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Indigenous Knowledge and Drought in the Arid Zone of Rajasthan

Weather prediction as a means to cope with a hazardous climate

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The Legacy of Indigenous Knowledge

Indigenous knowledge is acquired know-how and wisdom by observation of specific natural and social phenomena connected with the experience of supernatural powers that influence life. Modern scientific knowledge on the contrary has more of a pure selfcommitment according to the rules of its respective theories and methods. However, modern science has hardly ever succeeded in replacing local indigenous knowledge entirely, and particularly in rural areas of Third World countries it is still part and parcel of a holistic, more often than not sacred, world view and a valuable source of self-reliant cultural persistence in a period of rapid social change.

Meteorological phenomena for instance form an important part of the indigenous knowledge of rural village dwellers because they are directly linked to survival in times of natural calamities, both physically and socially. Frequent occurrences of drought in the arid region of Rajasthan have led the villagers of this area to evolve indicators of drought prediction. These indicators appear to have developed out of previous generations' experiences and observations, which often help them to predict whether there will be rain in a coming season or not. The knowledge about weather prediction seems to have further emerged from empirically verified changes in the environment, particularly climate and vegetation characteristics, animals' and birds' behaviour, and social activities. These manifold aspects of knowledge function locally as indicators to predict the nature of the year to come.

The studies of Srivastava (1974), Sheldon and Parke (1975), Mukherjee (1976), Rao (1976), UNESCO (1976), Malhotra (1977),

Bharara (1978, 1980, 1982), Mann (1978), Reining (1978) and Spooner (1978) have stimulated interest in developing the concepts, nature scope measures of changes in society and the measurement of social indicators in relation to drought and desertification with a view to facilitating planning, policy formulation and evaluation of progress. However, the knowledge about the social indicators of drought prediction appears to be limited and unexplored. The present paper is a modest attempt to identify the traditional social indicators of drought prediction in an arid region as well as an attempt to contribute to the discussion of the relevance of indigenous knowledge in the development process of a predominantly rural society.

The study presented here is based on local evidence and empirical data. It deals with the origin of prediction; traditionally perceived and believed indicators of drought prediction; nature, extent, source and period of observation of indicators; behavioural changes for predicting the nature of the year and correlating a particular incidence to the occurrence of rain.

Nowadays the people, irrespective of caste and creed, have developed knowledge of facts pertaining to environment including climatic and vegetational changes, animal and social behavioural changes for predicting the nature of the year. Studies by Ducasse (1953) show that a knowledge of facts is a belief based on evidence sufficient to prove that what is believed is true. Our studies also show that it is this kind of knowledge that largely governs the villagers' behaviour in the matter of drought prediction. However, no scientific support convinces the factual observation, yet the farmers, through their age-old experience, believe in the indicators which help them to face the oncoming drought hazards in the area. These indicators have now become a guide to warning for predicting what to expect in the ensuing year. Though they may not be scientifically true, such cognitive indicators are believed in by the majority of the population. Usually such indicators are measured in terms of changes by simple qualitative observations. Observation as a phenomenal approach to participation in a regional shared reality characterizes the world view of a rural sociocultural unit that traces its identity from the very geographical region it inhabits. The observation of natural and social phenomena and their perceived changes are a mode of being autochthonous. True in this autochthonous sense is only what is locally known and sanctioned as having an impact on local everyday life. All knowledge in a broader and abstract sense without having any close observable relationship to phenomena is less relevant to a local peasant, shepherd or

nomad. There is no knowledge apart from a traditional natural life style, at least no knowledge that links facts from observation and the metaphysics of prediction.

Nature and natural phenomena are traditionally believed to belong to the realm of the sacred and so is the knowledge referring to it (Nasr, 1981). Interpretations from natural and social phenomena of the local surroundings do have a meaning for social life and an impact on the perception of the near future and indicate that rural people are still part and parcel of their environment. Although it is not an unimportant factor whether predictions based on this traditional perception become always true or not, the most important factor seems to be the ever persisting relationship with the whole of nature and the perception that what for man turns out to be his future is already present in nature before hand. The interpretation of observed indicators of good or bad agricultural years to come is never fully reliable partly because there may be mistakes of observation or in the interpretation of the observed facts. For a basic belief in the nature of prediction by observation, however, this does not matter very much. Perhaps, on the contrary, this may be taken as a very common failure and thus as evidence of the fact that man, however cunning he may be, remains in the hands of nature.

