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Editorial Team: Arati Gurung and Nirmala Bohara

For the 649th - 650th issues of Headlines Himalaya, we reviewed researches from five sources and selected 18 researches from five countries. We selected five researches from Nepal and 13 researches from other Himalayan countries (India, China, Bhutan and Pakistan).

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Nepal-Himalaya

BLACK CARBON CONCENTRATION IN THE CENTRAL HIMALAYAS: IMPACT ON GLACIER MELT AND POTENTIAL SOURCE CONTRIBUTION

Chaman Gul, Parth Sarathi Mahapatra, Shichang Kang, Praveen Kumar Singh, Xiaokang Wu, Cenlin He, Rajesh Kumar, Mukesh Rai, Yangyang Xu, and Siva Praveen Puppala

Environmental Pollution 275: 116544

This study discusses year-long (October 2016–September 2017) observations of atmospheric black carbon (BC) mass concentration, its source and sector contributions using a chemical transport model at a high-altitude (28°12'49.21"N, 85°36'33.77"E, 4900 masl) site located near the Yala Glacier in the central Himalayas, Nepal. During a field campaign, fresh snow samples were collected from the surface of the Yala Glacier in May 2017, which were analysed for BC and water-insoluble organic carbon mass concentration in order to estimate the scavenging ratio and surface albedo reduction. The maximum BC mass concentration in the ambient atmosphere ($0.73 \mu\text{g m}^{-3}$) was recorded in the pre-monsoon season. The BC and water-insoluble organic carbon analysed from the snow samples were in the range of $96\text{--}542 \text{ ng g}^{-1}$ and $152\text{--}827 \text{ ng g}^{-1}$, respectively. The source apportionment study using the absorption Ångström exponent from in situ observations indicated approximately 44% contribution of BC from biomass-burning sources and the remainder from fossil-fuel sources during the entire study period. The source contribution study, using model data sets, indicated ~14% contribution of BC from open-burning and ~77% from anthropogenic sources during the study period. Our analysis of regional contributions of BC indicated that the highest contribution was from both Nepal and India combined, followed by China, while the rest was distributed among the nearby countries. The surface snow albedo reduction, estimated by an online model – Snow, Ice, and Aerosol Radiation – was in the range of 0.8–3.8% during the pre-monsoon season. The glacier mass

balance analysis suggested that BC contributed to approximately 39% of the total mass loss in the pre-monsoon season.

Further reading: <https://doi.org/10.1016/j.envpol.2021.116544>

FARMER'S PERCEPTION AND DETERMINANTS OF DAIRY CATTLE INSURANCE IN NEPAL

Sandip Subedi and Rishi Ram Kattel

Cogent Food and Agriculture 7: 1911422

This study was conducted to identify the factors that motivate the farmers to adopt dairy cattle insurance. This study was based on the field survey conducted in the Chitwan and Nawalparasi districts of Nepal. A total of 160 cross-sectional households sampled were obtained using a simple random sampling technique. Data were collected using a pre-tested interview schedule and focal group discussion in 2017. About 64 percent of respondents were found to get technical assistance for insurance through agro-vets. The study revealed that dairy cattle insurance was an important risk management tool among who experienced cattle loss. Lack of knowledge and information about the benefits of cattle insurance was found to be the major reason for not joining cattle insurance. Risk coverage by insurance was identified as a satisfying factor of insurance in the study. A probit model was used to assess the motivating factors for the adoption of cattle insurance and revealed that cattle breed, access to loan, income from livestock, and a number of cattle had a positive and significant relationship with the adoption of cattle insurance whereas household size and district dummy had a negative and significant relationship with the adoption of cattle insurance. The findings imply for policymakers, insurance companies, and sellers of risk management strategies.

