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DOCUMENTATION OF TRADITIONAL KNOWLEDGE OF BAIGAS OF DINDORI DISTRICT, MADHYA PRADESH WITH SPECIAL REFERENCE TO THEIR STRATEGIES IN COPING CLIMATE CHANGE

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ABSTRACT:

Baigas of Dindori district acquire a distinctive knowledge of plant genetic diversity needed to fight plant and animal diseases and their know how to breed varieties that can cope with stressed environments. They are one of the largest tribal group in the world, mostly found in the forests of central India. They practice shifting cultivation Bewar (slash & burn) in forest areas of Baigachak region. They possess enough knowledge about wild varieties of Agricultural crops, edible tubers, vegetable crops etc. Traditional Bewar seeds conserved by the community possess qualities to grow in extreme environmental conditions and utilized to fight climatic disturbances like severe drought and floods (Kulthi- *Macrotyloma uniflorum*), Jhunjhuru- *V. unguiculata*), Pigeon Pea- *Cajanus cajan*, Adzuki Bean- *Vigna angularis*). Traditionally they are protecting Agricultural crops from insect infestation while using different fruits, seeds and leaves extract (Harad- *Terminalia chebula*), Neem *Azadirachta indica*) seed paste is used for removing caterpillar, flies attack from Rice and other Agricultural crops. In recent past, the Baigas land has experienced substantial deforestation and the rich heritage of indigenous knowledge is being lost forever. Therefore, there is urgent need to preserve and document age old knowledge pass through generations. An attempt has also been made to explore the traditional knowledge of Baiga tribes while predicting weather conditions and their climate change coping strategies during severe drought and famine conditions.

KEY WORD: Traditional, Medicinal, Tribal, Baiga, Famine, Drought, Indigenous.

INTRODUCTION:

Forest plays a major role in climate mitigation strategies through carbon sequestration and the provision of products substituting fossil energy and materials. Furthermore, forests contribute significantly to regional climate regulation and to continuous water supply in large and small scale water cycles. These regulating services of forests including their alleviating functions can be essential for adaptation strategies by the local communities through climate change (Ravindranath *et.al.*,2006). Indigenous people in the world have used various strategies to respond and adapt to climate change: diversified resource base chiefly to minimize the risk due to harvest failure, they grow many different crops and varieties, and they also hunt, fish, and gather wild food plants. Change in crop varieties and species and change in the timing of activities like crop harvests, wild plant gathering, fishing, changes in resources resorting to wild foods in the case of emergency situations such as droughts and floods are their coping strategies to combat adverse climatic condition (Salick and Byg, 2007). Indigenous groups have always been confronted with changing environments. Their strategies for coping with change have allowed them to successfully negotiate historical shifts in climate and environment, by modifying existing practice, shifting their resource bases or restructuring their relationships with the environment. There is growing awareness that indigenous peoples may find themselves not only on the frontlines of climate change impacts, but also of impacts due to rapidly expanding efforts to mitigate climate change (Nakashima, 2008).

Traditional societies in many cases have built up knowledge over long periods about changes in the environment and have developed elaborated strategies to cope with these changes. However, traditional knowledge systems in mitigation and adaptation have for a long time been neglected in climate change policy formulation and implementation and have only recently been taken up into the climate change discourse. Traditional and indigenous peoples, who have survived over long periods to many kinds of environmental changes, including climate change, may have valuable lessons to offer about successful and unsuccessful adaptations which could be vital in the context of climate change. Some indigenous groups are said to possess local and traditional knowledge, developed through generations of interactions with natural forested areas (Brookfield and Padoch, 1994; Turner *et. al.*, 2000; Davidson-Hunt and Berkes,2001). One of the remaining hunter-gatherer communities in East Kalimantan is the Punan people. According to the phases of the moon, they decide upon activities such as planting agricultural and tree crops, clearing cultivation areas, hunting etc. But with the changes of climate these lunar signals may no longer coincide with the favorable times for these activities and the Punan may be misled in taking their decisions (Boedhihartono, 2004).

