



# Nature-based solutions and digital management for Viksit Bharat @2047: Reimagining Himalayan tourism, education, and climate-resilient livelihoods

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## Abstract

The Viksit Bharat@2047 is an outline for India's vision. It outlines the need for economically sound, socially equitable, and ecologically sustainable ways to develop the economy in the future. Although the Himalayan Region is ecologically sensitive, its potential to create sustainable tourism, jobs based on forestry and education will become more pronounced. The future of the environment is in danger due to climate change, the lack of regulation of tourism, the degradation of the ecosystem and the lack of digital integration. The purpose of this article is to show how forestry-based Nature's Based Solutions (NbS) combined with digital management can be a way for the Himalayan Region to develop in a sustainable way that meets both its development needs and its National Sustainability Goals. This paper will analyse policy data with respect to global best practices; and conceptual synthesis, and will cover how the conservation of forests, restoration of waterways and landscape planning can be done jointly with digital tools such as geospatial, data and virtual learning technologies. The emphasis is placed on sustainable tourism and Sustainable Development Education as two of the main drivers behind the development of inclusive economies that are supported by resilient forest ecosystems. Eco-tourism, wellness tourism and community-based tourism, guided by NbS principles associated with forestry as well as supported through Digital Governance, can create livelihoods that are climate-resilient while conserving natural capital. Higher education institutions located within the Himalayan region can also serve as knowledge centres through the embedding of forestry, sustainability and digital skills into their curricula establishing alignment between their programs and the National Education Policy 2020. To this end, this study has proposed an integrated Ecology – Technology – Education framework that will provide direction for policy and practice toward 2047.

**Keywords:** Nature-based solutions, Forestry, Sustainable tourism, Himalayan development, Digital management, Viksit Bharat@2047

## 1. Introduction

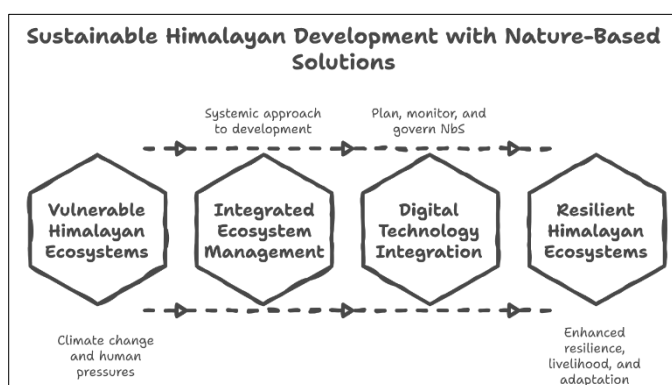
The Vision of Viksit Bharat@2047 articulates a long-term vision for India that seeks to provide a roadmap for the nation towards achieving an inclusive, sustainable, and innovation-based approach to development. There is now a growing consensus within India as it nears the 100th anniversary of its independence that it cannot develop its economy without developing the ecological environment it inhabits, building resilience to climate change impacts, and developing its population knowledge base. In addition to a growing consensus on the need for economic development and ecological sustainability, the role of sensitive ecological areas, e.g., the Himalaya is becoming critical for India as it relates to water security, biodiversity, cultural heritage, and the provision of tourism-based livelihoods.

The Indian Himalayan Region (IHR) supports millions of people while also providing critical ecological services, but is

becoming increasingly vulnerable to climate change and anthropogenic pressures. Research by various scientists has found that temperature is increasing, precipitation is becoming more variable, and there are higher rates of landslides, forest degradation, and livelihood insecurity across the states of the Himalayas (Negi *et al.*, 2019; Sharma *et al.*, 2009) [9, 14]. Rapid development of tourism without adequate consideration for the fragility of mountain ecosystems located within pilgrimage and wellness tourism corridors has placed greater strain on these fragile environments, particularly in the state of Uttarakhand. Mountain development has been traditionally organized around enhances in infrastructure and sectoral planning. As a result, ecological limits are often disregarded and currently existing models do not provide solutions to interrelated problems including climate change, loss of biodiversity and rural outmigration. There is a growing body of literature suggesting that new approaches requiring integrated, ecosystem-based

development management/systemic development management strategies that will have the capability of achieving environmental objectives and meeting socio-economic ambitions simultaneously will be limited (Pandey *et al.*, 2021) [11].