Further reading: <https://doi.org/10.1080/23311932.2021.1911422>

A MULTIDISCIPLINARY APPROACH OF LANDSLIDE CHARACTERIZATION: A CASE OF THE SIWALIK ZONE OF NEPAL HIMALAYA

Bharat Prasad Bhandari and Subodh Dhakal

Journal of Asian Earth Sciences: X 5: 100061

The landslide is a common problem in the Siwalik zone of Nepal Himalaya during the monsoon period. The heterogeneity of lithology comprising of thickly bedded sandstone and mudstone, weakly cemented conglomerate beds, and permeable quaternary deposits on moderate to steep slopes are primarily responsible for the landslide in this zone. In this study, a multidisciplinary approach is used for the landslide characterization. The polygon-based landslide inventory map was prepared by using Sentinel-2, Landsat-8, and Google Earth imageries. The draft inventory map was verified and updated by several field visits. The final inventory map was overlaid with topographical, geological, and hydrological maps in Q-GIS and explored the landslide characteristics. Landslide distribution to geological units, thrust zone, slope, aspect, and rainfall amount along with the geotechnical properties are manifested and the relation between each selected factor is discussed. The study shows that a multidisciplinary technique provides the better option for landslide characterization.

Further reading: <https://doi.org/10.1016/j.jaesx.2021.100061>

LANDSLIDE SUSCEPTIBILITY MAPPING WITH GIS IN HIGH MOUNTAIN AREA OF NEPAL: A COMPARISON OF FOUR METHODS

Pawan Gautam, Tetsuya Kubota, Lok Mani Sapkota, and Yoshinori Shinohara

Environmental Earth Sciences 80: 359

Landslide susceptibility mapping (LSM) assists identifying and targeting landslide preventive measures, thereby minimizing potential losses. Multiple approaches are employed for LSM in various physiographic regions; however, their applicability has differed across studies, with limited understanding on the most suitable approach for LSM in high mountain areas. Hence, we conducted LSM in the Indrawati watershed, a high mountain area of Central Nepal, employing four approaches: frequency ratio, logistic regression, artificial neural network, and support vector machine. Nine landslide causal factors (slope, aspect, elevation, geological formation, proximity to river, proximity to road, land cover, soil type, and curvature) were considered for LSM. Rainfall-induced landslides were mapped by the on-screen digitization of satellite images and field observations. The landslides were randomly split into a ratio of 80:20 for training and validating the susceptibility maps. The LSMs obtained by four methods were then validated and compared using area under curve (AUC), kappa index, and statistical inferences (sensitivity, specificity, positive predictive value, negative predictive value, and accuracy). Our study showed that Eutric Cambisols, a class of soil type, has a strong association with landslide occurrence among the 52 classes of the nine causal factors. We found that the artificial neural network approach possessed the best prediction capability (AUC value = 86.9%) among the four methods, followed by logistic regression (85.6%), support vector machine (81.2%), and frequency ratio (80.1%) approaches. However, Kappa index and other statistical inferences suggested the support vector machine approach to be the second-best method. Overall, we found that the artificial neural network yields more accurate and reliable results and hence considered as a promising approach for susceptibility mapping in high mountainous region of Hindu-Kush Himalaya. The findings of this study might be useful for landslide analysts, development planners and decision-makers in conducting LSM and development planning in high mountain regions.

Further reading: <https://doi.org/10.1007/s12665-021-09650-2>

FACILITATION BY A DWARF SHRUB ENHANCES PLANT DIVERSITY OF HUMAN-VALUED SPECIES AT HIGH ELEVATIONS IN THE HIMALAYAS OF NEPAL

Rabindra Parajuli, Michael J. O'Brien, Bishnu Timilsina, Francisco I. Pugnaire, Christian Schöb, Suresh K. Ghimire

Basic and Applied Ecology 54: 23-36

Facilitation is a global phenomenon that occurs when one species promotes the growth, survival, or reproduction of another species, mostly in stressful environments. However, the importance of facilitation by shrubs in maintaining plant community diversity is not well evaluated in the Himalayas, especially for the richness and conservation of medicinal and human-valued species. Therefore, we aimed to explore the facilitative role of a dwarf shrub species, *Berberis angulosa*, in maintaining plant composition and richness of human-valued species in the Langtang valley of Nepal's Himalayas. We censused plant species in open patches and beneath *Berberis* during monsoon and post-monsoon (dry) seasons at three elevations.

Total species richness and richness of human-valued species were significantly higher inside the *Berberis* canopy than in gaps; the former being 39% and the latter 46% greater under shrubs than in open sites. Facilitation by *Berberis* shrubs promoted plant community diversity irrespective of season and elevation; however, higher differences in mean species richness for both total plant species and human-valued species during the dry season and at high elevation indicated increased facilitation intensity under more stressful conditions. The facilitative

effect of *Berberis* shrubs increased, combining both seasons, overall plant diversity by 19% (total=105), and human-valued species by 16% (total=56). Our results show the importance of facilitation by nurse shrubs in structuring plant communities and protecting medicinal and socio-ecologically important plants, thus enriching ecosystem services in the Himalayas. These results suggest nurse plant species should be incorporated into conservation policies and management strategies for effective biodiversity conservation and sustainability, especially in the face of climate change.