Local communities have always aimed to adopt variations in their climate. They possess enough knowledge about wild varieties of Agricultural crops, edible food, tubers, rhizomes, vegetable crops etc. Traditionally they are storing and utilizing wild tubers, yams, medicinal plants etc. efficiently during the

harsh climatic conditions (Mishra and Singh, 2009; Mishra, 2010). Baigas of Dindori district acquire a distinctive knowledge of plant genetic diversity needed to fight plant and animal diseases and their know how to breed varieties that can cope with stressed environments. Baigas are one of the largest tribal group in the world, mostly found in the forests of central India. They practice shifting cultivation *Bewar* (slash & burn) in forest areas. Baiga communities collect maximum forest resources for their subsistence among forest dwelling communities in the world (Mishra *et.al.* 2011).

Rhizomes, tubers, fruits, seeds etc of wild plants are important food supplement for the local populace and are important sources of food consumed during famine. Since time immemorial, Baigas are using wild relatives of Agriculture crops, vegetables, rhizomes etc. This paper explores the traditional knowledge of Baiga tribes to combat climate extremes, sever drought and floods conditions etc. utilizing Agriculture, vegetable crops and forest products. Paper also documents good traditional practices related to agricultural, vegetable and wild products utilized during extreme environmental conditions.

METHODOLOGY:

Three blocks of *Baigachak* area were inventorized thoroughly with the Baiga community along with forest officials (Table-1). Each site was visited 2-3 times, and old aged persons were interviewed for collecting information.

The study was conducted from 2010 (just after the rains) to 2011 in all the three seasons. This period of study has helped the team to record the indigenous knowledge of the Baigas from a variety of contexts, such as community food gathering activities, community farming activities etc. The study documents local knowledge of the Baigas about methods, management options. The data collection was mainly through transect walks and observation with the key informants. The key informants were selected after focus group discussions in the selected sites. The information's about the utilization of wild products collected from the natural forests was obtained from the local inhabitants, local medicine men, Vaidyas and forest officials. During field visits of the study area efforts were made to collect information's regarding agri products, NTFPs etc which are of commercial importance as well as used as food supplement in harsh climatic or famine conditions, by the locals.

Random questionnaire based survey of 20% households was done on selected forest ranges of Dindori. Data on Agricultural crops and wild plants used in famine, drought conditions, various traditional practices and forecasting methods in predicting Drought, rainfall etc. was collected. Information's on wild plant parts (seeds, leaves, fruits etc.) used to fight crop diseases and their curing methods were also collected. Besides this, their indigenous climate change coping strategies was also documented.

Focus group discussions along with forest department officials, villagers, *Vaidyas* were organized at field level to confirm various indigenous practices adopted by the Baigas of Dindori district. Old aged persons

(*Gunias*) in each village were interviewed separately to get idea about traditional coping strategies to fight various crop diseases using wild products and their mode of application.

RESULTS:

Baigas traditionally conserving various agricultural crop seeds, vegetable, wild tubers etc. to combat changing environmental conditions. Traditional Bewar crop seeds possess different qualities to grow in extreme environmental conditions and to fight climatic disturbances like severe drought and floods. A list of different Agricultural crops (Bewar), cereals etc used by the Baigas in severe drought and floods conditions is depicted in Table 2. In the continuous subsequent droughts crops like Kurthi (*M.uniflorum*), Jhunjhuru (*V.unguiculata*), Pigeon Pea (*C. cajan*). These crops were largely utilized in continuous drought conditions by the Baiga tribes. Similarly, they traditionally store and utilize vegetable crops like Kumhada (*B. hispida*), Dengra (*D. graciae*), Adzuki Bean (*V. angularis*), Amta particularly during heavy flood conditions.

Baigas also practice astrology and they use the positions of the fruit, flower, leaves, moon and sun to predict weather changes. Time-reckoning experts observe the condition of tree fruits, leaf and flowering pattern and position of the stars during the night and inform the local people that summer is setting in or winter is coming (Table-3). Some of the indicators of drought are-vigorous flowering in the bamboo and fruiting in Sal tree indicates drought will occur. Furthermore, the physical appearance and conditions of both domestic and wild animals are important indications of future events i.e. Cats children die due to cold this indicates heavy cyclones will occur. When Cat delivers two children's this means rainfall will occur for two months, If three children's than three months of rains, if four children than four months of rains. Likewise rainfall will be more if fruits of Jamun (*E. jambolana*) vigorously fruited & ripe in June month and Pipal (*F. relegiosa*), Saja (*Terminalia spp*) gets new leaves before cold season than this indicates good rainfall. Sometimes when Achar (*B.lanzan*) fruited more in forest, this indicates good rainfall.

