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Editorial Team: Dikshya Poudel and Prabina Dhakal

For the 685th – 686th issues of Headlines Himalaya, we reviewed researches from seven sources and selected 15 researches from five countries. We selected five researches from Nepal and 10 researches from other Himalayan countries (India, China, Bhutan and Pakistan).

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ELEPHANTS IN NEPAL: CORRELATING DISEASE, TOURISM AND WELFARE

Michelle Szydlowski

Journal of Applied Animal Welfare Science 24: 1-13

Asian elephants and humans have long shared their lives, but recent changes in human perspectives on animal use have created ripples through the small country of Nepal. Captive elephants are caught in the crossfire between local communities, elephant owners, mahouts, and NGOs in debates over their treatment, health, welfare and use in tourism. In addition, zoonotic disease, natural disasters and political strife affect the lives of captive elephants and mahouts. For example, during the COVID-19 pandemic, elephants, caregivers and owners found themselves facing income loss, decreased welfare from housing and husbandry issues, and food shortages. Many owners sold elephants, fired mahouts, and “quit” the tourism industry. Others sought help from outside organizations, community members, and governmental agencies to retain ownership of what they viewed as valuable commodities. NGOs and grassroots organizations assisted in the hopes of keeping elephants in Nepal, thus preventing them from long, treacherous walks across the border and into situations where they might face further welfare decreases. This article combines elephant stable visits and interviews with mahouts, owners, NGO, and government staff between January 2019 and December 2021. It highlights the ongoing health and welfare challenges faced by elephants and mahouts in Nepal.

For more information: <https://doi.org/10.1080/10888705.2022.2028628>

MITOCHONDRIAL GENETIC DIVERSITY AND STRUCTURE OF THE LANGUR POPULATION IN A COMPLEX LANDSCAPE OF THE NEPAL HIMALAYA

Laxman Khanal, Mukesh Kumar Chalise, Xue-Long Jiang, and Randall C. Kyes

Diversity 14: 69

Heterogenous landscape features of the Himalayan region shape the genetic structure of animal populations by delimiting spatial patterns of dispersal and reproduction. Integrating population genetic analysis with landscape features could yield results that shed light on the evolutionary diversity of the taxa therein. This study assessed the population genetic structure of the Nepal Himalayan langurs (*Semnopithecus* spp.) across almost their entire distribution range in the complex landscape of the Nepal Himalaya using the mitochondrial cytochrome b (CYTB, 1140 bp), cytochrome c oxidase I (COI, 676 bp), and control region (1088 bp) sequences. Sequences were successfully retrieved from 52 samples belonging to 17 troops of wild Himalayan langurs in Nepal. The concatenated alignment of the three loci (2904 bp) defined 35 unique haplotypes with haplotype and nucleotide

diversities of 0.961 ± 0.017 and 0.0204 ± 0.004 , respectively. The results of a median joining haplotype network and of inter-haplotypic phylogenetic analyses revealed five major clades across the country: one from the eastern, two from the central, and two from the western region of Nepal. No haplotypes were shared among the regions. The Mantel test results indicated that the landscape heterogeneity of the Himalaya has shaped the population genetic structure of the Himalayan langurs due to the combined effects of isolation by resistance and isolation by distance phenomena. The strong population genetic structure and deep mtDNA divergence warrants a detailed taxonomic assessment of the Himalayan langurs across their entire range.

