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Integrating Traditional Knowledge Systems with Agriculture and Disaster Management: A Case for Chitora Communal Lands

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Abstract

A research was conducted to investigate the integration of traditional knowledge systems with agricultural activities and its use in disaster management. The research was done from 15 August to 15 November 2003 in Chitora communal lands in Manicaland Province. One hundred (100) elders aged between 45 and 80 years were interviewed. The results showed that agricultural activities were related to wind systems, migratory and mating trends of wild animals and the position of the moon. The colour of the horizon at sunrise and sunset, appearances of rare animals and bird breeding patterns in river valleys were used in drought prediction. Traditional knowledge systems alerted people of possible disasters such as delays in the start of rains, untimely or excessive rains and spells of too high or too low temperature. Farmers are provided with guidelines for seasonal planning, selection of crops suited to anticipated conditions and the likely impacts of weather on farming operations. The study recommends the acknowledgement and utilisation of existing traditional knowledge systems in forecasting droughts, planning crop farming and the general development of communal areas in a sustainable manner.

Key words: Traditional knowledge, disaster management, seasonal planning

Introduction

Wherever humans have settled around the world, being able to predict the weather has been an advantage. Even without the modern way of dividing the time into minutes, hours, days, weeks, months and years, humans have been able to understand these diurnal and seasonal changes of the environment. Such knowledge could be used in determining timing of important agricultural activities and in predicting disasters.

Climate variability has a considerable influence on the success of agricultural production in the rural communities in Zimbabwe. Of great importance in determining agricultural production are climatic elements like rainfall and temperature. Rainfall is the single important element since most communal areas depend on rain fed subsistence agriculture for their livelihood. Others like temperatures and humidity influence availability of moisture to crops through their influence on the rates of evaporation. Communities have lived with and experienced climate-related disasters throughout the time of their existence. Weather related hazards like floods, hail, thunderstorm and strong winds have caused death of livestock and crops and should be understood in order for protective measures to be taken but man lives by culture rather than instinct in order to remain alive.

The recent recorded droughts were in 1981-82, 1992-93 and 2002-2003 seasons. The 1992-93 drought, recorded the worst in living memory, caused loss of 60 % of the national cattle herd in Zimbabwe (Ngara and Rukobo, 1992). The excess rainfall, as was experienced in 2000 during the cyclone Eline also affects the well-being of the communities and at times leads to loss of life and damage to property and infrastructure (The Manica Post, 3-9 February, 2006). Losses associated with extremes of weather and climate made the communities in the rural areas of Zimbabwe to develop their own traditional methods to monitor and predict weather.

Before the advent of modern scientific methods rural communities must have realized that some animals, birds, insects and plants had the capacity to detect and respond to changes in the atmospheric conditions. The level of human cultural development also corresponds to suffering when a disaster strikes. They also mastered the positions of stars, the sun and associated shadows and the moon, the wind strength and direction and the cloud position and movement and the lightning patterns (First Science, 2004). The knowledge about past disasters and climate in Africa are the accumulated experiences that have been handed down to generations through oral traditions.

This research sought to investigate how traditional knowledge systems can be integrated into agricultural activities in order to minimise losses associated with extremes of climate and weather. The results of the research could be useful in conjunction with weather forecasting information from the meteorological office to improve timing of agricultural operations and disaster management activities.

