

Headlines Himalaya

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Editorial Team: Gaurav Kumar Raut and Anueva Acharya

For the 619th-620th issues of Headlines Himalaya, we reviewed journal articles from ten sources and selected 17 researches from five countries. We selected one research from Nepal and sixteen researches from other Himalayan countries (India, China, Bhutan and Pakistan).

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Nepal-Himalaya

POPULATION STRUCTURE AND REGENERATION OF HIMALAYAN ENDEMIC LARIX SPECIES IN THREE HIGH-ALTITUDE VALLEYS IN NEPAL HIMALAYA

Man Kumar Dhamala, Prakash Chandra Aryal, Madan Krishna Suwal, Sijar Bhatta, and Dinesh Raj Bhujju

Journal of Ecology and Environment 44:22

The Himalayan forests are of great importance to sustain the nature and community resource demands. These forests are facing pressures both from anthropogenic activities and ongoing global climatic changes. Poor natural regeneration has been considered a major problem in mountainous forests. To understand the population structure and regeneration status of *Larix* (*Larix griffithiana* and *Larix himalaica*), we conducted systematic vegetation surveys

in three high-altitude valleys namely Ghunsa (Kanchenjunga Conservation Area, KCA), Langtang (Langtang National Park, LNP), and Tsum (Manaslu Conservation Area, MCA) in Nepal Himalaya. The average values of diameter at breast height (DBH), height, and sapling height were compared for three sites and two species using Kruskal-Wallis test. Population structure was assessed in terms of proportion of seedlings, saplings, and trees. Regeneration was analyzed using graphical representation of frequencies of seedlings, saplings, and trees in histograms. The results showed that the population structure of *Larix* in terms of the proportion of seedling, sapling, and tree varied greatly in the three study areas. KCA had the highest record of seedling, sapling, and tree compared to other two sites. Seedlings were the least among three forms and many plots were without seedlings. We found no seedling in MCA study plots. The plot level average DBH variation among sites was significant (Kruskal-Wallis $\chi^2 = 7.813$, $df = 2$, $p = 0.02$) as was between species (Kruskal-Wallis $\chi^2 = 5.9829$, $df = 1$, $p = 0.014$). Similarly, the variation in average tree height was significant (Kruskal-Wallis $\chi^2 = 134.23$, $df = 2$, $p < 0.001$) among sites as well as between species (Kruskal-Wallis $\chi^2 = 128.01$, $df = 1$, $p < 0.001$). All the sites showed reverse J-shaped curve but more pronounced for KCA and MCA. In comparing the two species, *Larix griffithiana* has clear reverse J-shaped diameter distribution but not *Larix himalaica*. The varied responses of *Larix* manifested through regeneration status from spatially distinct areas show that regeneration limitations might be more pronounced in the future. In all the three studied valleys, regeneration of *Larix* is found to be problematic and specifically for *Larix griffithiana* in MCA and *Larix himalaica* in LNP. To address the issues of disturbances, especially serious in LNP, management interventions are recommended to sustain the unique Himalayan endemic conifer.

For further reading: <https://doi.org/10.1186/s41610-020-00166-7>

India-Himalaya

LANDSCAPE TRANSFORMATION OF AN URBAN WETLAND IN KASHMIR HIMALAYA, INDIA USING HIGH-RESOLUTION REMOTE SENSING DATA, GEOSPATIAL MODELING, AND GROUND OBSERVATIONS OVER THE LAST 5 DECADES (1965–2018)

Irfan Rashid and Sheikh Aneaus

Environmental Monitoring and Assessment 192: 1-14

Wetlands are among the most vulnerable and dynamic ecosystems of the world. Any change in the anthropogenic footprint or climate affects the health of these pristine ecologically and socioeconomically important ecosystems. In the present study, land use land cover changes (LULCC) and fragmentation of natural landscape changes in an urban wetland, Khushalsar, located in the heart of the Srinagar City, were assessed using high-resolution satellite data, geospatial modeling approach, and ground observations over the last ~5 decades (1965 and 2018). The