Prediction - a historical trace up

Man is the prime predictor of droughts. His correct prediction depends upon the correct interpretation of indicators. Originally interpretation required expertise knowledge of environmental objects comprising indicators. Villagers report that this knowledge was monopolised by high caste Rajput cultivators known as predictors. The first predictors were believed to be of Rajput origin from Tavria, a village in Jaisalmer District in western Rajasthan.

Prediction of the nature of the coming year is considered to be a traditional skill. Its origin is traced to the thirteenth century, the time of the Rajput seer (*pir*) Harbuji Sankhla, who was Jagirdar of a village in Phalode tehsil in central Rajasthan. Harbuji Sankhla is said to have observed birds and animals, which implies that they were assumed to be in some way closer to the physical processes of nature in order to find ways of predicting droughts. Because of his success the skill to predict became the monopoly of the Rajput caste, some of whom cultivated it from one generation to another. The predictor was considered to be

divinely guided. From the day of conception a Rajput mother would endeavour to rear her child as a predictor. Throughout pregnancy she would each day put water in a pitcher by a tree where particular birds could drink from it. On birth a male child's first drink was taken from the pitcher. If the child survived, it was believed to command the language of the local birds and animals and became a *sugni*, an omen seer or predictor.

With the social changes of the last few decades the caste monopoly of drought prediction no longer exists. Now the lore concerning drought is a matter of general discussion and effort. It is based on observation of simple qualitative changes in climate and vegetation and behaviour. Arguments from western science have no apparent impact on it. In the form of a collection of sayings it is widely used as a guide for the coming year. These sayings constitute a type of ethnographic material that lends itself to structural analysis. Here, however, the aim is simply to demonstrate their function in rationalizing a holistically perceived reality. Reality and recollection have been correlated earlier in relation to precipitation figures. Here the question of reliability is ignored and the focus is directed instead to the synoptic nature of common sense rationalisation.

Methodology

The study was undertaken in the arid zone Rajasthan comprising of eleven districts, namely Barmer, Bikaner, Jaisalmer, Jodhpur, Nagaur, Churu, Jalore, Jhunjhunu, Sikar, Pali and Ganganagar. Within the zone the study area was chosen so as to represent three different ecological pattern areas of predominantly pastoral nomadism, mostly rainfed and rainfed with irrigation facilities. These representative areas comprised three different districts viz. Jaisalmer as a pastoral area; Nagaur as a rainfed area and Pali as a rainfed area with irrigation facilities. In a pastoral tract the average annual rainfall is 165 mm which is quite low and therefore pastoral nomadism and migration is prevalent. Nagaur District was selected from the dry farming tract having high textured soils. The average annual rainfall here is 388 mm with rainfed cultivation as the main occupation. Pali district representing irrigated areas with winter (*rabi*) crops has an average annual rainfall of 490 mm and is a suitable area for minor irrigation. Four villages from each tract were selected. All the households of the selected villages were stratified on the

basis of caste and from each caste strata about 10% of the households were selected for intensive interviewing by a method of simple random sampling. 309 schedules were filled in from the sample respondents.

Indicators of Drought prediction

The nature and extent of traditionally perceived and believed indicators of drought prediction are given below:

Table 1: Traditionally Believed/Perceived Drought Indicators

Drought indicators	Households believing Number	Households not believing Number	Total Number
Climatic behavioural changes	255	54	309
Vegetational behavioural changes	228	81	309
Animal-bird behavioural changes	154	155	309
Social behavioural activities	142	167	309

Climatic followed by vegetational characteristics were the most predominant indicators the peasants believed in and were perceived by more than 80 per cent and c. 75 per cent of the households respectively. Specific animal-bird behaviour and human behavioural activities were the indicators perceived by about half of, resp. less than half of the households. Hardly 20 per cent of the total number of households did not express belief in any of the indicators. This group of households beliefs that there is no association between rainfall and these indicators. Nevertheless, identification and development of these indicators have helped in building up gradually a knowledge of relationships between different parts of the socio-ecological system. Taking into account some of the principal indicators, we will see how the people correlate a particular incidence to rain.

