

# Headlines Himalaya

June 01 – June 15 (2022)

No. 701 – 702

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For the 701<sup>th</sup> - 702<sup>th</sup> issues of Headlines Himalaya, we reviewed researches from seven sources and selected 12 researches from five countries. We selected three researches from Nepal and nine researches from other Himalayan Countries (India, China, Bhutan and Pakistan).

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- NEPAL**      *ENERGY AND GREENHOUSE GAS FOOTPRINT ANALYSIS OF CONVENTIONAL AND REDUCED TILLAGE PRACTICES IN RAINFED AND IRRIGATED RICE–WHEAT SYSTEMS*
- POST-RELEASE GROWTH OF CAPTIVE-REARED GHARIAL GAVIALIS GANGETICUS (GMELIN, 1789) (REPTILIA: CROCODILIA: GAVIALIDAE) IN CHITWAN NATIONAL PARK, NEPAL*
- AN ASSESSMENT OF CLIMATE CHANGE IMPACTS ON WATER SUFFICIENCY: THE CASE OF EXTENDED EAST RAPTI WATERSHED, NEPAL*
- INDIA**      *IMPACT OF UNSUSTAINABLE ENVIRONMENTAL CONDITIONS DUE TO VEHICULAR EMISSIONS ON ASSOCIATED LIFETIME CANCER RISK IN INDIA: A NOVEL APPROACH*
- A BENCHMARK STUDY ON ECONOMIC IMPACT OF NEEM COATED UREA ON INDIAN AGRICULTURE*
- ESTIMATION OF RAINFALL-INDUCED SURFACE RUNOFF FOR THE ASSAM REGION, INDIA, USING THE GIS-BASED NRCS-CN METHOD*
- CHINA**      *MANAGEMENT PRACTICES SHOULD BE STRENGTHENED IN HIGH POTENTIAL VEGETATION PRODUCTIVITY AREAS BASED ON VEGETATION PHENOLOGY ASSESSMENT ON THE QINGHAI-TIBET PLATEAU*
- CHARACTERISTICS OF CHANGES IN URBAN LAND USE AND EFFICIENCY EVALUATION IN THE QINGHAI–TIBET PLATEAU FROM 1990 TO 2020*
- MITIGATION STRATEGIES FOR HUMAN–TIBETAN BROWN BEAR (URSUS ARCTOS PRUINOSUS) CONFLICTS IN THE HINTERLAND OF THE QINGHAI-TIBETAN PLATEAU*
- LIVELIHOOD RESILIENCE IN PASTORAL COMMUNITIES: METHODOLOGICAL AND FIELD INSIGHTS FROM QINGHAI-TIBETAN PLATEAU*
- BHUTAN**      *EMPLOYING CITIZEN SCIENCE TO UNDERSTAND AMPHIBIAN AND REPTILE DIVERSITY AND DISTRIBUTION IN THE HIMALAYAN KINGDOM OF BHUTAN*

**PAKISTAN** SPATIO-TEMPORAL VARIATION OF SEASONAL HEAT ISLANDS MAPPING OF PAKISTAN DURING 2000–2019, USING DAY-TIME AND NIGHT-TIME LAND SURFACE TEMPERATURES MODIS AND METEOROLOGICAL STATIONS DATA

## Nepal-Himalaya

### ENERGY AND GREENHOUSE GAS FOOTPRINT ANALYSIS OF CONVENTIONAL AND REDUCED TILLAGE PRACTICES IN RAINFED AND IRRIGATED RICE–WHEAT SYSTEMS

