

A Case Study of India's First Model Carbon Positive Eco-Village in Phayeng, Manipur: Adapting to Climate Change

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Abstract

The state of Manipur, located in the northeastern region of India, harbors a diverse range of animals and flora. The state of Manipur is known for its unspoiled landscapes, frequently referred to as the "Switzerland of the East." These landscapes comprise a central intermontane valley that is encompassed by lush green hills, constituting almost 90 percent of the state's overall geographical area. The state of Manipur, with a land area slightly greater than that of Israel, harbors a diverse range of exceptionally rare flora and fauna. Notably, Manipur is the exclusive habitat for unique species including the Sangai, Shirui Lily, and Dziriko Lily. Manipur exhibits numerous instances of environmental initiatives and conservation measures throughout the contemporary era characterized by significant environmental calamities and climate change. This is demonstrated by Phayeng, a little village situated in close proximity to Imphal, the capital city of Manipur. Phayeng has achieved the distinction of being the inaugural carbon-positive village in India, primarily because to the proactive engagement and environmental awareness demonstrated by its inhabitants. The residents of Manipur possess a significant amount of knowledge on environmental and social capital, which they may effectively utilize to support the achievement of Phayeng's Carbon Positive program. This research aims to provide insights into successful cases and examine potential consequences for forest inhabitants in their encounters with environmental threats and disasters.

Keywords: Manipur; Biodiversity Hotspots; Phayeng; Carbon Positive

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Introduction

A multitude of forums and platforms have been formed with the aim of facilitating climate-change resilient actions that prioritize finding solutions. These initiatives span from the Rio Earth Summit in 1992 to the Paris Agreement in 2016. Nevertheless, a significant portion of this realm of negotiation is dominated by individuals in positions of authority, whilst those at the grassroots level predominantly experience the dual burdens of exclusion from policy-making discussions and the adverse consequences of human-induced climate change. It is widely acknowledged that individuals belonging to marginalized communities have disproportionate impacts as a result of global warming and climate change. According to the World Economic and Social Survey 2016: Climate Change Resilience - an Opportunity for Reducing Inequalities, former United Nations Secretary-General Ban Ki-Moon (2016) lamented that individuals who are economically disadvantaged, vulnerable, and socially marginalized face a higher likelihood of being adversely affected by climate-related hazards. These individuals, who have often been excluded from experiencing socio-economic advancements, are unfortunately at a heightened risk (para. 5). It is a well-established fact that marginalized communities, especially those residing in developing regions, exhibit a distinct inclination towards fostering a mutually beneficial rapport with the natural environment. These communities possess invaluable indigenous wisdom that comprehends the nuances involved in maintaining a sustainable and mutually beneficial coexistence between human endeavors and the intricate facets of the Earth's ecosystem. The phenomenon under discussion is a vestige of acquired knowledge that has been transmitted over successive generations through spoken accounts, cultural customs, and traditional practices of indigenous communities. These practices have effectively fostered a favorable connection with our surrounding natural ecosystem. As stated by UNESCO, this locally-based knowledge system offers distinct geographical and temporal benefits in terms of formulating effective strategies to mitigate the impacts of climate change and environmental uncertainties (Moody, 2020, para. 10). The current situation necessitates the imperative involvement of individuals who possess extensive indigenous knowledge in the prominent domain of discourse, particularly in regards to crucial decision-making and consensus-building on climate matters.

This study aims to explore the importance of recognizing and utilizing indigenous knowledge-based practices at the local level, with a focus on identifying positive implications that might be derived from

such recognition. This recognition carries two implications. Firstly, it can be utilized to leverage ecological knowledge in addressing environmental issues and restoring ecosystems, particularly those that have been crucial to sustaining the socio-economic system of indigenous communities. Secondly, the restoration of ecology has the potential to enhance both the livelihoods of individuals reliant on these ecosystems and environmental conservation efforts. The Afar pastoralists residing in the North Eastern region of Ethiopia employ many elements of the natural environment, such as livestock, insects, birds, trees, and other wildlife, as indicators for forecasting weather and climate patterns (Moody, 2020, para. 10). The significance of the knowledge system of this pastoralist group can foster agreement among diverse stakeholders, including policymakers, civil society, academics, activists, and others, in generating constructive resolutions that safeguard the sustainability of the ecosystems inhabited by the Afar Forest dwellers, as well as their traditional livelihoods. Both aspects are crucial for establishing a comprehensive and interdisciplinary framework for environmental conservation. The instance of Phayeng village in the state of Manipur, located in North East India, serves as a significant example in understanding the potential ramifications for rural India and other vulnerable populations worldwide.

