

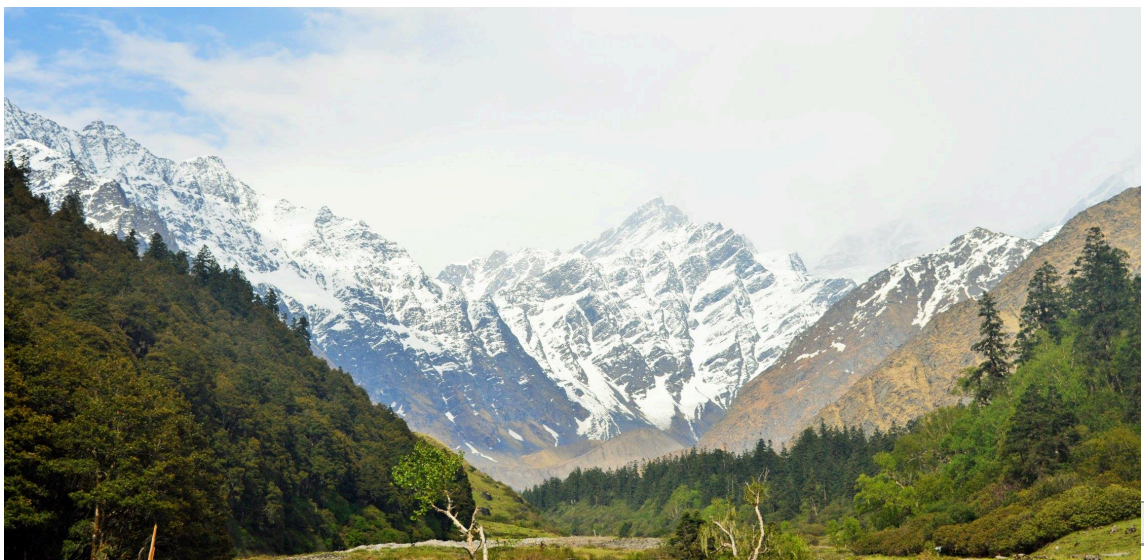
Evanescence

Visioning the Dokrani-Dingad Landscape in the Era of
Climate Change

Masters of Landscape Architecture, Thesis

HIMALAYAN LANDSCAPES

“Thousands of tired, nerve-shaken, over-civilized people are beginning to find out that going to the mountains is going home; that wildness is a necessity” – John Muir



Sonal Thanawala

2015MLA0015

Under guidance of:

Saurabh popli



SCHOOL OF PLANNING AND ARCHITECTURE, BHOPAL

NEELBAD ROAD, BHOURI, BHOPAL - 462030

MAY, 2017

Department of Architecture

School of Planning and Architecture, Bhopal

Declaration

I Sonal, **2015MLA0015** hereby declare that the thesis titled “**Evanescence; Visioning the Dokrani-Dingad landscape in an era of climate change**” submitted by me in partial fulfilment for the award of Master of Landscape Architecture in School of Planning and Architecture Bhopal, India, is a record of bonafide work carried out by me. The matter embodied in this thesis has not been submitted to any other University or Institute for the award of any degree or diploma.

Sonal Thanawala

Certificate

This is to certify that the declaration of **Sonal Thanawala** is true to the best of my knowledge and that the student has worked for one semester in preparing this thesis.

Saurabh Popli
Thesis Guide & Landscape Co-ordinator

Recommended

Prof. Tapas Mitra
Head, Architecture
Affairs

Prof. Ajay Khare
Dean, Academic

Approved

External Examiners
May, 2017, Bhopal

_____ **Ar. Nandita Parikh**

_____ **Ar. Aarti Grover**

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Abstract

The Dokrani-Dingad landscape is an important, highly used landscape on NH-34, 40kms from Utrakashi towards Gangotri in the Garwhal Himalayas. Dokrani Bamak is an important medium sized glacier of the Garwhal Himalaya that forms the source of the Bhagirathi river system. It comprises of two cirques found within the watershed created by the Draupadi-ka-Danda (5600msl) and Jaonli (6000 msl) peaks. The Dingad stream emerges at the mouth of this 5 km long glacier at an altitude of 3800 msl and joins the Bhagirathi at Bhukki village (2kms walk from NH34) about 25 km downstream. The ecology of the Dingad valley comprises Quercus, Pine, Rhododendron & Deodar at the lower reaches and Himalayan Birch (Bhojpatra) and Fir, with within steeply rising high altitude (approx. 3500msl) alpine meadows in a dramatic settings of u-shaped valleys and high peaks formed foundationally through tectonic forces and glacial action. The region is a cultural landscape, its origins lost in antiquity, formed and tracing its origins from the gods, and their peoples, the transhumant communities called *van-Gujjars*, nomadic herders who perform seasonal migrations; popular among scores of trekkers and numerous campsites are found within this highly scenic area; in addition, the Nehru Institute of Mountaineering situated at Uttarkashi, in the Garwhal region of Uttarakhand has used the glacier and surrounding areas for training purposes. Each year, the valley is visited by several hundred trainee mountaineers and others adventure-enthusiasts. Research is being conducted by Scientists from Wadia Institute of geology, on climate change & glacial retreat. However, large-scale visitation, and poor awareness in this fragile landscape has led to the degradation of its ecology. Further, increasing climate variability compounds anthropogenic pressures¹.

¹ Anecdotal evidence points to an increasing frequency of landslides, species out-migration, generation of waste, pollution of water resources, & changing species compositions in the alpine meadows

Increasing frequency of landslides, species out-migration, generation of waste, accumulation of non-degradable waste at higher altitudes, pollution of water resources, & changing species compositions in the alpine meadows have been observed in the recent years.

Over time, contests over resource extraction and space are likely to develop in rapidly degrading ecosystems, highlighting the need for applying newer approaches that incorporate consensus through participatory approaches, and multi-dimensionality. Landscape approach has been advanced as means of “reconciling conservation and development through interventions in different components of a landscape matrix some of which are managed toward livelihood development goals and others for conservation.” (Sayer et al² 2013)

In this thesis an attempt is made to reconciling the competing needs of development along with conservation. User centered and participatory design and management, Increasing legibility, interactive elements, can increase people’s awareness & admiration for the landscape. The present study attempts to synthesize experts’ findings from several domains of research interest, with the needs of the landscape and its users.

² vol. 110 no. 21. Jeffrey Sayer, 8349–8356, doi: 10.1073/pnas.1210595110

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1 Introduction

1.1 Background- Different takes on “Landscapes”.

1.1.1 Landscapes & the Himalayan Context

A **landscape** is most commonly defined as “the visible features of an area of land, its landforms and how they integrate with natural or man-made features.” It is a composition, including geophysical features landforms, land cover, people, built structures. Movement of wind, water & biological (human, plant & animal) activities play a major role in altering & modifying the landscape over time. The definition of Landscape varies depending on the research & management context, variation in phenomenon observed.

Mountain landscapes have been seen as scenic landscapes, the terms **picturesque, sublime & pastoral** evolved in the 18th century in the context of Alps. They are also famous amongst the adventure enthusiast & mountaineers for the thrill they offer. “**Himalayan Landscapes**” **evokes a memory / image in every individual.**” This study **identifies the elements & values critical to the image of the Himalayas.**

The term **landscape scenery** is commonly used for an aesthetic composition, mostly with dominating natural elements. “Landscape” in the early civilizations referred to the **scenic aspects / aesthetically pleasing compositions** observed in nature. As John Muir, known as father of national park system said “Everybody needs beauty, places to play & pray in, where nature may heal & cheer & give strength to the body & soul alike.” During this period Landscape architecture tried to replicate nature.

People from various cultures prefer **natural environments** better than built or otherwise human- influenced environments. Several researches have concluded that similarities in evaluations of natural scenes far **outweigh the**

differences across cultures or smaller groups. (Ulrich 1993) Natural scenes also contribute to restoration from stress (Ulrich 1991). Biophilia hypothesis by Edward O Wilson suggesting that humans possess an innate tendency to seek connections with nature & other forms of life can be related to Ulrich's researches. The **21st century** has seen an increasing urge among people to **reconnect to nature in India**. Tourists' visits to the Himalayan landscapes have increased drastically.

Certain landscapes were believed to possess physical attributes that are pleasing; this **Objective approach** to landscape preferences was common. Himalayan landscapes being the highest are known world-wide, for their uniqueness, diversity, beauty, and sacred values. "Beauty lies in the eyes of the beholder" led to the development of **subjective approaches** to landscape. According to this approach, the person's pre-conditioning also plays a major role in his preference for landscapes. Both these approaches of identifying **landscape preferences** are widely used to design & manage landscapes. This study identifies **landscape preferences** of the locals, pastoralists, mountaineers & tourists in the Dokrani-Dingad precinct. **It also identifies aesthetic preferences & tolerances of different groups of people using the landscape.**

Landscapes are mosaics in many senses of the word: mosaics of vegetation types, mosaics of land ownerships, and mosaics of land uses, to name a few. These mosaics are characterized by different landscape patterns and processes. They are large areas **encompassing an interacting mosaic of ecosystems and human systems** that are characterized by a set of common management concerns (Clement and others, 2014). Forman and Godron (1986) defined landscape as a heterogeneous land area composed of a cluster of **interacting ecosystems** that is repeated in similar form throughout. The Dokrani-Dingad landscape is a highly diverse & complex system with multiple ecosystems, interacting & constantly changing the landscape. Multiple users, land uses & extensive use

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of these ecosystems have induced stresses on this landscape. The study **adopts a landscape approach & deals with understanding the functioning of these ecosystems and its interaction. It also documents & analysis the impacts of these interactions over time.**

1.2 Mountain Landscapes

1.2.1 Introduction and Importance:

Introduction

The term “Mountain Landscapes” has a memory or an association for every individual. They are viewed as majestic, scenic, timeless, mystical, sacred & eternal. Travel to mountains has a mention in history across civilizations. There are many philosophical beliefs surrounding travelling to the mountains. It is said to uplift the spirit, broadens one's perspective, providing hope & inspiration, Pushing myself to a new level of possibility. Experiencing uncertainty & arising difficulties through the mountain journey makes one value the predictability & ease we experience in our daily lives. They offer instances & experiences which can help people find & test their limits. It provides balance, a contrast from the urban experience that is crowded, polluted & noisy. The massive scale of the mountains makes one feel small & insignificant, while its beauty & diversity makes one feel privileged at the same time. It is an overwhelming, and incredibly powerful experience.

Many ancient cultures including hinduism & buddhism have pilgrimage routes on high mountain passes. The large mass of the mountains along with a pyramidal structure is believed to have higher concentration of energy. The egyptian pyramids seem to be inspired by mountains.

The nature dominant diverse setting, with minimal cultural signatures have something to offer to all age groups, genders & cultures. It offers both active & passive recreation opportunities including enjoying aesthetic beauty, scenery, cultural experience, inspiration for photography & artwork, trekking,

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mountainnering, rock climbing & skiing. Travelling also enables learning, meeting new people from different cultures.

It re-connects us to the world where humans co-exist in the laps of nature. It enhances our knowlwdge about various flora & fauna, also developing a understanding of the importance these organisms for our existance.

Importance

According to UNEP (United Nations Environment Programme) and ICIMOD (International Centre for Integrated Mountain Development) approximately **120 to 170 million people** are **visiting mountain regions** around the world each year, **taking up 15 to 20% of the global tourism market**, and their number is ever growing.

About 10% depends directly on mountain resources for their livelihood & wellbeing & an estimated 40% depends indirectly on mountain resources for water, hydroelectricity, timber, biodiversity & niche products,mineral resources & recreation. (Schild 2008). They serve as a source of inspiration & knowlegde supporting streams of science based on observations of natural environment like ecology & Biomimicry.

1.2.2 Western Perceptions & Timeline of Development

1.2.2.1 Americans Perception of Nature, Mountains & Wilderness Act

TIMELINE

In the early **1600's**, wilderness was viewed as something **savage and feared**.

In the **1700's**, due to early Puritan **religious influence**, **wilderness was admired and revered in a religious light, as a connection to God**.

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In **1803**, after the Louisiana Purchase and settlement of the frontier, Americans **no longer viewed wilderness as a vast, unlimited resource**, but began to see it **as passing away and becoming scarce**.

During the **1950s and 1960s**, as the American transportation system was on the rise, **concern for clean air and water quality began to grow**; and the potential that no lands in the United States would **remain wild and free**. A **conservation movement** began to take place with the intent of establishing **designated wilderness areas, preserve and protection them in their natural condition**.

1.2.2.1.1 People, Literature & Art Leading to the formulation of the Wilderness Act

John Muir (1838-1914) : Scottish-American naturalist, environmental philosopher, glaciologist, pioneer in the wilderness conservation movement and founder of Sierra club. Important publications include **“The Mountains of California”** & **“Our National Parks”** In these books he establishes a relation, comparison of Elements & processes of nature as promoters of human wellbeing.

Inspiring writings/ Ideologies

“Climb the mountains and get their good tidings. Nature's peace will flow into you as sunshine flows into trees. The winds will blow their own freshness into you, and the storms their energy, while cares will drop away from you like the leaves of autumn.”

“Few places in this world are more dangerous than home. Fear not, therefore, to try the mountain passes. They will kill care, save you from deadly apathy, set you free, and call forth every faculty into vigorous, enthusiastic action.”

“Even the sick should try these so-called dangerous passes, because for every unfortunate they kill, they cure a thousand.”

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“We are now in the mountains and they are in us, **kindling enthusiasm**, making every nerve quiver, filling every pore and cell of us.”

“Raindrops blossom brilliantly in the rainbow, and change to flowers in the sod, but snow comes in full flower direct from the dark, frozen sky.” **Seasonality & Interconnectedness.**

“Thousands of tired, nerve-shaken, **over-civilized people** are beginning to find out that **going to the mountains is going home**; that **wildness is a necessity**”

1. ALDO LEOPOLD- (1887–1948) :

Leopold shows that the **removal of a single species** can result in **serious negative consequences in an ecosystem**. “The cowman who cleans his range of wolves does not realize that he is taking over the wolf’s job of trimming the herd to fit the change. He has not learned to think like a mountain. Hence we have dustbowls, and rivers washing the future into the sea.”

(Here, to think like a mountain means to have a complete appreciation for the profound **interconnectedness of the elements in the ecosystems.**)

Land Ethics: Fundamental change in the way humans relate to nature. **“Conservation is a state of Harmony between Man & land”**

According to Leopold “When we see **land as a community** to which we belong, we may begin to use it with **love and respect**. There is no other way for land to survive the impact of mechanized man. That land is a community is the basic concept of ecology, but that land is to be loved and respected is an **extension of ethics.**”

“A thing is right when it tends to **preserve the integrity, stability, and beauty of the biotic community**. It is wrong when it tends otherwise.”

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2. **Margaret (Mardy) Thomas Murie (1902–2003)** : Murie devoted her adult life to preserving wilderness areas across North America. Her patience, passion, and perseverance made her a natural leader in the wilderness movement during the 20th century.

“I am testifying as an emotional woman and I would like to ask you, gentlemen, what’s wrong with emotion? **Beauty is a resource in and of itself.** I hope the United States of America is not so rich that she can afford to let these wildernesses pass by, or so poor she cannot afford to keep them.”

3. **Howard Zahniser (1906–1964)**: He was also from a very early age a great lover of birds. He would say, when you love birds you learn more about them, you **realize their ties to the land & their need to live in the world.**

"A **wilderness...is hereby recognized as an area where the earth and its community of life are untrammelled by man.**"

He believed that in the present phase of our civilization we have a profound, a fundamental **need for areas of wilderness** - a need that is not only **recreational and spiritual** but also **educational and scientific**, and withal essential to a true **understanding of ourselves, our culture, our own natures, and our place in all nature.**

“We are, **dependent members of an interdependent community** of living creatures that



Figure 1 : Mountain photography by Ansel Adams

together derive their existence from the Sun.”

4. **Ansel Adams (1902–1984):** He was an American Photographer & Environmentalist. Famous for his black and white landscape photographs of Yosemite National Park. Printed on calendars, books & internet photography reached the masses & inspired people to travel to see the beauty of mountains & nature.

“**Wilderness** is not only a condition of nature, but a **state of mind and mood and heart,**”

THE WILDERNESS

ACT 1964

Philosophy: The term "wilderness" is defined as "an area where the earth and community of life are untrammelled by man, where man himself is a visitor who does not remain" and "an area of undeveloped Federal land retaining its primeval



Figure 2: Artistic impression by _____ for the Wilderness Act

character and influence, without permanent improvements or human habitation, which is **protected and managed so as to preserve its natural conditions.**"

Criteria for designation:

- Human influence is "substantially unnoticeable,"
- There are opportunities for solitude and recreation, and
- The area possesses "ecological, geological, or other features of scientific, educational, scenic, or historical value."

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Important management restrictions:

- Leave no trace- Packing all trash out of the wilderness,
- No Logging- using a stove as opposed to a fire.
- camping at least 200 feet (61 m) from trails or water sources,
- staying on marked trails, and keeping group size small.
- to provide undeveloped habitats for threatened or endangered species.
- This vast assortment of flora and fauna is a major consideration for addition into the wilderness preservation system.

1.2.2.2 *European Perception & Mass Tourism into the Alps*

TIMELINE

In the **6th century**, the guilds prescribed the common European practice of journeying as an obligatory element of training, often lasting three to four years.



Figure 3: European scholars traveling through alps in the 12th century

Majority of the people tried to avoid the alps, as they believed dragons and other foul creatures inhabited them.

Between the **6th & 11th century** Agriculture & transhumance cultures developed in the Alps. Alps were also regarded for their military importance to civilizations & people crossed them for trade & pilgrimage.

During the **12th century**, the desire to experience the world emerged. The fundamental idea was that one could mature and learn while travelling, experience the world and improve one's craft in order to grow through a test

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and return as an accomplished man. Travelling & wandering was seen as a means of confronting oneself & achieving self-realization.

16th & 17th century

scholars, especially those from cities near the Alps, began to show a greater interest for the mountain phenomena. Their curiosity was also aroused by important questions of the genesis of the earth and



the interpretation of the Bible. Artists started viewing the Alps & nature for their

romantic, picturesque & sublime qualities. The fear of the medieval ages was replaced by charm & appeal for the mountains invited people to visit the Alps.

Figure 4: Railways in the Alps initiated mass tourism to mountains in Europe

Mid 17th century to the end of 18th century “Grand Tour” As the Grand Tour became part of the “liberal education” of young aristocrats, interest in the Alps also grew among the scientific community. This included Swiss naturalists and their counterparts in other European nations, especially England. The writings of some naturalists reveal both growing knowledge of the Alps, and continuing fear of what might lurk therein.

By the **18th century**, a distinctive enthusiasm for nature and the Alps spread in European society. **In the 1850s** mountains and climbing, emerge as a sport.

In the **19th & 20th century**, Alps were developed as a recreation space for the people, with the inclusion of active recreation activities like trekking,

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fishing, skiing; and was opened to the tourists. Infrastructure development, which included mountain railways & cable cars, were developed in order to facilitate mass movement to the Alps. This early **social tourism** was characterized by a new **collective ethos mixed with non-commercial elements** that have been **understood as the precursors of "soft tourism"**. These **intermingled with distinct forms of sociability, the conscious appreciation of the environment** and consideration for the local population, countryside and cultural assets.

In the **21st century** Acid rain from cars and industry has **damaged forests**, leaving **barren hillsides** that add more **danger from landslides** to other problems arising from mountain tourism. Efforts by pro-environmental Green Party members to pass laws supporting railways and other transportation alternatives are being countered by the Automobile Party.

People & Literature on Mountains

1. **Fernand Braudel (1902-1985)**: He was a French historian, who studied the alps for his research "The Mediterranean." He Describes Alps as "an **exceptional range** of mountains from the point of view of **resources, collective disciplines, the quality of its human population & good no of roads.**"
"Everything must be recaptured and relocated in the general framework of history, so that despite the difficulties, the fundamental paradoxes and contradictions, we may respect the **unity of history which is also the unity of life.**"
2. **Albrecht von Haller (1708–1777)**: He was a Swiss anatomist, physiologist, **naturalist & poet**. Famous poems on alps include "Die Alpen" ("**The Alps**") describing the vigorous and pure natural and human environment of the Alps with effete urban civilization.

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Other poems delved into fundamental religious, ethical, and metaphysical questions related to mountains.

3. **Horace-Bénédict de Saussure (1740–1799):** Geologist, meteorologist, physicist, mountaineer & Alpine explorer. His book “Voyages dans les Alpes” describes the ascent of Mt Blanc
4. **Jean-Jacques Rousseau (1712-1778):** He was a philosopher, writer & composer. His novel- “**Julie, ou la nouvelle Heloise**” has played an important role in the **romanticization of the alps**. It consists of letters from two lovers living in a small town at the foot of the Alps.
5. **Joseph Addison (1672-1719):** He was a poet, essayist & politician. (the English journalist) described the Alps as this “**awful and tremendous amphitheater.**” This led to the theories related to **sublime** landscapes (the existence of pleasure along with fear.)
6. **Thomas Gray (1716-1771):** He was an English poet, letter writer & a classical scholar. During his visit to French Alps describes “Mont Cenis, I confess, carries the **Permission Mountains have of being frightful rather too far; and its horrors were accompanied with too much danger to give one time to reflect upon their beauties.**”

1.2.3 Eastern Perception and Timeline of development

1.2.3.1 *Indian Beliefs & Myths of the Himalaya*

The peaks, valleys, rivers and rocks of the Himalaya have long been **perceived as sacred landscape** to its peoples, pilgrims, and scholars as well as to its climbers, surveyors and scientists.

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Also known as the **“Adobe of God”** it has several mentions in sacred texts of **Hinduism & Buddhism** in the Indian Sub continent. In **Hindu mythology**, **Himavat** is the personification of the Himalayan Mountains. He is **the father of Ganga, a heavenly river** that flew from the toe of Vishnu, but which was **brought down to the earth** (by the prayers of the sage Bhagirath) **to purify the ashes of the dead**. To save the earth from the shock of Ganga's fall, Lord Shiva



Figure 5: Painting by Nicholas de Roeriet depicting the spirituality in the india himalayas.

caught the river on his brow and the mat of his hair thus checked Ganga's flow in the Himalaya through seven streams - the Bhagirathi (Ganga proper) rising in Gangotri being one of them. To the Hindus, various mountain peaks are home to various deities; Nanda Devi is attributed to Goddess Pravati, who is also the consort of Shiva, while Mount Kailash is considered as Shiva's paradise and Shivling is thought to be Shiva's Lingam (stone phallus). Vishnu (believed as the creator) himself also has his foot in the Himalaya, close to the Ganges: Kedarnath and Badrinath are attributed to him in several myths.

The Vishnu- Himalayan parallelism **“Lord Vishnu is believed to have become incarnate ten times. He descended to the earth in ten different forms (avatars) to preserve righteousness in the world.”** has mythological beauty and richness. It can be related to the Himalaya in the terms that **“Mountains reincarnate (Tethys to Himalaya) to preserve the planet's 'right environment' for life.”** In the **geographic & Climatic Histories**, these Mountains are seen as **A Provider & A Protector**; protecting the land

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from the piercing cold winds blowing from the north & providing rainfall by blocking the clouds from the south west. Giving birth to a climate so pleasing. The rivers originating from the Himalayan Glaciers have provided with fertile soils to the plains & have ensured continuous supply of water to support civilizations & rich biodiversity. It has also protected the territory for long **from foreign invasion**.

1.2.3.2 *Timeline*

In the **1st century BC** The trans-Himalayan connection, with Tibet began for **trade** with the beginning of gold mining.

In the **9th century** after the development of **agriculture** its commodity composition changed when salt was exchanged for grain (according to S.C. Das salt was mined from the 6th century). Wool was another important commodity for trade. This trade with Tibet continued in an attenuated form even during British rule till as late as 1962.

The **9th and 10th century** copper plate grants suggest **intensification of agro-pastoral activity**. Later, with the further diffusion of agricultural activity, the middle Himalayas were populated and copper and iron technology was now applied for making agricultural implements and copper utensils. **Mining of copper and iron** and manufacture of tools and utensils was an important activity, and

From **15th century (Mughal period)** the region was known for its **exports** of copper & iron. This continued till the early 20th century, when import of copper and iron from England rendered mining unviable.

Till the **17th century**, mountain people commonly practiced **Agriculture, animal husbandry and transhumance**.

During the **British rule, 18th Century** the ownership rights of the forests were transferred to the Government. **Deodar & Sal forests** were **logged**

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extensively for its timber & **used for making Railway sleepers**. The World war also increased the demand for supply of wood leading to additional exploitation. These species along with **Chir pine (used for extraction of Resin)** were planted extensively, **changing the ecology of the Himalayan forests**. In this period the **Oak species** that supported human settlement started depleting in numbers due to its low economic value. Also, the British generals engaged in **recreational activities like hunting, fishing & trekking**. The mountain regions like Shimla, Kashmir were developed for these activities. Hunting was the major reason for the dwindling number of many wild species at the turn of the 20th century.

During the 1930s, climbing expeditions gained popularity; this was **characterized by travelling light, without complicated logistics**. Locals were hired as guides (Sherpa) for their knowledge about the mountainous terrains. This led to the exploration of unique places of ecological & scenic beauty like the **“Valley of Flowers”** that was discovered by Frank Smythe while returning from the Mt Kamet expedition. This period marks the beginning of trekking & Mountaineering in India.

By late 19th & 20th century, there was realization about how long term bio-physical processes shape the environment. Problems arising out of the relationships between man and nature became more prominent. The web of use patterns became more complex & **extraction of resources was at its peak**.

In the **21st Century**, rapid urbanization, increasing tourism with unplanned development are degrading the mountain landscapes. A no of major natural calamities like the cloud burst in Kedarnath, Asiganga Floods. The unplanned development has led to massive damages to people as well as ecology.

1.2.3.3 *People & Literature on Mountains*

1. **Nicholas de roereit:** a Russian painter, writer, archaeologist, theosophist and philosopher; known for hypnotic expressions of his paintings. Between 1925-29 Roereit, with his 6 friends visited Indian Himalayas as a part of the Asian expedition. As part of the mission he, was to act as the embassy of western Buddhism to Tibet. During this period he painted the Himalayas highlighting their cultural character.
2. **Ruskin bond:** Is an Indian author of British descent. He lives with his adopted family in Landour, in Mussoorie, India. Some writings that describe Himalayas include *Rain in the Mountains: Notes from the Himalayas*, and *Dust on the Mountains*.
3. **Stephen Alter:** Is an American non-fiction writer born and raised in India. Having spent his childhood in the lower western Himalayas many of his writings describe the Himalayan landscape and its cultural values. His famous works include *All the Way to Heaven: An American Boyhood in the Himalayas* (1998), *Sacred Waters: A Pilgrimage Up the Ganges River to the Source of Hindu Culture* (2001) and *Becoming a Mountain: Himalayan Journeys in Search of the Sacred and the Sublime* (2014).

1.2.4 Conclusions & Way forward

Through the ages **Literature, Art & Photography** have played a major role in inspiring for people to travel & explore new places. They have been the medium attributing an image to a place; adding an iconography to unique places. Today **people travel to places** with a **preconceived image** of the place. While developing a place, **accounting to the conceived image is an es**

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2 Site & Project Introduction

2.1 The Garwhal Himalayas: A Historic Perspective

With spectacular hilly terrain, stunning natural beauty, ancient temples, swift rivers and lush greeneries, the district Uttarkashi is one of the favorite districts for tourist to visit. This place is a real paradise for adventure enthusiasts and sports lovers. The Nehru Mountaineering Institute is a premier institute for adventure tourism. Buggyals or a “high altitude meadows” ie Dayara, Kandara, Gidara etc., Tals (lakes) ie. Saattal, Dodital, Nachiketatal, Kedartal etc. and Gangotri National Park are also popular among different tourists. Gangotri, having the main temple of Ganga, the holiest river in the country, is one of the Chardham of Uttarakhand Gaumukh Glacier is the physical source of Bhagirathi (Ganga) and is of great importance to the pilgrims. In the cold region of the Gangotri national park (Neelang Valley) more than 450 species of vascular plants, 15 species of mammals and 150 birds species have been recorded.

2.2 Agriculture & Transhumance (upto 17th century):

The middle mountains (with forests of oak and pine) also did not have fully sedentary peasant populations. Cattle maintained for manure had to be moved to places where fodder was available, resulting in high mobility. Millets were cultivated on the slopes and rice in hot malarial valleys. Human habitation avoided the valleys and homes were built on slopes. Terracing helped retain moisture for a system of agriculture primarily based upon monsoon rains and some canal irrigation from rivers. It also prevented **and run-off of soil nutrients**.

The concept of a **mixed mountain agriculture system** suggests that the key to the success of **agro-pastoral transhumance in Himalayan valleys** was the **vertical oscillation** of cultivators, herders and beasts following the

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vicissitudes of climate in an effort to exploit niches at several altitudinal levels.

For mountain people the forests have been the support system of life, supplying them with fodder for cattle, water & Fuel for fire. They developed a great understanding of the ecology & behavioral patterns of the plant & animal life that sustained in the forests. The species compositions were modified, promoting the growth of useful plant species. **The conservation of forests & its ecology was maintained in the form of religious practices.**

2.2.1 The British Rule:

In the early 17th century the britishers encouraged the practise of agriculture. This lead to its expansion & cutting down of forests. Later in the mid 17th century the forests were considered as a separate entity and a governor general was appointed for its management. This reduced the rights of people on the forests. In the early 18th century the laying of indian railways began. This lead to an inceasred demand for timber to make sleepers. Commercial harvesting of trees of Sal (*shorea robusta*), Deodar & chirpine was practised extensively. Over time plantation of these economically viable trees was encouraged & the ecological cycle was broken. The Oak that was an ecologically important species & important to locals was also being harvested but not cultivated. This lead to reduced sizes of oak forests that supported subsistance economy. The size of the forests kept shrinking & its dependencies increasing. The british rule marks the beginning or unsustainable extraction from forests; that has lead to its depletion & degradation .

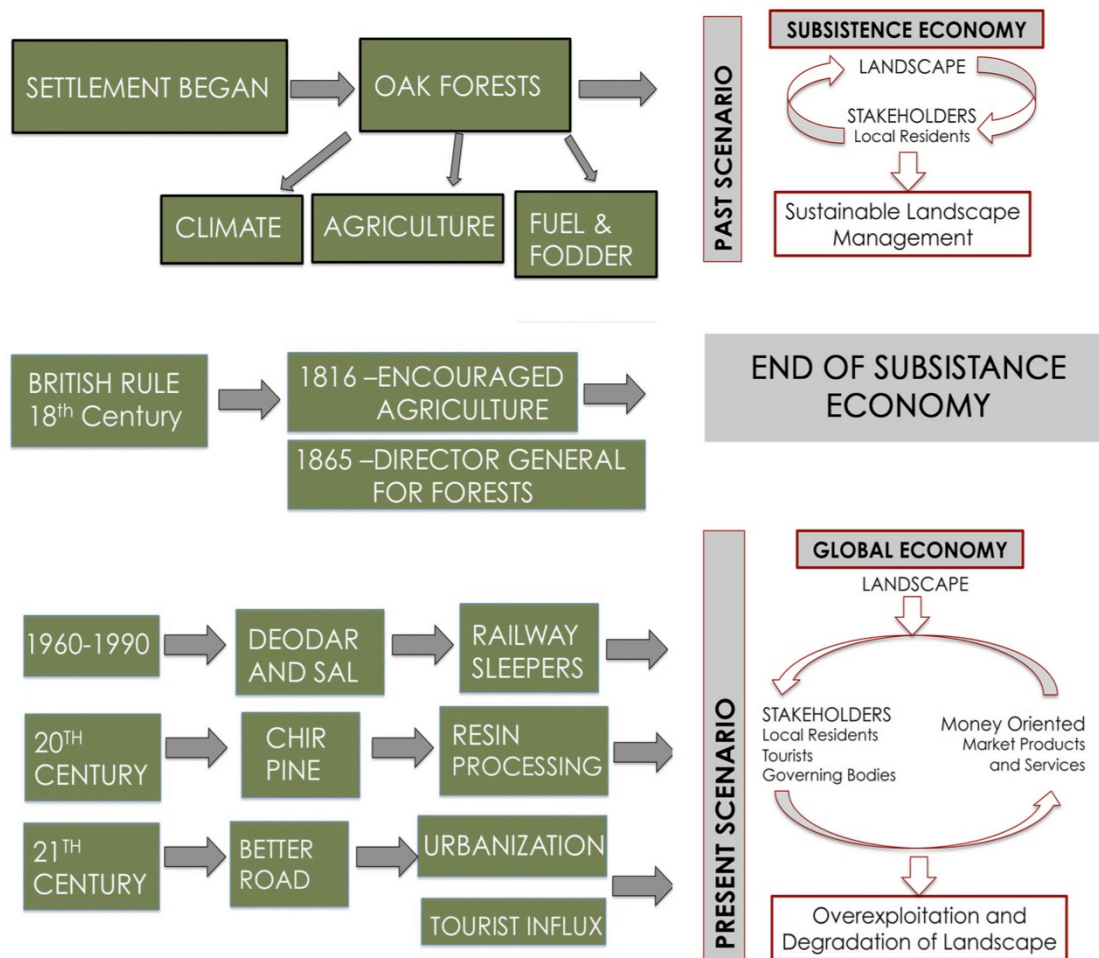


Figure 6: Timeline of Development in the Indian Himalayas

2.2.2 Important Forest Conservation Movements

2.2.2.1 *The Chipko movement :*

The **Chipko movement** or **chipko andolan** was primarily a forest conservation movement in India that began in 1973 by women from Uttarakhand. The name of the movement comes from the word 'embrace', as the villagers hugged the trees, and prevented the contractors' from felling them.

After the Indo-China war, Chamoli gained a sight in Indian government and trees were commenced to cut down to make an easier path for soldiers. The affected people realized the importance of steady mountains and opposed to cut them. In 1962, Gaura Devi was elected as the chairman of the same in

Reni village. By the time she associated with Chandi Prasa Bhatt, Gobind Singh Rawat, Vaswanand Nautiyal and Hayat Singh who gave her hand in saving the environment.



The governmental workers

were ordered by officials to swap the trees in Reni district. On hearing this Gaura Devi Collected 21 women & children & marched towards the forest. All the women stood hugging the trees warning the workers to cut them before cutting the trees. “Forest is like our mother’s home, we shall protect it come what may. If the forests are cut down the flood strike will swap our everything” A slogan by Gaura Devi during the Chipko movement.

2.2.2.2 *The Raksh Sutra Movement*

After the chipko movement the state government took up the responsibility of



Figure 8: Graphic representation showcasing the moto of the Raksha Sutra Movement protecting the forests & imposed a ban on felling of trees above the height of

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1000m above sea level. Felling & selling of trees still continued as a trade; the forest corporation often declared green trees as dry, half broken & uprooted, marking them for felling. Senior officials did not monitor felling activities as made mandatory. During 1993-96 extensive forest cover around jangla near Gangotri, Chaurangikhal and Rayala was ravaged by setting aside the laws.

Drawing inspiration from their age-old traditions, the villagers, particularly the womenfolk, have once again come forward to launch another novel movement to save their forests and environment. Known as the *Rakshasutra* (Safety thread) movement. It began in July 1995, when word spread one night that the UPFC had surreptitiously smuggled in a group of Kashmiri labourers to cut down trees in the Rayala jungles in Tehri Garhwal. Some women villagers trekked uphill to prevail upon the UPFC contractor to stop cutting the trees & leave the jungle.

By the time the women villagers reached the site, three huge Rai trees had been cut down. Shocked at such wanton destruction, women villagers then and there took a vow to protect the trees and in a symbolic gesture tied *Rakshasutras* around 2,500 trees.

2.2.2.3 *Learning's & Conclusions*

These movements drew the attentions not only of the political power but also of environment lovers and scientists. Movements like Chipko can be seen as more than a defense mechanism of a little community & its values, they are an affirmation of the way of life '***more harmoniously adjusted with natural processes***'.

The local people have played an important role in shaping & conserving the pristine locations in the Himalayas. Being insiders, their lifestyles have evolved integrated with the eco-system functioning. It is very essential to

integrate their understanding to the efforts of conservation & management.

2.2.3 Urbanization & development of tourism (20th-21st Century)

During the indo-china war, road network in the himalays improved drastically. Post war, this facilitated easy access & visits by tourists gained popularity. It also connected the locals to urban areas & upgraded their lifestyle. The urban development ideas started being used on steep slopes of the himalays. Currently most of the hill slopes are seen covered in concrete structures. The construction techniques used create vibrations which are hazardous due to the instable geomorphology. Recent years has also witnessed massive losses to people & ecology; Major disasters like the floods at asi ganga, cloud burst events in 2012 & 2013 are frequent. The glaciers are melting rapidly, increasing the water stresses in this region. The degraded forests & unplanned urban development are aiding to increase the losses in the region.