Table 2: Traditional Indicators of Drought Prediction

Indicators Type	Indicators Item	Period of observation	Observed behavioural changes	Character of year predicted
1.Climatological:				
a) Belief in wind-cloud-direction month-relationship	Eastern and southwestern wind	May-June	Blowing of southwestern wind indicates no rain in future and since then *Banjaras* load salt and move from place to place for sale	Famine
		Aug.-Sept.	Blowing of eastern wind in Sept. and western in Oct.	Surplus
		July-Aug.	Eastern wind in Aug. and western in Sept.	Famine
	Wind and Clouds	May-June	Rumbling of clouds on first day after the end of May-June	No rain during July-Aug.
	Clouds and lightning		Clouds, lightning and thunder; clouds like partridge wings	Rain is definite
	Rain and month	Dec.-Mar.	If it rains in Dec., Jan. or Mar.	Surplus good or Famine
b) Belief in *Nakshatras* (*Zodiac* Period) *tithi* (date)-day-month relationship	*Mool Nakshatra*	*Diwali*'s fifth-*tithi*	On the fifth-*tithi* after *Diwali*, if *Mool Nakshatra* on MON/THU/FRI	Good
	Mercury, Venus Planets	June-July	*Budh* Planet (Mercury) rising in June-July, *Sukar* planet (Venus) sinking in July-Aug.	Great Famine
	Saturday	Dark half of May	If it is SAT on the tenth day of dark half of May-June	Great Famine
c) Belief in *Nakshatra* wind-heat relationship	*Mrug/Rohini Nakshatra* (*Zodiac* periods)	*Mrug* (1st week of June); *Rohini* (14 to 24 June)	Non-windy weather during *Mrug Nakshatra* No scarching heat during *Rohini Nakshatra*	No rain No rain
d) Omen of windflame	Wind and flame	*Diwali* and Holi festivals	Windy night not allowing to lighten lamps on *Diwali*, non straight flame while burning *Holika* on Holi night	Drought
e) Belief in moon, stars and their movement	Stars and Moon	*Punam* (full moon night in Nov.)	*Kirti* stars (a cluster of stars) crossing moon from right hand side, left hand side	Good year, Famine year
f) Belief in rain-day relationship	Rain and day	First week after Holi festival	After Holi, if there is rain on first MON/TUE/THU/SAT/SUN	25%,30%,45%, 100%,115% *Zamana* (full harvest)
2.Vegetational:				
a) Blooming and fruiting of local trees	*Khejri* (Prosopis cineraria)	April-May	If normal fruiting/If three times more than normal fruiting	Normal/Surplus
	Neem (Azadirachta indica)	June-July	Heavy fruiting	Good
		July-Aug.	Better growth of new leaves	Good
	Bordi (Zizyphus nummularia)	July-Aug.	Fruiting in odd season	Good

Indicators Type	Indicators Item	Period of observation	Observed behavioural changes	Character of year predicted
b) Blooming and fruiting of shrubs	*Aakra* (Calotropis procera)	Apr.-May	Heavy fruiting	Good
	Kair (Capparis decidua)	July-Aug.	Heavy fruiting in odd season	Good
	Phog (Calligonum polygonoides)	Odd season	Heavy fruiting	Drought
	Kheemp (Leptadenia pyrotechnica)	Mar.-Apr.	Heavy fruiting	Good
c) Blooming and fruiting of grasses	*Sewan* (Lasiurus sindicus)	Sept.	Good growth	Good
	Mussa (Tephrosia purpurea)	July-Aug.	Better fruiting	Normal
3. Animal-Bird Activities:				
a) Insect-grain-rat relationship	Insect/rat behaviour	*Akhateej* day	Day before *Akhateej*, a cultivator keeps grains in his field and on *Akhateej* observes action of rats/insects towards grains:	
			If grains untouched by rats/insects	Good
			Half of grains removed	*Kura Kacha* (Half)
			All the grains removed	Famine
			Directions of removal of grains indicates	Import of grains in that direction
b) *Akhri Chhorna* - Changing in sheep/goats resting place	Sheep and Goats	June-Sept.	Shifting of sheep and goats original resting place at hight time in particular direction indicates	Rain expected within 24 hours
c) *Khurali Karna* - Dogs digging pits	Dogs action	*Akhateej* day	Dogs don't eat bread but stock it in a dug out pit	Surplus
d) Animals movement	Village bull, She camel	*Akhateej* day	Moves around the village. She runs too much to and fro, dashes her feet, does not sit	Rain is certain
e) Animals/birds voice	Jackal	Day time	Howling Jackal	Great famine
	Teetar (grey partridge)	*Akhateej* day	Hearing sound on left hand side in the evening	100% *Zamana*
	Suganchiri (black sparrow like bird)	*Akhateej* day	While going in the field *suganchiri* (Lanin excubitor) is found on right hand side:	100% *Zamana*
			If *Teetar* chirps once only in the north	25% *Zamana*
			If *Teetar* chirps four times in the north	120% *Zamana*

