, with altitudes ranging from 102 m to 5050 m above sea level (a.s.l). The altitude effect of $\delta^{18}O_p$ across the region of interest is apparent with an altitudinal lapse rate as 0.17‰/100 m. Seasonal trends in $\delta^{18}O_p$ and δD_p show low values during June–September and higher values during October–May at all of the study sites, with the noticeable decrease of $\delta^{18}O_p$ during summer indicative of the presence of the Indian monsoon over the eastern Nepal Himalaya. The average d-excess values in the summer precipitation increase with altitudes til 3800 m a.s.l before decreasing

afterward to 5050 m a.s.l. This corroborates with previous meteorological discovery in the region, and probably confirms the replacement of prevailing westerly by the southerly monsoon flows during summer monsoon season.

For further reading: https://doi.org/10.1016/j.quaint.2020.09.052

India-Himalaya

EFFECT OF LAND USE, SEASON, AND SOIL DEPTH ON SOIL MICROBIAL BIOMASS CARBON OF EASTERN HIMALAYAS

Nima Tshering Lepcha and N. Bijayalaxmi Devi

Ecological Processes 9: 65

Soil microbial biomass, an important nutrient pool for ecosystem nutrient cycling is affected by several factors including climate, edaphic, and land-use change. Himalayan soils are young and unstable and prone to erosion and degradation due to its topography, bioclimatic conditions and anthropogenic activities such as frequent land-use change. Through this study, we tried to assess how soil parameters and microbial biomass carbon (MBC) of Eastern Himalayan soils originated from gneissic rock change with land-use type, soil depth and season. Chloroform fumigation extraction method was employed to determine MBC from different land-use types. Soil physical and chemical properties varied significantly with season, land-use and soil depth ($p < 0.001$). The maximum values of soil properties were observed in the rainy season followed by summer and winter season in all the study sites. Annual mean microbial biomass carbon was highest in the forest (455.03 $\mu g\, g^{-1}$) followed by cardamom agroforestry (392.86 $\mu g\, g^{-1}$) and paddy cropland (317.47 $\mu g\, g^{-1}$). Microbial biomass carbon exhibited strong significant seasonal difference ($p < 0.001$) in all the land-use types with a peak value in the rainy season (forest- 592.78 $\mu g\, g^{-1}$; agroforestry- 499.84 $\mu g\, g^{-1}$ and cropland- 365.21 $\mu g\, g^{-1}$) and lowest in the winter season (forest – 338.46 $\mu g\, g^{-1}$; agroforestry – 320.28 $\mu g\, g^{-1}$ and cropland – 265.70 $\mu g\, g^{-1}$). The value of microbial biomass carbon decreased significantly with soil depth ($p < 0.001$) but showed an insignificant increase in the second year which corresponds to a change in rainfall pattern. Besides, land-use type, season and soil depth, soil properties also strongly influenced microbial biomass carbon ($p < 0.001$). Microbial quotient was highest in the agroforestry system (2.16%) and least in the subtropical forest (1.91%). Our results indicate that land-use, soil depth and season significantly influenced soil properties and microbial biomass carbon. The physical and chemical properties of soil and MBC exhibit strong seasonality while the type of land-use influenced the microbial activity and biomass of different soil layers in the study sites. Higher soil organic carbon content in cardamom agroforestry and forest in the present study indicates that restoration of the litter layer through retrogressive land-use change accelerates microbial C immobilization which further helps in the maintenance of soil fertility and soil organic carbon sequestration.

For further reading: https://doi.org/10.1186/s13717-020-00269-y

SUITABILITY OF SPRING WATER FROM THE UPPER BEAS RIVER BASIN IN KULLU VALLEY (WESTERN HIMALAYA, INDIA) FOR DRINKING AND IRRIGATION PURPOSES

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Arabian Journal of Geosciences 13: 1186