The study area

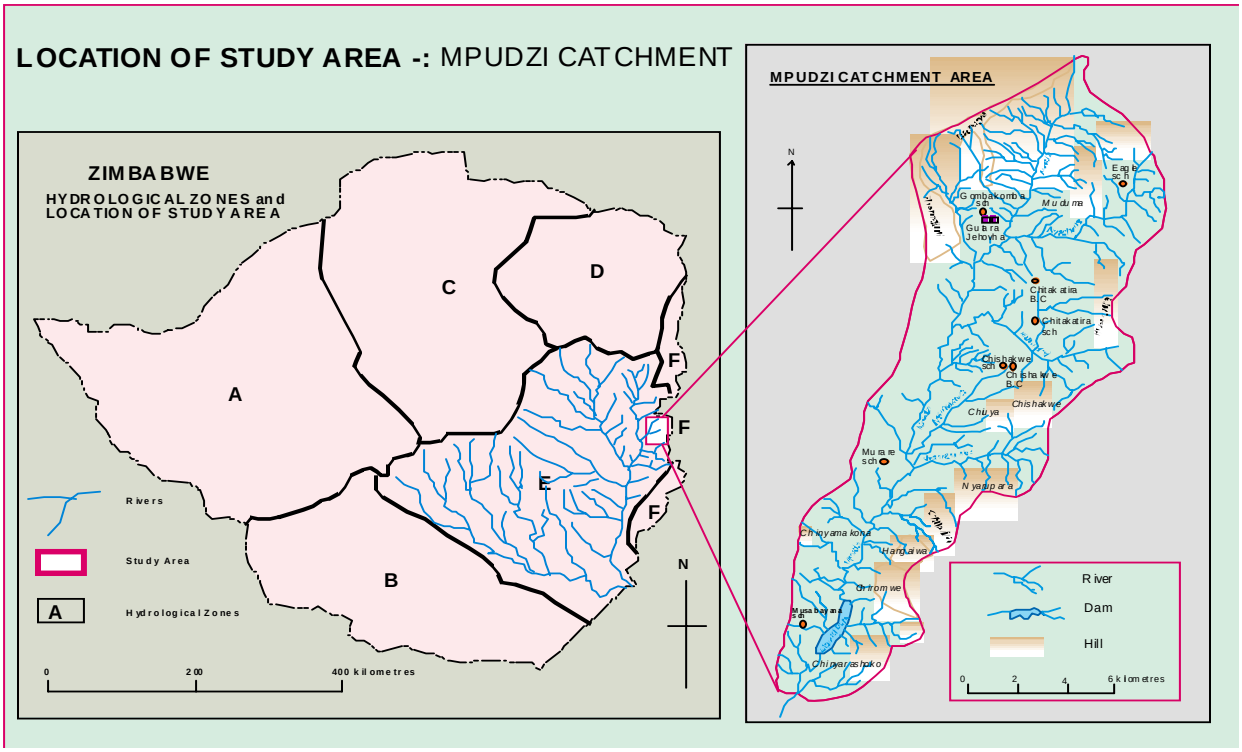

Figure 1: Chitora Communal Area covering the South eastern parts of Mpudzi River Catchmernt

Chitora Communal area is located about 56 km south east of the city of Mutare in Manicaland Province within the catchment of Mpudzi River a subcatchment of Odzi Rievr as shown on the map. The area is generally mountainous, hilly, and punctuated by sharp gradients. Granites and gneisses with isolated pockets of dolerites characterize the geology of the area. Soils range from shallow sands to pockets of red soils in some localities. The rivers are heavily silted a situation that risks the life of reservoirs.

Three geographic regions called the Flora Zambeziaca, Afromontane and the Cape floristic dominate Zimbabwe. The Flora Zambeziaca is the richest and dominates most of the country including the study site where miombo woodlands are observed. Vegetation variations are noted

from mountaintops to the bases site with high concentrations observed along river and stream valleys. There are observable pieces of natural vegetation but the human factor on this has taken its toll. Most of the land has been cleared for agriculture, firewood and for brushwood fence for gardens.

The area cuts across the four agricultural zones of the country due to the variations in topography. The dominant type of farming in the area is subsistence agriculture. Non-arable land is mainly used for grazing under communal tenure. During droughts communities in this area survive on food handouts from the Government and non-governmental organizations like Plan International. A considerable number of children are given education assistance by Plan International. Thus, the communities can be described as poor with limited access to economic resources.

Materials and Methods

The study was a descriptive survey on how traditional knowledge systems can be integrated into agricultural activities with a view to minimise the extremes of weather in Chitora Communal Lands in Manicaland Province. To thoroughly explore the questions surrounding the critical role that traditional knowledge systems play in forecasting it was imperative to solicit detailed data at extremely fine resolution. This necessitated the use of primary data as support to the existing secondary data. A series of in depth formal and informal interviews, focus group discussions and meetings were organised with the elders.

Interviews enabled the collection of data from a cross section of elders in the community as a general technique to tap into the existing wealth of experiences that have been enriched through generations. Elders were thus treated as key informants and helped to generate specific technical and social indigenous knowledge on weather forecasting, agricultural planning and disaster preparedness. Specific data categories collected through this method included a description of the changes in behaviour by animals, flowering patterns of fruit trees, interpretation of the movements of winds and the general body feelings of the elders in relation to weather and climatic elements. It was possible to establish the appropriate types of human responses to the perceived environmental changes. Cultural practices like the rain making ceremonies were described as a local response to the patterns of weather and these could only be conducted at specific locations, not all year round but at specific periods of the year. This was an open approach aimed at maintaining maximum flexibility so as to obtain as much information as possible. Interviews served as means to gather data through probing the perceptions, attitudes, beliefs and feelings of the elders about the critical role of integrating traditional methods into forecasting and disaster preparedness.

