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Resilience and Adaptation of Indigenous People to Climate Change

Agnas Augustine[1], Dr. A Enoch[2]

[1]Doctoral Research Scholar (JRF) in Social Work, Madras School of Social Work, Egmore, Chennai, Tamil Nadu
[2]Assistant Professor, Department of Social Work, Madras School of Social Work, Egmore, Chennai, Tamil Nadu

Corresponding Author: Agnas Augustine

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ABSTRACT

Climate change affects the indigenous people who live closer with nature than anybody else. They are the first ones to realise it and tune their life according to the changes of earth even before the outer world notices. Their socio-cultural activities, spirituality, day to day life and even subsistence relies on nature. These communities are the least contributors to climate change due to their environment friendly practices. This review paper studies resilience strategies of indigenous people who are original settlers or early settlers of the land who have been part of the ecosystem for centuries. The people who managed to sustain till the date have seen numerous changes in nature across centuries. So, their resilience is multifaceted as the challenges fall on broad categories which includes variations in environment which leads to changes in traditional practices and culture. The concept of resilience always indirectly projects its parallel concept of vulnerability (Ford, James D. et al.). Those who have fallen in the process of resilience reminds us the importance of sustainable development.

Keywords: Resilience, Adaptation, Indigenous Practices, Traditional Ecological Knowledge

INTRODUCTION

Indigenous people live in harmony with nature. For them the environment near is not mere surrounding, rather they impersonate it. In diverse contexts around the world, there are recorded deep connections between Indigenous peoples and geography, which serve as the basis for traditional belief systems. A sentient being with the capacity for reciprocity, cooperation, and/or injury, nature is spoken to in interpersonal terms in many Indigenous cultures, where there is no distinction between the human and non-human worlds (Sheremata, 2018). They read windiness, rain, storms and all natural phenomena connecting to emotions of nature. As nature intertwined with the culture and spirituality of tribal people, minute changes occurring in it leaves deep imprints on the life of tribals. They have deep reverence to nature and they are interconnected with all living organisms around them. They use specific species of plants for each ritual. For example, the Todas in Nilgiri district of Tamil Nadu uses a variety of plant species from the birth of a child. When a Toda woman is conceived, the bridegroom gives her bow and arrow made of tender branches of a specific plant. The tribe uses specific plants as firewood in the temple and for marriage rituals. Their barrel-vaulted houses and temples are made of certain bamboo species and the tribe uses changes in

nature to predict seasons and environmental phenomena like upcoming monsoon and rain. This brief explanation shows how much a tribe depended on nature for day-to-day life, for food and shelter. The rituals and activities of each day constitute the culture of a tribe. Human invasions to the habitats of tribals with economic intentions has brought monoculture in cultivation and loss of natural vegetation. Massive production of cash crops such as tea, coffee and Eucalyptus has wiped out natural species of flora and fauna. So now it is not easy for indigenous communities to find various culturally or ritually important species around them. Like the Todas, many indigenous groups around the world find difficulty with the changed environment.

Resilience and Adaptation to Climate Change

According to the American Psychological Association, resilience is the process and outcome of successfully adapting to difficult or challenging life experiences, especially through mental, emotional, and behavioral flexibility and adjustment to external and internal demands. The combination of coping, adaptive and transformative skills result in resilience, which in turn leads to tenacity, incremental adjustments, or transformational responses to environmental change. Vulnerability is sometimes the opposite of resilience; it can arise when coping, adaptive, and/or transformative capacities are diminished, absent, or weakened, or when the enormity of changing circumstances overwhelms these capacities. However, vulnerability and resilience are not always mutually exclusive; they can coexist in a population and differ depending on the type of stressors, period, and social group (Weichselgartner & Kelman, 2015). Numerous factors influence both resilience and susceptibility to climate-related risks. Inequalities in gender, age, knowledge and risk perception, class/caste, ethnicity, access, control and ownership of resources, whether at the household, community, or societal level, are typically factors that impact these conditions, which range from the degree of exposure and sensitivity to climate-related hazards to varying capacities in adaptation. The social conditions under which people live, the extent of dependence on land-based resources, divergent levels of government support, and the amount of assets available and accessible by individuals or local communities, all create differentiated levels of exposure and sensitivity to natural hazards (Smith & Rhiney, 2016). In general, vulnerability refers to a system's (individual's or a community's) susceptibility to damage from a climate stimulus or stimuli; it encompasses both sensitivity to climate and adaptive capacity (Ford and Smit, 2004; (Adger et al., 2013; Pearce et al., 2015).