Indicators Type	Indicators Item	Period of observation	Observed behavioural changes	Character of year predicted
4. Human activities: Belief in:				
a) Social contacts	Collective observance of omens, rites, rituals and beliefs	*Dooj* day before *Akhateej* festival	On *Dooj* night going by chance to a friends house and asking for something if he refuses to give: Gives happily:	Drought Good
b) Cotton-water relationship	Omens, rites, rituals	*Akhateej* day	Observing action by putting two small cotton pools named *Zamana* (normal year) and *Kal-akal* (famine) in water	Pool remaining floating later then the other indicates *Zamana* or *Kal*
c) Earth-water relationship	-do-	-do-	Four unbaked earthen cups (named 4 monsoon months) are filled with water	First dissolved cup indicate month of monsoon beginning
d) *Zamana* prevailing *Kal-akal*	-do-	-do-	Two persons (*Zamana/Kal-akal*) get on fight with beating drums and wooden swords	First broken sword indicates looser, not to exist; other will prevail
e) Good omen of *jat* cultivator	-do-	-do-	*Rajputs* and *mahajan* castes first give *bhoj* (meals) to a *jat* cultivator and then shower water on his head to expect	Normal rainfall
f) *Rahu* and *Kaitu* fore-fathers of *Bheel* community	-do-	-do-	Offering *bhoj* (meals) to *Bheel* community to make their fore-fathers happy	*Rahu* and *Kaitu* will feel happy and shower rains
g) Worshipping gods/goddesses	-do-	Before starting cultivation	Offering prayers, worshipping *gogaji/Jog Maya*	Better yields
h) Heat-seed relationship	Holi fire	March	Putting some local grains with water in a pitcher under the Holi fire for observing germination trend	The grain which shows the best germination trend indicates the type of coming year

Belief in relationships between rainfall and natural elements like wind, wind direction, cloud and month; Zodiac period (*nakshatra*), date (*tithi*), day and month; *nakshatra* wind-heat and wind-flame omen; moon-stars and their movements etc comprise climatic indicators of drought prediction. Prediction based on these natural elements, in absence of modern meteorology, sometimes comes true and sometimes not. However, these relationships between natural elements and rainfall, based on repeated behavioural changes in the elements observed during particular periods, are confirmed and passed on from generation to generation. The social and cultural values themselves passed on over generations in this folk wisdom constitute a socio-cultural value. Apart from the question whether a prediction comes true or not, it is a focal point of social and community cohesion to maintain it. People constantly watch and take an interest in social and natural phenomena, they discuss them and thus participate in a local culture that enables them to share a common experience of their environment.

Trees such as *khejri* (Prosopis cineraria), *neem* (Azadirachta indica), *bordi* (Zizyphus nummularia); shrubs - *aakra* (Calotropis procera), *kair* (Capparis decidus), *phog* (Calligonum polygonoides), *kheemp* (Leptadenia pyrotechnica); and grasses *sewan* (Lasiurus sindicus) and *mussa* (Tephorosia purpurea) are the major species whose vegetational behaviour is taken to predict droughts. These vegetational indicators are more widely believed by the agricultural communities like Rajput and Jats. They cherish a hypothesis that blooming and fruiting of specific local trees, shrubs and grasses are closely associated with the rainfall of the area. Sometimes changes in fruiting are also the indicator of an even or odd season. These indicators provide an informative value with regard to the availability and stocking of feed for livestock, fruit for human consumption, and grazing of livestock in the vicinity or migrating to another area for grazing.

Animals such as rats, dogs, sheep and goats, bull, she-camel and jackal, insects and birds like *teetar* (grey partridge) and *sugan chiri* (Lanius excubitor) comprised the most widely believed indicators of drought prediction. The people watch their animals and birds for signs of strange behaviour. Animals are believed to be more sensitive to physical effects than human beings. Dogs hear better and birds can feel the slightest vibrations. Changes observed on the suspicious day of *akhateej* festival form the source of inferences drawn for predicting the forthcoming year. The activities of particular animals or birds are believed to indicate the yield of the future crop.