Focus group discussions were important in weighing and balancing the information collected through interviews with a view to produce generalisations that represent the traditional knowledge existing within the community. The majority of the people had long period of stay in the area. They are different origins with differences in knowledge and ways of interpretation of the physical environment. The crystallisation of these variables could only be possible with the use of FGDs that were carefully planned along gender, traditional roles in the community and age. Focus Group Discussions of up to five people were organised and the various techniques available within the community on weather forecasting and its integration into disaster management were explored. The establishment of groups based on the above mentioned criteria is always prone to the effects of excluding critical information that could be enshrined within those considered as young but have been enriched through their dead elders on the weather forecasting. The study had to be all-inclusive to avoid such inaccuracies and traditionally costly omissions. In this vein prior to the detailed involvement of the elders in the study a rapid rural appraisal by the way of meetings with villagers in Chitora Ward were conducted. This general methodology was critical in establishing the general traditional knowledge that exists within the community and how this could be integrated into weather forecasting and disaster management. Rapid rural appraisal (RRA) was important in collecting information from a cross-section of the village within a short space of time. The information that collected through the active participation of the villagers was then used to establish categories of the knowledge that existed. These were then crafted into interviews and themes for focus group discussions were established. It created the much need rapport with the community and to eliminate speculation on perceived discrimination of individuals in programmes.

The relative strengths and weaknesses of these techniques as research methods in geography and environmental studies have been long established. A triangulation approach was adopted because of the diversity of methods and overlapping datasets employed in the study. Triangulation served as a vehicle for cross checking the authenticity and validity of the various data sets generated through a focus group discussions, interviews field observations, rapid rural appraisals discussions and document reviews.

Results

The results are summarised in Table 1 below.

Table 1. A summary of the results of interviews and discussions made with elders in Chitora Communal Area, Manicaland Province in Zimbabwe

FEATURE	OBSERVATION	PREDICTION	IMPLICATIONS
Swallows	Large swarms	Wet conditions approaching	Land preparations in the field
Swallows and water fowls	Lay eggs on raised patches in river valley	Floods	Planting on wet land and gardens in river valley can be avoided
Swallows and water fowls	Breed on the ground under cover of grasses and reeds	Low rainfall to drought conditions	Early planted crop in river valleys and wetlands will be beneficial. Drought tolerant crops like sorghum, rapoko and pearl millet should be planted on the greater part of the field.
White and black stock bird	Large numbers	Normal to above normal season	No need to panic. Normal cropping programme can be followed
Black and brown ants	Collecting food in the houses in large numbers	Long wet spell	Impending rains can leach fertilizers applied during this period. Children should avoid playing in rivers. Fire wood should be collected to dry places for use during the wet spell
Black and Brown ants	Bring out the dead and damp food after a wet spell	Short dry weather after which the rains will resume	No need to rush into the field to cultivate, as weed will re-establish when rains resume. No need to rush applying Nitrogenous fertilisers as these will be washed away and leached when rains resume
Cicada	Singing and in large numbers in September	Mark the beginning of a normal to above normal season. Wet conditions approaching.	Land preparation in field should kick off
Elders	High frequency of drinking water	Wet conditions approaching	Plan accordingly
Fire	Spontaneous fires in the sacred Mountains	Early rains and an above average season	Plan accordingly
Wind	Cold Westerly wind	Dry weather	Weeding should continue. Cut weeds will not re-establish