Attachment to Land and Resilience of Indigenous people

Habitat changing is noted among different indigenous communities around the world in order to increase climate resilience. Despite offering resilience and well-being, Indigenous cultures' emphasis on place can also make them more vulnerable to disturbances brought on by environmental change. Understanding this some Inuit communities are shifting from land-based (such as caribou) to aquatic-based livelihoods, while others are experiencing strong emotional reactions that result in ecological grief. For instance, changing ice and weather regimes limit access to traditional hunting and fishing locations. In these situations, environmental change becomes immediate and personal, disturbing belief systems, social cohesiveness, and cultural traditions while exacerbating the effects of place disruption brought on by land displacement (Smith and Rhiney (2016) and McNamara et al. (2017)

Communities lost valuable cultural assets as a result of climate change. Many had to leave their own land for survival. However, some repercussions are clearer. There is strong proof that cultures are weakened as well as endangered when individuals are uprooted from places they hold dear. As well as, lost locations of significance cannot be

adequately compensated for or replaced (Adger et al., 2013).

Mobility, Customary Laws and Climate Resilience among Indigenous People

Changes in precipitation patterns, temperature, seasons, fertility of soil, and change in natural vegetation has posed serious risk to the life of tribes (Sasmitha, R., & Arunachalam, R. (2019). For a tribe which is depended more on animal husbandry, changes in rainfall may not have immediate effect on their yield. For them time given for adaptation is more. Tribes who can access large areas have an edge on resilience because of availability of more resources like land for shifting cultivation, ponds and forest products for subsistence. For populations who are isolated due to land displacement and intrusion to forest, resources available for alternative options for resilience are minimal. The traditional institutions as well as the indigenous knowledge in the past have played a significant role by making the mountain communities less vulnerable to uncertainties arising from global change. (Barua et al., 2014). Many Indigenous pastoralists are more vulnerable to environmental stress because the privatization of land and the enforcement of administrative boundaries replaced traditional institutions for risk management through mobility and joint ownership of assets and resources (Eckert et al., 2018). Diminished customary laws and authority of chieftains has lessened intensity of community ventures. Reliance on a limited supply of resources and shortage of culturally significant resources can also limit the ability to adjust through migration or shifting livelihoods and place communities at continual risk of environmental change (McNamara et al., 2017; Smith & Rhiney, 2016). Indigenous resource management strategies have also placed a strong emphasis on attachment to multiple locations, especially in areas that are vulnerable to environmental change (such as the Arctic and desert environments). This allows for flexibility and mobility in utilizing a variety of environments to maintain the symbolic, cultural, and livelihood roles of place during times of change (Zander et al., 2013)

Five major categories can be used to characterize the diverse adaptive techniques that pastoralists have developed in response to socio-environmental change: market exchange, storage, livelihood diversification, mobility, and communal pooling (Agrawal, 2010). Mobility or seasonal migration helps to avoid unfavourable conditions in a particular area by reaching out to resources over a large landscape. Pastoralists' decisions regarding the movement and diversification of livestock are based primarily on their ecological knowledge (Knapp and Fernandez-Gimenez, 2008). Example for this can be noted from how the Yolngu peoples historically traveled extensively to secure essential resources in light of environmental stress (Furberg et al., 2011) . A study done among Gujjar-Bkarwals and Chopans of Kashmir migrate to higher altitudes during summer season for lush pastures for their livestock and return to the base land during winter. These tactics make it possible to distribute risk throughout time, place, and asset sectors. To ensure that the entire pastoral system can continue to function while recuperating from socio-environmental shocks, indigenous herding systems prioritize flexibility above stability (Leslie and McCabe, 2013).

