FROM VICTIMS TO VICTORS: ODYSSEY OF INDIGENOUS COMMUNITIES IN CLIMATE CHANGE THROUGH TRADITIONAL KNOWLEDGE

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ABSTRACT

With each passing day, the impact of climate change has become more pronounced. Rare natural disasters are now the new normal of life. Such disasters have only exacerbated the disparity, with those who have the least liability suffering the most. Indigenous & tribal communities' reliance on nature has metamorphosed them from being vulnerable to being precarious. With climate change affecting every nook and cranny, one simply cannot remain oblivious to what is happening in the surroundings. Strategies & policies need not be only mitigative & adaptive, but can also be pre-emptive. By harbouring the traditional knowledge of indigenous & tribal communities, the pernicious impacts of climate change can be assuaged. Equipped with this knowledge, the very vulnerable indigenous people can be at the forefront of this battle to curb GHG emissions. The author of this essay has relied on primary sources like treaties, conventions, reports, as well as secondary sources like articles, research papers, news articles, etc., to arrive at the conclusions. Through a thorough analysis of traditional indigenous knowledge & the practices based on it, the author endeavours to demystify the relational nexus between key components like climate change, sustainability, indigenous traditional knowledge & practices concerned therewith. Contentions regarding the relevance of such practices have been scrutinised to ensure that obsolete & irrelevant practices do not get featured in mitigation & adaptation policies. By segregation of traditional climate practices into 4 field criteria, only those practices are inculcated which have satisfied the test of relevancy, adaptability & efficiency.

Keywords: Climate Change, Sustainable Practices, Indigenous & Tribal Communities, Traditional Knowledge.

INTRODUCTION & OBJECTIVES: THE BUILDING BLOCKS

Climate change is no longer an exclusive domain of policymakers & scientific community now. The repercussions of this phenomenon are palpable in the general populace, also. With scientific predictions transpiring into realities, we can no longer afford the luxury of remaining oblivious to this phenomenon. With paucity of time & dearth of climate finance, we are between the devil & the deep sea. However, we are at driver's seat, & the future will hinge on our actions. With the advent of state-of-the-art technologies, the proclivity is towards deploying exorbitant technology even when the same lacuna can be addressed by traditional knowledge of indigenous & tribal communities. The author of this essay intends to analyse the unique position of indigenous & tribal communities in the light of climate change, through the following objectives,

- To give an unequivocal interpretative analysis of key terminologies at stake without any deviation in the subject matter.
- To analyse the unique dynamics between climate change & the indigenous communities through the available dataset.
- To evaluate the multi-dimensional aspects of traditional knowledge.
- To examine the relevance of traditional practices in the wake of climate change with the help of key parameters that will adjudicate the efficiency of the said traditional practice.

DEFINITION: WHAT IS WHAT?

IPCC observes that Climate change is a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere & which is in addition to nature; climate variability observed over comparable time periods.[1] In simple terms, climate change refers to the environmental changes induced explicitly or implicitly due to man-made activities. Impact of climate change is however disproportionate. Multiple editions of IPCC have vouched that socially, economically, culturally, politically, institutionally

[1] . United Nations Framework Convention on Climate Change, May 9, 1992, S. Treaty Doc No. 102-38, 1771 U.N.T.S .107.

marginalized communities are prone to the not only climatic catastrophe but also to the adaptation & mitigation mechanisms.[2] Indigenous communities are one of the socially, culturally, politically & economically vulnerable groups. Due to their proximity with nature & their dependence on natural resources for subsistence means that these communities will face wrath of pernicious climate conditions.

Multiple attempts have been made to define these indigenous & tribal people at individual as well as on institutional level though not a single definition fulfils the requirement of universality. Reyes-Gracia defined Indigenous people as ethnic groups who are descended from & identify with the original inhabitants of a given region.[3] On the contrary, at institutional level, Article 1(b) of Indigenous & Tribal People Convention of International Labour Organization identified indigenous people based on their descent from populations which inhabited the country, or geographical region to which country belongs, at the time of conquest or colonisation or establishment of present state boundaries who retain some or all of their social, economic, political & cultural institutions.[4] The same convention recognised tribals as those whose social, cultural & economic conditions are perceptibly different from other sections of the national community. The convention further added that regulation of such people is often done through either their own customs & traditions or through special laws.[5] These definitions can be identified on 2 broad planes - criteria of subjectivity & objectivity. While exhaustive ILO definitions are example of objectivity, the prerogative of self-identification as an indigenous or tribal is peculiarity of subjectivity.[6]

