An Environmental Research Abstract

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For the 589-590th issues of Headlines Himalaya, we reviewed journal articles from four sources and selected eight happenings from four countries. We selected four happenings from Nepal and four happenings from other Himalayan countries (India, China, and Bhutan). The overall coverage of this issue is agriculture, water, energy, climate change, and environment.

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RESPONSIBLE AGRICULTURAL MECHANIZATION INNOVATION FOR THE SUSTAINABLE DEVELOPMENT OF NEPAL'S HILLSIDE FARMING SYSTEM

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Sustainability 12 (2020): 374.

Agricultural mechanization in developing countries has taken at least two contested innovation pathways—the "incumbent trajectory" that promotes industrial agriculture, and an "alternative pathway" that supports small-scale mechanization for sustainable development of hillside farming systems. Although both pathways can potentially reduce human and animal drudgery, the body of literature that assesses the sustainability impacts of these mechanization pathways in the local ecological, socio-economic, cultural, and historical contexts of hillside farms is either nonexistent or under-theorized. This paper addresses this missing literature by examining the case of Nepal's first Agricultural Mechanization Promotion Policy 2014 (AMPP) using a conceptual framework of what will be defined as "responsible innovation". The historical context of this assessment involves the incumbent trajectory of mechanization in the country since the late 1960s that neglected smallholder farms located in the hills and mountains and biased mechanization policy for flat areas only. Findings from this study suggest that the AMPP addressed issues for smallholder production, including gender inequality, exclusion of smallholder farmers, and biophysical challenges associated with hillside farming systems, but it remains unclear whether and how the policy promotes small-scale agricultural mechanization for sustainable development of agriculture in the hills and mountains of Nepal.

For further reading: https://doi.org/10.3390/su12010374

IMPLICATIONS OF BIOGAS AND ELECTRIC COOKING TECHNOLOGIES IN RESIDENTIAL SECTOR IN NEPAL – A LONG TERM PERSPECTIVE USING AIM/ENDUSE MODEL

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Renewable Energy 143 (2019): 377-389

This paper aims to analyze the effects of biogas and electricity based cooking on energy use and greenhouse gas (GHG) as well as local air pollutant emissions during 2010–2050 in the case of Nepal, which is highly dependent on traditional biomass (mainly fuelwood) for cooking. The country is rich in hydropower resources. A long-term bottom-up energy system model has been developed using Asia-Pacific Integrated Model/Enduse (AIM/Enduse) model for the analysis. The study developed a business as usual (BAU) scenario and three alternative cooking scenarios. Three alternative scenarios, named as "CL", "CM" and "CH" scenarios; consider low, medium and high level of penetrations of electric- and biogas-based cooking options, respectively. The changes in energy use and electricity generation in the BAU and alternative scenarios have been compared. Fuelwood consumption in the residential sector in 2050 when compared to the BAU would decrease by 12.5% in CL, 19.0% in CM and 24.2% in CH scenarios; and liquefied petroleum gas (LPG) consumption would decrease by 12.8% in CL, 16.3% in CM and 19.6% in CH scenarios. The electricity generation requirement in 2050 would increase by 9.4% in CL, 13.9% in CM and 17.0% in CH scenarios. Finally, the assessment of GHG and local pollutant emissions shows the decrease in all gases in CL, CM and CH scenarios when compared to the BAU.

For further reading: https://doi.org/10.1016/j.renene.2019.05.026

UNDERSTANDING HOUSEHOLDS' LIVELIHOOD VULNERABILITY TO CLIMATE CHANGE IN THE LAMJUNG DISTRICT OF NEPAL

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Environment, Development and Sustainability (2020): 1-24