Traditional Ecological Knowledge and flexibility as adaptation strategy

TEK is a dynamic, cumulative and live social memory that can be used to inform adaptation strategies for both routine and unusual occurrences. Adaptability is a process of ongoing education and adaptation. Improvisation and creativity are acquired from individual experiences in the environment and are passed down through generations to generate a multitude of alternates at any given moment (Wheelersburg & Kvist, 1994).When combined, this corpus of cumulative environmental and resource knowledge, or TEK, enables hunters to remain flexible and

agile when hunting in the face of changing climates (Ford et al.,). TEK supports resilience, or adaptive capacity, in the face of shifting climate conditions.

But nowadays indigenous knowledge possessed by tribal populations is deteriorating significantly due to multiple reasons. A field study done by the researcher in Kotagiri taluk of Nilgiris district shows that many tribes have left their traditional agricultural practice and now work in various jobs including employed in large agricultural lands producing tea, coffee and other cash crops. Low agricultural productivity is one of the causes for this change. A study done in Mexico states that a significant portion of the population has experienced decreased interaction with the natural environment as a result of changes in employment activity. The decline of local botanical knowledge is linked to these new social conditions. Another significant problem is that the area's growing deforestation is quickly erasing the subject of ethnobotanical knowledge itself (Saynes-Vásquez et al., 2013). Diminished Traditional Ecological Knowledge has definitely taken a toll on the pace of resilience. Traditional Ecological Knowledge is becoming more widely acknowledged across the Pacific Islands, particularly Vanuatu, as a valuable repository of knowledge and methods for coping with climate change threats. Through a variety of strategies, such as communal resource pooling, food and water storage, elevated settlements, and rituals for forecasting climatic and environmental variability, Pacific Islanders have adapted to weather extremes and multiple sea level changes over centuries, according to archeological evidence and oral histories (Granderson, 2017). Aboriginals in Australia have used their local knowledge on fire to improve feeding habitat for agame and ease hunting. This is an example of conservation of biodiversity and adaptation (*Madhav Gadgil, Fikret Berkes, and Carl Folke (1993) (Chapter 36) - Foundations of Socio-Environmental Research*, n.d.)

Indigenous communities who keep livestock also explicits adaptiveness through cleaning and sanitation and timely vaccinations given to animals. Indigenous ecological knowledge is an essential component of adaptive environmental management (Berkes, 1998, Kassam, 2009, Turner and Clifton, 2009). The Lahaula tribes in western Himalayan valley use Domesticated Yaks (*Bos grunniens*) crossed with local cows to produce cold tolerant offspring of several intermediate species like Gari, Laru, Bree, and Gee for drought power and sources of protein. Inuit populations in the Arctic use coping strategies to deal with short-term disequilibrium, such as an exceptionally unusual weather season or limited fish stocks. These include switching species, temporarily altering subsistence practices, and modifying the time, location, and method of hunting (Laidler et al., 2009).

Technological Advance, TEK and Resilience of Indigenous people

Traditional Ecological knowledge helps indigenous people to overcome adverse climatic conditions through emergency preparedness with the help of technology. Inuit hunters are becoming more and more aware of the potential for danger when traveling and hunting on both land and ice. They are taking extra efforts to prevent and be ready to handle new hazards because they understand the limitations of mechanical technology, which can malfunction (Pearce et al., 2010a; Ford et al., 2006). Expert hunters speak with Elders before venturing onto the land or ice, and they keep a careful eye on the wind, clouds, and weather for any subtle clues that could indicate dangerous conditions (Gearheard et al., 2006, 2010). Hunters have an opportunity to gain a small advantage in this dynamic and ever-changing environment by depending more and more on technology tools like snow scooters, GPS, and buffers (Pearce et al., 2015).Global Positioning Systems (GPS) and other technologies, including satellite phones, Very High Frequency (VHF) radios, and distress beacons, have been used as adaptive

strategies for travel conditions that are difficult to predict with traditional methods alone (Laidler et al., 2009).