Further reading: <https://doi.org/10.1016/j.baae.2021.04.004>

India -Himalaya

PREDICTIVE DISTRIBUTION MODELING OF *SWERTIA BIMACULATA* IN DARJEELING-SIKKIM EASTERN HIMALAYA USING MAXENT: CURRENT AND FUTURE SCENARIOS

Debasruti Boral and Saurav Moktan

Ecological Processes 10: 26

As global temperatures continue to rise, species distribution modeling is a suitable tool for identifying rare and endangered species most at risk of extinction, along with tracking shifting geographical range. The present study investigates the potential distribution of *Swertia bimaculata* in the Darjeeling-Sikkim region of Eastern Himalaya in current and future climate scenarios of GFDL-CM3 (Geophysical Fluid Dynamics Laboratory-Climate Model 3) for the year 2050 and year 2070 through MaxEnt presence data modeling. Two sets of variables were used for modeling current scenario. The models were evaluated using AUC (area under the curve) values and TSS (true skill statistic). Habitat assessment of the species shows low and sporadic distribution within the study area. A significant decrease is observed in the possible range of the species in the future climate scenario with the habitat decreasing from 869.48 to 0 km². Resultant maps from the modeling process show significant upward shifting of the species range along the altitudinal gradient. Still, results should be taken with caution given the low number of occurrences used in the modeling. The results thus highlight the vulnerability of the species towards extinction in the near future.

Further reading: <https://doi.org/10.1186/s13717-021-00294-5>

FUNCTIONAL TRAITS, GROWTH PATTERNS, AND LITTER DYNAMICS OF INVASIVE ALIEN AND CO-OCCURRING NATIVE SHRUB SPECIES OF CHIR PINE FOREST IN THE CENTRAL HIMALAYA, INDIA

Mukesh Kumar and Satish Chandra Garkoti

Plant Ecology 222: 723-735

Across the continents, plant invasion is identified as one of the main threats to ecosystem functioning and stability. The main objective of this research was to evaluate the differences in the functional traits between invasive alien (*Ageratina adenophora* (Spreng.) and *Lantana camara* L.) and native (*Berberis asiatica* Roxb. Ex DC., *Pyracantha crenulata* (D. Don.) M. Roemer and *Rubus ellipticus* Sm.) shrub species of chir pine (*Pinus roxburghii* Sarg.) forest in the central Himalaya. Three 0.5 hectare chir pine forest stands were selected and individuals of similar diameter were tagged for comparative studies of leaf traits, growth pattern, and biomass accumulation in structural organs of each invasive alien and native species. Our one-way ANOVA and Tukey's post hoc test results showed that both the invasive alien species have significantly ($p < 0.05$) higher SLA, LWC, total chlorophyll content, foliar nutrient (N

and P), RGR, LMR, SMR, nutrient uptake, and nutrient use efficiencies than native species. Leaf litter decomposition rate and nutrient release were also significantly ($p < 0.05$) higher in both the invasive alien species. Native species, *R. ellipticus*, shared some of the traits, such as leaf area, chlorophyll content, RGR, LAR, LMR, and nutrient uptake efficiency with invasive alien species. The majority of traits differed among invasive alien and native species, implying that the success of invasive alien species is best described by being functionally distinct from native species. These findings indicate that invasive alien species had advanced functional traits which may be playing an important role in a rapid spread in the central Himalaya.