Baigas are known for their indigenous knowledge about wild species used to fight various crop diseases. Traditionally they are protecting Agricultural crops from insect infestation while using different fruits, seeds and leaves (Table-4). Many wild fruits and leaves possess insect repellent qualities and Baigas are using various tree fruits like Harad (*T. chebula*), Neem (*A. indica*) seed paste is used for removing caterpillar, flies attack from Rice and other Agricultural crops. Sal gum (*S. robusta*) exudates were burnt in the field and fumes are helpful in removing insects from different agricultural crops. Similarly, Sal and tendu (*D. melanoxylon*) leaf extract is sprayed (foliar) in different crops to remove caterpillar, flies, insects etc. Sometimes stems of Besharam (*I. cristata*) were inserted in between the crops; this method is effective in removing flies in Rice fields.

DISCUSSION:

Utilization of different indigenous crops like Kodo, Kutki (Little Millet) by Baiga tribes is an aged old practice to combat adverse climatic conditions. These varieties are pest and insect resistant and grow well in drought situations. Some vegetables were easily grown in flood conditions and can be stored for a longer duration after drying and processing. Bawar crop seeds like Jhunjhuroo (Cow Pea) possess qualities to grow in extreme weather situations and are prone to insect infestations. These crops were largely utilized in continuous drought conditions by the Baiga tribes. Indigenous people in the world have used the following strategies to respond and adapt to climate change: diversified resource base (to minimize the risk due to harvest failure, they grow many different crops and varieties, and they also hunt, fish, and gather wild food plants); change in crop varieties and species; change in the timing of activities (crop harvests, wild plant gathering, hunting and fishing); change of techniques; change of location; changes in resources and/or life style (resorting to wild foods in the case of emergency situations such as droughts and floods); exchange (obtaining food and other necessities from external sources through exchange, reciprocity, barter, or markets in times of crises); and resource management (enhancing scarce and climate-sensitive resources management (Salick and Byg, 2007). The knowledge and experiences of Baiga tribes of Dindori district support these findings.

Pastoralists and farmers have adopted the strategy of spreading risks across locations, time and the diversity of materials they use. They grow the same landrace in different places. In so doing they spread their risks across locations. If something fails in one location, it will do well in another. They also spread risks across seasons. When a landrace does not work in one season, they go to the local market and exchange it with the variety that will grow well on their own location. The former one may grow well in other places in a more appropriate planting season. This exchange has created a system which has allowed the landrace to be grown on a wide range of locations (Kelbessa, 2006).

Baigas also practice astrology and they observe Animal and plant behavior to predict weather changes. Expert Baigas observe the condition of forest tree fruits, leaf and flowering pattern and inform the local people that drought will take place or cyclone is coming based on flowering in Bamboo and Sal. Similarly, physical appearance and conditions of both domestic and wild animals are important indications of future events. Fortune-tellers can count the roots of entrails and observe their position and can predict the beginning and ending of rain, whether someone would die or will recover from illness, whether peace or war, famine or prosperity will prevail in the future, the kind of person who will be born, the nature and future of animals, spirits' actions (what spirits are planning and what humans can do to forestall, propitiate and humour them), one's duration of life, and the behaviour of the natural environment. The people believe that unless fortune-tellers fail to correctly read those entrails do not lie. Many informants agree that they are a reliable means of prediction (Kelbessa, 2005 and Kelbessa, 2006).

For the Oromo community, the physical appearance and conditions of both domestic and wild animals are important indications of future events. The unusual destruction of crops by baboons, pigs, or rats is also an indication of famine in the future. People are thus advised to save crops for the future. Likewise, some people in other parts of the world learn their survival strategies from the behaviors and activities of animals. Traditional Inupiaq hunters, Eskimos who live on the arctic coast of Alaska, use the behavior of ringed seals surfacing in open leads as a reliable way to forecast the weather (Kelbesa, 2007a, 2007b).