Spring water is a reliable source of potable water to many communities and habitants in western Himalayan region of India. The present study evaluates the hydrochemical nature of spring water using various drinking parameters and agricultural indices in upper Beas basin of Kullu Valley, Himachal Pradesh, India. Fifty springs were sampled for the estimation of physico-chemical parameters and major ions. The results indicate that majority of the spring waters in the study area are suitable for drinking as well as irrigation purposes except for few locations. About 14% of springs showed high nitrate content (45 to 92.6 mg/L) more than BIS permissible limit of 45 mg/L. The source of contamination could be sewage disposal, livestock waste and fertilizers. Fluoride (0.16–0.49 mg/L) was found to be within permissible limits for drinking. Drinking Water Quality Index ranges from 1.74 to 108, and Irrigation Water Quality Index ranges from 0.27 to 8.21. Both these indices indicate that the spring water falls in excellent to good category and is suitable in terms of potability and irrigation uses. Hydrogeochemical characteristics of the spring waters indicate that alkaline earths (Ca^{2+} + Mg^{2+}) dominate alkalies (Na^{+} + K^{+}) and strong acids (SO_4^{2-} + Cl^{-}) dominate weak acids (CO_3^{2-} + HCO_3^{-}). Based on Piper's classification, the spring water data falls in no cation–no anion dominant zone followed by carbonate hardness (secondary alkalinity) zone and hydrochemical trends (Piper's and Gibb's plots) inferred that spring water chemistry is mainly controlled by water rock interaction followed by rainwater chemistry.

For further reading: https://doi.org/10.1007/s12517-020-06143-7

China Himalaya

THE EFFECT OF CLIMATIC AND EDAPHIC FACTORS ON SOIL ORGANIC CARBON TURNOVER IN HUMMOCKS BASED ON $\delta^{13}C$ ON THE QINGHAI-TIBET PLATEAU

Hanzhi Li, Feng Yan, DengfengTuo, Bin Yao, and Junhan Chen

Science of the Total Environment 741: 140141

Hummocks (thúfur, pounus) are peculiar landforms usually formed by repeated freeze–thaw processes and differential frost heave, and are common in frost soil regions, especially in the Qinghai-Tibet Plateau. However, little is known about the response of $\delta^{13}C$ in soil organic carbon ($\delta^{13}C_{SOC}$) to soil and climate properties in hummocks. The β value indicates the decomposition rate of soil organic carbon (SOC) in soil, and was obtained from the slope of the regression between the log10-transformed SOC concentration and $\delta^{13}C_{SOC}$ in soil depth profiles. In this study, we investigated $\delta^{13}C_{SOC}$ and SOC contents along a soil profile (0–60 cm), together with edaphic and climatic properties, both in hummocks and control plots (alpine grasslands) on the northeastern Qinghai-Tibet Plateau. Then, the variations in $\delta^{13}C_{SOC}$ and β values, and the main factors affecting them, were analyzed. The results show that $\delta^{13}C_{SOC}$ increases with soil depth, while SOC decreases both in the hummocks and control plots. However, β values in the hummocks were significantly ($P < 0.05$) higher than in the control plots while $\delta^{13}C_{SOC}$ showed no difference between hummock and control. Redundancy analysis showed that altitude is the main control factor for $\delta^{13}C_{SOC}$ and β in the hummocks. Climate type was the main factor affecting $\delta^{13}C_{SOC}$ in the control plots, while mean annual precipitation and soil fractal dimension were the main factors controlling β. Overall, climate, rather than soil, is the key factor that affects the carbon turnover rate in the hummock in the northeastern QTP. The findings of this study will expand our understanding of the soil carbon cycle and $\delta^{13}C_{SOC}$ changes, especially in the case of hummocks.

For further reading: https://doi.org/10.1016/j.scitotenv.2020.140141

WATER EROSION IN THE MIDDLE REACHES OF THE BRAHMAPUTRA IN TIBET: CHARACTERISTICS AND DRIVING FACTORS IN THE RECENT 30 YEARS

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Global Ecology and Conservation 24: e01343

The fragile ecological environment is one of the core reasons for the sustainable development of society in the Brahmaputra River of Tibet. Ecological restoration is one of the main means for human beings to effectively curb ecological degradation. To curb environmental degradation, the Tibet Government carries out ecological restoration, however, its efficacy is unknown. To increase the understanding of the impacts of ecological restoration on soil erosion and ecological service functions, we used the universal soil loss equation to determine the temporal and spatial variability in soil erosion for years 1985–2015. We also monitored changes in land-cover, and climatic variables to understand the driving forces of soil stability and movement. The results showed that the dominant land cover types in the study area were forest and grassland. Soil erosion generally decreased annually, while precipitation and temperature increased, and vegetation cover increased slowly. Soil erosion decreased mainly in the middle and southwestern parts of the basin. Temporal variability in soil erosion in the Brahmaputra River was mainly affected by precipitation, temperature, vegetation, and slope gradient. Soil erosion was positively correlated with precipitation and temperature, and areas with increasing temperature were mainly distributed in the degraded grassland areas in the north, where risk of soil erosion increased.