Sustainable Development is the phraseology that has been as recurrent as Climate Change in the global context. This Term was 1st structured in the World Commission on Environment & Development's Brundtland Commission Report as development that meets the needs of present without compromising the ability of future generations to meet their own needs.[7] However, the history of sustainability is laden with a rich tapestry. The impetus which the term sustainable

[2] . International Panel on Climate Change, Climate Change 2014: Impacts, Adaptation & Vulnerability. Part A: Global & Sectoral Aspects. Contribution of working group II to 5th Assessment Report of IPCC. (C.B. Field, V.R. Barros, D.J. Dokken et. al. eds., 2014), pp 1-32.
[3] . Reyes-Gracia V, Fernandez-Llamazares A, McElwee P et.al., the contribution of Indigenous Peoples & Local communities to ecological restoration ,27(1) Restoration Eco. 3-8 (2019).
[4] . International Labour Organization Indigenous & Tribal Peoples Convention (ILO No. 169), June 27 ,1989, 28 I.L.M 1382(1989).
[5] . Id. ILO No.169, article 1(a).
[6] . M. Oelz, R. K. Dhir & M. Harsdorff, Indigenous peoples & Climate change: from Victims to Change Agents through Decent Work, International Labour Office, Gender, Equality & Diversity Branch of ILO, (2017).
[7] . Brundtland G.H. (1987) Our Common Future: Report of World Commission on Environment & Development. Geneva, UN Doc. No. A/42/427.

development gained during the 1972 UN Conference on Human Environment has not ebbed a little until now.[8] In fact, the environmental discourse over the past 50 years was marked by several UN summits, conferences, declarations, conventions & protocols like the Rio conference of 1992, the Earth Summit of 2000, the Kyoto Protocol of 1997 & Millennium declaration of 2000, etc., which inadvertently moulded the dynamics of sustainability. [9] Sustainable practices are one such dimension of sustainability aimed at mitigating the detrimental impact of climate change. In layman's language, sustainable practices are those which have sustainable development at its core. This aspect of sustainable practices somewhat resembles the Sustainable Lifestyle. Sustainable lifestyles are the way of living, social behaviours & choices that minimise environmental degradation while supporting equitable socio-economic development & better quality of life for all.[10] As the UN definition of sustainable lifestyle is more encompassing, for the sake of convenience, we will consider the sustainable practices through the prism of sustainable lifestyle.

Article 7.5 of the Paris Agreement acknowledges the prominence of traditional & local knowledge of indigenous & tribal people in mitigation & adaptation mechanisms.[11] Through institutions like UNFCCC & instruments like SENDAI framework for Disaster Risk Reduction have highlighted the pressing need to inculcate the traditional knowledge in mitigation & adaptation mechanisms.[12] There is hardly any consensus on the definition of traditional knowledge & its contours. In legal jargon, the Indigenous & local knowledge system is the dynamic body of integrated, holistic, social & ecological knowledge, practices & beliefs pertaining to the relationship of living beings, including people, with one another & with their environment.[13] Specialized Agencies like the World Intellectual Property Organization[14] & institutions like the Convention for Biological Diversity have also furnished their own interpretations about traditional knowledge whose verbatim may differ, but the essence remains

[8] . Report of United Nations Conference on the Human Environment, May 5-16 ,1972, UN A/CONF.48/14/Rev.1.
[9] . Karen Whitfield, Quick Guide to Sustainable Development, History & Concepts, Senedd Cymru (2015) (June 1, 2024, 4;00 PM). https://senedd.wales/research%20documents/qg15-003%20-%20sustainable%20development%20history%20and%20concepts/qg15-003.pdf.
[10]. United Nations Education Programme, Why Sustainable Lifestyles Matter (June 1,2024, 4;13 PM) https://www.unep.org/explore-topics/resource-efficiency/what-we-do/sustainable-lifestyles.
[11]. Paris Agreement to the United Nations Framework on Climate Change, December 12, 2015, T.I.A.S No.16-1104.
[12]. United Nations General Assembly, Sendai Framework for Disaster Risk Reduction 2015-2030, U.N. Doc. A/RES/69/283(2015).
[13]. Intergovernmental Platform on Biodiversity & Ecosystem Services, Indigenous & Local Knowledge, IPBES Secretariat, 2016 (June 2, 2024, 1;00 PM) https://www.ipbes.net/glossary-tag/indigenous-and-local-knowledge#:~:text=A%20cumulative%20body%20of%20knowledge,another%20and%20with%20their%20environment.
[14]. United Nations Convention on Biological Diversity, June 5, 1992, 1760 U.N.T.S. 79(1992).

the same[15]. In simple words, traditional knowledge is a body of knowledge pertaining to the fields which are intimately related to nature & such knowledge is passed from one generation to the next, usually through oral means of communication.