For more information: <https://doi.org/10.3390/d14020069>

SPATIAL SEGREGATION BETWEEN WILD UNUGULATES AND LIVESTOCK OUTSIDE PROTECTED AREAS IN THE LOWLAND OF NEPAL

Shivish Bhandari, Ramiro D. Crego, and Jared A. Stabach

PloS one 17: e0263122

Understanding how wildlife interacts with human activities across non-protected areas are critical for conservation. This is especially true for ungulates that inhabit human-dominated landscapes outside the protected area system in Nepal, where wildlife often coexists with livestock. Here we investigated how elevation, agricultural land, distance from roads, and the relative abundance of livestock (goats, sheep, cow and buffalo) influenced wild ungulate chital (*Axis axis*), nilgai (*Boselaphustrago camelus*), wild boar (*Sus scrofa*) and sambar (*Rusa unicolor*) abundance and occurrence. We counted all individuals of wild ungulates and livestock along 35 transects conducted between November 2017 and March 2018 in community forests of Bara and Rautahat districts in the lowlands of Nepal. We assessed abundance and occurrence relation to covariates using Generalized Linear Models. We found that livestock outnumbered wild ungulates 6.6 to 1. Wild boar was the most abundant wild ungulate, followed by nilgai, chital, and sambar. Elevation and livestock abundance were the most important covariates affecting the overall abundance of wild ungulates and the distribution of each individual ungulate species. Our results suggest spatial segregation between wild ungulates, which occur mainly on high grounds (> 300 m.a.s.l.), and livestock that concentrate across low ground habitats (< 300 m.a.s.l.). Our results provide a critical first step to inform conservation in community forest areas of Nepal, where wildlife interacts with people and their livestock. Finding better strategies to allow the coexistence of ungulates with people and their livestock is imperative if they are to persist into the future.

For more information: <https://doi.org/10.1371/journal.pone.0263122>

GOVERNANCE OF FORSET RESOURCE USE IN WESTERN NEPAL: CURRENT STATE AND COMMUNITY PREFERENCES

Manoj Bhatta, Kerstin K. Zander, and Stephen T. Garnett

Ambio 51: 1-15

Improved governance of natural resource use is critical to the sustainability and maintenance of environmental quality. In western Nepal, unsustainable resource extraction is seen by the local community as a major threat to forest sustainability. While most respondents to a survey of 243 households inside and outside a protected area (PA) thought the laws for managing resource use were adequate and appropriate, a far smaller proportion thought they were achieving their objectives. Disenchantment with the existing governance regime was strongest outside the PA, probably because there was greater investment in community engagement within the PA. The most likely

reason for this failure is the deeply embedded corruption within the forest governance system. Devolution of power to local communities by increasing governance participation is one of the most likely means of containing corruption. It was therefore not surprising that *governance participation* was rated as the most important governance principle by respondents in a best–worst scaling experiment. Respondents also regarded *effectiveness*, *accountability* and *transparency* as important governance principle to improve management of forest resource extraction from red panda habitat.

For more Information: <https://doi.org/10.1007/s13280-021-01694-9>

POTENTIAL RANGE SHIFT OF SNOW LEOPARD IN FUTURE CLIMATE CHANGE SCENARIOS

Xinhai Li, Liming Ma, Dazhi Hu, Duifang Ma, Renqiang Li, Yuehua Sun, and Erhu Gao

Sustainability 14: 1115

The snow leopard (*Panthera uncia*) lives in alpine ecosystems in Central Asia, where it could face intensive climate change and is thus a major conservation concern. We compiled a dataset of 406 GPS-located occurrences based on field surveys, literature, and the GBIF database. We used Random Forest to build different species distribution models with a maximum of 27 explanatory variables, including climatic, topographical, and human impact variables, to predict potential distribution for the snow leopard and make climate change projections. We estimated the potential range shifts of the snow leopard under two global climate models for different representative concentration pathways for 2050 and 2070. We found the distribution center of the snow leopard may move northwest by about 200 km and may move upward in elevation by about 100 m by 2070. Unlike previous studies on the range shifts of the snow leopard, we highlighted that upward rather than northward range shifts are the main pathways for the snow leopard in the changing climate, since the landform of their habitat allows an upward shift, whereas mountains and valleys would block northward movement. Conservation of the snow leopard should therefore prioritize protecting its current habitat over making movement corridors.

