An Environmental Research Abstract

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For the 595-596th issues of Headlines Himalaya, we reviewed journal articles from nine sources and selected fifteenresearches from five countries. We selected nineresearches from Nepal and threeresearchesfrom other Himalayan countries (China and Pakistan). The overall coverage of this issue is biodiversity, wildlife, water management, climate change, agriculture and environment.

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BIOMASS FUEL USE AND CARDIAC FUNCTION IN NEPALI WOMEN

JasleenTiwana, Catherine Benziger, Laura Hooper, Karl Pope, Vijay Alurkar,RamchandraKafle, Tula R. Sijali, John R. Balmes, Joel D. Kaufman, and Michael N. Bates

*Global Heart*15: 11

Exposure to household air pollution (HAP) from cooking with biomass fuel affects billions of people. We hypothesized that HAP from wood smoke, compared to other household fuels, was associated with adverse cardiovascular outcomes, of which there have been few studies. Methods: A cross-sectional study was completed in 299 females aged 40–70 years in Kaski District, Nepal, during 2017–18. All participants underwent a standard 12-lead ECG, ankle and brachial systolic blood pressure measurement, and 2D color and Doppler echocardiography. Cur-rent stove type was confirmed by inspection. Blood pressure, height, and weight were measured using a standardized protocol. Hypertension was defined as ≥140/90 mmHg or prior diagnosis. Hemoglobin A1c (HbA1c) was obtained, with diabetes mellitus defined as a prior diagnosis or HbA1C ≥ 6.5%. We used adjusted linear and logistic multivariable regressions to examine the relationship of stove type with cardiac structure and function.The majority of women primarily used liquified petroleum gas (LPG) stoves (65%), while 12% used biogas, and 23% used wood-burning cook-stoves. Prevalence of major cardiovascular risk factors was 35% with hypertension, 19% with diabetes mellitus, and 15% current smokers. After adjustment, compared to LPG, wood stove use was associated with increased indexed left atrial volume (β = 3.15, 95% CI 1.22 to 5.09) and increased indexed left ventricular end diastolic volume (β = 7.97, 95% CI 3.11 to 12.83). There was no association between stove type and systemic hypertension, left ventricular mass, systolic dysfunction, diastolic dysfunction, pulmonary hypertension, abnormal ankle-brachial index, or clinically significant ECG abnormalities.Biomass fuel use was associated with increased indexed left atrial volume and increased indexed left ventricular diastolic volume in Nepali women, suggesting subclinical adverse cardiac remodeling from HAP in this cross-sectional study. We did not find evidence of an association with hypertension or typical cardiac sequelae of hypertension. Future studies to confirm these results are needed.

For further reading: https://doi.org/10.5334/gh.405

PRO-INFLAMMATORY EFFECTS IN EX VIVO HUMAN LUNG TISSUE OF RESPIRABLE SMOKE EXTRACTS FROM INDOOR COOKING IN NEPAL

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*Annals of the American Thoracic Society*17: 688-698

Exposure to biomass smoke is believed to increase the risk of developing chronic obstructive pulmonary disease. However, little is known about the mechanisms underlying responses to biomass smoke in human lungs.This study had two objectives: first, to quantify “real-life” exposures to particulate matter <2 µm in diameter ($PM_{2.5}$) and carbon monoxide (CO) measured during cooking on stoves in rural areas of Nepal in different geographical settings; and second, to assess the effect of biomass smoke extracts on inflammatory responses in ex vivo human lung tissue.Personal exposures to $PM_{2.5}$and indoor near-stove CO concentrations were measured during cooking on a range of stoves in 103 households in 4 different Nepalese villages situated at altitudes between ~100 and 4,000 m above sea level. Inflammatory profiles to smoke extracts collected in the field were assessed by incubating extracts

