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Climate Change Impact in the Tribal Localities of High Rainfall Zone of Tamil Nadu

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ABSTRACT

The study was conducted in the high rainfall zone of Tamil Nadu during the years 2022-23 to document the impact of climate change, assess awareness and perception of the tribal communities and to suggest suitable strategies. The study was conducted in two tribal dominant villages of Kanyakumari district with 60 tribal respondents selected using simple random sampling technique. The PRA methods such as focused group discussion, seasonal calendar, time line and interactive group meetings were employed to document the climate based issues and further categorized in to eco system based, livelihood based and socio cultural life based. On these impacts, awareness and perception of the respondents were assessed. Standardized interview schedule was employed for data collection. The results showed a marginal increase in the maximum temperature and minimum temperature. Marginal declining trend was observed in relative humidity and rainfall distribution compared with the base year value. The wind behaviour showed an erratic variation. Respondents faced different issues on their livelihood, ecosystem and socio-cultural life. It has been suggested to establish a separate climate based nodal agency to address the issues of climate change in the tribal localities.

INTRODUCTION

The indigenous tribes all over the world are dependent on the resources of the natural ecosystem. The forest products like, wild edible fruits, plants, medicinal herbs, tubers, honey, tree bark and other forest collections such as wild mushrooms provide them income from local markets. Their food system is mostly dependent on the local millets, fruits, vegetables, tubers, wild banana and to some extent local varieties of rice and other cereals. The over utilization / mismanagement of the natural reserve base, deforestation, excessive carbon emission have modified the climatic factors in the localities of the tribal communities, which affect their sociological life. The climate variabilities have not been much studied due to several constraints like poorly distributed meteorological stations, poor strength of remote sensing data, sudden and unpredicted variations in cloud distribution and micro climatic variations of the naturally bound tribal localities (Hallegatte et al., 2009; Rana et al., 2013; Pepin et al., 2015). In this angle, UNSDN (2021) reported that the effect of climate change is disproportionately distributed among tribal communities. Ghosh et al., (2021) stated that these changes have created severe effect on these tribes' income generation activities and food system which are very much related to the ecological subsistence and maintaining the forest resources.

The undesirable climatic variations are mostly erratic variations in the rainfall distribution, increased levels of day and night temperature, unpleasant relative humidity, erratic wind behaviour and unpleasant snow fall distribution. Sejian (2013) stated that the local fodder and pastures are very much affected by unfavourable variations in climatic factors, especially the higher temperature. In the same line Rani et al., (2013) stated that declined crop yield is a prime consequence of the unfavourable higher temperature. Kayet

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et al., (2016) reported that the climate change have impacted the livelihood, ecosystem and socio-cultural activities of local tribes.

As regard resilient practices, Sai et al., (2022) reported that the local tribes have repaired their surface water storage structures and provided vaccination and nutritive fodder to their animals. They also followed other advocated animal health care management practices. Vijayabhinandana et al., (2022) opined that the local tribes have to be trained on the management of the unfavourable climate variability to protect their own natural ecosystem. Rajeshkumar (2019) strongly observed that the local tribes are having close association and in-depth knowledge of their own natural ecosystem and guarding their ecosystem. Their climatic perceptions reflect local issues and response, which are relatively accurate and for devising appropriate remedial strategies. Minj (2013) and Sharma (2019) opined that the variations in climatic factors affect food system and general sociological life of tribes and hence an in-depth study is required to be carried out. Ghanghas et al., (2015) stressed the need for the knowledge of the climate change impact of the local ecosystem by the extension functionaries so that appropriate remedial measures could be taken up. Negligence of human and social dimensions of climate change on Indigenous peoples create serious concern and hence the study has been taken up.

METHODOLOGY

Among the seven agro climatic zones of Tamil Nadu, the present study was conducted in the High Rainfall Zone considering the presence of large volume of tribal communities. From the High Rainfall Zone, the Kanyakumari district was identified for the study considering the maximum tribal population in this district. Again on the same criteria the block 'Thiruvattar' was selected. The villages viz., Mudavan Potrai and Moncode were selected from this block considering the large volume of tribal communities. The 'Kani tribe' is the most prominent local tribe in both villages. From each village thirty tribal respondents having vast experience in the local ecological and socio-cultural aspects were identified hence totally there were sixty tribal respondents, among whom the present study was conducted.