For more information: <https://doi.org/10.3390/su14031115>

India-Himalaya

AIR CONTAMINANTS AND ATMOSPHERIC BLACK CARBON ASSOCIATION WITH WHITE SKY ALBEDO AT HINDUKUSH KARAKORUM AND HIMALAYA GLACIERS

Irfan Zainab, Zulfiqar Ali, Usman Ahmad, Syed Turab Raza, Rida Ahmad, Zaidi Zona, and Safdar Sidra

Applied Sciences 12: 962

Environmental contaminants are becoming a growing issue due to their effects on the Cryosphere and their impact on the ecosystem. Mountain glaciers are receding in the HKH region and are anticipated to diminish further as black carbon (BC) concentrations rise along with other pollutants in the air, increasing global warming. Air contaminants and BC concentrations were estimated (June 2017–May 2018). An inventory of different pollutants at three glaciers in Karakoram, Hindukush, and the Himalayas has been recorded with Aeroqual 500 and TSI DRX 8533, which are as follows: ozone ($28.14 \pm 3.58 \mu\text{g}/\text{m}^3$), carbon dioxide ($208.58 \pm 31.40 \mu\text{g}/\text{m}^3$), sulfur dioxide ($1.73 \pm 0.33 \mu\text{g}/\text{m}^3$), nitrogen dioxide ($2.84 \pm 0.37 \mu\text{g}/\text{m}^3$), PM_{2.5} ($15.90 \pm 3.32 \mu\text{g}/\text{m}^3$), PM₁₀ ($28.05 \pm 2.88 \mu\text{g}/\text{m}^3$), total suspended particles ($76.05 \pm 10.19 \mu\text{g}/\text{m}^3$), BC in river water ($88.74 \pm 19.16 \mu\text{g}/\text{m}^3$), glaciers ($17.66 \pm 0.82 \mu\text{g}/\text{m}^3$),

snow/rain (57.43 ± 19.66 ng/g), and air (2.80 ± 1.20 $\mu\text{g}/\text{m}^3$). BC was estimated by using DRI Model 2015, Multi-Wavelength Thermal/Optical Carbon Analyzer, in conjunction with satellite-based white-sky albedo (WSA). The average BC concentrations in the Karakoram, Himalaya, and Hindukush were 2.35 ± 0.94 , 4.38 ± 1.35 , and 3.32 ± 1.09 ($\mu\text{g}/\text{m}^3$), whereas WSA was 0.053 ± 0.024 , 0.045 ± 0.015 , and 0.045 ± 0.019 ($\mu\text{g}/\text{m}^3$), respectively. Regression analysis revealed the inverse relationship between WSA and BC. The resulting curves provide a better understanding of the non-empirical link between BC and WSA. Increased BC will inherit ecological consequences for the region, ultimately resulting in biodiversity loss

For more information: <https://doi.org/10.3390/app12030962>

GEOCHEMICAL RECORDS OF TECTONO-CLIMATIC ENVIRONMENTAL CHANGES IN ^{14}C -DATED PEATS FROM ZIRO VALLEY OF EASTERN HIMALAYA, ARUNACHAL PRADESH, INDIA

Avijit Das, Arpita Roy Choudhury, and Anindya Das

Arabian Journal of Geosciences 15: 285

Geochemical proxies have been employed in this study to assess the vegetation, hydrology and atmospheric dust changes in ^{14}C -dated, high-altitude, tropical peats of Eastern Himalaya in Ziro Valley for new insight into the region's past tectono-environmental changes. Peat geochemistry at seven sampled locations was studied by comparing the depth profile of the ash content, molar Ca/Mg ratio, Sr and Al (conservative lithogenic element) against the ^{14}C -dated ages of peat sections in a sequence. The trophic status of the peat from the seven locations indicated the presence of both ombrotrophic and miner atrophic peats. The age-depth profile of peat from two locations showed that geochemical changes due to fluvial accumulation resulting in high mineral-rich ash content occurred around the time of the Last Glacial Maxima, about 25 ka ago. Atmospheric Pb deposition in the peat archives of Ziro was also assessed from the variation of Pb and Pb/Sc ratio in the depth-age plots. The $\delta^{13}\text{C}$ values of the peat sections from the seven locations in this study ranged from -26.56 to -28.01‰ and it indicated a dominance of the C-3 plants around 42 ka.

