

# Headlines Himalaya

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Editorial Team: Monica Neupane and Rachana Sharma

For the 661<sup>st</sup> – 662<sup>nd</sup> issues of Headlines Himalaya, we reviewed researches from five sources and selected 18 researches from five countries. We selected four researches from Nepal and 14 researches from other Himalayan countries (India, China, Bhutan and Pakistan).

Headlines Himalaya, a weekly research based fact file is an attempt to keep our global readers abreast with the happenings in the Himalaya. Please share it with your colleagues and friends. Also, subscription is free. Enjoy!

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## **Nepal-Himalaya**

### **ROLE OF RENEWABLE ENERGY TECHNOLOGIES IN CLIMATE CHANGE ADAPTATION AND MITIGATION: A BRIEF REVIEW FROM NEPAL**

Suman Acharya

*Renewable and Sustainable Energy Reviews* 151: 111524

Renewable energy plays a crucial role in both climate change mitigation and adaptation in highly climate-vulnerable nations such as Nepal. This paper reviews various types of renewable energy technologies and their status, potential for adoption, relationship to climate change, and mitigative and adaptive roles in Nepal. Nepal has installed micro-hydro projects, solar power, improved cooking stoves, biogas technology, improved water mills, and wind energy to mitigate and adapt to climate change. There is a growing potential for renewable energy development in Nepal, such as hydropower, solar, wind energy, biogas, and improved cooking stoves. Roughly 70% of Nepal's energy consumption is generated from traditional energy sources while renewable energy accounts for approximately three percent. The gradual increase in the use of renewable energy has reduced greenhouse gas emissions and enhanced carbon sequestration. By adopting renewable energy technologies, Nepal has reduced emissions by 221,129 tCO<sub>2</sub>e from 2017 to 2018. Nepal's second Nationally Determined Contribution targets a 15% increase in national energy use from renewables with a reduction of 23% of CO<sub>2</sub> emissions by 2030 using biogas and improved cooking systems. Furthermore, a significant increase in the adoption of renewable energy has become a pivotal strategy in adaptation to climate change in social, health, and economic sectors resulting in time savings, alternative income sources, improved health and educational status, local job opportunities, and the promotion of social capital. The benefits of adapting to climate change and mitigating CO<sub>2</sub> emissions via renewable energy are significant at the local, national, and international levels. This study recommends that the government of Nepal focus work on energy policy reviews to address local energy demand and climate change issues by utilizing renewable energy resources at the local level, which has global implications.

Further Reading: <https://doi.org/10.1016/j.rser.2021.111524>

## **THE EFFECTS OF TUNNEL TECHNOLOGY ON CROP PRODUCTIVITY AND LIVELIHOOD OF SMALLHOLDER FARMERS IN NEPAL**

Diwakar KC, Dinesh Jamarkattel, Tek Maraseni, Dilip Nandwani, and Pratibha Karki

*Sustainability* 13: 7935

Technologies-based production practices are critical for agricultural growth and sustainable development in low-income countries like Nepal. In the last few years, tunnel house has been increasingly promoted as tools to enhance smallholder farmers' livelihood and tackle climate adversaries. However, little is known about what factor determines its adoption and whether it helps smallholders adapt to climate change and experience better livelihood. We address these gaps using the cross-sectional survey data collected from 62 adopters and 92 non-adopters in three municipalities of Bagmati Province. We employed descriptive analysis and probit model and found out that age, farm size, and ethnicity strongly influence the technology adoption amongst smallholder farmers. Additionally, treatment model and ordinary least square (OLS) regression were utilized to examine tunnel technology's effect. Our study shows that tunnel significantly increases production by 32 tons/year/hectare and protects crops from climate change effects such as heavy rainfall and temperature change. Likewise, tunnel technology increases the net crop income by \$1700/year/hectare. However, the economic benefit is not substantial compared to technology's adoption cost as adopters incur enormous costs of \$12,000/year/hectare on equipment, labor and resources. These results suggest policymakers should concentrate on reducing the technology's cost, which could be achieved through subsidies, financial support, or price control mechanisms. Ensuring technology's affordability can contribute to smallholder farmers' sustainable livelihood in Nepal and countries with similar contexts.