Based on spatial variation and time, climate change has various levels of impacts on different communities and sometime with the state of development as well. The rural mountainous households that depend on natural resources for subsistence livelihoods and agriculture are particularly vulnerable with changing climate. Livelihood vulnerability assessment at local level is imperative to formulate appropriate adaptation policy and programs to address their livelihood challenges. This paper explored two vulnerability assessment indices, livelihood vulnerability index and IPCC vulnerability index by surveying 150 households from three village development committees (VDCs) in Lamjung district, Nepal. Data related to climate variables, natural disasters, water and food security, health, socio-demographics, livelihood strategies, and social network were collected and combined into indices. Both indices differed based on well-being status, gender of the household head and location across the households of three VDCs. The analysis was based on indices constructed from selected indicators measuring exposure, sensitivity, and adaptive capacity. Results indicated that very poor and poor households, and female-headed households were more vulnerable than medium, well-off and male-headed households. The availability of livelihood diversified strategies, education, establishment of early warning system to climate extreme will help to reduce vulnerability to climate change in the study areas. The findings help in designing priority areas of intervention for adaptation plan to reduce vulnerability and enhance the resilience of the mountainous households to climate change.

For further reading: https://doi.org/10.1007/s10668-019-00566-3

A POSTMORTEM OF FOREST POLICY DYNAMICS OF NEPAL

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Land Use Policy 91 (2020): 104338

Evolution of public policy is governed by various factors of political change, institutional realignment, and global environmental discourse. Improved understanding of these factors is a prerequisite for policy-makers to solve forestry related socio-economic and environmental issues. In this study, we assessed the policy and institutional shifts in Nepal's forest policy regime through discursive institutionalism framework. We conducted a literature review, including Nepal's forest policy documents that were developed after 1950, and undertook an in-depth interview with twenty-five people representing five stakeholders groups. Based on specific features and objectives of the policies, we classified and discussed four different evolving periods of forestry sector: (1) strict protection period (1950–1975); (2) resource creation for crisis management period (1975–1986); (3) participatory forestry period (1986–2008); and (4) period of broad-based global normative discourse (2008 onwards). Our results showed that framing of ideas and discourse, and its interacting environment (dialectic space and discursive sphere) have determined institutionalization and deinstitutionalization of the country's forest policy. In addition, Nepal's forest policy pathways were shaped by a shift in 1) domestic political systems, 2) global environmental discourse and institution, and 3) the process of paradigmatic change and transformation. We conclude that policy durability and discursive shift in public policy are governed by how policy making-institutions embrace public aspirations and consider socio-political context of the country while framing policy discourse. We argue that articulation of discourses into discursive spheres and its ways of deliberation for discursive practices largely defines the trajectories- institutionalization and deinstitutionalization of public policy.

For further reading: https://doi.org/10.1016/j.landusepol.2019.104338

India-Himalaya

LAND USE EFFECT ON BUTTERFLY ALPHA AND BETA DIVERSITY IN THE EASTERN HIMALAYA, INDIA

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Ecological Indicators 110 (2020): 105605.

Conservation of biodiversity in agroecosystems is a global challenge as conversion of forest to agroecosystems has been one of the major causes for biodiversity loss through habitat transformation. The agroecosystems, especially those traditionally managed or organic, are reported to retain high biodiversity including endemic, specialists and conservation concern species. Among others, butterflies are the most vulnerable taxa reacting sensitively and rapidly to climate and habitat changes, and represent as bio-indicators to predict the health of an ecosystem. However, the assessment of land use effect on butterfly diversity has not yet been undertaken in the Eastern Himalayas. Therefore, this study was designed along agroecosystem-forest gradient to understand: the patterns of butterfly alpha diversity taking into account the variation across seasons, elevation, forest specialization and larval host specificity; the patterns of butterfly beta diversity; and plausible environmental determinants of butterfly alpha and beta diversity. We assessed the patterns of taxonomic alpha and beta diversity of butterflies and their determinants in the Indigenous Farming Systems (IFS) {large cardamom-based agroforestry systems (LCAS), mandarin orange-based agroforestry systems (MOAS) and farm-based agroforestry systems (FAS)} along with adjacent natural forests (Forests) in the study area during December 2012–August 2017. We recorded 268 species of butterflies from six families which included two-third forest specialists, one third monophagous and one-fifth conservation concern species. Along the agroecosystem-forest gradient, alpha diversity of butterflies declined for total, forest specialists, monophagous and protected species. However, pair wise beta diversity increased and the multiple beta diversity was dominated by substitution components. Alpha diversity was determined by tree species richness, tree density, canopy cover, elevation, mean annual precipitation (MAP), season, whereas tree species richness, tree density, tree basal area, canopy cover, elevation, mean annual temperature, and MAP influenced beta diversity. We also identified 15 indicator species dominated by forest specialists suitable for long term ecological monitoring program in the Eastern Himalaya. The organic and traditionally managed agroecosystems of Sikkim play a complementary role to the protected areas (PAs) in fostering biodiversity conservation and ecosystem service provision, especially in the areas with high human pressure and low PA and forest coverage.