All the above-mentioned aspects are intertwined with each other. Activities caused by humans have induced climate change that disproportionately affects indigenous & tribals. Sustainability endeavours to assuage the concerns engendered by climate change through sustainable practices. Traditional practices of indigenous & tribals formed a large part of the corpus of these sustainable practices. All these events, though apparently give solitary impression, their analysis ought to be done in an interconnected fashion.

THE NEXUS: LINK BETWEEN CLIMATE CHANGE & INDIGENOUS COMMUNITIES

Global surface temperature was 1.1degree Celsius above the pre-industrial level in the year 2011-2020. Atmospheric concentrations of prominent greenhouse gases like Carbon Dioxide, Methane & Nitrous Oxide are at an all-time high. The IPCC report has made it amply clear that climate change disproportionately affects countries like Least Developed Countries (LDC) & Small Island Developing States (SIDS) who are least responsible for climate change. This disparity is evident even within the population. Top 10% of the population contributes to 34-45% of global GHG emissions, while the bottom 50% emitting only 13-15% GHG emissions.[16] Indigenous communities often live in penury, which is further aggravated due to discrimination in social, economic & environmental dimensions. Despite constituting only 5% of the global population (370 million), 15% of the overall global poor are indigenous & tribal people.[17]

Indigenous & tribal communities mostly reside in geographical terrains like high mountains, tropical rain forests, polar areas, coastal lines & small islands, etc. World Bank estimates that nearly 13 million people in East Asia & Pacific, which is an abode for nearly 70-80 % of indigenous & tribal communities, will face extreme poverty due to climate change. IPCC &

[15]. R. Kumar Dhir & A. Ahearn, Indigenous Peoples & Climate Change: Introduction, ILO in collaboration with Oxford School of Geography & Environment (2019).
[16]. IPCC, 2023: Summary for Policymakers. In: *Climate Change 2023: Synthesis Report.* Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee, and J. Romero (eds.)]. IPCC, Geneva, Switzerland, pp. 1-34, 10.59327/IPCC/AR6-9789291691647.001.
[17]. World Bank, Implementation of Operational Directive 4.20 on Indigenous Peoples: An independent desk Overview, Vol.1, Report No. 25332(2010).

UNFCCC have already made it clear that communities in Asia, Africa, Central & Latin Americas, LDCs, Arctic & Small Islands will have to bear the brunt of climate change. [18]It signifies that climate change will only exacerbate the already precarious situation for indigenous communities. If we talk about livelihood & sustenance, fishing, rudimentary agriculture, hunting & gathering are some of the employment avenues for indigenous communities. More than 70 million indigenous communities rely on natural resources like forests for their livelihood[19].

Oceans, which account for 70% of the global earth surface, are one of the major absorptions sink of carbon dioxide & heat.[20] However, this heat absorption has caused sea warming & glacier melting, leading to a rise in sea level. IPCC records that there has been a 0.2m rise in mean sea level between 1901 and 2018.[21] Accumulation of anthropogenic gases like Carbon dioxide has inadvertently provided a fillip for ocean acidification. Ocean acidification has dealt a major blow to the oceanic ecosystem & has threatened the existence of biodiversity, habitats & pisciculture regions. Impact of climate change on cryosphere elements like ice sheets, glaciers, snow & permafrost is so colossal that, except for a few, most ice sheets have experienced loss in mass balance. The estimated 2022-23 ice sheet balance was about -217 Gt.[22] Melting of permafrost increases the chances of arid conditions. Grassland soil, which stores carbon dioxide, has been debilitating under extreme climatic conditions. Despite accounting for only 5 % of the global population, indigenous communities protect 22% of the Earth's surface & 80% of the remaining diversity.[23] In the end, it boils down to the conclusion that close & complex relations of indigenous communities with nature mean that negative spillovers emanating from climatic conditions will adversely affect them despite being the least responsible for these changes. However, their traditional knowledge of nature puts them in the driver's seat. With several reports highlighting the prolific importance of traditional knowledge, the same vulnerable indigenous groups can act as agents for climate change by catalysing their traditional knowledge.