Further Reading: <https://doi.org/10.3390/su13147935>

## **TOWARDS A COLLABORATIVE GOVERNANCE REGIME FOR DISASTER RISK REDUCTION: EXPLORING SCALAR NARRATIVES OF INSTITUTIONAL CHANGE IN NEPAL**

Caroline Russell, Julian Clark, David Hannah, and Fraser Sugden

*Applied Geography* 134: 102516

This paper contributes to the study of collaborative governance (CG) - systems where autonomous actors work together around shared objectives using pooled resources to address a common goal. Among CG's claimed benefits are boosting actor capacities for transformative action and increasing their resilience to complex multi-scaled challenges such as hazards and sudden catastrophic events. We engage with collaborative governance through a case study of changing public policy and institutional structures that govern hazards in Nepal. Following the shocking event of the 2015 Gorkha earthquake, Nepal's approach to disaster risk reduction (DRR) has been reshaped by federalisation and institutional reforms that aim to embed a governing system based on greater collaboration. We argue this amounts to a state transition to a collaborative governance regime (CGR) for DRR. Using primary qualitative data derived from 17 semi-structured interviews at national, provincial, and local scales, we identify state-sponsored scalar narratives around 1) actor capacities and tendencies in DRR; 2) knowledge production on DRR and its dissemination; and 3) formal and informal institutional DRR roles and responsibilities. We show how these narratives are being used as anchor points for a new CG approach to national DRR strategy. However, our analysis shows these narratives risk excluding local participation in DRR by marginalising grassroots politics to emphasise top-down state-led goals. In turn, this leads us to question the viability of the emerging governance regime as a truly collaborative project embedding principles of

sustainability and inclusivity. We conclude that if these state scalar narratives continue to shape national policy, they will impede the potential for transformative collaborative action for DRR in Nepal.

Further Reading: <https://doi.org/10.1016/j.apgeog.2021.102516>

### **DESIGNING A COMMUNITY-BASED INSURANCE SCHEME TO REDUCE HUMAN–WILDLIFE CONFLICT**

Roshan Sherchan, Rajesh Kumar Rai, Roshani Rai, and Arun Dhakal

*Environment, Development and Sustainability* 23: 1-19

Globally, human–wildlife conflict (HWC) is a burning issue, which the conservationists have attempted to address through various conservation strategies. One of the widely adopted strategies is the provision of compensation for the loss caused by wildlife. The existing mechanism of compensation in Nepal is time-consuming and insufficient. This study, therefore, attempts to assess the feasibility of a community-based insurance scheme (CBIS), which is expected to be time-efficient with no additional burden to farmers. The CBIS scheme is an insurance mechanism to be operated by a locally elected committee and provides compensation to the premium paying farmers only. The study was carried out in the Jhapa District of Nepal, one of the most affected districts by wild elephants. We conducted a household survey using a questionnaire for 509 respondents from the five most affected villages. We chose a choice experiment to determine the preferences of respondents for CBIS. Four activities including compensation for crop damage, and human casualties (serious injuries and death), and fence management were selected under the CBIS. The regression analysis revealed that only the compensation for crop damage was statistically significant. The estimated annual crop damage caused by elephants was worth USD 1.49 million. The estimated premium exceeded the expected insurance payout, indicating the suitability of the scheme. The estimated premium was USD 0.38 per hectare for a 1% increase in damage payout. The total annual premium would be USD 0.136 million for a 25% payment of the damage, while the expected annual insurance payout would be USD 77,788. The annual premium can be lower if the government allocates the budget for the CBIS, out of the existing relief distribution program. The engagement of local municipalities in the CBIS management can make the scheme more viable.