The first step focuses on the documentation of the climate induced impacts from the study area. By employing the PRA methods such as focused group discussion, seasonal calendar, time line and interactive group meetings with the local tribes, the climate-based issues were documented. The expertise of the local extension workers, social workers and tribal development authorities were utilized to document the climate induced issues. Such documented impacts were further categorized in to eco system based, livelihood based and socio cultural life based. Secondly, on these impacts, the level of awareness and perception of the native tribes were assessed. For this analysis, thirty tribal respondents from each identified village were selected and thus the total sample size was 60tribal respondents Structured and standardized interview schedule was employed for data collection from the sample respondents. The data were collected during January – February 2023. Finally, based on the above results, appropriate policy recommendations, suggestions and strategies were proposed by involving the eminent personalities and experts in this field.

RESULTS AND DISCUSSION

Recent changes in the climatic factors

To study the recent changes in the climatic factors, the average values from the years 2012 to 2021 were considered. The average values for the years from 1981-2021 were kept as base year values. Against the base year values, the recent year values were compared to find out the recent variations / changes in the climatic factors. For easy understanding, the above facts are presented in the Table 1. With regard to the maximum temperature, there existed a marginal increase against the base year value of 29.02°C. As regard the minimum temperature, the same marginal increasing trend was observed throughout the assessment years against the base year value of 26.04°C. Regarding the relative humidity, the study area experienced a marginal decrease till 2020 against the base year value of 80.41 per cent. Only during 2021, there as a sudden increase in the relative humidity of +2 per cent against the base year value. The rainfall distribution showed a marginal declining trend against the base year value of 4.02 mm. Only during 2021 there was a noticeable increase in the rainfall seen (+1.23 mm). The wind velocity showed a marginal increase during the initial years from 2012 to 2014 against the base year value of 4.47 m/s, after which it showed a marginal declining trend till 2021.

Table 1. Recent changes in the climatic factors of the study area

Year	Increase or decrease in maximum temperature (°C)	Increase or decrease in maximum temperature (°C)	Increase or decrease in relative humidity (%)	Increase or decrease in rainfall (mm)	Increase or decrease in wind velocity (m/s)
Base Year#	29.02	26.04	80.41	4.02	4.47
2012	+0.49	+0.39	-2.21	-1.93	+0.25
2013	+0.25	+0.20	-0.92	-1.21	+0.16
2014	+0.22	+0.28	-0.26	-0.61	+0.05
2015	+0.25	+0.43	-0.11	-0.09	-0.34
2016	+0.73	+0.28	-1.51	-2.18	-0.11
2017	+0.44	+0.22	-0.48	-0.91	-0.06
2018	+0.22	+0.08	-0.11	-1.27	-0.34
2019	+0.74	+0.67	-1.14	-0.28	-0.23
2020	+0.56	+0.55	-0.20	-0.60	-0.12
2021	-0.15	+0.25	+2.07	+1.23	-0.02

Previous thirty years average values

Impact of climate change on the livelihood activities of the respondents

The climate based issues and issues on the mismanagement of the natural resources are interrelated and hence both of these issues were documented and studied. By having vast interaction with tribal leaders, extension workers, social workers and tribal development authorities, we have documented 09 issues which are presented in the Table 2. All the tribal respondents were aware that honey collection is highly affected nowadays due to higher atmospheric temperature coupled with erratic wind behaviour and they also had the right perception for this particular issue. An overwhelming majority of the respondents (96.67%) were aware that the cashew crop once provided profitable returns, failed nowadays due to frequent cyclonic storms. They were also very much aware of the fact that the present local ecosystem fails to support them financially and hence they are forced to work as labourers outside. Almost the same percentage of the respondents had the right perception on the cause of the above issues. 91.67 per cent of the respondents were aware that some of the local promising medicinal plants have disappeared due to deforestation coupled with resultant unfavourable variations in climate change and they also possessed a right perception about this issue. There were few such medicinal plants, viz., Panampazham, Vittipazham, Kodampuli, Elengi, Muttapazyham and Berikai which provided them rich income for the local tribes. They collected the leaves, flowers and roots of these local medicinal plants and sold them in the outside market. Further most of the respondents (86.67%) were aware that the local wild edible fruits viz., Redmunthiri, Puzhipumunthri, Bilimbipazham, Kollampazham which once provided promising income almost vanished from the locality due to varying higher temperature coupled with deforestation, on which 80.00 per cent of the respondents were seen with right perception. The local turmeric, yellow myrobalan (kadukkai), gooseberry, tree barks, anantamul (vetiver-nannari), Sal tree (kungaliyam) once provided them promising income, couldn't fetch income now due its declined quality on the changing climatic factors (Higher Temperature, unseasonal rainfall, unfavourable higher RH), coupled with suitable low priced alternatives in the outside market. A good majority of the tribal respondents (66.67%) were aware about this fact and at the same time almost a similar percentage of the respondents (65.00%) have correct perception.