Shikha Thapa Magar, Jagadish Timsina, Krishna Prasad Devkota, and Liang Weili

*Paddy and Water Environment* 20: 1-15

Conventional tillage practices in rice–wheat cropping systems of the Indo-Gangetic Plains are not only energy-intensive but also release large quantities of greenhouse gases (GHGs) resulting in calls for more sustainable tillage practices. To assess total energy use, energy-use efficiency, GHG emissions and total global warming potential, three reduced tillage rice–wheat systems were compared to standard conventional practice. Dry direct-seeded rice, unpuddled transplanted rice and puddled transplanted rice were paired with zero tillage wheat systems for two years in 84 on-farm trials in two Terai districts of Nepal, and compared to the puddled transplanted rice-conventional tillage wheat. In both districts, the total energy use was lower ( $p < 0.05$ ) by 17–18% in dry direct-seeded rice and 15–17% in unpuddled transplanted rice than in puddled transplanted rice, and lower by 12.5–19% in zero tillage wheat than in conventional tillage. In both crops, the total global warming potential was lower for reduced tillage practices compared with the conventional counterparts. Higher energy-use efficiency with lower global warming potential could be a resilient and risk minimization strategy for crops in the rice–wheat systems established with reduced tillage under both irrigated and rainfed environments. To offer the most promising incentive for a transition from conventional to reduced tillage practices, availability and optimum use of herbicides, easy access to planting machines, and availability of skilled service providers are necessary.

For further reading: <https://doi.org/10.1007/s10333-022-00902-w>

### POST-RELEASE GROWTH OF CAPTIVE-REARED GHARIAL *GAVIALIS GANGETICUS* (GMELIN, 1789) (REPTILIA: CROCODILIA: GAVIALIDAE) IN CHITWAN NATIONAL PARK, NEPAL

Bed Bahadur Khadka, Ashish Bashyal, and Phoebe Griffith

*Journal of Threatened Taxa* 14: 21002-21009

Supplementation of wild populations of the Critically Endangered Gharial *Gavialis gangeticus* with individuals reared in captivity is a widely used conservation management tool in Nepal and India, although its efficacy is uncertain. Measuring post-release growth in Gharial can provide valuable information on acclimation of captive-reared Gharial to the wild and provide growth rates to inform population recovery models. We studied post-release growth of Gharial reared in the Gharial Conservation Breeding Centre, Nepal, following their release into the Chitwan National Park. We used recapture data from known individuals to determine growth and change of mass for 26 Gharial recaptured 0.5–10 years after release. We found that Gharial recaptured two or more years post-release had increased in mass and length despite being over six years old at release, however there was a triangular relationship between time since release and growth: some Gharial had grown very slowly, whilst others had grown much faster. All Gharial recaptured less than two years since release had lost mass and had negligible

growth in total length. This data show that there is considerable variation in post-release growth rates, which will lead to some individuals being very old before they reach a potentially mature size class, with unknown implications for reproduction. This variation is important for predicting or modelling recovery in populations where the release of Gharial from captivity is a management tool. Our results also suggest the two years after release are an acclimation phase—when Gharial lose mass and do not grow—which should be considered by release strategies in order to give Gharial the best chance of survival after release.

For further reading: <https://doi.org/10.11609/jott.6692.14.5.21002-21009>

### **AN ASSESSMENT OF CLIMATE CHANGE IMPACTS ON WATER SUFFICIENCY: THE CASE OF EXTENDED EAST RAPTI WATERSHED, NEPAL**

Anupama Ray, Vishnu Prasad Pandey, and Bhesh Raj Thapa

*Environmental Research* 212: 113434

An understanding of water sufficiency provides a basis for informed-planning, development and management of water resources. This study assessed spatio-temporal distribution in water sufficiency in the Extended East Rapti watershed in Nepal. The “Palika” (local government unit) is considered as a spatial-scale and seasons and future periods as temporal-scale. The water sufficiency was evaluated based on water sufficiency ratio (WSR) and water stress index (WSI). A hydrological model was developed to simulate water availability. An ensemble of multiple Regional Climate Models was used for assessing climate change impacts. Results showed water sufficiency by mid-century is projected to decrease; WSR by 40% and WSI by 61%. Despite projected decrease in water sufficiency, annually available water resources are projected as sufficient for the demands until the mid-century, however, seasonal variability and scarcity in future is projected in most Palikas. Such results are useful for water security planning in the Palikas.