Values, Beliefs and Bonding of Indigenous people for Climate Resilience

The closeness of indigenous community to nature becomes a saviour for the environment. They perceive nature as an integral part of them and efforts are taken to heal its wounds. The moral relationships of responsibility to preserve and care for nature (e.g., through habitat protection, sacred sites, access rules, and species conservation), lessen the effects of environmental change, and lower environmental pressure (e.g., by preventing deforestation and creating species-rich habitat) are all supported by this intimacy and closeness to place, which fosters resilience to environmental change. According to Bhakat (1990), sacred groves in India are primarily located in areas with a high concentration of tribal people. They are referred to by various ethnic names. On the basis of their traditional ideas and religious convictions, the locals administer and protect them. The native traditional communities, who have a spiritual bond with their natural surroundings, maintain the holy groves wherever they are found (An, n.d.). Connection to place has been linked to better health outcomes in Canada and Australia, and it has been said that this gives people the strength to deal with the changes they see. (Green and Minchin, 2014; Clifton and Turner, 2009). The indigenous people maintain their relationship with land and biodiversity through stewardship and educational activities (Zander et al., 2013) Indigenous people are less willing to relocate in adversities due to their relationship with nature.

Indigenous communities have strong ties between them. Their sense of sharing and supporting each other helps to navigate through difficult times. Deeply ingrained in many Indigenous belief systems, solidarity, communalism, loyalty, and brotherhood serve as the foundation for collective action and are created and perpetuated through cultural traditions. Collective action has a variety of effects on resilience and is closely related to institutions. Cultural norms of reciprocity and sharing are crucial for risk management, risk sharing, and catastrophe recovery. For instance, sharing food is highly regarded in many Indigenous cultures and is essential for increasing food availability and variety as well as serving as a stress-reduction strategy (Eckert et al., 2018). though we recognize that gender dynamics and other facets of Inuit knowledge (such as social values, environmental stewardship, community dynamics, and beliefs) also play interrelated roles in adaptation to changing conditions (Laidler et al., 2009).

It makes perfect sense to look to Indigenous Peoples for guidance and support. These are long-term locals who have acquired the ability to conserve, maintain, and promote their resources in situ((Anderson, 2005), Deur and Turner, 2005, Turner and Berkes, 2006) through systems of knowledge, practice, and belief. They have also developed resilience, which is the capacity to withstand disruption and adapt to change. Notably, those who have spent generations living in environments that are always changing, like those found along coastlines, or who travel to isolated, varied mountain habitats, are probably the ones who have the strongest coping mechanisms and are less likely to be caught off guard than those who are accustomed to consistency and predictability in their lives (Turner & Clifton, 2009).

Climate Resilience efforts of Indigenous people can be encouraged by supporting their stewardship principles, cultural revitalization efforts and reasserting indigenous management rights(Eckert et al., 2018)

Best Climate Resilient Practices

The indigenous population takes actions that equip themselves and their surroundings for climate change. Modifying locations and altering agricultural practices helps to alleviate risks. Uluibau Village, Moturiki Island, central Fiji is along Pacific Island coasts. The community is situated on a

frequently flooded coastal flat that rises less than 1 m above mean high tide level. In order to address this issue, the community has piled trash behind the trees and planted chopped trees along the rear of the beach (Nunn, 2007).

The Apatanis use finger millet on the bund (small dam) for paddy cum fish culture, as well as terrace and wet agriculture. The plateau is in the process of being designated as a World Heritage Site because of these unique characteristics of sustainable farming methods and people's traditional ecological knowledge in maintaining ecosystems (Kumar & Ramakrishnan, 1990). One of the most developed tribal societies in northeastern India is the Apatanis, who have long practiced valley rice cultivation. It has a strong understanding of land, forest, and water management and has long been recognized for its thriving economy. Effective canal systems are used to water wet rice fields. Numerous streams that originated in the forest are diverted into a single canal for management, and each agricultural field is connected to the canal by a bamboo or pinewood pipe (Aich et al., 2022)

The Apatani tribes use only organic farming methods and refrain from using any synthetic soil additives. Additionally, regular application of rice chaff, livestock manure, agricultural waste, and kitchen garbage helps to maintain soil fertility. The paddy-cum-fish agroecosystem is positioned strategically to receive all the runoff nutrients from the hills (Rai, 2005).