spatiotemporal changes in LULC of the wetland were assessed for 3 time periods that include 1965–1980, 1980–2018, and 1965–2018. Additionally, landscape fragmentation tool (LFT) was used to quantify fragmentation of land cover. The analysis of LULCC indicated that built-up areas in the vicinity of the wetland increased by 510% between 1965 and 2018. The aquatic vegetation and marshy lands increased by 150% and 33% respectively. The area under agriculture, plantation, open water, and barren lands decreased mostly taken over by built-up areas. Within the wetland, the area under open water spread reduced by 75% while the aquatic vegetation increased by 150% from 1965 to 2018. The built-up areas including roads also showed a substantial increase. The LFT analysis revealed four categories of landscapes i.e., patch, edge, perforated, and core areas. Since the natural land cover types were taken over by land use predominantly built-up areas, the core natural areas and perforated landscapes in the Khushalsar shrunk by 34% and 94% respectively indicating fragmentation of natural environment. The lack of sewage treatment facility, reckless unplanned urbanization within and in the vicinity of the wetland, is responsible for the degradation of the Khushalsar wetland.

For further reading: <https://doi.org/10.1007/s10661-020-08597-4>

RICHNESS OF NON-TIMBER FOREST PRODUCTS IN HIMALAYAN COMMUNITIES—DIVERSITY, DISTRIBUTION, USE PATTERN AND CONSERVATION STATUS

Haseeb Ul Rashid Masoodi and R. C. Sundriyal

Journal of Ethnobiology and Ethnomedicine 16: 1-15

Non-timber forest products (NTFPs) are important resources for sustenance of rural communities; a systematic planning to manage diverse NTFPs may immensely contribute to food and livelihood security of forest dwellers. Considering this, the present study has been undertaken in the Himachal Pradesh state in north India. It aims to provide detailed information on diversity, distribution, use pattern, and conservation status of selected NTFPs that have market potential, and suggest a possible way for their sustained management and possible role in livelihood upgradation of dependent communities. An inventory of NTFP species was prepared by collecting secondary information from published scientific studies in journals, books, and other periodicals as well as species being traded as per Forest department records. Search on various online databases were also used (Scopus, Google Scholar, PubMed, ISI Web of Science) using specific search terms such as “non-timber forest products,” “NTFPs,” “medicinal plants,” “wild edible plants,” and “Himachal Pradesh,” “Western Himalaya,” and “Northwest Himalaya.” A list of potential NTFPs was prepared having market value. To evaluate the relative usefulness of different species, a quantitative valuation was also used by calculating various indices, such as use value (UV), relative frequency of citation (RFC), relative importance index (RI), cultural importance index (CI), and cultural value (CV). A total of 811 species have been screened that has significant potential for the State, and categorized in 18 groups as per their use. The family use value was highest for Asteraceae (FUV = 76.75). Among plant parts used, whole plants, roots (including rhizomes and tubers), leaves, flowers, fruits, seeds, stems, and barks were used by the forest dwellers.

Maximum NTFPs were collected from the warm temperate zone, followed by the temperate, sub-alpine, sub-tropical, and alpine zones. Sixty-one percent of species had medicinal importance, followed by species used for food and fodder purposes. Although species richness of medicinal plants decreased with altitude, however, most plants extracted from high altitudes were highvalue species fetching better income. As many as 125 NTFPs were identified under the diverse level of threats according to IUCN criteria and as per the local stakeholders' perceptions. High dependence on NTFPs by poor and marginal communities for domestic needs as well as market demand of selected species leads to create excessive pressure on them. Unfortunately, the state agencies are not having any robust conservation plan for NTFPs. For long-term management of NTFPs sector, a species-specific conservation strategy, proper harvesting protocol, cultivation practices, the supply of quality planting material, product development and diversification, value chain development, and ensured market is greatly desired. This will not only lead to conserving NTFPs resources in their natural habitats but also lead a sustainable livelihood generation for forest dwellers.