Nature-Based Solutions (NbS) is one viable solution. By aligning human activity to work in harmony with natural systems rather than in a confrontational manner, NbS will enhance ecosystem resilience and provide significant additional benefits in terms of livelihood and climate change adaptation. There is an opportunity to use digital solutions and technologies to plan, monitor and govern NbS, which will provide the foundation for a Himalayan Development Model to address the requirement for long-term and sustainable development in accordance with Viksit Bharat@2047.



## 2. Objectives of the research project

1. The study will evaluate the importance of Nature-Based Solutions for developing climate-resilient infrastructure in the Himalayan region of India.
2. The study will analyze how digital stewardship can be used to enhance sustainable tourism and promote environmental governance.
3. The study will explore the contribution of education and skill development towards supporting nature-based tourism and transitioning to sustainable livelihoods.
4. The study will utilize the framework of Viksit Bharat@2047 to develop an integrated approach to combining ecology, technology, and education.

## 3. Methodology

A conceptual and analytical research design is used in this study as it is most commonly used in sustainability science, tourism studies and research oriented to developing policies when the purpose is to create integrative frameworks and future directions versus testing hypotheses with primary data. Conceptual methodologies are particularly suitable for examining complex socio-ecological systems, in which environmental process interactions, governance structures, educational systems, and livelihoods need to be evaluated as a whole system (Maxwell & Mitterpalli, 2010) [7].

To undertake the analysis conducted in this study, a systematic synthesis of secondary literature was used, including peer-reviewed journal articles, global assessments and national

policy documents about climate change, Nature-Based Solutions, sustainable tourism and educational reform. Integrative, literature-based methodologies are promoted for use in sustainability research that addresses long-term development and scenario based planning (Sayer *et al.*, 2013 [13]; Cohen-Shacham *et al.*, 2016) [3].

This study is contextualized within a specifically Indian Himalayan Region by drawing on selective India feedback empirical policy literature, primarily related to ecosystem service provision, climate vulnerability, and community-based tourism in mountainous areas (Negi *et al.*, 2019; Goswami *et al.* 2023) [9, 5]. By grounding the conceptual framework in local context, the framework will be more relevant and less likely to be generalized too broadly.

This methodological approach complements policy analysis and normative foresight to align with national development visions, such as Viksit Bharat and education reforms under NEP 2020. Cross-sectoral synthesis is also an accepted approach to generating conceptual frameworks for informing policy discourse about and guiding future empirical research in sustainability and tourism studies (Pretty *et al.*, 2018 [12]; OECD, 2020) [10].

The purpose of this methodology is not to produce statistically generalizable results; rather, it is to generate analytical insights and an expandable framework to assist planners, educators, and policymakers involved in developing climate-resilient tourism and education-led development in ecologically sensitive areas. Methodological Contribution: This study demonstrates the effectiveness of synthesis-based methodologies as a means of addressing complex socio-ecological development challenges through a single conceptual framework that integrates Nature-Based Solutions, digital stewardship, and education. It also provides a replicable approach to future sustainability and tourism research in ecologically sensitive regions.

