

# **INDIGENOUS EARLY WARNING INDICATORS OF CYCLONES: POTENTIAL APPLICATION IN COASTAL BANGLADESH**

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## **Abstract**

Over the last 30 years, resources have been invested in Bangladesh for building cyclone shelters and setting up national warning systems, linked to regional weather forecasting and local volunteer networks. Preparedness remains patchy, however. On the chars and in some rural coastal districts – which are extremely vulnerable to cyclones and tidal surges - protective infrastructure is still scarce. Many rural people do not fully understand the signal system, and women especially lack information due to the purdah culture. Livelihood pressure is acute, producing a tendency to leave preparations until too late. Poor access to information and services is reinforced by social systems, whereby the elite exploit the poor. Thus, a combination of physical, economic and social factors can result in the most vulnerable people being the least forewarned and prepared.

During an ActionAid disaster preparedness pilot project in 2000, documentation of older people's disaster experiences demonstrated knowledge of local warning indicators based on animal behaviour or natural phenomena. This knowledge is not always being passed on to younger generations, and is increasingly disregarded as 'unscientific'. This paper suggests that some of these indicators could be incorporated into locally managed warning systems, to increase the empowerment and resilience of poor and vulnerable people.

## **Vulnerability and Poverty**

The off-shore islands in the Ganges/Brahmaputra delta are known as chars, which means "children of the land". Created by silt which floods down the rivers from the Himalayas to the Bay of Bengal, the chars build up over time and also erode according to the rivers' flow. Flat, with limited forestation and less than one metre above sea level, the chars are extremely vulnerable to cyclones, storms and tidal surges. There are few cyclone shelters and the paths to them are unsafe during times of flood. Life is precarious - but river erosion and population pressure elsewhere has brought thousands of poor people to the chars to seek new livelihoods.

Recurrent disaster has an impoverishing effect for most households, due to loss of assets and employment opportunities as well as loss of life. This offsets the efforts of

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development projects (Howell 2000). Research by ActionAid-Bangladesh also confirms that the middle poor can suffer long term effects as well as the poorest.

*“Previously (before the cyclone) I had many fishing nets, a big boat and many fishermen used to work under me. But now I possess nothing. I myself catch fish.”*  
Abdul Barek Hawlader, Char Kukri Mukri

*“Before the tidal surge I maintained a shop, but I fell into poverty afterwards. Day by day our condition became worse.”*  
Abdul Motabeb Hossain, Char Motahar

### **Socially Constructed Vulnerability**

Bangladesh society functions through social hierarchies; the relations between rich and poor are often referred to as a ‘patron-client’ system. On the chars, the manipulation of resources by elite moneylenders and landowners - who exploit the rich potential of the alluvial soil and productive fishing grounds - means that most char inhabitants are locked into a cycle of debt (Siddiqi 1996). Over 90 percent of families are landless. Livelihoods for the poor consist almost exclusively of sharecropping, or fishing under the ‘dadon’ system whereby the catch (and profits) are controlled by the person who gives loans for the boat and equipment. Interest rates are extortionate (reportedly up to 200 percent per annum) and if a fisherman dies his family can inherit the loan. (Such systems are illegally enforced on the chars, often by violent means.) This economic dependence combined with the physical hazards limits the resilience of poor households to recurring disasters, since it is hard to build up assets or diversify skills. Ironically, they are dependent during and after disasters on the charity of those who exploit them.

Most chars have an earth embankment to help combat ordinary tidal surges, and the better off build their houses on a raised earth platform. The elite will usually ‘commute’ on a seasonal basis since they also have houses or relatives on the mainland. Poor people are more likely to live in marginal, low-lying areas most prone to flooding – or even on the embankment itself. They are least likely to live near a cyclone shelter or a safe path, and most reluctant to leave their homes and possessions (since they have no means to replace them). Pressure to produce food or a daily wage is acute, and it is therefore tempting to ignore cyclone warnings and go fishing, and to postpone time-consuming preparations for disaster.