with human lung tissue fragments and subsequent Luminex analysis. In households using traditional cooking stoves, the overall mean personal exposure to $PM_{2.5}$during cooking was 276.1 µg/m3 (standard deviation [SD], 265 µg/m3), and indoor CO concentration was 16.3 ppm (SD, 19.65 ppm). The overall mean $PM_{2.5}$exposure was reduced by 51% ($P = 0.04$) in households using biomass fuel in improved cook stoves, and 80% ($P < 0.0001$) in households using liquefied petroleum gas. Similarly, the indoor CO concentration was reduced by 72% ($P < 0.001$) and 86% ($P < 0.0001$) in households using improved cook stoves and liquefied petroleum gas, respectively. Significant increases occurred in 7 of the 17 analytes measured after biomass smoke extract stimulation of human lung tissue (IL-8 [interleukin-8], IL-6, TNF-α [tumor necrosis factor-α], IL-1β, CCL2, CCL3, and CCL13). High levels of real-life exposures to PM2.5 and CO occur during cooking events in rural Nepal. These exposures induce lung inflammation ex vivo, which may partially explain the increased risk of chronic obstructive pulmonary disease in these communities.

For further reading:https://doi.org/10.1513/AnnalsATS.201911-827OC

MIGRATION AND HOUSEHOLD ADAPTATION IN CLIMATE SENSITIVE HOSTSPOTS IN SOUTH ASIA

Amina Maharjan, Ricardo Safra de Campos, Chandni Singh, Shouvik Das, Arjun Srinivas, Mohammad RashedAlamBhuiyan, Sultan Ishaq, Muhammad Awais Umar, TanzinaDilshad, Krity Shrestha, SuruchiBhadwal, Tuhin Ghosh, Natalie Suckall, and Katharine Vincent

*Current Climate Change Reports*6: 1–16

South Asia is highly vulnerable to the impacts of climate change, owing to the high dependency on climate-sensitive livelihoods and recurrent extreme events. Consequently, an increasing number of households are adopting labour migration as a livelihood strategy to diversify incomes, spread risks, and meet aspirations. Under the Collaborative Adaptation Research Initiative in Africa and Asia (CARIAA) initiative, four research consortia have investigated migration patterns and their inherent linkages to adaptation to climate change in climate hotspots. This article synthesizes key findings in regional context of South Asia.The synthesis suggests that in climate-sensitive hotspots, migration is an important livelihood diversification strategy and a response to various risks, including climate change. Typically, one or more household members, often young men, migrated internally or internationally to work in predominantly informal sectors. Remittances helped spatially diversify household income, spread risks, and insure against external stressors. The outcomes of migration are often influenced by who moves, where to, and what capacities they possess.Migration was found to help improve household adaptive capacity, albeit in a limited capacity. Migration was mainly used as a *response* to risk and uncertainty, but with potential to have positive adaptation co-benefits.

For further reading:https://doi.org/10.1007/s40641-020-00153-z

ASSESSMENT OF SOCIO-ECONOMIC FACTORS IMPACTING ON THE CROPPING INTENSITY OF AN IRRIGATION SCHEME IN DEVELOPING COUNTRIES

Santosh Kaini, Ted Gardner, and Ashok K. Sharma

Irrigation and Drainage 69: 363-375

An increase of cropping intensity of irrigation schemes is required to address the challenge of global food security. Socioeconomic factors also have a significant impact on the cropping intensity within an irrigated area. This research is focused on understanding the impact of socioeconomic factors on cropping intensity in an irrigation scheme. To assess the socioeconomic factors and cropping intensity, a framework was developed, which we believe

can be adopted in other irrigation schemes in developing countries. The framework was applied to an irrigation area in Nepal. An interview checklist and observation techniques were used as the primary data-gathering method, which followed the concepts articulated in the developed framework. A census survey was also conducted in 72 farmer households. The results showed that farmers' socioeconomic status and their sociocultural practices affected cropping intensity. The research also highlighted that mechanization in agricultural practices, coordination between irrigation and agricultural district offices with farmers, market facilities for agricultural inputs and agricultural products, and land tenancy agreements all significantly influenced agricultural intensification. Based on the findings of this research, an approach to intensify cropping intensity by farm owners and farming tenants has been developed, which can be applied in irrigated areas in the developing world.