This research is grounded in a secondary case study of Phayeng hamlet, which is widely recognized as the inaugural carbon-positive hamlet in India. The text also explores theoretical perspectives on the environment, such as the Determinism Vs Possibilism Debate (Dorrell & Henderson, 2018) and Griffith Taylor's Stop-Go Theory (Strange & Bashford, 2008). The primary objective of this study is not to offer solutions to the challenges and difficulties encountered by forest inhabitants. Rather, it is focused on establishing a framework for describing the results of conversations and discussions centered around extracting meaningful insights from the distinctive experiences of the indigenous population residing in Phayeng village.

The following section shall briefly describe about Phayeng – India's first carbon positive village.

About Phayeng

Phayeng is an aesthetically pleasing village located inside the Imphal West District of Manipur. Phayeng, a town with a population of fewer than 3000 individuals, has gained recognition as India's inaugural carbon positive settlement due to the collective endeavors of its residents and the government.

Their collaborative initiatives aimed to mitigate the adverse environmental impacts on the village and revive its once thriving ecosystem. Phayeng, similar to numerous other locations in Manipur, possesses an ecologically sensitive belt with diverse flora and fauna, as well as abundant natural resources including woods, streams, rivers, and other such elements (Devi, 2002). The conservation of rich ecosystems, such as Phayeng, is of utmost importance, particularly in the current era characterized by environmental crisis. This conservation is necessary to ensure the preservation of our natural resources and the sustenance of traditional livelihoods among marginalized communities. The reliance on these natural resources by marginalized groups is significantly more crucial than that of individuals who do not directly depend on them. As mentioned earlier, Manipur is recognized as one of the 36 biodiversity hotspots worldwide, harboring a diverse array of fauna, aquatic organisms, exotic plant species, and numerous delicate ecological zones within its relatively small geographic area. The abundance of flora and fauna species found in the small state of Manipur is highly remarkable and stands out in comparison to many regions of India, and potentially even globally. The Manipuri people exhibit a wide range of dietary preferences, which is indicative of their diverse culinary practices. Their diet includes a rich assortment of exotic and fragrant herbs, along with a deep-rooted understanding of traditional medical herb usage. India is home to four significant regions of high biodiversity, namely the Himalayas, the Indo-Burma area, Sundaland, and the Western Ghats. The region in which Manipur is situated, known as Northeast India, has two distinct geographical divisions due to the overlapping presence of the Himalayas and the Indo-Burma belt. Manipur is situated within the Indo-Burma region and is characterized by its proximity to the lower Himalayan ranges. This elucidates the abundant biodiversity of Manipur and its distinctive flora and fauna species (Pullaiah & Reddy, 2002).

Manipur, from a geographical standpoint, encompasses a landmass spanning 22,347 square kilometres. Its precise location is situated within the latitudinal range of 23°83'N - 25°68'N and the longitudinal range of 93°03'E - 94°78'E. Manipur, known as "A Jeweled Land" in translation, is situated in a verdant region of North East India. The state of Manipur is characterized by its topographical features, which predominantly consist of hilly terrain. However, it also encompasses a flat intermontane valley located at its central region. The topography of Manipur can be broadly categorized into two distinct regions:

the Hills, encompassing approximately 90% of the total land area, and the Valley, constituting the remaining 10%.

The terms "Hills" and "Valley" are commonly employed in popular discourse to denote both the geographical and cultural divide between the hill tribes, namely the Nagas and Kuki-Chin Mizos, who primarily adhere to Christianity and exert influence over the hill districts of Manipur, and the Meiteis, who predominantly practice Hinduism and exert influence over the Valley districts of Manipur. Manipur has been bestowed with the epithet "Jewel of India" by Pandit Jawaharlal Nehru, owing to its picturesque terrain characterized by rolling hills, verdant valleys, azure lakes, and lush forests. Currently, it is vital to acknowledge the significance of the lake referred to as Loktak.