Further Reading: <https://doi.org/10.1007/s10668-021-01652-1>

## **India-Himalaya**

### **ENVIRONMENTAL CHANGE PERCEPTION AND ENGAGEMENT OF MOUNTAIN-DWELLING IN THE WESTERN HIMALAYAS, AT RAJOURI DISTRICT, JAMMU AND KASHMIR, INDIA**

Mohd Zeeshan, Huanyuan Zhang, Liqing Sha, Gnanamoorthy Palingamoorthy, Zayar Phyo, Ziwei Chen, Goldin Quadros, and P. A. Azeez

*Weather, Climate and Society* 13: 847-857

Substantial temperature rise is reported in the Himalayas, and the vulnerability of the region to climate change is well recognized. An apt adaptation strategy to cope with climate change calls for informed people's participation, which was rarely investigated in the western Himalayas. Having been better informed, people in developed areas adopt better actions against climate change that are well guided by their perception. In contrast, Rajouri in Jammu and Kashmir represents a relatively impoverished and climate change–vulnerable region. Therefore, we gauged people's perceptions and actions in this area from a household survey from 717 randomly selected individuals.

Further, consistency of perception was compared with meteorological records on temperature, humidity, wind speed, rainfall, and aboveground biomass from 1983 to 2013. The findings revealed that temperature increased significantly while changes in rainfall, wind speed, and relative humidity were insignificant. Although people sensed a rise in temperature and deforestation correctly, most of them differ with respect to rainfall, wind speed, and humidity. They reported rising pollution and traffic but no change in crop productivity or crop varieties. Of the respondents, 91% considered climate change as a risk, 86.8% reported reactive actions to it, and 82.8% reported proactive actions. Locals from varied socioeconomic backgrounds are not much informed about climate change; hence, the reasonability of their responses and positive adaptation actions needs further research. To engage people in climate adaptation actions, we suggest disseminating precise scientific information about local climate through awareness programs and by engaging them in climate change activities through suitable organizations.

Further reading: <https://doi.org/10.1175/WCAS-D-21-0051.1>

### **MODIS NDVI MULTI-TEMPORAL ANALYSIS CONFIRMS FARMER PERCEPTIONS ON SEASONALITY VARIATIONS AFFECTING APPLE ORCHARDS IN KINNAUR, HIMACHAL PRADESH**

Himangana Gupta, Lakhvinder Kaur, Mahbooba Asra, Ram Avtar, and C. Sudhakar Reddy

*Agriculture* 11: 724

Apple cultivation in the Kinnaur district of the northern Indian State of Himachal Pradesh faces challenges from climatic changes and developmental activities. Farmers in the neighboring districts have already faced a major loss of livelihood due to seasonal changes. Therefore, it is important to study the extent of seasonal variations in the apple growing locations of this region. This study makes that attempt by assessing seasonality variations during a 15-year period from 2004 to 2018 when maximum construction activities occurred in this region. The study uses geospatial and statistical techniques in addition to farmer perceptions obtained during a field visit in November 2019. A temporal pattern using a normalized difference vegetation index (NDVI) based on Moderate Resolution Imaging Spectroradiometer (MODIS) was studied for seven apple-growing locations in the district. The results show high seasonal variations and reduced snowfall at lower elevations, resulting in less chilling hours, which are necessary for the healthy growth of apples. The normalized difference snow index (NDSI) and rainfall show a high correlation with apple growth. Local farmers are unprepared for future seasonal disturbances, as they lack early warning systems, insurance for apple crops, and alternative livelihood options.