Some indigenous people in Tanzania, Mozambique and Zambia have developed their own prediction schemes based on the observation of the behaviour of the surrounding world. It would appear that the local communities are knowledgeable not only of whether there might be floods or drought in the coming season, but also on whether the season is going to be long or short and evenly or poorly distributed rains with an early or late onset (The Pilot Project Research Team (PPRT), 2002). The people in the three countries commonly use the following methods as indicators of local climate change: the appearance of plants, flowering density of certain trees, immature dropping of fruits by certain tree species, dripping of water from the leaves of some trees before the onset of the rains, higher than normal flowering density of certain trees, higher than normal ambient temperatures, wind direction, appearance of insects, appearance of certain animals, mists and rumbling sounds in mountains and hills, birth of babies (birth of many baby girls as indication of good rains), and appearance of the moon (PPRT, 2002).

Indigenous peoples interpret climate change in various ways. Their interpretation depends on personal observations, experiences and local cultural framework. The scientific explanations of climate changes have mainly concentrated on anthropogenic, greenhouse gas emissions, local interpretations of observed climate changes are often much more varied and encompassing (Salick and Byg, 2007). Ethiopian peasant farmers are aware that lack of trees can lead to drought. Modern science also confirms that trees can absorb excess carbon dioxide. Like peasant farmers, scientists use a combination of observed soil water conditions and river levels to estimate flood risk. They also use observations of soil moisture and plant conditions to estimate drought risk (Basher and Briceño, 2005).

Conclusions

Bewar cultivation (shifting cultivation) which is aged old practice is completely stopped which has some positive economic benefits for the Tribal's. Old traditional *Bewar* seeds were going to be extinct in near future which possess quality to grow in harsh climatic conditions particularly in drought, frost and floods i.e. (Ravans-*V. anugularis*, Jhujhuru- *V. unguiculata*, Kurthi-*M. uniflorum*, Mandia- *E. coracana*, Til- *S. indicum*, Baigani tuar- *C. cajan*, Kang- *S. italica*). The result of the present study supports the need to integrate indigenous knowledge with scientific knowledge for the design and implementation of best practices in climate change mitigation and adaptation strategies. Traditional knowledge is essential for preserving bio-diversity, which is considered a very successful mitigation strategy. There is need to

develop gene banks to preserve genetic information of local varieties or indigenous species. Genetic traits of these species and the knowledge of cultivators may prove instrumental in future breeding programs to introduce resistance against pests or diseases, for harsh climatic conditions. These gene banks should cooperate with farmers and communities who still cultivate local varieties to preserve such essential knowledge and skills in situ.

Climate change affects all countries in the world, the world poorest countries face the most severe impact. Those who lack the resources to adapt, to find alternative sources of food and healthcare will suffer a lot from climate change. Change in climate has also caused a decrease in forest and cultivation area, reduction in ecosystem integrity and resilience, biodiversity loss and more disease occurrence. The previous discussion also shows how peasant farmers and other indigenous people in the world have been coping with environmental hazards, and adapting their livelihoods to changing conditions for generations. However, indigenous mechanisms are not sufficient by themselves to deal with the effects of climate change. They should be complemented by modern strategies.

This study, thus, suggests that academicians, planners and tribal communities have to work together to address the adverse impacts of climate change. Scientists and policy makers who want to address the impacts of global climate change can derive important lessons from tribal communities, locals and pastoralists' strategies for addressing weather-related risks although indigenous strategies have been affected by various internal and external factors. It is important to incorporate indigenous knowledge and perceptions into the climate change forum in the country. It would always be useful to involve local communities in the design and implementation of climate coping strategies. Local communities should be encouraged to grow drought-resistant and early-maturing crops, protect forests, and improve empirically tested coping strategies.