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[18]. IPCC ,2023: Summary for Policymakers, *supra* note no. 16, A.2.5, at 6.
[19]. Sustainable Development Goals (Goal 15), Sustainably manage forests, combat Desertification, halt & reverse Land Degradation, halt Biodiversity Loss, United Nations, June 3, 2024, 4:35 PM), https://sdgs.un.org/goals/goal15.
[20]. World Meteorological Organization, State of the Global Climate 2023, WMO-No. 1347, (2023).
[21]. IPCC ,2023: Summary for Policymakers, *Supra* Note 16, A.2.1, at 5
[22]. WMO, State of the Global Climate 2023, *Supra* Note 20, at 13-14.
[23]. The World Bank, Social Dimensions of Climate Change: Workshop Report 2008, at.1, Vol.113, Doc. No. 44929 (2008).

TRADITIONAL KNOWLEDGE & PRACTICES: FUTURE OF SUSTAINABILITY

Global Climate Finance crossed the threshold of almost 1.3 trillion US dollars in the year 2021-2022, compared to 2019-2020. Though the levels are staggeringly high, they are still grossly inadequate, with the available corpus for climate finance representing a mere 1% of global GDP. The available climate finance is not equally distributed amongst countries all over the world, as a significant chunk of investments goes to countries like China, the USA, Brazil, India, Japan & European Nations.[24] With the saturation of climate finance in a handful of countries, economically vulnerable countries are forced to fend for themselves against pernicious climatic conditions. The majority of climate finance is dedicated to mitigation efforts, though the sustainable climate practices comprise mainly mitigation & adaptation strategies. If we want to realise the commitments proclaimed under the Paris Agreement within the given timeframe, the world needs prop up almost 9.5 trillion by 2030 & 10 trillion till 2050.[25] The cost of inaction is hovering around USD 1 266 trillion, accentuating the impending need for climate action. It becomes evident that despite a substantial rise in climate finance, due to its skewed distribution, it is by no means a panacea for all maladies.[26] Unlike other mitigation efforts, which involve an exorbitant burden on state coffers, traditional knowledge & practices based on it are not only environmentally sustainable but also economically viable. After a prolonged period of scepticism for traditional indigenous knowledge, the global community has finally recognised the value addition that such practices can bring in the crusade against climate change. Indigenous traditional knowledge & practices have, in the past, withstood sustained onslaughts from scientific communities who eschewed such knowledge by considering it redundant & rigid. For ex. group of the scientific community in New Zealand who in the past propounded the inadequacy of traditional knowledge in climate mitigation practices.[27]

The same scientific community not only extolls such knowledge but also cajoles the international community to imbue such practices to deal with climate change.

Though the effectiveness of such traditional knowledge cannot be underestimated, one needs to be cognizant of the fact that not every traditional practice of indigenous & tribal communities

[24]. WMO, State of the Global Climate 2023, *Supra* Note 20, at 30.
[25]. Climate Policy Initiative, Global Landscape of Climate Finance 2023, (2023).
[26]. Caroline Alberti, The Cost of Inaction, Climate Policy Initiative (2024).
[27]. F. Berkes, Indigenous Ways of Knowing & the study of Environmental change, Vol. 39(4), Journal of the Royal Society of New Zealand, pp 151-156 (December 2009).

is from the perspective of sustainable development. Though usually based on observable facts, it is nearly impossible to furnish a full proof solution to modern problems. Thus, before its integration into the other mitigation strategies to counter climate change, closer scrutiny of such practices to gauge their effectiveness is a sine qua non. In the end, best practice is nothing but the result of the amalgamation of indigenous knowledge with modern technologies. Such a practice is a mix that will provide more value than each one if pursued separately. [28]Keeping in mind this benchmark of best practice, we have considered the traditional practices that are not confined only to the indigenous communities & their regions, but will also provide value and benefit to ordinary people. In similar circumstances these knowledge & practices based on it will yield the same result, irrespective of the fact that such a practitioner may or may not belong to an indigenous group. 4 key study areas have been recognised based on the gravity of the threat that is looming due to climate change. These 4 areas are as follows,

- Weather Forecasting.
- Food Security.
- Water Scarcity.
- Forest Conservation.