Vulnerability is also characterised by poor access to information. The poorest are least likely to hear radio warnings or understand the meaning of different warning signals. Uneducated people are most likely to feel alienated from a ‘scientific’ system. Women especially lack knowledge and information due to the purdah system, whereby they do not visit the market (where radio warnings might be heard or news discussed) or publicly interact with others.

Other cultural factors also affect vulnerability. Women are not allowed to leave the house without their husband’s permission, even to go to a cyclone shelter. Their long hair and saris hamper survival strategies such as swimming and tree-climbing, and they greatly fear losing clothing due to public shame (Howell 2001). It is notable that in the 1970 cyclone, according to a union parishad (local council) official, the entire

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adult female population of the island of Monpura was lost, and in 1991 mortality rates were much higher for women and children than for men. Moreover, conditions in cyclone shelters rarely conform with purdah values (women must not show themselves to strange men), and many women fear being molested. Being out of the home with strangers can impact negatively on the woman's own, and family, status (Schmuck 2000). The shelters are also uncomfortable, overcrowded and unhygienic.

Religious beliefs are significant beyond gender issues, since cyclones are traditionally seen as punishment from Allah (Howell 2001 and Schmuck 2000). The chars are a particularly conservative environment compared to mainland Bangladesh. Attitudes to preparedness are often influenced by religious leaders, some of whom advocate prayer as the only appropriate and necessary measure. There is widespread belief that Allah decides who lives and dies.

*“Some people depend only on Allah and some don't want to leave their house. They think it is irreligious or against the will of Allah for men and women to stay in cyclone shelters together.”*  
*Biwi Shafia Begum, Dhal Char*

*“Allah sends flood as punishment. The best way to escape it is to be less ungrateful to Him and seek His help.”*  
*Mohammad Nezamul Haq*

Such beliefs and simple explanations for events may be helpful as a psycho-social survival strategy (Schmuck 2000) but they are also used as a power tool by religious leaders and other elites, to discourage cooperative preparedness measures amongst the poor.

It is evident that such socially-constructed vulnerabilities can only be overcome through long-term strategies such as education, rights awareness-raising and land reform, while decreased physical vulnerability also depends on better infrastructure such as safe shelters. However, knowledge of preparedness measures together with reliable early warning systems can help to limit loss of life and property, and empower people to take control of their environment. Unfortunately, existing warning systems still tend to bypass those most at risk and are developed in a 'top-down' manner without the participation of the affected communities.

### **Current Early Warning and Preparedness**

After the severe cyclone in 1970 which resulted in the loss of some 500,000 lives, substantial sums were spent in Bangladesh on building cyclone shelters and setting up national warning systems. The Red Crescent Cyclone Preparedness Programme (CPP) plays an important role with its network of radio installations and trained volunteers. The latter have responsibility in local communities to hoist flags (representing warning levels 1 to 10) and spread warnings by megaphone among the local population. There is a detailed hierarchy of warning levels (being revised at the time of writing) with official instructions for ports and shipping of all types. Nationally, an increased number of people have access to private radios for weather forecasts. Internationally, warning technology has improved greatly, for instance with developed satellite imaging and analysis of global weather systems. In Bangladesh,

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there is thus much greater reliance on modern scientific data and local knowledge is in danger of being disregarded.

NGOs such as ActionAid who work with local partners are discovering that despite these systems, household preparedness and survival potential appear to be very much dictated by economic and social circumstance. Cyclone shelters and other protective/enabling infrastructure are still scarce on the chars and in the most rural coastal districts. (For example, on Char Jahiruddin in 2000 there were two usable cyclone shelters for a population of 20,000 people.) Even where shelters exist, there may be no safe road to them during a tidal surge, and access may require wading or swimming through snake-infested waters. Early action in response to early warnings is therefore important.