For further reading: <https://doi.org/10.1186/s13002-020-00405-0>

DIMENSIONS OF CHANGING PERCEPTION TOWARDS WILDLIFE CONSERVATION IN EAST SIANG DISTRICT OF ARUNACHAL PRADESH, EASTERN HIMALAYAS

Joanica Delicia Jyrwa, Bheem Dutt Joshi, Avijit Ghosh, Yomto Mayi, Mihin Nipa, Ngilyang Anga, Mary Pali, Mukesh Thakur, Kailash Chandra, and Lalit Kumar Sharma

Global Ecology and Conservation 24: e01265

Perception towards the wildlife conservation of locals determines the future of conservation programs, hence we assessed the perception of forest communities in East Siang district towards wildlife conservation in their surroundings. We collected questionnaire data from 1079 respondents of East Siang District, Arunachal Pradesh during Nov 2018 to Feb 2019. The influence of different parameters including socio-demographic, socio-economic and human-wildlife interactions on local communities opinions concerning wildlife conservation were examined. The respondents provided wide and diversified responses about the significance of wildlife for different purposes such as food consumption (hunting) to mixed concerns (aesthetic, moral and future values) and ecological balance. The responses were recorded and tested independent variables, namely age, gender, household size, education, house type, crop damages, livestock attacks, human attacks, village, circles and occupation. The ANCOVA test revealed that villages ($p=0.000$), circles ($p=0.001$), education ($p=0.012$), human attacks ($p=0.003$) and gender ($p=0.033$) were significantly associated with their opinions. Whereas the socio-economic status of locals also had a role in shaping perceptions about the wildlife conservation. The respondents belonging to the lower socio-economic classes have the negative attitude while upper classes have a positive attitude. Our research suggests that primary (adjusted standardized residual: $asr = 2.3$) and middle school ($asr=2.7$) educated male respondents consider wildlife as food resources ($asr = 3.7$). However, the graduates believed that wildlife has a role in ecological balance ($asr = 6.6$). The increase in wildlife attacks on humans is unlikely to support conservation ($asr = 4.5$). It is suggested to

enhance awareness creations, adoption of best practices to mitigate wildlife-human conflict and alternative livelihood for promoting wildlife conservation in the study landscape.

For further reading: <https://doi.org/10.1016/j.gecco.2020.e01265>

CARBON SEQUESTRATION IN THE BIO-EDAPHIC ECOSYSTEM OF NATIONAL HIGHWAY-27 IN GUWAHATI, ASSAM, INDIA

A. Bhattacharya, K. Saikia, M. Takhelmayum, and P. Sarkar

Heliyon 6: E04969.

Vehicular pollution in cities is engendering the need to enhance the sequestration of CO₂ through bio-edaphic factors, such as trees and soil. Hence, this pioneering study aimed to analyze the interdependencies of the bio-edaphic ecosystem during carbon sequestration on a national highway in Guwahati, Assam, India. To quantify the tree carbon stock, soil physicochemical properties, soil nutrients, bulk density, organic carbon, and soil carbon stock, trees with diameters at breast height (dbh) ≥ 2 cm and soil samples from different depths (0–15 cm, 15–30 cm, and 30–45 cm) were taken from six areas spread over 36 plots of equal size (2 × 10 m) arranged in a zig-zag manner. The studied parameters were compared among the different areas. It was found that the tree and soil carbon stock, along with soil nutrients, were greater in the Garchuk-Lokhra area (sample area-4). A significantly strong correlation was observed between the soil carbon stock and the above and below-ground biomass of trees (AGB, $r = 0.865$; BGB, $r = 0.847$), which indicated the co-dependencies of the bio-edaphic ecosystem in accumulating carbon. *Peltophorum ferrugineum* (Decne.) Benth is recommended for planting because it has emerged as a tolerant species and has the greatest carbon storage potential. The bio-edaphic ecosystem of the national highway is now on a carbon-friendly trajectory that follows the UNFCCC guidelines and the REDD+ (reducing emissions from deforestation and forest degradation) strategy. However further research on carbon budgeting is required.

