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THE LOGICAL ECONOMY OF WATER SECURITY, ECOSYSTEM SERVICES AND LIVELIHOOD IN THE HIMALAYAS

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Abstract

The Indian Himalayan district has a unique position among the world's alpine ecosystems. These geodynamically young mountains are important not just from an environmental standpoint and as a source of life, providing water to a large portion of the Indian subcontinent, but they also house a diverse range of vegetation, animal, human networks, and social diversity. Regardless of the riches of normal assets, vast segments of its kin are still undervalued and live on a subsistence level. The indiscriminate use of ordinary assets is causing environmental deterioration and disrupting the usual effects of hazards. There is a need to promote a new worldview in order to restore a balance between monetary and ecological goals while maintaining socio-social norms.

Keywords: *Water Security, Ecosystem, Himalayas*

Introduction

With the growing recognition those mountain areas' natural resources are vital to both upland and downland people, the Global Agenda for Sustainable Development have brought mountains into sharp focus. In order to achieve financial upliftment, improvements must satisfy local yearnings and public impulses. However, advancement mediations imply a focus on assets as well as changes to current normal structures. Given the fragility and frailty of the Himalayan ecosystems, as well as the uniqueness of mountain specificities1, advancement in the mountains will need a different technique. Advancement intercessions that ignore the goals of mountain specificities will inevitably result in asset misuse and accelerated environmental deterioration, which will be bad for close residents as well as downstream inhabitants. Such terrible results of spontaneous disasters are increasingly becoming the norm, with the most consistent being the regular rates of avalanches, river obstructions, and flash floods in the mountains, as well as recurrent floods in the fields. Despite the negative repercussions of limited improvement efforts, the impact of environmental-driven changes on mountain frameworks as a result of impractical methods and waste age is alarming. In both fact and theory, an abnormal weather shift and its repercussions for ice sheet decline have far-reaching effects. The extreme vulnerability of mountain ecosystems and its components to human and environmental change has prompted considerable worry along these lines. As a result, it is to be anticipated that the complexities of such problems continue to get substantial examination at international fora such as the WSSD (World Summit on Sustainable Development, Johannesburg, August 2002) and the Bishkek Global Mountain Summit (October 2002). These occurrences have resulted in a consensus that mountains would need certain techniques and assets for sustaining livelihood necessities and improving personal pleasure. This would need an integrated technique that considers tightly intertwined components of human socio-social/financial frameworks as well as natural ecosystem parts/processes.

Objective

[1] Study on ecosystem services and livelihood in the Himalayas
[2] Study on socio-economic activities in Himalayas

The Himalaya

The Himalaya is the most intricate and extensive mountain range in the world, separating the northern part of the Asian continent from South Asia. The locality, as a separate geological and biological entity, appears prominently throughout the planet's primary biophysical settings. This massive mountain range (more than 2500 km long, 80 to 300 km broad, and rises from low-lying fields to north of 8000 m asl) created its own distinct ecology and has an influence on the environment of much of Asia2. The area's exceptional diversity of geographical features results in a huge range of environmental and territorial circumstances. Worldly and geographical variations resulting from geological orogeny diversity have resulted in a clear variance in environment and geography, and hence in the distribution of biotic components.

This geographic location, along with the diverse distribution of biodiversity components, has resulted in biogeographically complex instances of the area. The eastern Himalaya (including upper east India) is considered a blooming plant support, with over 8000 different species of blooming plants, whilst the western Himalaya has north of 5000 different types of blooming plants. The Indian Himalayan region (IHR) is home to about half of all flowering plants in India, with 30% of the vegetation being indigenous to the region.

The IHR4 has about 816 tree species, 675 foods, and almost 1743 varieties of restorative value. Given the growing threat to biological diversity, the Himalayan district's conservation and wise use of biodiversity might provide huge financial benefits to the local population and undoubtedly contribute to sustainable development5,6. The region is renowned as the "water pinnacle of the planet." Glacial masses occupy around 10-20% of the region, with 30-40% of the remaining areas receiving periodic snow cover7, ranging from 0.48 0.43 to 2.20 1.25 million km2. Despite the vast water resources (1,200,000 million m3 annual progressions of Himalayan Rivers), patterns such as diminishing administrative effects of frozen masses, streams, and waterways are gradually occurring in the area.