Further reading: <https://doi.org/10.1007/s11258-021-01140-6>

A PRELIMINARY ASSESSMENT OF THE 7TH FEBRUARY 2021 FLASHFLOOD IN LOWER DHAULI GANGA VALLEY, CENTRAL HIMALAYA, INDIA

Naresh Rana, Shubhra Sharma, Yaspal Sundriyal, Sameeksha Kaushik, Subhendu Pradhan, Ghanshyam Tiwari, Firoz Khan, S P Sati, and Navin Juyal

Journal of Earth System Science 130: 78

A short-lived flashflood in Rishi and Dhaul Ganga rivers on 7th February 2021, Uttarakhand Himalaya, killed 65 people with 141 reported missing (official estimate) and devastated two hydropower projects. Geomorphological observations supported by meteorological data suggest that the flood was triggered by a combination of avalanche and debris flow. The Dhaul Ganga valley has preserved ponded sedimentary sequences (laminated sand and silty-clay), suggesting that the valley is prone to episodic mega foods in the recent geological past. Considering that the receding glaciers in the higher Himalaya have left behind enormous sediment, unusual weather events are likely to generate such disasters more frequently as the climate becomes warmer. Thus, the study calls for not only incorporating the disaster risk assessment in the developmental planning of the Himalayan region but also recommends routine monitoring of the potential areas of structural failures in the glaciated valleys along with supra-glacial lakes.

Further reading: <https://doi.org/10.1007/s12040-021-01608-z>

ASSESSMENT OF TERRAIN STABILITY ZONES FOR HUMAN HABITATION IN HIMALAYAN UPPER PINDAR RIVER BASIN, UTTARAKHAND USING AHP AND GIS

Senjuti Nandy

Environmental Earth Sciences 80: 356

Stable and vulnerable free terrain is always preferred for human habitation. Therefore, delineation of terrain stability zones is very much essential for the development and growth of planned and sustainable settlement habitation in any region. To assess the terrain stability for human habitation of the Himalayan Upper Pindar River Basin, Uttarakhand, a systematic regional planning approach is used based on a multi-criteria evaluation framework. It is analysed with the help of the analytical hierarchy process (AHP) combined with geographical information system (GIS). Combine effect of twelve parameters or criteria, i.e. landslide-prone areas, Peak Ground Acceleration (PGA), average slope, geology, soil, snow-affected area, relative relief, rainfall, Topographic Wetness Index (TWI), altitudinal zone, dissection index, and vegetation through AHP method, reveals a great variety of terrain stability in the spatial level of the study area. According to the final thematic map of terrain stability zones, the whole region is classified into five zones, namely stable, moderately stable, moderately vulnerable, vulnerable, and highly vulnerable. 19.31% area of the south-western part of the basin have stable terrain compared to

approximately 19.64% highly vulnerable zone of the study area for human habitation in the north-east. The moderately stable and the moderately vulnerable terrain are noted in 20.92% and 19.45% of the study area, respectively. Thus, from the analysis, regions of the basin with high stability terrain for human habitation and growth of settlement are identified with the AHP model and the final result may be drawn as the vulnerability of terrain is gradually decreasing from the north-eastern part of the basin to the south-western section.

Further reading: <https://doi.org/10.1007/s12665-021-09634-2>

RUNOUT MODELLING AND HAZARD ASSESSMENT OF TANGNI DEBRIS FLOW IN GARHWAL HIMALAYAS, INDIA

Rajesh Kumar Dash, Debi Prasanna Kanungo, and Jean Phillippe Malet

Environmental Earth Sciences 80: 338

Debris flows are frequently occurring natural processes in geologically complex terrains of the Indian Himalayas. Debris flow runout modelling leading to hazard assessment is essential for planning, designing, and execution of mitigation measures. In the present context, debris flow hazard assessment has been carried out for the Tangni debris flow in Garhwal Himalayas, India. Runout modelling was carried out using a Voellmy model-based 3D numerical simulation for estimation of flow intensity parameters such as runout distance, flow velocity, height and pressure along the propagation path. For calibration of the model inputs, back analysis of Tangni debris flow event that occurred in 2013, with its known runout length and deposition volume as the criteria, has been conducted. The best calibrated values of frictional parameters are obtained at $\mu = 0.10$ and $\xi = 400 \text{ m/s}^2$. Using the best calibrated values of frictional parameters, hazard assessment was carried out for two potential release areas separately, with different initial volumes, and in combination to derive the probable runout distance along with other flow intensity parameters for different scenarios that may happen in the future. It has been observed that this debris flow scenario including the combination of two potential release areas will block the Alaknanda River, forming a landslide dam with a probable height of 6 m. Debris flow runout modelling-based hazard assessment will be helpful in determining quantitative information on flow intensity parameters, where complete data on past events are generally not available or were not possible to capture for the Indian Himalayan region.