Forests have to be conserved, regenerated and even created to preserve the 'ecological integrity' of the Himalayan environment.

2.2.4 The Eco-Sensitive Zone Declaration: December 2012

2.2.4.1 Introduction

The Ministry of environment and forests issued a notification on 18th Dec, 2012 [S.O.2930(E)] declaring the entire watershed of bhagirathi about 100kms as an ecosensitive zone. In this Notification, the ministry acknowledges that this region is rich in biodiversity and essential for the maintenance of environmental flow & ecology of the river. It also states that continuous & phenomenal increase in the human & cattle population, the anthropogenic pressures on the ecosystems & environment has tremendously increased, causing irreparable damage to the fragile mountain ecosystem. The Ecosensitive zone covers an area of 4179.59 sq kms & includes Govind & Gangotri national Parks.

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The Dokrani-Dingad water shed also falls within this zone.

2.2.4.2 *Notification & masterplan key Considerations (Anexxture-5)*

Zonal plan considerations(MOEF): Relevent Points

(pt4) Developmwent shall provide for restoration of denuded areas, conservation of existing water bodies, management of catchment areas, watershed management, groundwater management, soil & moisture conservation & other aspects of ecology & environment.

(pt7) Construction shall follow the traditional concepts & architecture of the area.

(pt8) shall include eco-friendly development for providing livelihood security to locals & bonafide residents.

(pt10) Encourages the development of walking paths for pilgrimage tourism & local use.

(pt14) there shall be no consequential reduction in green area such as forest area, agricultural areas etc.

(pt16) Development & protection of slopes: No development shall be undertaken in areas having a steep slope (a gradient of 20 degrees or more) or areas that fall in fault of hazars zones or fall on the spring lines & first order streams or slopes with high degree of erosion.

(pt20) Natural Heritage: scenic beauty, confluence of river, waterfalls, pools, srings,gorges,open areas, wooded areas, walks to be identified & their conservation should be implemented. Guidelines to be made to regulate activities around critical locations to retain its special character.

2.2.4.3 *Issues faced in the implementation*

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This notification that was **issued in 2012**, has faced a lot of opposition from the uttarakhand state government officials; approval & implementation is **pending till 2017**. After the floods in 2013 the locals began to acknowledge the importance of the notification; but the political leaders have been misguiding the locals about the consequences of ESZ declaration.

Chief minister Singh Rawat, has urged the government to review the notification, deeming it as a move that **has hurt the economic interest of the local people**. The state governments plan of **providing** electricity to all villages has been on hold due to this central government notification, issuing a ban on hydro-electic projects within the esz. The Chief minister announced a hunger strike as an opposition to the Bhagirathi ESZ in January 2017.

The Uttarakhand government is also accused of submitting the master plan long after the stipulated time of 2 years. Also this Master plan prepared has been rejected over several loopholes by the central government. According to Sanjay upadhyay from NGT, "Despite NGT directing the state to submit substantial plans for ecology restoration, **the state government has been making goofups, with no concrete steps for conservation.**" Also the master plan was submitted without soliciting opinion of stakeholders to be affected by ESZ provisions.

2.2.4.4 Considerations from & Modifications in ESZ -Dokrani-perspective

The notification issued by the central government (MOEF & NGT) acknowledges the pristine nature & ecological value of the area in the upper catchment of the Bhagirathi. This can be seen as an important **1st step towards sustainable development & landscape conservation** in the Indian himalayas.

The process of Master Plan development involves **15 different departments** & the guidelines are prepared **in isolation**. This is a loophole in seamless

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planning. There is an absence of an expert to synthesize the understandings of all these departments & monitor its implementation. It is essential to **prepare the guidelines as a committee** with representatives from each department & a member of the Central board (NGT/MOEF) to fasten the process of Master Plan preparation.

After the preparation & approval of the Master Plan, the current practice is to develop small plots of land in accordance to the plan. The ecosystem services spread across larger areas & an holistic approach including the areas of influence & dependence is essential while developing the villages/ settlement areas. Development guidelines, management plan & design strategies all together are essential to promote & ensure sustainable development. **A landscape architect can be involved, with other experts on geology, ecology, water resources & stakeholders for a Landscape Scale proposal.**

In the Dokrani – Dingad precinct, Bhukki is the only permanent settlement which covers about 2% of the area it has influenced & changed over the years. These villages are the centres which have supported & directed the high altitude pastoral, tourist & mountaineering activities. Also, the trails & camps across different altitudes (human activity area) cover an area of 10% of the complete landscape. Clearing a small patch of the forest, dumping of food waste & merely the movement of people affects the movement patterns of various species. It also leads to occurrence of invasive species, reduction of species who prefer core forest areas & increase in edge species. Locating camps on ridges could also reduce the scenic value of the location.

Landscape scale development along with management plans & **involvement of stakeholders** is essential for **conserving the pristine himalayas as stated in the ESZ notification.**

2.2.5 Present Scenario: Tourism:

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According to a study by S.P Bansal et al (2010), department of tourism there was a 15% growth in tourist arrival in 2007 as compared to 2006 & there as been a constant increase ever since. Another study by Uttarakhand tourism department states that, the Total tourist arrivals in Uttarakhand are expected to reach around 67 million by 2026. (22 million were recorded in 2014.) In the recent years, it has been noticed that majority of the tourist population is a young generation, whose prime purpose of visit is Leisure & excursion.

The most popular destinations for tourists to Uttarakhand were Rishikesh, Haridwar, Gangotri, Uttarkashi, Kedarnath, Badrinath, Auli, Nainital and Gaumukh.

	Scenic Beauty	Trekking Facilities	Spiritual centers
Domestic Tourist	43.6%		44.2%
Foreign Tourist	59%	51.3%	52.1%

The Dokrani- Dingad landscape being on the Uttarkashi-Gangotri highway is en-route the popular tourist circuit. Being a highly scenic & diverse landscape & with opportunities for leisure as well as adventure activities is a potential site.

The project combines the need for tourist infrastructure, conservation needs & knowledge of local community to develop & manage the Dokrani-Dingad Landscape.

2.3 Site Introduction

UNDERSTANDING THE DOKRANI-DINGAD LANDSCAPE

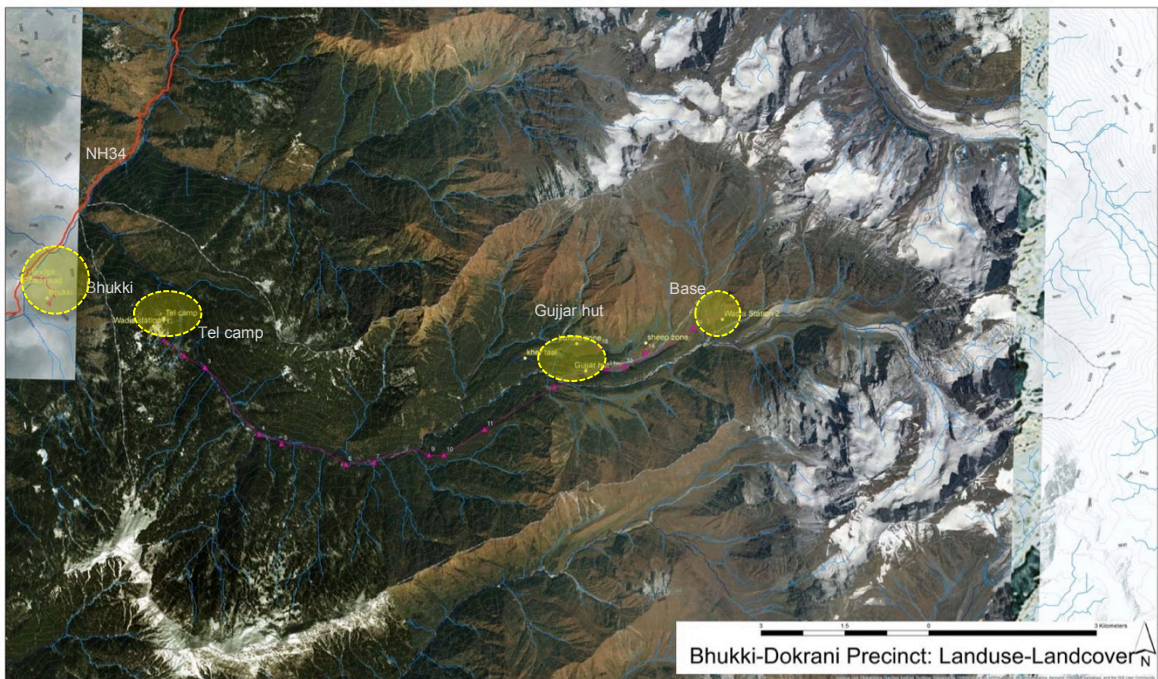
The Dokraini–Dingad Valley is a high altitude glacial landscape set on the hill slopes adjoining River Bhagirathi on the northeast to south. This Himalayan landscape is **accessed mainly through 2 villages** Bhukki & Hurri on the NH34, 40kms from Uttarkashi towards Gangotri. Most of these

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tourists visit Uttarkashi & Gangotri; Dokrani-Dingad being enroute can be developed to be included in this circuit, for nature tourism.

2.3.1 Components of the Landscape

Dokrani Bamak is a medium sized glacier originating from the Jaonli (6000 amsl) & Draupadi ka danda (5600 amsl) peaks. Dingad Stream originates from this glacier at an altitude of 3500m & meets Bhagirathi near Bhukki. The area selected for study includes entire watershed comprises an area of 75sq



Map 1: Sattelite imagery of the landscape with trek route & location of villages.

kms & the adjoining village Bhukki.

The lowest portion of this landscape, at Bhukki is permanently occupied & people residing here practice rain-fed agriculture. Tela, a forest village, practiced agriculture till 2012; it is also used as a campsite by trekkers & mountaineers visiting the landscape. The surrounding forest composition & few large clearings are indicators of the forest dependent lifestyles of the earlier generations. Further up the alpine meadows at Gujjar hut is being used by van gujjars for summer grazing of buffalos. This also houses a

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glacial lake, with a small temple. The villagers visit this in the month of August to make offerings. The area above is of importance to the mountaineers. Nehru Institute of Mountaineering conducts regular training in this area. Wadia Institute of Himalayan Geology also has set up a climate & glacier-monitoring laboratory. Also extraction of herbs & medicinally important plants occurs at different locations in the landscape.

It is a **diverse landscape** formed by a **mosaic** of settlements, farmlands, grass collection zones, broad evergreen forests, deciduous forests, coniferous forests, alpine meadows, high altitude scrub vegetation, snow fields, steep barren slopes, Scree & moraine slopes, Glacier & towering peaks that enclose the **view shed**.

The landscape begins at the edge of the Sub-tropical zone, and extends up to the Alpine Zone even beyond the tree line. Bhukki, falls on the **edge of the Sub-tropical Zone & Broad leaf temperate forest**. Tela is surrounded by



Figure 10: View of the Dingad valley

Broad leaf temperate forests, many Akhrot & Banj trees are observed

here. Beyond Tela from an altitude of 2800m the Coniferous Zone extends up to 3500m is dominated by deodar forest. Broad leaf temperate & Coniferous Forests support a rich flora & fauna. The Alpine Zone (above 3500m) is at the highest altitude it comprises of the scrub vegetation, bugyals, snowfields, glaciers, steep slopes & Peaks. Commonly spotted vegetation includes Buras, Pangar, Imir, Ganjar, Moru, Akhrot, Ringal, Chid, Khersu, Deodar, Bhojpatra, Semru & Juniper. The landscape also supports a rich fauna that includes Snow leopards, Black & brown bear, Musk deer,

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Bharal (blue sheep), Himalayan Thar, red fox, Yellow throated Marten, royal pika, Monal Pheasant, Himalyan snowcock, bearded vulture & snow pigeon.

It is a diverse & unique landscape, with many scenic elements & offering a variety of experiences. The area went through many changes during the ice ages when glaciers carved the landscape. Large ice sheets covered some portions of land and dammed up rivers in others, creating glacial lakes. Fluvio glacial landforms, indicating the process of landscape formation are visible above the treeline. The flora & the landform are major spatial elements. Changes in the form & canopies of the forest with altitude offer changing asthetic experiences. Close to the treeline the opening up of the viewshed along with the views of the majestic peaks in the foreground of flower dominated alpine maedows is a treat. The changing topography offers variation throughout the trail. The presence of water, unique fauna create soundscapes, draw interest & add to the delight.

2.3.2 Stakeholders & Different Perspectives

Multiple stakeholders own patches of this landscape, as also different ethnographies are dependent on the landscape. Seasonality plays a major role in regulating the movement of the stakeholders. The **settlers (village**



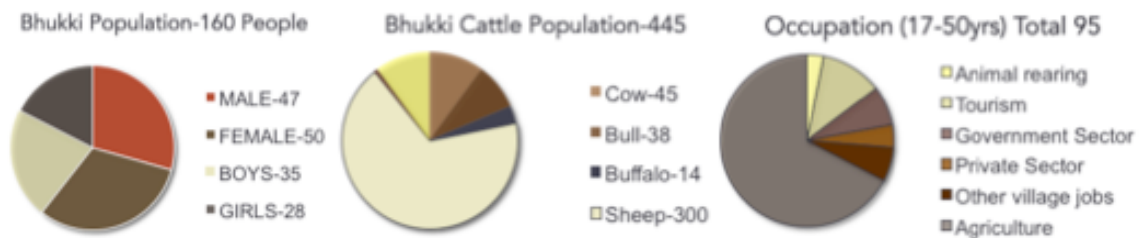
Figure 11: Stakeholders in the Dokrani-Dingad landscape.

residents) land at Bhukki & tela. The settlers depend on the forests for firewood, fodder & other non-timber forest produce as well as on the glacier for provision of water. For this group the landscape is **a livelihood provider** & their understanding & awareness of the ecology is good. The **forest**

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department owns the entire forest. Access routes through the forest are provided for the locals as well as tourists & mountaineers. Nehru institute of **mountaineering** a government **institute** offering Mountaineering **training** has been conducting its courses (15 days each) in this landscape for over 20 years. The high altitude zones that include the glacier & the surrounding peaks are the most important landscape elements to this group. It looks at the landscape as an **Adventure provider**. The agrarian settlement is around 60 years old in this landscape. **The van Gujars**, are trans-human communities that migrate to the bugyals in the summer months for providing fodder to their buffaloes.

Figure 12: Pie charts showing, bhukki village population & occupation data.



They build temporary houses with wood, mud & hay on the periphery of the bugyals. They are seasonal settlers spending 4-5 months annually in the landscape. For this community also the landscape is a **livelihood provider** & hence they have some knowledge of the ecological functioning of the landscape. **Large logs of trees are felled** by this community for building their huts & **for creating enclosures for cattle**. Settlers from nearby villages also bring their sheep to graze in these meadows during the summer months. The **tourists & travellers** value the landscape for religious as well as aesthetic reasons. It is a source of **leisure & recreation**.

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Table 1: Seasonality and Patterns of use of the Dokrani- Dingad landscape

Ethnographic groups	Months											
	White Season				Green Season				Yellow Season			
	Jan	Feb	Mar	Arpil	May	June	July	Aug	Sept	Oct	Nov	Dec
Settler												
Pastoralist												
Mountaineer												
Tourist												

2.3.3 Existing Management policies

The landscape is a part of the Bhagirathi **Eco-Sensitive zone**, as per the notification by Government of India in the **Ministry of Environment & Forests** number S.O.1400 (E), dated 1st july2011. This notification identifies the landscape as a unique ecosystem being rich in aquatic flora & fauna. It also recognizes that continuous & phenomenal increase in the human & cattle population, the **anthropogenic pressures** on the ecosystems & environments has tremendously increased, **causing irreparable damage** to the fragile mountain ecosystems. A Zonal master plan that respects & understands the above-mentioned characters of the landscape is under approval. **Comprehensive planning & design** means to ensure its successful implementation are **lacking**. The **forest department** considers a large portion of the landscape as a **reserved forest**. According to the rules of reserved forest no tree cutting is allowed in the zone. The trans-human communities as well as tourists & mountaineers have to pay an **access fee** to the department to use the landscape. Multiple access routes & lack of check posts within the forest leads to unmonitored use of the forest.

The **settlers own a small portion of the land** within the landscape, but **depend on a much larger area** for their livelihoods. **Fodder** for cattle & **firewood** for household purposes are extracted from the forest. The early settlers depended completely on the forests & have modified the forest

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composition, supporting the growth of useful species like of Buras, Pangar, Imir, Ganjar, Moru, Akhrot, Ringal & chid. Since the shift of the forests under the forest department the dependency patterns have been modified drastically. Enlisting as a reserve forest, has led to a ban on felling of trees, settlers are still allowed to extract fodder & firewood with a restriction put to felling.

Challenges Threats & Issues

Changing climatic regime has resulted into **insufficient returns from rain fed agriculture**. The cropping patterns are changing, and no of people dependent on agriculture are reducing. Agriculture being labor intensive, demands more physical fitness. **Increased Climate variability & increasing water stress**, are adding to **reduced gains from agriculture**. People are moving towards **other sources for income**, especially government jobs or jobs in the tourism industry. These offer better economic returns & are less labor intensive.

Urban Development in the Himalayan lowlands along with climate shifts has also lead to **shifting pastoral cultures**; cattle like buffalos are brought to the alpine meadows for summer grazing. The pastoral heard, that initially consisted of the sheep now also consist of buffalos. The **grazing requirement of 1 buffalo is 6 times** that of the sheep. The nomads are turning into semi-settlers for educating the younger generation & looking at

Understanding the Landscape Pressures/ Dynamics						
	People (2017)	Past (2007)	Future (2027)	Cattle Units	Duration of use	Support staff
Settler	160	160	120	806	12 months	
Pastoralist	60-70	140	40	2900	4 months	
Mountaineer	5 x 110ppl	100	5 x 110		15 days	5 x 85
Tourist	50	20	150		2-3 days	

Table 2: Statistical information to understand the Dokrani-dingad Landscape dynamics

agriculture to support their economic needs. The **exposure to plastics & other non-degradable materials** is increasing. Disposal of these materials at **high altitudes** along bugyals in the summer months is **spoiling the ecology**. Moreover the bugyals have been extensively used & their species composition is drastically altered, supporting less no. of cattle.

Better connectivity, education and exposure are uplifting their livelihoods. **Tourism industry** is growing tremendously in the Indian Himalayas. The government is promoting tourism in the name of development & economy generator. Extensive developments to cater to the increasing inflow is **hampering the image of the Himalayas**; cluttering it with massive concrete buildings on the steep slopes. Massive construction activities, produce vibrations that cause landslides in the geologically young steep slopes of the Himalayas. The frequency of **mountaineering & tourist activity** are **increasing** in the Landscape. The dependency of people & their patterns of use of the landscape are changing. **Longer periods of stay at sensitive locations at higher altitudes** close to the glacier are leading to **accumulation of waste & pollution of water sources**. There are no checkpoints to monitor the tourist inflow & outflow. Multiple access points to this site add to unregulated use of the space. Higher altitudes in the Himalayas are also home to many medicinal herbs & endemic species. Unmonitored access to the landscape also threatens the survival of these species. **Illegal extraction** of medicinal herbs & **hunting** is **common**.

The extreme weather events that are increasing both in frequency & magnitude **are indicators** of the **impacts of urbanization & mountain tourism** on the pristine Himalayan ranges.

Forest clearing to satisfy the needs of the **increasing population** leads to introduction of invasive species on the edges and reduces the habitat area for core species, making them **vulnerable**. Overuse of the trails is leading to **compaction, increasing erosion, deforestation** for firewood &

threatening the fragile ecology. Degraded landscapes are **less resilient** in the scenario of climate change. Degradation also **reduces the scenic quality** of the landscape. All these activities have changed the image of the Himalayas, with **only few spaces retaining the original pristine quality.** It is essential to preserve these locations as **reserves of nature for their Aesthetic, Spiritual (inspirational), Ecological qualities.**

2.3.4 Relevance in a larger societal context

Research on climatic trends and observations in many places have predicted that water stresses arising from rapid melting of glaciers would be common. Most of the Indian rivers are glacial & about 80% of the population depends on it.

Increasing no of tourists is observed in the mountains as they cater to the scenic, recreational & adventure needs of the urban population. A well managed & monitored landscape can support more visistation.

It would also trigger the shift from the extraction based settler economies to economies that support conservaton. It would also lead to the upgradation of the local lifestyle while generating income.

A healthy landscape has better probablity to evolve with the changing climate. They also can help reduce the risks due to landslides & flash floods caused by extreme climatic events like cloudburts etc.

A proper management for these Himalayan landscapes can allow the use of these pristine locations along with retaining its original, pure & pristine character. In a larger context it can imbibe a culture/ ethic that promotes the symbiotic relationships between man, land & its flora & fauna as is seen in through history.

2.4 Project Details

2.4.1 Aim:

To design a 'Landscape Experience' along the glacial trails in the Bhukki-Dokrani Precinct with a focus of 4 ethnographic groups the Settler, the Tourist, the Pastoralist and the Mountaineer.

2.4.2 Objectives:

- To discern the story of creation of the natural landscape, working with layers of natural & cultural footprint.
- To establish Values inherent in the landscapes. (Ecological resource, Social resource, Visual resource.)
- Referring to scientific literature to understand user preferences & to identify elements & components in the landscape essential for retaining the established values.
- Referring to cases & methods for restoring the functioning (reducing stress & shocks) & to manage the landscape, ensuring visitation for larger prolonged period.
- To analyze the site data in the light of indicators established from scientific literature & delineation of critical areas.
- Design interventions and management plan to enhance / correct the above stated landscape values & facilitating for more visitation with less ecosystem degradation.

2.4.3 Scope & Limitation:

- Scenic character evaluation is based on the published literature on preferences. Questionnaire based site-specific inventory for visual preferences could not be prepared due to time limitations.
- Readily accessible published literature on ecology & geology are used as a base to understand & analyze the landscape. In depth patch analysis is absent for many regions of the site.
- The site-based observations are restricted to visually accessible areas along the trail landscape. Assumptions are made based on these observations & available research literature for the entire site.
- Anecdotal evidences are used as a guide for aspects essential in the study where ready literature is not available.

2.4.4 Expected Outcome:

- Identification of shocks & stresses on the Indian Himalayas based on changing patterns of use & interaction with ecosystems in the scenario of globalization & climate change.
- Preparation of guidelines / checklist of parameters to be considered for Landscape Management, Planning & design at a Regional scale in the Garwhal Himalayas.
- Planning & Management strategies that ensure ecological health of the landscape, preservation of its scenic elements, while facilitating for large visitation. Development of policies for the same.

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- Design interventions that improve legibility, anchor & educate the public while providing a memorable experience of the landscape.
- The central idea is to reduce people's dependence on extraction from forests & help in the conservation of the fragile landscape.

3 Literature Study

3.1 Elements of Visual Design in the Landscape

Points, line, plane; solid volume and open volumes forms are the elements that form a view. A point is an entity with no dimension, very small objects, crossing lines trees are all seen as points. A line is an entity with one dimension. A line is a point pushed by some force along a vector of some length they can be imaginary, edges of planes are also seen as lines. Any line of any length contains an infinite number of points and subdivided lines. A plane is an entity with two dimensions, A plane is a line pushed by some force along a vector of some length. These can be flat, curved or twisted; faces of built form are planes. Any plane of any size contains an infinite number of points, lines and other subdivided planes. Planes in different positions may enclose a space and form a volume. A volume is an entity with three dimensions. A volume is a plane pushed by some force along a vector of some length. Any volume of any size contains an infinite number of points, lines, planes and other subdivided volumes. Interiors of buildings, deep valleys, and the space beneath the forest canopy are all volumes.

Every basic element has a highlighting character; like a point marks a position in space, like lines have a directional character, plane can have a screening character, solid volumes add to the sense of depth.

There are many variables that modify the character of these basic elements. These include number, position, direction, orientation, size, shape (form), interval, texture, density, color, time, light, visual force, visual inertia. These variables add intersect and highly affect its visual appearance. Change in the Variables, like light, position, density adds to the dynamic nature of a basic element.

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It is very rare that these basic elements exist in isolation; more commonly they are the composition of the basic elements & the variables.

Further the structural elements like balance, tension, rhythm, proportion and scale along with ordering elements like axis, symmetry, hierarchy, datum and transformation add to the visual complexity.

All the above discussed elements and factors, basic elements, variables; structural & ordering elements together describe the visual aspects of a scene. An understanding of these visual aspects is essential to understand visual perception. (Spon 1993)

3.2 Understanding Landscape Visual Perception

3.2.1 Physiographic / Objective parameter of Visual Assessment:

The ability to identify features in our environment is to recognize visual elements that stand out in the landscape by their size, height, color, or any other aspect that contrasts with the surrounding. People from different cultural backgrounds, different age groups, etc have varied visual preferences. The objective parameters deal with physical aspects like color, contrast, shade, size, volume, texture, variety and use majority opinion regarding visual appeal for assessment. Objective parameters of visual assessment are easier to evaluate. Key factors include Landform, Vegetation, Water, Color, Adjacent scenery, Scarcity, Cultural modifications. Units with the **most variety & most harmonious** composition are rated as having the greatest scenic value.

3.2.2 Subjective parameter of Visual Assessment

A place has meaning to us as individuals when it relates to, & has in fact become the setting for, events of our personal life. Recognition & deliberate repetition of meaningful elements provide a culture with a powerful mechanism for self-proclamation & stability. **(Henry sanoff)**

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Observer based assessments of the environmental quality consist of preferential judgments and comparative appraisals (Craik & Zube, 1976). Preferential judgments represent subjective reactions to specific environments, while comparative appraisals judge the quality of specific environments against a standard of comparison (Craik & McKechnie). It has been shown that landscape preferences may vary with age. Appraisal measures the interaction between the human observer & the visual environment. Subjective parameters of visual assessment are dependent on physiological analysis and are more difficult to evaluate.

3.2.3 Aspects and Qualities of visual perception

Landscapes provide information that is received through multiple senses and that is processed simultaneously. They are perceived not only in terms of preference but also through symbolic meanings and motivational messages. Perceptions of landscapes are also shaped by cumulative experience over space and time and can change as landscapes change. People respond to landscapes aesthetically but also respond in terms of perceptions of ecological health, safety, cleanness, and other dimensions. These dimensions are interdependent and can interact in complex ways. Landscapes possess spatial, temporal, multisensory, multi dimensional & cognitive qualities. (Gobster 2008) Landscape perception has **social, cultural, philosophical, and ethical aspects** to it as well as **psychological ones**. Perception of landscape is colored by the immediate perceptual social context and by our acquired experiences as individuals and through our society and culture. (R.A.Preece 1991). Sensitivity levels are a measure of public concern for scenic quality, these also affect visual perception .

3.2.4 The perspective cues by Gibson:

Texture: When a surface gradually becomes denser, it appears to recede from the observer. Size: as objects decrease in size, they appear to recede

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from the observer. Aerial: Objects lose detail when their distance from the observer increases. Upward location: The horizon line appears to rise as the observers' distance increases. Texture Shift: Changes in texture density give the appearance of an occluding edge. Continuity: When objects overlap, the simpler form is perceived as being nearer to the observer. Transition: Sharp contrasts in light and shade reveal an edge. (Gibson 1979)

3.2.5 Visual Harmony & Landscape value by Henry Sanoff

Visual harmony is evaluated using the three fundamental concepts of identifiable character, visual variety & deviations from the characteristic landscape.

There are various paradigms to understand preferences & evaluate landscape values. According to **psychophysical paradigm**, landscape is valued for its **ability to stimulate responses** in observers. The key concept of **cognitive paradigm** is that landscape has value for people because of **the intellectual or social associations** that they make with various settings. The human experience of landscape is related to an evolutionary reconciliation of safe refuge within the environment with retention of prospects of it (Appleton 1975); that preference is shown for those aspects of environment that relate to the needs of the perceiver. Work within the **experiential paradigm** studies landscape values derived from **active human participation** in the environment. The landscape acquires meaning through the situations in which it is experienced, as those situations change the meaning & experiences change.

3.2.6 Visual Perception distances

There are three distance zones that are based on visibility from travel routes and observation points. These are determined by traveling in the field and physically testing what can be seen and how: The objects in the foreground are perceived in detail; in this zone the texture, detail, patterns, shadows are

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all very prominent. The foreground is a zone upto $\frac{1}{2}$ m from the point of observation. The middle ground is a zone which forms the setting of the object, usually ranging from $\frac{1}{4}$ m to 5m from the observer. Here the color, larger mass detail, form are visible. The objects and masses ranging from 3m to 24km to the observer form the background. The climate also plays a major role in altering visual perception distances, especially in the Background. Objects beyond 24km are seldom seen.

Attention to detail reduces with the distance from the observer. While developing large landscapes, with long viewing distances like nature trails the visual perception distances help in determining the extent of intervention.

3.3 Visual Resource Theories

Visual assessment studies focus on evaluating the visual characteristics, locational installation, & social life of a place or a route on a perpetual basis within a functional relationship. **Users admirations & expectations** have an influence on their awareness. Researchers from various streams have come up with theories to understand landscape preferences based on visual resource. Some of these theories are discussed in this section.

Aesthetic experience deals “ with the subjective thoughts, feelings and emotions expressed by an individual during the course of an experience.” “ they are intangible, holistic and gratifying” in that the recipient derives satisfying pleasure from merely beholding the object.

In the 14th century the Italian painter **Ambrogio Lorenzetti** (1290 -1348) of the sienese school portrayed the visual aesthetic effects of public policy on urban and rural landscapes in Sienna. The significant point made was, that landscapes have **an inherent beauty to be appreciated**. Since the early 1970s the the aesthetic appreciation of landscapes has been institutionalized in design, planning and management, along with ecological, economical and technical considerations.

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Researchers of environmental psychology, **Rachel and Stephan Kalpan** developed a **visual preference matrix**. It identifies two major classes important to people, to understand and to explore. Coherence and legibility are the most important aspects that help in understanding the scene. **Coherence** refers to the ease with which one can grasp the organization of the scene. Repeating elements permit a very assessment of how a scene hangs together. **Legibility** is the assessment of how well one could find ones way within a depicted scene. It concerns the inference that one will be able to maintain ones orientation, that one will find ones way and back as one wanders more deeply into the scene. A scene that is opens enough to offer visual access, but with distinct and varied objects to provide landmarks is high in legibility. **Complexity** and **Mystery** are identified as the most important aspects that enable exploration. Complexity entails an assessment of this two dimensional aspect of the scene in terms of exploring. It involves the richness or the number of different objects in the scene. **Mystery** offers the promise of learning more about an environment as one move further into it. Authors such as Osborne (1970), Stolnitz (1969), and Beardsley (1970) assert that **aesthetic experiences** have a **completeness** and **coherence**, a unity that makes them stand out from the experiences and flow of everyday life. Landscapes that provide for all the above parameters are highly preferred by humans.

Another theory, **Attention Restoration** by Stephan Kalpan provides an analysis of the kinds of experiences that lead to recovery from such fatigue. Natural environments turn out to be particularly rich in the characteristics necessary for restorative experiences. According to this theory, **being away, fascination, extent and compatibility** are the components central to restorative experience. Natural settings are highly restorative as they cater to all the above-discussed components. **Natural settings** that are easily accessible offer an important resource for resting ones directed attention (being away). Nature is well endowed with fascinating objects as well as

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offering many processes that people find engrossing. Natural settings like mountain trails are large tracts of land without boundary (Kaplan 1995). For many people, functioning in the natural setting seems to require less effort than functioning in more 'civilized' settings, even though they have much greater familiarity with the latter (Cawte 1967). Several studies have addressed the role of nature scenes in holding attention and interest (e.g. Ulrich, 1979, 1981; as cited by Ulrich & Parsons, 1992). **The Biophilia hypothesis** suggests that humans possess an innate tendency to seek connection with nature and other forms of life. (Wilson 1984)

Jay Appleton (1919 – 27 April 2015) was a British geographer who proposed '**habitat theory**' and advanced the notion of '**prospect-refuge**'. It was proposed to describe the reason why certain environments feel secure or meet human needs. One of the principle needs Appleton identifies is the capacity **to observe** (prospect) **without being seen** (refuge). He concluded that most people have an "inborn desire" for environments that allow the capacity to observe without being seen – to assess threats from a place of safety. He called this the 'Prospect-Refuge Theory'. (Appleton 1975).

Ittleson (1960) identified the three main components of perceptual process, of defining 'thereness' & 'thatness' as impingement by the physical object, excitation of the physiological sensors, and assumption in the psychological realm.

Gestalt theory of visual perception is the philosophy of mind of the Berlin School of experimental psychology. It is an attempt to understand the laws behind the ability to acquire and maintain meaningful perceptions in an apparently chaotic world. The central principle of Gestalt psychology is that the mind forms a global whole with self-organizing tendencies. "The whole is *other* than the sum of the parts" was a famous phrase by a psychologist Kurt Koffka. In the study of perception, Gestalt psychologists stipulate that perceptions are the products of complex interactions among various stimuli.

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Contrary to the behaviorist approach to focusing on stimulus and response, gestalt psychologists sought to understand the *organization* of cognitive processes (Carlson and Heth, 2010).

James Gibson (January 27, 1904 – December 11, 1979), an American psychologist, claimed that the environment decides perception, and that meaning is in what the **environment "affords" the observer**. *The Perception of the Visual World* (1950) and *The Ecological Approach to Visual Perception* (1979) include his major contributions to the visual theory. He argues that perception is direct, and not subject to hypotheses testing as Gregory proposed. There is enough information in our environment to make sense of the world in a direct way. His theory is sometimes known as the **'Ecological Theory'** because of the claim that perception can be explained solely in terms of the environment. (J. Gibson, *The senses considered as Perceptual systems* 1966). His basic work rejected the perspective that perception in and of itself is meaningless, he instead argued meaning is independent of the perceiver. For Gibson: **sensation is perception**: what you see is what you get. There is no need for processing (interpretation) as the information we receive about size, shape and distance etc. is sufficiently detailed for us to interact directly with the environment. (J. Gibson 1986).

The inferences of the above mentioned theories help to understand the human preferences, and psychological effects of different settings in a natural landscape setting. A few parameters from each of these theories are used to identify physical indicators of scenic beauty along the Dokrani-Dingad trail. They give a general idea of human preferences & help form the design framework.

3.4 Human-Ecological theories,

The above-discussed theories are generalized; not including in depth study regarding behavioral changes with varying age group, cultural backdrop, the

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purpose of visit & the nature of interaction involved. They also are not sufficient to understand how human & natural ecosystems function.

The human ecological theories help understand how landscapes change in response to interacting biophysical and socio cultural processes. The critical concept is that of relationship. (ndubisi n.d.) Of all the natural & social sciences, ecology provides the best understanding of the landscape since it deals with the "reciprocal relationship of all living things to each other (including humans) and to their biological & physical environments. (Steiner 1991)

Gerald young in his study of human ecology describes man as the ecologically dominant in the plant and animal community, interacting in a distinctive and creative way, with maximum impacts. (Young 1974, Young 1974)

Culture , a mediating factor in all human transactions with the biophysical environment has 3 main dimensions. A normative dimension which consists of patterns of thought that guide behavior. A behavioral dimension, made up of patterns of social interaction. Non-normative dimension, consisting of material products that culture creates such as arts skill and technology. According to **David Canter, a place is** a state of harmony created by the dialogue between human activities, conceptions and the physical attributes of the environment viewed from a historical perspective. It is **an intersection of natural processes, activity systems and experience**. These different constructs of space & culture enrich our understanding of landscape perception. It also helps to re-establish identity & uniqueness of places.

Jackson and Steiner proposed a interactive system for land use planning, in this a multi disciplinary approach is used , insider views and their adaptive strategies guide the development of plans and the implementation process.

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Their **Human ecology for land-use planning** approach focused on identification of **interactions** between the components and natural system, user groups & their demands made on the ecosystem. It also focused on understanding the effectiveness of existing regulations in achieving the future needs of each user group. Social values are integrated into ecological planning. (J. Steiner 1985)

Steiner in his book **The Living Landscape**, argued for **connecting socio-economic analysis to bio-physical information** through an analysis of established visuals, landscape patterns & identification of interactions. He contended, every locale has unique qualities that should be included in landscape assessment and planning.

The applied ecosystem Approach, views the ecosystem as a combined human and natural system in which the components are related to interact. It also states that the ecosystem is self regulating and has a limited capacity. This concept was developed in the late 1950s and early 1960s to understand human dominated and natural landscapes and how they respond to change.