Social behavioural activities commence from the day of celebration of *akhateej* festival, the day of predicting the nature of the coming year. Collective observances and performances of various beliefs, omens, rites, rituals etc form the social code of predicting the drought. The social aspects of drought prediction are ascribed to the inferences drawn from social contacts, belief in cotton, water-earth relationship, *zamana* prevailing over *kal-akal*, reception of a *jat* cultivator, *rahu* and *kaitu* believed to be forefathers of the Bheel community, worshipping gods/goddesses, heat-seed relation and soul-rain relationship.

Folklore and prediction

Indicators of drought prediction have been woven into the villagers' folk culture, as revealed in the local sayings. The following sayings show their knowledge and beliefs regarding the winds, clouds, storms; vegetation; animal behaviour and social relations and their relationship to a good or bad harvest.

Winds

"Savan men suryo chalai bhadarvai paravayi,
Asoj men pichhava chalai bhar bhar gada layayi.

"If the northwestern wind blows in *savan*, the eastern wind blows in *bhadun*, or the western wind in *asoj*, they bring carts full of grain.

"Jad bahe hada have kun,
Banjara lade lun"

When the southwestern wind blows, the *banjaras* load salt on their animals, they move from place to place for sale and this reveals a bad year.

"Nada tankan balad bikavan,
Tu mat chalai aadha savan"

O eastern wind, who causes people to hang up the rope that fastens the yoke and to sell the ox, do not blow up to mid *savan*.

"Jeth beeti pehli parwa, kathak ambar hari,
Asadh sawan khet sukho, bhadar huai birkha karai"

Thunder on the first day after the end of *Jeth* means two dry months and no rain before *Bhadun*.

Stars

From watching a particular *nakshatra*, *tithi*, day or month the people make guesses regarding the harvest.

"Diva biti panchami som, sukar, guru mool,
Dank kahe he bhaddalj nipajai satun tool"

On the fifth lunar day after the *Divali* holiday, if *mul* (an astronomical position of the moon), falls on Monday, Thursday or Friday, the *Bhadaria Joshi* says all the seven grains will grow.

"Sudi asadh men budh ko uday bhayo jo pekh,
Sukra ast sawan rahai maha kal avarekh"

If Mercury is seen rising in the bright half of the lunar month of *Asad*, or if Venus is sinking in *Savan*, a great famine will occur.

"Jeth badi dasami divas je sanissar hoy,
Pani hoy na dharan men birle jivai koy"

If Saturday falls on the tenth day of the dark half of *Jeth*, there will be no water on the earth and only a few people will remain alive.

Clouds

"Teetar pankhi badali bidhava kajjal rekh,
O barasai o ghar karai ya men min na mekh"

Clouds with winds like a partridge, will bring rain and a widow with *kajal* in hereyes will marry without doubt.

Vegetation

"Savan surangi khejri, kati biranga khet,
Savan birangi khejri, kati suranga khet"

If the *khejri* is colourful in *Savan*, the fields are colourless in *Kati*. If the *khejri* is colourless in *Savan*, the fields will be colourful in *Kati*.

Animal Behaviour

"Din men syal sabad jo karai
Nischaya hi kal halahal padai"

When the jackal howls during the day, a great famine is certain.

"Aagam soojai sandani daude thalan apar,
Pag patake baithe nahi Jad menh avan har"

The she-camel knows beforehand and runs to and fro. She stamps her feet and will not sit when rain is to come.

"Chidi nahay dhool men to pani aavai,
Jal men nahave chidakali to pani javai"

When the sparrow bathes in the dust the rain will come, when the sparrow bathes in the water the rain will go.

Social Relations

"Aakha teej dooj ki rain jay achanak jache sain,
Kachak beech mangi nat jay to janijai kal subhay.
Hans kar dai nathe nahi koy, mane sahi jamano hoy"

The night before the *Akhateej* festival in March, if one goes suddenly to a friend's house and asks for something and it is refused, there will be famine; if he gives gladly the year will be good.