Wind	Damp north easterly	Wet weather in the next twenty-four hours. Light showers most likely.	Fertilisers can be applied in between the showers
Wind	Heavy and stormy towards the direction from which rain is coming	The rains will disperse .	When working in the field do not stop.
Wind	Gentle winds in the direction of the rains	Wet conditions within six to twelve hours	Normal work
Clouds	Low cloud perching on top of the Eastern Bingaguru Mountains.	Wet spell for about a week	Weeds can re-establish
Clouds	High dispersed cloud	Dry weather	Weeding can continue
Clouds	Clear sky, but heavy clouds appearing on the eastern Horizon	Storm within 6 to 24 hours	Take refugee in time
Clouds	Low cloud after rains	Mark the end of the wet spell	Fieldwork can resume.
Clouds	Different types	Associated with weather in the same way as in Morden meteorology and Geography	Advise accordingly
Sky and Atmosphere	Strong haze in September Called *maomi* in local language.	Above average season	Normal preparations should be done
Sky and Atmosphere	Red sky in the west towards sunset	Dry conditions persist	Danger of an agricultural drought
Sky and Atmosphere	Clear blue sky or with clouds of great vertical extent in the eastern horizon	Rainfall expected within 12 to 24 hours	Prepare accordingly
Sky and Atmosphere	Hot and damp conditions after rains	More rain expected	Do not weed. Avoid going in to the river

Sky and Atmosphere	Cold winds after rains	Dry conditions to follow	Prepare to work in the fields
Moon	Full phase to new moon period	Rains expected to "clean" the new moon	Hope for resumption of crop growth after a dry spell. Weed crop for fertilizer applications when the rains fall.
Moon	Cloud conditions, no rains up to half moon	Dry spell to follow for up to 21 days until full to new moon period. A common phenomenon associated with the dry spell of early to mid January	Danger of an agricultural drought
Trees	Certain wild fruits and berries abundant	Above average season expected	Normal preparations
The shooting of the sausage tree		Onset of the rain season Preparation for rain making ceremonies	Land preparation, dry planting of millet begins Sourcing of draught power
Sun	Glaring sun no much heat output in January and September	Low rainfall to drought	Seek for drought tolerant crops
Sun	Glaring sun and very hot conditions in January and September	Normal to above normal rains	Normal preparations

Discussion

The migratory tendency of the white and black stock could be associated with the approaching summer season. Morden scholars have also reported that many animal species undergo movements of varying distances depending on the prevailing rainfall patterns. An example of a bird whose presence is rain associated is the Woodland Kingfisher of west Africa, the swallow and the white and black stock (Wikipedia, 2006). The local type of kingfisher is assoiated with heavy falls within days of its appearnce as the intepretation is that the nature of the sound that it produces resembles clattering of rain drops charecteristic of a heavy downpour. Land preperations and precautionary measures can be adopted to safeguard from the impending storms that could be linked to the expected rains.

Heavy rains are predicted when ants emerge from their holes in large numbers to collect food from homes and the veld in Chitora and this is associated with an impending long wet spell. The ants disappear less than twenty-four hours before the storm. Ant behavior triggers farmers to collect firewood to dry places in preparation for a long wet spell. Ant behaviour has long since

been regarded as a portent of rain to come (Australian Broadcasting Corporation, 2006). If ants seem hyperactive, or if they build high walls around the entrances to their nests then it will rain and seeing them in strange places like the ceiling or ice chest was another sign of rain (Australian Broadcasting Corporation, 2001).

Intense thirst and a high frequency of drinking water is a sign that rains will fall. However, the period intervening this behaviour and the coming of rains was not specified. Thirst is related to heavy sweating when there is a high vapour pressure gradient between the atmosphere and the body during hot dry days (Monteith, 1996; Mount, 1976). A high vapour pressure gradient stimulates thirst and apparently on such dry days evaporation rates are high and when the rising water is cooled sufficiently to condense, convectional rains can be received (Barry and Chorley, 1998). The rate of water loss from the body can be linked to the rate to which that water must be replaced. If these two variables do not match then it lead to dehydration and consequently death.
The other important predictor of weather was the position and the size of the moon. Simply stated, changes in the Moon's movement can trigger changes in our weather (King, 2005). This could be explained in terms of f the four interfacing tides caused by lunar gravitation. If the Moon has an effect on the sea tides, then it should control the distribution of water. The effect spreads onto the atmosphere and weather through distribution of the clouds. From a local perspective the new and full moon phases are perceived as linked to the movements of the rain bearing winds in the area. In most of the cases the elders are more than convinced that during the rain season the new has to come with a wet spell. Once the new moon is there 'in the skies' and no rains have been received that a prolonged dry spell is expected. However, in the interim people can continue with weeding. This usually occurs between the months of December and January a period that has been established also by the meteorological office with mid summer dry spells for the country. When this occurs, elders in the area encourage that, drought resistant crops be grown as maize can easily give in to the heat before maturity.