People may ignore the warnings for several reasons: economic activity, lack of understanding and also their experience that the official warnings are not infallible. Sometimes a high warning level is given, but the storm weakens, or veers away to hit the coast elsewhere. Without a clear understanding of the cause of cyclones, this appears to be a failure of the warning system.

*“Nowadays Red Crescent and ActionAid explain about the signals, we hear news about the signals, but sometimes ... there is no flood.<sup>1</sup> And sometimes the flood happens when there is no signal. So we are reluctant to leave our house ...”*

*Muhammad Sultan, age 107<sup>2</sup>*

*“I don’t know what the Disaster Signals Systems really mean .... We often hear announcements of possible disasters, but later we find them to be false alarms.”*

*Muhammad Bulu Mia, age 43*

Some local people, however, including women, do know of traditional warning signs based on natural phenomena.

*“I don’t know anything about different types of disaster or about the signals – I only know that the danger signal is really dangerous. I also listen to the ‘goroom goroom’ sound of the river.”*

*Biwi Shafia Begum, age 40 +*

*“I know there are Disaster Signals ranging from Signal No. 1 to 10, but I have no idea what they mean. I can predict any disaster coming when the sky turns gloomy, bees move around in clusters, the cattle become restless and the wind blows from the south”.*

*Mohammud Nurul Islam, age 45*

As outlined above, there are many obstacles to preparedness and survival in this environment: religious beliefs, superstition, rigid gender roles, lack of protective infrastructure, economic vulnerability and local insecurity all play a part. In a severe cyclone, safety options are few. But without credible and sensitive warning systems, even the available options will be under-utilised. So could local indicators combine

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<sup>1</sup> ‘Flood’ in these quotations means ‘tidal surge’, or combined tidal surge/cyclone.

<sup>2</sup> Ages are not recorded in local culture. Those shown here are as given by informants and were verified where possible through ages of children, memories of disaster years, etc.

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with the scientific system to create a more credible warning system, understood and controlled by those who most need it?

### **Local Knowledge: Indigenous Early Warning**

During a pilot project implementing disaster preparedness and management training for poor people on four chars surrounding Bhola Island, an NGO (ActionAid) also gathered information from older people on their multiple disaster experiences. The aim is to understand better local preparedness and survival strategies, as well as local early warning indicators. Accounts of the 1970 cyclone in particular<sup>3</sup> illustrate the importance of local early warning indicators at that time.

*“Noticing the continuous cry of the dogs my elder brother predicted a flood and warned us. Then I noticed that the leaves of the cotton tree had turned upside down. I understood my brother was right. At that time there was no radio, no flag or no warning from loudspeaker. So we had learnt to read the natural signs of the calamity.”*

*Muhammad Nezamul Haq, age 87*

*“The wind had been blowing violently from Wednesday ... There was no radio in those days. I guessed there could be a flood ... my mother told me to tie our cattle beside the pond. She also predicted a flood. She had closely watched the movements of flies, mosquitoes and ants. The dogs were crying mournfully.”*

*Muhammad Abdul Ali Majhi, age 78*

Knowledge of these indicators varies from char to char. While some people still use them, many see this as ‘old-fashioned’ knowledge which has been superseded by the newer scientific warning system (whether or not the signal system is properly understood or utilised). There is little evidence that it is being passed on to younger people, who may not yet have experienced a really serious disaster.

*“We saw and heard old people saying that continuous crying of dog and turning of leaves of Mandar tree upside down brings flood. Some say the movement of ants to higher places also predicts flood. But now we give more importance to the modern warning system”.*

*Muhammad Nezamul Haq, age 87*

Table 1 shows warning indicators representative of those gathered from four chars (Dhal Char, Char Jahiruddin, Char Motahar and Char Kukri Mukri) by ActionAid-Bangladesh field staff during 96 individual semi-structured interviews with both men and women.

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<sup>3</sup> For most older people interviewed, the worst disaster in living memory.