The Loktak, which is the largest freshwater lake in North East India, harbors a significant diversity of aquatic flora and fauna, alongside a substantial population of migratory avian species and other terrestrial organisms that are directly dependent on the lake's environment. It is noteworthy that the Loktak is situated within the intermontane valley of Manipur and is believed to be the vestige of a vast aquatic ecosystem that formerly encompassed the entirety of Manipur's central valley region. This phenomenon accounts for the fertile landscapes found in the Manipur Valley, which support a diverse array of plant and animal species. The Loktak is commonly referred to as the "floating lake" because to the presence of floating green biomass, known as phumdis, on the surface of the lake. The accelerated expansion of phumdis, resulting in the reduction of Loktak Lake, is a matter of worry, notwithstanding the fact that phumdis are among the most notable ecological features of Loktak. The excessive growth of phumdis, a type of floating vegetation, may be attributed to anthropogenic influences, including heightened pollution levels and the indiscriminate disposal of waste materials into rivers, particularly those connected to the Loktak Lake in Imphal. These human activities contribute to the expansion of algae on phumdis, as the latter serve as a natural mechanism for decomposing solid waste. Similarly, the disappearance of numerous wetlands and lakes in Imphal can be attributed to the excessive pace of trash disposal. The lake is mostly associated with Sangai (*Rucervus eldii eldii*), also known as the brow-antlered deer, which serves as the state animal of Manipur. This species is exclusively found inside its natural habitat, the Keibul Lamjao National Park. The park is characterized by its verdant expanse of phumdis, which are considered to be the sole floating islands in existence globally. The Shirui Lily

(*Lilium mackliniae*) and Dziiko Lily are two endemic plant species found in Manipur, specifically in the highlands and Dziiko Valley respectively.

Both the hill and valley districts of Manipur face distinct ecological challenges. Deforestation and jhum cultivation have emerged as significant issues in the hill districts, comprising a total of 10 districts. Conversely, the valley districts in Manipur, totaling 6, have experienced escalating population density and urbanization, thereby exerting mounting pressure on the fragile ecological marine and lush landscapes of the valley. Imphal, the administrative center of Manipur, is situated in the Valley region, exhibiting significantly greater population density in comparison to the hill districts, encompassing both its urban agglomeration and metropolitan areas. Indeed, a significant proportion exceeding fifty percent of Manipur's populace is concentrated within the Valley region, including a mere ten percent of the state's overall land area. Consequently, the heightened population density directly correlates with increased ecological vulnerability and the imposition of greater strain and pressure on the environment. In contrast, the environmental issues encountered in hilly regions exhibit a comparable level of vulnerability. In fact, these areas are particularly susceptible to a range of hazards, including landslides, earthquakes, wildfires, drought, and other similar phenomena. Phayeng Village is situated in close proximity to the capital city, and its neighboring ecological zone is recognized as the primary source of water supply for the capital city. Phayeng is located in the Imphal West District, at the foothills of the *Kangchup Hill* range. The region is characterized by several hill streams, although most of them have ceased to flow, leaving only the *Maklang* stream/river as the primary water source for the preservation of the surrounding forest.

Socioeconomic Profile of Phayeng Village

The inhabitants of Phayeng Village belong to the *Chakpa* groups, which are one of the most prominent Scheduled Castes groups in Manipur and are part of the '*Lois*' community. Despite their lesser status, the Lois are ethnically and linguistically related to the Meiteis, and consider themselves to be the original indigenous people of Manipur, long before the Meiteis consolidated their power and domination (Nath et al., 2019). Their exact origin is unknown, although they are either believed to have originated with the several clans of the Meiteis (where they later amalgamated with the seven ancient

clans of the Meiteis) or are the indigenous early settlers of Manipur Valley, considerably older than the Meiteis. The prominence of silk rearing culture among the Lois also led to speculation among some historians that they might have either come from China or had contact with earlier kingdoms of China that were familiar with silk culture (Devi, 2002, p. 11).