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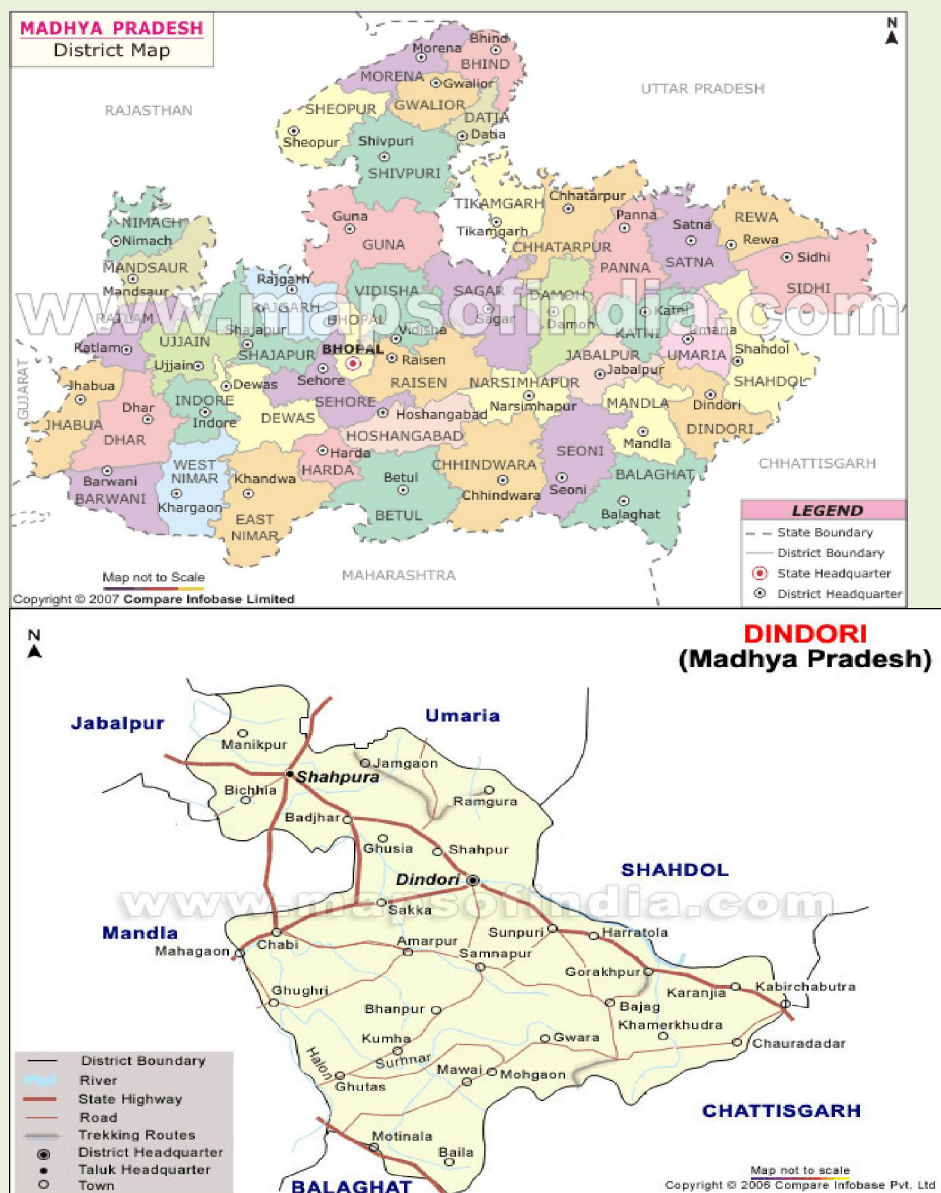


Fig.1.of Madhya Pradesh showing study site- Dindori district.

Table:1. Details of study area and selected villages for survey in Dindori forest division

Name of District	Forest range	Name of selected village
Dindori	Bajag (<i>Baiga chak</i> area)	Jalda, Khamehra, Chada, Tatar, Silpidi
	Karanjiya	Kandatola, Kindrabehra, Ladradar, Domuhani, Kabir chabutra
	Samnapur	Dhaba, Pondi, Ajar, Kandawani, Dhurkuta

Table:2. *Bewar* crops (agricultural) used in sever drought and flood conditions by Baiga tribes of Dindori district