## 4. Results

### 4.1 Nature-based solutions in the context of the Indian Himalayan region

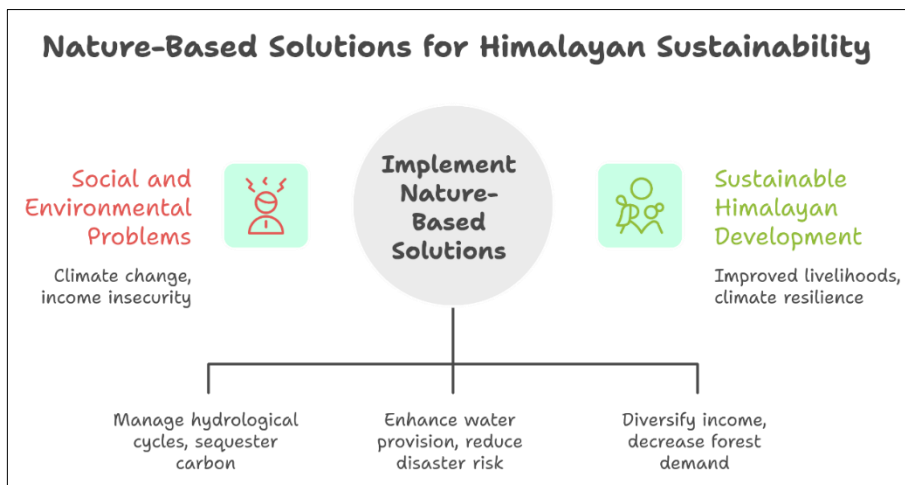
Nature-Based Solutions call for using conservation, restoration, and sustainable management of ecosystems to solve social and environmental problems like climate change and lack of income security. Forests in the Indian Himalayan Region form an ecological anchor on which hydrological cycles are managed, slope stability is maintained, carbon is sequestered, and many forms of biological diversity are supported. Research compiled allows us to conclude that the role of the forest ecosystem in providing rural people livelihoods and increasing their ability to cope with climate change is paramount (Goswami *et al.* 2023) [5].

Because watershed-based NbS interventions (e.g., spring rejuvenation, catchment restoration, riparian vegetation management) are particularly effective at enhancing the provision of water, reducing the risk of disasters, and improving the aesthetic quality of the environment in mountainous areas, they will support the farming and tourism industries. Additionally, evidence has shown that ecosystem-

based adaptation measures are more inexpensive and widely accepted than engineering-based solutions in fragile ecosystems (Sharma *et al.*, 2018) [15].

Agroforestry further augments NbS results by promoting the incorporation of trees into farming systems, diversifying the

income base for farmers, and decreasing the demand for products harvested from natural forests. Taken together, these activities illustrate that NbS are not simply conservation tools but also important measures for achieving sustainable development within the context of the Himalayas.



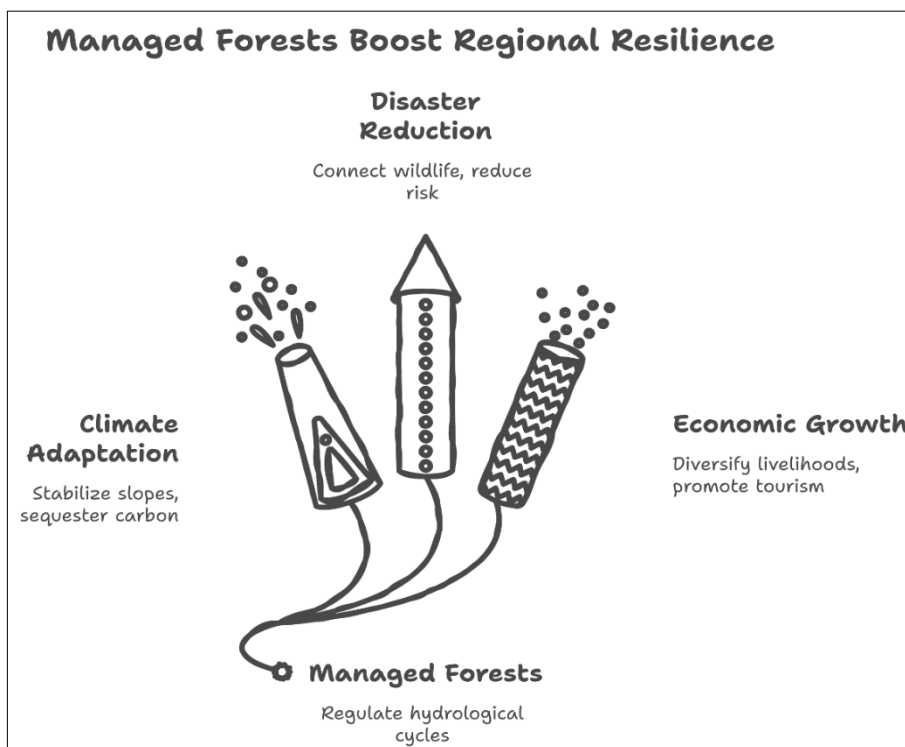
**4.2 Forestry makes up Earth's operational core of nature-based solutions for the Himalaya.**