Further Reading: <https://doi.org/10.3390/agriculture11080724>

### **IMPLICATIONS OF CHANGES IN TEMPERATURE AND PRECIPITATION ON THE DISCHARGE OF BRAHMAPUTRA RIVER IN THE URBAN WATERSHED OF GUWAHATI, INDIA**

Ishita Afreen Ahmed, Shahfahad, Dipanwita K. Dutta, Mirza Razi Imam Baig, Shouraseni Sen Roy, and Atiqur Rahman

*Environmental Monitoring and Assessment* 193:518

The urban watershed of Guwahati situated on the bank of the Brahmaputra River is one of the fastest growing cities of India. During the last two decades, water security concerns due to climatic variabilities have become a pronounced issue in the urban watershed of Guwahati. Thus, the study aims to calculate the long-term temporal trends of temperature, precipitation, extreme climate indices, and river discharge to assess the variations and patterns of hydro-climatic variations in the urban watershed of Guwahati from 1991 to 2019. Furthermore, the

current study also tries to correlate these extreme climatic indices to river discharge to determine the degree of hydro-climatic variations. The Mann–Kendall statistical techniques and Sen’s estimator were used to calculate the statistical significance, stability, and averaged magnitude of trends in the hydro-meteorological data. The result shows that the wetness indices, R20 and RX5Day, reported a decline in Guwahati’s urban watershed from 1991 to 2019, resulting in a reduction in intensity and duration of heavy rainfalls while the dry spell (CDD) has been more distinct in the study area with a rise in the average temperature by 0.023 °C/year. Similarly, the most significant statistical trend was found in the monsoonal discharge of the Brahmaputra with a negative trend of – 204.16 m<sup>3</sup>/s/year. The results also show that fluctuations in rainfall patterns have a direct impact on the discharge of the Brahmaputra. These phenomena can affect the quantity of river water resulting in a severe impact on water security in the study area.

Further Reading: <https://doi.org/10.1007/s10661-021-09284-8>

### **ASSESSING FLOOD-INDUCED ECOLOGICAL VULNERABILITY AND RISK USING GIS-BASED IN SITU MEASUREMENTS IN BHAGIRATHI SUB-BASIN, INDIA**

Sufia Rehman, Mohd Sayeed Ul Hasan, Abhishek Kumar Rai, Ram Avtar, and Haroon Sajjad

*Arabian Journal of Geosciences* 14: 1520

Climate change–induced disasters and anthropogenic influences are making the ecological environment vulnerable. Thus, assessment of ecological vulnerability and risk is essential for devising suitable adaptation and management strategies. The paper makes a concerted effort to analyze flood-induced ecological vulnerability and risk using site-specific parameters in Bhagirathi sub-basin of India. Analytical hierarchy process (AHP) was used to assign weightage to the selected parameters. Association of parameters with vulnerability was examined through multiple regression analysis. Findings revealed that most of the area in eastern, central, and deltaic sub-basin was found under high vulnerability and risk. Disturbance index, rainfall, temperature, SAVI, vegetation type, low biological richness, slope, and NDVI identified the potent factors for high vulnerability to flood, while high inundation was the prime determinant for very high flood risk in the study area. Evaluated findings may be helpful in prioritizing the areas for ecological restoration and conservation.

Further Reading: <https://doi.org/10.1007/s12517-021-07780-2>

### **INTEGRATED WATER QUALITY MONITORING OF MAHI RIVER USING BENTHIC MACROINVERTEBRATES AND COMPARISON OF ITS BIODIVERSITY AMONG VARIOUS STRETCHES**

Nitasha Khatri, Krutarth Raval, and Ashutosh K. Jha

*Applied Water Sciences* 11: 143

Use of benthic macroinvertebrates has been in vogue as indicator organisms for water quality monitoring since long. Traditional methods of water quality monitoring incorporate mostly monitoring of physicochemical parameters. However, it is the biomonitoring studies that could help in more accurate water quality monitoring. Due to anthropogenic impact at water sources, integrated water quality monitoring has become a necessity. An integrated study comprising physicochemical parameters and biomonitoring using benthic macroinvertebrates was carried out at six sites along the Mahi river basin, the command area of which has witnessed tremendous economic and cultural progress over a period of time. Diversity Score and Saprobic Score were calculated, and Water Quality Class was determined as per Biological Monitoring Working Party score given by Central Pollution

Control Board and results in moderate pollution at all locations, whereas Water Quality Class as per ISI-IS 2296–1982 at M-1, M-4, M-7 and M-12 shows slight pollution. Jaccard's similarity index compared the biodiversity of benthic macroinvertebrates at all the sites from upstream to downstream locations. It was maximum, i.e., 52.94% between the locations at M-4 and M-7. Species richness (S) has also been monitored at the said locations. The Diversity Score 0.83 is maximum at the Galteshwar (M-12) location of the Mahi river, which indicates that the location was the most ecologically diverse region among all.