Further Reading: <https://doi.org/10.1007/s12665-021-09637-z>

MAXIMUM ENTROPY-BASED FOREST FIRE LIKELIHOOD MAPPING: ANALYSING THE TRENDS, DISTRIBUTION, AND DRIVERS OF FOREST FIRES IN SIKKIM HIMALAYA

Polash Banerjee

Scandinavian Journal of Forest Research 2021: 1-14

The recent episodes of forest fires in Brazil and Australia of 2019 are tragic reminders of the hazards of forest fire. Globally incidents of forest fire events are on the rise due to human encroachment into the wilderness and climate change. Sikkim with a forest cover of more than 47%, suffers seasonal instances of frequent forest fire during the dry winter months. To address this issue, a GIS-aided and MaxEnt machine learning-based forest fire prediction map has been prepared using a forest fire inventory database and maps of environmental features. The study indicates that amongst the environmental features, climatic conditions and proximity to roads are the major determinants of forest fire. Model validation criteria like ROC curve, correlation coefficient, and Cohen's Kappa show a good predictive ability (AUC = 0.95, COR = 0.81, $\kappa = 0.78$). The outcomes of this study in the form of a forest fire prediction map can aid the stakeholders of the forest in taking informed mitigation measures.

Further reading: <https://doi.org/10.1080/02827581.2021.1918239>

COMPARATIVE EVALUATION ON MUNICIPAL SEWAGE SLUDGE UTILIZATION PROCESSES FOR SUSTAINABLE MANAGEMENT IN TIBET

Guanyi Chen, Rui Zhang, Xiang Guo, Wenzhu Wu, Qianqian Guo, Yanbin Zhang, and Beibei Yan

Science of the Total Environment 765: 142676

In recent years, a sharp increase in the amount of municipal sewage sludge (MSS) in Tibet has posed serious threats to the fragile ecological environment. Tibetan sludge, with a high content of volatile and low heavy metals, has re-utilization advantages, and thus, the selection of appropriate utilization processes for Tibetan MSS is of great importance. In this study, not only the processes themselves, but also other factors including legislations and environmental pollution were investigated. This study introduced the current waste management legislation situation (especially for MSS) in China and Tibet, China. Moreover, a series of SWOT (strength & weakness and opportunity & threats) analyses were conducted to compare anaerobic digestion (AD), incineration, pyrolysis (PY), gasification, and anaerobic digestion coupled with pyrolysis. The results showed that anaerobic digestion coupled with pyrolysis was the optimal treatment option, because anaerobic digestion was suitable for the low oxygen content in Tibet. Although only 50–60% of the organic matter in MSS could be degraded by anaerobic digestion, the residual organic matter (energy) could be further decomposed by pyrolysis, converting it into pyrolytic gas, bio-oil, and biochar, as valuable products. Sludge digestate pyrolysis could reduce environmental risks, save energy, recover materials, and produce high value-added materials. Moreover, it provides a “zero waste” solution for sludge disposal and promotes a “Circular Economy.” The challenges and obstacles of MSS anaerobic digestion coupled with pyrolysis in Tibet were also investigated. This study provides an important technical reference for the comprehensive utilization of Tibetan MSS.

Further reading: <https://doi.org/10.1016/j.scitotenv.2020.142676>

DANCING ON THE TOP: PHYLOGEOGRAPHY AND GENETIC DIVERSITY OF HIGH-ALTITUDE FRESHWATER FAIRY SHRIMPS (BRANCHIOPODA, ANOSTRACA) WITH A FOCUS ON THE TIBETAN PLATEAU

Zhixiong Deng, Yating Chen, Xiaolin Ma, Wei Hu, and Mingbo Yin

Hydrobiologia 848: 2611-2626

Fairy shrimp are the most divergent taxon of large branchiopod crustaceans and have a worldwide distribution. Yet the diversity and distribution of fairy shrimps in the “Roof of the World” remain poorly known. Here, based on morphology, we identified three species of fairy shrimp (*Branchinecta orientalis*, *Chirocephalus graziellae* and *Branchipodopsis affinis*), among 14 fairy-shrimp populations from the Tibetan Plateau, China. Their phylogenetic relationships were verified based on mitochondrial DNA sequences (cytochrome *c* oxidase subunit I gene) and two nuclear markers (18S ribosomal RNA gene and internal transcribed spacer 2). Syntopy of different species of fairy shrimp was observed. Some haplotypes were shared among populations, and sequences from *B. affinis* exhibited a star-like pattern in haplotype networks, suggesting a recent rapid expansion. Finally, a high genetic diversity of fairy shrimp was detected on the Tibetan Plateau. Obtained results contribute to a better knowledge of the diversity of high-altitude fairy shrimps.