The Lois has similar ethno-cultural, linguistic and food habits with the Meiteis however the Lois were considered as of inferior clans after being subdued by the dominant clans of the Meiteis during power struggle of various clans trying to establish suzerainty over the Valley. They were thus said to be dispersed by the Meitei kings and overthrown from the fertile valley and pushed to the fringe where they still occupy the various foothills of Manipur Valley. Over time, the Lois became highly intermixed with migrants of other ethnic groups, war captives, and Meitei fugitives, criminals, outcasts, and rebel of kings who were frequently exiled to the Lois' villages by the Meitei Kings. This enslavement of the Lois by the Meiteis was exacerbated by the Hindu influence in the Valley. As Manipur became a Hindu kingdom by the 18th century (complete establishment of Hinduism by the 18th century, although various forms of Hinduism had already penetrated Meitei society from much earlier dates), the Lois and other communities who refused to adopt Hinduism were said to be pushed to the peripheries of the Valley, where they were treated as lower castes as rudimentary forms of untouchability and the Hindu caste system began to appear. When the Meiteis started following the Vaishnavavite sect of Hinduism (Gaudiya Vaishnava branch of Chaitanya Mahaprabhu) in majority as per the royal decree following the declaration of Vaishnavism as the state religion of the erstwhile kingdom of Manipur, non-converts who refused to embrace Hinduism were also exiled to the Lois' villages (Sanajaoba, 1988). Today, the Lois and others who were treated as lower castes can be found settled in foothills of Manipur Valley and constitute the present Scheduled Castes communities of Manipur; and follow an ancient religion based on animism, nature worship like sacred mountain, pond, grove or sylvan cults which was also followed by the Meiteis before their conversion to Hinduism. While Hinduism penetrated into the Valley and intermingle with Meitei's pre Hindu tradition and culture giving a unique syncretic society, the Lois and the surrounding hill tribes viz. the Nagas¹ were considered as inferior and the entire Meiteis

¹ Note that the non-Naga tribes like the Kukis and their allied tribes are believed to have migrated to Manipur much latter while the Nagas have preserved their folklore and oral history of their origin from the hills of Manipur itself including few major tribes of Nagaland who are believed to have originated from Makhel hills of Manipur.

became to be henceforth grouped as either Kshatriyas (owing to Meiteis being a martial race) or Meitei Brahmins or *Bamon* as locally called (Bamon are usually descended from intermixing of indigenous Meitei people and North Indian/Bengali settlers who came to Manipur to spread Hinduism where they were granted lands by the Meitei kings and allowed to intermarry with local Meitei women ultimately becoming fully part of Meitei community after adopting the food habits, costumes and language; this phenomenon is pretty common among many martial races of Northeast India like the *Koch* and *Ahoms* who also granted lands to Bengali/Maithili Brahmins and specially invited them to settle in their kingdom for performing major religious ceremonies).

Agriculture (rain fed) and its allied activities remain the mainstay of people's livelihood and economy in Phayeng village along with fish farming, animal husbandry like piggery, livestock/poultry, making of local rice beer etc. The literacy rate of the community is 75.17% compared to that of 76.94% of Manipur (Laishram & Dey, 2013). The male literacy rate stands at 83.88% while the female literacy rate is 67.13% (Census, 2011). The people of Phayeng village thus come under marginal workforce predominantly. Because of their marginal and subsistence means of livelihood which is dependent on the vagaries of climate, Phayeng village thus suffers from high vulnerabilities of climate change and in fact, rampant deforestation in surrounding hillocks along with drying up of streams have attracted the attention of government and villagers following which the village was handpicked to become a carbon-positive model eco-village.

Project Interventions

In 2015, the government of Manipur, in collaboration with the Directorate of Environment and the Department of Forests & Environment, initiated a project with a central financing of 10 crore INR. This project aimed to make Phayeng the first carbon-positive village in India, with the active involvement of local villagers. The project has received financing from the National Adaptation Fund for Climate Change (NAFCC), a government initiative aimed at providing assistance for climate change adaptation efforts in different states (Government of Manipur, 2015).

After the project was finished, the villages received education regarding the significance of environmental conservation and the adoption of sustainable lifestyles. In the beginning, individuals depended on the monsoon for agricultural and horticultural purposes, typically prioritizing the

harvesting of a single crop. This led to significant vulnerability in terms of sustaining livelihoods and environmental degradation, primarily owing to a lack of knowledge on sustainable practices. The project was created with the aim of facilitating the villagers' understanding of these intricacies and managing their vulnerability index by fostering the adoption of innovative and sustainable practices and behaviors. It is imperative to acknowledge that the local residents are encouraged to employ their traditional knowledge pertaining to plant life, fauna, and forest ecosystems within their immediate surroundings. The indigenous religions of the Lois and Meiteis have long been intertwined with a historic and traditional sylvan cult. This cult has served as a means of preserving natural resources, particularly forests, which are considered sacred groves. Consequently, the local communities have a moral obligation to nurture and safeguard these groves. This practice has endured for countless centuries. The project has incorporated this conventional approach to forest conservation. The villagers possess extensive indigenous knowledge pertaining to the establishment of significant symbiotic ties with their environment, a practice that has been passed down through centuries. However, the advent of modern times has witnessed the ascendancy of human consumerist culture, resulting in the inevitability of global climate change. It is imperative to raise awareness among villagers regarding the importance of preserving their traditional indigenous knowledge to safeguard the ecosystem. Additionally, they should be motivated to use innovative approaches, such as rainwater harvesting, to effectively tackle the emerging difficulties of the contemporary era. Regarding the change, a former village chief remarked:

“We had no tree on these hills earlier. Our fathers had deforested them because of timber-related disputes. But villagers started realizing that the area had become extremely warm; there was no water and people were falling ill. So, villagers decided that the forest should be rejuvenated at any cost. Our Umang Kanba (forest protection committee) came up with various rules and involved all 660 families in the village in recreating the forest” as reported by Nandi (2019, para. 5).

Implications of Project Interventions

- Following the successful conclusion of the project, the local community has effectively transitioned away from their previous dependence on monsoon-fed agriculture. They have

achieved this by adopting a more varied approach to cultivation, which involves the year-round growth of horticultural crops such as watermelon, beans, cabbage, and broccoli. The combination of these several causes has led to a substantial growth in their financial earnings. In recent times, the village of Phayeng has gained attention as a carbon-positive destination, drawing tourists due to its indigenous heritage. Consequently, endeavors are currently being made to facilitate ecotourism activities that generate money and develop eco resorts that prioritize environmental conservation and the rehabilitation of the local ecology. Therefore, the comprehensive alterations and favorable consequences of the Phayeng carbon-positive eco-village project can be delineated as follows:

- The promotion of environmental conservation and the recognition of the significance of ecological restoration in mitigating the effects of climate change are crucial. This can be achieved through the dissemination of knowledge and the adoption of practices that highlight the advantages of increased tree coverage in enhancing the micro-climate of villages, as well as the benefits of effective ground water and watershed management in improving catchment areas and revitalizing stream water. The project also includes sustainable water management, which aims to conserve streams and provide reliable irrigation sources for sustainable agricultural practices. This is particularly important as agriculture in the area was previously highly vulnerable due to its heavy reliance on unpredictable monsoon patterns. Additionally, the project aims to improve the lifestyle and hygiene levels of villagers by ensuring a safe drinking water supply.
- The advantages of sustainable practices have previously been discussed, and they include the promotion of diversification in subsistence agriculture. This shift involves transitioning from mono crop plantations to horticulture cultivation, allowing villagers to grow multiple crops. This approach serves two purposes: first, it helps develop resilient strategies to address the challenges posed by climate change, and second, it ensures the establishment of sustainable and dependable livelihoods. According to Nandi (2019), the implementation of this initiative has resulted in a significant rise in income, with a 30% increase observed among the villagers (p. 11).

- The hamlet has also diversified its economic activities by embracing ecotourism, which has resulted in additional financial benefits and opened up new avenues for implementing creative environmental preservation strategies. The villagers' understanding of forest management has facilitated the development of their own monitoring strategy and system. This has allowed them to internalize the concept of empowerment, thereby fostering a sense of accountability and responsibility. The enhancement of villagers' capacity and the establishment of institutions, such as micro-finance, micro-insurance, and skill development initiatives, should also be acknowledged.
- In addition, emphasis has been focused on the utilisation of indigenous knowledge and culture, such as the ancient tradition of villagers to revere and conserve their forest. In particular, the initiative seeks to revitalise the traditional knowledge of local villagers regarding aromatic and medicinal plants that are also rich in bioresources and sustainable attributes. Some of these include *Aquilariamalaccensis* (a critically endangered species), *Artabotryshexapetalous*, *Curcuma Caesia* (Yaimu), *Elshotizablanda*, *Pandanusfoetidus*, *Plectranthusternifoliusand*, *Ocimumbasilicum*, *Acoruscalamus* (Oak Hidak), *Hedychiumspicatum* (spiked gingerlily), *Rauwolfiaserpentina* (Sarpagandha), etc. (Government of Manipur, 2015, p. 43).

Theoretical underpinning and implication for vulnerable forest dwellers in India and worldwide.