WEATHER FORECASTING:

One of the primary reasons behind hesitancy in embracing the traditional knowledge was the biased notion that such knowledge lacks experimentation & is solely predicated on trial & error basis. The assumption that traditional knowledge is inaccurate & rigid, whereas the scientific one is logically valid & coherent, is no longer consistent. Weather forecasting was one such aspect of traditional knowledge where every practice had to face the suspicion of the scientific community. Weather forecasting, in simple terms, is the science of predicting the future weather & atmospheric conditions even before they actually occur. Indigenous communities, for a long time, have relied on direct observation of animate as well as inanimate objects in nature for weather forecasting.[29] The variability of climate change has indeed made many streams of

[28]. A. Nyong, F. Adesina & B.O Elasha, The Value of Indigenous Knowledge in Climate Change Mitigation & Adaptation Strategies in the African Sahel, Vol. 12(5), Springer, pp 787-797(2007).
[29]. A. Mercer, D. Dominey- Howes, K. Lloyd, The Potential for combining Indigenous & Western Knowledge in reducing vulnerability to Environmental Hazards in SIDS 2007, Vol. 7, Environmental Hazard, pp 245-256(2007).

traditional knowledge concerned with weather forecasting redundant.[30] However, in many domains, such knowledge is still pertinent. Unlike conventional science of weather forecasting, the traditional indigenous approach is concerned with smaller geographical areas. Estimates of conventional weather forecasting have usually limited applicability when it comes to the day-to-day affairs of indigenous communities.[31] The ambit of the conventional scientific approach of weather forecasting is already truncated due to the concerns regarding financial viability & interpretative challenges when it comes to indigenous communities.[32] Simeulue & Moken tribal communities & their application of traditional knowledge to forecast weather during the 2004 Indian Ocean Tsunami Catastrophe accentuates not only the relevance of traditional knowledge but also its efficacy. Where more than 2,30,000 lives were lost due to the tsunami & earth quake, the same tribal communities were able to save thousands of lives. By observing the sudden retreat of water, these communities swiftly relocated from the shores to the higher terrain. [33]Another case study of traditional weather forecasting is observed by Afar pastoralists of North-East Ethiopia. The weather forecasting practices followed by this tribe have defied assumptions that traditional knowledge of weather forecasting is based on trial & error pattern. Any prediction in the Afar community is not taken at its par value, as the community is aware of the inherent limitations of such a traditional knowledge system. To eliminate the scope for errors, the community has developed a triumvirate of information mechanics. Adda the traditional administration system, collates weather-related information from weather & climate assessment missions known as Edo & communication networks for dissemination of weather information, which are identified as Daru. Information derived from all the 3 sources is then used to formulate the most probable weather predictions.[34] Even in the Indian subcontinent, the plentiful blossoms of trees like peach & apricot are considered to bring good rain. Increased appearance of ants & ant-hills signals warming of the environment, based on which locals consider their farming practices in accordance with the extant environment, like crops that can withstand varying degrees of heat.[35] All over the world, there is no dearth of such traditional guess-estimations; traditional weather forecasting is by no means an alternative to scientific

[30] . C. Rancoli, P Kirshen, L. Ingram, Reading the rains: Local Knowledge & rainfall forecasting in Burkina Faso, Vol. 15, Society & Natural Resources, pp 409-427(2002).
[31]. *Id,*at 30
[32]. K. Shoko & N. Shoko, Indigenous weather forecasting systems: A case study of the abiotic weather forecasting indicators for wards 12& 13 in Mberengwa district of Zimbabwe, Vol.9, Asian Social Science, pp 285-297(2013).
[33]. D.Elias, The Knowledge that saved the sea gypsies, Vol.3(2), A World of Science UNESCO, pp 20-23(2005).
[34]. M. Balehegn, S. Balehey, The role of customary institutions in climate change adaptation among Afar pastoralists in north-eastern Ethiopia, Indigenous & People & Climate Change ILO, pp 35-51(2019).
[35]. P. Rautela & B. Karki, Weather Forecasting: Traditional Knowledge of the People of Uttarakhand Himalaya, Vol. 3(3), Journal of Geography, Environment & Earth Science International, pp 1-14(2015).

patterns of weather forecasting. In the end, the best practice is the one which amalgamates both scientific and traditional approaches to produce greater yields. Co-production of weather patterns based on a system which considers traditional as well as scientific aspects will have relevance not only at the global level but also at the micro level.[36]

FOOD SECURITY:

FAO defines food security as a situation wherein all people at all times have physical & economic access to sufficient, safe & nutritious food which meets their dietary needs & food preferences for an active & healthy life.[37] Though remarkable progress has been achieved in the reduction of hunger, malnutrition & multidimensional poverty, the number of people suffering from acute food insecurity has jumped to 345 million in 2022.[38] This leads us to the conclusion that out of the 3 A's of food security, accessibility & affordability are still missing, thus making the component of availability redundant. The UN Food and Agriculture Organisation (FAO) estimates that there is a need to produce about 50% more food by 2050 to feed the increasing world population.[39] This becomes an uphill task when food systems are responsible for about 21-37% of global GHG emissions. Evidence from IPCC has indicated with strong confidence that climate change not only affects the present but will also have ramifications in future. As the demands for sustainable agricultural practices are getting louder, traditional agricultural knowledge of indigenous communities comes into the picture. World Bank recommends effective water management, soil improvement & crop rotations as some of the measures to ensure sustainable yet equally affordable & accessible food systems.[40] Kuttanad Kayalnilam farming practice in Kerala is one such example of a traditional indigenous practice through which sustainable food security can be achieved. Indigenous communities, through the Kayalnilam farming practice, have been cultivating paddy farming below sea level for centuries. In this system, with the help of bio bunds & canals, water irrigation is ensured. To avoid the influx of excess water, dewatering techniques are resorted to while the temporary barriers are erected to block salt. This technique has withstood the

[36]. E. Weatherland, S. Gearheard, R.G. Berry, Changes in Weather Persistence: Insight from Inuit Knowledge, Vol.20, Global Environmental Change, pp 523-528(2010).
[37]. World Food Summit Plan of Action, Nov. 1996, U.N. Pub.No. A/CONF.164/10(1996).
[38]. The World Bank, What You Need to Know About Food Security & Climate Change, 2022(June 4,2024 5;30 PM), https://www.worldbank.org/en/news/feature/2022/10/17/what-you-need-to-know-about-food-security-and-climate-change.
[39]. Food & Agricultural Organization, The Future of Food & Agriculture: Alternative Pathways to 2050(2018).
[40]. C. Mbow, C. Rosenzweig, Food Security in Climate Change & Land, An IPCC Special Report on Climate change, desertification, land degradation, sustainable land management, food security& greenhouse gas fluxes in terrestrial ecosystems 2019(June 5,2024, 12:00 PM), https://www.ipcc.ch/srccl/chapter/chapter-5/.

onslaught of seasonal flooding & saline water intrusion. Another striking feature of this practice is the inculcation of technology in dewatering mechanics. Modern mechanism has replaced manual labour, which signals the confluence of traditional as well as scientific knowledge.[41]

The Atapani cultural landscape in Arunachal Pradesh & Zabo farming of Nagaland have epitomised the sustainability in food production. Atapani communities' simultaneous cultivation of paddy as well as fish has been recognised even by UNESCO.[42] Natural products like bamboo shoots for the construction of pipes & structures make the entire system not only environmentally sustainable but also economically feasible. Cultivation of paddy in watery fields restricts erosion whereas the practice of pisciculture in the same paddy field acts as pest control system.[43] Zabo farming of Nagaland also has striking resemblances with that of Atapani, although with the uniqueness of its own. The ingenuity of the Zabo community in the construction of stone-walled terraces has ensured water retention & has effectively stemmed soil erosion. In rugged geographical hilly terrains, Zabo farming has ensured that cultivation practices will not suffer. Zabo farming solves the conundrum of soaring need for agricultural produce that has engendered due to population explosion, without affecting the environment in a negative manner.[44] All these practices are still in vogue, not because they are traditional but because they still provide them livelihood for indigenous communities without any blot on nature.

WATER SCARCITY:

Water is one of the essential conditions for life, in the absence of which life cannot sustain itself for long. Climate change is still in its inchoate stage & the water situation is already precarious. 2 billion people even now lack access to safe drinking water & half of the world has been accustomed to severe water scarcity at least for part of the year.[45] With climatic conditions negatively affecting elements of the cryosphere like glaciers & snow covers, the frequency of

[41]. Food & Agriculture Organization of the United Nations, Kuttanad Below Sea Level Farming System in India (June 5 ,2024, 3:30 PM), https://www.fao.org/giahs/giahsaroundtheworld/designated-sites/asia-and-the-pacific/kuttanad-below-sea-level-farming-system/en/.
[42]. UNESCO World Heritage Convention, Atapani Cultural Landscape (June 5, 2024, 3:30 PM), https://whc.unesco.org/en/tentativelists/5893
[43]. A. Govil, M.R. Kanchan, Atapani Cultural Landscape of Ziro, Traditional & indigenous practices for climate resilience in India, pp 54-55(2023).
[44]. N, Murry & S. Das, Zabo Farming System: A Sustainable Farming based on Traditional Knowledge for Natural Resource Management Practiced by Tribal in Nagaland, India, Vol.14(2), International Journal of Agriculture, Environment & Biotechnology, pp 203-205 (2021).
[45]. United Nations, The Sustainable Development Goals Report 2022, U.N. Doc. ST/ESA/3779, (2022).