3.5 Ecological Aesthetics: Connections and Conflicts between Visual & Ecological Theories.

Aldo Leopold (1981) and contemporary scholars of environmental aesthetic philosophy (for example, Callicott 1983; Eaton 1997; Rolston 1995; Saito 1998) and ecological design (for example, Howett 1987; Mozingo 1997; Nassauer 1995; Thayer 1989), an ecological aesthetic maintains that there is a type of beauty in the landscape that is associated with its ecological health, diversity, and/or sustainability. Landscape intactness has been defined as a quantifiable estimate of naturalness measured on a gradient of anthropogenic influence. The Physical state of the landscape & its intactness is derived from visual, functional & ecological perspectives. It also reflects

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the state of repair of individual features & elements that make up the character in any one place.

Paul gobster through his research, understands the relation between ecology & aesthetics and explores ways to attain synthesis. **Humans cannot directly sense ecological quality**, though there may be a tendency, based on evolutionary processes and cultural expectations, to assume that good ecological quality is associated with good aesthetic quality. In some cases aesthetic and ecological values will be positively correlated, but there is no guarantee this will always be true. What is aesthetically pleasing may or may not reflect ecosystem health. The ecological value of a landscape might, in and of itself, give pleasure to a person who knows how to recognize relevant ecological phenomena. This recognition may occur separately from or along with the feeling of pleasure that is understood as aesthetic experience. As individual preferences, choices, and actions are aggregated over broader social and societal levels, their potential to change landscapes, regions, ecosystems, and other environmental phenomena can be profound. Societal actions are further played out through political and other influences on programs, management practices, and policies. **Aesthetic experiences lead to changes in the landscape**, but also that landscape changes can affect aesthetic experiences, such as when a hurricane or clear-cut devastates a cherished landscape. As landscape patterns change, people's aesthetic experiences of places change as well, ultimately affecting their actions (e.g., choices of where to build or where to object to logging). Landscapes also may change people as they learn from observing and interacting with landscapes—for example, as farmers or foresters learn about the underlying ecological processes that produce crops and lumber. Landscape patterns that elicit aesthetic responses of immediate pleasure or

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Table 1. Some major distinctions between scenic versus ecological aesthetics. Adapted from Gobster (1999) and Parsons and Daniel (2002).

Scenic Aesthetics	Ecological Aesthetics
Human	
Affective/emotional	Cognitive/knowledge-based
Stimulus-response/snapshot in time	Experiential/temporal-spatial dimensions
Visual	Multisensory/movement
Preference/lowest common denominator?	Appreciation/elitist?
Landscape	
Visual/static/inanimate	Multimodal/dynamic/animate/ephemeral
Picturesque/formal/composed/face value	Vernacular/symbolic/indicator species
Bounded/fixed/framed/specific places	Surrounding/entire landscape/ambient
Naturalistic/dramatic/vivid/scenic	Natural/subtle/unscenic
Tidy/scenery	Messy/ecological processes
Interactions and Outcomes	
Perceptual	Experiential
Pleasure	Understanding and pleasure
Passive/object-oriented	Active/participatory/engaging/involvement
Short-term/mood change	Long lasting/restorative/unity/sense of place
Status quo	Catalyst for internal and external change

displeasure are an important starting point for formulating actions to affect landscape change. (Paul Gobster 2007)

Some settings that are highly preferred by humans discussed in the earlier section are least preferred ecologically.

3.6 Important terminologies

3.6.1 Landscape Intactness / Landscape aesthetics

The Physical state of the landscape & about its intactness, derived from visual, functional & ecological perspectives. It also reflects the state of repair of individual features & elements that make up the character in any one place (GLVIA 2002). Aldo Leopold 1949 described landscape intactness / integrity as “ A thing is right when it tends to preserve the integrity , stability and beauty of the biotic community. It is wrong when it tends otherwise.”

3.6.2 Landscape preferences:

refer to ‘ the degree to which the landscape is liked’ as a measure of its possession of positive qualities relative to other landscapes.

3.6.3 Senso-environmental change:

It is movement from a forested area to clearing, or visa versa, to be significant to hikers who used cameras to photograph areas of special scenic character in their treks. **Cherem (1973)** The environment contains social, cultural & symbolic information & transmits many nonverbal messages that elicit appropriate behavior. **(Wanger,1992)**.

3.6.4 Perceptible realm

While human and environmental phenomena occur at widely varying scales, humans engage with environmental phenomena at a particular scale: that of human experience of our landscape surroundings. That is the human “perceptible realm.”

3.7 Essential evaluation Parameters: Dingad-Dokrani Landscape.

Physical attributes & Spatial quality

- **Structure:** The **arrangement of & relation** between the parts or elements that form the landscape. It includes the position of different elements like trees, boulders, bridges in relation to the Landform & topography. Structure in this context refers to the visual, ecological & **functional** aspects of the landscape. It helps define the **spatial organization/ pattern**. The degree of variation & contrast between landscape elements, its spatial Organization i.e the Edge density, Heterogeneity, aggregation
- **Complexity:** The behavior of a system whose components **interact in multiple ways** making it complicated. It refers to the **diversity & richness** of a landscape. Certain amount of complexity in a scene helps **retain interest** for a longer duration making it more preferable. Complex systems usually

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have a **mix of less visible with more visible elements**. Involvement of multiple elements, stakeholders & functionality in a spatial context within a landscape add to its complexity. Complexity is a factor in the Kaplan's Informational Processing Theory, where complexity provides content and things to think about (Kaplan & Kaplan, 1989). The Biophilia hypothesis presented by Kellert and Wilson (1993) states the importance of diversity in relation to nature, both with regards to species and landscape types.

- **Coherence:** It is a systematic or logical connection or consistency that is observed in the landscape. The integration of diverse elements, relationships, or values, that are discrete in color, shape, volume, size placed together forming a pleasing composition. These constitute both the natural & man-made elements that fit well in the scene. Repetition of elements, form, similarities/closeness of colors exhibit coherence.
- **Disturbance:** The lack of contextual fit & coherence in a landscape. An overly complex landscape is likely to affect its legibility, makes it difficult to perceive. A **miss fit** in the scene like, the appearance of an very bright object in a natural landscape or a landslide of a densely vegetated slope evokes disturbance. It refers to elements that affect visual harmony, & have a **negative effect** on the spatial experience of a particular landscape.
- **Uniqueness:** This refers to the rarity of a element or a composition. Less availability leads to more demand adding value to such landscape. Unique landscapes are more preferred. Uniqueness is a phenomenon that draws attention & demands interest as a result of its rarity.
- **Ephemerality:** This refers to the temporary nature of a phenomenon, usually liked with growth, seasonality & weather. This includes seasonal variation in natural vegetation, agricultural land, presence of Water & snow, Presence & absence of fauna.

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- **Imageability:** The ability of the landscape to create a strong visual image in the observer & thereby making it distinguishable & memorable. The way the landscape is experienced can add to its image-ability. Eg. After walking through a dense jungle on a steep terrain for a long duration, the entry into a flat, open Bugyals with flowers, is seen as a pleasant surprise making it memorable. People you are travelling with, the purpose of the visit also influence the image-ability.
- **Mystery:** The degree to which you can gain more information by proceeding further into the scene (Lynch & Gimble 1992). Structure, distance, partial visibility, accessibility & directionality contribute to the feeling of Mystery. Landscapes that are puzzling or contain ambiguity & uncertainty due to their composition are mysterious.
- **Directionality:** Orientation, a placement within a larger context. Facilitating a movement. Composition of elements in the landscapes, guide the movement of the viewer. Guiding a person's behavior or thought.
- **Openness & Enclosure:** Enclosure is a spatial attribute that refers to a boundary, barrier, and envelope. Openness refers to lack of restriction & secrecy. These include both visual & physical barriers. Visual scale, the density, shape & size, positioning, degree of penetration of the elements help define openness & enclosure within a landscape setting.
- **Stewardship:** The sense of order & care present in the landscape reflecting active & careful management. The level of cultivated-ness, presence of weeds, management frequency, type, status of man-made structures are indicators of stewardship. How everyday activities can help manage the landscapes. Like the Van Gujars's seasonal migration to the alpine meadows for cattle grazing also helps retain the grassland ecology by preventing woody shrubs to develop and also reduces fire risks. This job of taking care of something through careful management is stewardship.

Subjective preferences:

Fascination: Attract the strong attention & interest of someone. According to Attention retention theory by Kaplan, The task that allows "effortless attention", or may have sufficient scope to sustain interaction without boredom, or may simply be more compatible with a person's interest is fascination. Directed attention is seen as a limited resource that tends to get overused and depleted in our modern, urban society. Soft fascination, particularly in nature, replenishes our attention capacity.

Hostility: It is a measure of harshness, opposition or dislike, leading to discomfort in a landscape setting. Every ethnographic group has gone through a different pre-conditioning in terms of tolerance to climate & physical stresses; these include walking duration & distances, exposure to sun, wind, cold etc. Hence these preferences vary as per ethnographic groups.

Interactive: It is the capacity of the landscape to influence the user & promote involvement in a particular activity. Promoting participation. This varies based on the person's pre-conditioning, purpose of visit & companions.

3.8 Understanding LANDSCAPE APPROACH

The landscape approach is a methodology, that consider resource patterns and uses across broad scales to inform management in the face of changing demographics, a changing climate, and other challenges for Effective management of multiple-use lands.

Using a landscape approach requires explicitly acknowledging diverse values and perspectives of stakeholders and the need to balance tradeoffs among different and often conflicting land uses.

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Understanding Landscapes, Patterns, and Processes is important to Implement a Landscape Approach. Landscape patterns affect ecological processes across the landscape. Road networks foster the spread of invasive species. The presence of invasive plants and the size, type, and proximity of vegetation patches affect wildfire frequency, intensity, and extent. The size and proximity of habitat patches and surrounding patterns of land use affect the extent to which populations of habitat specialist species are functionally connected.

Sustaining the health and diversity of public lands includes consideration of upland, diverse ecological processes; water quality; and habitat for species of conservation concern. sustaining productive rangelands that provide forage for wildlife and domestic live- stock, sustaining forests that provide harvestable timber, and sustaining production of renewable and nonrenewable energy. understanding multifunctionality, acknowledging complexity, embracing interdisciplinarity, and striving to achieve sustainability are concepts critical.

3.9 Understanding LANDSCAPE TYPOLOGY

Topology, in our sense, is not just about descriptive geometry and does not only deal with technical questions about continuous surfaces in mathematics, it also pays greater attention to the deeper poetic and philosophical meaning of a landscape, and helps us grasp as much about its making as about the perception of intrinsic beauty.

There exists a schism between the way landscape is understood scientifically, either as a functional normative network or an ecological system, and the way the same place exists cognitively, poetically, and emotionally for people. Pragmatic concerns about landscape all too often lack any kind of poetic and aesthetic consideration.

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Topology is meant **to weave meaningful symbolism** back into a particular place **by understanding its terrain and surface condition, and by modifying the inherent significance of natural features as they interact with the purpose of man, his daily life and destiny.** Thus, topology is all about the **interrelated cohesiveness** of things and people; it is about how a tree meets the ground and how water sounds as it runs over a stone.

Topology is about developing a new set of disciplinary tools capable of responding fully to a continual terrestrial situation, and it is precisely this continuity that gives us more insight and potential when developing solutions. Topology can help fields of action that seldom cross paths habitually to merge on the plinth of territorial continuity, considerably reinforcing the discipline of landscape while opening it to others. The challenge of landscape topology is to integrate heterogeneous fields of action that can be both physical and philosophical and scientific and poetic – integrating past, present, and future potentials into a single meaningful whole.

3.10 Conclusions

The outcomes of landscape perception are varied. Landscape perception can result in preferences, choices, uses, and experiences that can have deep aesthetic or restorative value. Perception calls forth action that can lead to behavioral and environmental change. The above-mentioned parameters are considered while locating campsites & other pause locations in the Dokrani-Dingad trail. For a large and complex landscape like the Dokrani-Dingad the landscape approach is essential while designing and preparing management plans. The vast landscape is further classified into typologies, areas with similar character for ease preparing mitigation & design strategies.

4 Case Studies

4.1 The Satoyama Landscapes:

4.1.1 Introduction

Satoyama is a Japanese agrarian landscape, from the **Edo period**. The name means a zone or area between mountain foothills and arable flat land. Literally, **Sato** means **arable and livable land** or homeland, and **Yama** means **hill** or mountain. It is a mixture of forests, wet rice paddies, cultivated fields, pastures, streams, ponds & irrigation ditches surrounding a Japanese farming village. It comprises the **entire landscape necessary to supply the needs of the community**. In this system the forests are managed by local agriculture communities & have developed through human interventions in natural systems over years. **Leaf litter** collected from forests was used as



Figure 13: Artistic representation of a typical Satoyama landscape.

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manure for farms; **wood** was collected for construction purposes. The constant collection of leaves & wood kept the forest open & prevented the succession of large trees & dense shade. Their mosaics provided a variety of habitat types & supported a rich biodiversity. It displays **a harmonious relationship between humans & nature.**

4.1.2 Ecology & Landscape Management strategies

This system depends on **habitat modification**, which is **a trait common to humans & nature**. Managed landscapes can have a great deal of biodiversity & add an important dimension to the landscape mosaic (K.Takeuchi et al. 2003).

It was also a system developed to mitigate disasters during the rains. Human settlements were arranged linearly along the base of the hills. Immediately in front of the hills were the vegetable gardens & beyond that were the lowland paddy fields. The Forested slopes controlled erosion, while dikes were used to direct water from the woodland to the terraced paddies & then entering the local stream. This network of dikes worked even for managing the snow melt & irrigating the paddy. It also supported aquatic biodiversity & enabled migration of fishes.

The term Satoyama was originally used to denote forests surrounding farm villages and managed by farmers for different needs—timber for buildings, wood for fuel and charcoal production, leaf litter and twigs used as fertilizer for crops, particularly in the rice paddy fields situated in the lowlands. Sometimes silk production occurred in the mountain forests. Different food products were also collected, such as bamboo shoots, nuts of chestnut (*Castanea crenata*) and horse chestnut (*Aesculus turbinata*), mushrooms, and young shoots of ferns and herbs (Kobori and Primach 2003, Takeuchi 2003, Tsunekawa 2003, Iguchi 2002). These areas might be called Satoyama woodlands, as they comprise uplands surrounding cultivated

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valleys dominated by rice paddy fields between wooded uplands and open farmland in the valleys. Some management strategies followed include:

- Trees were cut at the stem base every 10 years.
- 50 ha of paddy required 500-600ha of Satoyama woodlands for litter gathering.
- Coppicing for coal production was a common practice.
- The water from snowmelt was collected in cannels & used to flood the rice paddies & eventually meet the sea.

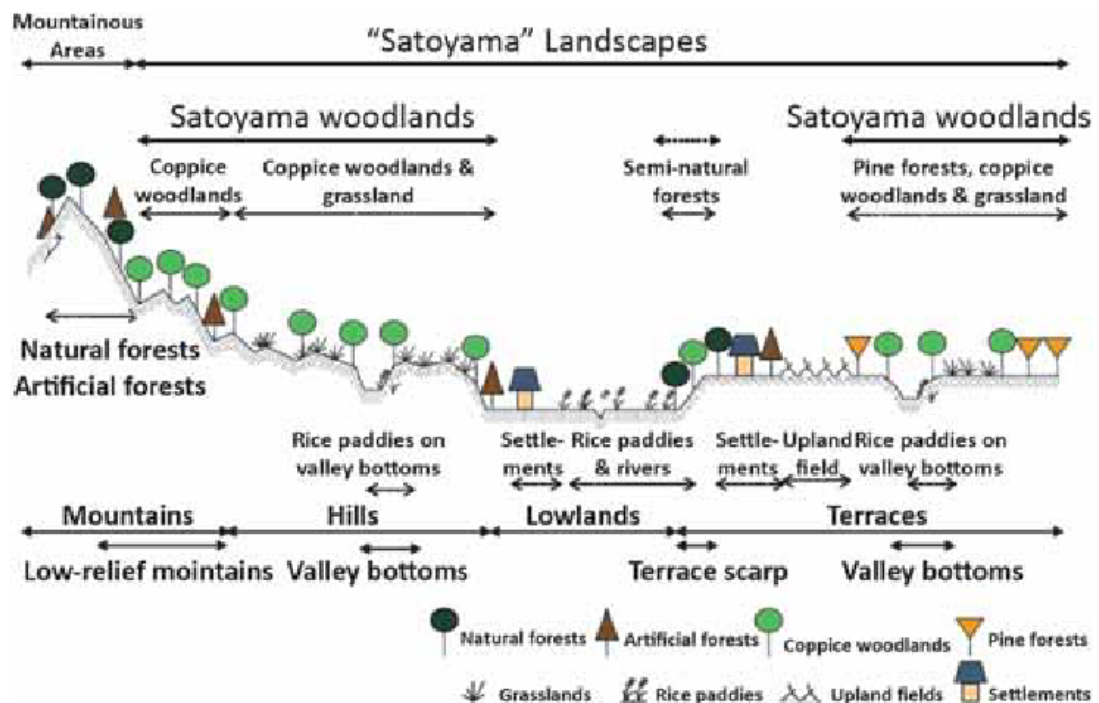
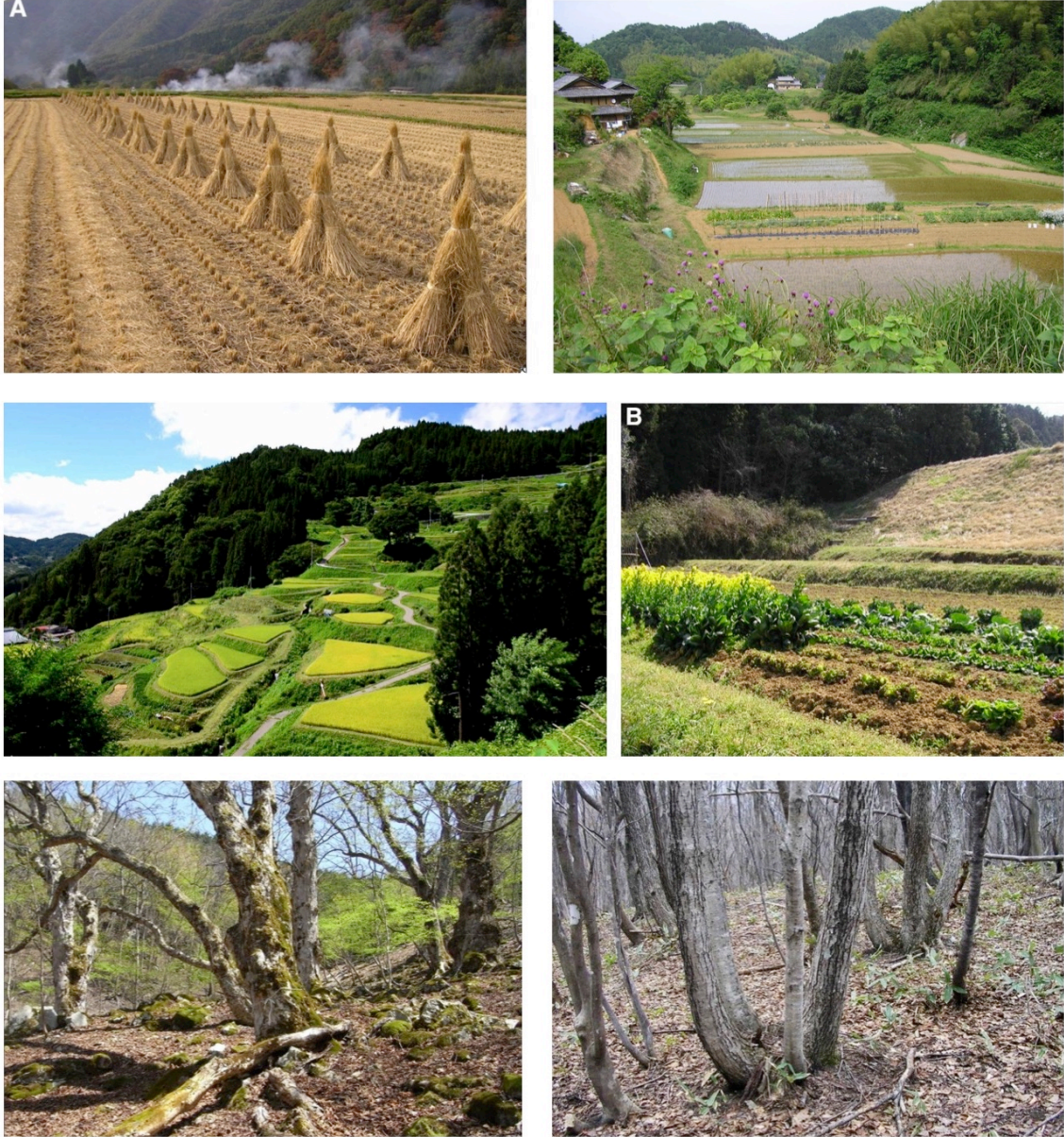


Figure 14: Typical Section through a satoyama landscape

4.1.3 Loss of Satoyama

Figure 15: Images showing different zones of a Satoyama landscape.

Satoyama Landscapes



1. Rice fields during harvesting
2. Rice paddy during sowing
3. Lush green Rice paddy
4. Vegetable cultivation
5. Birch forest Satoyama woodland
6. Copice trees in Satoyama woodland

During the **late Edo era & Meiji era (1868-1912)**, farmers began use of commercial fertilizers; leaves were no longer needed for fertilizer, intensity of forest management reduced. Farming being economically less viable many

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farmers moved to cities in search of jobs. Satoyama landscapes close to urban areas were replaced by residential development. The decline of the rural population & the aging of the remaining farmers made it physically impossible & economically unviable to maintain these landscapes. The use of Modern technology to compensate for labor has completely shattered the Satoyama landscapes. Wetlands started disappearing rapidly, increase in pesticides & herbicides were killing insects & aquatic species. Many fresh water aquatic plants & fishes are facing extinction. The Satoyama forests have also been impacted by the modernization of agriculture. Coal & oil have replaced wood & charcoal, as primary sources of energy & trees are no longer cut for fuel. As the forests become overgrown & more shaded, many plant & animal species are being lost. Wildflowers in particular are rapidly declining.

4.1.4 Satoyama Conservation

In the 20th century, Satoyama were the forgotten landscapes of Japan. In the 1980s, local movements for conserving Satoyama landscapes began. In the 21st Century, Satoyama is seen as a **prototype for sustainable development**. The earliest conservation activity taken up was management of vegetation & preserving symbolic species of Satoyama landscapes. Later the focus was enlarged from preserving specific species to preserving & managing the entire Satoyama landscapes. Local government, nature enthusiast groups & environmentalists support this conservation activity. Satoyama woodlands are being **rediscovered as attractive leisure areas**.

4.1.4.1 *The Satoyama Experience*

Public education & public participation was integrated for landscape management. This established trusting relationships between landowners & local citizens, making preservation from development more effective. Some localities have established environmental units and citizens have organized new associations to take initiatives in this activity. **People** are invited to take

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part in **restoration work** over weekends, and in some cases they are welcomed to **cultivate** small “garden lots” with rice or vegetable paddy fields in Satoyama village landscapes. Such enticements have brought many families and school groups to visit nature areas (Tabata 2001, Iguchi 2002, Nakagawa 2003, Kuramoto 2003). For a great many Japanese, **Satoyama woodlands** are easily accessible areas where everybody can **enjoy nature** as a contrast to the stressful daily life in crowded cities. The various activities include cycling tours, town & village walks, long stays, art & cultural festivals (local food, harvesting paddy, sowing paddy)

4.1.4.2 *Impementation Process Tokyo Example*

To counter the steady loss of traditional agricultural landscapes & wildlife habitat, the **Totoro Hometown fund campaign** was started in **1990** as an effort to save areas of satoyama located in **Sayama Hills** (outskirts of Tokyo).

This campaign was initiated by local residents together with a private environmental organization. The project later received support from national Environmental agency.

“Totoro” a central character from an extremely popular animated film “Tonari no Totoro” (My neighbor Totoro) was used as the campaign mascot. [The film is set in the 1950s in a satoyama landscape, in which Totoro is a furry round animal that lives in the forests of satoyama & helps children who get into trouble in the absence of adults]

The project was built around four major activities. During the initial phase a broad range of people were encouraged to contribute to buy land for conservation as satoyama. A total of 110million yen (equal to 1million USD) was collected.

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Farmers and urban citizens working to conserve and manage the satoyama landscape in Sayama Hills clockwise from top left, children managing rice paddies in summer, fall rice harvest, collecting fallen leaves in a mixed forest to encourage spring wildflowers, children and adults identifying dragonfly nymphs and removing exotic fish and crayfish

Figure 16: Restoration work of Tokyo Satoyama landscape

Second phase involved calling volunteers to restore the Satoyama landscapes with the help of local farmers. A total of two thousand people worked together to re-build rice paddies & water reservoirs. For many city people it was the first opportunity to work on farms & they a great satisfaction in reconnecting to the traditional agriculture.

Third Phase involved researchers along with local to gather information about the endangered species, cultural history & landscape.

The final stage included the development of an environmental education program was designed for Japanese children. This helped them familiarize the landscape & culturally important species.

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4.1.4.3 *Implementation Process Yokohama Example*

Yokohama conservation involved co-operation between volunteers & university researchers. In 1997, a new campus of Department of Environmental & Information Studies was established on the site of neglected satoyama land, a little more than 1 hectare of forest was set aside for conservation.

This area had been abandoned for over 30 years, consisting of overgrown deciduous & evergreen trees & a fruit orchard. Dense tangle of vines, bamboos & weeds dominated the forest.

The forest is now being restored & managed by university researchers with closely associated objectives.

To use the forest for teaching & directing research about satoyama ecology, management & restoration. Students are given access to information accumulated in the past years in order to make comparisons over time.

To establish educational links between the university community & citizens of Yokohama. A group of volunteers that included local citizens, faculty, students & university administrators began the restoration project by surveying & inventoring the areas resources.

The area was divided into 5 zones each with its conservation goals & management programmes. For example a zone of mixed deciduous broadleaf trees was restored by removing the vines, bamboo clumps & other plants that covered the entire forest floor. It is now being monitored to document changes in the wildflower community.

Another zone is being managed for bamboo, with bamboo poles & edible shoots being harvested in a controlled manner. These are then used in traditional Japanese recipes at volunteer social gatherings.

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The Muashi Project conservation area is very small, but has received considerable local support & publicity. This project is linked to more widespread conservation efforts undertaken by the yokohama city government to preserve 1,267 hectares of citys remaining 3,000 hectares of Satoyama wooded areas.

4.1.5 Conclusion & Relevance

Many traditions & cultures in asia have developed observing the ecology. Over the years with industrialization & urban development many of these traditional systems are no longer functioning. The urban public has been disconnected from this knowledge. Involving & educating the publing, including them in the restoration process, involvement & acknowledgement of the skills of the locals is esesntial for large scale conservation projects.

Studying & understanding the cultural systems & adopting important strategies with management strategies to suit modernday lifestyle is key to conservation of biodiversity. It can be seen as a sustainable prototype for upcoming development in rural areas.

4.2 Earth Art

4.2.1 Introduction:

LAND OR EARTH ART started as an American movement that uses the natural landscape to create site-specific structures, art forms, and sculptures. This movement was between 1967-1978. **'Art is not only for museums & Galleries.'** was the basic idea behind the movement. Artists started placing their artworks in a new context, where it was more easily accessible to the public.

4.2.1.1 *Key Principles*

- Site Specificity Ephemerality (temporary nature)
- New Context (outdoors)
- Allowing public interaction & ease of accessibility
- Materials used from nature available on site.
- Exposure to natural forces (sun, wind rain, tides, erosion, etc)
- Capturing the change (photo/video documentation)

4.2.1.2 *Types of Artwork*

MONUMENTAL ART WORKS These artworks were usually in the outskirts of the city on large open-spaces & the scale was large. Few examples of these artworks are Double Negative by Michael Heizer in 1969, Spiral Jetty by Robert Smithson, 1970 and the wave field by Maya Lin in 1995. Procuring land for this type of artwork was a difficult & time taking. In the 19-century these kinds of artworks were made in large public spaces within the city.

EPHEMERAL ART WORKS These artworks are temporary in nature. They require small spaces & can be built anywhere. The message of the artwork needs to be documenting through photographs or videos. The stages of transformation usually have a message regarding a natural phenomenon or process.

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PERMANENT ART WORKS These artworks do not wither with time. Unlike Monumental art works they can be implemented in the city context as well as large amount of space is not essential.

ART WORK FOR MUSUEMS (Temporary exhibitions) Earth or Land art for Museums is a recent development. For this natural materials are used to create temporary / permanent installations in museums in urban precincts.

4.2.2 Examples

4.2.2.1 *Striding Arches- Andy Goldsworth, Scotland 1988*

It is a series of red sandstone arches that can be found on the hilltops at Cairnhead, in Scotland. According to Andy Goldsworth " The path is made by People walking. The work is not finished until the path has been made. People are as much part of the art work as stone"

These arches have become anchor points in the landscape. They play an important role in attracting people, orienting them as well as facilitate interaction.

4.2.2.2 *Spiral Jetty – Robert Smithson, Great Salt Lake,Utah, April1970*

The close communion between Spiral Jetty and the super-saline Great Salt Lake emphasizes the **entropic processes of erosion and physical disorder**, a phenomenon that fascinated Smithson. Made of **black basalt rocks** and earth gathered from the site, Spiral Jetty is a **15-foot-wide coil that stretches more than 1,500 feet into the lake**. Built when the lake was unusually low, it has only been above water level a few times since it was built. Rozel Point was selected for the reddish quality of the water in that section of the lake (an effect of algae).

Materials Used: mud, precipitated salt crystals, rocks, water.

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4.2.2.3 *Ephemeral Artwork- Andy Goldsworth, Scotland*

Born 26 July 1956) is a British sculptor, photographer and environmentalist producing site-specific sculpture and land art situated in **natural and urban settings**. He lives and works in Scotland. His works draw out the **endemic character of a place**.



Figure 17: Ephemeral art works of Andy Goldsworth at Scotland

4.2.3 Conclusion & Relevance

This form of art has evolved to educate the public about the environment. Educating the public & improving their knowledge about the landscape is essential for its conservation.

The Sculptures / art work at various locations along the trail & camps would also act as anchors within the landscape, improve its legibility & also offer affordances in certain cases. They would also act as agents facilitating an interaction of people with the landscape elements.

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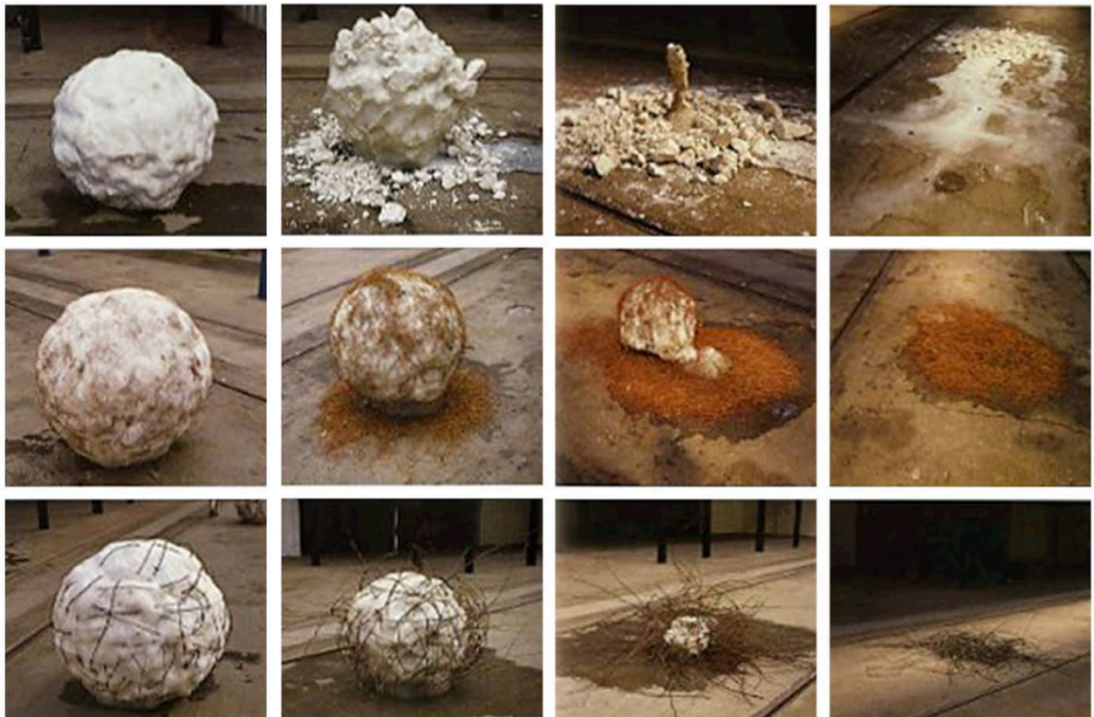


Figure 18: Snowballs in summer (glasgow 1988), photo documentation of a ephemeral artwork by Andy Goldsworth

Participatory events could be organised for making art work, with the involvement of a specialist & locals. Also the ephemeral nature of certain artworks would attract tourists into the landscape both as participants & viewers.

Involvement in creating the landscape would educate & attach people to the landscape providing for its longterm conservation goals & strenthening of local economy

5 Method Adopted

1. To discern the story of creation of the landscape working with the natural & cultural layers.

- Using satellite imagery & GIS to generate basic data like elevation, hydrological pattern, landuse- landcover.
- Collecting maps & research papers from different organizations like Survey of India, Geological Survey of India, Wadia Institute of Himalayan Geology.
- Primary surveys of the residents at Bhukki.
- Anecdotal evidences collected from experiences & observations of villagers, pastoralists & mountaineers frequenting the landscape.
- Collection of Historic images & comparing it with on site observing to evaluate the degradation over years.

2. To establish Values inherent in the landscapes. (Ecological resource, Social resource, Visual resource.)

- Analysing the collected information to establish values inherent in the landscape.
- To identify the landmarks & pause points in the site, for various ethnographies (socio-cultural resources).
- To identify areas experiencing shocks & stresses on the landscape and locating degraded patches in the landscape.

3. Referring to scientific literature to understand user preferences & to identify elements & components in the landscape essential for retaining the established values.

- Referring to theories of Visual preferences & identifying important indicators.

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- Referring to theories & literature that help understand Ecosystem functioning. Establishing indicators of healthy & degraded ecosystems for the Dokrani-Dingad landscape.
 - Referring to theories that establish connections & conflicts between visual preference & ecological preferences.
4. Referring to cases & methods for restoring the functioning (reducing stress & shocks) & to manage the landscape, ensuring visitation for larger prolonged period.
- Understanding the key concepts & stages involved in the implementation. Major Obstacles faced during the process if any.
 - Understanding the outcomes in terms of improving ecological integrity & supporting visitation.
5. To analyze the site data in the light of indicators established from scientific literature & delineation of critical areas.
- To identify the ecologically important patches & corridors for endangered species, with an understanding of eco-system functioning.
 - To identify the locations of scenic value in the landscape, with the help of indicators.
 - To identify the potentials, issues & threats in the landscape & delineate critical areas that needs to be focused on during design & management to retain the established values.
6. Design interventions and management plan to enhance / correct the above stated landscape values & facilitating for more visitation with less ecosystem degradation.
- To strengthen the local economy, while reducing its dependency on extraction based activities.