This small collection of sayings illustrates a concern with rationalization of out-of-the-ordinary events or coincidence, cloud formation, animal and bird behaviour and social relations, as well as the symbolization of

drought in the intensification of the salt trade, empty grain carts, idle yokes, the sale of animals, and social monstrosities such as a 'painted' widow, and, finally, personalization and personification of famine sprawled across the drought-prone region. In discussions the same informants cited many more examples of similar ideas, some of which are well-known astrological coincidence, others, such as unseasonal natural phenomena, reflecting the occupational concern of farmers. The overall context is defined by an example that gives a perspective beyond the prospect of the immediate year: 7 famines (*kal*), 27 good years (*zamana*), 63 poor years (*ghisan*), which fits very closely with the table of actual years (Bharara, in: Spooner and Mann [eds.] 1982).

This material is of course of the type that is usually classified as superstition. However, it demonstrates the way of thinking of peasants which may be assumed to be closely related to the behaviour patterns of villagers which programmes of ecological management and economic development set out to change - often unsuccessfully.

Much of the material - though not all - also falls under the heading of common sense (Geertz, 1975). It appears to derive from ad-hoc rationalization which generates rules of thumb, and though arbitrary from the point of view of scientific argument, is selfperpetuating and has a social value as it allows persistence of the identity of a local folk culture. It is important to note that it is also functional, in the sense that it goes towards satisfying the need for order. It serves to order experiences and guide expectations. Closeness to nature and self-reliance in matters of economic- security combine the elaborateness of indigenous knowledge and measures to face expected natural calamities in an autochthonous and effective way. To interpret signs in nature and to listen to nature is a built-in mechanism of a sustainable relationship with a peasant's natural and social environment without having to rely on help from outside the community.

Knowledge as far as rural life and agriculture is concerned is a part of a villager's personality and any anonymous know-how to be acquired in school or any other formal education would never take its place. Even if a villager's interpretation of natural phenomena fails, it adds to his general experience of observation. Science can never adequately satisfy this need at the level of everyday thinking of poor village dwellers. There is too much that science cannot adequately explain to them, and many of its explanations are beyond the grasp of people other than professionally trained scientists. Faith in science and technology, which are spreading and increasing mostly in modern urban settings, tend to take over from

this type of common sense rationalization, often by discrediting it before replacing it. To the extent that the ordinary villager has a limited grasp of scientific explanation, he probably suffers a certain anomy as a result of this reduction or weakening of order caused by the spread of scientifically based information. But judging from western experience, faith in science and technology never entirely supplants this common sense or entirely changes this way of thinking. In so far as the latter survives, it deserves more serious and intensive study.

Validity of years predicted

For validity, the nature of year predicted on the basis of local indicators was compared with the actual nature of year calculated on the basis of rainfall and crop maturity.

Traditional indicators known as means of drought prediction and the validity of the years predicted are given below:

Table 3: Means of Drought Prediction and Validity of Years Reported

Means of Drought Prediction	Validity of years predicted			
	True		Untrue	
	Years No. (%)	Households No. (%)	Years No. (%)	Households No. (%)
Climatic behavioural changes	73 (77.7)	245 (79.3)	21 (22.3)	64 (20.7)
Vegetational behavioural changes	64 (68.1)	220 (71.2)	30 (31.9)	89 (28.8)
Animal-bird behavioural changes	40 (42.6)	150 (48.5)	54 (57.4)	159 (51.5)
Social behavioural activities	31 (33.0)	142 (46.0)	63 (67.0)	167 (54.0)
Overall	52 (55.3)	189 (61.1)	42 (44.7)	120 (38.9)

On an average came 55 per cent true and 45 per cent untrue, as reported by 61 per cent and 39 per cent of the sample respondents respectively. Climatic followed by vegetation behavioural changes reported by 79 and 71 per cent of the households coincided 78 resp. 68 per cent with the

actual prediction for all years nature of the year predicted. Animals'-birds' behavioural changes and social behavioural activities reported by 48 resp. 46 per cent of the households coincided only 42 resp. 33 per cent with the actual nature of the years predicted. A ratio of 55 per cent true and 45 per cent untrue predicted years over a period of 94 years of observation is statistically speaking insignificant. However, what scientifically speaking seems to be insignificant turns out to be relevant as far as the persistence of indigenous indicators of weather prediction are concerned which are closely linked to the maintenance of what we may call cultural identity. In spite of a comparatively unreliable number of predictions that could be proved to be correct over the years people are more likely to stick to their indigenous way of weather prediction. Maybe they consider it the most authentic method of coping with the climatic effects of a semi-arid zone on their living conditions and life style.