Further reading: <https://doi.org/10.1007/s13201-021-01451-z>

## China Himalaya

### **STUDY ON ECOLOGICAL ADAPTABILITY CONSTRUCTION CHARACTERISTICS OF RESIDENTIAL BUILDINGS IN KANGBA AREA, TIBET, CHINA**

Yufeng Wang and Hongjun Cao

*Environmental Science and Pollution Research* 28: 1-11

Located in the southwest of the Qinghai-Tibet Plateau, Tibet is characterized by high cold, high radiation, and large differences in temperature between day and night. Tibetan residential buildings are famous for adapting to the harsh ecological environment and maintaining durability. Based on the residential buildings in Tibet, this paper extracts the technical process and color decoration culture in the construction process in order to adapt to the harsh natural environment. This paper first analyzed the four ecological construction modes of Tibetan residential buildings, analyzed the interior layout characteristics and cultural customs connotation, and introduced the architectural decoration characteristics and decorative color painting. The results show that the ramming type of adobe mainly includes the selection of building foundation, wall laying, floor and roof construction and so on, and its insulation effect is better. The rubble masonry type mainly adopts irregular gneiss, supplemented by clay, which has strong compressive capacity. Logs dry type using log masonry, heat preservation. and shock resistance is better. Concrete-infilled wall frame is composed of horizontal and vertical load-bearing system, which has stronger seismic performance. Tibetan residential buildings generally have two or three floors. The first floor is the enclosure and sundry room, the second floor is the rest place, and the third floor is the Sutra hall and sun terrace. The overall outdoor color of Kangba Tibetan buildings is mainly red and black, while the indoor color is mainly blue and red, with wood carvings and furniture. The layout of Tibetan villages can be divided into centripetal layout and scattered layout. Tibetan residential buildings provide a new sustainable development direction for the current global urbanization process at the expense of the ecological environment. It can alleviate the crisis of global resource shortage, climate warming, and biodiversity degradation.

Further reading: <https://doi.org/10.1007/s11356-021-15670-z>

### **OPPORTUNITIES FOR HOUSEHOLD ENERGY ON THE QINGHAI-TIBET PLATEAU IN LINE WITH UNITED NATIONS' SUSTAINABLE DEVELOPMENT GOALS**

Minghao Zhuang, Xi Lu, Wei Peng, Yanfen Wang, Jianxiao Wang, Chris P. Nielsen, and Michale B. McElroy

*Renewable and Sustainable Energy Reviews* 144: 110982

Approximately seven million population in the Qinghai-Tibet Plateau of China, a global climate sensitive region, still rely primarily on yak dung for household cooking and heating. The treatment and combustion of yak dung result in a variety of negative impacts in terms of local alpine grassland degradation, indoor air pollution, public health risk, as well as global climate change. There is an urgent need to explore alternative pathway for affordable and clean energy as indicated in the United Nations' Sustainable Development Goals for 2030. This perspective has analyzed the key challenges rooted in yak dung use on the Qinghai-Tibet Plateau region. Based on this, this perspective has further proposed a new complementary energy system to take advantage of locally available, clean and sustainable energy sources of wind and solar power, and have provided economic analyses. Meanwhile, this perspective has pointed out the potential barriers to promoting the new complementary energy system in the Qinghai-Tibet Plateau region due to traditional habits, economic factors and policies. Finally, strategies for transitioning from yak dung to the proposed alternative energy system is discussed at the end. Successful energy transition for the Qinghai-Tibet Plateau region offers an important option to achieving many other sustainable development goals related to climate change, economic development, and environment. The perspective is expected to shed light on the development of sustainable energy in other developing region or countries in the world to address multiple societal goals.