For further reading: <https://doi.org/10.1007/s12517-022-09560-y>

China Himalaya

EVALUATING COMMUNITIES WILLINGNESS TO PARTICIPATE IN ECOSYSTEM CONSERVATION IN SOUTHEAST TIBETAN NATURE RESERVES, CHINA

Lingxia Xu, Wanyun Xu, Chao Jiang, Huxuan Dai, Qiaoqi Sun, Kun Cheng, Chun-Hung Lee, Cheng Zong, and Jianzhang Ma

Land 11: 207

Southeast Tibet is significant in maintaining key ecological functions and providing ir re-placeable ecosystem services but is also extremely vulnerable and susceptible to the impacts of human activities. Understanding the attitudes of local residents toward ecosystem conservation is considered essential for nature resource management. We therefore aimed to conduct an evaluation framework under hypothetical scenarios to measure communities' willingness to participate in ecosystem conservation using the contingent valuation method (CVM).

Second, this study determined the underlying factors that might affect local's willingness to participate and then compared the willingness to pay (WTP) and willingness to work (WTW) for different types of nature reserves. We found that income, education, community attachment, and acceptance of a payment scheme are significant factors determining the average amount that residents are willing to pay for ecosystem conservation, while their income, acceptance of a work scheme, and education are significant factors influencing the average service time that residents are willing to devote to work. Our results revealed that community residents have considerable willingness to participate in ecosystem conservation, which points not only to the great value attached to the ecosystem service function of Southeast Tibet nature but also suggests that people's willingness to participate is influenced by a conglomeration of socio-economic characteristics and their previous experience. The information herein can be used to implement conservation planning that involves community co-management and policymaking for sustainable development and will be beneficial to the dynamic conservation and adaptive management of Tibetan nature reserves.

For further reading: <https://doi.org/10.3390/land11020207>

QINGHAI-TIBETAN PLATEAU GREENING AND HUMAN WELL-BEING IMPROVING: THE ROLE OF ECOLOGICAL POLICIES

Shijin Wang and Yanqiang Wei

Sustainability 14: 1652

Appropriate human activities can have significantly positive effects on vegetation dynamics. In the past 50 years, various ecological policies have improved both ecological change and human well-being in the Qinghai–Tibetan Plateau (QTP), efficiently achieving multiple Sustainable Development Goals (SDGs) of the United Nations' 2030 Agenda for Sustainable Development. During 1981–2017, the annual mean normalized difference vegetation index (NDVI) of the protected areas (PAs) tended to increase significantly at a rate of $2.93 \times 10^{-4}/a$ ($p < 0.01$), while non-PAs only increased by $0.6 \times 10^{-4}/a$ ($p < 0.5$). Improvement in the NDVI of the PAs is more obvious than that of non-PAs. Specifically, the earlier the establishment of the PAs is, the more significant the greening effect will be. Moreover, ecological protection has not slowed improvements in human welfare; on the contrary, the Human Development Index (HDI) has nearly doubled in the past 40 years. In terms of global ecological construction, the Chinese government has demonstrated the responsibilities of a large country in global ecological governance. Chinese initiatives can guide other nations in contributing to the global sustainability aspirations embodied in the 2030 SDGs Agenda. This study can be used as a reference for other countries in the world to coordinate the development of ecological protection and well-being.

For further reading: <https://doi.org/10.3390/su14031652>

EFFECTIVENESS OF PROTECTION AREAS IN SAFEGUARDING BIODIVERSITY AND ECOSYSTEM SERVICES IN TIBET AUTONOMOUS REGION

Kaipeng Xu, Xiahui Wang, Jinnan Wang, Jingjing Wang, Rongfeng Ge, Rensheng Tian, Huixia Chai, Xin Zhang, and Le Fu