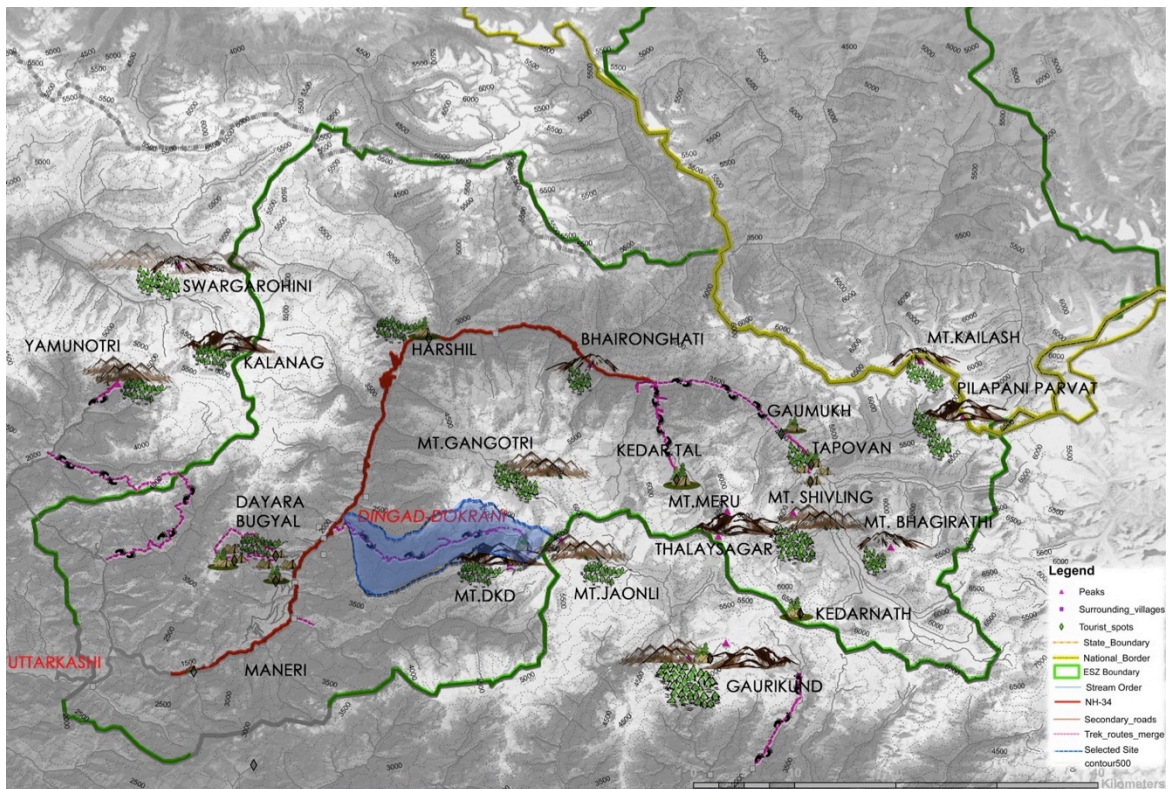
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- To develop the landscape for nature recreation / tourism, with the locals as stakeholders & managers of the landscape.
- To develop anchor points along the trail, guiding their movement & educating them about the landscape. Providing for diversions & alternative routes to reduce trail compaction & as alternate routes in case of emergencies.
- Highlighting elements of ecological importance, marking locations of scenic beauty & socio-cultural importance to ensure an entirety of experience while travelling through the landscape.
- Design interventions at critical locations on site, along with providing for stay & managing the use of resources & waste generated.
- To propose a management Plan / strategies involving stakeholders & public participation to conserve and maintain the desired landscape.

6 Site documentation

6.1 Location & Context

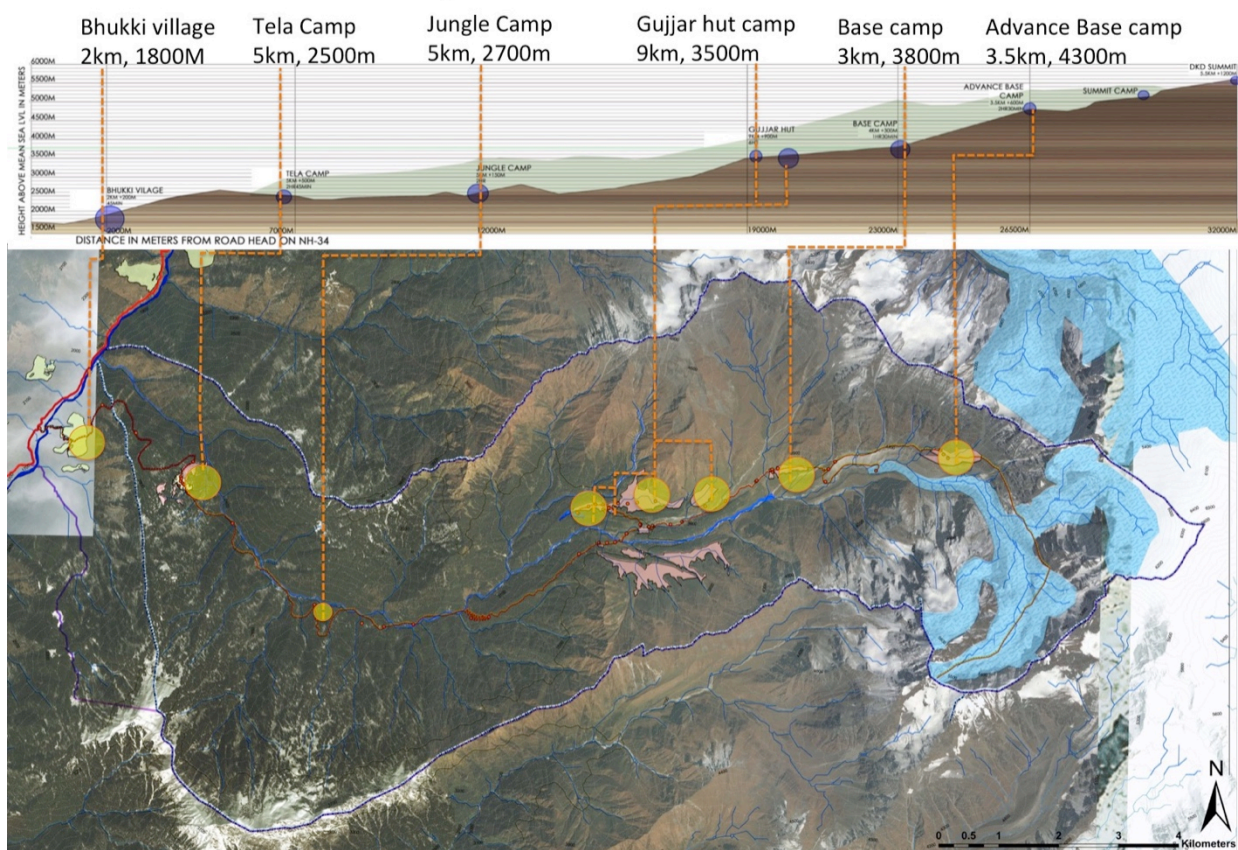
The site is in gharwal himalayas, a part of the upper catchment of the bhagirathi river in the uttarkashi district. It is at a distance of 54kms from uttarkashi on nh-34, towards gangotri; bhatwari & gangnani are important villages in the vicinity. It is surrounded by himalayan peaks, religious & tourist places like harshil, gaumukh, tapovan, kedartal, dayara bugyal, gangotri 1,2,3 jaonli, dkd,meru peak, mount kailash, and shivling.



Map 2: Dokrani-Dingad landscape precinct

6.2 The Site: Cultural Landscape

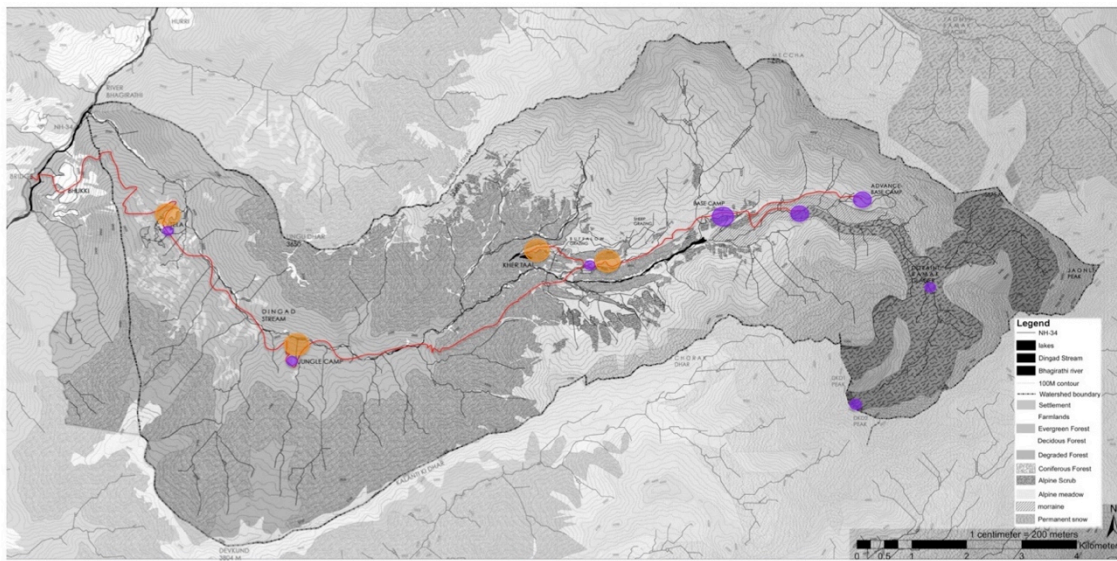
Human dominated/ influenced landscape regions include **Bhukki Village 1800M amsl**, main occupation is agriculture, **Tela camp** historically a forest village at an altitude of **2500m**. **Jungle camp a small campsite** in the midst of dense forest; often used to break the journey to Gujjar hut. **Gujjar hut** is the site common among **pastoralists**. It is at the ecotone of coniferous forests & alpine scrub. **Base camp** is setup on the lateral moraine before the **glacier snout**. **Wadia laboatory** is set up here. It is the most imporant camp for **mountaineering courses**.



Map 3: Sattelite imagery and section, showing habited locations in the Dokrani-Dingad landscape.

6.2.1 Stakeholders of the Landscape

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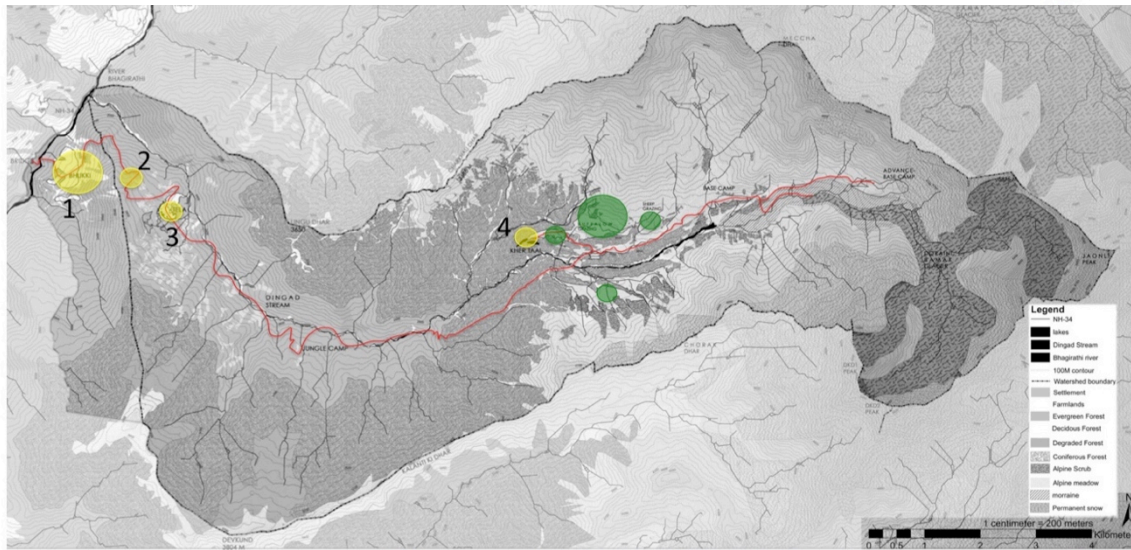
Adventure Seeker ●

TRAINEES: 110 Ppl X 5Grps
For 20 days each Mid April to June & Sept-Oct
SUPPORT STAFF: 85ppl X 5

NATURE LOVERS: 50-100 Ppl
For 4-6 days, May-Aug & Dec-Jan.



Nature lovers ●



Villagers ●

POPULATION-160 PEOPLE

MALE	47
FEMALE	50
BOYS	35
GIRLS	28



Pastoralist ●

POPULATION 60-70 Van Gujjars (4-5 families) & 2 Sheep herders from Mid April to Aug

Cattle: 300 Buffalos
300 sheep

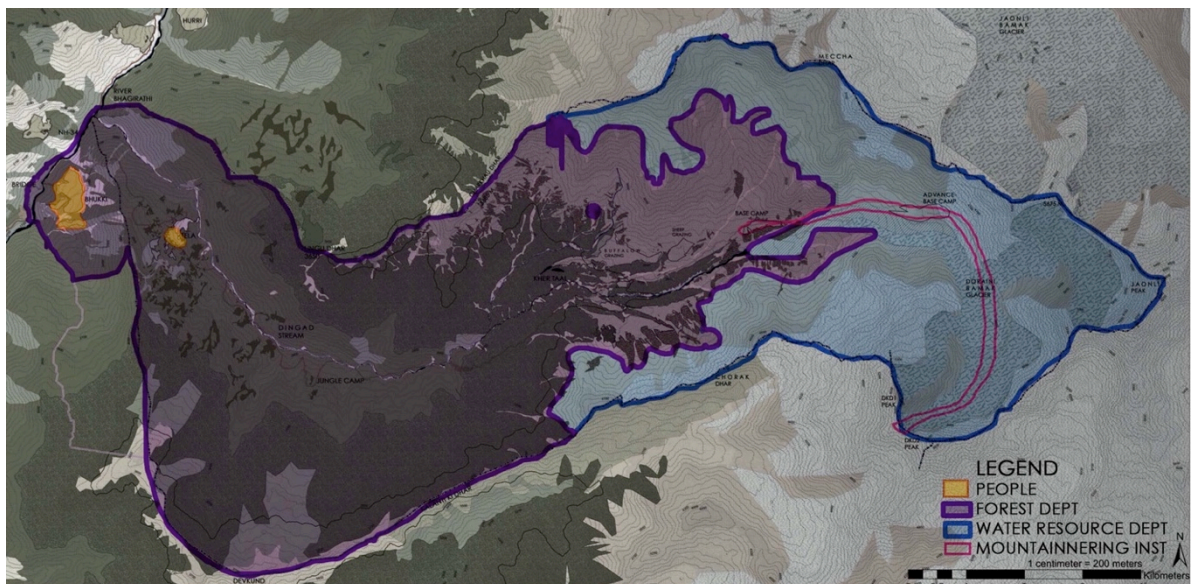
Map 4a: Location of Sakeholders (Insiders) in the landscape.

Map 4b: Location of Sakeholders (Outsiders) in the landscape.

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managing & maintaining the landscape. The Permanent residents (Bhukki) depend on the forest for firewood & fodder; diminishing the oak forest zones at lower altitudes. The Seasonal Residents (the Van Gujjars) reside in the alpine meadows during the summer months & are stewards of these grazing lands. The mountaineering community dominates the visitor category. They venture into high altitudes, laying trails & adding waste above the alpine meadows & on the glaciers. They can broadly be divided as insiders & outsiders based on the knowledge regarding the landscape, their pattern of use & landscape values associated.

6.2.2 Zones of Governance



Map 5: Zones of governance in the Dokrani-Dingad landscape

Part of the site upto 2500m is owned by the villagers. Forest department governs land from 2000m upto 3800m. The The water resource dept governs the glaciers. while the mountaineering institute manages people above 3800m. The policy framework in these respective regions changes & is monitored by the respective governing bodies. All the forest area is

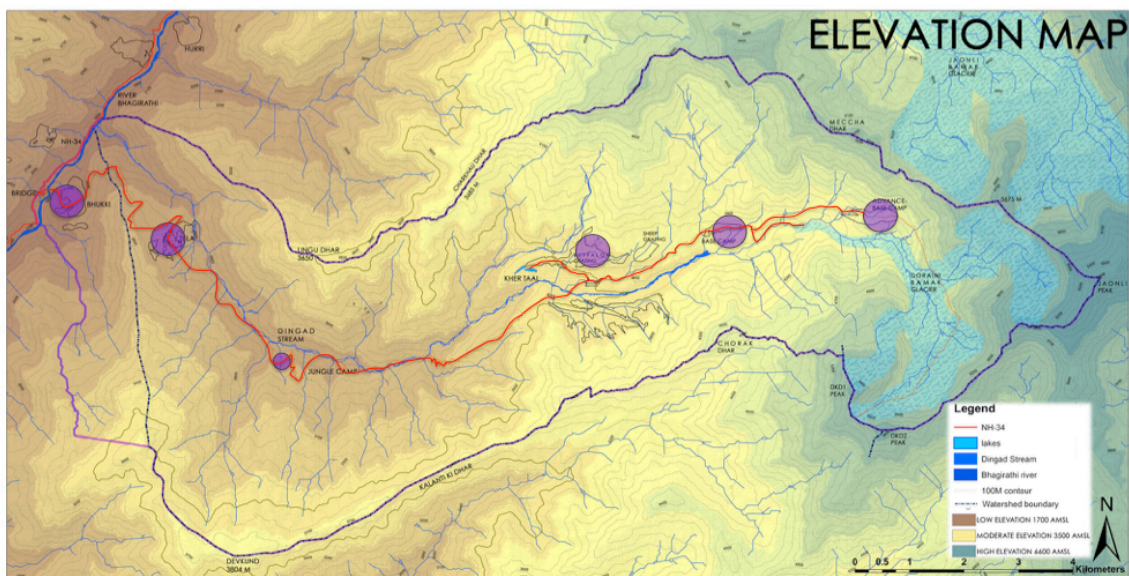
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marked as reserved forest banning extraction of herbs & cutting down of trees.

6.3 Natural Landscape: Abiotic Elements & Features

6.3.1 Elevation

The altitude varies **from 1800m to 6500m**, with total **difference in elevation as 4700m**. The summit of DKD can be reached in 7-10 days through a 33km long hike. Climatic conditions vary along with the gain in elevation/ altitude changing the natural landscape character creating a Diverse landscape. Himalaya Intro: The ecology of the Himalayan region transforms as elevation increases. Tropical and subtropical broadleaf forests



Map 6: Elevation map of dokrani-dingad landscape with settlement locations

are found at the base of the mountains. Because of variation in topography, weather, soils, and rainfall, high diversity is observed across the landscape.

Dramatic landforms, High diversity in flora & Fauna along with a High Seasonality is observed **with the increase in Elevation.**

6.3.2 Seasonality

Evanescence



Dominant
Yellow
& Blue.

The skyline of the towering peaks grab the attention of the viewer.



Dominant
white

Snow capped conifers grab the visual interest.



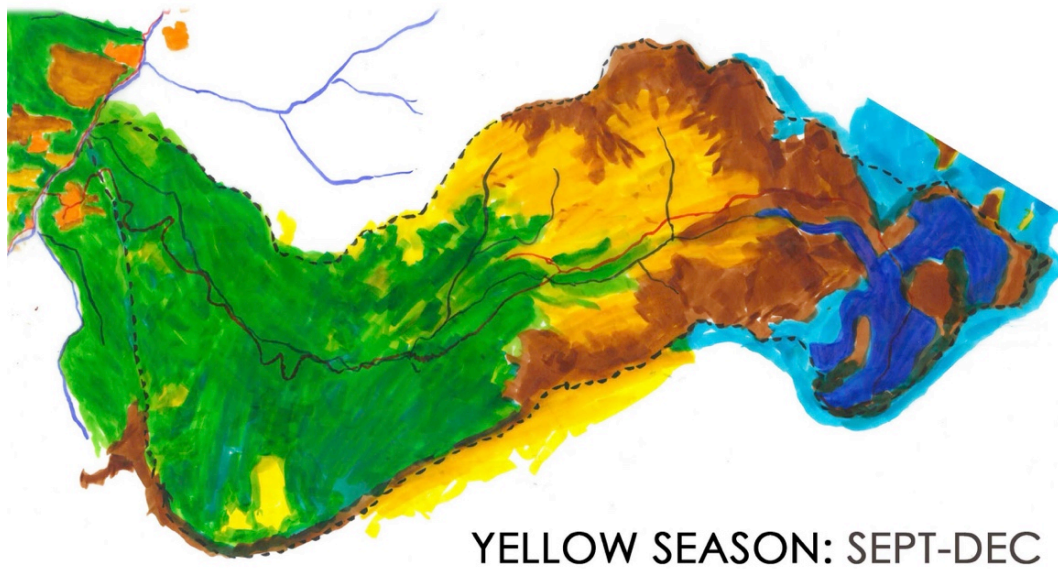
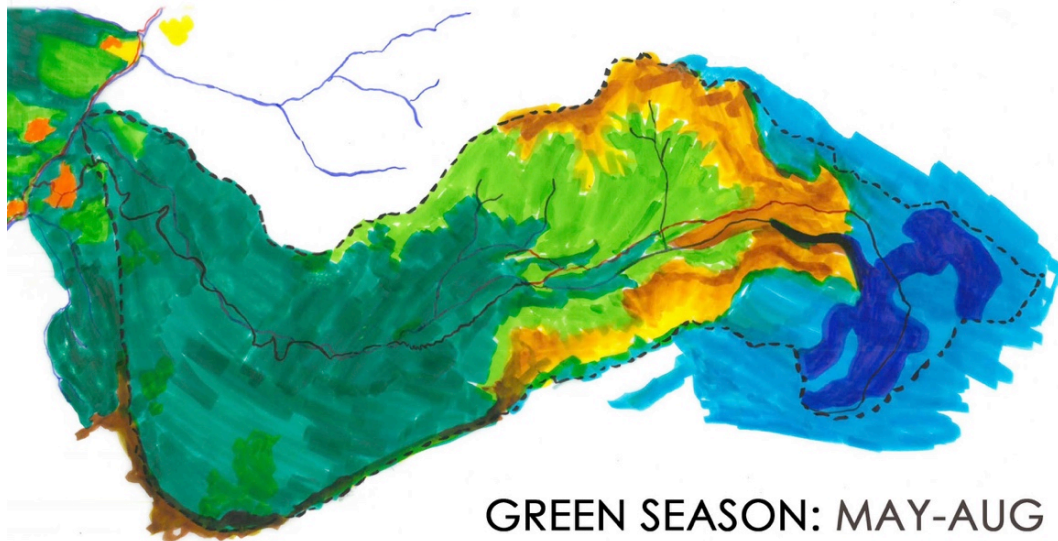
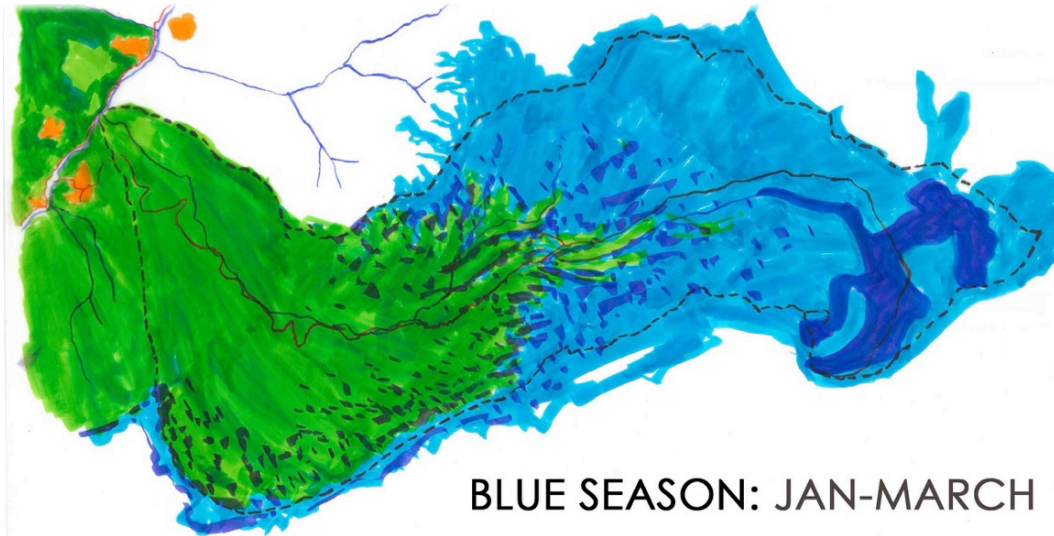
Dominant
Green
& Yellow

The flowering bugyals grab the attention of the viewer.

High variation is observed in the landscape throughout the year. The Winters (White Season) have a dominant foreground covered in snow the trees forming screens are also partly hidden. The viewing distances are less, with fog & clouds blurring the backdrop. The Summers (Green season) have a dominant green & yellow, here the flowering bugyals & the fresh leaves of the tree canopy form screens across the landscape. The Pre-Winter months (Yellow season) has a dominant yellow foreground & bright blue backdrop; with clear skies the viewing distances are long highlighting the towering skyline of surrounding peaks.

Figure 19: Image of the Gujjar hut campsite in different seasons

Map 7: Maps showing seasonality in the Dokrani-Dingad landscape.



6.3.3 Geology & Soil Forming Materials

6.3.3.1 Geology:

Geologically, the area exposes three major Groups from North to south viz. i) Central Crystallines ii) Garhwal Group iii) Jaunsar Group. The Quaternary deposits occur alongside of the valleys and in topographic depressions. The **Central Crystalline** belt consists of complex mylonite gneisses, slates, garnetiferous schist and kyanite bearing schist, calc- silicate rocks and quartzite with associated migmatite, syntectonic granite gneisses and late to post tectonic tourmaline bearing granite including the famous Badrinath and Gangotri granites (Gopendra, K. 2005). The **Garhwal Group** comprise quartzite, limestone, chlorite schist and metabasics with quartzite being the most prominent litho unit. The **Jaunsar Group** comprises phyllites, meta-argillites, and greywacke. These rock types form prominent high hill range on either side of the River and are well exposed in the road section and along the tributaries/ nalas of Bhagirathi River.

AMPHIBOLITE

It is a common rock type in mountain ranges and shield areas. Amphibolite is a **non-foliated metamorphic rock** that forms through recrystallization under conditions of high viscosity and directed pressure. It is a very common product



of regional metamorphism, which is **associated with mountain building episodes** (such rocks are often lineated or foliated because mountain building is a dynamic event that involves motion). Amphibolites are often associated with other metamorphic rocks like quartzite, schist, marble, gneiss. Stripes of metamorphic rocks like these are often next to one another in geological

Figure 20: Amphibolite stone

Evanescence

maps. Amphibolite **rarely hosts economic minerals**, but the rock type is **widely used as a construction material**, especially because of its attractive textures, dark color, hardness and polishability and its ready availability. Also used in road building (aggregate) and as railroad ballast.

Gneiss

Gneiss is a **foliated metamorphic rock** identified by its bands and lenses of varying composition, while other bands **contain granular minerals** with an interlocking texture. Other bands contain



Figure 21: Gneiss stone

platy or elongate minerals with evidence of preferred orientation. It is this banded appearance and texture - rather than composition that define a gneiss. Generally **rough to touch**, is one of the oldest rock. Used as building stone & paving.

Schist

Schist is a **metamorphic rock with well-developed foliation**. It often contains **significant amounts of mica** which allow the rock to **split into thin pieces**. It is a rock of intermediate metamorphic grade between **phyllite** and **gneiss**. The sedimentary rocks from which it forms. These are usually shales or mudstones. Cannot be used as construction material as it is not strong.



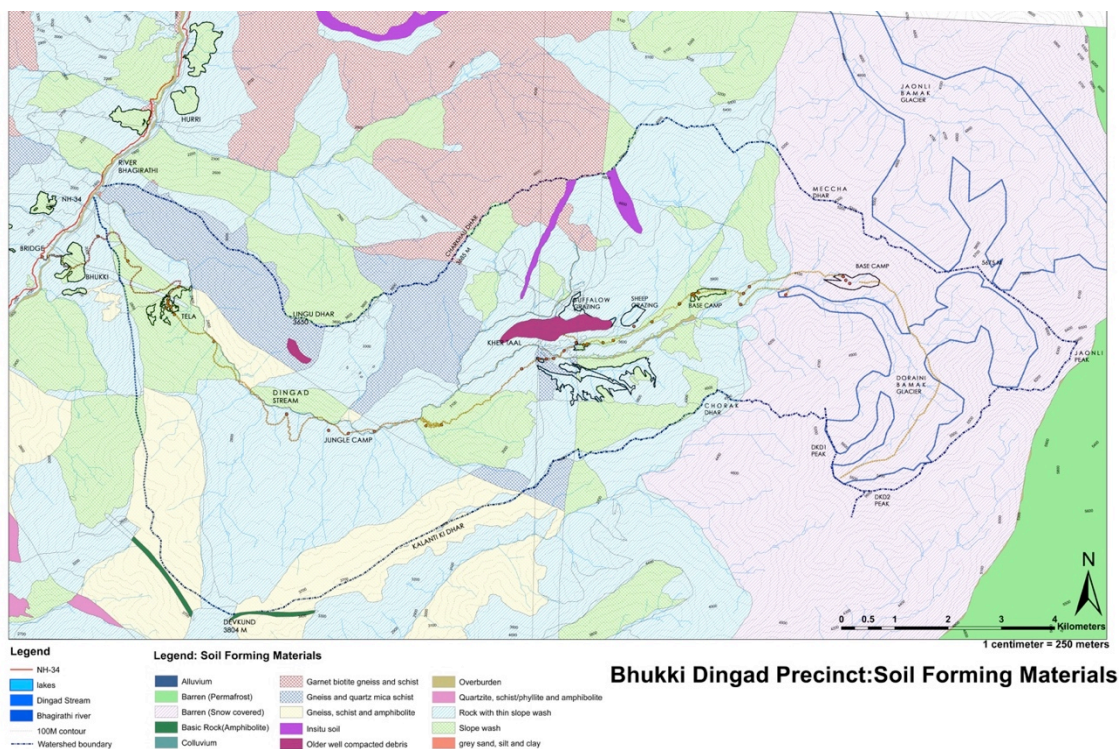
Figure 22: Schist stone

6.3.3.2 Soil Forming Materials

Evanescence

Slope Forming Material: Slope forming material (SFM) is another important categorical geo-factor theme, which categorizes areas into discerning types of material occurring on slope, starting from exposed different types of rock masses and overburden material. SFM and its spatial distribution & depth play a crucial role in causing different types of landslides. The spatial distribution of soil/overburden and its thickness is controlled by erosion processes and slope morphometry. About 60% study area exposes the hard rock of different types. This also includes slopes having less than a meter of overburden cover. Rock type present in the area includes phyllites, phyllitic quartzite, limestone, quartzite, slate, schist, gneiss, granitic gneiss, shale, sandstone, dolomite, amphibolite, basic intrusives etc. At many places these are highly sheared due to the thrusting effect. About 30% of the area contains overburden material of more than a meter thick. The material includes mainly, river borne material, colluviums and transported soil.

Map 8: Map showing the soil forming material in the Dokrani-Dingad landscape (source- Geological survey of India)



Evanescence

More than 75% landslides occur within overburden laden slopes. In overburden the younger loose debris & alluvial material including RBM & and in the rocks the phyllite, slates, schist and gneiss are found more susceptible to the sliding.



Figure 23: In-situ rock quartzite (left) and River borne material (right)

Depth of slope forming material : For the rocky slopes with thin to moderate (up to 2m) cover it was easy to ascertain the depth of material from surrounding rocky outcrops and rocks covered with overburden. But for thick overburden the depth of material has been taken purely visual



Figure 24 : Morrainic deposit (left) and Scree(right)

estimation and optimal guess, which may differ in actual. The depth of material has been categorized in following four classes for practical purpose and map (Plate-8) has been updated accordingly - area comprises nil to very thin overburden thickness (up to 2m) followed by thickness 2-5m and >5m.

Evanescence

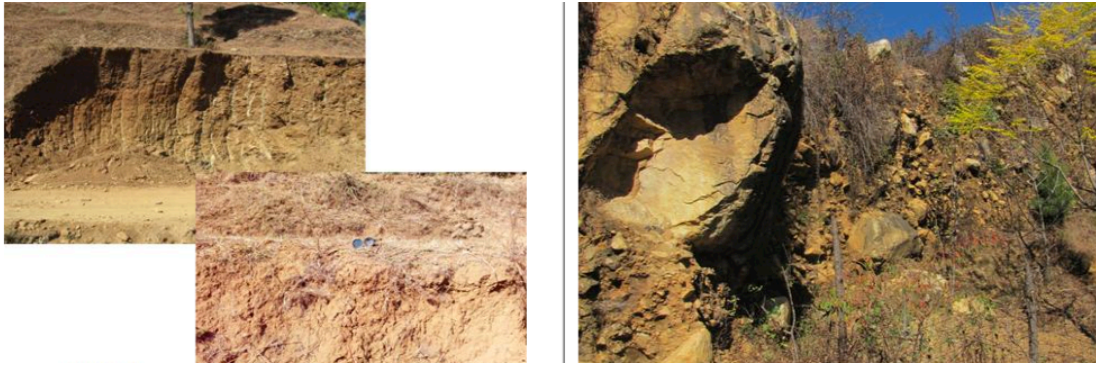


Figure 25: Insitu soil (left) and Transported soil (right)

6.3.4 Geomorphology

The lowly dissected area covers the major portion of the area followed by moderately dissected and highly dissected hill slopes. In terms of distribution of landslides, most number of landslides falls along river/nala/water bodies in denudation hill slopes followed by highly dissected hill, moderately dissected hill, lowly dissected hill and piedmont slope. The Action of the wind & the action of the glacier (Water) are the major elements modifying the landforms. Some of the prominent landforms observed on the site include:

Intermontane plateau: When a plateau is surrounded by mountains on all

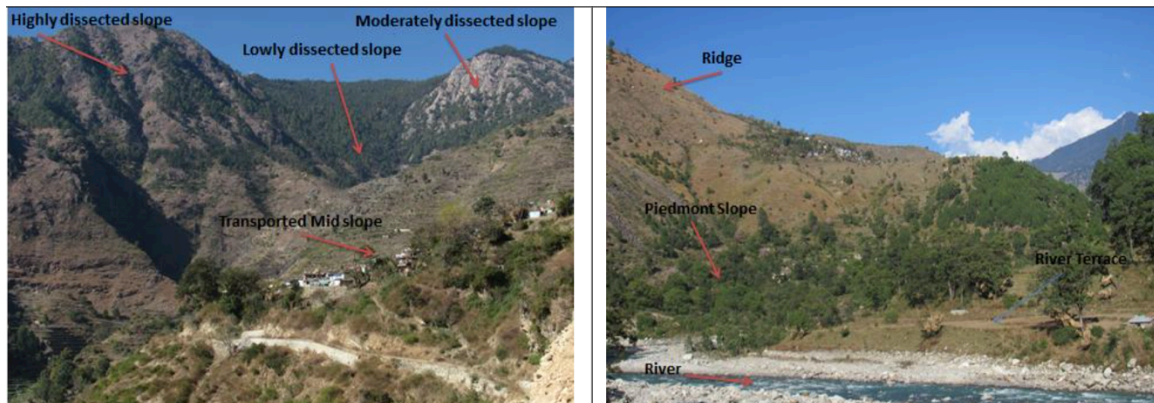


Figure 26: Various hill slopes (left) and geomorphic landforms (right)

sides, it is called intermontane plateau. GLACIER & water origin. Intermontane plateaus are the highest in the world, bordered by mountains. The Tibetan Plateau is one such plateau.

Evanescence

Highly Dissected hills: Highly eroded hills. Structural origin / Denudational origin.

Channel Bar: A **bar** in a river is an elevated region of sediment (such as sand or gravel) that has been deposited by the flow. Fluvial origin

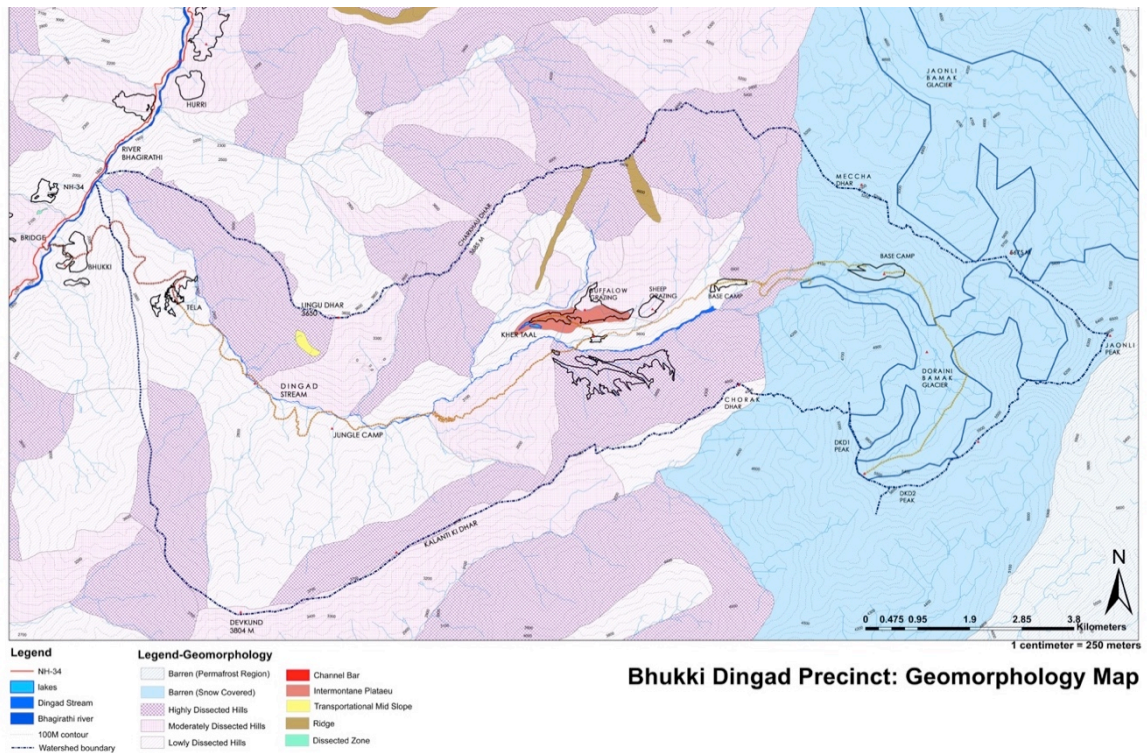
Transportational Mid Slope: frequently occurring angles (26-35 degrees). Transportation of material by mass movement (flowslide, slump, creep), terraced formation, surface & sub-surface water action. Active region characterized by mass movement, terracette formation, slope wash and subsurface water action

Ridge: A **ridge** or mountain **ridge** is a geological feature consisting of a chain of mountains or hills that form a continuous elevated crest for some distance. a long, narrow raised part of a surface, especially a high edge along a mountain

Dissected zone: The topography is immature and slope-developing processes are continuing, and hence the profiles of slopes are not complete. The crest slope, the free face and the debris slope are three categories of the slope easily identified in the area.