For further reading: <https://doi.org/10.1016/j.envres.2022.113434>

## **India-Himalaya**

### **IMPACT OF UNSUSTAINABLE ENVIRONMENTAL CONDITIONS DUE TO VEHICULAR EMISSIONS ON ASSOCIATED LIFETIME CANCER RISK IN INDIA: A NOVEL APPROACH**

Parteek Singh Thind, Deepak Kumar, Sandeep Singh, Jasgurpreet Singh Chohan, Raman Kumar, Shubham Sharma, Changhe Li, Gianpaolo Di Bona, Antonio Forcina, and Luca Silvestri

*International Journal of Environmental Research and Public Health* 19: 6459

The Indian Western Himalayas (IWHs) are a world-famous tourist spot, and every year millions of tourists visit this area in fossil fuel-driven vehicles. Emissions from these vehicles persistently deteriorate the pristine environment of the IWHs. Therefore, in the current study, efforts were made to assess the compromised environmental conditions of Manali, Himachal Pradesh, India that resulted from the inflow of tourists and the activities undertaken by them. This study revealed that Manali could sustainably accommodate only 0.305 M tourists/month, and this threshold was reported to be crossed in the months of April, May and June. Furthermore, to augment these findings, water and ambient air samples were collected and analyzed for the presence of elemental carbon (EC) from one of the medium tourism potential regions of Manali, i.e., the Hamta glacier. The

tributary receiving water from the Hamta glacier and the ambient air of the area was observed to be contaminated with  $42 \pm 12$  ppb and  $880 \pm 43 \mu\text{g m}^{-3}$  of EC, respectively. It was observed that the inhalation and ingestion of EC-contaminated air and water could jeopardize human health due to a high lifetime cancer risk. However, without the intervention of eco-tourism in the study area, higher environmental health effects were also speculated. The observations made in this study are expected to trigger the interests of the researchers, international scientific community and regional authorities working towards the unsustainable development of the IWHs and deteriorating environmental conditions.

For further reading: <https://doi.org/10.3390/ijerph19116459>

### **A BENCHMARK STUDY ON ECONOMIC IMPACT OF NEEM COATED UREA ON INDIAN AGRICULTURE**

K. B. Ramappa, Vilas Jadhav, and A. V. Manjunatha

*Scientific Reports* 12: 9082

The policy of mandatory production and distribution of Neem Coated Urea (NCU) was implemented by the Government of India since 2015. In this article, authors have made an attempt to explore the benefits of NCU recognized by the producers of six major crops such as paddy, maize, sugarcane, tur, jute and soybean across six major states viz., Karnataka, Maharashtra, Madhya Pradesh, Bihar, Punjab and Assam. The results reveal that NCU use has contributed positively in terms of increasing the yield levels of main product and by-products, as well as net returns with regard to almost all reference crops however; the extent varies from crop to crop. Moreover, NCU has helped reduce the cost of production by minimizing the cost of urea as well as other fertilizers and pesticides usage. Interestingly, the diversion of urea has stopped completely, post the production and distribution of NCU. Hence, it is concluded that the application of NCU has a positive impact on Indian agriculture, by way of increasing yield levels & returns for the farming community. These results are in line with the PM's vision of doubling farmers' income by 2022 and Sustainable Development Goals of the Country.

For further reading: <https://doi.org/10.1038/s41598-022-12708-1>

### **ESTIMATION OF RAINFALL-INDUCED SURFACE RUNOFF FOR THE ASSAM REGION, INDIA, USING THE GIS-BASED NRCS-CN METHOD**

Laxmi Gupta and Jagabandhu Dixit

*Journal of Maps* 17: 1-13

The NRCS-CN method, integrated with GIS and remote sensing, can be used for estimating curve numbers (CN) and surface runoff in geohydrological systems. The study area is divided into 63 sub-basins, and the land use land cover (LULC)-hydrologic soil group (HSG) complex is identified for each sub-basin. The CN values for three antecedent soil moisture (AMC) conditions are calculated and corrected for surface slope variations. The surface runoff depth is determined using the rainfall data for 16 years (2005–2020). The average runoff depth and mean annual precipitation ranges from 444.50 to 1960.55 mm and 936.99 to 3520.55 mm, respectively. For all sub-basins, strong correlations between runoff depth and rainfall ( $R^2 \geq 0.8$ ) as well as between simulated runoff and measured runoff ( $R^2 \geq 0.8$ ) are observed. The Nash–Sutcliffe model efficiency coefficient (NSE) values suggest that the model's efficiency is good to satisfactory.