This region has an overall geographical area of roughly 530,795 km2 and is home to 31,593,100 people, accounting for 16.16 percent of the whole region and 3.73 percent of India's total population. IHR's education rate (7 years or more) (approximately 67%) is likely higher than the public average (65.4%) reported in 2001 figures. Its backwoods are rich in biodiversity, which is used to alleviate a variety of people's problems. The forest biomass esteem in various Central Himalayan oak timberland stands, 545-782 t ha-1 yr-1, is typical for the region8. The Himalaya, with its massive green cover, acts as a carbon dioxide "sink." The annual carbon sequestration by the timberlands in the western and northeastern Himalaya is estimated to be 6.49 mt, with a value of $843 million USD (A. K. Tewari, unpublished data). The Himalayan forests are responsible for one of the most important ecosystem management functions. The beautiful scenery, varied canals and streams cascading down mountain ridges, many communities and faiths, and spectacular native/ethnic network festivals all draw visitors from all over the world, whether they are nature lovers, tourists, or seekers of peace and truth.

Environmental security and peoples' aspirations

Individuals of the IHR, as someplace else in other mountain ecosystems, are excessively dependent for their subsistence on their surrounding regular assets and creation from critical fields like horticulture, ranger service, animals, and so on The dependence of the constantly increasing population on constrained assets, lack of practical innovations to ease the mountain specificities and improved creation to satisfy the demands are depleting the assets accompanying expanding negligibility of ranchers, at last advancing poverty10. In spite of its rich biological and social advantages, the area remains immature. Present patterns of environmental wellness indicate that existing mediations are unworkable. Financial pointers also don't mirror the best consequences on monetary upliftment. Furthermore, the natural delicacy of the mountains as well as the enlarged vulnerability of the Himalaya to human-instigated environmental consequences makes folks lives in the shadow of concerns of regular threats. Enormous number of research conducted in the region zeroing in on development intercessions/drives reflects the informal double-dealing of assets triggering rising environmental degradations. Decreased thick timberland cover11,12, sped up soil disintegration and expanded silting of water bodies13,14, evaporating of springs15,16, substitution and vanishing of species17,18 and expanded proportion of energy exhausted in grain, fuel assortment, and agrarian action that increment drudgery of the womenfolk19 are a portion of the obvious side effects of environmental chronic sickness.

Environment as a holocoenotic resource system

Nature is the science that inspires practical interrelationships between diverse aspects of the environment on the one hand, and between live beings and the environment on the other. A important ecological law is that the ecosystem is holocoenotic in nature, which means that any alteration in one portion would surely impact the circumstances of any remaining sections. For example, deforestation causes increased run-off (thus floods), increased soil disintegration (thus siltation of water bodies), extinction of species (thus quality disintegration), and atmospheric CO2 stacking (henceforth an Earth-wide temperature boost). As a result, the nation's need for wood and kindling has an impact on the Himalayan woods, and deforestation in the Himalaya has an impact on the flood situation in the Gangetic Plains. This explains how the magnitude of deforestation consequences varies from local to territorial to global. In this regard, the environment not only comprises a life-emotionally supporting network for biological life forms, but it also serves as a method of interacting asset subsystems. The phrase asset connotes the board. Appropriate administration will not destabilise a framework since a unique harmony will be maintained among its subsystems and pieces. In this way, environmental deterioration is the outcome of a blunder that leads to irregularity and asset overuse.