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**Table 1**

WEATHER PATTERNS	Sky turns gloomy and overcast # Black rolls of cloud Weather unusually hot and humid/hot spells after rain # Strong wind blows from the south/south-east # East wind blows at full moon
SEA/RIVER PATTERNS	Big waves/dark rolls of water ‘Goroom goroom’ noise in the river Smokey or cloudy shapes in the sea Pond and river water becomes hot *
ANIMAL BEHAVIOUR	Cattle become restless and stop eating grass *** # Cattle/dogs wail continuously/at night *** # Ants climb trees with eggs on their backs # Bees move around in clusters <i>Kurpals</i> (type of gull) fly high and cry Birds fly without destination Increased number of flies and mosquitoes # Insects attack cattle ** Fish jump in the rivers and ponds Crows/cockerels call/fly at night Frogs call constantly Foxes bark during the day Crabs come into the house and courtyard *****
OTHER	Bending trees Water hyacinth in the canal Leaves of the <i>mandar</i> and cotton tree turn upside down New leaves of trees fall to the ground Muddy smell on the wind *

\* Up to one day before

\*\*\* 3 – 7 days before

\*\* 1 – 2 days before

\*\*\*\*\* 10 - 12 days before

# Most commonly mentioned across all four chars

### Potential Application of Indigenous Indicators

It can be seen that most of the indicators are based on animal behaviour and weather patterns. More research and monitoring is necessary to determine exactly which ones (if any) are reliable in both tidal surge and cyclones, and to what extent they can indicate the severity of an impending disaster. It is obvious that some of these phenomena, such as a cloudy sky, also manifest under ‘normal’ weather conditions. Some are contradictory (such as wind directions) and need more analysis across different locations. However, it is certainly possible that if a particular combination of two or three of these indicators were used to give extra validation to the official warning signals, then more accurate – and more believable - early warning could be achieved.

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Most importantly, this information is easily visible and simply disseminated among rural people, without any special equipment. For this reason, it would be most useful to focus on indicators which are most widely applicable, and can be monitored near people's homes, such as those relating to animal behaviour (ants climbing trees with their eggs seems a likely example). This would also put women at the centre of their own warning system, and might act as a trigger for them to ask their husbands for more information about flags or radio transmissions.

Timing is crucial. The devastating 1970 tidal surge and cyclone occurred in most places in the middle of the night; indicators which only manifest a few hours beforehand would be missed if people have already gone to bed. What is fascinating about these indicators is that many, especially those relating to animals, apparently give a good lead time for preparation before what is essentially a rapid onset disaster.

*"We take notice of continuous crying of the dogs, increase of flies and mosquitoes, movement of ants, crying of kurpals, hot and humid weather and so on. These signs occur about 5 - 7 days earlier."*

*Muhammad Abdul Ali Majhi, age 78*

*"The dogs had been howling for four days before the flood hit in 1970."*

*Bibi Sahera Khatun, age 85*

Water temperature, by comparison, is usually noticed only 6 or 7 hours before a cyclone hits, or sometimes 24 hours before a particularly severe one. Even this, in daylight, gives reasonable time to bury important papers and valuables, take cattle to a high place, store dry food and clean water for the post-disaster period, strengthen houses, secure boats and equipment, and move to a shelter or strong house where possible.

### **Do Appropriate Warnings lead to Appropriate Action?**

We have to ask why so many people saw natural warning signs before the 1970 disaster yet still were caught unprepared. Admittedly, those currently giving the information obviously survived and some indeed took precautions.

*"A strong wind was blowing. The atmosphere warmed up alarmingly. Dogs were wailing without any break. I felt some flood or cyclone was going to hit us. So, I packed all my utensils, home articles and other valuable belongings in sacks and put them beneath soil for safety. At around 2 in the night, the water started flooding in my place."*

*Shahinur Begam, age 60+*

Most case studies, however, describe waking up to find the house floating away without having made any preparations, and several people undertook journeys despite seeing multiple warning signs. There is also evidence of 'following the herd'.