For further reading: <https://doi.org/10.1080/17445647.2022.2076624>

### MANAGEMENT PRACTICES SHOULD BE STRENGTHENED IN HIGH POTENTIAL VEGETATION PRODUCTIVITY AREAS BASED ON VEGETATION PHENOLOGY ASSESSMENT ON THE QINGHAI - TIBET PLATEAU

Hua Liu, Shiliang Liu, Fangfang Wang, Yixuan Liu, Lu Yu, Qingbo Wang, Yongxiu Sun, Mingqi Li, Jian Sun, and Zhenli Han

*Ecological Indicators* 140: 108991

Climate change and human activities have severely affected the structure and function of vegetation on the Qinghai-Tibet Plateau (QTP). Management practices have contributed to vegetation growth on the QTP, yet the response of vegetation productivity to management during the growing season remains unclear. Here, a fitted sixth-degree polynomial function was used to extract phenology-based vegetation productivity, which was quantified as the integrated normalized difference vegetation index (INDVI) over the length of the season during 2000–2019. Additionally, a new management practice intensity indicator was established to quantify the degree of ecological project and policy effectiveness on vegetation productivity. Three main results were obtained: (1) On a pixel-by-pixel basis, phenology-based vegetation productivity can avoid the impact of start-of-season (SOS) and end-of-season (EOS) variations. Vegetation productivity increased over 66% of the area of the QTP during 2000–2019, and the area with a significant increasing trend in vegetation productivity accounted for 9.15% of the QTP, including 5.65% in grassland and 0.23% in cultivated land. (2) Areas of increased vegetation productivity, grassland productivity, and cultivated land productivity affected by the positive impact from climate change accounted for 23.76%, 16.61%, and 0.31%, respectively, while they accounted for 41.29%, 28.10%, and 0.59% for human activities, respectively. (3) The regions of high-level management practice intensity accounted for 26.51% of the QTP but only 2.57% and 0.03% of grassland and cultivated land productivity, respectively. The regions of decreased grassland productivity still accounted for 21.85% of the QTP. Therefore, improving vegetation management practice intensity on grassland can increase regional vegetation productivity. These findings can provide effective guidance for regional vegetation management.

For further reading: <https://doi.org/10.1016/j.ecolind.2022.108991>

### CHARACTERISTICS OF CHANGES IN URBAN LAND USE AND EFFICIENCY EVALUATION IN THE QINGHAI –TIBET PLATEAU FROM 1990 TO 2020

Shujing Fu, Xuexia Zhang, Wenhui Kuang, and Changqing Guo

*Land* 11: 757

The Qinghai–Tibet Plateau has seen decades of changes in land use/cover as a result of urbanization and regional planning policy. Research on the efficiency of social development aids in the pursuit of social and environmental sustainability. Based on CLUD and socioeconomic statistical data, this study systematically analyses the spatiotemporal evolution characteristics of urban land use in the Qinghai–Tibet Plateau and evaluates its social development efficiency from three perspectives—the holistic, the municipal, and urban hierarchy—by using indicators such as the Moran index, land use efficiency, and urban expansion speed and proportion. Results show that the urbanization rate climbed from 21.26% to 54.95%, and the area of urban lands increased from 201.93 km<sup>2</sup> to 796.59 km<sup>2</sup> from 1990 to 2020, with urban lands expanding from the Lanzhou–Xining City Area to the

central and south of the Qinghai–Tibet Plateau. The holistic urban land use efficiency grew from 1.14 to 1.53, while the UPD decreased slightly from 1.44 to 1.31, and the UED increased steadily from 1.40 to 12.97 per decade. Moreover, we should pay attention to the rational allocation of land in human, social and ecosystem terms to comprehensively improve the quality of urbanization across the plateau.

For further reading: <https://doi.org/10.3390/land11050757>

### **MITIGATION STRATEGIES FOR HUMAN–TIBETAN BROWN BEAR (*URSUS ARCTOS PRUINOSUS*) CONFLICTS IN THE HINTERLAND OF THE QINGHAI-TIBETAN PLATEAU**

Yunchuan Dai, Yi Li, Yadong Xue , Charlotte E. Hacker, Chunyan Li, Babar Zahoor, Yang Liu, Diqiang Li, and Dayong Li