Interdependence of ecological and socio-economic activities

The difficulties in the Himalaya are mind-boggling, with convoluted links between friendly, monetary, and environmental concerns. As a result, the preparations cannot be attended to in detachment. To use a model, the agro- and backwoods ecosystems are so unexpectedly intertwined and subservient that it is pointless to talk timberland the board in disengagement without including agriculture. It is estimated that the cost of means horticulture on the woodlands environment is considerable in the Central Himalayan region. For example, seven units of energy are used from the woods utilising kindling, grub, and vegetal manure for every unit of energy obtained in agronomic production. A higher proportion of forest to farmland (5.18: 1) is necessary for agricultural food production, as opposed to the existing proportion of 1.66: 1. Concerns have arisen as a result of the fall in this percentage, indicating that the transporting limit of woods has now been reached. Furthermore, field progress or

revegetation of no man's land is unthinkable without addressing the challenges of creature farming, grub, and fuel. The traditional agri-silvi-peaceful way of life of the area's inhabitants is no longer viable, both environmentally and economically.

It is obvious that board sectoral practises (or improvement) will not work, and so the fundamental technique that will work is a complete one that is consistent with ecological and social norms. This technique also advises that the slope and connected fields be used as the macro planning unit, with more modest fundamentally and practically determinable units used for tiny level preparation. The various ecosystems should be organized into protective, helpful, and waste dissipative frameworks and should be managed in accordance with their roles22. As a result, the foundation of any preparation for practical progress in mountain areas must be founded on man's interaction with nature. A sense of equality and value is desired to depict the connection. Each culture is the result of people seeking to survive within their environment while also attempting to improve the exploitation of its resources.

Over hundreds of years, way of life and creativity frameworks have grown steadily via trial and error and perceptions, until they have become so socially integrated that they resemble genetic knowledge. This has been instilled in many ancient social structures, but in the sophisticated avaricious culture, 'economic' takes precedence over 'nature.' There is a need to develop a different perspective in order to rebuild harmony between monetary interests and ecological goals. Although there are several affiliations between the ecological and monetary frameworks, the most basic and obvious is this: the ecological framework offers unprocessed components to the monetary framework and consumes the trash created by the monetary framework (Figure 1). As a result, the framework will be constrained by the ecological framework's useful and waste-assimilation restrictions. When one or both of these boundaries are exceeded, ecological consequences are unavoidable.

When the Ganga's waste-dissipative limit was exceeded, a significant pollution problem emerged, which is presently costing the public authority a large sum of money, with still a far-fetched degree of final consequence. Similar to the case with water bodies on the slopes, when timber extraction or biomass extraction beyond the limit of harvestable utility of the backwoods, the final alternative began to diminish As a result, ecological and financial considerations must be unified in order to create an environmentally sustainable turn of events. Both ecological and financial aspects may be addressed independently in a variety of ways, but combining ecological and monetary considerations adds geometrically to the complexity of development programs24. When socio-social frameworks are added to the ecological-financial links, the situation becomes even more complicated (Figure 2). Regardless, development pushed only by monetary considerations has altered desires, esteem frameworks, and board necessities. The application of ecological considerations to enhance aims and cycles is further complicated by segment and legal constraints. It is advisable for the management of such ecological assets on which adjacent networks rely to be decentralised, and for these networks to be decentralized.

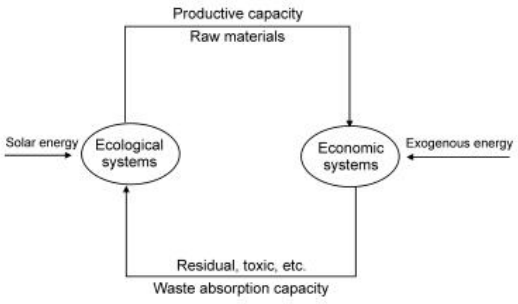


Figure 1. Inter-relationship between ecological and economic systems (after Singh20)