Scientific Reports 12: 1161

The Tibet Autonomous Region of China constitutes a unique and fragile ecosystem that is increasingly influenced by development and global climate change. To protect biodiversity and ecosystem services in Tibet, the Chinese

government established a system of nature reserves at a significant cost; however, the effectiveness of nature reserves at protecting both—biodiversity and ecosystem service functions in Tibet is not clear. To determine the success of existing nature reserves, we determined importance areas for the conservation of mammal, plant, bird, amphibian, and reptile species, and for the protection of ecosystem service functions. The results indicated that important conservation areas for endangered plants were mainly distributed in the southern part of Nyingchi City, and for endangered animals, in the southern part of Nyingchi and Shannan Cities. Extremely important conservation areas for ecosystem service functions of carbon sequestration, water and soil protection, and flood regulation were mainly distributed in the southern part of Nyingchi and Shannan Cities, northern and southeastern parts of Nagqu City, and southern part of Ngari area. Based on an analysis of spatial overlap in protection areas, we conclude that existing natural reserves need to be expanded, and new ones need to be established to better protect biodiversity in Tibet Autonomous Region.

For further reading: <https://doi.org/10.1038/s41598-021-03653-6>

Bhutan-Himalaya

DYNAMICS OF INDIGENOUS COMMUNITY'S FOOD AND CULTURE IN THE TIME OF CLIMATE CHANGE IN THE HIMALAYAN REGION

Suraj Das and Anindya Jayanta Mishra

Journal of Ethnic Foods 9: 1

Global climate change has become the most significant challenge of modern times, confronting the lives and security of vulnerable societies around the world. The anticipated impact of climatic variability will be severe on local communities, particularly those residing near high-risk prone zones such as coastal areas and mountain regions. The indigenous knowledge and locally-held beliefs act as a refuge, which also prompt and prohibit the responsiveness towards climatic instabilities. Subsequently, ensuring food and nutritional security is the primary task of strategy makers. Hence, comprehensive knowledge of the indigenous traditional food habits and cultural values, beliefs, and gendered norms need to be explored on a priority basis to address the adverse impact of environmental changes, emphasizing the urgency of the Himalayan societies. Despite that, the integration of indigenous knowledge is not on the priority list of the researcher. Thus, this article reviews the existing literature on customary food habits to analyze the bidirectional association between climate change and the dietary practice of the indigenous communities for adaptation policy. PRISMA Statement technique is used for a systematic review of Scopus and Web of Science databases identified 24 related studies from 14 countries, with a specific focus on the Himalayan region, which resulted into four themes viz. impact of climatic variability of indigenous societies, the impact of climate change on community's customary food beliefs, the impact of climate change on gender defined norms, climate change adaption strategies. The findings show that the current literature has failed to include the socio-ecological beliefs of traditional communities associated with dietary habits. Thus, the focus should be given to integrate the locally held beliefs of customary societies for the successful adoption of climate change adaptation and food security programs.

For more information: <https://doi.org/10.1186/s42779-022-00118-7>

MODIFICATION OF LAND USE/LAND COVER AND ITS IMPACT ON GROUNDWATER IN PESHAWAR CITY, PAKISTAN

Pukhtoon Yar, Jiao Huafu, Mohammad Aslam Khan, Wajid Rashid, and Salman Khan

Journal of the Indian Society of Remote Sensing 50: 159–174

Land use and land cover modifications have been undergoing at a hasty pace across the world. The dynamics of growth and change in land use in Peshawar City during the period 1991–2014 was studied utilizing GIS and remote sensing technologies. Using Landsat TM imageries, this study examined land use alterations in urban and peri-urban Peshawar and their impact on ground water. Beside this, the study used temporal and spatial dataset of water table for the year 1991 and 2014 that were gathered from Water and Works Department Peshawar, Pakistan. This study also used Cellular Automata–Markov (CA–Markov model) to predict the future change in built up area up to 2044 on the basis of past trend (1991–2014) and its impact on the encroachment or loss of agricultural land as well as the level of ground water. The past trend of fluctuation of groundwater (in feet) with the expansion in size of built-uses was also used to predict future trend in ground water depletion. The most severe impact in terms of groundwater depletion will take place in the southern parts of the city. The sharp decrease of groundwater table was observed in the central parts of the city compared to the peripheries. If this declining trend of groundwater level continues that might put an amplified stress on underground aquifers and may trigger to land subsidence or other environmental hazards.