Further reading: <https://doi.org/10.1016/j.rser.2021.110982>

#### **QUANTIFYING THE VARIABILITY OF FOREST ECOSYSTEM VULNERABILITY IN THE LARGEST WATER TOWER REGION GLOBALLY**

Siqi Sun, Yihe Lu, Da Lu, and Cong Wang

*International Journal of Environmental Research and Public Health* 18: 7529

Forests are critical ecosystems for environmental regulation and ecological security maintenance, especially at high altitudes that exhibit sensitivity to climate change and human activities. The Qinghai-Tibet Plateau—the world's largest water tower region—has been breeding many large rivers in Asia where forests play important roles in water regulation and water quality improvement. However, the vulnerability of these forest ecosystems at the regional scale is still largely unknown. Therefore, the aim of this research is to quantitatively assess the temporal–spatial variability of forest vulnerability on the Qinghai-Tibet Plateau to illustrate the capacity of forests to withstand disturbances. Geographic information system (GIS) and the spatial principal component analysis (SPCA) were used to develop a forest vulnerable index (FVI) to assess the vulnerability of forest ecosystems. This research incorporates 15 factors covering the natural context, environmental disturbances, and socioeconomic impact. Results indicate that the measure of vulnerability was unevenly distributed spatially across the study area, and the whole trend has intensified since 2000. The three factors that contribute the most to the vulnerability of natural contexts, environmental disturbances, and human impacts are slope aspect, landslides, and the distance to the farmland, respectively. The vulnerability is higher in forest areas with lower altitudes, steeper slopes, and southerly directions. These evaluation results can be helpful for forest management in high altitude water tower regions in the forms of forest conservation or restoration planning and implementation towards sustainable development goals.

Further reading: <https://doi.org/10.3390/ijerph18147529>

#### **THE PERFECT STORM: EXTREME WEATHER EVENTS AND SPECULATION ALONG CARDAMOM COMMODITY CHAINS IN SOUTHWEST CHINA**

Jean-François Rousseau and Y. Xu

This article probes how extreme weather events in Southwest China in 2016 impacted actors in the black cardamom commodity chain. Harvest failures led to sudden supply disruptions, triggering a price spike that worsened an ongoing price bubble which had been driven by long-lasting speculative maneuvers from large market actors but was also beneficial to ethnic minority farmers. Extreme weather events created both risk and profit opportunities for farmers in the Sino-Vietnamese borderlands and Han traders located at nodes further along the commodity chain. We document how actors reacted to these circumstances, and analyze the factors that influenced their capacity (or lack thereof) to benefit from extreme weather event-driven market vagaries. We find that ethnicity, position, and role along the commodity chain, plus access to financial and social capital, are all involved. Access to information is key, but is distributed asymmetrically along the commodity chain; multidirectional trust relations allow larger market actors to gain and maintain greater access to market information than other stakeholders. We engage with scholarship on commodity chains, extreme weather events, and price spikes, arguing that these bodies of literature are seldom addressed together and that extreme weather events should receive closer attention as factors shaping power relations within commodity chains.