droughts & inundations is bound to rise. Percolation of saline water into the groundwater streams due to a rise in the mean sea level has posed a great threat to freshwater resources.[46] Water-related disasters have claimed 70% of deaths that have occurred over the last 50 years. [47] As the incidence of floods & droughts is projected to be higher for regions like Asia & Africa, respectively, the need for urgent action is imminent.[48] WMO has suggested solutions like improved water management, early warning systems, & climate friendly agriculture to tackle this Goliath.[49] However, these solutions might be economically exorbitant in a particular locality. The void that may probably erupt due to prolonged acquisition & adaption of these advanced technologies can be filled by the traditional practices.

We have already seen the use of Bamboo in the Atapani cultural landscape as a sustainable conduit for passage for water. Use of the Bamboo drip system is, however, observed all over in north-eastern states. The bamboo drip irrigation system of Meghalaya adroitly utilises the limited water resources in hilly terrain. The hilly region of Meghalaya cannot retain a large amount of water & ground cannel utilisation is also near to impossible. Like the Atapani cultural landscape, this practice involves only naturally sustainable materials like bamboo shoots, forked branches, & fibre rich twine to keep the system intact.[50]

Surangams of the Western Ghats are an ingenious way of water management through catalysing traditional knowledge of hydraulic engineering. Surangams differ in size- some are rectangular, whereas some are dome-shaped. These Surangams not only preserve water but also keep a tab on emissions as they are usually covered with vegetation, which traps atmospheric carbon. Aflaj irrigation in Oman & Qanats of Afghanistan are some of the global practices which resemblance with Surangams[51].

Kuhls irrigation system of Kangra Valley, which taps into the unique potential of snow water & rainwater in mountainous terrains. Passage of water from the mountainous region to the

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[46]. Bates B.C, Z.W. Kundzewicz, S. Wu & J.P. Paluikof, Climate change & Water, Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat Geneva (2008).
[47]. The World Bank, Water Resources Management (June 6, 2024,10: 00 PM), https://www.worldbank.org/en/topic/waterresourcesmanagement.
[48]. World Meteorological Organization, 2021 State of Climate Service: Water, WMO No.1728(2021)
[49]. World Meteorological Organization, Early Warning systems must protect everyone within 5 years (March 21,2022), https://wmo.int/news/media-centre/early-warning-systems-must-protect-everyone-within-five-years.
[50]. P. Ryngnga, Traditional Irrigation System: Bamboo Dripping System in Meghalaya, Vol.7(10), International Journal of Science & Research (2018).
[51]. A. Govil, M.R. Kanchan, Bamboo Drip Irrigation of Meghalaya, *Supra* Note 43, pp 38-39

plains is ensured through the ranges (Dhaula Dhar) in the Himalayas.[52] If the Kuhls irrigation integrates rainwater & snow water from upper terrain, Jheel- Virdas in Banni Grassland of Gujrat ensure the access of water in desired quality & quantity to the pastoralists & nomadic tribes.[53] After selection of the requisite terrain, Jheels & Virdas are built to accumulate rainwater, which infiltrates into the aquifer, thus providing an ample water supply even after the rainy season. During the summer season, Jheels are desilted & Virdas are dug to tap this water. Though direct imitation of these practices may or may not be entirely, however, in similar circumstances, if the same inputs are provided, these practices will give the same outcome.[54]

FOREST CONSERVATION:

Approximately 1/3rd of Earth's land surface is covered with forests. These 4 billion hectares of land area are home to multiple species of trees, amphibians, avians & mammals.[55] Forest ecosystems not only provide livelihood opportunities for more than 1 billion people but also serve as a source for water, food, medicines & clean air. Especially in the case of indigenous communities, who consider the forest as their abode, any slight deviation in the forest ecosystem can cause serious repercussions for them. Forests are unique not only because they provide sustenance but also because of their capability to act as a carbon sink. As forests absorb large chunk of carbon than what they emit, IPCC has identified a pivotal role agriculture, forestry & land use can play. [56] IPCC pins its hopes on AFOLU to reduce global emissions to keep global warming at 2 degrees Celsius. However, this is easier said than done. As the current AFOLU practices account for 1/5th of global emissions, urgent action is warranted. [57] Certain Indigenous knowledge & practices derived from it can help to address this gargantuan challenge.