Evanescence

Map 9: Map showing Geomorphology of the Dokrani-Dingad Landscape.
(source: Geological survey of India)



Bhukki Dingad Precinct: Geomorphology Map

6.3.5 The Glacial Landscape

6.3.5.1 The Historic Dokrani Landscape:

The Dokrani Bamak is a well documented medium size glacier in the Gharwal Himalayas. Scientists from Nehru Institute of Himalayan Geology have been documenting the glacial retreat starting 1991. A laboratory has been set up at Base Camp near the snout of the Glacier. A variety of studies including behavior of the snow to different climatic conditions, soil section analysis to



Figure 27: Small glacier Hurra (Oct 2005)-photo by scientist Dhobal

Evanescence

understand the growth periods of flora over moranic deposits & studies to understand the evolution & climatic preferences of species have been done over the years.

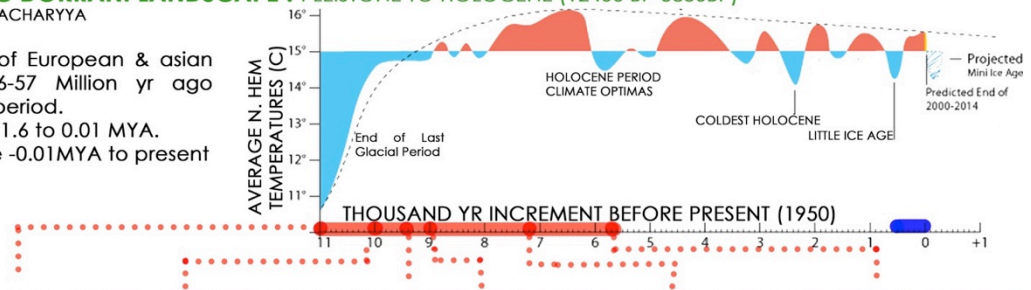
The melt waters from the historic Hurra Glacier have formed the Kera Taal trapped between the two lateral moraines. The image on the right is clicked by dohbal a scientient from Wadia institute of Himalayan Geology in 2005.

Figure 28: Graphical representation of the research done on Dokrani Bamak glacier by wadia Institute of Himalayan geology

HISTORIC DOKRANI LANDSCAPE : PLEISTONE TO HOLOCENE (12406 BP-5830BP)

BY A. BHATTACHARYYA

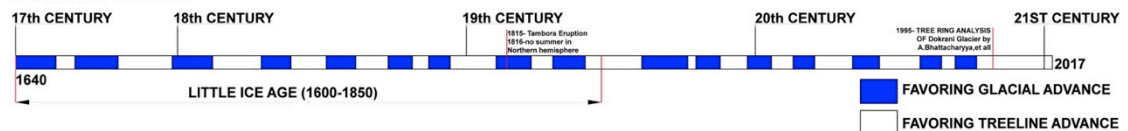
Collision of European & asian plates 36-57 Million yr ago
EOcene period.
Pleistone 1.6 to 0.01 MYA.
Holocene -0.01MYA to present



12406 CAL BP	10633 CAL BP	9670 CAL BP	9000 CAL BP	7100 CAL BP	5830 CAL BP
Cool + Dry Phase	Warm + Moist Phase Climate amelioration	Cool + Dry Phase Climate Deterioration	Cool + Dry Phase Climate amelioration	Cool + Dry Phase Increased aridity	Warm + Moist Phase Climate amelioration
Alpine Steppe	forest -upward migration Meadow with small trees	Forest Stagnation Steppe increase	Steppe present Indicators of variability	Rise in Steppe	forest -upward migration Decline in steppe

CLIMATIC VARIATIONS THROUGH TREE RING ANALYSIS (1640 TO 1995 AD)

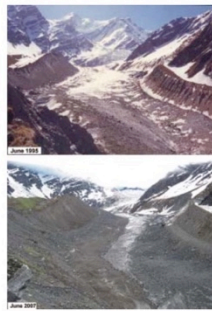
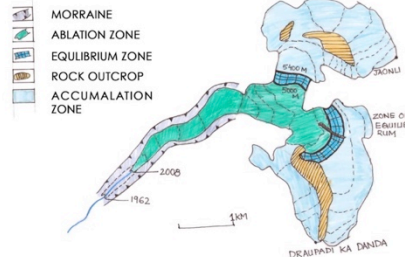
BY A. BHATTACHARYYA



RECENT GLACIAL DOCUMENTATION (1962- 2008)

BY DOBYAL,

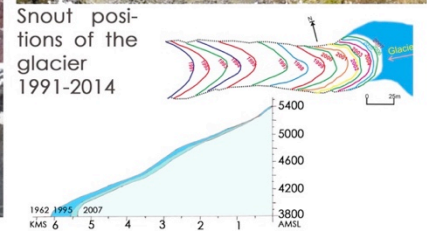
The snow line is seen retreating with each passing year 3500M in May 1994 to 4200m in May 2014.
The 6100m long glacier has retreated & reached 5350m in length 1962-63 to 1991 is 480 m, average rate of 16.5 m/yr 1991-2000 is 161m, average rate of 17.8 m/yr 2000-2007 is 110m, an average rate 15.5 m/yr .



Glacial retreat 1962 to 2008



Snout positions of the glacier 1991-2014

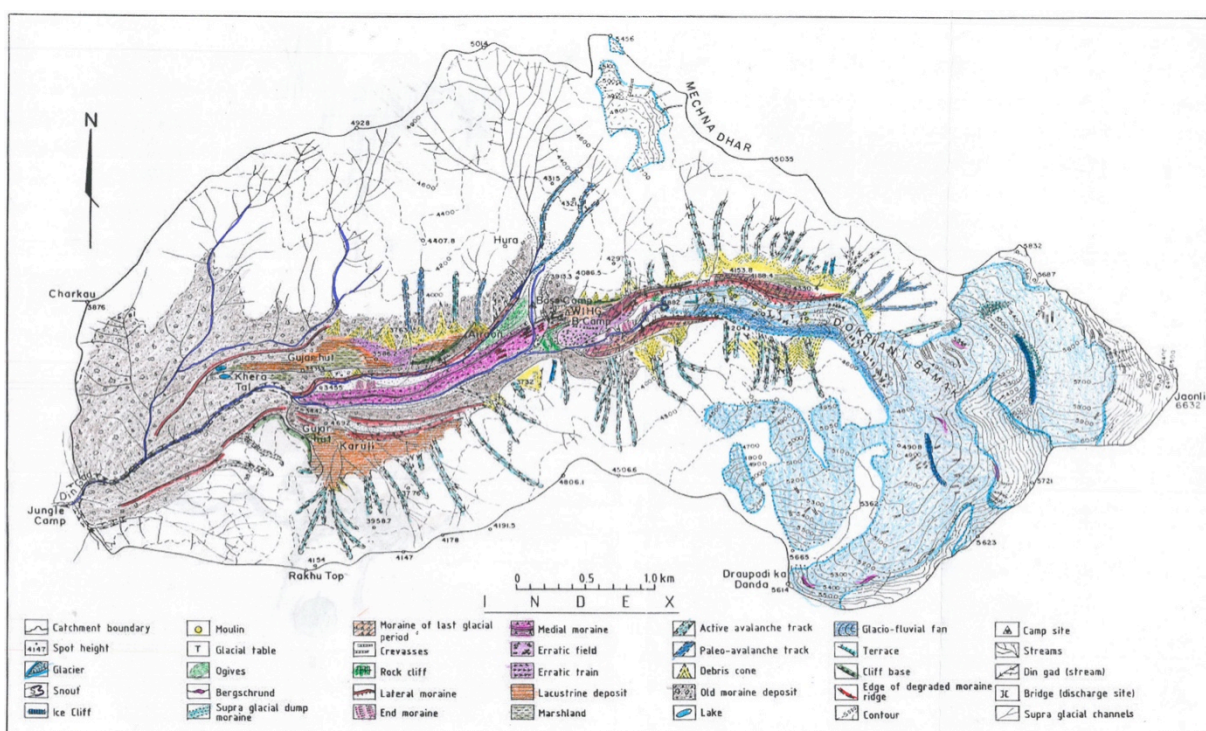


Evanescence

6.3.5.2 Glacial geomorphology:

The Glacial melt & retreat over the years have formed a variety of landforms. The area beyond the tree line starting from Gujjar hut is a geomorphic museum displaying the story of its formation through various landforms.

U-shaped Valleys, Erratic terrains, Erratic Field, Lateral Moraine, End Moraine, Supra Glacial Moraine, Glacial lake, Lacustrine deposits, marshlands, Ogives, moulin, U-shaped valley, crevasses, Ice cliffs, ice walls, Rock cliff, avalanch tracks, Debris cone, cliff base, Glacio-fluvial fan, Supra glacial channels can all be seen in the landscape.

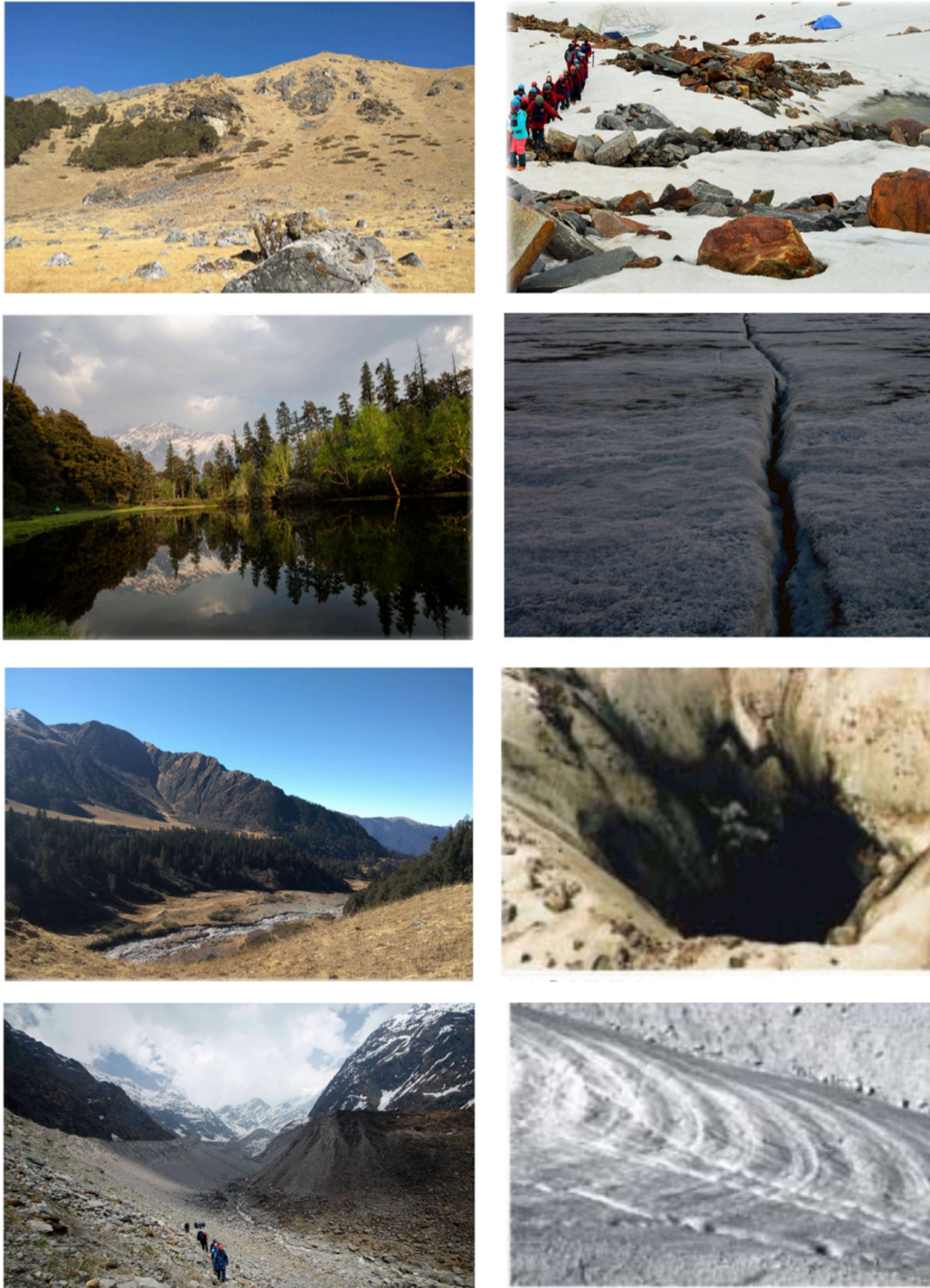


Map 10: Geomorphology map of the Dokrani glacier catchment (1995)

Source- Wadia institute of Himalayan Geology

Evanescence

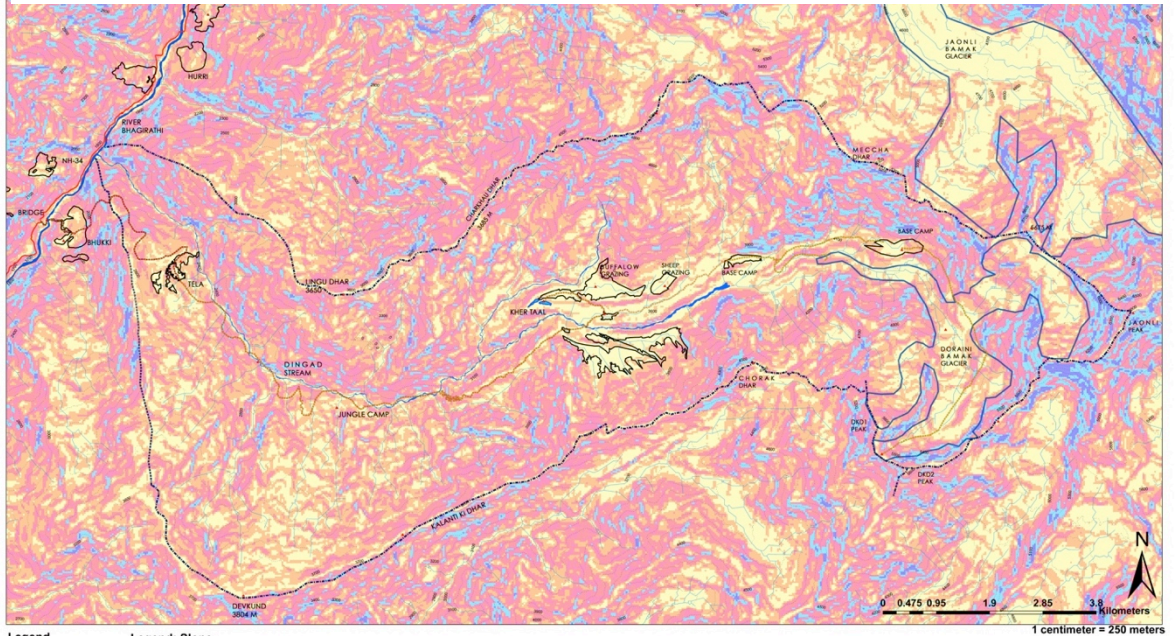
Figure 29: Geomorphic features in the Dokrani glacier catchment



1. Erratic terrain
2. Supra Glacial moraine.
3. Glacial Lake
4. Crevas
5. U-shaped valley.
6. Moulin
7. Lateral Moraine.
8. Ogives.

6.3.6 Slope: Angle & Aspect

Map 11: Slope angle map of the Dokrani-Dingad Landscape.



Bhukki Dingad Precinct: Slope Map (%)

6.3.6.1 Slope Angle:

However for practical purpose it can be classified into six different classes as: i) 0-15°- Very gentle ii) 15°-25°- Gentle iii) 25°-35°- Moderate iv) 35°-45°- Moderately Steep v) 45°-60°- Steep vi) 60°-90°- Very Steep/Escarpment The slopes having moderate to moderately steep angles ranging from 25°-40° are found more susceptible to sliding.

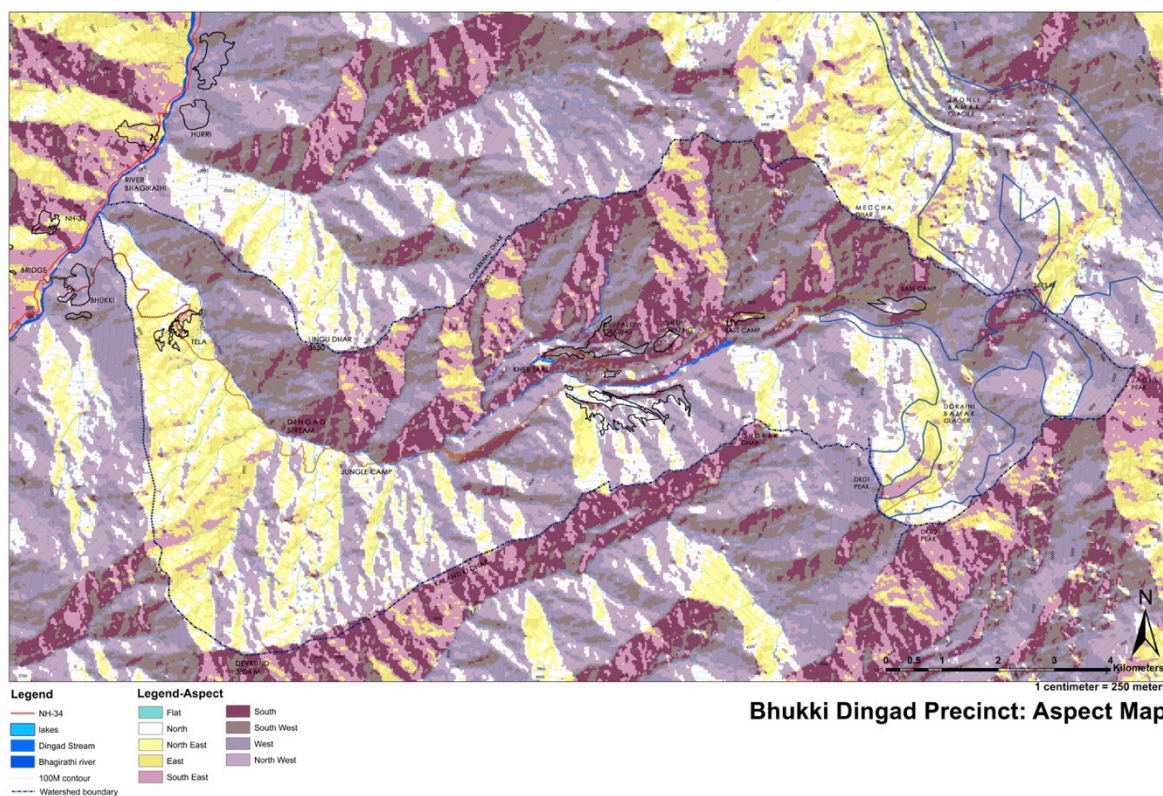
6.3.6.2 Slope Aspect:

In the study area the general trend of the Himalayan range is NNW-SSE and slopes are inclined towards NE and SW due to tight folded structure. However, all kinds of aspect values as per classification have been observed in the area, as it is under continuous denudational process delineating

Evanescence

geomorphic features like hills, ridges, spurs; break in slope, river valleys, gullies, etc.

The slopes facing SE, SSE and SSW are found more susceptible for sliding.



Map 12: Slope Aspect map of the Dokrani-dingad landscape (Source- GIS)

6.4 Natural Landscape: Biotic Elements

6.4.1 Landscape typology / Landcover Map:

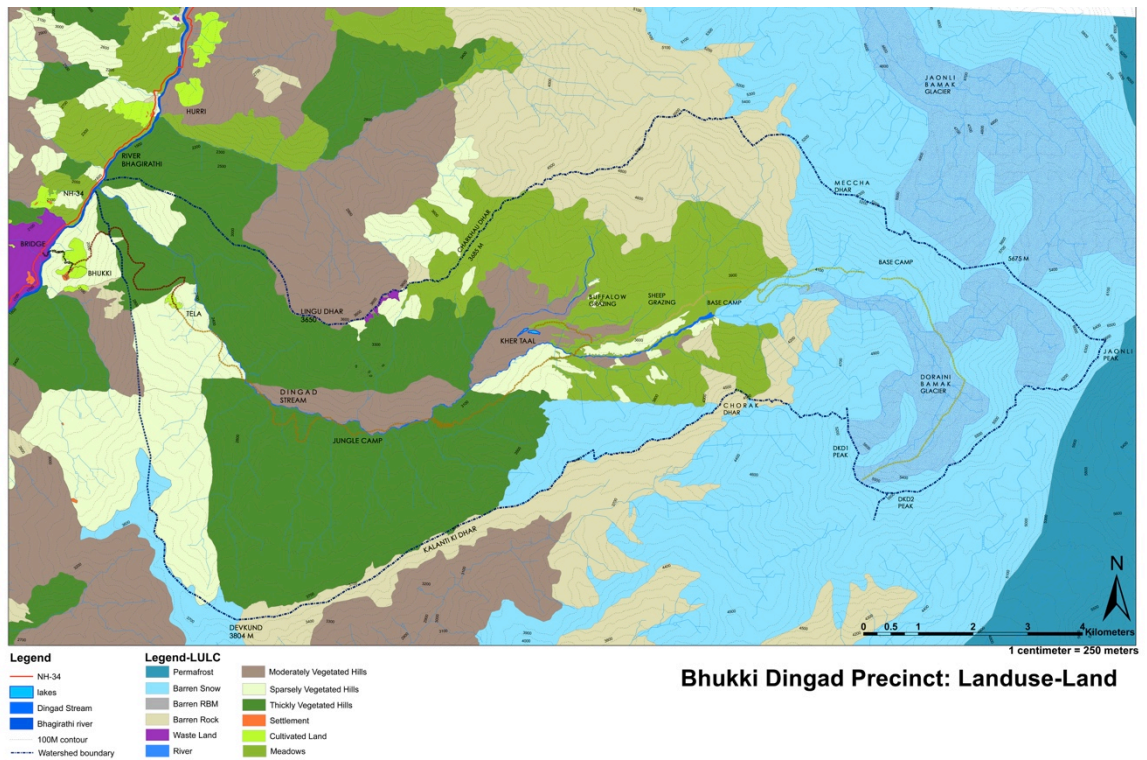
Land use land cover (LULC) pattern is one of the important parameters in governing the slope stability. Vegetation has major role to resist slope movements, particularly for failure with shallow slip/rupture surfaces. Land use patterns like cultivation, urbanization and other anthropogenic activities also changes the regime and affects the stability of the area. Hence, all these factors need to be accounted & weighted suitably while preparing the susceptibility maps. The predominant LULC pattern is thick vegetation

Evanescence

followed by moderate vegetation, sparse vegetation and cultivated land .
Alpine meadows, barren rbm, barren snow, Glacier/ permanent slope.

Out of the entire 13 categories extensive slope cut, sparse vegetation area and waste lands are found susceptible to the sliding.

Map 13: Landuse and landcover map of Dokrani- Dingad landscape



6.4.2 Forest Types

The Himalayan Range receives most of its moisture from the southwestern monsoon that originates in the Bay of Bengal. The moisture-laden monsoon winds are funneled through the Gangetic Plains toward the mountain range, where most of the precipitation is intercepted by the eastern Himalayas. The western extent therefore receives less precipitation. The drier climate in the west influences the vegetation. For instance, the treeline declines from 4,000 m in the east to about 3,500 m in the west (Kendrick 1989).

1. Broad leaved-conifer forest 2,500m- these are common in the middle Himalayas

- **Evergreen:** Pinus, Quercus
- **Deciduous:** Alnus, Corylus, Juglans, Ulmus species

2. Temperate Forest- Higher elevations in the Himalayas.

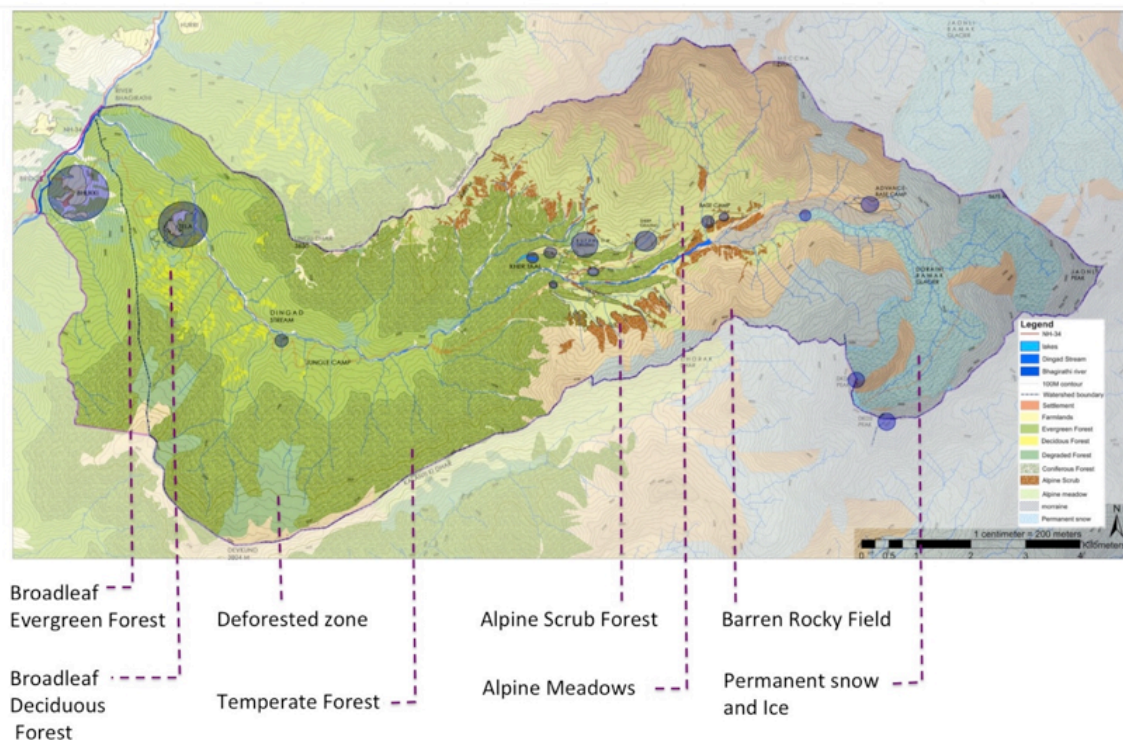
- **Lower temperate forest** 3000m- Pinus, Quercus, Taxus, and Cedrus
- **Upper Temperate forest**-3500m - Abies-Betula-Rhododendron

3. Sub-Alpine Conifer forest: 3700m- The form the treeline. Betula-Rhododendron-Juniperus scurb

4. Alpine meadows: 3500m & above: These are found beyond the treeline and is dominated by ferns and other diversified taxa belonging to Apiaceae, Asteraceae, Cyperaceae, Gentianaceae, Geraniaceae, Lamiaceae, Polygonaceae, Primulaceae, Poaceae, Ranunculaceae and few others. These occupy the highest livable plant zone.

Evanescence

Map 14: Forest types / Landscape typology map of Dokrani- Dingad landscape.



6.4.2.1 *Western Himalayan Broadleaf Forests [IM0403]*

This ecoregion is nevertheless of regional conservation importance for its biodiversity and for its role as a critical link in the chain of Himalayan ecosystems that are layered along the steep south-facing slopes. Several of the Himalayan birds and mammals that exhibit altitudinal seasonal migrations depend on contiguous habitat up and down the steep Himalayan slopes for unrestricted movements. Habitat loss in these steep slopes will also compromise the ecological integrity and hydrology of the watersheds, with far-reaching consequences that will be felt in the Ganges delta thousands of kilometers away.

Evanescence

Location and General Description

These temperate forests form a narrow east-west-directed band between 1,500 and 2,600 m. This ecoregion lies along the middle Himalayas.

Two distinct forest types can be recognized in this ecoregion: evergreen broad-leaved forests and deciduous broad-leaved forests. The former, dominated by **Quercus semecarpifolia**, *Quercus dilatata*, *Quercus lamellosa*, and *Quercus incana*, usually is on the moister **southern slopes**, which are more influenced by the monsoon (Puri et al. 1989). These forests often are associated with species of Lauraceae (e.g., *Machilus odoratissima*, *Litsea umbrosa*, *Litsea lanuginosa*, *Phoebe pulcherrima*). They also have a **dense understory with mosses, ferns**, and several **epiphytes on the trees**, typical conditions expected in moist forests in the lower elevations. The **drier forests**, especially on the **north-facing slopes** and **along the higher elevations**, are characterized by *Quercus ilex*, sometimes mixed with conifers such as **Abies, Picea, Cedrus, and Pinus spp.**, with an Arundinaria-dominated understory (Puri et al. 1989).

Deciduous broadleaf forests are distributed along riverbanks to the west of the Kali Gandaki River. These forests are composed of *Aesculus indica*, *Juglans regia*, *Carpinus viminea*, *Alnus nepalensis*, and several *Acer* spp. In drier places, these species are associated with **Ulmus wallichiana**, and **Corylus colurna**. Whereas **Alnus nepalensis & Alnus nitida** are the common species along most of the riverine forests (Shrestha and Joshi 1997).

Evanescence

DECIDUOUS ZONE



EVERGREEN ZONE

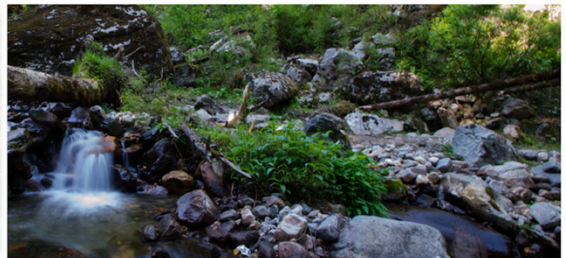


Figure 30: Species of the Broadleaf Deciduous and Evergreen forest

Biodiversity Features

This western Himalayan ecoregion harbors several large, focal vertebrates of conservation importance. Some of these species include the Asiatic black bear (*Ursus thibetanus*), leopard (*Panthera pardus*), and, in open, steeper hills and woodland habitats, the Himalayan tahr (*Hemitragus jemlahicus*). As important as the species is the ecoregion's role as an integral part of the overall Himalayan ecosystem, which relies on altitudinal connectivity for ecosystem function.

Current Status

Nearly two-thirds of this ecoregion has been cleared or degraded. But several large patches of forests still remain in the extreme western part of the ecoregion.

Types and Severity of Threats

The threats to the remaining blocks of natural habitat from logging and agricultural clearing continue unabated. In the wetter areas where *Quercus lamellosa* dominates, the upper limit of cultivation is about 2,100 m; therefore, most of the forest below this elevation has been extensively cleared for farming. But the higher regions are used for grazing, especially during the summer, and regularly set fires to promote new plant growth for cattle destroy the understory (FAO 1981). Therefore, forest regeneration is retarded, and the long-term viability of the forest is compromised. Erosion from a combination of road building, overgrazing, and excessive fuelwood collection is of serious concern in this steep-sloped ecoregion.

6.4.2.2 *The Western Himalayan Sub-Alpine Conifer Forests [IM0502]*

This ecoregion plays a critical ecological role as part of the Himalayan ecosystem, with interconnected processes that extend from the Terai and Duar grasslands along the foothills to the high alpine meadows and boulder-

Evanescence

strewn scree that lie above the treeline. Several Himalayan birds and mammals exhibit seasonal migrations up and down the steep mountain slopes and depend on contiguous habitat for these movements. If any of the habitat layers are lost or degraded, these movements can be disrupted. Therefore, conservation of this ecoregion is critical to maintain the biodiversity-species and processes-of this youngest and tallest mountain range on Earth.

Location and General Description

The ecoregion represents the sub-alpine conifer forests between 3,000 and 3,500 m in the Himalayan Mountain Range. The western extents of the Himalayas have more extensive conifer forests of blue pine (*Pinus wallichiana*), chilgoza pine (*Pinus gerardiana*), fir (*Abies spectabilis*), silver fir (*Abies pindrow*), and spruce (*Picea smithiana*) than the moister eastern part of the mountain range.

The ecoregion has several recognizable forest types based on floral associations. These include pure fir forest (*Abies spectabilis*), mixed oak-fir forest (*Quercus semecarpifolia* and *Abies spectabilis*), mixed rhododendron, fir, and birch forest (*Rhododendron campanulatum*, *Abies spectabilis*, and *Betula utilis*), and mixed coniferous forest (*Abies spectabilis*, *Pinus wallichiana*, and *Picea smithiana*) (Shrestha and Joshi 1997). Cypress (*Cupressus torulosa*) and deodar (*Cedrus deodara*) are common above 2,400 m (FAO 1981). Fir (*Abies spectabilis*) usually forms a continuous belt between 3,000 and 3,500 m on the southern side of the main ranges and can be mixed with *Quercus semecarpifolia*, *Betula utilis*, and a rhododendron understory. These sub-alpine areas have a number of economically important species such as *Daphne bholua*, *Arundinaria* spp., *Betula utilis*, and a large number of medicinal plants (Shrestha and Joshi 1997).

Biodiversity Features

Evanescence

This belt of conifer forest sitting immediately below the alpine meadows in the western Himalayas does not have a spectacularly rich fauna or flora but does harbor several focal species of large mammals of conservation importance, including the brown bear (*Ursus arctos*).

Current Status

Although the ecoregion is less populated than some of the other Himalayan ecoregions (especially those in the lower elevations), more than **70 percent of the natural habitat has been cleared or degraded**. This ecoregion contains some of the least disturbed forests in the western Himalayas.

Types and Severity of Threats

The steep slopes of some of the high mountains have been deforested for intensive cultivation, although the practice of terracing has greatly reduced erosion. Large-scale collection of the morel mushroom (*Morchella esculenta*) from this ecoregion by the local people for export coincides with the breeding season of several pheasants and high-altitude mammals. Collection of wood by the local people for their own use and for sale to tourist trekkers and mountaineering parties is also a substantial threat, especially because the high-altitude forests are very slow to regenerate.

6.4.2.3 The Western Himalayan Alpine Shrub and Meadows [PA1021]

The western meadows are semi-arid & are characterized by a lower treeline; the alpine meadows occupy an elevation (between 3,000 and 5,000 meters). The dominant genus of shrub in these montane shrublands is *Rhododendron (semru)*, which exhibits high species turnover along the east-west extent of the ecoregions. In spring and summer the meadows, known locally as the bughiyals, become a resplendent tapestry of contrasting blue, purple, yellow, pink, and red flowers of delphiniums, gentians, poppies,

Evanescence

roseroots, louseworts, anemones, and asters. The major species of grasses in the area include *Arundo donax*, *Phragmites karka*, *Apluda mutica* (Bassi), *Themeda arundinacea* (Ulla), *Cymbopogon* spp. (Jarakush), *Bothriochloa bladhii* (Sindhur), *Imperata cylindrica*, *Sachharum spontaneum*, *S. benghalense* and *S. narenga* among others.

This ecoregion has large areas of habitat suitable for conserving viable populations of the high-altitude Himalayan predators. Most of the ecoregion's mammals are small species, such as the Himalayan palm civet, pale weasel, Himalayan weasel, pikas, and voles, that scurry about the undergrowth and among the boulders.

Location and General Description

About a fourth of this high-elevation ecoregion is bare rock and ice. This alpine area was formed during the early Pleistocene, after a long geological process that thrust up the Inner Himalayas (Ram and Singh 1994).

The Eco region experiences cold winters

during which snowfall

blankets the slopes. Snowmelt during April and May results in additional moisture. The summers are mild. Cloudy days and fog are common, with clear skies limited to a few hours during the day. Climate and aspect influence vegetation. The north-facing slopes, which are less exposed to sunlight, are



Krommoltz : Rhododendron



Juniperus clusters on grassy slopes.

Figure 31: Flora of the Alpine scrub & meadow

Evanescence

cooler and retain more moisture. These harbor a more typical Himalayan flora. But within this general trend, the complex topography also creates rainshadows, resulting in very localized climatic variations.