Further reading: <https://doi.org/10.1007/s10750-021-04584-z>

ATMOSPHERIC THERMAL AND DYNAMIC VERTICAL STRUCTURES OF SUMMER HOURLY PRECIPITATION IN JIULONG OF THE TIBETAN PLATEAU

Yonglan Tang, Guirong Xu, Rong Wan, Xiaofang Wang, Junchao Wang, and Ping Li

Atmosphere 12: 505

It is an important to study atmospheric thermal and dynamic vertical structures over the Tibetan Plateau (TP) and their impact on precipitation by using long-term observation at representative stations. This study exhibits the observational facts of summer precipitation variation on sub diurnal scale and its atmospheric thermal and dynamic vertical structures over the TP with hourly precipitation and intensive soundings in Jiulong during 2013–2020. It is found that precipitation amount and frequency are low in the daytime and high in the night time, and hourly precipitation greater than 1 mm mostly occurs at night time. Weak precipitation during the daytime may be caused by air advection, and strong precipitation at night time may be closely related with air convection. Both humidity and wind speed profiles show obvious fluctuation when precipitation occurs, and the greater the precipitation intensity, the larger the fluctuation. Moreover, the fluctuation of wind speed is small in the morning, large at noon and largest at night, presenting a similar diurnal cycle to that of convective activity over the TP, which is conducive to night time precipitation. Additionally, the inverse layer is accompanied by the inverse humidity layer, and wind speed presents multi-peaks distribution in its vertical structure. Both of these are closely related with the underlying surface and topography of Jiulong. More studies on physical mechanism and numerical simulation are necessary for better understanding the atmospheric phenomenon over the TP.

Further reading: <https://doi.org/10.3390/atmos12040505>

SPATIO-TEMPORAL CHANGES OF VEGETATION NET PRIMARY PRODUCTIVITY AND ITS DRIVING FACTORS ON THE QINGHAI-TIBET PLATEAU FROM 2001 TO 2017

Yin Zhang, Qingwu Hu, and Fengli Zou

Remote Sensing 13: 1566

The Qinghai-Tibetan Plateau (QTP) is the highest plateau in the world. Under the background of global change, it is of unique significance to study the net primary productivity (NPP) of vegetation on the QTP. Based on the Google Earth Engine (GEE) cloud computing platform, the spatio-temporal variation characteristics of the NPP on the QTP from 2001 to 2017 were studied, and the impacts of climate change, elevation and human activity on the NPP in the QTP were discussed. The mean and trend of NPP over the QTP were “high in the southeast and low in the northwest” during 2001–2017. The trend of NPP was mostly between $0 \text{ gC}\cdot\text{m}^{-2}\cdot\text{yr}^{-1}$ and $20 \text{ gC}\cdot\text{m}^{-2}\cdot\text{yr}^{-1}$ (regional proportion: 80.3%), and the coefficient of variation (CV) of NPP was mainly below 0.16 (regional proportion: 89.7%). Therefore, NPP was relatively stable in most regions of the QTP. Among the correlation coefficients between NPP and temperature, precipitation and human activities, the positive correlation accounted for 81.1%, 48.6% and 56.5% of the QTP area, respectively. Among the two climatic factors, the influence of temperature on NPP was greater than that of precipitation. The change of human activities and the high temperature at low altitude had positive effects on the increase of NPP.