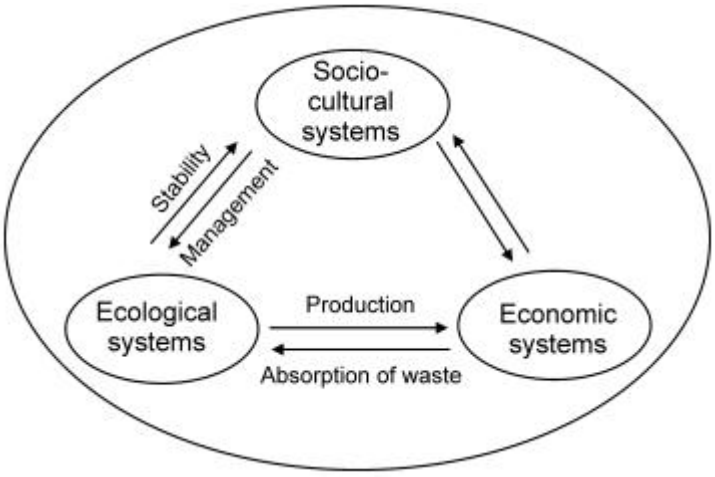


Figure 2. Superimposition of socio-cultural system on relationship of ecological and economic systems (after Singh20) Arrows between socio-cultural and economic systems represent aspirations and 'value systems'.

Given a successful say over the deployment of these assets, this is now the best test both widely and globally. Protection, water asset and hydro-power advancement, advancing neighborhood based administration, upgrading foundation, working on quality instruction, and limiting working to ensure benefits are a couple of require activities to further expand the IHR's livelihoods, pay, and climate.

ECONOMIC DEVELOPMENT IN HIMALAYAS

We highlight the Darjeeling region in West Bengal, India, which is part of the Eastern Himalayan biodiversity hotspot. This north-eastern district is home to 11% of India's fauna and 10% of its floral species. This region's human population is rapidly growing (14 percent expansion in last ten years; Government of India 2013). This area has a large proportion (46.4 percent) of helpless households (with per capita wage less than US $ 1.25 per day), compared to India's national average of 32.7 percent (SECC 2011). Regardless, destitution evaluations based on money pay are generally a fragmented assessment; a more comprehensive neediness evaluation necessitates comprehending multifaceted views and various elements that contribute to destitution A multifaceted neediness assessment considers vital demands as well as prosperity proportions (Cohen 2010). Focusing on the financial wages of provincial renters provides little insight into the multifaceted connections between their occupation and biological systems. It also does not suggest how employment may be pushed forward. Understanding these connections enables specific steps to be implemented that may improve environmental benefits and help provincial disadvantaged businesses grow There are two key protected areas around Darjeeling-Singalila National Park and Senchel Wildlife Sanctuary that support both botanical and faunal local biodiversity. We provide two models from this area that portray (I) how monetary activities cause changes in biological systems and, as a consequence, influence neighborhood local area, and (ii) what purview concerns signify from an advancement standpoint and may end in unfavorable outcomes.