For further reading: <https://doi.org/10.1016/j.heliyon.2020.e04969>

China Himalaya

SOCIO-ENVIRONMENTAL DYNAMICS OF ALPINE GRASSLANDS, STEPPES AND MEADOWS OF THE QINGHAI–TIBETAN PLATEAU, CHINA: A COMMENTARY

Haiying Feng and Victor R. Squires

Applied Science 10: 6488

Alpine grasslands are a common feature on the extensive (2.6 million km²) Qinghai–Tibet plateau in western and southwestern China. These grasslands are characterized by their ability to thrive at high altitudes and in areas with

short growing seasons and low humidity. Alpine steppe and alpine meadow are the principal plant Formations supporting a rich species mix of grass and forb species, many of them endemic. Alpine grasslands are the mainstay of pastoralism where yaks and hardy Tibetan sheep and Bactrian camels are the favored livestock in the cold arid region. It is not only their importance to local semi nomadic herders, but their role as headwaters of nine major rivers that provide water to more than one billion people in China and in neighboring countries in south and south-east Asia and beyond. Grasslands in this region were heavily utilized in recent decades and are facing accelerated land degradation. Government and herder responses, although quite different, are being implemented as climate change and the transition to the market economy proceeds apace. Problems and prospects for alpine grasslands and the management regimes being imposed (including sedentarization, resettlement and global warming are briefly discussed.

For further reading: <https://doi.org/10.3390/app10186488>

UNEXPECTED HEAVY METAL POLLUTION IN WETLAND SOILS ALONG THE YARLUNG TSANGBO RIVER IN TIBET, CHINA: ASSESSMENT AND SOURCE APPORTIONMENT

Zhongsheng Zhang, Qianjin Che, and Zhenshan Xue

Water, Air, & Soil Pollution 231: 1-11

The Qinghai-Tibetan Plateau (QTP), as the third pole, has recently experienced unexpected heavy metal pollution. However, few were available on heavy metal pollution and source apportionment in regions near South Asia, where the economy is currently experiencing rapid development. This paper evaluated heavy metal pollution in wetland soils along the Yarlung Tsangbo River (YTR), the largest river in the QTP. Results indicated minor contamination levels of Cu, Pb, Zn, Hg, As, Mn, and Cr. However, Cd pollution was serious and was the main pollutant. Nemerow synthesis index values (*PN*) were relatively high and ranged from 4.54 to 10.47 caused by high loading from Cd and Zn. Roughly 92% Pb, 89% Cr, and 89% Mn were from natural sources while 86% Cd and 61% Zn were from anthropogenic sources in wetland soils along the YTR. Differences in heavy metal contents and sedimentation rates were accentuated by the metal accumulation rates of each site. Cd, Zn, and Hg accumulation rates were estimated to $0.966 \text{ mg m}^{-2} \text{ year}^{-1}$, $0.187 \text{ g m}^{-2} \text{ year}^{-1}$, and $0.061 \text{ mg m}^{-2} \text{ year}^{-1}$ in the 1800s and increased to $5.351 \text{ mg m}^{-2} \text{ year}^{-1}$, $1.144 \text{ g m}^{-2} \text{ year}^{-1}$, and $0.263 \text{ mg m}^{-2} \text{ year}^{-1}$ in the 2000s, respectively. This implied unexpected heavy metal pollution in wetland soils along the YTR basin and more attention should be paid to avoid the risk of heavy metal pollution here.

For further reading: <https://doi.org/10.1007/s11270-020-04851-0>

RECENT ABNORMAL HYDROLOGIC BEHAVIOR OF TIBETAN LAKES OBSERVED BY MULTI-MISSION ALTIMETERS

Pengfei Zhan, Chunqiao Song, Jida Wang, Wenkai Li, Linghong Ke, Kai Liu, and Tan Chen

Inland lakes in the Tibetan Plateau (TP) with closed catchments and minimal human disturbance are an important indicator of climate change. However, the examination of changes in the spatiotemporal patterns of Tibetan lakes, especially water level variations, is limited due to inadequate access to measurements. This obstacle has been improved by the development of satellite altimetry observations. The more recent studies revealed that the trend of central TP to grow decreased or reversed between 2010 and 2016. However, thus far, this trend has not been investigated to determine whether this pattern would last for the following years. This study aims to combine the traditional (launched before 2010, e.g., TOPEX/POSEIDON, ERS-1, ERS-2, Jason-1/-2, and Envisat) and recently advanced (launched after 2010, e.g., SARAL and Sentinel-3) altimetry observations to understand the Tibetan lake changes further in recent years. Therefore, we acquired information on the continuous lake level changes in Tibetan lakes using the lake level sequence integration method based on multisource altimetry satellites. The results revealed that water level changes in 22 examined lakes showed abrupt rises in 2016–2018, but the onsets and magnitudes of the rises varied among the lakes. During the study period, the water levels of the lakes (except Nam Co) revealed a drastic rising tendency with a mean rate of 0.74 m/a, which was remarkably higher than the average rate of water level rise over the period 2010–2015 (approximately 0.28 m/a). Specifically, the water level of the nine lakes in the Northern TP (NTP) displayed a significant rising trend, with an average rate of 0.82 m/a. In the Central TP (CTP), the lake level changes were generally divided into two categories. The water levels for the lakes in the Western CTP rose rapidly, while, in the Eastern CTP, the lake water levels rose slowly, with an average rising rate less than 0.40 m/a. The water levels for the lakes in the Northeastern TP (NETP) and Northwestern TP (NWTP) kept a stable rising tendency. According to the results of the climate analysis, the spatial differences of the lake level rise rates were primarily caused by the spatial and temporal changes of precipitation over the TP.