The breeding pattern of game animals like the impala, kudu, birds, and bushbuck to mention a few is also used in seasonal forecasts and disaster prediction. When game animals give birth in large numbers, it signifies a normal to above normal season. Most tropical animals become fertile when day length is short so that they parturate in summer when food is abundant (Mount, 1976). Humans have long since discovered the mysterious reduction in animal birth rates, and survival of wild animals from disasters like drought. Similarly, drought in Chitora is anticipated when waterfowls breed on the ground and in lower patches on flood plains. Elsewhere in literature there does not seem to be any predictors of a coming drought, but there are signs of when a drought is going to break. In Australia for example, if hawks sat so close together on a tree branch, that latecomers are not able to land, then the drought had reached its lowest point. Or if ibis's

congregated in large numbers in dry waterbeds or cleared flat ground, and did their famous dance for hours on end, then the drought was about to break (Australian Broadcasting Corporation, 2001).

Another good example of animal ability to predict disasters could be what happened recently when the Tsunami struck. Despite loss of 24000 people, wild animals seemed to have escaped the Indian Ocean tsunami, adding weight to the notion that they possess a “sixth” sense for predicting seasonal quality and impending disasters (Planet ark, 2004). Wildlife around Chitora has been reduced in numbers due to a combination of human and ecological factors. Part to the lack of animal diversity stems from the competing needs for grazing land by domestic animals and the expansion of crop agriculture into marginal areas which are habitats to the wild animals. In this regard it becomes difficult for the young generations to tap into the existing ecological wisdom when some of the animals are difficult to encounter. Given the inaccessibility they have to the modern print and electronic media there is a high probability that they entirely depend on their instincts to manage disaster risk.

In Chitora, elders interpret clouds in the same way as in modern day geography and meteorology. The cumulo-nimbus cloud is associated with a heavy storm with lightning and thunder (Barry and Chorley, 1998). The familiar mackerel sky (cirrocumulus clouds) often precedes an approaching warm front, with a strong likelihood of veering winds and precipitation (British Broadcasting Corporation Weather, 2006). Even in the English culture, a morning sun illuminating clouds to the west may be an indication of an approaching depression.

Sacred mountains like the Ndorwe, Tsetsera, Binga and Ngoya on the eastern boarders are used to forecast weather. The covering of these mountains tops by mist signifies the coming of rains within twenty-four hours. Strong condensation in such area with an altitude of 2500 to 3000 m above sea level is not uncommon. Moist air from the Indian Ocean is forced up these mountains and condenses after adiabatic cooling. After staying in this area for a long period and by receiving information from oral tradition, the elders must have mastered this pattern of wind movement and rainfall. The social patterns of the commuity in Chitora have been changing due to a number of extrinsic and intrinsic factors. The extrinsic factors have to do with incoming of people from surrounding areas and far a field including the coming in of the white settlers. The adoption of the alien beliefs and styles of life has made indigenous knowledge irrelevant in the face of those who had embraced modernisation as articulated by the settlers. The intrinsic factors are grouped around the spatio -temporal variations of culture as induced by societal dynamism. A major attribute to this was the conflicts among leaders and leaders in society, particularly the failure to adhere to the perceived ways of conducting cultural ceremonies that are linked to droughts.

These disputes are often linked to the frequent occurrence of droughts of droughts in the area. The frequent droughts tat are experienced the world over cannot escape the human-to-human conflicts and the human biophysical environment conflicts. Climate change takes in a number of parameters from the socio-economic conflicts that affect our world today, to extent that the conflict- drought linkages that are given by the elders in this community may not be void of the truth of weather forecasting and disaster management.

Spontaneous fires on these mountains in September and October are regarded as a sign of a good season. When these sacred mountains ignite spontaneously as the summer approaches, it signifies the coming of rains within a week or so, and activities like land preparation and dry planting of pearl millet, rapoko and vlei maize normally start. Calvert (1993) wrote of 'a rare to occasional fire in the late hot to early rainy season reaching aerially destructive proportions only in relatively small areas or patches of, say, 0.01 ha to a hectare or two before being extinguished by accompanying rain' that is common in Zimbabwe. Though the smoke that is released into the atmosphere is not fixed the presence of smoke makes the sky haze and the chances that it adds to the impurities in the air around which condensation takes place are high. Given this underlying fact the locals will be correct to relate the spontaneous fire outbreaks to the formation of rain. The indigenous methods emphasise oral tradition, beliefs that are passed from one generation to another and not in recording the information in documents that could be read by the future generations. This always bring some inaccuracies on relying on traditional forms of forecasting but then the modern approaches always work with margins of error that could be also misleading in terms of drought forecasting and mitigation.