Further reading: <https://doi.org/10.1080/15387216.2020.1792323>

## **Bhutan-Himalaya**

### **URBANIZATION, CARBON NEUTRALITY, AND GROSS NATIONAL HAPPINESS: SUSTAINABLE DEVELOPMENT PATHWAYS FOR BHUTAN**

Miho Kamei, Tashi Wangmo, Benjamin D. Leibowicz, and Shuzo Nishioka

*Cities* 111: 102972

Bhutan is a rapidly growing economy currently undergoing swift and extensive rural-to-urban migration. Its commitment to carbon neutrality, as well as its unique Gross National Happiness (GNH) objectives, make Bhutan a fascinating laboratory for studying sustainable development strategies and how they can be specifically tailored to align with local contexts and values. This paper uses the framing of the Shared Socioeconomic Pathways (SSPs) from the global climate change mitigation literature to develop a vision for a locally appropriate SSP for a sustainable Bhutan, encompassing energy supply, energy demand, and urban and regional planning. The approach outlined here demonstrates how research-based recommendations from the academic literature can be combined with knowledge of local considerations to develop place-based visions for sustainable societies. The proposed sustainable pathway for Bhutan (SSP1) outlines a future in which the nation continues to sequester more carbon than it emits while maintaining traditional cultural values, a strong sense of community, and a burgeoning economy. Outcomes of alternative scenarios are described according to the nine domains of GNH. Focusing on Bhutan as a real case study, this paper thus demonstrates how mitigation measures can be selected and implemented to align with unique cultural values and national aspirations.

Further reading: <https://doi.org/10.1016/j.cities.2020.102972>

### **ON-SITE DOMESTIC WASTEWATER TREATMENT SYSTEM USING SHREDDED WASTE PLASTIC BOTTLES AS BIOFILTER MEDIA: PILOT-SCALE STUDY ON EFFLUENT STANDARDS IN BHUTAN**

Ugyen Dorji, Pema Dorji, Hokyong Shon, Umakant Badeti, Cheki Dorji, Chimi Wangmo, Lenoard Tijing, Jaya Kandasamy, Saravanamuthu Vigneswaran, Amit Chanan, and Sherub Phuntsho

*Chemosphere* 286: 131729

In this study, a 1000 L/d capacity one-off on-site wastewater treatment system was operated for over a year as a pilot alternative to the conventional on-site treatment as currently used in urban Bhutan. An up-flow anaerobic sludge blanket (UASB) was used for blackwater treatment (to replace “septic tank followed by an anaerobic biofilter (ABF) (to replace soak pits) for the treatment of a mixture of greywater and UASB effluent. Shredded waste plastic bottles were used as the novel biofilter media in the ABF. During a yearlong operation, the pilot system produced a final treated effluent from ABF with average BOD<sub>5</sub> 28 mg/L, COD 38 mg/L, TSS 85 mg/L and 5 log units of *Escherichia coli*. These effluents met three out of four of the national effluent discharge limits of Bhutan, but unsuccessful to meet the *Escherichia coli* standard over a yearlong operation. Further, process optimisation may enable more significant *Escherichia coli* removal. An economic analysis indicates that the total unit cost (capital and operating expenditures) of this alternative wastewater treatment system for more than 50 users range between USD 0.27–0.37/person/month comparable to USD 0.29–0.42/person/month for the current predominant on-site system, i.e., “septic tanks”. This pilot study, therefore, indicates that this wastewater treatment system using shredded waste plastic biofilter media has high potential to replace the current conventional treatment, i.e., “septic tanks”, which are often overloaded with greywater and discharging effluents which does not meet the national standards.

Further reading: <https://doi.org/10.1016/j.chemosphere.2021.131729>

#### **REGIONAL AND LOCAL IMPACTS OF THE ENSO AND IOD EVENTS OF 2015 AND 2016 ON THE INDIAN SUMMER MONSOON—A BHUTAN CASE STUDY**