For further reading: <https://doi.org/10.3390/rs12182986>

CASCADING IMPLICATIONS OF A SINGLE CLIMATE CHANGE EVENT FOR FRAGILE ECOSYSTEMS ON THE QINGHAI-TIBETAN PLATEAU

Shanlong Lu, Fu Chen, Jinfeng Zhou, Alice C. Hughes, Xiaoqi Ma, and Wenwen Gao

Ecosphere 11: e03243

With changing climates globally, we see changes in not just average conditions, but also in extreme events, and such events require special attention due to their unpredictable yet significant impact on native biotas. One such event is the formation of a landscape scar at Zonag Lake caused by a climate change-induced outburst flooding event that occurred on 15 September 2011. During the winter, the scar region became a new birthplace for sandstorms, and since the flooding, remote sensing monitoring shows that between 2011 and 2020, there were 285 sandstorm days (between November and March), relative to none prior. The outburst flooding event and consequential sandstorms

threaten the key lambing area of the Tibetan antelope (Chiru), affect the water balance of the Zonag Lake and downstream lakes, and may even impact on the flow in the Yangtze River. Active human intervention may be needed to repair this new desert spit and reverse the slew of consequences which may otherwise lead to significant population declines in one of the major Chiru breeding grounds due to the progressive loss of vegetation productivity across their main breeding area.

For further reading: <https://doi.org/10.1002/ecs2.3243>

SHORT-CHAIN CHLORINATED PARAFFINS IN SOILS INDICATE LANDFILLS AS LOCAL SOURCES IN THE TIBETAN PLATEAU

Jun Li, Liang Xu, Yihui Zhou, Ge Yin, Yan Wu, Guo-Li Yuan, and Xinyu Du

Chemosphere 263: 128341

Background contamination levels of contemporary persistent organic pollutants (POPs) may be elevated due to local discharges, and hence it is of high importance to assess and monitor them in alpine and Polar Regions. This study investigated the role of waste disposal in the Tibetan plateau as the local source of short-chain chlorinated paraffins (SCCPs). SCCPs were determined in soils from the urban landfill and rural dumpsites, with a concentration range of 56.8–1348 ng/g dw. The gradient descent of SCCP levels from Lhasa landfill to the surrounding soils with increasing distances suggested a significant SCCP release from waste disposal. The transport pattern was well fitted by the Boltzmann equation after normalization in terms of soil organic carbon contents. Compared to the landfill cells closed in early years, the recently closed cells contained higher concentrations but lower proportions of the short-chain congener groups, likely reflecting the SCCP use history in Tibet. In open-burning dumpsites, higher SCCP levels and dominance of lighter congener groups indicates that such crude waste treatment process might cause an extra release of volatile SCCPs. This study elucidates local SCCP inputs to the background environment, and demonstrates that both urbanization and badly-managed landfill have been contributing to the presence of contemporary POPs in the Tibetan Plateau.