For further reading: https://doi.org/10.1016/j.gecco.2020.e01343

HYDROCHEMISTRY DIFFERENCES AND CAUSES OF TECTONIC LAKES AND GLACIAL LAKES IN TIBETAN PLATEAU

Meiping Sun, Huian Jin, Xiaojun Yao, Luxia Yan, Xiaofeng Li, and Yongpeng Gao

Water 12: 3165

The Tibetan Plateau has the largest lake cluster in China and in the world. In order to clarify the differences of lake hydrochemistry of Tibetan Plateau, water samples were collected from 32 lakes, including 22 tectonic lakes and 11 glacial lakes, along the Tibetan Plateau road, from September to October 2016. We detected and analyzed the major ion concentrations and characteristics of samples, and discuss the hydrochemistry type, controlling factors, and major ion sources of lake water. The results showed that, firstly, tectonic lake samples on the Tibetan Plateau have much higher physicochemical parameters and ion contents than glacial lakes, and Total Dissolved Solids (TDS) contents fluctuate from high to low latitudes. The variations of ion concentrations in the northern part of the Qiagui Co were more fluctuating and have two obvious peaks, while the variations in the southern part were moderate. The TDS of glacial lakes were low and leveling off in the upper and middle reaches of the basin, while higher and more variable in the lower reaches. Secondly, the tectonic lakes were mainly chloride saline lakes, with Na^+ as the major cations, and SO_4^{2-}, Cl^- as the major anions. Glacial lakes were mainly carbonate and sulfate type lakes, Ca^{2+} and Mg^{2+} were the major captions, HCO_3^- was the major anion, and SO_4^{2-} was the second. Thirdly, the hydrochemistry processes of the tectonic lakes were mainly controlled by evaporation-crystallization, and the ions mainly came from evaporate of basin. Glacial lake water samples were mainly influenced by the weathering of basin rocks, with ion sources strongly influenced by the weathering of basin carbonates than evaporates, with calcite and dolomite being important sources of Ca^{2+}, Mg^{2+}, and HCO_3^-.

For further reading: **https://doi.org/10.3390/w12113165**

Pakistan- Himalaya

SEDIMENTOLOGICAL ATTRIBUTES OF THE MIDDLE JURASSIC PELOIDS-DOMINATED CARBONATES OF EASTERN TETHYS, LESSER HIMALAYAS, PAKISTAN

Abdus Saboor, Muhammad Haneef, Muhammad Hanif, and Muhammad Azhar Farooq Swati

Carbonates and Evaporites 35: 123

The carbonate factories of the tropical to sub-tropical regions characterize a number of facies, attributable to biological and oceanographic variables. For this purpose, the Middle Jurassic carbonate rock unit (Samana Suk Formation) of the Upper Indus Basin of Pakistan was studied to understand the various Tethyan platform attributes. Four sections from Hazara area were chosen which were also compared with a section from the Nizampur Basin. The resultant microfacies were placed in their paleoenvironmental settings to reveal the facies distribution and geometry of the platform. The platform represents a gently dipping ramp, dominated by peloidal–bioclastic–ooidal grainstones and peloidal lime mudstones. The allochems and fauna show some contrasting signatures regarding paleoclimate. These microfacies infer about existence of a relatively extended tropical climatic belt in the paleo Tethys during the Middle Jurassic. The notable presence of planktonic lime mudstone facies corresponds with global marine transgression, occurring in the middle of rock unit. The nature of ooids and types of fauna of sub-tropics to tropics advocate an extended warm climatic zone in comparison with today. The dominance of gently dipping inner-ramp shoals accompanied by lagoons to steep dipping outer-ramp planktonic lime mudstones restricted the development of least encountered middle-ramp facies. The ramp platform was struck by waves and tides of different strengths including low-middle amplitude storms and the overall absence of evaporites and primary dolostones designate a humid region as manifested by euryhaline conditions. The study has drawn paleoenvironmental and palaeoceanographic similarities with sections in Tanzania, western India, NW Iran, NW Afghanistan and Western Australia. The oceanic parameters compare with present day Trucial Coast of Persian Gulf, reflecting an almost similar nature of paleoceanography in the paleo Tethys.

For further reading: https://doi.org/10.1007/s13146-020-00662-w