The colour of the atmosphere and the sky were also regarded very useful in predicting weather. It was maintained that persistent coldness after the month of August is a sign of dry spells or late rains. The cold wind experienced could be the passing of the cold front after a mild to strong storms (Barry and Chorley, 1998). Persistent cold fronts coming into the country from the southeast coast of the Indian Ocean are not unusual and they might have effects on the starting of the summer season as the land is cooled, conditions that are not ideal for convective rainfall. However, the cold fronts are also responsible for frontal rainfall in the Eastern Districts of Zimbabwe. Cooling of the land could only be ideal for the growing of crops like wheat but are not suitable for maize and millet crops that are dominant in the area.

Equally important is the direction of the wind. Warm northeasterly winds bring in rainfall in Chitora. The rains have to follow certain belts for them to fall in Chitora. Rainfall is received in Chitora area in all the cases it passes through Bingaguru and Ndorwe mountains. This shows a strong understanding of the microclimate of the area by the residents. The high ground usually

experiences orographic rains that are usually persistent from mid to late summer in the area. The local people seem to have learned a lot from the behaviour patterns of the rains and winds that occur in the area.

Farmers expect prolonged dry spells when persistent winter coldness extends into spring. This weather pattern is often characterised by whirlwinds that raises a lot of dust. The dust causes the redness of the sky at sunrise and sunset, a phenomenon called *hore tsvuku* in local language. The redness of the sky, which depends on the amount of dust particles in the air, is regarded as predictor of long dry spell. Similar interpretation is given in Britain where a red sunset also suggests that dry weather is approaching (British Broadcasting Corporation Weather, 2006).
Low clouds after the rains mark the beginning of dry conditions after rains. Geographically, a low cloud is a sign of temperature inversion, when warmer air is above cooler air. Low cloud forms when the air near the ground cools and cannot hold as much moisture, causing water droplets to condense to form fog and mist. The presence of a low cloud shows absence of strong convections and is a clear sign of dry weather in the short term (British Broadcasting Corporation Weather, 2006).

Conclusion

Most agricultural activities in communal areas are closely linked to the weather, and communities often have a store of local weather and natural disaster knowledge. The local people relate the behaviour of plants and animals to the general features of the impending rain season. The abundance of the common wild fruits is usually linked to a good season. However, the problem arising from such interpretation is that information available to the people has been learnt through oral tradition and there are no corresponding historical records of crop yields in the area. It is true that the area has suffered some of the most serious droughts in recent years just like any other part of Zimbabwe but there is no national programme that has actively involved the locals into drought disaster preparedness. The community depends on the crisis management of droughts that has been adopted in recent years by donors and the central government.

The best option would be to integrate the local wisdom into national plans so that off and on farm coping and survival strategies are put in place for the community. Such knowledge could be used in determining timing of important agricultural activities and in predicting disasters. The lower parts the communal area are to the rain shadow of the rainy Eastern Highlands of the country that it is possible that the peasant farmers are able to understand the general behaviour of the rain bearing winds for the area and the premise for fusing modern technology into these existing knowledge. However, the accuracy of this knowledge is doubted. Inaccuracies in facts are not

only an inherent attribute of the complexity of traditional knowledge systems but in modern weather forecasting there are also errors of measurement and statistical computations. The generality of the people in Zimbabwe have been made to think that all droughts in the country are linked to the El Nino phenomena but scientific evidence point to the fact that not all droughts were linked to this weather organism. In most cases there is a scientific interpretation to traditional folklore and mottos used but there seem to be limited scientific interest in exploring the existing gaps. Perhaps it is a clash of value systems between the modernization philosophy and the traditionalist value system that is perceived 'primitive.' Exploration into such value systems has the potential to unlock sustainable resource utilization, weather forecast and changes in crop and land use management.

Governmental and nongovernmental effort can intergrate this traditional store of knowledge in their programmes in order to improve agricultural productivity and minimise loss of life in times of disasters. The community based approach that taps into the existing ecological wisdom gives cause for optimism provided the similarities and differences in traditional systems and modern systems of weather forecasting are further explored and understood.

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