For further reading: <https://doi.org/10.1016/j.chemosphere.2020.128341>

MOISTURE-DRIVEN CHANGES IN THE SENSITIVITY OF THE RADIAL GROWTH OF *PICEA CRASSIFOLIA* TO TEMPERATURE, NORTHEASTERN TIBETAN PLATEAU

Wenqi Song, Changcheng Mu, Yuandong Zhang, Xu Zhang, Zongshan Li, Huiying Zhao, and Xiaochun Wang

Dendrochronologia 64: 125761

Precipitation is one of the most important climate factors controlling tree growth, yet it is not fully understood how changes in precipitation affect the relationship between growth and temperature. On the northeastern edge of the

Tibetan Plateau, nine tree-ring chronologies of *Picea crassifolia* were developed along a precipitation gradient from semi-arid (mean annual precipitation, 255 mm) to semi-humid (710 mm). We analyze the growth-climate relationships along this precipitation gradient and assess whether these associations are regulated by local precipitation. From 1960 to 2014, temperature increased significantly while precipitation remained stable at the nine sampling sites. The radial growth of *P. crassifolia* decreased at the semi-arid sites but increased at the semi-humid sites. Growth-temperature relationships gradually changed from negative to positive along the precipitation gradient (from dry to wet sites), particularly during summer. The moist *P. crassifolia* sites are also characterized by positive correlations with the Palmer Drought Severity Index. The temporal growth-temperature relationships varied significantly among the different spruce sites over the last five decades. Although temperature remains the main factor controlling the growth of *P. crassifolia*, local precipitation variability is becoming increasingly important. Our findings indicate that considering species distribution areas supports the analyses of the impact of climate change on tree growth.

For further reading: <https://doi.org/10.1016/j.dendro.2020.125761>

SELECTION SIGNATURES ANALYSIS REVEALS GENES ASSOCIATED WITH HIGH-ALTITUDE ADAPTATION IN TIBETAN GOATS FROM NAGQU, TIBET

Meilin Jin, Jian Lu, Xiaojuan Fei, Zengkui Lu, Kai Quan, Yongbin Liu, Mingxing Chu, Ran Di, Caihong Wei, and Huihua Wang

Animals 10: 1599

Tibetan goat is an ancient breed, which inhabits the adverse conditions of the plateaus in China. To investigate the role of selection in shaping its genomes, we genotyped Tibetan goats (Nagqu Prefecture, above 4500 m) and three lowland populations (Xinjiang goats, Taihang goats and Huanghuai goats). The result of PCA, neighbor-joining (N-J) tree and model-based clustering showed that the genetic structure between the Tibetan goat and the three lowland populations has significant difference. As demonstrated by the *di* statistic, we found that some genes were related to the high-altitude adaptation of Tibetan goats. Functional analysis revealed that these genes were enriched in the VEGF (vascular endothelial growth factor) signaling pathway and melanoma, suggesting that nine genes (*FGF2*, *EGFR*, *AKT1*, *PTEN*, *MITF*, *ENPEP*, *SIRT6*, *KDR*, and *CDC42*) might have important roles in the high-altitude adaptation of Nagqu Tibetan goats. We also found that the *LEPR* gene was under the strongest selection (*di* value = 16.70), and it could induce upregulation of the hypoxic ventilatory response. In addition, five genes (*LEPR*, *LDB1*, *EGFR*, *NOX4* and *FGF2*) with high *di* values were analyzed using q-PCR. Among them, we found that *LEPR*, *LDB1* and *FGF2* exhibited higher expression in the lungs of the Tibetan goats; *LEPR*, *EGFR* and *LDB1* exhibited higher expression in the hearts of the Huanghuai goat. Our results suggest that *LEPR*, *LDB1*, *EGFR* and *FGF2* genes may be related to the high-altitude adaptation of the goats. These findings

improve our understanding of the selection of the high-altitude adaptability of the Nagqu Tibetan goats and provide new theoretical knowledge for the conservation and utilization of germplasm resources.