Katherine Power, Josefine Axelsson, Norbu Wangdi, and Qiong Zhang

*Atmosphere* 12: 954

The Indian Summer Monsoon (ISM) plays a vital role in the livelihoods and economy of those living on the Indian subcontinent, including the small, mountainous country of Bhutan. The ISM fluctuates over varying temporal scales and its variability is related to many internal and external factors including the El Niño Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD). In 2015, a Super El Niño occurred in the tropical Pacific alongside a positive IOD in the Indian Ocean and was followed in 2016 by a simultaneous La Niña and negative IOD. These events had worldwide repercussions. However, it is unclear how the ISM was affected during this time, both at a regional scale over the whole ISM area and at a local scale over Bhutan. First, an evaluation of data products comparing ERA5 reanalysis, TRMM and GPM satellite, and GPCC precipitation products against weather station measurements from Bhutan, indicated that ERA5 reanalysis was suitable to investigate ISM change in these two years. The reanalysis datasets showed that there was disruption to the ISM during this period, with a late onset of the monsoon in 2015, a shifted monsoon flow in July 2015 and in August 2016, and a late withdrawal in 2016. However, this resulted in neither a monsoon surplus nor a deficit across both years but instead large spatial-temporal variability. It is possible to attribute some of the regional scale changes to the ENSO and IOD events, but the expected impact of a simultaneous ENSO and IOD events are not recognizable. It is likely that 2015/16 monsoon disruption was driven by a combination of factors alongside ENSO and the IOD, including varying boundary conditions, the Pacific Decadal Oscillation, the Atlantic Multi-decadal Oscillation, and more. At a local scale, the intricate topography and orographic processes ongoing within Bhutan further amplified or dampened the already altered ISM.

Further reading: <https://doi.org/10.3390/atmos12080954>

## Pakistan- Himalaya

### ASSESSMENT OF THE PUBLIC ACCEPTANCE AND UTILIZATION OF RENEWABLE ENERGY IN PAKISTAN

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*Sustainable Production and Consumption* 27: 312-324

The acceptance of renewable energy technologies is a complicated and multifaceted process influenced by a broad range of factors. Therefore, this study aims to examine the factors influencing consumer intention to utilize renewable energy (RE). Moreover, the current research highlights the factors that encourage or discourage consumers from utilizing RE by expanding the structural context of the Theory of Planned Behavior (TPB) by integrating three new considerations (the perception of self-effectiveness, beliefs about the benefits of RE, and perception about neighbor participation). The data used for analysis were collected from 351 households in four large cities, including Rawalpindi, Lahore, Gujranwala, and Faisalabad, in Pakistan. We utilized the Structural Equation Modeling (SEM) approach to check the relationship between constructs and latent variables. The results reveal that the driving factors, i.e., the perception of self-effectiveness, awareness, and perception about neighbor participation have significant and positive effects on consumer intention to utilize RE. However, consumer beliefs related to the cost of RE utilization have a negative effect on their intention to utilize RE. More interestingly, it was observed that beliefs about the benefits of RE and environmental concern have insignificant effects. The outcomes of this study can assist policy makers, experts and consumers in understanding renewable energy consumption and gaining awareness about environmental problems while simultaneously improving environmental sustainability practices.

Further reading: <https://doi.org/10.1016/j.spc.2020.10.031>

### GENOME SEQUENCE OF THE ASIAN HONEYBEE IN PAKISTAN SHEDS LIGHT ON ITS PHYLOGENETIC RELATIONSHIP WITH OTHER HONEYBEES

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In Pakistan, *Apis cerana*, the Asian honeybee, has been used for honey production and pollination services. However, its genomic makeup and phylogenetic relationship with those in other countries are still unknown. We collected *A. cerana* samples from the main cerana-keeping region in Pakistan and performed whole genome sequencing. A total of 28 Gb of Illumina shotgun reads were generated, which were used to assemble the genome. The obtained genome assembly had a total length of 214 Mb, with a GC content of 32.77%. The assembly had a scaffold N50 of 2.85 Mb and a BUSCO completeness score of 99%, suggesting a remarkably complete genome sequence for *A. cerana* in Pakistan. A MAKER pipeline was employed to annotate the genome sequence, and a total of 11,864 protein-coding genes were identified. Of them, 6750 genes were assigned at least one GO term, and 8813 genes were annotated with at least one protein domain. Genome-scale phylogeny analysis indicated an unexpectedly close relationship between *A. cerana* in Pakistan and those in China, suggesting a potential human introduction of the species between the two countries. Our results will facilitate the genetic improvement and conservation of *A. cerana* in Pakistan.

Further Reading: <https://doi.org/10.3390/insects12070652>