*"I noticed some Kurpals (a kind of gull) flying high in the sky and crying as I boarded on a boat. It made me apprehensive of flood. I also felt the water of the river with my hand. It was unusually warm. Then I became sure of flood. I thought it would be better not to go to Monpura. But seeing others I changed my decision: the same thing*

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*would happen to me as to others. I took a pair of coconuts for my sister in Monpura. They would also serve as a life-buoy in the river. In mid-river I observed the 'knife' fishes were jumping. It confirmed my apprehension."*

*Kala Mia Hang, age 75*

Currently there is less inclination to travel far if a disaster is imminent (especially among those who had the worst experiences of previous disasters) so some lessons have been learned. Many interviewed, however, explained that they have a hierarchy of preparedness strategies which usually include seeking a cyclone shelter as a last resort. This is often too late. Overall, there seems to be a disregard for the scientific system which is perceived as often wrong, together with an increasing disregard in many quarters for local knowledge which is perceived as old-fashioned and superstitious. If the latter was more organised and incorporated into a true 'system', then possibly it would be perceived more seriously.

More research is needed to establish all the reasons for ignoring warnings, which may relate to religious and traditional beliefs but sometimes are for practical reasons such as fear of robbery. Since the chars are largely populated with migrants, in many areas there is poor social cohesion and an apparent lack of trust. A local early warning system could be a possible focus for increased cooperation, which would also work towards raised collective consciousness and empowerment for the poor.

Previous research has also discovered that appropriate communication and local participation are crucial factors which can dramatically affect the success of an early warning system (Twig 2003). At-risk communities are more likely to respond to a system which is based on their own perceptions and needs, and in which they play a central role. Locally developed indigenous knowledge is a good basis for building up a participatory system, and one which has been used in sub-Saharan Africa - albeit in the context of monitoring slow onset emergencies such as drought (ActionAid 2002). It is important to recognise that this is not a new idea: almost a decade ago practitioners knew that "People at risk need to be involved in the design, development and operation of *their* warning system" (Bureau of Meteorology and Australian Emergency Management Institute 1993, in Twig 2003). Therefore national systems such as that in Bangladesh need to revisit both the content of the system and its communications strategies, as well as ensuring that local volunteers include people from marginalised households.

### **Conclusions and Recommendations**

With an increasing population on the chars due to river erosion of other land, and a growing young population with less experience of major disasters, we cannot afford to ignore any potential low-cost strategy which might improve survival and mitigate property losses. Perhaps the aim should be to seek the 'best of both worlds'. Just as modern and traditional medicine can jointly increase appropriate treatment options, we need to explore whether certain combinations of the best indigenous indicators and the best scientific indicators can offer a more appropriate, reliable and comprehensive warning system for vulnerable rural people.



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To move forward, more anecdotal evidence should be compiled, with particular emphasis on lead time, availability and perceived reliability in different disasters. Selected indicators should then be monitored in future when cyclones threaten and occur. If found reliable, these could be incorporated into NGO and government training programmes and disaster monitoring systems. Ongoing development programmes could adapt to support the process: for instance, forestry and livestock programmes in disaster-prone areas could include suitable species which play a part in early warning, survival and recovery.

Most importantly, vulnerable people should be central to the process, not only in information-gathering but in management. The process could be empowering for older people and for women, whose specialist knowledge would be important. People's committees, and/or community networks of individuals in different locations could have responsibility for monitoring the local signs at certain times of year, and communicating the information in an appropriate way.

To make a sustainable impact on vulnerability, however, it is evident that such activities must be combined with increased government responsibility for protective infrastructure and measures for rights-based social change to protect and empower the most vulnerable. In the chars, this is a real challenge, since many powerful people, including some local government officials, have an interest in preserving the status quo. International NGOs (most of which have policies to promote the involvement of the poor in project management) could play an important role here, through their local partners, with a combination of action and advocacy. Such work will be difficult since it involves a variety of stakeholders with very different interests; but it may well be that locally relevant early warning is a useful focus on which to base such a process, which can then address other social issues.

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