Impact of climate change on ecosystem and socio-cultural life

All the respondents were well aware about the fact that the endemic birds like sparrow, weaver bird (sleepless sparrow), parrot, cuckoo (kuyil), and peacock had almost disappeared due to deforestation and current changes in climatic factors (Rainfall, temperature and wind) (Table 3). They also possessed right perception on the cause of this issue. An overwhelming majority of the respondents (96.67%) were aware that the local native banana varieties like neipoovan, kathali, ethan and karpooravalli were out of the system due to crop lodging issue as they encounter frequent cyclonic storms. The area experiences intensive deforestation now a daysand even a less intensive cyclonic storm hit their locality in a great way. Here 91.67 per cent respondents had right perception on the cause of the issue. An overwhelming majority of the respondents (96.67%) were aware about the disappearance of a locally promising fodder crop called 'seenampul' due to land conversion and camp fire activities by the tourists

The respondents were aware about the changing food habits. Previously they consumed lot of millets (samai, varagu), bamboo rice, local wild fruits, vegetables, greens and tubers. Now due to human mismanagement activities of the natural resources like deforestation, land conversion and land promotion activities and associated variation in the local climatic conditions, these local crops are vanishing from their locality gradually and hence they are gradually shifting to majorly on rice and other non-locality based food products. The results on their perceptual understanding also reveal that, cent per cent of the respondents were seen with right perception about this issue and associated causes (Table 4). Further, they were well aware that their culture experienced changes due to political situations and introduction of modern values. The

Table 2. Awareness and perception of the climate change impact on livelihood

S.No.	Issues	Awareness (%)	Perception agree (%)	Perception disagree (%)
1.	Profitable traditional millet cultivation is almost disappeared now due to the changing climatic conditions	83.33	75.00	25.00
2.	Cashew was the one of the profitable crops, which failed now due to frequent cyclonic storms	96.67	96.67	3.33
3.	The local major crops failed to give profitable returns due to crop lodging issues owing to heavy rainfall and erratic wind behavior now a days	75.00	66.67	33.33
4.	Honey collection was affected due to higher temperature coupled with erratic wind behavior	100	100	0
5.	The local wild edible fruits once provided promising income almost vanished from the locality due to varying higher temperature coupled with deforestation	86.67	80	20.00
6.	The local medicinal plants once provided rich income miserably disappeared due to deforestation coupled with resultant unfavourable variations in climate change	91.67	91.67	8.33
7.	The local tubers fail to give usual yield with marketable quality due to continuous water logging on the unseasonal and erratic rainfall	73.33	63.33	36.67
8.	Declined quality of local tree / plant parts on the changing climatic factors (Higher Temperature, unseasonal rainfall, unfavourable higher RH), coupled with suitable low priced alternatives in the outside market	66.67	65.00	35.00
9.	As local ecosystem fails to support financially, now working as laborers outside	96.67	90.00	10.00

Table 3. Awareness and perception of the climate change impact on ecosystem and socio cultural life

S.No.		Awareness (%)	Perception agree (%)	Perception disagree (%)
Ecosystem				
1.	Endemic birds almost disappeared due to deforestation and current changes in climatic factors (Rainfall, temperature and wind)	100	100	0
2.	Local native banana varieties were out of the system due to crop lodging issue as they encounter frequent cyclonic storms	96.67	91.67	08.33
Socio cultural life				
1.	Changing water use tradition due to the destruction of natural surface water storage structures	83.33	78.33	21.67
2.	Changing food habits due to changing local crops	100	100	0
3.	House roofing previously with locally available grass called 'Tharuvaipul', coconut thatches and bamboo– Now concrete. This is due to changing socio cultural values, non availability of these plant materials due to deforestation and gradual negligence	100	91.67	08.00
4.	Jack tree urn for grinding purpose now mixie introduced	98.33	90.00	10.00
5.	Their culture changed due to political situations and introduction of modern values, camp fire, tourist, plastic materials, alcohol bottles	10	100	0
6.	Previously they prepared cultural dress with 'Mara yuruvi' tree bark materials and used them during their temple festivals, now changed due to the non availability of these tree (deforestation)	90.00	80.00	20.00
7.	Restricted family and social ceremonies and festivals due erratic climatic factors and the associated factors	83.33	75.00	25.00

frequent trespass by the tourists and others in the name of development workers introduce the modern values in to the local system knowingly or unknowingly. The camp fire activities by the tourists create lot of disturbances to the local ecosystem besides deteriorate their socio-cultural values. There were lot of garbage of plastic materials and alcohol bottles. The respondents also possessed right perception on this issue.

