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Perspective Article

Geospatial Mapping Of Biomass Supply And Demand In Nepal

Kim Robinson*

Editorial Office, International research Journal of Engineering Science Technology and Innovation, USA.

Email: engsci@epubjournals.com

INTRODUCTION

In Nepal, a geospatial mapping approach was used to examine the spatial distribution and demand for biomass sources for household energy. The relationship between biomass supply and demand is critical for establishing efficient rural energy programmes in the setting of rural homes. Lowlands, hills, and mountains, which have diverse geographical distribution and need for biomass, were chosen to represent the country's primary topographical areas. Field surveys and tests were used to calculate the supply potential of fuelwood using a Geographical Information System (GIS) tool, as well as the potential of agricultural wastes and dung and household energy demands. In the lowlands, hills, and mountains, families having safe access to biomass sources were 57 percent, 50 percent, and 3 percent, respectively. Due to a scarcity of forest biomass in the lowlands, crop leftovers and animal dung were widely employed, but forest biomass was widely used in the hills and mountains, with crop residues and animal dung being used infrequently. The GIS model allowed for a more accurate assessment of biomass energy supply potential in communities, which is critical for developing energy policy for long-term clean cooking solutions. This geographical mapping technique is expected to be relevant to the examples of other developing nations where biomass is the primary source of home energy. In underdeveloped nations, biomass accounts for a major amount of household energy use. Biomass is an essential energy source to achieve the United Nations' clean energy generation aim under the Sustainable Development Goal 2030. Because biomass is mostly utilised as a traditional fuel in underdeveloped nations, there is a scarcity of scientific data on biomass sources and distribution, which has hampered the development of innovative technologies and policies for household energy supply and demand management. The Geographic Information System (GIS) has an effective computational tool to compute the entire geographical distribution of biomass resources. Distance, mode of conveyance, and essential terrain characteristics in GIS might be used to determine the technological potential of biomass energy.

GIS-BASED ENERGY RESOURCE

GIS-based energy resource modelling offers geographical distribution, which is critical for the development of future energy technologies and systems. The GIS approach aids in the creation of informative maps depicting the spatial distribution of various biomass resources, as well as the comparison of various energy choices, as well as environmental and economic restrictions. Nepal's energy demands are largely met by biomass fuels, which account for around 85% of total energy consumption (about 77 million barrels of oil equivalent). For cooking and space heating, over 90% of this biomass energy is used in the residential sector. Biomass comes from three sources: fuelwood, agricultural leftovers, and livestock manure, which provide 88 percent, 5%, and 7%, respectively. The hills and mountains, as opposed to the plains, have comparatively good forest resources among the three primary geographically distinct areas of the country. Due to a lack of fuelwood in the lowlands, agricultural leftovers and animal dung are extensively employed for domestic energy needs, although such applications are rather restricted in the other two zones. Direct biomass combustion has resulted in severe indoor air pollution, forest ecosystem degradation, and agricultural output loss. Over the last few decades, the government and various international agencies have launched various programmes aimed at providing clean energy sources for cooking and reducing biomass consumption, primarily through the distribution of biogas and improved cooking stoves (ICS) with various types of subsidies. Biogas technology distribution has the potential to significantly reduce conventional biomass consumption, however it is currently employed by less than 3% of households. A equally low percentage of families utilise improved cooking stoves (ICS). These findings suggest that household energy consumption is inefficient, since they mostly rely on conventional biomass combustion. Because of significant indoor CO2 emissions from inefficient biomass burning in non-ventilated buildings, the health impact on residents is considerable, especially during cooking hours. Furthermore, ICS and biogas are used seldom, despite the fact that they are more efficient and cleaner than typical biomass burning. As a result, in the long run, assessing the possibility for sustainable biomass supplies for cleaner energy generation is a critical step in long-term energy planning, based on which the need for additional energy technologies may be examined. Biomass mapping would be useful information given the requirement for technical intervention in order to use biomass as clean fuels. Fuelwood is the primary energy source for practically all families in mountainous areas, whereas it is roughly 67 percent in hills and 57 percent in lowlands. Households in the lowlands rely on alternative fuels such as dung cake, liquefied petroleum gas (LPG), kerosene, and biogas. In the lowlands, about 22% of these homes burn dung cake, but in the other two zones, no such houses exist. Rural households use more fuelwood than urban households, and the monthly national average usage of fuelwood is higher than that of other developing nations. Despite the fact that agricultural leftovers are utilised for cooking and space heating, especially in the lowlands, national energy statistics do not include this information. Other sources, such as power, garbage, coal, briquettes, and so on, are labelled "others." Furthermore, there are no specialised architectural designs for houses that include space heating. About 22% of homes have concrete walls, 29% have cement-bonded stone walls, and the rest have walls built of native materials including thatch, straw, wood, and mud. Heat is lost in the winter due to direct biomass burning with poor ventilation and a lack of space heating and cooling systems, whereas excessive heating occurs in the summer. Due to a lack of resource knowledge, Nepal's national biomass energy strategy found that indigenous biomass could not be used successfully for electricity generation. Biomass evaluation is essential for managing a sustainable biomass supply for many alternative purposes, such as energy generation, in a society that also offers the possibility to develop local bio-economy. Due to self-awareness developed by many community-level groups, governmental institutions, non-governmental agencies, and commercial energy corporations, present energy policies and programmes are mostly focused on household demand. Various government and non-government groups have acted directly in some circumstances, providing upgraded cooking stoves to impoverished and socially excluded homes via subsidies and incentives. Designing effective programmes for rural homes is difficult due to a lack of trustworthy information on biomass sources. The real potential for energy output is determined by the availability, accessibility, and calorific value of biomass energy sources. This is particularly relevant in Nepal, where topographical differences influence the distribution of forest biomass and hence the availability and use sources. Because numerous variables determine collected biomass, such as distance between sources and end-use sites, the size of resource-protected regions, transportability, and associated economic concerns, geospatial mapping of biomass is critical. To identify the spatial distribution of biomass sources, these factors may be modelled in GIS.