Sr. No.	Agri. crops used in sever drought conditions	Crops/Plant Used in floods conditions
1	Kurthi (Horse Gram) <i>Macrotyloma uniflorum</i>	Kumhada <i>Benincasa hispida</i>
2	Rahar (Pigeon Pea) <i>Cajanus cajan</i>	Kutki (Little Millet) <i>Panicum sumatrense</i>
3	Jhunjhuroo (Cow Pea) <i>Vigna unguiculata</i>	Dengra (Graces Warbler) <i>Dendrocia graciae</i>
4	Urad Black(Gram) <i>Vigna munga</i>	Rawans (Adzuki Bean) <i>Vigna angularis</i>
5	Bhejra <i>Solanum</i> spp.	Sikia (Millet) <i>Persea americana</i> millet
6	Kheera (Cucumber) <i>Cucumis sativus</i>	Salhaar
7	Sanwa <i>Panicum crasgaliver frumentacum</i>	Bhalukaang, (Karikaang)
8	Kang/ (Kangni) <i>Setaria italica</i>	Kochai/ Amta Dodka

Table 3. Various traditional forecast methods in predicting drought, cyclone, rainfall in Dindori district

S.No	Indicators	Traditional forecast methods in predicting Drought, cyclone, rains etc.
1	Indicators of sever Drought	➤ Bamboo flowering indicates drought in that particular year. ➤ Vigorous fruiting in Sal tree indicates drought will occur. ➤ Four mud pieces were kept in four different directions (N,E,W,S) beneath Ghada (mud made container) filled with water. Rains were good enough in the direction where mud pieces were dissolved.
2	Indicators of heavy Cyclone (Andhi Toofan)	➤ Munga fruits were thin in size, indicates heavy cyclone in that particular year. ➤ Rain droplets are big size, indicates big cyclone in that particular year. ➤ Cats children die due to cold this indicates heavy cyclones will occur.
3	Indicators of heavy Rains	➤ When frost is sever in winters, than rainfall is heavy in next year. ➤ When moon is fully covered in the month of Vaisakh Purnima, than rains are heavy in that particular year. ➤ If frost happens around Dipawali festival than rainfall is more. ➤ When Cat delivers 2 children means 2 months of rains, If 3 children's than 3 month rains, if 4 children than 4 moths rainfall will occur. ➤ Jamun fruited & ripe in June month, this indicates good rainfall. ➤ If Bhui (<i>Careya arborea</i>) fruited & ripen in June month than this indicates monsoon will be soon coming. ➤ Pipal (<i>F. religiosa</i>), Saja (<i>Terminalia spp</i>) gets new leaves before cold season than this indicates good rainfall. ➤ Achar (<i>B.lanzan</i>) fruits more in forest, than this indicates good rainfall.

Table-4. Various indigenous methods of Baigas of Dindori district for curing crop diseases

S.No.	Name of species	Methods	Formulation act in different ways
1	Harra (<i>Terminalia chebula</i>)	Seeds of harra were crushed and mixed with water than foliar sprayed on rice crop	Liquid act as caterpillar, flies repellent
2	Neem (<i>Azadiracta indica</i>)	Leaves were crushed, water soaked for 2-3 days & than spray on different Agric-crops	Most of the insects dies and the extract act as repellent to Flies also.
3	Hing (<i>Ferula assafoetida</i>)+ Neem (<i>A. indica</i>)	Leaves of Neem & Hing crushed adding water & than spray on crops	Fumes act as insect repellent

S.No.	Name of species	Methods	Formulation act in different ways
4	Sal gum (<i>Shorea robusta</i>)	Sal (ral) gum exudates were burnt in the field	Fumes act as repellent
5	Sal leaves (<i>Shorea robusta</i>)	Leaves of sal tree crushed and water is added & then spray on crops	Caterpillar, flies, Insect dies
6	Besharam (<i>Ipomea spp.</i>)	Wet stem were put/ inserted in boundaries of Agriculture crop and also in between rows	Method is effective in removing flies in Rice crops/Agric. field
7	Gohrarh	Roots of this species were crushed and extract added with water is sprayed on all type of Agric. crops	Effective in pathogens, viruses damaging cereals, maize, rice & other Agric. crops
8	Tendu leaf (<i>Diospyros melanoxylon</i>) +	Leaves were crushed & adding water then spray on crops	Effective in removing caterpillars, winged insects and very small insects