House roofing was previously constructed with locally available grass called 'Tharuvaipul', coconut thatches and bamboo and now they shifted to concrete. This is due to changing socio cultural values, non availability of these plant materials due to deforestation and associated unfavourable variations in the climatic factors. Cent per cent of the tribal respondents were well aware of this issue and most of them were possessed with right perception. The respondents were also aware about the changing trends in the household utensils made up of local materials. Previously used mud pots, leaf plates, urns prepared out of local wood and other house hold furniture and utensils made out of local wood and stones. Now, due to intensive deforestation, soil erosion, soil transportation and non availability compatible plant / tree materials, they depend more on modern utensils and household items. Previously they prepared their cultural dress with 'Mara yuruvi' tree bark materials and used them during their temple festivals, now changed due to the non availability of these tree due to deforestation and associated variations in the climatic factors lead to the declined quality of the bark material. Ninety percentage of the tribal respondents were aware about this issue and a vast majority (80.00%) of the respondents had right perception about this issue. The local tribes had their own tradition of celebrating family and social festivals and ceremonies during the monsoon months and after harvesting their major food crops. Now due to erratic variations in the climatic factors, these festivals and ceremonies are being celebrated with restricted days and even foregone sometimes.

Table 4. Endangered native vegetation / birds / animals as results mismanagement of natural resources and consequent unfavourable climate change

Crops - Area reduced / disappearing	Wild fruits and vegetables	Native birds / animals	New crops / Exotics introduced
• Cashew • Local banana - Neipoovan - Kathali - Ethan - Karpooravalli • Millets - Little millet - Kodomillet • Bamboo rice • Local wild tubers	Wild edible Fruits Redmunthiri, Puzhipumunthri, Bilimbipazham, Kollampazham Medicinal herb Panampazham, Vittipazham, Kodampuli, Elengi, Muttapazyham and Berikai Wild Edible plants Mullukeerai, Camparavalli, Naluellaikeerai, Yanainerunjil and Kalthamarai, Kovakkai, Kantharichillies, Sathurapayiru (local beans), Pirandai, Valuthulangai brinjal, Thoppi brinjal, local pumkin, Kari pirandai, Red bhendi, Vella matti (Mattipayir) Local fodder Seenampul, Tharuvaipul Tree bark - Mara yuruvi	• Sparrow • Weaver bird (sleepless sparrow) • Parrot • Cuckoo (kuyil) • Peacock	Crops • Paddy • Rubber • Neeruzhavan Kottai Birds • Poultry (Giriraja)

Table 5. Socio cultural issues and the major contributing factors

Changes in regular food habits	Changes in the health management practices	Changes in the dressing pattern	Changes in the celebration of family festivals / ceremonies	Changes in the housing pattern	Disappearance of traditional utensils	Changing culture of water use tradition
1. Introduction of exotic vegetables 2. Promotion by MNC processed grains, vegetables and value-added products with profit motive 3. Habitat destruction 4. Conversion of agricultural land and forests into commercial sites	1. Pollution of Overall environment 2. Erratic changes in climatic factors 3. Contamination in the food products 4. Water pollution 5. Changes in the food habits 6. Air pollution	1. Changes in the environment 2. Climatic variations 3. Tourism (societal pollution)	1. Disappearanceof Local crops/ varieties 2. Changes in the attitude of local tribes 3. Disappearance of endemic plants	1. Changes in environment 2. Non availability of local construction materials 3. Frequent land slides	1. Introduction of modern utensils 2. Non availability oflocal materials 3. Changes in the food habits 4. Changes in the attitude	1. Shortage of water for domestic purpose 2. Drinking water diverted to farming (spring) 3. Construction 4. Introduction of exotictrees

Suggestions and strategies

The local tribal leaders, local extension workers and experts having rich experience in tribal ecosystem were requested to suggest their views in developing appropriate strategies In line with their suggestions to mitigate the documented climate based issues in line with the results given in the Tables 5 & 6. Based on their suggestions the following modules are proposed. This module covered the aspects viz., stabilizing their livelihood activities, protecting and maintaining the ecosystem resources and socio-cultural values.

CONCLUSION

There existed a marginal increasing trend in the maximum and minimum temperature, marginal declining trend in relative humidity and rainfall distribution and erratic wind behaviour. Their local millets, cashew and major crops declined to give profitable yield in a great way. The major wild edible plants, fruits, tubers and medicinal plants also disappeared. Honey and forest collection also affected. Their endemic plants, fruits, tubers, medicinal plant, local fodder and endemic birds almost disappeared. Land degradation, environmental pollution and loss of soil fertility are common. They faced many socio-cultural issues like, changing water use tradition, hanging food habits, changing house construction materials, preparation of house hold utensils and home furniture, change of their total culture. It is recommended to establish a government nodal agency specially to protect their indigenous overall culture including their livelihood and ecosystem. Periodic educational training programmes are suggested to educate them on preserving their ecosystem.

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