For more information: <https://doi.org/10.1007/s12524-021-01464-w>

MODELING POTENTIAL DISTRIBUTION OF NEWLY RECORDED ANT, *BRACHYPONERA NIGRITA* USING MAXENT UNDER CLIMATE CHANGE IN POTHWAR REGION, PAKISTAN

Ammara Gull E. Fareen, Tariq Mahmood, Imran Bodlah, Audil Rashid, Azeem Khalid, and Shahid Mahmood

PLOS ONE 17: e0262451

Climate change has been discussed as to exert shifts in geographical range of plants, animals or insect species by increasing, reducing or shifting its appropriate climatic habitat. Globally, Pakistan has been ranked at 5th position on the list of countries most vulnerable to climate change in 2020. Climate change has resulted in the losses of biodiversity and alteration in ecosystem as a result of depletion of natural habitats of species in Pakistan as well as in the world. Ants have been regarded as indicators of environmental change and ecosystem processes. *Brachyponera nigrita* (Emery, 1895) was reported for the first time from Pakistan (Pothwar region). Objective of our studies was to model geographic distribution of newly recorded ant species, *B. nigrita* based on two representative concentration pathways (RCP) (RCP4.5 and RCP8.5) for 2050s using maximum entropy model (Maxent) in Pakistan. In modeling procedure, 21 occurrence records and 8 variables namely Bio4 (Temperature seasonality), Bio8 (Mean temperature of wettest quarter), Bio10 (Mean temperature of warmest quarter), Bio12 (Annual precipitation), Bio13 (Precipitation of wettest month), Bio15 (Precipitation seasonality), Bio17 (Precipitation of driest quarter) and Bio18 (Precipitation of warmest quarter) were used to determine the current and future distributions. Performance of the model was evaluated using AUC (area under curves) values, partial ROC, omission rates ($E = 5\%$) and AICc (Model complexity). The results showed the average AUC value of the model was 0.930, which indicated that the accuracy of the model was excellent. The jackknife test also showed that Bio4, Bio18, Bio17 and Bio15 contributed 98% for the prediction of potential distribution of the species as compared to all other variables. Maxent results indicated that distribution area of *B. nigrita* under future predicted bioclimatics 2050 (RCP 4.5 and RCP8.5) would be increased in various localities of Pakistan as compared to its current

distribution. In Pothwar region, moderately suitable and highly suitable areas of this species would increase by 505.932321 km² and 572.118421 km² as compared to current distribution under 2050 (RCP 4.5), while under 2050 (RCP 8.5), there would be an increase of 6427.2576 km² and 3765.140493 km² respectively in moderately suitable and highly suitable areas of *B. nigrita*. This species was associated with termites, collembolans and larval stages of different insects. White eggs, creamy white pupae and many workers of this species were observed in a variety of habitats. Unknown nesting ecology, species identification characters supported with micrographs has been given which will help researchers for further ecological studies.

For more information: <https://doi.org/10.1371/journal.pone.0262451>

INTER-AGENCY COLLABORATION AND DISASTER MANAGEMENT: A CASE STUDY OF THE 2005 EARTHQUAKE DISASTER IN PAKISTAN

Ikram Shah, Tahir Mahmood, Sajjad A. Khan, Noor Elahi, Muhammad Shahnawaz, Adnan A. Dogar, Fazli Subhan, and Khoula Begum

