

ABSTRACT

The Himalaya is the youngest mountain system in the world with its unique characteristics of relief, geology, climate, and biodiversity. The region shows cultural variations from east to west as well as south to north across the mountain ranges. The lofty snow-capped summits, deeply-dissected topography, youthful drainage and complex geological structure of this great mountain system are always a source of attraction, challenge, and inspiration for the researchers from different parts of the world from ancient times in history. The Himalaya is the main source of water for the rivers in the Indo-Gangetic plains, and all the major river systems of north India. The glaciers of the Himalayas contribute significantly to the water yielding capacity of the major river systems viz. the Ganga, the Brahmaputra and the Indus. Most of the Himalayan rivers having their origin in the Middle or Greater Himalaya or beyond in the Tibetan part pass through the Siwalik or outer Himalayan range in wide and often steep gorges. It is noticed that the eastern Himalayan region exhibits variation in many aspects such as geo-environment, hydrometeorology, settlement pattern, ecology and the natural as well as the anthropogenic hazards compared to the western part, though they lie in the same arc of this great mountain system. Mountains are the primary indicators of changing climate. From recent studies, it is found that there is an observed reduction in snowfall, change in intensity of rainfall and significant shift in temperature indicating the effect of climate change in the Himalayan region in recent years owing to global warming. River basins represent the characteristics of a particular geographic region. Considering all the above mentioned issues in regard to the Himalayas, two representative river basins viz. the Subansiri from the eastern Himalaya and the Alaknanda from the western Himalaya are studied with the available data to address a number of objectives identified for the study based on the research queries related to the theme. To achieve the objectives and test the hypotheses some methodologies have been formulated and adopted for the research after a thorough survey of related literature. To have answers in regard to the identified objectives and justify the theme, the entire work is divided into different heads that are grouped into seven chapters. Study of relevant literatures related to the theme provided a better understanding of both the basins of eastern and western Himalayas.

Geoenvironmental set-up of both the Subansiri and the Alaknanda basins in terms of physiography, meteorology, snow and glaciers, soil, geology and tectonics, forest cover and ecology are discussed in the third chapter of this study. Both the eastern and western Himalayan basins are endowed with enormous natural resources. However, the geoenvironmental characteristics of the Alaknanda basin in western Himalayas differ from those of the Subansiri basin in eastern Himalayas.

Hydrometeorological analyses of both the eastern and western Himalayan basins are carried out based on the available data. It is revealed from the study that the monsoon rainfall is relatively more dominant in the eastern Himalayan basin compared to the western Himalayan basin, while temperature shows higher values in case of the Alaknanda basin. The hydrographs show relatively higher discharge with greater variability characterizing the Subansiri basin as against the Alaknanda basin of western Himalayas for the same season. Water quality study involving few selected environmental parameters shows that the tested parameters of both the basins do not exceed the permissible limit of drinking water quality standards of organisation like WHO and BIS, but the water of the Subansiri carries more suspended solid particles in water than the Alaknanda river.

In view of the limited availability of SOI toposheets (as both the basins include restricted areas along the international boundaries), two small catchments viz. Gayung and Sipu from eastern Himalayan Subansiri basin and Bhardari and Kyar from the Alaknanda basin of western Himalayan region were selected as the representatives of each basin to estimate the morphometric characteristics of both the Subansiri and the Alaknanda basins. The analysis of the morphometric parameters indicates the youth and immature topography of the eastern Himalayan basins undergoing accelerated erosion, while comparatively mature and stable topographic development is observed in case of the western Himalayan sub-basins. Land use/ land cover (LU/LC) change is mainly the result of anthropogenic activities to support the population of that area. The LU/LC change detection revealed that the percentage of area under vegetation cover is comparatively more in the Subansiri basin than the Alaknanda basin, but the water/snow and glacier coverage is more in the Alaknanda basin of western Himalaya. There is a negative change of vegetation cover in both the basins which may be due to the increasing population pressure. Most of the areas of both the basins have steep hills and dense forests. However, there are comparatively more built-up areas and agricultural fields in the Alaknanda basin than the Subansiri basin. The barren lands cover

comparatively more areas in the Subansiri basin than the Alakanda basin which needs proper utilization for sustainable development and watershed management.

Analysis of demographic and socio-economic scenarios indicates that the Subansiri basin is more sparsely populated and relatively poorly connected and developed than the Alaknanda basin. Facilities like bus services, telephone and postal services, medical services, power and electricity, number of dams proposed or under construction, tourism potential and related facilities etc. are comparatively less developed in the Subansiri basin than the Alaknanda basin. Number of workers and literate persons are also comparatively more in the Alaknanda basin than in the Subansiri basin.

It is seen that the natural hazards like landslide, flood and earthquake are common in both the basins as they are located in highly seismic regions. The entire Subansiri basin falls under the seismically most active zone V. Most parts of the Alaknanda basin fall under the seismic zones V but a few areas lie in the seismic zone IV. The geological structure and characteristics of rocks are more fragile in the Subansiri basin compared to the Alaknanda basin. Anthropogenic activities like building of mega dams, establishing polluting factories etc. that emit green house gases which contribute to global warming and climate change are more dominant in the Alaknanda basin of the western Himalayas . Plants are the main absorber of CO₂ gas, but due to human intervention a declining trend of forest cover is seen in both the basins. The study presents a comprehensive review of the Subansiri and the Alaknanda basins of eastern and western Himalayas with a comparison of the geoenvironmental setting, hazard scenario , socioeconomic status and human activities of both the regions lying in the two extremities of the great Himalayan arc.