Since the inception of human civilization, our way of life has been shaped by the forces of nature, as we strive to develop strategies for survival and adapt to our environment. Throughout history, men have consistently endeavored to generate opportunities and explore diverse avenues to not only traverse the natural world, but also to exert influence over its trajectory. As an illustration, despite the necessity for early European voyages to traverse the Mediterranean Sea and the Atlantic Ocean in order to reach Indian ports such as Goa or Pondicherry, they encountered significant transit places along their route, such as the Cape of Good Hope situated in southern Africa. Nevertheless, we successfully altered the course of natural maritime pathways through the construction of the Suez Canal, which serves as an artificial link between Africa and Asia. This ambitious endeavor defied the inherent geographical constraints by connecting the Mediterranean Sea and the Red Sea. The Panama Canal, an interoceanic waterway, serves as a convenient alternative to circumnavigating the southern tip of Argentina in order

to go from the Caribbean Islands to the West Coast (California), as it connects the Atlantic and Pacific oceans. Humans have perpetuated this practice by erecting towering buildings, fabricating man-made islands, endeavoring to induce artificial precipitation, and establishing expansive desalination facilities to procure potable water from the oceans. The concept described bears resemblance to Possibilism, an ideological framework that promotes the active assertion of human agency in generating possibilities and the desire for the construction of a just and responsible dominion over the natural world.

Conversely, it can be argued that humans are inherently subordinate to nature and susceptible to the capriciousness and extremities of the environment. Hence, a multitude of cultural groups, ranging from pygmies residing in Africa to Polynesian tribes, and encompassing diverse populations such as modern Brazilian youths adorned in vibrant light cotton garments and fashion-conscious Parisians, exhibit significant influences from their respective environments. These influences manifest in various aspects, including hair texture and curls, skin tone and complexion, clothing fabrics, dietary practices, and other related factors. Both affluent nations, such as Japan, and third-world countries, like Guatemala, frequently encounter devastating earthquakes. In these instances, human lives are susceptible to being swiftly eradicated within a little span of time due to the imminent arrival of destructive tsunami waves or cyclones that impact coastal cities and villages. The aforementioned perspective is evident in the philosophical framework known as Determinism. While it is indeed accurate to state that human evolution can be attributed to natural selection, there is a prevailing argument that the advent of modern technology has facilitated the cultivation of advanced horticultural practices. For instance, proponents assert that individuals have successfully established technologically advanced fruit and vegetable gardens within the arid landscapes of Israel, or that residents of Sweden can relish the consumption of tropical fruits within purpose-built greenhouses tailored to accommodate such species in colder climates. Consequently, a distinct divergence arises between the perspectives of Determinism and Possibilism within the academic discourse. Critics of Possibilism may express apprehensions regarding the escalating consumerist tendencies of mankind, positing that such a trajectory could potentially result in environmental degradation as a consequence of the relentless search of expanding options. Simultaneously, individuals who are skeptical of the concept of Determinism may express apprehension on the potential consequences of solely relying on natural forces, as they fear that such reliance may regress human civilization to a primitive and less advanced state.

The term Neo-Determinism was introduced by Griffith Taylor to delineate a moderate standpoint that bridges the gap between the aforementioned contrasting ideologies. The approach developed by Taylor is commonly referred to as 'STOP-GO.' The concept of determinism can be likened to the presence of a red-light traffic signal on a heavily trafficked street. Taylor elucidated that when endeavoring to generate opportunities within the realm of nature, it is imperative to discern and interpret the indications presented by nature in order to delineate our course of action. This may be likened to the conventional traffic signals, where the red light signifies the need to halt, the yellow light signifies preparedness, and the green light signifies permission to go. Just as unrestricted movement cannot occur without incidents, uncontrolled human actions are bound to result in unforeseen effects when they exceed certain boundaries or constraints. Consequently, the implementation of extensive megadam projects in susceptible landscapes, such as mountainous regions or areas prone to strong seismic activity, has led to the occurrence of landslides and floods. In a similar vein, widespread deforestation and extensive industrialization inside ecologically vulnerable regions have led to global climate change, with repercussions that extend beyond individuals who were not directly involved in these extensive industrial activities. Forest inhabitants, such as those residing in areas intersected by extensive railway networks, may not actively participate in or reap the benefits of such projects within their natural habitats. However, they experience the repercussions worldwide as their livelihoods are compromised by direct exposure to climate-related hazards like heat waves or landslides (Singh & Reji, 2020).