The Lahaul tribe maintained a significant number of livestock and agro-biodiversity, all of which highlight a high degree of germplasm conservation. Because the area is covered in ice for the other six months of the year, Lahaulas who live in the frigid desert region of the Lahaul Valley are only able to cultivate for six months, from June to November. Nitrogen fixing trees like Seabuckthrone (*Hippophae rhamnoides*) are also cultivated along with the crops to meet the fuels and fodder requires for the long winter period. Crop rotation is a common practice among the Lahaulas. Domesticated wild crop, local variety, and cash crops are rotated to ensure soil fertility and maintain agro-biodiversity. By using mixed agricultural and livestock methods, ice-water collecting, and combinatorial production of traditional and cash crops, Lahaulas are able to sustain a high level of agro-biodiversity. indigenous methods for making effective use of water supplies. Irrigation uses earthen canals (Kuhi or Nullah) to collect melting snow water. Water flow and soil loss are slowed down by ridges and furrows that run parallel to the slope (Singh, 2004). Fertile soil gradually becomes unproductive due to nutrient leaching caused by the thick snow cover (Di & Cameron, 2002). In a specifically constructed communal composting chamber, cattle manure, night soil, kitchen scraps, and forest leaf litter are composted to meet the large amount of organic manure requirement.

Three important ancient traditional agricultural practices are used by the Irular tribes, who live in the Palamalai mountainous region of the Western Ghats and the Nilgiri hills. These include indigenous pest management, traditional seed and food storage methods, and weather prediction based on long-standing experiences. The Irular tribes engage in mixed agriculture. The tribes have created and strictly adhere to unique preservation techniques for crops, vegetables, and seeds because of the excessive humidity in the area(Aich et al., 2022) In addition to being adept at observing the natural world, Irular tribes have a significant understanding of weather phenomena that are connected to biological activity or atmospheric conditions. Irular predicts the probability of rainfall by observing the behavioral fluctuations of termites, sheep, ants, and dragonflies. While dense fog is regarded as a negative sign of rainfall, atmospheric phenomena such as the moon's ring, evening rainbows, and morning cloudiness are regarded as favorable indicators. Since various plant-based pesticides that are entirely biological in origin have been documented, the Irular tribes also acquired a great deal of

knowledge about pest management. These natural pesticides work in a variety of ways, including as contact poisoning, growth inhibitors, stomach poison, antifeedant, and anti-repellent. These insecticides are all made from extracts of common Indian plants, such as tobacco, neem, chilli, Bbul etc. The entire agricultural method is extremely organic in nature and devoid of any chemical pesticide, which reduces the cost of farming and at the same time help to maintain environmental sustainability (Raj et al., 2024). The Apatani people are able to withstand extreme events like flash floods, landslides, and cloud bursts through the presence of extensive forest cover, highly well-structured irrigation system, contour agriculture, and layered agricultural fields. The Irular tribe also exhibits resilience to the harsh events because of their weather forecasting skills and seed protection methods (Aich et al., 2022).

CONCLUSION

Due to years of exposure to climate change, responses of indigenous communities have evolved to defend themselves from its adverse effects. Number of strategies are devised by them to sustain livelihood, agricultural practices, culture and traditions. Even Though what they lost cannot be fully replaced at any cost. Though, they can perform in a much better way with the help of government authorities. Legal support provided by governments can protect communities from illegal intrusion to their land and Displacement. Resilience and adaptation of the communities against climate change will be more effective under the guidance of their customary law. Legal protection given to tribal governance systems can give space for venturing rejuvenation activities among themselves. Instead of dumping resources, it can be administered in proper planning with the beneficiaries.

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