For further reading: <https://doi.org/10.3390/ani10091599>

DYNAMICS OF GLACIER SURFACE VELOCITY AND ICE THICKNESS FOR MARITIME GLACIERS IN THE SOUTHEASTERN TIBETAN PLATEAU

Kunpeng Wu, Shiyin Liu, Yu Zhu, Qiao Liu, and Zongli Jiang

Journal of Hydrology 590: 125527

Influenced by climate warming, glacial hazards become increasingly frequent after glacier mass loss in the southeastern Tibetan Plateau. Investigations of mountain glacier surface velocities and volume are of great significance. However, no information is given regarding the specific changes in ice flow to climate warming, the spatiotemporal variations of glacier surface velocity and ice thickness are still unclear. In this study, offset tracking was used to measure glacier surface velocity in the southeastern Tibetan Plateau using Landsat TM/ETM+/OLI imagery from 1990 to 2018. And then spatially-distributed glacier ice thickness was estimated from mass-balance distribution data, glacier surface velocities and the principles of ice-flow. Results show that all maritime glaciers velocity in study area experienced a clear regional slowdown from 1991 to 2018, with robust overall trends of $-5.26 \text{ m a}^{-1} \text{ dec}^{-1}$ ($-19.8\% \text{ dec}^{-1}$) and $7.16 \text{ m a}^{-1} \text{ dec}^{-1}$ ($25.2\% \text{ dec}^{-1}$) at elevations below and above 4 600 m a.s.l., respectively. Total volume for glaciers with an area of 954.34 km² was found to be $\sim 86.64 \pm 11.09 \text{ km}^3$ in 2013, corresponding to an average ice thickness of $\sim 91 \pm 12 \text{ m}$. The average ice thickness thinned by $0.62\% \text{ a}^{-1}$ during 2000–2013, and an accelerated melting can be expected in the long term and then glacier volume decreases more rapidly than in the last decades.

For further reading: <https://doi.org/10.1016/j.jhydrol.2020.125527>

TRANSCRIPTOME ANALYSIS IDENTIFIED LONG NON-CODING RNAs INVOLVED IN THE ADAPTION OF YAK TO HIGH-ALTITUDE ENVIRONMENTS

Jin-Wei Xin, Zhi-Xin Chai, Cheng-Fu Zhang, Yu-Mei Yang, Qiang Zhang, Yong Zhu, Han-Wen Cao, Cidan Yang Ji, Jin-Cheng Zhong, and Qiu-Mei Ji

Royal Society Open Science 7: 200625

The mechanisms underlying yak adaptation to high-altitude environments have been investigated using various methods, but no report has focused on long non-coding RNA (lncRNA). In the present study, lncRNAs were screened from the gluteus transcriptomes of yak and their transcriptional levels were compared with those in Sanjiang cattle, Holstein cattle and Tibetan cattle. The potential target genes of the differentially expressed lncRNAs between

species/strains were predicted using *cis* and *trans* models. Based on *cis*-regulated target genes, no KEGG pathway was significantly enriched. Based on *trans*-regulated target genes, 11 KEGG pathways in relation to energy metabolism and three KEGG pathways associated with muscle contraction were significantly enriched. Compared with cattle strains, transcriptional levels of acyl-CoA dehydrogenase, acyl-CoA-binding protein, 3-hydroxyacyl-CoA dehydrogenase were relatively higher and those of glyceraldehyde 3-phosphate dehydrogenase, phosphoglycerate mutase 1, pyruvate kinase and lactate/malate dehydrogenase were relatively lower in yak, suggesting that yaks activated fatty acid oxidation but inhibited glucose oxidation and glycolysis. Besides, NADH dehydrogenase and ATP synthase showed lower transcriptional levels in yak than in cattle, which might protect muscle tissues from deterioration caused by reactive oxygen species (ROS). Compared with cattle strains, the higher transcriptional level of glyoxalase in yak might contribute to dicarbonyl stress resistance. Voltage-dependent calcium channel/calcium release channel showed a lower level in yak than in cattle strains, which could reduce the Ca²⁺ influx and subsequently decrease the risk of hypertension. However, levels of EF-hand and myosin were higher in yak than in cattle strains, which might enhance the negative effects of reduced Ca²⁺ on muscle contraction. Overall, the present study identified lncRNAs and proposed their potential regulatory functions in yak.