For further reading: https://doi.org/10.1002/ird.2427

GROWTH RING ANALYSIS OF DIPLOKNEMA BUTYRACEA IS A POTENTIAL TOOL FOR REVEALING INDEGENOUS LAND USE HISTORY IN THE LOWER HIMALAYAN FOOTHILLS OF NEPAL

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*Forests*11*: 242*

Slash-and-burn is a farming practice of the indigenous communities in the Himalayan foothills of Nepal. The traditional land-tenure system is based on a customary oral tradition. However, the government's persistent denial of land rights has fueled the indigenous conflicts in the last few decades. Deliverance of scientific evidence-based arguments may underpin the ongoing conflict-resolution dialogues between the authorities and the indigenous communities. Dating growth rings of trees in a slash-and-burn system might help the indigenous people to find evidence of their historic land uses in the mountainous landscape. In this pilot study, we examined the potential of *Diploknemabutyracea* (Roxb.) H. J. Lam growth rings for documenting land use history of Nepalese indigenous farming practices, as this species is being preserved during the slash-and-burn practices. The species is an economically important and ecologically interesting (as it flushes leaves when everything is dry, and sheds leaves while everything is green) deciduous tree species belonging to *Sapotaceae* family and widely distributed in Sub-Himalayan tracts. Five stem discs were studied which were originated from the Kandrang valley of the Chitwan district, Nepal. For the first time, we revealed distinct growth rings in this species which are marked by fibers with thicker cell walls. Growth-ring anomalies, i.e., wedging and partially missing rings, were also found. Four out of five samples could be crossdated at a marginal level ($GLK \geq 60$ and $t \geq 2.0$) which is a confirmation of the annual nature of growth rings. One of the samples showed black spots of oxidized wood which are traces of fire, suggesting evidence of slash-and-burn practices in the study area since 1933. This study suggests a strong potential of *D. butyracea* for growth-ring analysis to reconstruct indigenous land use history in Nepal.

For further reading: https://doi.org/10.3390/f11020242

LUCRATIVE DISASTER: FINANCIALIZATION, ACCUMULATION AND POSTEARTHQUAKE RECONSTRUCTION IN NEPAL

Dinesh Paudel, Katharine Rankin, and Philippe Le Billon

*Economic Geography*96: 1-24

This article investigates long-term processes of financialization unfolding in the aftermath of the 2015 earthquakes in Nepal, engaging with literatures on financialization and political economy of disaster and development. The article probes the evolving financialized social relations in Nepal in the context of humanitarian relief and reconstruction, paying particular attention to processes through which wide-scale political economies enter into the daily lives of disaster victims and play key roles in transforming their economic practice and subjectivity. In the name of relief and reconstruction, foreign investment combined with urban surplus capital has circulated within

Nepal as *finance* in rural, earthquake-affected areas—making the earthquakes a truly lucrative disaster. The article deploys a conjunctural approach to understanding disaster *financialization* as a multiscalar process constituted through geoeconomic logics, state–market complexes, and economic subjectivity. Each of these dimensions of disaster financialization is elaborated in separate sections of the article. We conclude by cautioning against *both* celebrations and outright rejections of finance as a viable and desirable modality for disaster reconstruction—calling instead for a more nuanced understanding of disaster financialization and its implications for affected populations.

For further reading: https://doi.org/10.1080/00130095.2020.1722635

ANALYSIS OF HOUSEHOLD ACCESS TO DRINKING WATER, SANITATION AND WASTE DISPOSAL SERVICES IN URBAN AREAS OF NEPAL

BhagirathBehera, DilBahadurRahut, and NarayanSethi

*Utilities Policy*62: 100996

In recent years, researchers have paid increasing attention to the provision of access to clean and sufficient drinking water, sanitation facilities, and proper waste management in developing countries. This paper examines household access to these services in urban areas of Nepal by studying the comprehensive data of the Nepal Living Standard Survey (NLSS) for the 1995-1996, 2003–2004, and 2010–2011 periods. Multinomial logit models are employed to identify and analyse potentially influential factors. We find that education levels, household wealth, and distance to markets are among the significant determinants of household access to safe and secure drinking water, flush toilets connected to septic tanks, and proper liquid and solid waste disposal. Households located in relatively developed regions, such as the Midwest and Far West, tend to have better access to these services compared to households located in the ecologically sensitive mountainous regions. Education and employment opportunities are also relevant to service access in urban areas of Nepal. Stakeholder involvement and effective governmental intervention are also necessary.