The early vegetation in this region was dominated by *Quercus semecarpifolia* and *Betula utilis*, but periodic climatic changes and glaciation events have given rise to the present alpine vegetation (Ram and Sing 1994).



Betula utilis on north aspects

The forest-alpine transition is now marked by krummholz-type

Figure 32: Bhojpatra tree at the edge of the treeline.

vegetation of *Rhododendron campanulatum*, *Rhododendron barbatum*, *Salix* spp., and *Syringa emodia* (Ram and Singh 1994).

Biodiversity Features

The ecoregion contains several localized hotspots of floral diversity and endemism. Notable areas are the Valley of Flowers, Nanda Devi (India's second-highest mountain), Tinker Valley, Rara-Shey-Dolpho, Dhorpatan-Annapurna, Pokhara, and Gorkha-Himalchuli.

The snow leopard (*Uncia uncia*) and the Tibetan wolf (*Canis lupus*) roam these high-altitude landscapes, hunting large ungulates such as the goral (*Nemorhaedus goral*), serow (*Naemorhedus sumatraensis*), Himalayan tahr (*Hemitragus jemlahicus*), argali (*Ovis ammon*), and blue sheep (*Pseudois nayur*). This ecoregion probably represents the eastern limit of the distribution of the brown bear (*Ursus arctos*); there have been unconfirmed reports of this species from western Nepal.

Evanescence

The forty mammal species known in the ecoregion do not include any endemics. But several species are threatened, including the snow leopard, serow, Himalayan tahr, argali, and Himalayan goral (IUCN 2000).

Current Status

Because of its remoteness and inaccessibility, much of the ecoregion's habitat is still intact. There are eleven protected areas that cover more than 8,500 km² representing about 25 percent of the ecoregion area (table 2). These include several large protected areas (e.g., Shey-Phuksundo, Annapurna, Kedarnath, Nanda Devi, and Dhorpatan). Three large protected areas also overlap across adjacent ecoregions (table 2).

Types and Severity of Threats

Grazing and trampling by large herds of domestic livestock, including cows, buffalos, horses, sheep, goats, and yak, are beginning to severely degrade the natural habitat (Ram and Singh 1994; WWF and IUCN 1995; Rawat 1998). As livestock herds increase in number and size and exceed the carrying capacity in the lower habitats, pastoralists have begun to drive the herds into these alpine meadows, increasing the degradation threats here (Ram and Singh 1994; Rawat 1998). An overnight campsite for pastoralists and their livestock as they migrate up and down the mountains can lay bare an area up to a hectare (Singh 1991, cited in Ram and Singh 1994).

Overexploitation of rare medicinal herbs is another conservation threat in the area (Rawat 1998). Most of the collection sites are already under heavy grazing pressure, and the harvest of medicinal plants places additional stresses on this fragile ecosystem.

Adding to the localized degradation threats are several **historical trade routes between India, Nepal, and Tibet that are still heavily used** in this region. The accessibility brings with it associated degradation threats such as

Evanescence

fuelwood collection and trail compaction due to heavy use by people and pack animals.

6.4.3 Himalayan Fauna:

This ecoregion has large areas of habitat suitable for conserving viable populations of the high-altitude Himalayan predator,

The snow leopard (Uncia

uncia): snow leopard habitat characteristics such as mountains with steep slopes dotted by rocky bluffs, ridges broken by outcrops, and valleys interrupted by cliffs. it provides them with good cover to hide



amongst rocks when hunting, while also helping with camouflage. They live between 3000 – 4500 m. Mating season for wild snow leopards is between January and mid-March.

Figure 33: The snow leopard

The blue sheep (Pseudois

nayur, Bharal): The Blue Sheep inhabits treeless slopes and alpine meadows and shrub zones above the timberline. The Sheep prefers relatively gentle hillsides covered with grasses and sedges,



but usually remains within 200 metres (650 feet) of cliffs up which it can climb to escape from predators. observed between 2500 to 5550

Figure 34: The Blue sheep / Bharal

Evanescence

m in open grassy areas, Highly tolerant of environmental extremes. Usually in a Herd range of 2-30 animals. The bluish-colored coat, which blends with the habitat's rocks, gives the blue sheep its name.

In the summer he eats alpine grass, and in the winter the menu primarily includes dry grass. Rounding out the diet are moss, leaves, shrubs and lichens. The populations faces two threats: poaching for meat and competition with livestock. Mating occurs between October and January, with the young being born from May to July. Least concern -IUCN.

Himalayan tahr (Hemitragus

jemlahicus): In the Himalayas, tahr inhabits temperate to sub-alpine forests up to treeline, commonly between 2,000 and 3,270 metres in northern uttarakhand (Gaston et al., 1981, 1983). Tahr are predominantly



Figure 36: The Himalayan Thar

grazers, feeding on grasses and herbs, but they do browse the

leaves of shrubs particularly when pastures are snow-covered. In the Himalayas the rut lasts from late October to January or even February (breeding war/ display). Himalayan tahr breed between April and July. The Himalayan tahr had a continuous distribution throughout Nepal

between 1,500 and 5,200 m, but this is now being increasingly disrupted by activities related to human encroachment (Green, 1978, 1979). It is considered near threatened as per IUCN.

Figure 35: The Alpine Musk Deer



Alpine Musk deer (Moschus

Evanescence

chrysogaster): It prefers an area with a high diversity of herb species near the broad-leaved forest. Musk deer showed a preference for a few plant species during summer as well as winter, such as *Gaultheria trichophylla*, *Ophiopogon intermedius*, *Sibbaladia cuneata* and *Cyperus* spp. state animal of uttarakhand. the musk deer avoids disturbed areas, hence controll on grazing & anthropogenic activities is essential for their conservation. Endangered as per iucn List.

The brown bear (*Ursus arctos*):

Himalayan brown bears prefer to live around *Rhododendron Campanulatum* tree. Due to habitat loss, killing by livestock h erders, and continuous poaching for its fur, claws and internal organs for the medicine trade, the Himalayan Brown Bear suffers constant decline throughout its range. Himalayan brown bears hibernate from October through April. They either sleep in natural caves or dense forest.



Figure 37: The Himalayan Brown Bear

Most Himalayan brown bears are diurnal, with a period of activity early in the morning and another later in the afternoon. The Himalayan brown bear will eat before sunrise and then in the afternoon. Some bears have become nocturnal to avoid humans.

The Himalayan brown bear is an omnivore. The Himalayan brown bear eats grass, roots, insects, fruits, berries and small mammals it can catch like gerbils and marmots. The Himalayan brown bear sometimes eats larger prey like sheep and goats, if available, and will browse on carcasses. This subspecies of brown bear is considered critically endangered by the IUCN.

The Himalayan brown bear prefers to stay above the timber line, staying at elevations of 3,000 to 5,400 m.

7 Site Analysis

7.1 Identifying the Values inherent in the Landscape.

The Dokrani- Dingad landscape is being valued for its Ecological diversity, Social Value (providing fodder & fuel). It is also highly valued for its thrill providing elements, aesthetic appeal & scenery.

7.1.1 Ecological Value:

The landscape consists of rare & endangered species like the bhojpatra, deodar forests, medicinal herbs & is home to the himalayan brown bear & the snow leopard. The forest between Tela & Gujjar hut are least disturbed and has a high probability of housing rare himalayan herbs. The locations where camping activities are common exhibit less diversity. Also the increasing visitation is leading to more clearing, extraction & deposition of non-decomposable waste at high altitudes that is spoiling the ecology.

7.1.2 Social Value:

The landscape has served as a resource to the locals providing with fodder & fuel. There are certain rituals which have been associated with the forest & are carried forth even today, but their meaning is being lost. These need to be preserved and should be used to educate people about the respect for nature that prevailed in the culture.

7.1.3 Visual & Thrill Providing Value

In the recent years the landscape is being visited by mountaineers & nature lovers. The altitude difference of 4000m in a linear distance of 25kms houses dramatic landforms & high floral diversity. The ridges moving in a serpentine fashion create mystery. The occasional presence of water bodies & deep valley views are dotting the landscape. The pine screens with the semru foreground

Evanescence

Table 3: Summary of the ecological, social & visual values on site.

TYPOLOGY	ECOLOGICAL VALUE	SOCIAL VALUE	VISUAL VALUE
Farmlands & Grass collection zones	Deforested zone, Prone to landslides & Forest Fire.	Source of Livelihood	Farmlands offer a lush green foreground
Broadleaf evergreen forest Banj & Moru oak, Pine, Rhododendron, Abies pindrow	Dense understory with moss. Oak species prefer north aspects & good water holding capacity	oak is a source of fodder & fuel, Extensive clearing for agriculture.	Dense understory adds to the variation & retains interest.
Broadleaf Deciduous forest. Pangar + Akhrot	Sparse to no understory. High water requirement	Fruit used by people	Open canopy, allows more light to filter. In forest setting this is preferred.
Deodar forest	Prone to forest fire, drought & pollution tolerant, north aspects	Wood good for construction	Tall barks (enhanced linearity)
Abies spectabilis, pindrow + khersu oak	Prefers moist slopes & wind tollerant. Kharsu protects soil fertility & promote recharge of mountain springs. Large ungulate habitat.	Fir timber used for interior works, oak is linked with agriculture sustenance.	This forms the terminating tree line forming screens & adding interest to the scene.
Semru + Betula utilis + Abies spectabilis	Habitat for Large Ungulates	Betula Bark is used for Religious Offerings	Stepped stands (cultured appearance)
Rhododendron campanulatum (Semru) forest	Grows on stony slopes and ledges. Himalayan brown bear habitat, insect pollinated	Medicinal value	Beautiful flowers April to June
Betula utilis (Bhojpatra)	Found in gulley's where snow lies for a long time. Wind pollinated. High CO2 content	Outer bask used as paper to write religious texts regarded sacred & medicinal uses	Sculptural stands with a rhododendron under story
Betula utilis + Juniper +(Semru) Rhododendron campanulatum		Aromatic value of juniper	Last visible
Juniper + (Semru) Rhododendron campanulatum on grassy slopes	Slope stability, pioneer species, Supports Himalayan Bear	Juniper used for incense.	Flowering & cultured appearance
Alpine meadows	Highly dependent on snowmelt.	Grazing land during peak summers	Prospect refuge, colorful flowers

Evanescence

7.2 Mapping the Values inherent in the Landscape.

7.2.1 Important Scenic Locations:

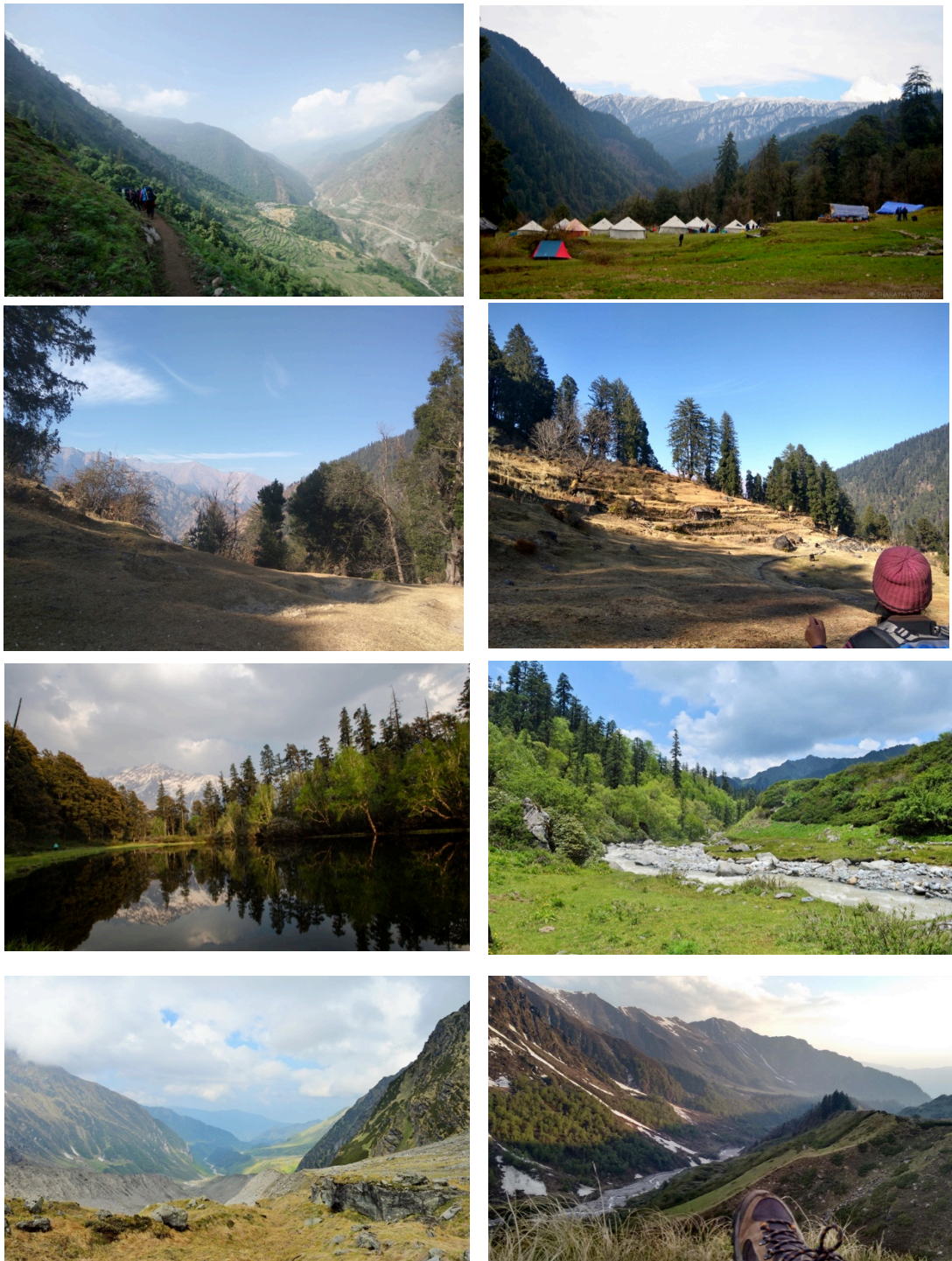
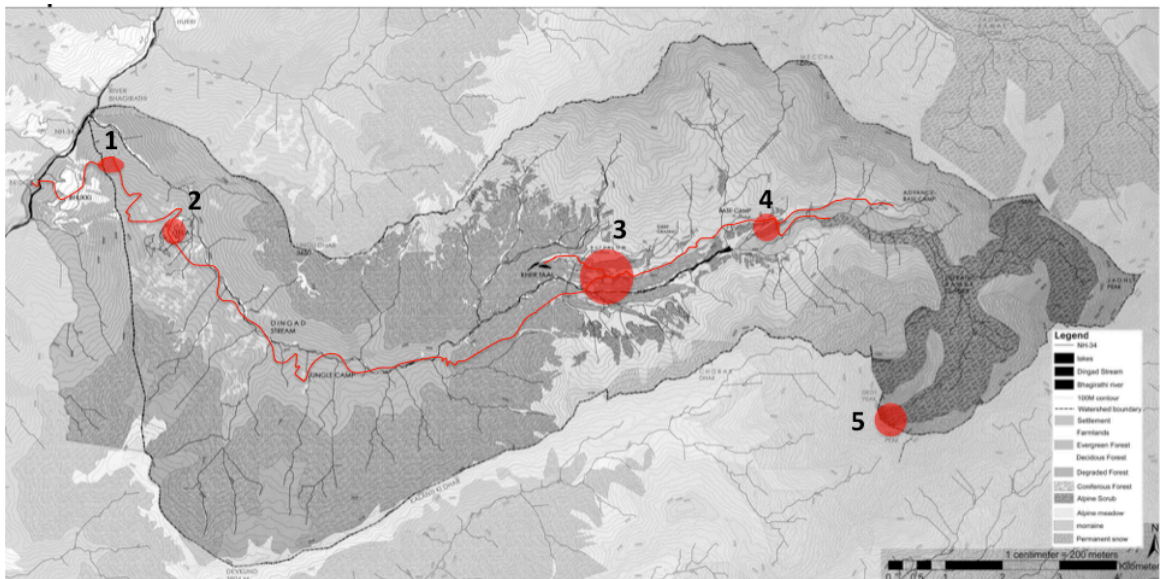


Figure 38: Scenic locations in the landscape.

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1. The first image shows a view of the valley along the NH, with the foreground of bhukki & its agriculture fields opens up at this location. It is an important location as it is the last point which is visually connected to the himalayan villages. Distant views of valleys are highly preferred views.
2. The Next three images are taken in different directions from tela camp. After a walk in the broadleaf evergreen forest for 2 hrs one reaches a large opening; Tela camp which was once a forest village. Here views of the valley towards the NH & Towards the Glacier both give a sense of directionality & mystery.
3. The next two images are at Gujar hut; here one reaches the end of the treeline after walking on steep forest slopes one reaches its end & the view of the bugyals with the towering peak backdrop opens up. At this junction one also meets the dingad stream after long. Here, a high variation in the landscape is observed, retaining a persons interest for long.
4. The last two images are at Base Camp, here one has crossed the tree line and is on the morrainic deposits close to the glacier snout. Views up towards the Glacier & down of the U-shaped valley are seen. A small stream cuts across this to meet the dingad. Junipers & semru dot the grass hill slopes.

Evanescence



Map 15: Scenic Location Map of the Dokrani-Dingad Landscape.

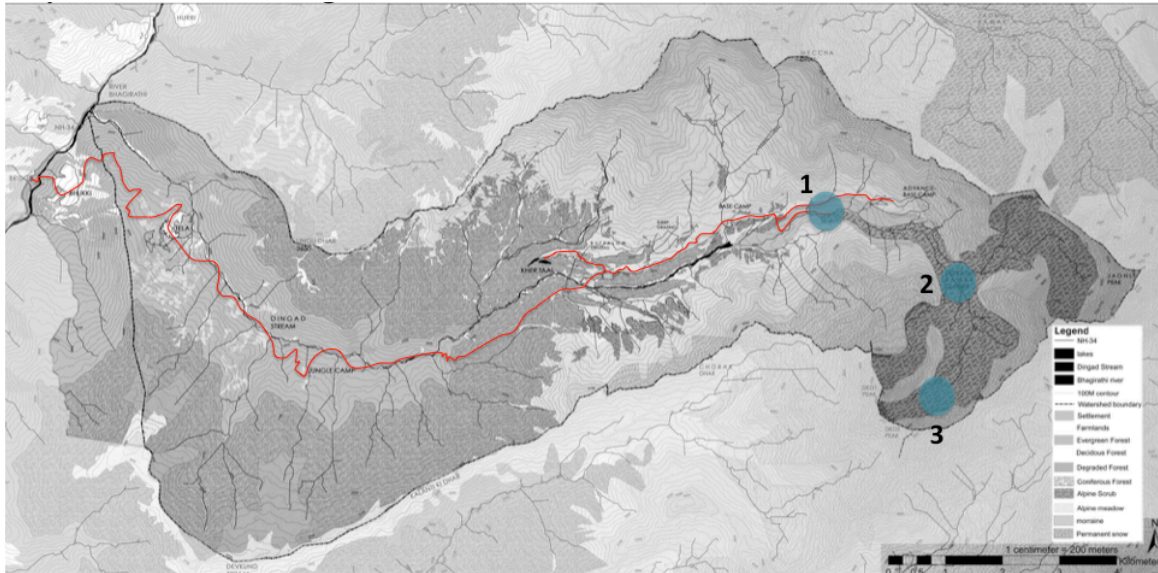
7.2.2 Important Thrill providing locations on Site

The area above the alpine meadows, including the glacier, the slopes with permanent snow & the peaks are important thrill providing elements in the landscape. They are of high importance to the Mountaineering community as training sites.

1. This is the the Location of the Glacier snout, which houses ice walls & cliffs that are used for ice craft training. It is also easily accessible from the base camp. Situated in the lateral moraine it is very dangerous with rockfall afternoon. High caution has to be maintained while entering this area.
2. This is a location over the glacier, this area has moderate snow covered slopes almost all through the year. It is used as a site for snow craft training.

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- This location is enroute the DKD summit on the glacier with a no of open crevases & a few ice collumns. Also ice walls that need to be climbed enroute the summit.



Map 16: Map showing Thrill providing locations in the Dokrani-Dingad Landscape.



Figure 39: Supra glacial moraine (left) and ice wall (right)

7.2.3 Important Socio-cultural Locations

There are a few locations & customs prevailing on the site, these display associations with the forest that developed over centuries.

Evanescence



Figure 40: Important cultural locations on the Dokrani-Dingad Landscape. (numbering from top left to right).

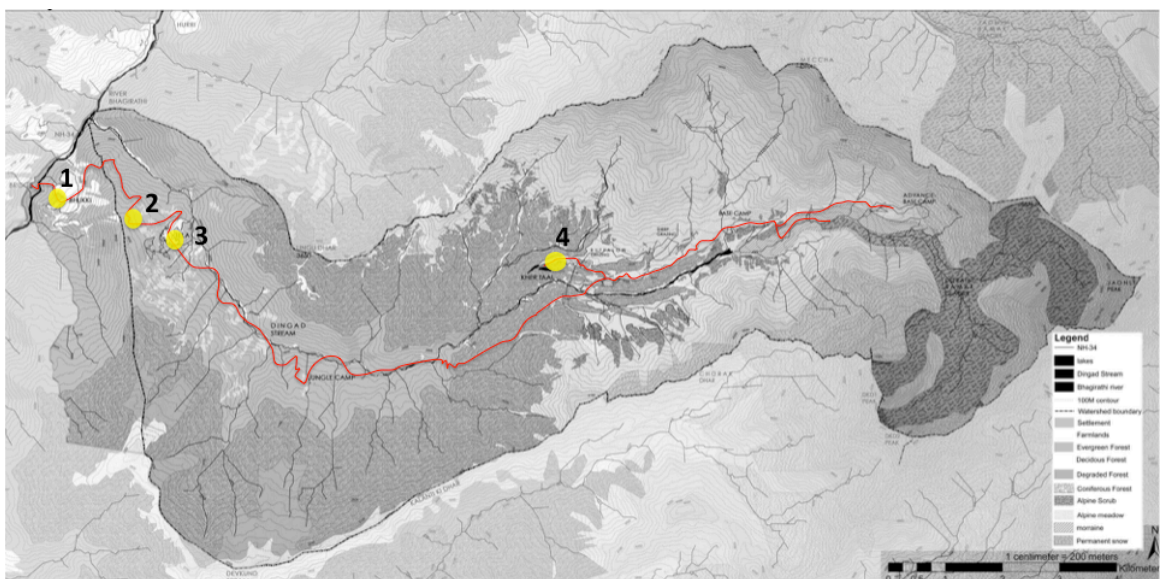
Temple marking entry to Village: In India it is a custom to have an entry gate and a temple just beyond it to mark the boundaries of the village. The first image shows the entry to the village, here landscape enhancement is essential to make the presence of the temple more bold.

2. Groundwater pit enroute Tela: The route from bhukki to Tela is 5kms & along the ridge. The access to the stream for water is very difficult. There is a small outlet into the ground water reserve, along the route almost mid-way to tela. It is a custom to drink water from this enroute tella. This custom ensures that one does not get dehydrated during their daily strainous journey to collect fuel & fodder. It also helps to maintain the waterpit clean.

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3. Sacred Moru Banj tree: The oak species has always been important to mountain people. Growing on the north aspects it is a provider of fodder & fuel supporting the agrarian economy. At Tela camp a small temple has been built around a banj tree now atleast 100 yrs old. It is also the largest tree with a canopy of about 8-9m.

4. Khera Taal Lake Temple : Villagers vist this alpine lake in the month of august to worship the lake & make an offering of the sacred bhramakamal flower for good fortune. Entry into the lake / even touching the water is not permitted. There is a Myth regarding this, anyone entering into the lake never comes out. This lake is a glacial lake, formed between two lateral morraines. High sediment accumulation in the lake bottom would make it nearly impossible for anyone entering in it to come out.



Map 17: Map of Socio-Cultural locations in Dokrani-Dingad landscape.

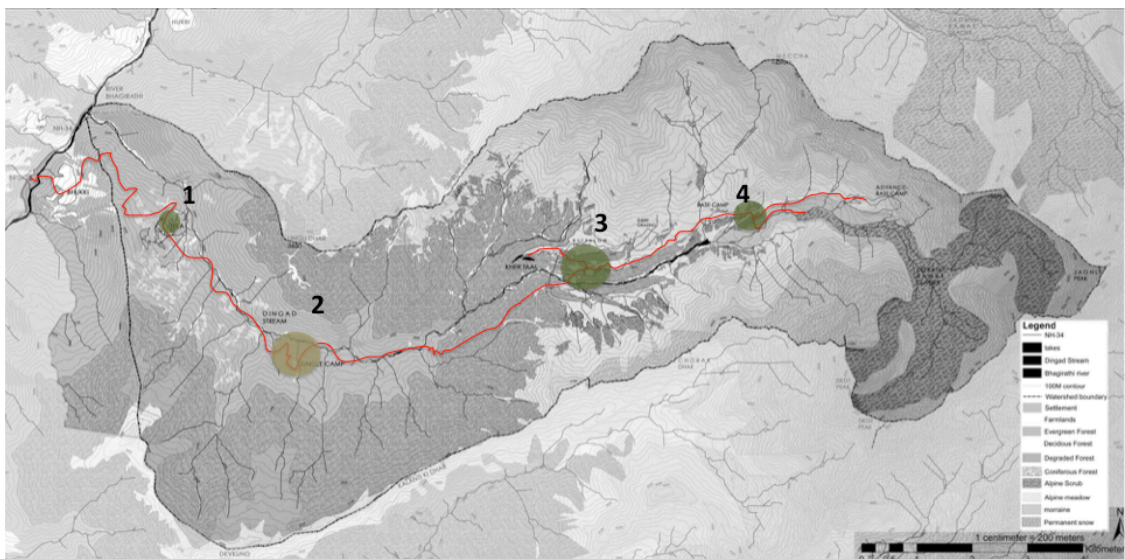
All the cultural practices in on the site are connected to ecological / scietific reasons. These value & cultural knowledge of the ascestors needs to be preserved and spread amongst the forthcoming generations.

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7.2.4 Important Ecological locations on site

The stretch of the forest between Tela & Gujjar hut, especially beyond jungle camp is ecologically most important. This is the stretch of the forest that has undergone least interference and modification; having a high liklinesss to house rare herbs. It would be an important location for studies related to plant evolution & their response to changing climate. Location 2 is important & needs to be preserved for its existing values.

Location 1,3 &4 are places with maximum alterations & disturbance to the ecology. Management policies need to be developed at these locations to ensure minimal damage to the ecology. Also strategies helping restore the landscape during non-use / less use months need to be thought about & implemented with the help of the forest depatment & participation of the locals & stakeholders.



Map 18: Map showing ecological locations in the Dokrani-Dingad Landscape.

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7.3 Important Pause Points and Landmarks

The site is viewed, experienced while walking and while one halts at landmarks and campsites. The interaction time is larger at the various halt points & the campsite. The landscape degradation & accumulation of waste is also higher at these locations. These are locations that should be developed in the initial phase.

Designing, managing & monitoring these locations is very critical to maintain the landscape integrity. Three important pause points are a part of this landscape viz: Tela camp, Gujjar hut & Base camp. Also analysis to identify the suitability of these locations as campsite for future needs to be done.

7.3.1 Pause 1: Tela camp

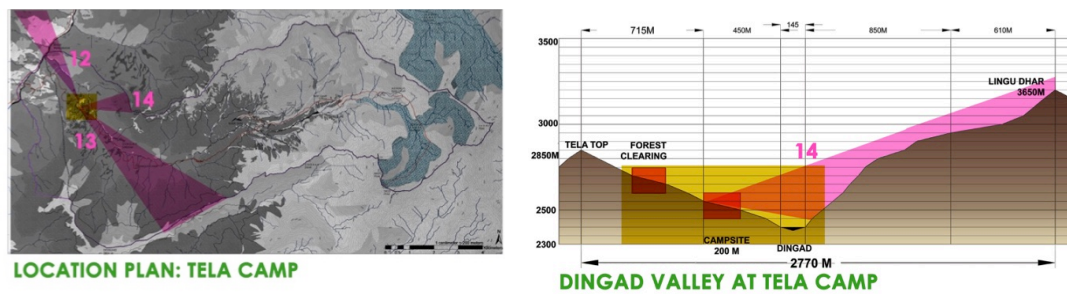


Figure 41 : Location of the tela campsite: Plan (left) & Section (right)

Tela a historic forest village is situated at an altitude of 2400m at a distance of 7kms from the entry point on the NH. It is the first essential pause point & a night halt along the trek route. With a walking time of 4-5 hours it is well connected to the road & surrounding villages. This location has a large clearing to house a no of tourists; moreover the villagers own farmlands that have been abandoned over the years due to extensive labor for trasportation to uttarkashi.

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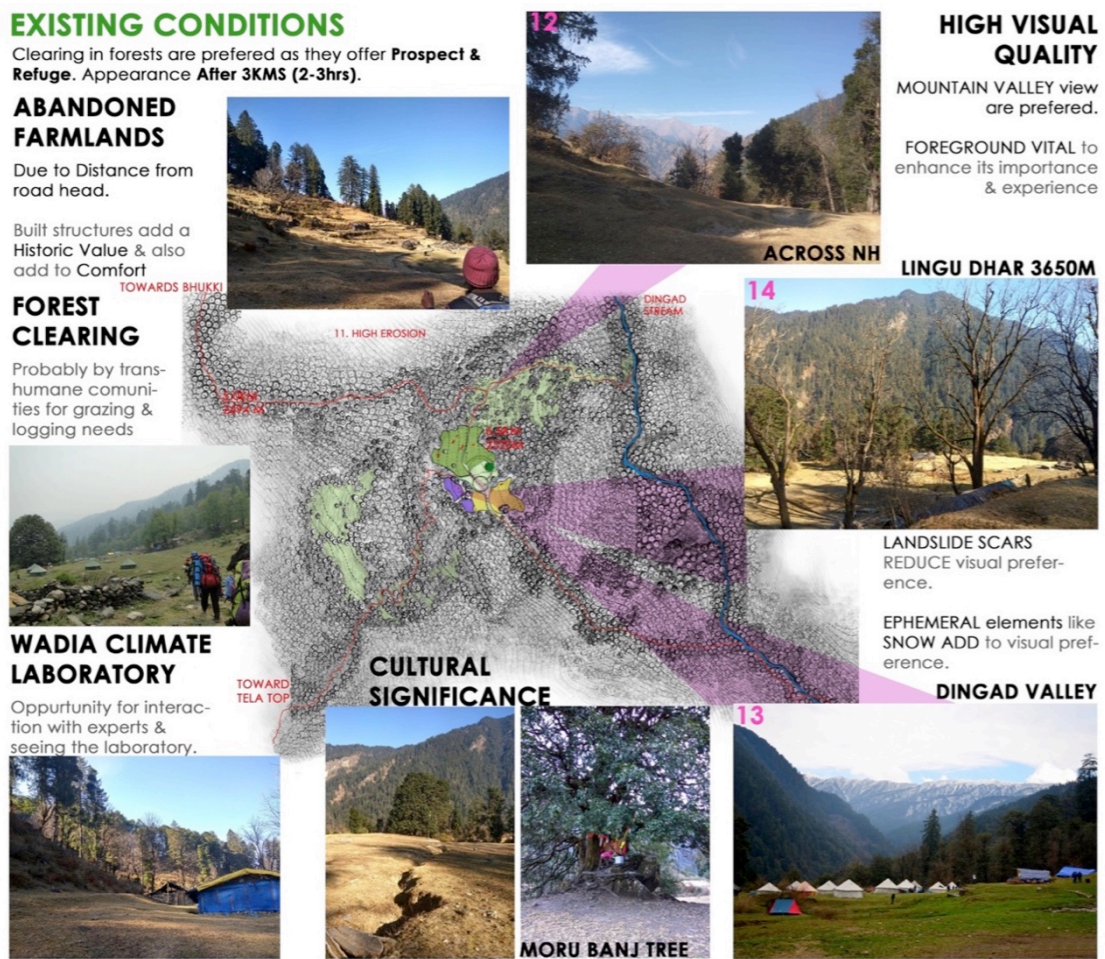


Figure 42: Documentation of existing conditions at Tela Camp.

It is also a location of Scenic and Socio-cultural importance. This location has the potential to function as a ecotourist agrarian village. With a walking distance of 4-5 hrs and surrounded by scenic beauty it is ideal location for first time trekkers & nature lovers who can devote only little time due to their busy schedules.

This location is to be developed as a community supported cultural tourism site. The agriculture fields are revived to provide to the tourists. Connectivity to the water stream & short trails in the forest need to be added to improve the experience for short time travellers. Design, planning & management to support large scale visitation is also essential.

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7.3.2 Pause 2: Gujjar Hut

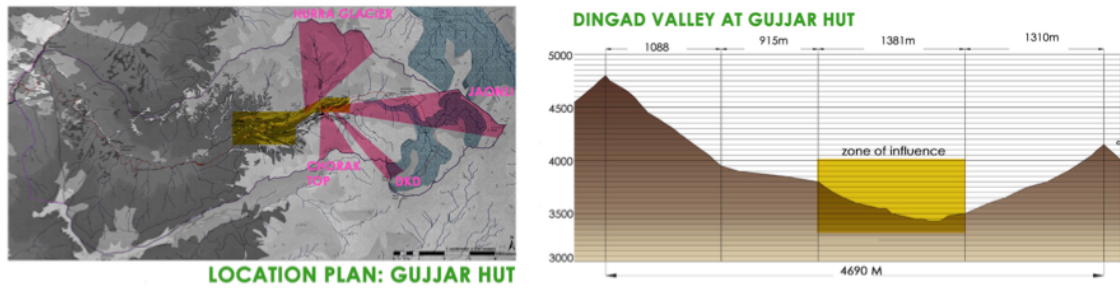


Figure 43: Location of Gujjar hut campsite, plan (left) and section (right).

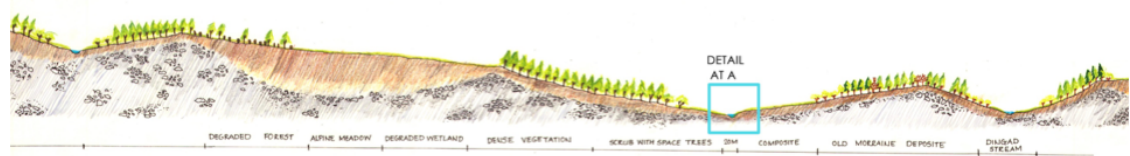


Figure 44: Section through the zone of influence

Gujjar hut (3500m) is a large alpine meadow & supports seasonal grazing. The Van gujjars migrate along with their cattle and reside in the meadows from April end to August. This is usually the second essential overnight halt at a distance of 13kms from tela. It is a long walk, strenuous of 7-8hrs in the dense forest to reach this location. A few tourists take a halt within the forest, but it is usually avoided due to danger of attacks from wild animals.

This is one of the most scenic locations along the trek; extensive bughals, towering peaks, a high variation in flora & occasional spotting of rare fauna along with the termination of the treeline make it highly preferred.

EXISTING CONDITIONS

GLACIAL LAKE CULTURAL IMPORTANCE

1. Annual visit by villagers
2. Myth about not entering the lake
3. Geological connect
4. Scenic value



HIGH VISUAL QUALITY

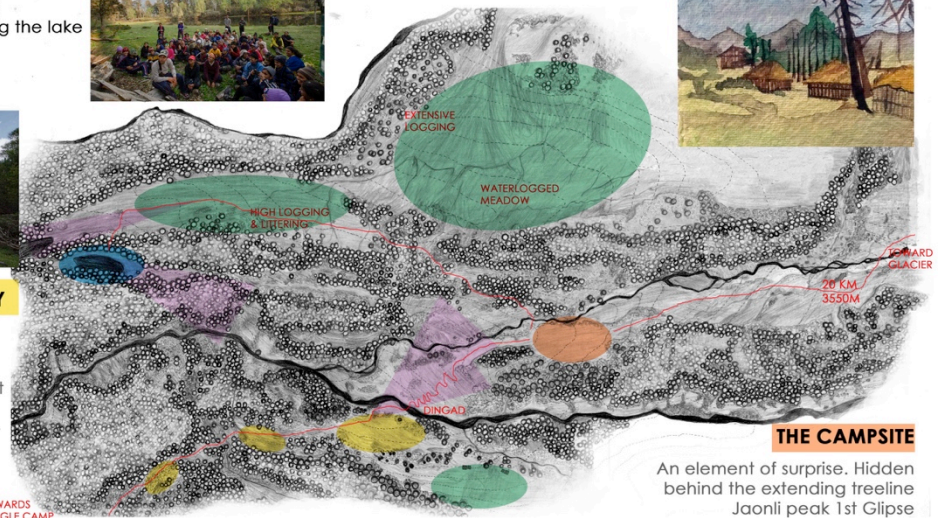
Opening up of the viewshed in a series of transition

1. Sculptural Semru Forest (rock dominated)
2. Colorful Meadow foreground added
3. Snow Clad mountain backdrop, viewshed larger/ distant

TOWARDS
JUNGLE CAMP

PASTORALIST LANDSCAPE

OVERUSED/ DEGRADED
CONDITION OF MEADOW.
HIGH SCENIC QUALITY
(PROSPECT & REFUGE)



THE CAMPSITE

An element of surprise. Hidden behind the extending treeline
Jaonli peak 1st Glipse

DINGAD VALLEY AT GUJJAR HUT

Figure 45: Documentation of existing conditions of Gujjar hut

This location conveys a story of its landscape formation; displaying a variety of landforms and features. This is to be developed into an open geological & geomorphic museum. This would give the visitors a better understanding & increase the respect for the landscape. Maintenance of this museum would also provide livelihood to the locals while attracting more tourists.