For further reading: <https://doi.org/10.1098/rsos.200625>

Bhutan-Himalaya

SEISMIC OBSERVATIONS, NUMERICAL MODELING, AND GEOMORPHIC ANALYSIS OF A GLACIER LAKE OUTBURST FLOOD IN THE HIMALAYAS

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Glacial lake outburst floods (GLOFs) are a substantial hazard for downstream communities in vulnerable regions, yet unpredictable triggers and remote source locations make GLOF dynamics difficult to measure and quantify. Here, we revisit a destructive GLOF that occurred in Bhutan in 1994 and apply cross-correlation-based seismic analyses to track the evolution of the GLOF remotely (~100 kilometers from the source region). We use the seismic observations along with eyewitness reports and a downstream gauge station to constrain a numerical flood model and then assess geomorphic change and current state of the unstable lakes via satellite imagery. Coherent seismic energy is evident from 1 to 5 hertz beginning approximately 5 hours before the flood impacted Punakha village, which originated at the source lake and advanced down the valley during the GLOF duration. Our analysis highlights potential benefits of using real-time seismic monitoring to improve early warning systems.

For further reading: <https://doi.org/10.1126/sciadv.aba3645>

Pakistan- Himalaya

MODELING SPATIO-TEMPORAL LAND TRANSFORMATION AND ITS ASSOCIATED IMPACTS ON LAND SURFACE TEMPERATURE (LST)

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Land use land cover (LULC) of city regions is strongly affected by urbanization and affects the thermal environment of urban centers by influencing the surface temperature of core city areas and their surroundings. These issues are addressed in the current study, which focuses on two provincial capitals in Pakistan, i.e., Lahore and Peshawar. Using Landsat data, LULC is determined with the aim to (a) examine the spatio-temporal changes in LULC over a period of 20 years from 1998 to 2018 using a CA-Markov model, (b) predict the future scenarios of LULC changes for the years 2023 and 2028, and (c) study the evolution of different LULC categories and investigate its impacts on land surface temperature (LST). The results for Peshawar city indicate the significant expansion in vegetation and built-up area replacing barren land. The vegetation cover and urban area of Peshawar have increased by 25.6%, and 16.3% respectively. In contrast, Lahore city urban land has expanded by 11.2% while vegetation cover decreased by (22.6%). These transitions between LULC classes also affect the LST in the study areas. Transformation of vegetation cover and water surface into built-up areas or barren land results in the increase in the LST. In contrast, the transformation of urban areas and barren land into vegetation cover or water results in the decrease in LST. The different LULC evolutions in Lahore and Peshawar clearly indicate their effects on the thermal environment, with an increasing LST trend in Lahore and a decrease in Peshawar. This study provides a baseline reference to urban planners and policymakers for informed decisions.

For further reading: <https://doi.org/10.3390/rs12182987>

GEOPHYSICAL AND GEOTECHNICAL CHARACTERIZATION OF SHALLOW SUBSURFACE SOIL: A CASE STUDY OF UNIVERSITY OF PESHAWAR AND SURROUNDING AREAS

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The proper design and successful construction of engineered structures require determination of the engineering properties of the soil. These properties, however, are conventionally determined in the laboratory using soil samples collected from the construction site. The collection of soil samples is generally an expensive and time-

consuming activity, while the extraction of an undisturbed soil sample is difficult. Furthermore, there are wide variations in the temporal and spatial properties of soil and their accurate evaluation requires high-density sampling. Recently, electric resistivity surveying has attracted much attention. It is commonly applied in the analysis of engineering sites, as it is rapid, cost-effective, and non-destructive. Based on this hypothesis, electrical resistivity was measured at four boreholes in the areas surrounding the University of Peshawar using standard methods of resistivity survey, i.e., Schlumberger electrode configuration. The resistivity data that was obtained by vertical electrical sounding (VES) from the fieldwork was correlated with geotechnical data obtained through the analysis of soil samples in the laboratory. Electrical resistivity had an inverse relationship with gravimetric moisture content and cohesion, with the highest regression coefficients observed in the case of GYM-UAP and Girls' Hostel-UAP ($R^2 = 0.97$ and 0.96) boreholes, respectively. Moreover, electrical resistivity had a significant linear correlation with the angle of internal friction and standard penetration test-N (SPT-N) values, with the highest regression coefficient of GYM-UAP ($R^2 = 0.99$) and Girls' Hostel-UAP ($R^2 = 0.95$), respectively. In conclusion, the obtained relationships between electrical resistivity and different geotechnical properties could be adopted for the assessment of geotechnical properties of soils, especially when many samples are difficult to obtain.

For further reading: <https://doi.org/10.1007/s12517-020-05947-x>