*Animals* 12: 1422

Personal injury and property damage caused by wildlife can worsen the relationship between humans and wildlife. In recent years, conflicts between herders and Tibetan brown bears (*Ursus arctos pruinosus*) (human–bear conflicts; HBCs) on the Qinghai-Tibetan Plateau have increased dramatically, severely affecting community motivation for the conservation of brown bears and other species. Understanding the types, effectiveness, and flaws of current HBC mitigation measures is critical to develop effective strategies to alleviate HBC. From 2017 to 2019, we conducted a systematic field survey regarding HBCs on the Qinghai-Tibetan Plateau. In addition, we invited bear specialists and multiple interest groups to hold an HBC seminar and proposed some potential mitigation strategies. We surveyed 312 families via semi-structured interviews and documented 16 types of HBC mitigation measures. A total of 96% of respondents were using more than two mitigation measures simultaneously. The effectiveness evaluation of HBC mitigation measures showed that: (1) removing food from winter homes while herders were at their summer pastures and asking people to keep watch of winter homes were effective at protecting food and houses; (2) traditional grazing methods (human guarding of livestock all day) and solar soundboxes (attached to livestock) were effective at protecting free-range livestock; (3) solar street lights had a deterrent effect on brown bears and were effective in protecting livestock, houses, and people; and (4) due to the unstable power supply of photovoltaic cells and improper installation of ground wires, electric fences were not ideal in practice. Evaluation of the potential mitigation measures at the seminar showed that upgrading electric fence technology, expanding electric fence pilot areas, installing diversionary feeders, and introducing bear spray were the most optimal solutions. This study provides a scientific basis for creating human–bear coexistence plans on the Qinghai-Tibet Plateau.

For Further Reading: <https://doi.org/10.3390/ani12111422>

### **LIVELIHOOD RESILIENCE IN PASTORAL COMMUNITIES: METHODOLOGICAL AND FIELD INSIGHTS FROM QINGHAI-TIBETAN PLATEAU**

Tong Li, Shuohao Cai, Ranjay K Singh, Lizhen Cui, Francesco Fava, Li Tang, Zhihong Xu, Congjia Li, Xiaoyong Cui, Jianqing Du, Yanbin Hao, Yuexian Liu, and Yanfen Wang

*Science of The Total Environment* 838: 155960

Livelihood resilience is crucial for both people and the environment, especially in remote and harsh ecosystems, such as the Qinghai Tibetan Plateau (QTP). This research aimed to fill the gap of assessing herders' livelihood resilience using more inclusive method. Using survey data from 758 pastoralists, complemented with focus group discussions and transect walks in the Three River Headwater Region (TRHR) on the QTP, we first developed a

livelihood resilience evaluation index comprising dimensions of buffer capacity, self-organization and learning capacity. The method of entropy-TOPSIS was then applied to assess the livelihood resilience of local herders, and the spatial patterns were analyzed by spatial autocorrelation method. The results showed the overall level of pastoral livelihood resilience resulted weak, with an east to west spatial gradient toward lower livelihood resilience. Self-organization was the most important dimensions of livelihood resilience, with social cohesion being a dominant factor. Buffer capacity resulted the less important, but the natural capital was significantly higher than the other four livelihood capitals. Furthermore, the northeastern region was a hotspot, while the northwestern region was a cold spot of livelihood resilience. While pastoral populations in the TRHR had high self-organization abilities and potentially high learning capacities, the overall low buffer capacity and livelihood capital limited the improvement of their livelihood resilience. The key findings provide support for enabling policies and integrated strategies to enhance social-ecological resilience. Study may help as paradigm shift reference for the livelihood resilience of pastoral communities in high-altitude areas globally.

For Further Reading: <https://doi.org/10.1016/j.scitotenv.2022.155960>

## Bhutan-Himalaya

### EMPLOYING CITIZEN SCIENCE TO UNDERSTAND AMPHIBIAN AND REPTILE DIVERSITY AND DISTRIBUTION IN THE HIMALAYAN KINGDOM OF BHUTAN