Journal of Disaster Risk Studies 14: a1088

In post disastrous situations, coordinated and integrated interventions aimed at relief and rehabilitation not only help facilitate reaching out to the affected communities in a timely fashion but also pave the way to channel scarce and valued resources towards end users in an efficient and effective manner. This article attempts to trace the origins and gradual development of 'inter-agency collaboration' and the implications thereof for disaster management strategies in Pakistan through an analysis of relief and rehabilitation interventions undertaken by the Government of Pakistan in collaboration with local and international Non-governmental Organisations (NGOs) and relief agencies in the ex- post of the 2005 earthquake. Data for this study were collected through structured and semi-structured interviews from government officials, representatives of NGOs and relief agencies and ordinary women and men in the earthquake stricken localities of Balakot and Mansehra districts of Pakistan. On the heels of the 2005 earthquake, both local NGOs and faith-based organisations in concert with international NGOs and relief agencies from around the world rushed to assist Pakistan in its rescue and relief operations at a time when the country was faced with the twin dilemma of both the non-existence of peculiar institutional arrangements for disaster management and a lack of the necessary technical and financial resources. The aftermath of the 2005 earthquake offered opportunity to the Government of Pakistan and the NGOs and relief agencies alike to transform their individual interventions into a robust and organised 'inter-agency collaboration', which was later on realised in the form of establishment of a national disaster management organisation called the 'Earthquake Reconstruction and Rehabilitation Authority (ERRA)'. The establishment of ERRA not only paved the way for avoiding duplication and wastage of resources but also ensued in reaching out to the affected communities in a timely fashion. The Pakistani case offers implications in terms of highlighting the salience of establishing 'inter-agency collaboration' in other settings.

For more information: <https://doi.org/10.4102/jamba.v14i1.1088>

GEOPHYSICAL AND GEOCHEMICAL CHARACTERIZATION OF SOLIDWASTE DUMPSITE: A CASE STUDY OF CHOWA GUJAR, PESHAWAR (PART OF INDUS BASIN)

Nabeel Afzal Butt, Muhammad Younis Khan, Seema Anjum Khattak, Gulraiz Akhter, Yonggang Ge, Muhammad Tahir Shah, and Asam Farid

Sustainability 14: 1443

Open and non-engineered dumping is a typical method for solid waste disposal in most cities of Pakistan. This practice of waste dumping poses a serious threat to the surrounding ecosystem and human population due to the release and transport of decomposed organic matter, i.e., leachate from dumpsite into the groundwater. The present study was conducted over a non-engineered and open dumpsite (Chowa Gujar), located in the outskirts of the highly populated city of Peshawar by using integrated geophysical techniques such as electrical resistivity tomography (ERT) and ground-penetrating radar (GPR) and geochemical techniques. The main goal was to delineate the characterization and depth of buried waste, to map the subsurface extension of contaminant plumes towards agricultural land and groundwater table and the concentration of heavy metals (HMs) in dump and agricultural soil. Geophysical results showed that the thickness of buried waste (predominantly composed of domestic waste) was around 4 m and the leachate plumes have percolated to the adjacent agricultural land. A range of heavy metals (mg/kg) such as Cr (20.5–26.6), Cd (2.6–5.7), Pb (0.35–21.25), Ni (2.5–53.05), Cu (29–68.3), Zn (45.7–77), and Co (18.9–23.2) have been found in the agricultural land adjacent to the dumpsite. The findings demonstrated that combined use of ERT and GPR successfully characterize the buried waste and spread of pollutant plumes spatially and vertically from Chowa Gujar dumpsite. The anomalous geophysical signatures were confirmed by geochemical characterization. The movement of leachate plumes towards agricultural land and groundwater table and the concentration of HMs in soil show that Chowa Gujar dumpsite is a potential source of contamination not only to the surrounding population but also to the agricultural land, surface (Bara River), and subsurface water bodies. In the study region, there is an urgency to take remediation and mitigation measures to reduce the level of pollution created by the dumpsite.

For more Information: <https://doi.org/10.3390/su14031443>

Highlight of the Issue

Remembering Charles Darwin

Charles Darwin (born on February 12, 1809 in England) was always remembered for his great contribution on the theory 'origin of species'. Darwin travelled in the HMS Beagle, a ship of the British Royal Navy as a naturalist in 1831 to survey South American coastline. Darwin's document on origin of species led to groundbreaking scientific discoveries in the advancement and evolution of life in this planet. With such great scientific contribution to the world, recent sciences have achieved greater findings based on his theory. We always appreciate Darwin for such wonderful input.

<https://darwinday.org/>

<https://www.daysoftheyear.com/days/darwin-day/>