For further reading: https://doi.org/10.1016/j.jup.2019.100996

NEGATIVE TRADE-OFFSBETWEEN COMMUNITY FOREST USE AND HYDROLOGICAL BENEFITS IN THE FORESTED CATCHMENTS OF NEPAL'S MID-HILLS

Manoj Badu, Ian Nuberg, Chandra Prasad Ghimire, Roshan Man Bajracharya, and Wayne S. Meyer

Mountain Research and Development 39: R22-R32

Widespread community forestry practices in Nepal's mid-hills catchments involve removal of forest products—including firewood, litter, fodder, and medicinal herbs—by the local communities. Uncertainty is growing about how sustainable the management of these catchments is and whether it can meet traditional needs and maintain ecosystem services, particularly water. As part of a broader study on the hydrological effects of community forestry practices, we measured selected soil properties, including saturated hydraulic conductivity (K_S), bulk density (BD,) and soil organic carbon (SOC) across 4 depths (0–10, 10–20, 20–50 and 50–100 cm) in 3 types of community forest sites—broadleaf, pine-dominated, and mixed—in the RoshiKhola catchment of Kavre district. The same measurements were made at a minimally disturbed religious forest site in the catchment that had higher $K_S$values than the mixed and broadleaf sites, signifying a lower degree of forest use-related disturbance. Likewise, SOC values for the religious forest were significantly higher ($P < 0.05$) and BD values significantly lower than the pine-dominated and mixed forest sites, particularly at shallower depths (0–50 cm). Importantly, comparison of the median $K_S$values (16–98 mm h^{-1}) with rainfall intensities measured at the catchment showed the less intensively

used pine-dominated site to be conducive to vertical percolation with possible greater contributions to subsurface storage even during high-intensity rainfall events. These results highlight the critical role of forest use practices in landscape hydrology and have implications for the management of the forested catchments in the broader Himalayan region, particularly in relation to the negative local perceptions of the role of pine plantations on declining water resources.

For further reading: https://doi.org/10.1659/MRD-JOURNAL-D-18-00066.1

China Himalaya

CLIMATE CHANGES IN THE LHASA RIVER BASIN, TIBETAN PLATEAU: IRRIGATION-INDUCED COOLING ALONG WITH A WARMING TREND

Dan Li, Yusi Chen, Tiesong Hu, Yuanlai Cui, YufengLuo, HongyingLuo, and QiangMeng

*Theoretical and Applied Climatology*140: 1043-1054

Characterizing the response of temperature variables to agricultural irrigation is expected to be an important challenge for understanding the full impact of water management on regional climate change. In this paper, the trend analysis and abrupt change test were applied to detect the global warming effect. Then, the quantitative irrigation-induced cooling effects on temperature variables between April and August from 1970 to 2010 in the Lhasa River basin were estimated using historical time series of gridded meteorological records and a map of the area equipped for irrigation. Trends in the maximum temperature (T_{max}) were statistically positive, and a significant increasing trend for the minimum temperature (T_{min}) was detected at the 0.01 and 0.05 confidence levels. No abrupt changing point of warming was detected in the time series for T_{max}. The abrupt changes in T_{min} in the irrigation concentration period took place in 1995, 5 years later than the corresponding change in April. Affected by global warming, the increase in temperature was the largest in July and August, when the irrigation-induced cooling effect was also the most significant. The irrigation-induced cooling effect for T_{max} and T_{min} in April–August (except for June) ranged from − 0.017 to − 0.009°C/decade and from − 0.011 to − 0.001 C/decade, respectively, and the cooling effect for diurnal temperature range (DTR) ranged from − 0.011 to 0°C/decade. The cooling effect on temperature reached above 0.01°C in July and August, but for the growing seasons, the effect was weak, only 0.001°C. The T_{max} and T_{min} trends during the whole growing seasons decreased by both 0.002°C/decade, respectively, with a 10% increase in irrigation land proportion. Even in July and August, the trends were expected to decrease by about 0.005°C/decade with a 10% increase in irrigation land proportion. The irrigation-induced cooling effect could partially slow global warming.