Economic activities and ecosystem change

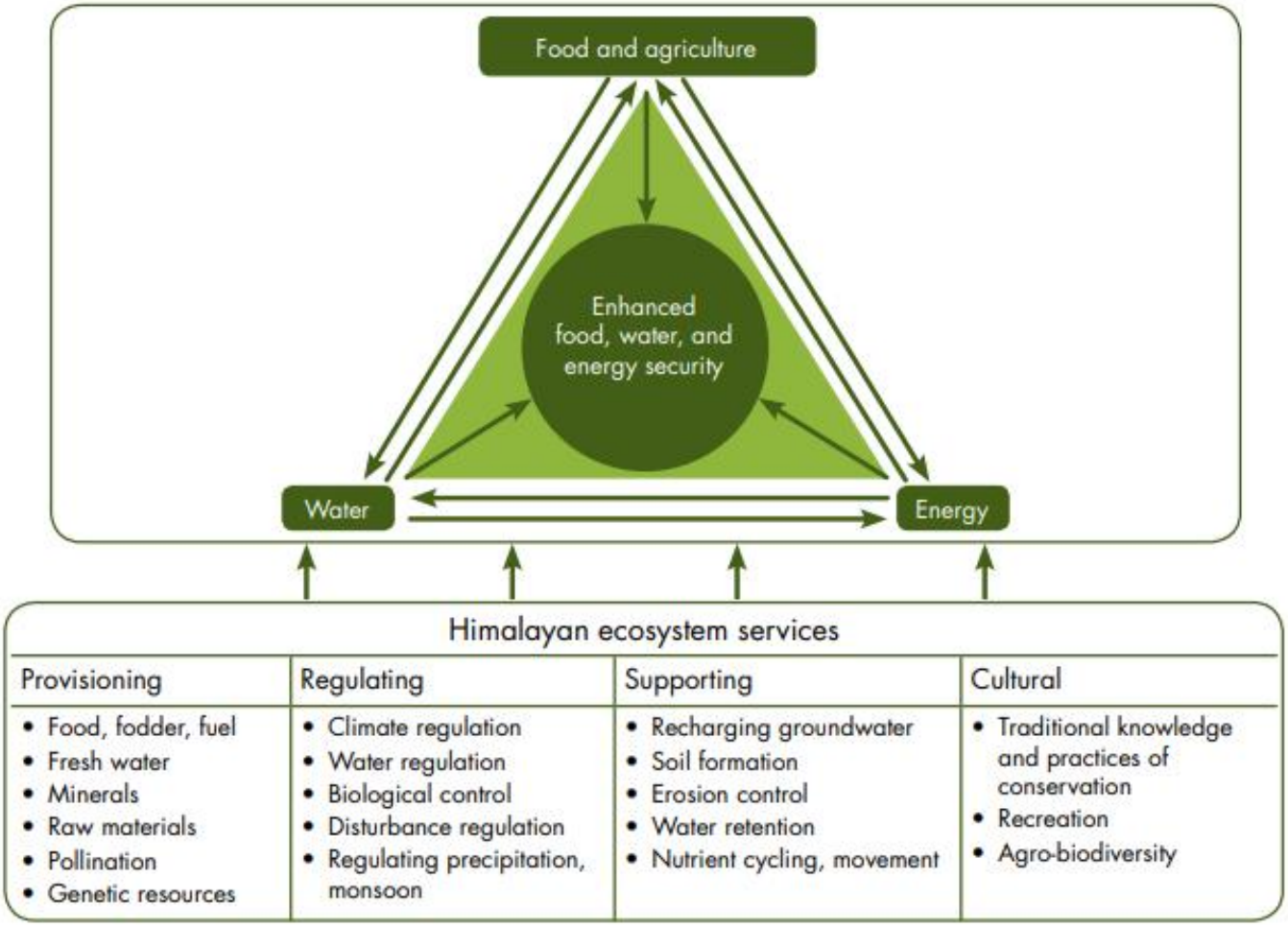
Monetary activities in the region are being advanced by development associations in collaboration with corporate to encourage ventures, for example, little hydro power stations, employing climatic

innovation under clean advancement instruments (CDM; UN 1998). CDM projects are promoted by the United Nations Development Program (UNDP) and supported by the United Nations Framework Convention on Climate Change (UNFCCC) in order to provide carbon offsets and mitigate the consequences of environmental change (UNFCC 2006). Advancement organizations believe that such financial movement will motivate job age for the country's poor, and that a further benefit may be achieved by sharing pay from the sale of carbon credits in the market. One such Endeavour is a small hydropower plant in Lodhama, which is located on the borders of the Singalila National Park in the Darjeeling district. Water is channelled from a creek that runs through town in this project. One projected result is a reduction in biodiversity in the stream (IUCN 2001; SANDRP 2012). The stream is regarded as a key determinant of environmental conditions in streams, which hence determines species composition (Hughes and Noss 1992; Dudgeon 2000; Bunn and Arthington 2002).A decrease in stream flow can have an impact on nearby riverine fish, frogs, and amphibians (for example, Amolops formosus), as well as a few local therapeutic (Terminalia bellerica, Terminalia chebula, Embellica officinalis, Azadirachta indica, Aegle marmelos, Ocimum sanctum) and blooming plants (Oroxylum indicum, Holarrhena antidysenter Reduced stream also results in decreased water accessibility for the water system, which causes crops to dry up (Fig. 3). This has an impact on the labour of the country's poor (per capita cash pay is US 16-34 c per day; Sandhu and Sandhu 2014), who are subject to agrarian pay from their limited lands. This municipality receives no share of the electricity generated by the water assets or any other benefit from this project. A power-producing company, on the other hand, earns money from the sale of power. Because this is a CDM project, they are offsetting carbon pollution for a connected multinational organization (MNC) that continues to pollute offsite. The loss of biodiversity at the site, followed by pollution offsite, is not a desirable outcome for the UNDP or the UNFCCC. In its submissions to the UNFCCC, the concerned business organization has gone to great efforts to address social and ecological concerns' in order to meet administrative requirements. Under such conditions, it is difficult to predict social or environmental challenges that may occur or are beginning to emerge.