Jigme Tshelthrim Wangyal, Deborah Bower, Karl Vernes, and Phuntsho Thinley

*Global Ecology and Conservation* 37: e02157

In the absence of systematic research institutions and local or long-term resident systematists added by Buddhist culture that discourages lethal sampling of animals, scientific collections are particularly sparse in Bhutan. Consequently, less charismatic taxa such as the reptile and amphibian fauna of Bhutan, including the Eastern-Himalayas, are poorly known. Citizen science was employed to better understand the occupancy and distribution of reptile and amphibian fauna in Bhutan. Using a dedicated amphibian and reptile Facebook group, we gathered 929 species records from 235 individuals between May 2014 and December 2019. Of the participants 70% were foresters, 10% were members of the general public, 6% were school teachers, 6% were college students, 5% were non-forester civil servants, and 3% were tour guides. Citizen scientists submitted records for 99 species of snakes, 70 species of amphibians, 87 species of lizards and 5 species of testudines. Of these, 70% of the records extended the published range of the species in Bhutan, and more than 48 species were new records for Bhutan. Our study demonstrates the potential of citizen science in developing countries with poorly documented fauna.

For further reading: <https://doi.org/10.1016/j.gecco.2022.e02157>

## Pakistan-Himalaya

### SPATIO-TEMPORAL VARIATION OF SEASONAL HEAT ISLANDS MAPPING OF PAKISTAN DURING 2000–2019, USING DAY-TIME AND NIGHT-TIME LAND SURFACE TEMPERATURES MODIS AND METEOROLOGICAL STATIONS DATA

Aqil Tariq, Faisal Mumtaz, Xing Zeng, Muhammad Yousuf Jat Baloch, and Muhammad Farhan UI Moazzam

Urban heat islands (UHIs) create severe human health risks. Pakistan has about 220 million inhabitants, with 287 people per Km<sup>2</sup> on average. Over the last 100 years, the maximum extreme temperature during the previous summer and winter seasons has been recorded. The forecast for the coming 50 years indicates a temperature rise in Pakistan, directly affecting physical and mental health. To address this challenge, this paper analyzes the spatial variability in Heat Islands (HI) in Pakistan from 2000 to 2019, combining MODIS satellite imagery with data from fifty meteorological stations. Different statistical and geostatistical models were applied, including geographically weighted regression (GWR), simple regression, and Geostatistical interpolation models. The results reveal the variations in nocturnal thermal on a fixed temperature of 11 °C, variations in frequency, and the change in day and night temperatures during summer and winter. Data fusion between MODIS and data from fifty metrological stations in Pakistan shows that spatial-temporal variation in the patterns of HI must be considered in planning processes when responding to climate change. The heat island's maximum nocturnal temperatures indicated a high rate of extension and magnitude compared to the daily recorded temperature, which implies that the overall area in the metropolitan category is covered by a temperature value of greater than 20 °C, raising severity to 10 °C in June. During June, intense night-time temperature values spread their concentration, heading towards the urban center over the Islamabad, Gilgit, Peshawar, Lahore, Quetta, and Karachi station sectors. During the day, the extension difference of the heat island was in the range of 8–10 °C, declining steadily from summer 2006 to summer 2015 before finally covering almost the entire metropolitan area. Higher values emerged after 2015–2019, rising in magnitude and expansion until 2019.

For further reading: <https://doi.org/10.1016/j.rsase.2022.100779>

## Highlight of the Issue

### Carbon dioxide levels at a record high

As the world celebrated the Environment Day with the theme “Only One Earth”, very little were aware about the reports published in May, 2022 regarding carbon dioxide levels in the atmosphere hitting an all-time record high. According to the report of National Oceanic and Atmospheric Administration, the CO<sub>2</sub> concentration reached 421 parts per million, which is 50% higher than levels prior to the industrial revolution. The rise is primarily attributed to the burning of fossil fuels and deforestation, which is already causing severe heatwaves, storms, droughts, and floods in many parts of the World. This unprecedented increase of the heat-trapping gas will further add to the current climate crisis, pushing the Earth into conditions not seen in the last 4 million years. Scientists emphasize on zeroing the global emissions by 2050 to avoid further dire climate consequences – an ambitious goal given the current state. With the governments around the globe incessantly failing to meet their climate commitments, this reporting could yet be another “wake-up call” to save the “Only One Earth” we have.

<https://www.theguardian.com/environment/2022/jun/06/carbon-dioxide-levels-increase-global-heating-study>

<https://timesofindia.indiatimes.com/home/environment/the-good-earth/carbon-dioxide-levels-highest-in-human-history/articleshow/91995618.cms>

<https://www.nytimes.com/2022/06/03/climate/carbon-dioxide-record.html>