Table 4: Comparison of the Nature of the Year Perceived/Derived from Social Indicators/Rainfall and Actual Zamana (1891-1984)

Nature of year	Years perceived/derived from (No.)		
	According to Rainfall data	According to Indicators	According to Actual Zamana
Severe drought	21	26	30
Mild drought	24	25	27
Normal year	22	19	16
Good/Surplus	27	24	21
Total years	94	94	94

The comparison of the nature of the year predicted in terms of severe drought, mild drought, normal year and surplus year based on social indicators, rainfall data and actual *zamana* during the period 1891-1984 revealed variations in the correctness of the prediction as compared to the scientific forecast and the actual situation as experienced. The correctness of the prediction varied from minimum 12 per cent to maximum

43 per cent. More than half of the total years predicted by indicators were found to be correct as compared with the years of full harvest (*zamana*).

Based on the knowledge of indicators the local people have analysed the historical situation and established causal relations between the socio-physical phenomena and drought occurences. The knowledge of indicators has helped the farmers in establishing causal relations and preparing themselves socially as well as psychologically to face drought hazards and to evolve adjustment mechanisms. This knowledge, if supplemented with modern planning techniques, may perhaps have far-reaching significance in planning for development.

Trends

Rural people derive trends of the nature of the year on the basis of actual *zamana* perceived through folk memory and locally believed traditional social indicators (Bharara, 1980). These locally derived trends and the perceived nature of the year have further been compared with the trends and the nature of the year calculated from actual rainfall data.

The comparison revealed minor differences in the nature of the year perceived and trends derived from folk-memory and actual rainfall. Folk-memory exhibited more authencity as regards the nature of the year and trends because of the actual *zamana* witnessed by the respondents; whereas taking only the mere rainfall data into account misrepresented the nature of the year and trends due to the unaccountability of various other associated climatic factors. The village people perceived years with statistically high rainfall as drought years such as 1903 (461 mm), 1917 (807mm), 1928 (469mm), 1971 (467mm), 1976 (436mm), and years with statistically less rainfall as good years 1926 (305mm),1933 (403mm), 1950 (430mm) (Bharara, 1982). These facts show that a holistic perception of natural phenomena, taking a number of indicators into account, provides a true representation of reality than mere figures about precipitation can ever do. In this particaular case of rainfall data it is important to know that rain in the dry zone of Rajasthan is unevenly distributed, and erratic (does not fall at the time when the crops need water).

Table 5: Comparison of Nature of Year and Trends Perceived/ Derived from Actual *zamana* and Rainfall Data

	Year perceived/derived from Actual *zamana* (by experience) No. (%)	Trend	Rainfall data (according to rainfall pattern) No. (%)	Trend
Severe Drought	6 (6.4)	every 15th or 16th year	6 (6.4	every 15th or 16th year
Droght	24 (25.5)	every 4th year	15 (16.0)	every 6th year
Mild Drought	27 (28.7)	every 3rd or 4th year	24 (25.5)	every 4th year
Average	16 (17.0)	every 6th year	22 (23.4)	every 4th or 5th year
Good/Surplus	21 (22.4)	every 4th or 5th year	27 (28.7)	every 3rd or 4th year
Overall years	94 (100.0)		94 (100.0)	

The trend through actual *zamana* reveals that on an average every 3rd year was a drought to severe drought year and every 4th or 5th year a good or surplus year. According to rainfall data every 4th or 5th year is a drought to severe drought and every 3rd or 4th year a good or surplus year. The trends in case of severe and mild drought years differ slightly due to overlapping classifications of the nature of the year perceived.

Conclusion

The prediction of climatic conditions in general combined with the expected agricultural yield in particular is a vital part of indigenous knowledge for coping with natural calamities. Peasants in the dry zone of Rajasthan have developed age-old practises to cope with the effects of drought and its disastrous consequences for livestock and man on a

sustainable and self-reliant basis. Man's ability to observe astronomical and meteorological phenomena, changes in the occurence or shape of plants and the behaviour of animals and fellow villagers indicates that he is living a social life close to nature. His knowledge will hardly ever be outrun by modern scientific methods of forecasting, because these lack the attachment that makes indigenous knowledge become a part of a villager's personality, his communal life and his link with supernatural powers respected by him and a part of his cultural identity. A modern and sustainability-oriented development can not afford to ignore indigenous knowledge. It is a fundamental source of know-how as well as being to socially adapted, and thus a resource to rely upon in times of increasing desertification and "social erosion".

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