The present study on Phayeng carries theoretical implications regarding the indigenous knowledge possessed by the villagers in determining boundaries or limitations with respect to their interaction with nature. Despite being influenced by modern consumerist desires, which led them to deviate from this ethos for an extended period, the villagers eventually recognized the significance of self-reflection and the establishment of sustainable norms. These efforts are aimed at ensuring the restoration of their ecological wealth. The government has strategically selected the community due to its indigenous wisdom, with the aim of establishing a carbon positive model eco-village. This initiative aligns with the principles of sustainable development, which prioritize human progress while respecting the natural constraints imposed by the environment. The identification of indigenous knowledge that has contributed to the long-term sustenance of forest dwellers holds considerable consequences. In the context of Phayeng village, the local community demonstrates the ability to effectively utilize their

indigenous knowledge, while concurrently advocating for its recognition and advancement. This approach enables them to attain empowerment and autonomy in sustaining their way of life and safeguarding their natural surroundings, while avoiding exploitation by industrial entities or conglomerates. Through this process, individuals have experienced increased empowerment and awareness, enabling them to participate in previously novel practices such as catchment area and watershed management or multi-crop harvesting. These practices aim to improve their standard of living while simultaneously safeguarding the ecological environment in which they reside. Forest inhabitants are recognized for their ability to maintain specific ecological equilibriums, including their extensive knowledge of seasonal growth patterns of undesirable plants, such as weeds and bushes, which are commonly utilized as fodder for their livestock. Consequently, individuals residing in forested areas have assumed responsibility for the removal of undesirable undergrowth and plants by utilizing it as fodder for their livestock. Conversely, it is imperative to acknowledge the significant productivity of their jobs, specifically in terms of the advantageous outputs such as milk and meat. Policymakers should acknowledge and use indigenous knowledge in order to construct environmentally conscious models of development. These models should enable forest dwellers to prosper and transition from their existing subsistence patterns, while ensuring the preservation of their natural values.

Conclusion

The global population of forest inhabitants is experiencing a decline, with their means of subsistence being endangered by the dual forces of rising urbanization and industrialisation, with the ecological ramifications of climate change. If individuals experience a loss of their means of subsistence and are compelled to engage in a workforce characterized by marginalization and exploitation, there is a heightened likelihood that they may face further marginalization. The phenomenon of climate change, coupled with anthropogenic activities that have detrimental effects on the environment, has resulted in ecological degradation, hence posing a significant threat to the migratory patterns and paths of various species. As a consequence, the migration of forest inhabitants has led them to seek safety in unfamiliar regions, where they may encounter heightened ethnic tensions, discriminatory practices, and instances of violence like as pogroms, riots, or even loss of life. The Phayeng approach holds potential for fostering economic and social empowerment within marginalized communities due to their

vulnerabilities. This is achieved through the provision of education on sustainability practices and the utilization of indigenous knowledge, resulting in tangible benefits for the beneficiaries. The following table presents the ramifications of Phayeng's successful narrative for forest inhabitants in India and globally.

Implications of Phayeng's Carbon Positive Model for Forest dwellers	Problem statement or issues	Vulnerability Mapping	Funding/Benefactor	Meaningful outcome
Phayeng	Rampant deforestation leading to ecological crisis Climate change leading to water issues and negative consequence on their livelihood	Phayeng lies in eco-sensitive foothill zones which are susceptible to both micro climate alteration and global level climate change. Traditional livelihood based on rain fed agriculture is also highly vulnerable	Manipur Government with its Environment Department took up a project on creation of Carbon-Positive Model Eco-Village along with funding from National Adaptation Fund for Climate Change	Villagers have not only been to sustain their livelihood but diversify and achieved substantial income growth as simultaneously they inculcate innovative sustainable practice made possible also through the promotion of traditional indigenous knowledge that has further led to socio-cultural and political empowerment.
Forest dwellers	Contemporary environmental issues and many merging issues like species' invasion along with rapid	Their livelihood based on following migratory patterns of certain	Need of the hour is collaborative initiatives of government, think tank institutes (to map the	Pastoralist's unique indigenous knowledge of their habitats and familiarity with

	industrialization have completely hampered their habitats, livelihood dependent on nature and consequently their socio-cultural and political identities	vegetation zones is highly vulnerable owing to unregulated development activities and global level climate change	vulnerabilities and potential of enabling sustainable practice through harnessing indigenous knowledge, civil societies/NGOs, etc.	seasonal patterns of vegetation growing characteristics should be acknowledged and promoted to empower the Forest dwellers to enable themselves with meaningful creation of sustainable practice based on the knowledge and further direct and diversify their livelihoods
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