7.4 Critically important locations in the Landscape.

The campsites are the locations suffering the maximum stress in the landscape. **Tela camp** being easily accessible & with people owning land this region would suffer great damages if not designed & managed properly.

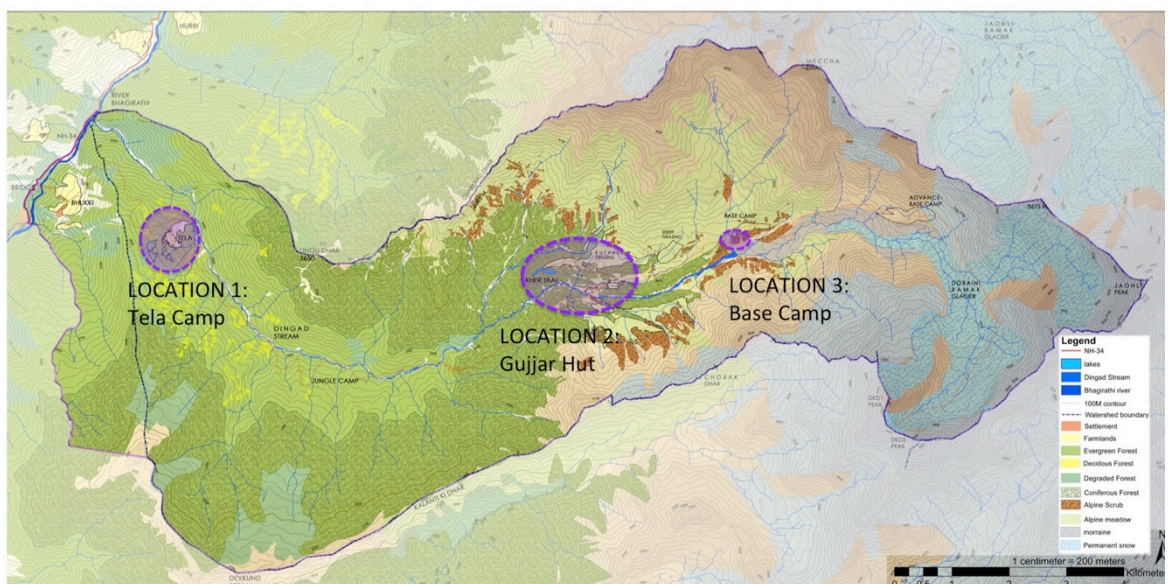
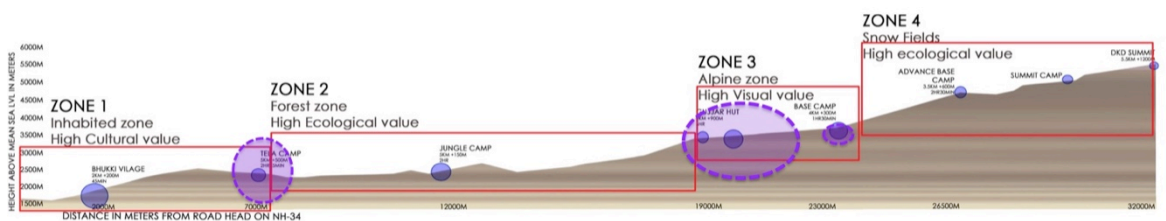
Gujar hut being a highly preferred site by locals, visitors & fauna, experiences conflicts of land uses. It is very likely that these conflicts would increase if the movement of all is not properly managed.

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It is also observed that these two existing campsite locations also possess important elements scenic, socio-cultural & ecological values. Preserving this is critical to preserving the identity of the landscape.

The **entry to the site on** the NH is not well defined, only people with prior knowledge about the location visit the landscape. Adding signages & designing a gathering space would help in attracting more visitors. It would also plot the landscape as an important location in the Uttarakhand tourist map.

The trail is the next, as most vulnerable to the increasing visitation. Trail compaction, degradation of ecology along the edges, accumulation of non-degradable waste, reduction in habitat for core species, and events of people venturing into the forests & disturbing the ecology are predicted. After



Map 19: Map showing critical locations

developing the campsites attention towards designing and management of the

Evanescence

trail is essential. Addition of anchor points & facilitating pause at important locations along the trail would be important.

7.5 Preparation of the Landscape development Brief

7.5.1 Design:

Detail design solutions are essential at various locations to enhance the user experience in the landscape. These would include designing locations for halting along the trail, campsite design, design of congregation spaces, design of signages and maps directing and educating the people about the landscape.

7.5.2 Planning & Management

Solutions for management of waste, both degradable & non-degradable need to be managed. Access to water for drinking, treatment of used water before it joins back the water stream is also very important. Management of grazing lands, introduction of alternative fuel to reduce cutting of the forest, maintenance of the campsites & the trail are all of importance. Setting up of checkpoints and appointing people to monitor hunting & extraction activities would also be essential. Locals need to be involved at various stages as service providers & stakeholders ensuring the proper functioning of the planned landscape.

8 Design & Management Policies

8.1 Design Determinants

A few parameters & approaches for the design were decided upon based on the existing site conditions.

8.1.1 Affordances:

Taking advantage of the existing setting to retain naturalness, reduce the energy spent on building otherwise, introducing minimal changes in the natural environment to make certain human actions more intuitive.

For example, at a location close to water stream with a view of the valley has a few large rocks. Using these rocks & rearranging them so they can be used to sit & interact while enjoying the view of the valley. Adding details like a connection to the main trail, a flowering plant that would attract attention, etc is an example of affordance.

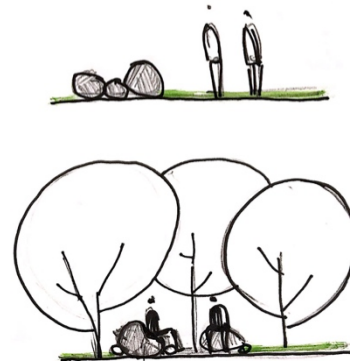
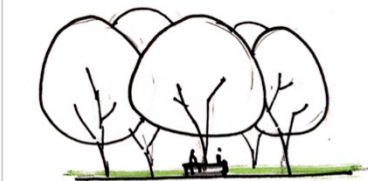


Figure 46: Affordances

8.1.2 Legibility & Anchor Points

In a natural setting, like a forest trail the surroundings look quiet similar & with no one to ask for directionality for miles, its sometimes difficult to gauge if one is on the right trail. Small interventions, like landart sculptures, milestones, signages, etc that act as anchors should be placed at regular intervals along the trail.



ANCHOR POINTS

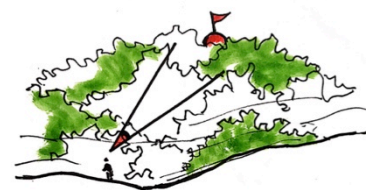


Figure 47: Legibility & Anchor points

Also while walking in the forest, due to lack of

Evanescence Design and Management Policies

knowledge an individual misses on few unique elements of the landscape. Like certain endemic plant species, the habitat of a unique bird etc. Improving legibility would mean adding certain elements like signages, etc that would force a person to stop and observe, improve their knowledge enroute.

8.1.3 Approaches

The location of the observer with respect to what has to be observed is very important. This regulates the emotions & feel within a spatial setting. Being on top of a hill with the view of the valley can make the person feel powerful, while standing in the valley surrounded by magnificent peaks could make him feel small. While designing the trail & locating the campsites this is an essential consideration. Care is taken that

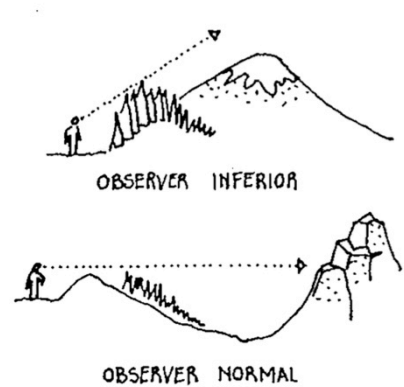


Figure 48: Approaches

a person approaches the landscape feeling submissive, with a intent that he respects what is there, rather than trying to modify it by taking control over it.

8.1.4 Visual perception parameters

Visual perception distances play an important role while designing on large site where detailing the entire area is not possible. The standard distances, upto 1m for foreground, upto 5m for middleground & beyond as background is taken into

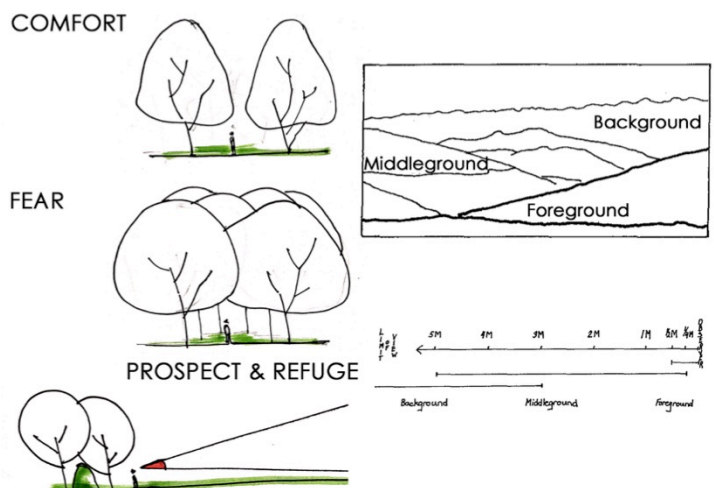


Figure 49: Visual Perception

consideration. Detailing in the landscape is done only in the foreground zone, some mass effects like planting are done in the middle ground, while the

Evanescence Design and Management Policies background is retained as it is. Only an attempt to blur prominent scars of landslides etc is done in these zones.

8.1.5 Ecological & Socio-cultural Considerations

Ocasional presence of colorful elements like alpine flowers are a treat to the eye & also create a soothing ambience. The himalayans are known for its abundant floral diversity and colorful flowers. A very few of these flowering species are seen along the trail. Planting of flowering species is done at intervals to increase legibility & retain interest. Rare & ecologically important plants, mainly flowering varieties are grown at campsites and along the trail.

These also attract pheasants which are unique to this eco-region. Ocasional soundscapes & presence of fauna enhance the experience of the viewer. An attempt is made to improve the ecology increasing the probability of these events.

Also locations that are socio-culturally important to the locals are preserved, highlighted along with information about its importance.




























SOCIO-CULTURAL CONSIDERATIONS



Figure 50: Ecological & socio-cultural considerations

EvanescenceDesign and Management Policies

Figure 51: Selected Plant palette

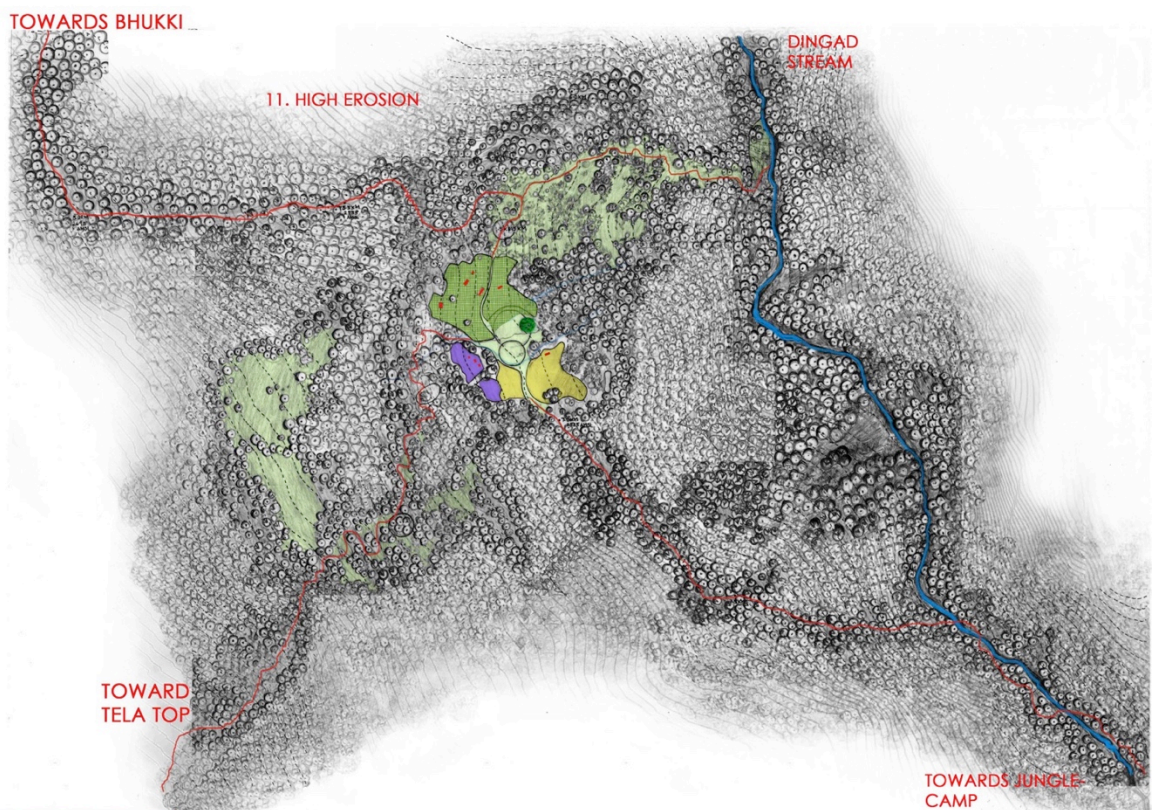
				<p>SELECTED PLANT PALLETTE FOR TELA CAMP</p> <p>COLORS TEXTURES & FORM</p>
<p>INDIGOFERA HETERANTHA:HIM INDIGO HT:2-3M, FLOWER: MAY-JUNE ECO/ HABIT: DROUGHT TOLERANT</p>	<p>CARDIOCRINUM GIGANTEUM: HIM GIANT LILY HT: 2M, FLOWER ECO/ HABIT:PARTIAL SHADE, MOIST WELL DRAINED, FRAGRANT</p>	<p>LEYCESTERIA FORMOSA HONEY-SUCKLE HT:1-2M ECO/ HABIT: BIRD ATTRACTING FLOWERING: MAY-JULY</p>	<p>FUCHSIAS: NATURALIZED WHITE-DARK RED PURPLE-BLUE HT:1-2M, FLOWER: MAY-AUG ECO/ HABIT: DROOPING, ORNAMENTAL, MEDICINAL</p>	
				<p>SELECTED PLANT PALLETTE COMMON FROM TELA TO GUJJAR HUT TELA</p>
<p>HYDRANGEA HETEROMALLA (WHITE, PURPLE) HT:2-5M, FLOWER: JUNE-JULY BIT: SUN TO PARTIAL</p>	<p>PAEONIA EMODI : HIM PEONY (PINK) HT: 30-75CM, FLOWER: APRIL-MAY ECO/ HABIT:SHRUBBY, MEDICINAL, WELL DRAINED & FERTILE</p>	<p>ERIGERON ACER VAR. MULTI-CAULIS HT:40-60CM, FLOWER: MAY-JULY ECO/ HABIT: PERENNIAL HERB</p>	<p>RIBES HIMALENSE : HIM GOOSEBERRY HT: 1-2M, FRUIT: JUNE-AUG ECO/ HABIT: EDIBLE, AWAY FROM PINE</p>	
				<p>SELECTED PLANT PALLETTE COMMON FROM TELA TO GUJJAR HUT TELA</p>
<p>GENTIANA KURROO HT:60-90CM, FLOWER: AUG-OCT ECO/ HABIT: HERBACEOUS, SPREADING</p>	<p>ANEMONE OBTUSILOBA : ANEMONE(WHITE/ YELLOW) HT:15-20CM, FLOWER: MAY-JULY ECO/ HABIT: HERB, SPREADING</p>	<p>PRIMULA DENTICULATA HT:15-30CM ECO/ HABIT: UPRIGHT FLOWERING: APRIL-JUNE</p>	<p>IRIS : DECORATA, KUMAONI HT:50-60CM FLOWER: APRIL-MAY HABIT: SLENDER, FIBEROUS ROOT WITH RHIZOME</p>	
				<p>SELECTED PLANT PALLETTE COMMON FROM TELA TO GUJJAR HUT TELA</p>
<p>SINOPODOPHYLLUM HEXANDRUM: HIM MAY APPLE (WHITE/ PINK) HT:15-40CM FLOWER:MAY-AUG MOIST CONDITIONS, ORNAMENTAL, MEDICINAL</p>	<p>GERANIUM HIMALAYENSE HT:10-12CM, FLOWER: JUNE-AUG HERBACEOUS SPREADING PERENNIAL</p>	<p>PENNISETUM FLACCIDUM : (PURPLE) HT:30-120CM ECO/ HABIT:ORNAMENTAL SPIKELET: JULY-AUG</p>	<p>CALTHA PALUSTRIS: MARSH MARGOLD HT:10-20CM, FLOWER: MAY-AUG ECO/ HABIT: ALONG STREAMS,</p>	
				<p>SELECTED PLANT PALLETTE COMMON FROM TELA TO GUJJAR HUT TELA</p>
<p>WALDHEIMIA GLABRA HT:40-60CM ECO/ HABIT: SPREADING FLOWERING: JULY-SEPT</p>	<p>MECONOPSIS ACULEATA : HIM POPPY(REDF/ BLUE) HT:40-60CM, JUNE-SEPT ECO/ HABIT: HERBACEOUS ANNUALS</p>	<p>VIBURNUM GRANDIFLORUM HT:1-3M, FLOWER: APRIL-MAY ECO/ HABIT:LARGE SHRUB</p>	<p>LEONTOPODIUM HIMALAYANUM: HIM EDELWEISS HT:15-20CM, FLOWER: JULY-OCT ECO/ HABIT: GLOBULAR</p>	
				<p>SELECTED PLANT PALLETTE COMMON FROM TELA TO GUJJAR HUT TELA</p>
<p>CALAMAGROSTIS EMODENSIS: GHARWAL REED GRASS HT:90-120CM, FLOWER: JULY-SEPT ECO/ HABIT: PERENNIAL CREEPING RHIZOMES</p>	<p>POLYGONUM AFFINE: HIMALAYAN KNOTWEED HT:40-60CM, FLOWER:JUNE-SEPT ECO/ HABIT: MAT FORMING, ERRECT</p>	<p>HIMALAYAN MARSH (PINK/PURPLE) HT:15-20CM, FLOWER: JUNE-JULY ECO/ HABIT:ERECT, MARSH, MEDICINAL HERB</p>	<p>SAXIFRAGA CERNUA: HT:15-20CM, FLOWER:JULY-SEPT ECO/ HABIT: MOIST SANDY PLACES</p>	
				
<p>SPIRAEA ARCUATA (WHITE & PINK) HT:50-100CM, FLOWER: MAY-JULY ECO/ HABIT:RIVER BANKS</p>				

8.2 Design of the Pause Locations

8.2.1 Tela Camp

This site is developed for Community based Cultural Tourism. Agriculture is restored here to support the tourism in the valley. A variety of living experiences including living in homestays with farmlands, living in Koti-banal style dormitories & living in tents are made possible. Experiencing the traditional lifestyles & practices like making rhododendron juice, Ringal bamboo products, and using Pangar seeds as detergent are some activities that the visitors could indulge into.

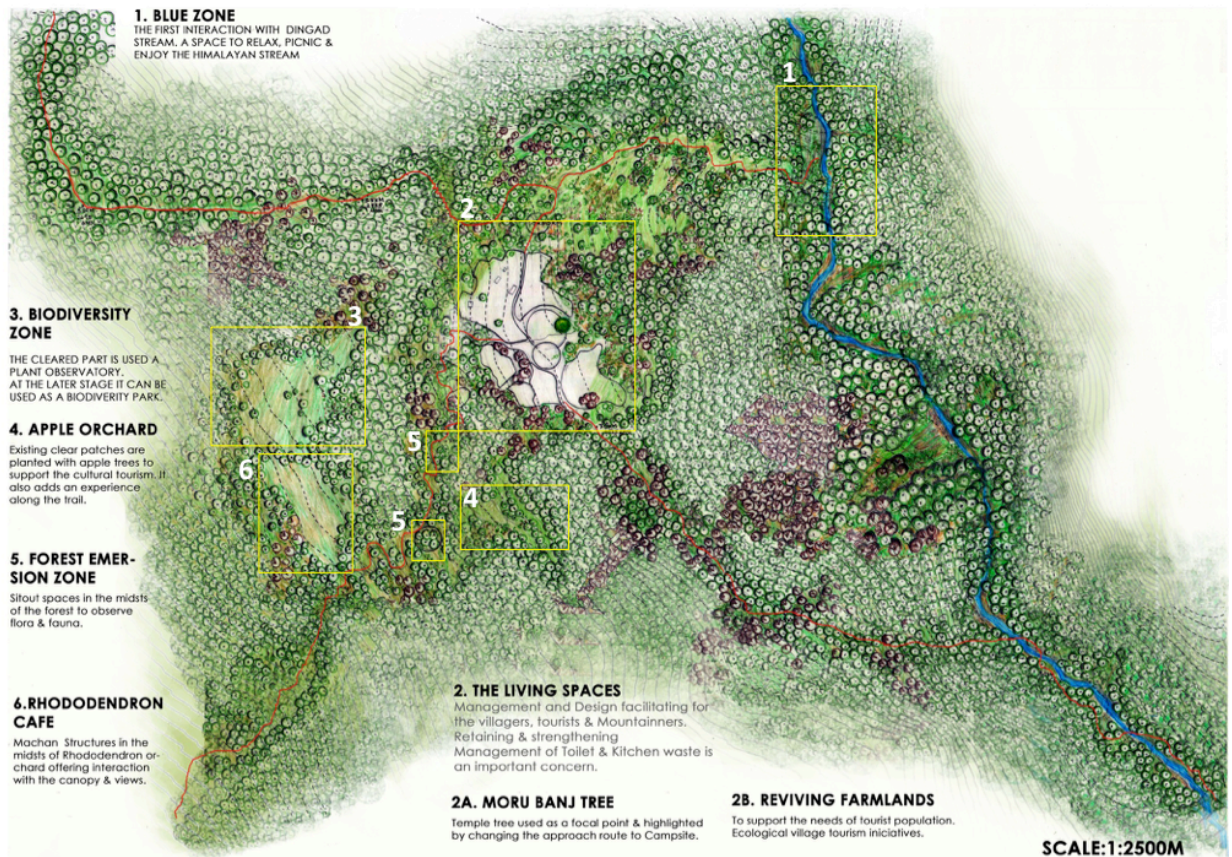
As an attempt to ensure that the visitors get to experience spending time in the wilderness & interact with nature short trails to the Dingad stream & into the forest to Tela top are enhanced.



Map 20: Map highlighting locations for design intervention at tela camp

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Creating a memorable experience, by improving visual quality of the space, is the key to developing the Tela camp. Another important motto is to strengthen the local economy, involving them in service-based tourism activities & shifting their dependencies from extraction based systems.



Map 21: Design Zoning Plan of Tela camp

8.2.1.1 The Blue Zone:

The trail to dingad stream & the area around it forms the blue zone. This is developed to facilitate the first interaction of the people with Dingad Stream. It is a short trail of 2kms downhill into the valley from the entry of tela camp. The trail terminates along the banks of dingad, with wooden decks leading to the waters edge & spaces provided for picnic. Water loving alpine plants & grasses are planted on the edges of the deck creating an ambience.

Figure 52: Plan of the Blue Zone

1. The Blue Zone : The First interaction with Dingad Stream

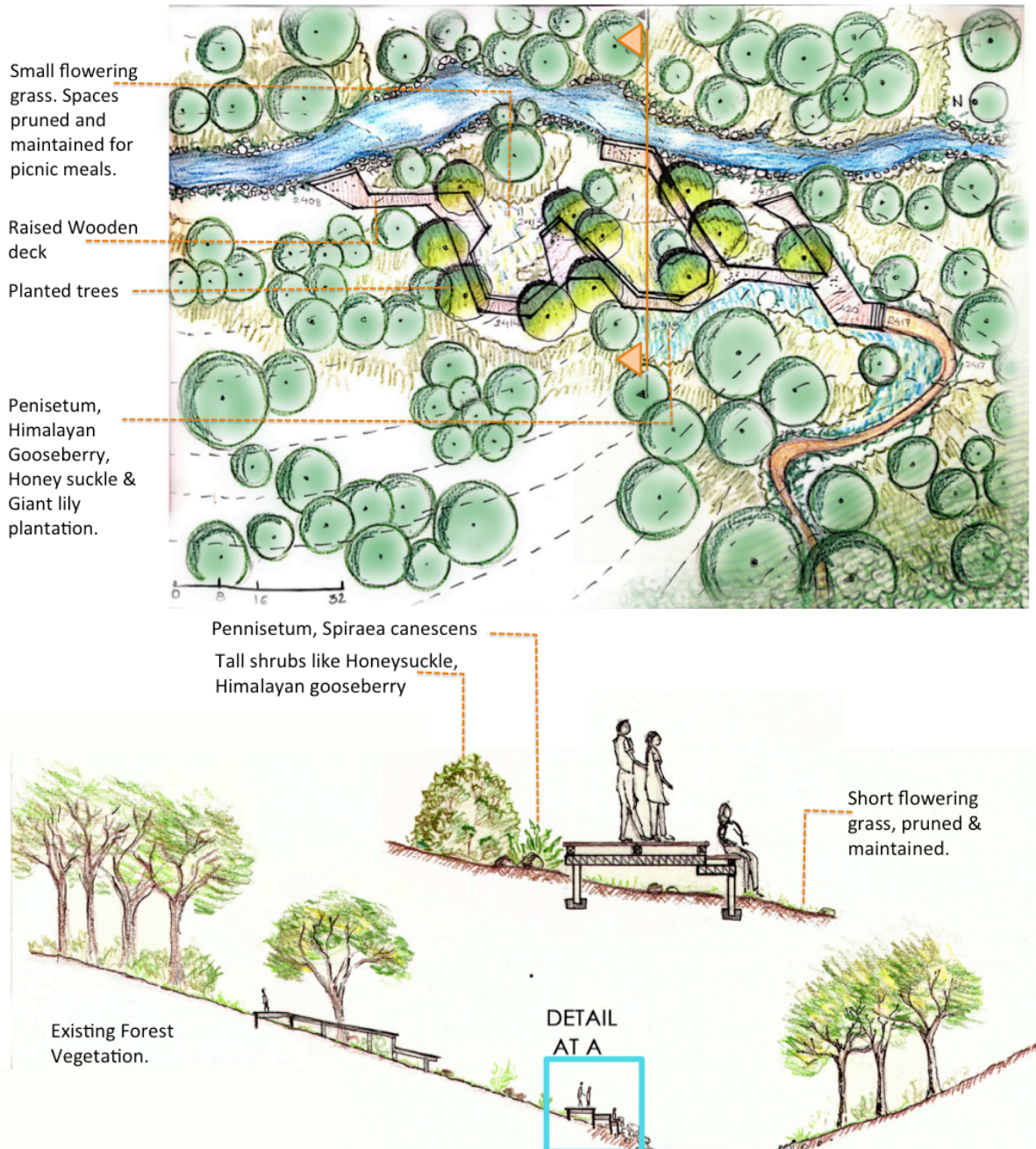


Figure 53: Sections through the Blue zone

8.2.1.2 The Living Spaces:

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The area surrounding the temple tree is terraced offering a better visual connectivity this area functions as a congregation space. The entire living zone is landscaped with beautiful alpine flowers, shaded canopes, benches offering views & terraced slopes. A place for campfire, while enjoying the view of the valley is designed at the entrance of the forest village. Instalations displaying the relationship of the locals with the forest are potrayed as sculptures made by locas at nodes.

valley is designed at the entrance of the forest village. Instalations displaying the relationship of the locals with the forest are potrayed as sculptures made by locas at nodes.

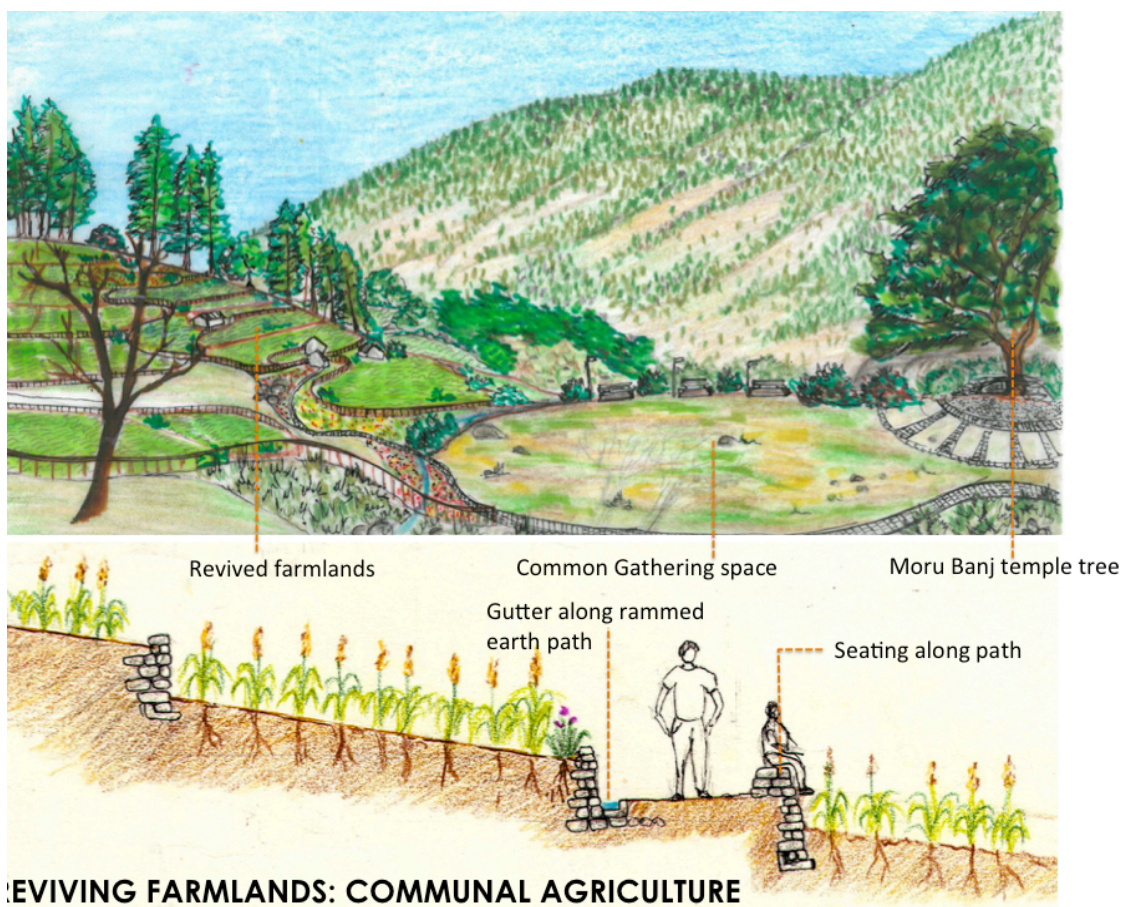
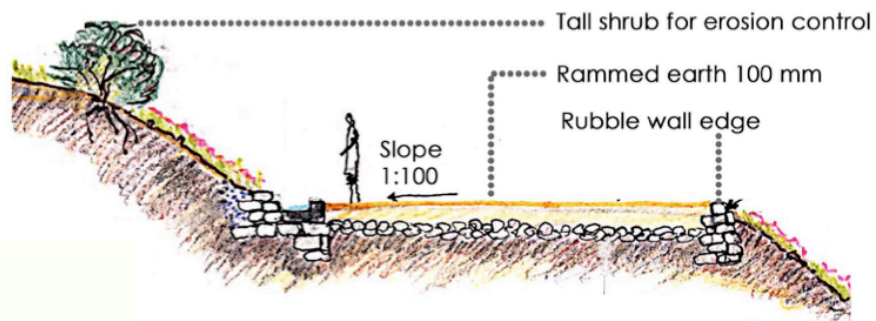
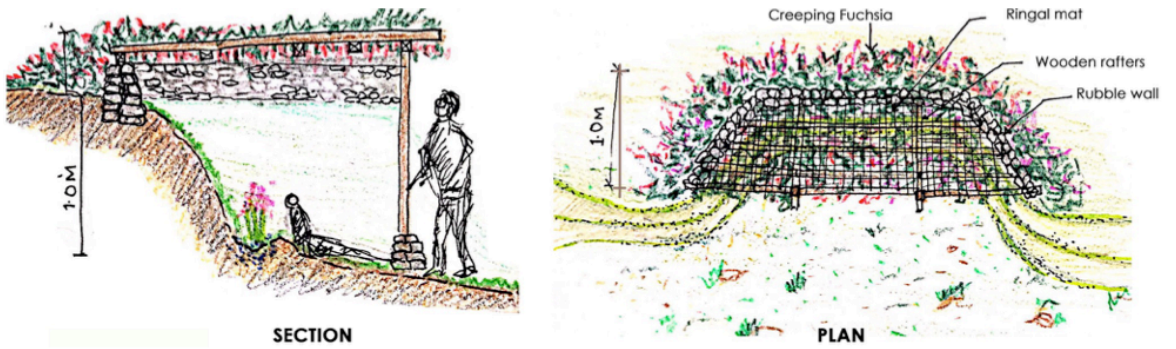


Figure 56: Section through the revived farmlands

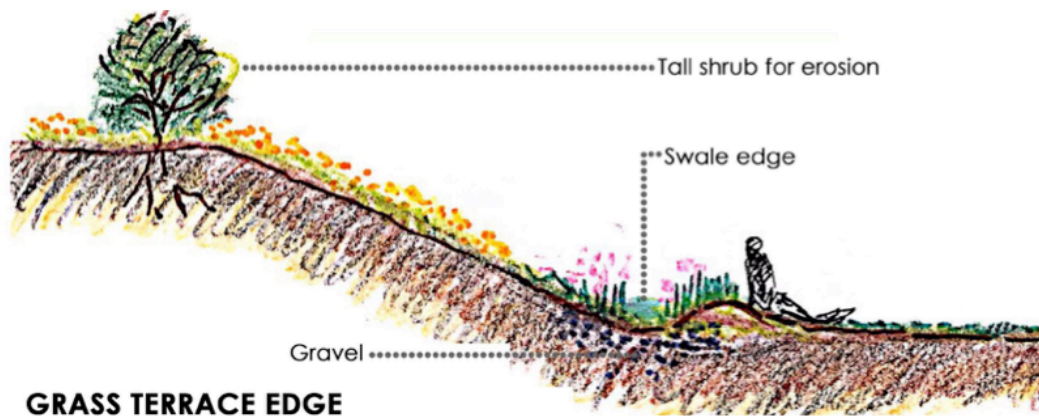
Some of the landscape details developed can be seen in the images below.

Figure 58: Plan and section of the Fuchsia Canopy overlooking the Temple tree



RAMMED EARTH TERRACE DETAIL

Figure 57: Section showing rammed earth terrace detail



GRASS TERRACE EDGE

Figure 59: Section through the Grass terrace edge.

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8.2.1.3 *Managing water & Waste*

This is one of the prime concerns in the living zone. Multiple sets of dry trench toilets are prepared on the site. Once full these trenches are introduced with inoculating cultures of bacterium & the next set of toilets are opened for use. By the time the last set of toilets are full the first has completed decomposition & is ready for use. The kitchen waste is also decomposed in pits similar to the toilet trenches.