Fig. 3 Conflict in sharing water resources in the Himalayas. Stream water is diverted to a small hydro power plant (a CDM project) by a pipeline in the Darjeeling district, India. (Photo H. Sandhu)

Emerge as townsfolk are divided from the rest of the world on the basis of monetary 'power.' As shown by their financial situation, these folks are now considered impoverished. Imbalances caused by asset control for the purpose of monetary advancement take away their right to utilise stream water appropriately for their food crops, which provided them their modest work. This project is not increasing the incomes of the poor in the nation since they are not employed in the project due to a lack of specialised skills or even on a casual basis. Furthermore, the redirection of stream water for power generation causes water pressure and has a negative impact on agricultural usefulness, transfer biodiversity, and associated biological system administrations. This project is one example in the district where environmentally and socially responsible endeavours organised by development organisations may result in unfavourable outcomes, when provincial low incomes do not increase and indigenous habitat continues to decline.

Figure 5: Food, water, and energy nexus and the contribution of Himalayan ecosystem services



How the Himalayas support the water, energy, and food security nexus

The Himalayan mountain framework provides environmental advantages that aid horticulture development, water security, and clean energy innovation downstream. The maintenance of Himalayan watersheds and associated woodlands, wetlands, and rangelands is critical to supporting these administrations and ensuring food, water, and energy security in India.

Source of water – surface and groundwater

Outside of the two polar caps, the Himalayas, the most notable and largest mountain range on the globe, contains the largest collection of ice on the earth. The area's more than 54,000 ice sheets have ice stocks of roughly 6,100 km3, supplying massive water supplies (ICIMOD, 2011). The glacier masses of the Himalayas serve as the headwaters for ten major waterway frameworks in Asia, providing assistance to about half of humanity. These streams get important pledges from the Himalayas' snow and frozen mass softening, which provides the fundamental foundation for both surface and underground water systems (Figure 6). The commitment of mountain release to dry season water is estimated to range from 30% to 60% in wet jungles and from 50% to over 90% in dry and semi-arid regions (Viviroli et al. 2003).