Fire is considered the key element in the indigenous community, unlike the belief of early westerners who attributed ecosystem damage to fire & supressed wild fires under the pretext

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[52]. A.K. Sharma, K.D. Sharma & B. Prakash, Death of Kuhl Irrigation System of Kangra Valley of Himachal Pradesh: Institutional Arrangements & Technological Options for Revival, Vol.70(3), Indian Journal of Agricultural Economics (2015).

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of environmental & ecosystem conservation.[58] Rather than considering fire as a threat to the environment, fire is revered & considered a sacred entity in indigenous communities. Taragu Benki & Soliga Adivasis are one of such communities that ensure sustainable practices via resorting to fire. While frequent bushfires are infamous in Australia, these tribes use fire in a controlled manner to cleanse the lower storey of the forest. The area of burning is identified after due consideration of vegetation & ecosystem in the area, wind directions, soil & topography, etc. Such practices are usually observed in the dry season, which clears the debris accumulated since the rainy season. The ash produced through these burning practices also nourishes the soil with nutrients. Artificial barriers like fire breaks & natural barriers like streams or rocks are put in place to ensure fire does not transgress the designated areas.[59]

Piscicidal plant fishing practices of Nagaland also strategically devise the natural vegetation to regulate overgrown species. Components used for such practice are biodegradable as well as damage-free to the ecosystem, for example. Plant species like Duboisia & Theporosia. Apart from these practices, faith-based conservations are also prevalent in such communities. Totemism, animism, shamanism, etc., are such religious & cultural practices of indigenous communities through which they not only endeavour to preserve the forests, but also the very species inhabiting them. Sacred Groves are one such example of faith-based preservation. Groves are designated areas which are considered divine or sacred. Such groves form the very epic centre of indigenous communities' life & their way of living. Not only are such grooves abode of spirituality & ecological eminence, but also preserve the environment through customary laws, regulations or taboo which proscribe any encroachment on such land.[60]

One needs to understand that the categories given here are not exhaustive & there exist practices which may transcend beyond these categories. For example, Khazan traditional practices ensure the conservation of coastal zone management, while the Phumdis & Ataphums of Manipur create habitat for the growth of flora & fauna either naturally or artificially. [61]These examples thus accentuate the limited scope which the author decided to analyse, keeping in mind word limits.

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CONCLUSION:

After a thorough understanding of concepts that constitute the bedrock of the entire analysis, interpretational ambiguities were resolved without compromising the letter and the spirit of these concepts. With the evidence collated from primary & secondary sources, a nexus was established between the 2 key components of the essay – climate change & indigenous communities. This very nexus helped to establish not only the relevance of traditional indigenous knowledge & practice but also their efficacy & efficiency. Based on the notion of best practice, indigenous traditional practices were segregated into certain key sectors. The inclusion or exclusion of any practice was hinged on its performance on indicators like adaptability, relevance & efficiency. Based on their performance, the conclusions were formulated, which are as follows:

- Climate change disproportionately affects indigenous people due to their pre-existing vulnerability in social, economic, political & cultural dimensions.

- Traditional indigenous knowledge of these communities was ignored till now due to the pre-conceived notions of redundancy and rigidity associated with it.

- Traditional indigenous knowledge & practices modelled on that have the capacity to play the pivotal role in climate change due to the innate limitations of emerging technologies and skewed distribution of climate finance.

- Not every traditional indigenous knowledge will be climate-friendly or relevant, as the scrutiny of their effectiveness is a sine qua non condition before their incorporation into Adaptation & Mitigation policies.

- Traditional knowledge alone will not be sufficient against extreme climate conditions. The best practice will be the one which inculcates the best features of both the scientific and the traditional knowledge.

- Selected traditional indigenous knowledge practices will be relevant only to the extent they are serving the purpose without any damage. Adaptability of these practises will decide whether they will remain relevant or become obsolete.

In the end, we are at the inflexion point, from where 2 paths will diverge. One path will lead to

a climate catastrophe wherein the most vulnerable will suffer without any liability on their part, while the other path will be the one wherein peaceful coexistence of humanity in an environment with the least possible pernicious downturns on the environment can be observed. We are in the driver's seat, and the choice will be ours…. what kind of future do we aspire for? the one where they very descendants & aboriginals, will be victims of climate change or the one in which the same indigenous & tribals will spearhead the crusade against climate change?