For further reading: https://doi.org/10.1007/s00704-020-03146-y

Pakistan- Himalaya

ESTIMATION OF FOREST CARBON STOCKS IN TEMPERATE AND SUBTROPICAL MOUNTAIN SYSTEMS OFPAKISTAN: IMPLICATIONS FOR REED+ AND CLIMATE MITIGATION

Anwar Ali, Muhammad Irfan Ashraf, Saeed Gulzar, and Muhammad Akmal

*Environmental Monitoring and Assessment*192: 1-13

Forests are important carbon pools as they provide pathway to mitigate climate change. Quantification of forest carbon has gained momentum after Paris Agreement in 2015. This information is a prerequisite for REDD+ implementation and carbon trading. Temperate and subtropical mountain systems of Khyber Pakhtunkhwa province host about one third of Pakistan's 4.51 million ha forests. Present study estimated forest carbon stocks in the Khyber Pakhtunkhwa province of Pakistan. The data was collected from 449 sites in different forests across the province using a stratified cluster sampling technique. Total carbon stock in the forests of the province was estimated at 144.71 million tons with an average of 127.66 ± 9.32 t/ha. Above ground carbon stock was 68.15 million tons accounting for 48% of the total forest carbon stock of the province. Further, below ground biomass and litter accounted for 10% and 1% respectively. The mean above ground carbon stock was 59.98 ± 4.26 t/ha. The highest above ground carbon stock was found in dry temperate forests (99.41 t/ha) followed by moist temperate (85.04 t/ha). Overall, temperate forests have above ground carbon stock of 90.52 t/ha. Temperate and subtropical forests of Pakistan with high carbon densities have ample potential for reducing forest sector emissions. Therefore, forests of Khyber Pakhtunkhwa province having substantial carbon stocks must be conserved for climate change mitigation. Present study provides a framework for carbon stock assessments in other temperate and subtropical regions of the world.

For further reading: https://doi.org/10.1007/s10661-020-8157-x

FATALISM, CLIMATE RESILIENCY TRAINNG AND FARMER'S ADAPTATION RESPONSES:IMPLICATIONS FOR SUSTAINABLE RAINFED WHAT PRODUCTION IN PAKISTAN

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Sustainability12: 1650

Climate change is a severe threat to the agricultural sector in general and to rainfed farming in particular. The aim of this study was to investigate the factors that can potentially affect the adaptation process against climate change. This study focused on wheat farmers and farming systems in the rainfedagroecological zone of Pakistan. Farmers' data related to climate change fatalism, the availability of climate-specific extension services, socioeconomic and institutional variables, and farm characteristics were collected. A logit model to assess farmers' decisions to adopt an adaptation measure and a multinomial logit model to assess their choice of various adaptation measures were used. The results showed that fatalistic farmers were unlikely to implement climate change adaptation measures. The variables related to the climate-specific extension services, including farmers' participation in training on climate-resilient crop farming and the availability of mobile communication-based advisory services, had highly significant and positive impacts on farmers' decisions and their choice of adaptation measures. Input market access and tractor ownership also had positive and significant impacts on farmers' decisions to adapt and their choice of adaptation measures. This study highlights the need to improve rainfed-wheat farmers' education levels to change their fatalistic attitudes towards climate change. Furthermore, government action is needed to provide climate-specific extension services to ensure sustainable production levels that will ultimately lead to food and livelihood security under a changing climate.

For further reading: https://doi.org/10.3390/su12041650