Managed forests help regulate hydrological cycles, stabilize slopes, sequester carbon, and connect wildlife; they are key to adapting to climate change and reducing disaster risk. Reserve forests, community forests and Joint Forest Management (JFM) areas in Uttarakhand together provide ecosystem services that help sustain tourism, agriculture and rural livelihoods (Goswami *et al.* 2023) [5].

Forest-based NbS interventions, such as assisted natural regeneration; mixed-species plantations; riparian forest restoration; will provide greater regional resilience without compromising the scenic and cultural values required for eco-tourism and wellness tourism.

Community participation in forest management results in better conservation and livelihood outcomes, particularly where the governance of the forest aligns with local institutions and market opportunities. (Negi *et al.*, 2019) [9].

From an economic development perspective, forestry livelihoods (including non-timber forest products, eco-guiding, forest interpretation services, and carbon-based initiatives) are a way to diversify economies in mountain areas experiencing agricultural stress and youth out migration. Therefore, linking sustainable forestry with tourism planning promotes the long-term economic viability of Nature-Based Solutions while preserving ecological integrity in support of the vision of Viksit Bharat@2047.

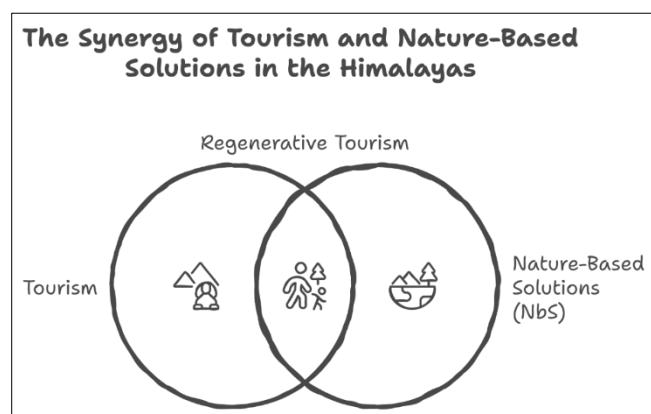


### 4.3 An NbS perspective on sustainable tourism

Tourism plays an important role in the economy of Himalayan states that rely heavily on spiritual, wellness, and nature-based tourism to draw in millions of visitors each year. Due to the lack of regulations on this sector, many areas have seen an increase in waste, habitat destruction, limited resources (water), and commodification of culture. Many researchers say that instead of relying on the amount of people who visit an area (volume), tourists in the mountains need to rely on how much of their visit would be sustainable (value) for the environment (Kala & Bagri, 2018) [6].

An NbS is a practical way to create a sustainable tourism model by aligning the visitor's experience with the ecology around them. Different types of tourism (eco-tourism, wellness tourism, and community-based tourism) that are all based on forest, river, and biodiversity hotspots create environmental stewardship and provide a source of income for local communities. There are quantitative studies performed throughout the Indian Himalaya that show an increase in both conservation and livelihood benefits through community involvement in the planning of tourism if the development of the destination has institutional support and capacity building efforts (Verma *et al.* 2024) [2].