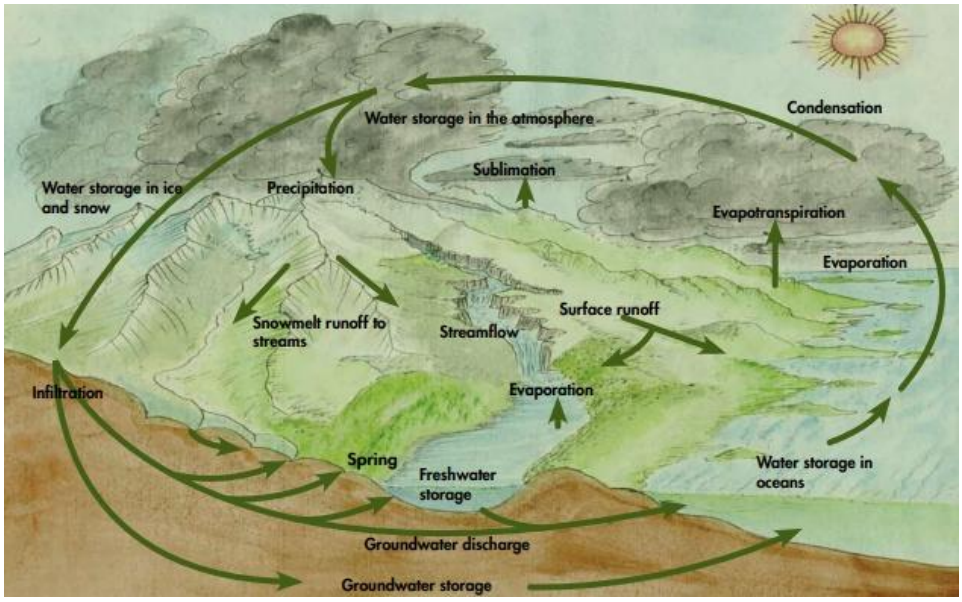


Figure 6: The water cycle

The Himalayan Mountains also retain a significant amount of groundwater, which contributes to the re-energization of both surface water and groundwater in the downstream basins (Figure 4). The Himalayan watersheds, with their timberlands, shrubs, and plants, as well as its stone, soils, and wetlands, provide consistent sources of water that flows downward underground. Some of it is discharged as surface water or springs at lower elevations, while the remainder recharges the Indus-Ganges-Brahmaputra plain's groundwater system. Groundwater, the Himalayas' undetectable environment management, is essential for water system in the whole agricultural scene of South Asia, as well as serving other human purposes and maintaining wetland biological systems. Further investigation is planned to determine the potential role of Himalayan watershed executives in reducing overflow and increasing penetration to ensure groundwater re-energizes downstream.

Energy security

Electric power consumption will rise in tandem with rising levels of industry, urbanisation, and economic growth. The Himalayas may play an important role in South Asia's energy security; the area's hydroelectric potential exceeds 500 GW (Table 1). If properly managed, hydropower might provide reliable access to energy to the great majority of the population while decreasing use of traditional energises, hence decreasing climatic black carbon, which is a serious concern in the region.

Table 1: Hydropower in the Himalayas

Country	Hydropower potential (MW)	Installed hydropower capacity	Access to electricity, 2005 (%)	Per capita electric power consumption, 2008 (kWh)
Afghanistan	Not available	Not available	7	Not available
Bangladesh	Not significant	Not available	32	208
Bhutan	23,760	1,465	Not available	Not available
China	272,000	Not available	99	2,455
India	114,398	24,630	56	566
Myanmar	Not available	NA	11	97
Nepal	42,130	658	33	89
Pakistan	46,000	6,608	54	436

Support to food production – climate regulation and agro-biodiversity

In addition to providing surface and groundwater, the Himalayan mountain framework creates favorable circumstances for agriculture by managing the microclimate environment as well as wind and storm distribution in South Asia. Since of its height and size, and because it is directly in the path of the storm, it effects precipitation as deluge or snow, preserving Northern India from the constant drying up that afflicts Central Asia. The Himalayas are also important agro biodiversity storage facilities. The Indian Himalayan region alone has around 675 edible plants and almost 1,743 different sorts of medicinal value. Mountains contain a particularly high hereditary diversity, not just because of their physical isolation, but also because mountain communities have ancient traditions of protecting certain plant and animal species.

Conclusion

The one-of-a-kind gorgeous Himalaya has already provided massive biological system labour and goods and, with proper preparation and the board, will likely do something similar in the future as well. Nonetheless, we should understand how the whole IHR is dealing with anthropogenic strain, which is causing a general deterioration of its existing situation. When signs of natural deterioration emerge, the most common option is to react to the situation and seek to resolve the difficulties by costly corrective procedures. However, it is much superior to have the option of anticipating the problem and going to great measures to avoid it from occurring in the first place. Legitimate training at various levels, a long-term data collection, and a thorough approach would bring us closer to controlled progress, ensuring higher personal pleasure, improved monetary position, and minimum negative influence in a hostile atmosphere.

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