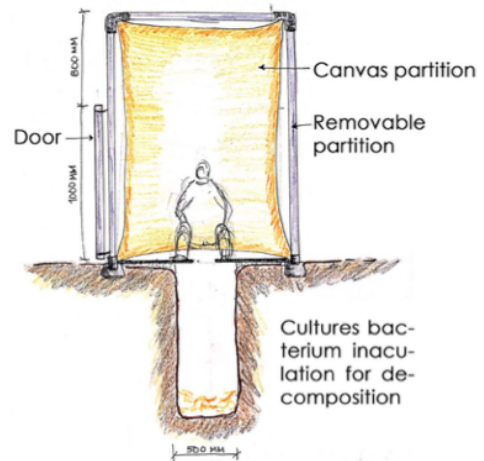


Figure 61: Section of the Trench toilet

The stream emerging from the forest and moving downhill to meet dingad is tapped for water. Bunds are made & planted with reeds for water purification. This purified water is stored in covered tanks with a tap. This is located close to the kitchen. The used water from the kitchen is made to pass through a swale to the stream & then through two stages of reed beds before joining the Dingad.

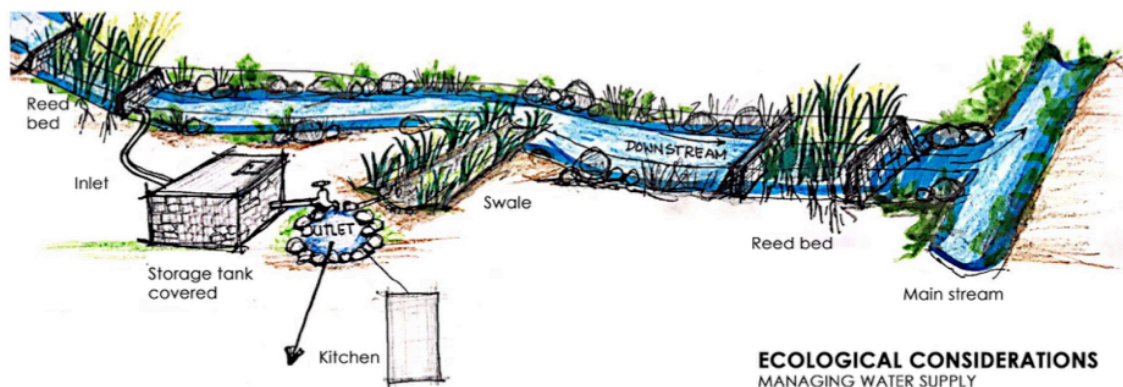
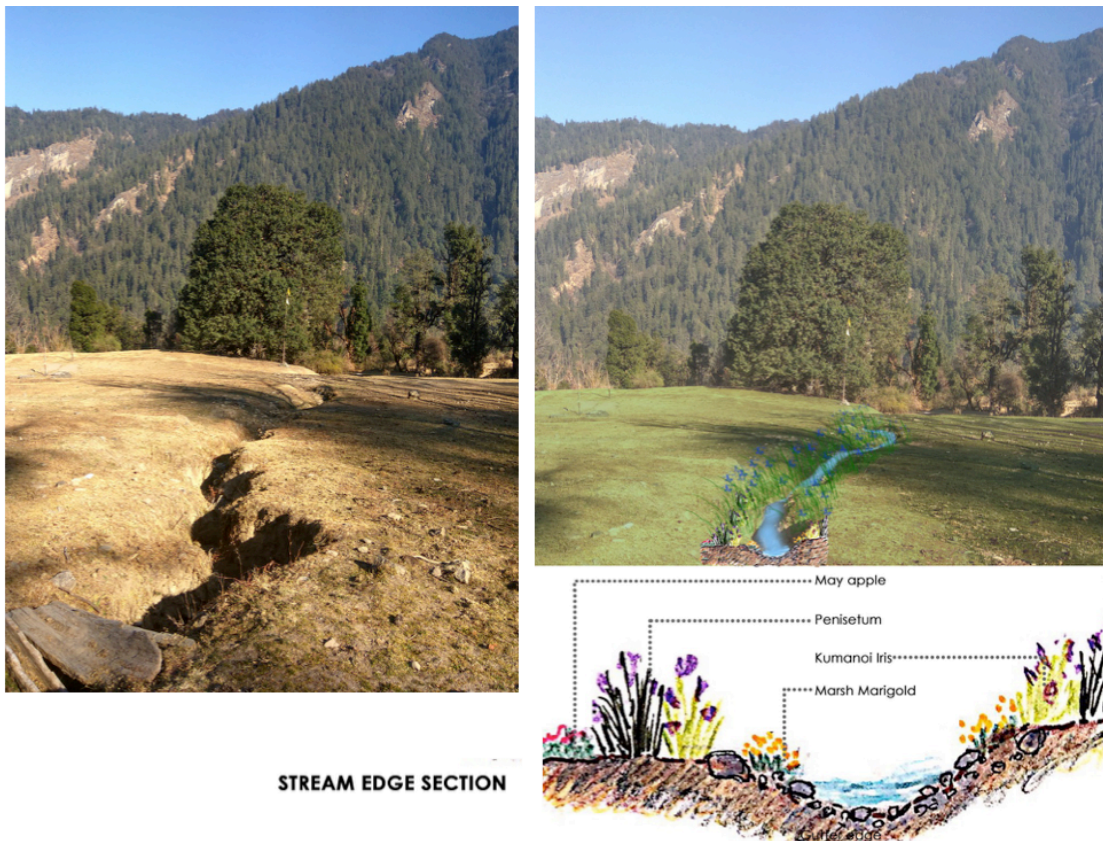


Figure 60: Sketch showing the ecological water management system



STREAM EDGE SECTION

Figure 62: Sketch and section showing the modified stream edge

8.2.1.4 Trail to Tela Top

The trail towards tela is designed to experience nature emersion. This includes the rhododendron forest & café, biodiversity zone, apple orchards & sitout spaces to enjoy the biodiversity in the forest. The biodiversity zone in the initial phase of development would function as a nursery for growing the various

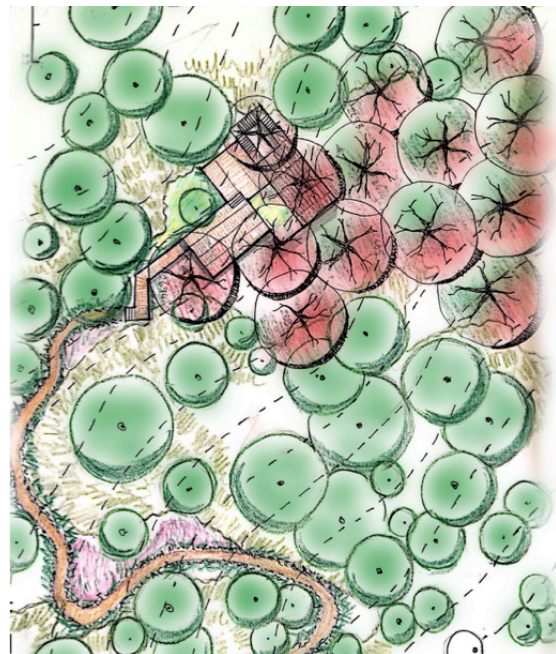


Figure 63: Plan of the Rhododendron cafe
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flowering species. It would be like a laboratory to check the growth of rare himalayan herbs & flowering plants before planting them at campsites & along the trail.

A bamboo viewing tower, emerging from the rhododendron canopies is built attached to the café offering views of the valley. The apple orchard is managed by the local community & a nominal entry is charged to enter & enjoy apples plucked directly from the trees.

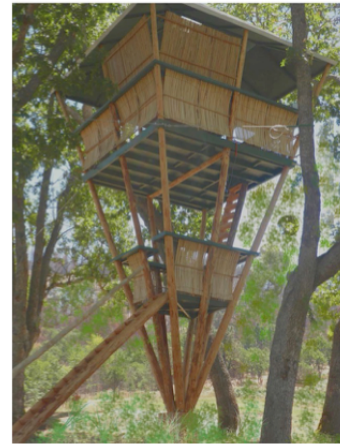


Figure 64: The bamboo viewing tower.

8.3 Gujjar hut

This is the most beautiful, complex & diverse location in the landscape. It is highly preferred by the pastoralists, tourists as well as large ungulates; overlapping landuses & extensive modification of ecology is commonly observed. The main objective of developing this to differentiate various landuses & manage them to ensure they function without disturbing each other and have the least impact on ecology.

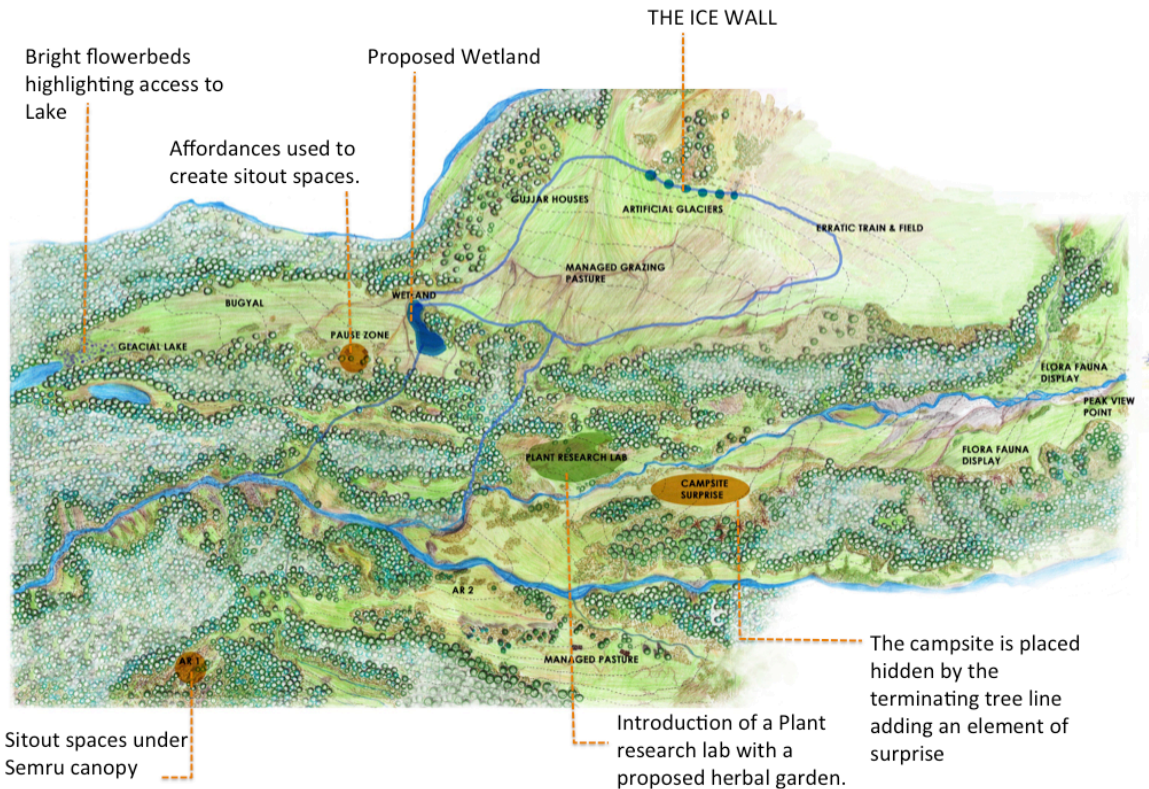
The landforms display a wide range of geomorphic features & narrate the story of its creation. This site is developed into an openair museum of Geomorphology improving the legibility & narrating the story in a manner that is more intuitive to understand.

Being at the edge of the treeline these bugyals offer 180 degrees views of the majestic himalayas. Also the moraine & its extending treeline isolates Khera tal & its bugyal as one enters the valley. It is an element of surprise & reveals itself slowly as one walks over the moraine for 15-20 mins from the camping location.

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Semru forest lounge, the herbal gardens, campsite, the wetland, the bugyal café, Khera tal, the ice wall & the various sites of geomorphic museum are the points of interest developed at this location.

Gujjarhut Campsite: Proposed Scenario Plan.



Map 22: Design zoning plan of Gujjar hut campsite

8.3.1 Improving Legibility

Poppies and gentianas are planted along the edges of the treeline directing the visitors movement towards the lake.

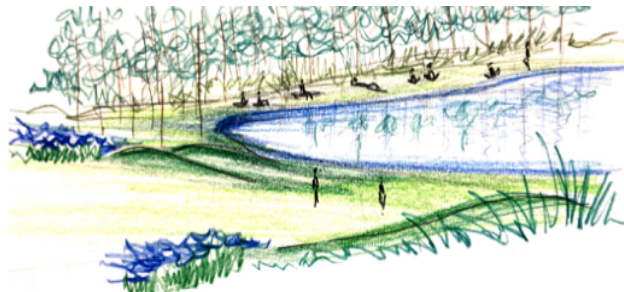




Figure 65: Highlighting the approach to khera taal

8.3.2 Signages:

This zone is home to a number of high altitude fauna including large ungulates, snow leopard and himalayan brown bear. An outline of the animal is added as a signage in their natural habitat. These are weaved in ringal by the local women and changed annually.



Figure 66: Informative signages at gujjar hut

8.3.3 The Ice Wall and the Wetland

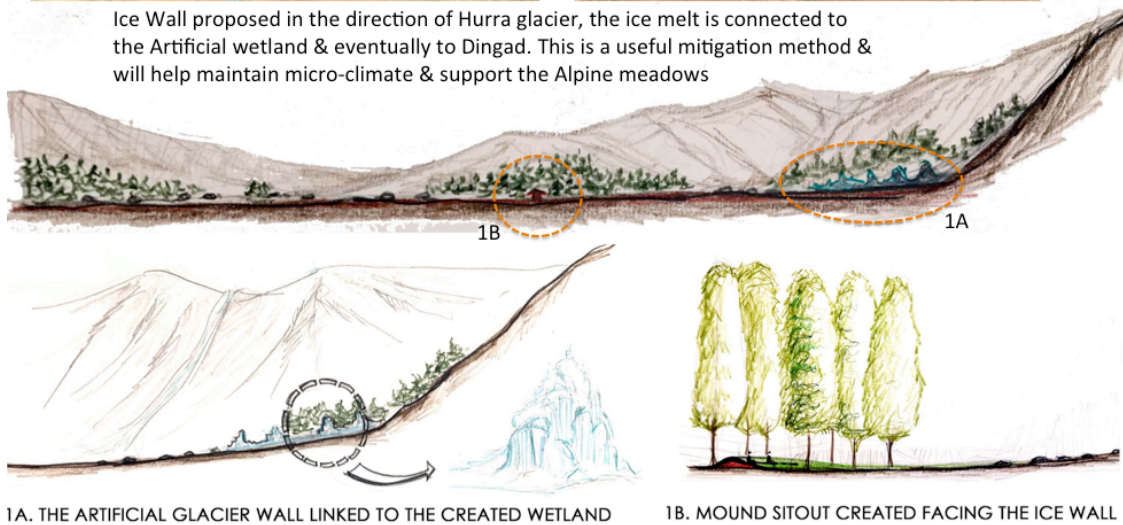
The ice wall is proposed in the direction of the historic hurra glacier. It is used as an aesthetic element, a narrative & as a mitigation strategy to maintain the micro-climate of the region. A channel surrounding the alpine meadow is used to carry the meltwaters & direct it to the created wetland. Overflow from this joins the dingad stream.

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The channel & the wetland both need to be maintained and excessive sedimentation needs to be cleared to ensure proper functioning of the system.



Ice Wall proposed in the direction of Hurra glacier, the ice melt is connected to the Artificial wetland & eventually to Dingad. This is a useful mitigation method & will help maintain micro-climate & support the Alpine meadows



1A. THE ARTIFICIAL GLACIER WALL LINKED TO THE CREATED WETLAND

1B. MOUND SITOUT CREATED FACING THE ICE WALL

Figure 67: Sketches of the Ice wall placement

8.3.4 The Bugyal Lounge

A lounge is created at the edge of the bugyal to enjoy its expanse. A degraded zone, where the Van gujar houses were once located is used. This is at the entry of the bugyal & in between the created wetland, with a forest edge. The stubs of the cut tree, the paved stone base of the gujjar houses & the wood from the old hut is used for the creation of this space.

The paving & cut barks of trees are used as affordances & used to the advantage of creating sit out spaces facing the created wetland.



5. GUJJAR HUT TO PAUSE: TAKING ADVANTAGE OF THE CREATED SETTING

Figure 68: Sketches of the Bugyal lounge

8.4 Entrance to site & Along the trail

8.4.1 The Entry

The entrance to the site is on the NH to Gangotri, there are a few shops along the road that mark its vicinity to a village. Only visitors with prior knowledge of the space would be able to locate the entry. A passerby, would not know that

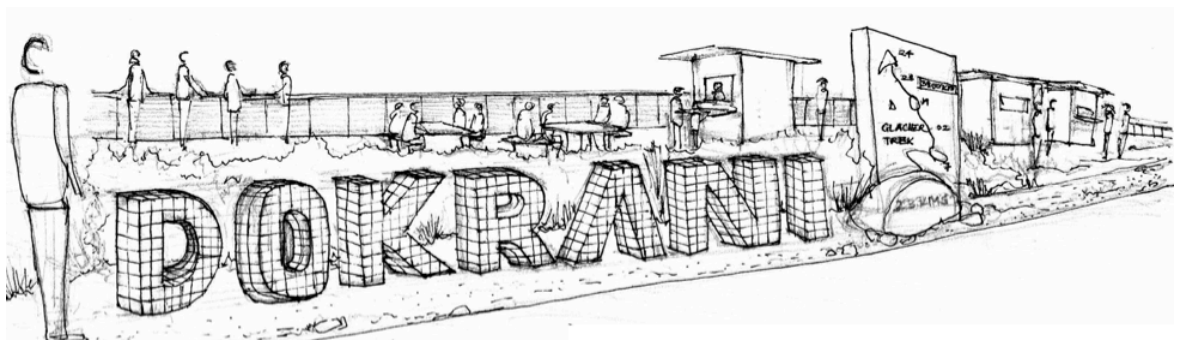


Figure 69: Sketch showing the entry to site

there is beautiful nature trail with camping sites & cultural experiences.

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Designing signages, information kiosk & a waiting zone to attract & cater to the tourist is essential.

8.4.2 Along the Trail.

The trail to the village is used on a daily basis by people & cattle, often with heavy loads. The road from the

Nh to the village is highly compacted and eroded. River stones in concrete are embeded with cement channels at the edges for the roads. This detailing is used only in areas of regular high thoroughfare all through the year. The pathways withen the village, at tela living area & campite at gujjar hut & basecamp are paved with locally available stones.

All other pathways are retained as rammed earth pathways. Walking long distances with load is better on earth than on stone as they have less impact on the knees. The edge of the rammed earth pathway is left natural, but regular pruning is done upto 1 metre on both the sides. Flowering grasses are planted on the pathway edge to mark arival to a location of importance.

Signages, milestones & anchor points are essential to guide the movement along the trail. Stone being the most abundant



Riverstone Pathway on route to Village with heavy daily wear & tear.

Figure 70: Section of paved pathway

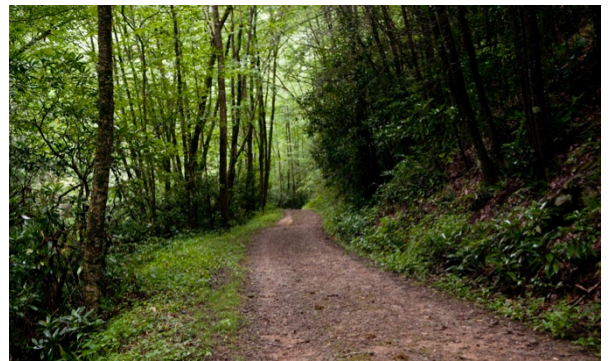
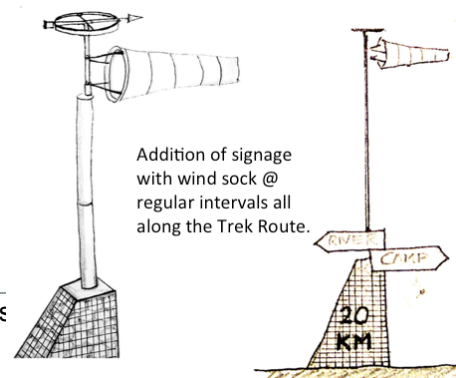


Figure 71: Edge detail of the rammed earth pathway all through the site (top) and at locations marking entry (bottom)



Addition of signage with wind sock @ regular intervals all along the Trek Route.

Figure 72: Milestone design

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material on site it is used, filled in a wiremesh to form milestones. A wind sock, altitude gauge, direction marker & signages are all merged with the milestone. These are placed at every km on the site.

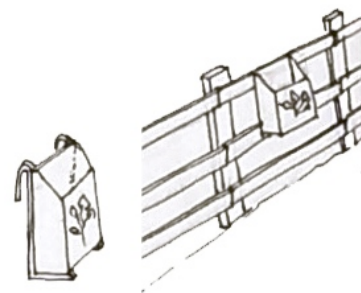
Highly eroded zones are fenced and boxes with seeds are placed on the fence. The trekkers can participate in restoring the ecosystem by dispersing



Figure 74: Sculptures & space markers along the trail

the seeds. Signages with date of start of plantation drive & removal of fence is added at each of these locations. This process helps in developing bonds of people with the landscape

Figure 73: Fencing around highly eroded areas

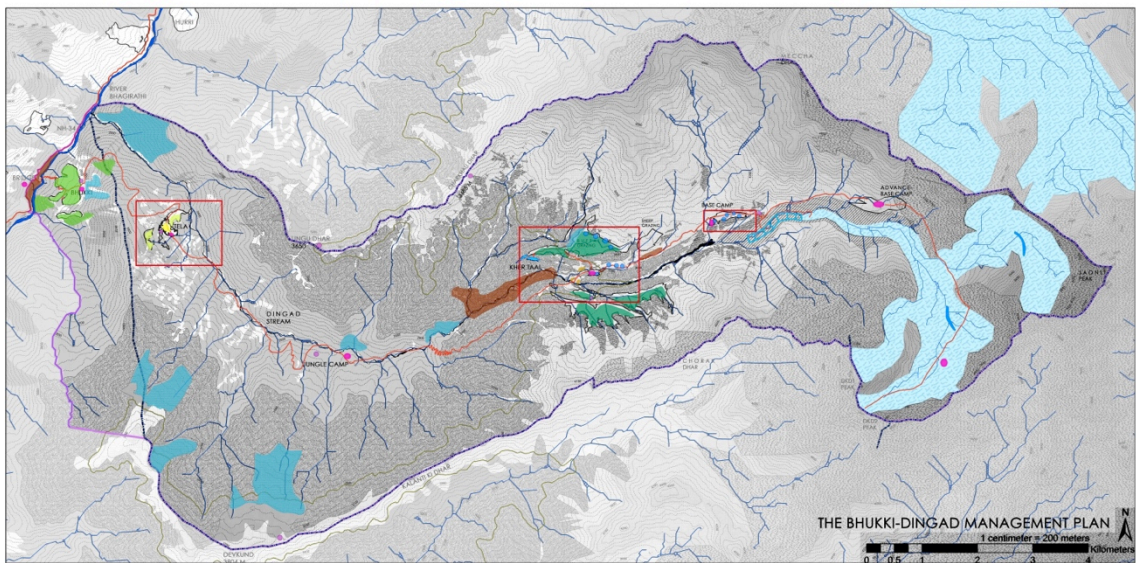


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around.

Anchor points that give an assurance that one has not ventured off trail while retaining interest are placed at intervals along the trail. These are earth art sculptures made of natural elements. They are used to frame important objects, provide places to sit, highlight a direction, etc. These are built and maintained by the locals.

8.5 Planning & Management policies.



Map 23: Map showing location of various Management strategies.

Developing policies for governance & management of the fragile landscape is also essential. Designing would enhance the user experience for a short duration and at intervals through the landscape.

Planning is essential for selection of appropriate locations for various activities; while policies & checkpoints would monitor its functioning on a

- Apple, buras, pangar and ringal plantation
- Reviving agriculture (support tourism)
- Afforestation (Improving slope stability and visual character)
- Landslide and erosion control
- Seasonal alpine grazing management
- Perennial grazing
- Monitoring station locations
- Design interventions - increasing legibility
- Bunds for conserving glacier
- Ice towers
- Utility and camping zones (water pollution and waste management)
- Alpine vegetation pilot (Flowering, wetland, medical alpine)

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regular basis.

8.6 Managing the fragile landscape

8.6.1 Perennial Grazing

Agriculture waste is to be collected at the end of every harvesting season. Fodder grass is grow on uncultivated agriculture fields. A fodder bank is created to monitor extraction & ensure less wastage. Ban is layed on buring of fields & grass collection zones.

8.6.2 Reducing Logging

Provision of gas / induction powered by solar energy is to be introduced to reduce the dependency on the forest. Incentives to be introduced to people using electricity over firewood.

8.6.3 Anthropogenic Degradation

Diversion channels to be introduced for water requirements at campsites & Villages. Water to be filtered naturally & stored in covered tanks for usage. The used water to enter mainstream only after passing through reed bed purification system. At Gujjar hut, pits for building snow towers to be prepared. This is to be used for water needs wherever possible. Overflow to meet the main stream.

Toilet waste is to be collected in trenches that are inaucated with bacterium for decomposition. Dry toilets to be promoted over toilets with water supply. The manure generated is to be used in the farmlands & excess can be sold. Portable toilets (wooden crates) to be used on snow covered campsites. Waste from this is to be disposed in pits, care to be taken that it does not enter the water stream. Kitchen waste also to be disposed in pits. Pits to be located away from water stream and to be prefered in clayey soils reducing chances of penetration & polution of water stream.

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Selling of plastics to be banned. Encouragement to locals to sell homemade products over packed products. These should be sold in paper bags. Disposal of plastics only at designated areas.

8.6.4 Glacier Conservation and Management

Construction of bunds to be done in the moraine zone to retain water for longer durations facilitating freezing of water.

Ice towers / walls to be built around meadows and at campsites to provide for the water needs of the people. This would also help in maintaining micro-climate in the long run.

8.6.5 Alpine Grazing

Fenced areas to be provided for grazing, alternate grazing is to be practised giving time for regeneration. This would help increase the productivity. Introduction of native forage grasses to be done whenever necessary.



Lolium perenne



Dactylis glomerata



Lotus corniculatus



Festuca rubra



Trifolium pratense



Trifolium repens

Figure 75: Plants introduced to support grazing

8.6.6 Bio-diversity Management

Introduction of endemic & endangered species of plants, based on the knowledge through historic reference and documentation. Field study & documentation to be initiated with the help of botanists & ecologists in less disturbed sites to identify rare plants & collect seeds/ samplings.

Introduction of medicinal herbs, flowering plants and re-creating wetlands to be tried as pilot projects in small sections of the site. Mass planting to be done on site only after proper research regarding the impacts on ecology.

8.6.7 Slope stabilization & Afforestation.

Heavily logged zones to be re-forested with native species. Geotextiles and other techniques to be used wherever necessary. Reforestation to begin with introduction of pioneer species. Landslide frequency along water streams is observed to be high. Steep slopes along streams above the tree line to be stabilised.

8.7 Monitoring the Fragile landscape.

8.7.1 Monitoring Human Activity

This includes keeping a check on the entry points, ensuring that illegal extraction of herbs, logging of forests & poaching does not occur. Posts for monitoring that no one enters the conservation zone and also to handle human animal conflicts if and when they arise.

8.7.2 Biodiversity Monitoring

This includes regular checks to observe the changes in the ecology caused by introduction of new species or due to changing climate. Monitoring of animal behavior patterns, including their population is done to understand their trends and anticipate their behavior.

8.7.3 Glacier Monitoring

A group of individuals from the village is appointed to keep a check on the functioning of the bunds & ice towers. The team is also involved with the research on glacier behavior in the context of climate

9 Annexure

9.1 Annexure 1- Forest Species

Biodiversity West himalayan broad leaf forest

The mammal fauna consists of seventy-six species, of which two vespertilionid bats are endemic to this ecoregion (table 1). Whereas *Murina grisea* is a near-endemic species that is shared with the Himalayan Subtropical Pine Forests [IM0301], the known range of *Myotis longipes* (Corbet and Hill 1992) is limited to this ecoregion.

Table 1. Endemic and Near-Endemic Mammal Species.

Family Species

Vespertilionidae *Myotis longipes**

Vespertilionidae *Murina grisea*

An asterisk signifies that the species' range is limited to this ecoregion.

The ecoregion's mammals also include several threatened species, including *Murina grisea*, and the serow (*Capricornis sumatraensis*) (IUCN 2000).

The bird fauna is rich, with about 315 species. These include ten species that are near endemic to the ecoregion (table 2). All ten are shared with adjacent ecoregions. However, the Himalayan quail is now presumed to be extinct (Grimmet et al. 1998). The Tytler's leaf-warbler and the Kashmir flycatcher breed in the northwestern Himalaya, including in this ecoregion, but migrate to the Western Ghats during the winter.

Table 2. Endemic and Near-Endemic Bird Species.

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Family Common Name Species

Phasianidae Cheer pheasant *Catreus wallichi*

Phasianidae Himalayan quail *Ophrysia superciliosa*

Phasianidae Western tragopan *Tragopan melanocephalus*

Aegithalidae White-cheeked tit *Aegithalos leucogenys*

Aegithalidae White-throated tit *Aegithalos niveogularis*

Fringillidae Spectacled finch *Callacanthus burtoni*

Muscicapidae Kashmir flycatcher *Ficedula subrubra*

Sylviidae Tytler's leaf-warbler *Phylloscopus tytleri*

Fringillidae Orange bullfinch *Pyrrhula aurantiaca*

Sittidae Kashmir nuthatch *Sitta cashmirensis*

An asterisk signifies that the species' range is limited to this ecoregion.

Several of the pheasants in this ecoregion are candidates as focal species for conservation management. Some of these include the western tragopan (*Tragopan melanocephalus*), Satyr tragopan (*Tragopan satyra*), Koklass pheasant (*Pucrasia macrolopha*), Himalayan monal (*Lophophorus impejanus*), and Cheer pheasant (*Catreus wallichi*). The ecoregion overlaps with the EBA, Western Himalayas (128), identified by BirdLife International (Stattersfield et al. 1998).

Evanescence
Biodiversity West himalayan Sub-Alpine Conifer Forests

Table 1. Endemic and Near-Endemic Mammal Species.

Family Species

Muridae *Hyperacrius wynnei*

An asterisk signifies that the species' range is limited to this ecoregion.

The mammals include several threatened species, including the southern serow (*Naemorhedus sumatraensis*), Himalayan tahr (*Hemitragus jemlahicus*), and markhor (*Capra falconeri*) (IUCN 1996) that warrant conservation attention.

The ecoregion's bird fauna consists of 285 species, of which 9 are endemic to the ecoregion (table 2). However, none of these are strict endemics (i.e., limited to this ecoregion).

Table 2. Endemic and Near-Endemic Bird Species.

Family Common Name Species

Phasianidae Himalayan quail *Ophrysia superciliosa*

Phasianidae Western tragopan *Tragopan melanocephalus*

Timaliidae Hoary-throated barwing *Actinodura nipalensis*

Aegithalidae White-cheeked tit *Aegithalos leucogenys*

Aegithalidae White-throated tit *Aegithalos niveogularis*

Fringillidae Spectacled finch *Callacanthus burtoni*

Timaliidae Immaculate wren-babbler *Pnoepyga immaculata*

Fringillidae Orange bullfinch *Pyrrhula aurantiaca*

Evanescence

Sittidae Kashmir nuthatch *Sitta cashmirensis*

Other species such as pheasants, and tragopans-e.g., Koklass pheasant (*Pucrasia macrolopha*), western tragopan (*Tragopan melanocephalus*), and Himalayan monal (*Lophophorus impejanus*)-are characteristic of these sub-alpine western Himalayan forests and have low disturbance thresholds. Therefore, they should receive conservation attention and can be used as focal species to monitor habitat integrity and as focal species for conservation management. The Himalayan griffon (*Gyps himalayensis*), a large bird of prey that soars high above the mountains in these alpine regions and embodies the sense of space in the high Himalayas, can be another focal species. The ecoregion overlaps with an EBA, Western Himalaya (128), identified by BirdLife International (Stattersfield et al. 1998).

Evanescence

Biodiversity West himalayan Alpine Scrub & Meadows

The snow leopard (*Uncia uncia*) and the Tibetan wolf (*Canis lupus*) roam these high-altitude landscapes, hunting large ungulates such as the goral (*Nemorhaedus goral*), serow (*Naemorhedus sumatraensis*), Himalayan tahr (*Hemitragus jemlahicus*), argali (*Ovis ammon*), and blue sheep (*Pseudois nayur*). This ecoregion probably represents the eastern limit of the distribution of the brown bear (*Ursus arctos*); there have been unconfirmed reports of this species from western Nepal.

The bird fauna is richer, with almost 130 species, including one that is endemic to the ecoregion (table 1). This near-endemic species is shared with the other western Himalayan ecoregions (Western Himalayan Broadleaf Forest [IM0403] and Himalayan Subtropical Pine Forests [IM0301]).

Table 1. Endemic and Near-Endemic Bird Species.

Family Common Name Species : Phasianidae Cheer pheasant *Catreus wallichi*

Other birds that are typical of these high-altitude ecosystems and can be used as focal species for conservation management planning include the blood pheasant (*Ithaginis cruentus*), western tragopan (*Tragopan melanocephalus*), Satyr tragopan (*Tragopan satyra*), and Himalayan monal (*Lophophorus impejanus*), which inhabit the shrubby ground cover, and the large avian predators, lammergeier (*Gypaetus barbatus*), golden eagle (*Aquila chrysaetos*), and Himalayan griffon (*Gyps himalayensis*)

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9.2 Annexure 2- Wilderness Act timeline

Sr. No	Person	Wilderness Quality	Time
1	William Bradford	As dark, savage, and sinister.	1620
2	Jonath Jonathon Edwards	Expresses emotion and admiration of nature and its relationship to God.	1702-1758
3	William Wordsworth	Poetry on nature, man, and society to be entitled "The Recluse."	1798
4	Washington Allston	Paintings "The Deluge" & "The Rising of a Thunderstorm at Sea," to portray an intimate relationship between man and nature.	1804
5		Peak of fur trade, beaver population declines dramatically.	1820-1830
6	Pawnee Chief Petalesharo	A speech to President Monroe describing the nomadic way of Indian life and notes that numbers of game animals such as buffalo are decreasing due to encroaching settlement and exploration.	1822
7	Thomas Cole	"St. John Preaching in the Wilderness. Believed that the wilderness was passing away and that there was a "necessity of saving and perpetuating its features." "	1827
8	Ralph Waldo Emerson	"Nature." The essay brings about profound changes in American attitudes toward nature. Emerson's "philosopher's camp" is a precursor to camping, leisure, and appreciation of nature.	1836
9	Henry David Thoreau	Author of Walden, writes that wilderness sanctuaries are the "need of civilized man."	1854
10	Frederick Law Olmstead	Pushes for protection of Yosemite Valley and is first to advance the idea of placing certain areas under government protection.	1864
13	George Perkins Marsh	Publishes Man and Nature, warning citizens to stop the devastation of natural resources during the Reconstruction Era.	1864
14	President Abraham Lincoln	Signs the Yosemite Bill " to protect an area and Conserve it for recreational enjoyment. "	1864
15	Artist Thomas Moran	Exhibits paintings of Yellowstone, helping to promote establishment of the first national park.	1872
16	John Muir	Organizes the Sierra Club to enlist public and governmental support for preservation of wilderness.	1892
17	Arthur Carhart	A Forest Service landscape architect recommends that the Trappers Lake area in Colorado not be developed for summer homes, but allowed to remain wild.	1919
18	Aldo Leopold	Ecologist, achieves designation of the first official wilderness area - the Gila Wilderness in New Mexico .	1924
19	Bob Marshall, Aldo Leopold, Benton MacKaye	Found The Wilderness Society as a national organization based in Washington DC to specialize in advocating wilderness protection.	1930

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9.3 Annexure 3- Alpine Flower Herbarium

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9.4 Annexure 4- Himalayan Trees

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9.5 Annexure 5- Questionnaire & Information (Bhukki Village)

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9.6 Annexure 6- Eco-sensitive zone documents

10 Maps

- 10.1 Satellite imagery with trek route and villages**
- 10.2 Location and context of the Dokrani-Dingad Landscape**
- 10.3 Satellite map and section of Habitable locations**
- 10.4 Elevation map of the Dokrani-Dingad Landscape**
- 10.5 Soil forming materials of the Dokrani-Dingad Landscape**
- 10.6 Geomorphology of the Dokrani-Dingad Landscape**
- 10.7 Geomorphology of the Dokrani catchment**
- 10.8 Slope angle of the Dokrani-Dingad Landscape**
- 10.9 Slope Aspect of the Dokrani-Dingad Landscape**
- 10.10 Land use and Land cover of the Dokrani-Dingad Landscape**
- 10.11 Landscape typology of the Dokrani-Dingad Landscape**
- 10.12 Map showing location of various management strategies.**

11 Bibliography

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Jury Panels: (4nos)