Himalayan locations can avoid the environmental impacts of mass tourism by using planning tools based on NbS principles, such as assessing the carrying capacity and using green infrastructure to restore habitats and/or ecosystems. Through this approach, Himalayan destinations can become global leaders in regenerative tourism development.



#### Box 1. Uttarakhand as a Living Laboratory for NbS-Based Sustainable Tourism

Uttarakhand offers many examples of Nature-Based Solutions with respect to facilitating sustainable tourism, while supporting climate resilience in the Indian Himalayas. The diverse forested landscapes; the sacred rivers (e.g., the Ganga); and the rich biodiversity found within protected areas form the basis for ecological and wellness tourism on this basis. Through the joint management of forest areas and eco-tourism opportunities created by village communities, income diversification has occurred; out-migration has decreased and community stewardship has increased for local natural resources. Research from the state has demonstrated that if

institutional capacity and policy alignment exist, the implementation of participatory tourism models that are linked with ecosystem conservation increase livelihood security and environmental outcomes (Kala & Bagri, 2018 [6]; Verma *et al.*, 2024) [2]. In addition, watershed restoration and forest conservation programmes in Uttarakhand have improved both the scenic quality of the area, as well as the availability of water resources, thus creating opportunities for supporting tourism-related infrastructure and visitor experience (Goswami *et al.*, 2023) [5]. Lastly, the integration of digital tools such as geospatial databases, remote sensing and smart destination management systems will ultimately position Uttarakhand as a best practice site for climate-resilient, community-focused tourism in keeping with the Viksit Bharat@2047 vision.

## 5. Discussion

### 5.1 Smart tourism and digital stewardship

Digital technologies are increasingly acknowledged as key facilitators of sustainable development, and numerous geospatial technologies, such as remote sensing and GIS, are available in the Himalayan region to assist with land-use planning, forest monitoring, and disaster risk management. These technologies also enhance early warning systems for landslides, flooding, and wildfires, thus improving climate resilience.

Regarding tourism management, digital platforms enable the regulation of visitors, marketing of destinations, and distribution of guidelines for the environment. Smart tourism systems allow authorities to track tourist traffic, manage seasonal peaks, and showcase less popular destinations, thereby alleviating the pressure on ecologically sensitive locations. Additionally, the use of digital storytelling and virtual tourism helps to achieve sustainability by increasing access while reducing the physical footprints associated with those physical access routes.

Digital stewardship can help to increase public participation in governance. Applications for community-based monitoring and open-data platforms offer local stakeholders the opportunity to take part in decision-making, and provide compatible tourism development with local ecological and cultural values.

### 5.2 Education as a Catalyst for NbS-Based Development

Education serves as the key to transforming NbS and digital innovations into long-term positive change for society. Higher education institutions in the Himalayan region can serve as hubs of sustainability knowledge. Through interdisciplinary curricula that combine environmental studies, tourism management, and digital skills training, higher education institutions can prepare students for a growing number of green jobs.

India's NEP (National Education Policy) creates a framework for education that is centered on promoting sustainability by creating a focus on learning through experience, relevance to the community, and utilizing digital technology (Tilak, 2021) [16]. By using fields of study such as forests, watersheds and

tourism to create hands-on learning opportunities, students are provided with real world applications of their learning. By providing educational opportunities through the use of digital learning platforms, students benefit from learning opportunities that would not normally be available to them due to geographical distance; digital learning increases access to educational resources for all students, including those living in rural or isolated communities (Jena, 2020) [4].

Through the alignment of education with NbS and sustainable tourism, Himalayan institutions can contribute significantly to inclusive growth and human capital development as part of Viksit Bharat@2047.