Further reading: <https://doi.org/10.3390/rs13081566>

Bhutan -Himalaya

TRANSITION TOWARDS SUSTAINABLE YAK FARMING IN BHUTAN: STAKEHOLDERS' VIEWPOINTS AND RECOMMENDATIONS FOR FUTURE STEPS

Nedup Dorji, Marjolein Derks, Peter W.G. Groot Koerkamp, and Eddie A.M. Bokkers

International Journal of Agricultural Sustainability 19: 1-20

The Bhutanese government initiated a highland development programme in the year 2016 to promote yak farming because the number of yak farming families is declining. However, there are several cross-cutting policies and issues that affect successful implementation of interventions to support yak farming in transition. We studied the challenges and opportunities to sustain yak farming and related trade-offs around problems and solutions through individual and focus group interviews with six stakeholder groups (i.e. herders from two regions, extensionists, park rangers, livestock officials, and forest officials). Overall, the herders rated forage availability and yak mortality as the main threats to yak farming, while government officials rated labour availability as the main threats. Most problems and solutions that were identified in the focus group interviews had diverging views among the stakeholder groups. There is clearly a need for a multi-stakeholder dialogue aiming to discuss problems and solutions together. This should take away misleading and disputed claims, and provide understanding about the approach to cope with risks and uncertainty around transhumance yak-based communities. A strong collaboration should lead to appropriate policy, which would reduce challenges and barriers, and simultaneously give opportunities to herders and their children to stay in yak farming in future.

Further reading: <https://doi.org/10.1080/14735903.2021.1917909>

SOCIAL-ECOLOGICAL WELLBEING OF COMMUNITIES ENGAGED IN ECOTOURISM: PERSPECTIVES FROM SAKTENG WILDLIFE SANCTUARY, BHUTAN

Heidi E. Karst and Sanjay K. Nepal

Journal of Sustainable Tourism 29: 1-23

This paper develops an integrative framework of wellbeing through wellbeing perspectives from development studies and social-ecological systems literature. The framework was applied in indigenous communities of a wildlife sanctuary-cum-ecotourism destination in eastern Bhutan. Qualitative methods, including 68 household interviews and six focus groups, were used to assess subjective, socio-relational, material and ecological dimensions of wellbeing in connection to ecotourism and conservation-development debates. Findings suggest the critical yet complex socio-relational aspects of life for wellbeing; the significance of power relations between stakeholders in relation to sense of wellbeing; and the constant trade-offs that correspond to issues of justice and control, particularly with natural resources. The study identifies the need for more research on gender, power and governance in fragile and protected areas engaging in ecotourism. Assessments informed by an integrative wellbeing approach can foster fruitful dialogue on trade-offs and decision-making in ecologically sensitive areas.

Further reading: <https://doi.org/10.1080/09669582.2021.1913500>

ETHNO-VETERINARY PRACTICE FOR THE TREATMENT OF ANIMAL DISEASES IN NEELUM VALLEY, KASHMIR HIMALAYA, PAKISTAN

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Plant species are not only used as fodder or forage but also contribute substantially in the treatment of various health disorders, particularly in livestock. This study is the first quantitative ethnobotanical effort on ethnoveterinary uses of medicinal plants conducted in the Upper Neelum Valley of Azad Jammu & Kashmir, Pakistan. Information pertaining to cure different ailments of animals were collected from 126 informants through semi-structured interviews, group discussion and field walks. In order to identify the plant species used and their preferred habitats, elderly and experienced members of the tribes, locally known 'Budhair' (aged), were interviewed and sometimes accompanied in the field. The data was further analyzed through ethnobotanical indices. In all, 39 plant species, belonging to 31 genera and 21 families were documented which were used by the indigenous communities of Kashmir Himalaya for curing 21 different diseases of 7 different types of livestock. The highest number of ethno-medicinal plants were contributed by the Polygonaceae family, followed by Crassulaceae, Asteraceae and other families. Roots were the most used part of the plant for preparing ethnoveterinary medicines, followed by the aerial parts. The highest frequency of citation (41) and relative frequency of citation (7.32) was recorded for *Saussurea lappa*, followed by *Rumex acetosa* (37/6.61), *Rumex nepalensis* (36/6.43), *Thymus linearis* (28/5.0) and *Angelica cyclocarpa* (28/5.0). The highest use value was recorded for *Saussurea lappa* (0.33), followed by *Rumex acetosa* (0.29), *Rumex nepalensis* (0.29), *Thymus linearis* and *Angelica cyclocarpa* (0.22 each). The current study has made an important contribution towards the preservation of indigenous plants-based knowledge from extinction. The phytochemical and pharmacological investigations of the plants with high use value can be a potential source of novel drugs to treat health problems of animals and humans.

Further reading: <https://doi.org/10.1371/journal.pone.0250114>