For further reading: https://doi.org/10.1016/j.ecolind.2019.105605

China Himalaya

CHANGES IN THE PERMAFROST TEMPERATURES FROM 2003 TO 2015 IN THE QINGHAI-TIBET PLATEAU

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Cold Regions Science and Technology 169 (2020): 102904

Alterations in the permafrost due to a warming climate increases the risk of permafrost thawing, accelerates carbon release, lowers super-permafrost groundwater, strengthens desertification, and destroys infrastructure. The permafrost temperature in six boreholes up to 40 m depth was measured from 2003 to 2015 along the Qinghai–Tibet Railway. Results showed an increase in the permafrost temperature, with an average of 0.14 °C decade^{-1} at 10 m depth. The deep permafrost showed significant warming with average rates of 0.11 and 0.09 °C

decade^{-1} at 20 m and 30 m depth, respectively. At 40 m depth, the cold permafrost showed significant warming trend, but no evident warming trend was observed in the warm permafrost. With the ground temperature increases, the depth of the zero annual amplitude of the ground temperature of the warm permafrost slightly increased, whereas that of the cold permafrost decreased. Permafrost thickness was <30 m at the BL1 and TT1 sites and was thinner by 2.1 and 0.8 m from 2003 to 2015. Such changes in the permafrost temperature may have been driven by the long-term increase in the air temperature and precipitation on the Qinghai–Tibet Plateau (QTP). In the high–middle mountain areas of the QTP, the thermal effect of warming climate on the cold permafrost reached a depth of >40 m. In the high plain and basin of the QTP, the thermal effect of the warming climate on the warm permafrost reached a depth of 30 m.

For further reading: https://doi.org/10.1016/j.coldregions.2019.102904

Bhutan-Himalaya

CLIMATE CHANGE EFFECTS ON WILDFIRE HAZARDS IN THE WILDLAND-URBAN-INTERFACE – BLUE PINE FORESTS OF BHUTAN

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Forest Ecology and Management 461 (2020): 117927

Increased wildfire activity in the Himalayan Mountains due to climate change may place rural livelihoods at risk, yet potential climate change effects on forest fires in this region are poorly investigated. Here we use Bhutan's blue pine (*Pinus wallichiana*) ecosystems to study the sensitivity of fire behavior to climatic changes. Wildland fires are one of the biggest threats to forest resources in Bhutan; blue pine ecosystems, in particular, are of high concern because of their importance for rural livelihoods and relatively high frequency of forest fires. Due to the geographical and socioeconomic characteristics of Bhutan, the region is highly sensitive to climate change. We investigated fire hazards in the wildland-urban-interface (WUI) of two valleys in Bhutan (Thimphu and Jakar), where human settlements and infrastructure are surrounded by blue pine forests. We applied FlamMap, a spatially-explicit wildfire simulation model, to simulate fire behavior under four climate scenarios. As indicators of fire behavior, we used flame length, rate of spread, crown fire activity, burn probability, and fire size. With the simulation outcomes we constructed a fire hazard map showing the hotspots of forest fire susceptibility. FlamMap predicts a two-fold increase in fire hazards in the WUI for both study areas owing to climatic changes. The capital city of Thimphu has, on average, greater fire hazards than Jakar, though fire hazards are spatially variable within both study areas. Our study contributes to the understanding of and ability to predict forest fire hazards in Himalayan blue pine ecosystems. The findings will help to more precisely allocate fire management resources in the WUI, plan suburban development to minimize fire risk to livelihoods, and adapt forest management in the face of climate change.

For further reading: https://doi.org/10.1016/j.foreco.2020.117927