**Box 2. Role of higher education institutions in Uttarakhand for sustainable tourism and environmental stewardship**

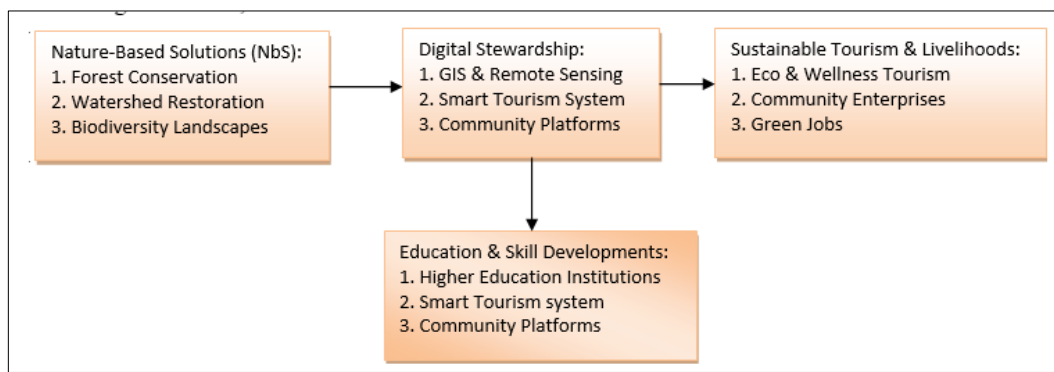
As regional hubs for knowledge and skills development, higher education institutions in Uttarakhand serve an important role as agents of change by converting sustainability policy into action on the ground. Many universities and government-degree colleges in the Himalayan Districts are beginning to include subjects related to environmental studies, tourism management, forestry, and the use of digital tools in their academic curriculum. By participating in field-based learning experiences within forests, watershed areas, and on-site at tourism destinations, students will have the opportunity to actively engage with Nature Based Solutions. Furthermore, by collaborating closely with local communities, students will help strengthen research and extension activities based on

applied research. The National Education Policy 2020 in India places an emphasis on experiential learning and integration of digital technology in all forms of education, including higher education institutions, thereby providing a conducive environment for institutions to help promote sustainable tourism, green entrepreneurship and climate-resilient livelihoods (Tilak, 2021) [16]. Overall, by linking educational content with local ecological and economic opportunities, the higher education system of Uttarakhand contributes to the development of human capital consistent with the long-term vision of “Viksit Bharat @ 2047”.

**5.3 Integrated framework for ecology - technology - education for Viksit Bharat@2047**

The preceding analysis indicates that an idea has emerged to develop an Ecology - Technology - Education (ETE) Framework for supporting Sustainable Development across the Himalayan Region based upon:

- **Ecology:** Nature-Based Solutions together with Ecosystem Restoration, Biodiversity Conservation and Climate Adaptation.
- **Technology:** Digital Stewardship via Geospatial Tools, Smart Tourism Systems and Data-Driven Governance.
- **Ducation:** Sustainability-Based Curricula, Skills Development and Community Learning aligned to NEP, 2020.



**Fig 1:** Conceptual framework illustrating the integration of Nature-Based Solutions, digital stewardship, and education in enabling sustainable tourism and climate-resilient livelihoods in Uttarakhand under the vision of *Viksit Bharat@2047*.

The integration of these three pillars will ensure that any development will remain as Ecologically Sustainable, Technologically Enabled and Socially Inclusive. The Framework is defined specifically to support the Himalayan Region, but has the potential to be applied across other Ecologically Sensitive Regions of India.

**6. Conclusion**

To achieve the goal of Viksit Bharat@2047, we will need to develop models that balance the economic needs of people with ecological limits. The IMHR will serve as an important testing ground for these models due to its rich natural and cultural resources. This paper has illustrated that through the use of digital stewardship and nature-based solutions (NbS) we can

create sustainable tourism, provide climate-resilient livelihoods and facilitate transformative education. If India positions the Himalayas as a living laboratory for NbS-driven development it can foster a resilient, equitable and environmentally responsible future.

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