Disruptive weather warnings and weather knowledge in remote Australian Indigenous communities

Flat and floodprone, East Kimberley

Fuel delivery, Balgo

Some of The People, Oombulgarri

Research report

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May 2004.

Weather warnings and weather knowledge in remote Indigenous communities

The National Health Strategy 1999
Australians are entitled to live in a safe and healthy environment

From:
DoH. 2000. *The National Environmental Health Strategy Implementation Plan.* Federal Australian Department of Health, enHealth Council.

"The Aboriginal Elders interviewed at Mapoon believe that their knowledge of seasonal weather patterns, passed on from generation to generation, is becoming less reliable for season predictions and that the Australian weather patterns are changing".

- A note from Joanna Williams (Bureau of Meteorology) Old Mapoon Weather Information Report, September 2003.

An old man on Palm Island said much the same thing about 'reading' clouds since 1992. - Goudie, September 2003.

Executive summary

Our ability to accurately predict the weather and communicate that knowledge is constantly improving. The Australian Bureau of Meteorology, established in 1908, remains focused on who should receive those predictions and how well they may hear and respond to them. Because of extreme and potentially catastrophic natural events in the past, the BoM continues to seek ways to best convey targetted weather warnings to people who need to know of a looming threat, so they can make informed decisions and responses. This is largely successful, and well appreciated in the 18 remote Aboriginal communities surveyed directly for this research. The nine-month research into weather warnings arriving at and translating into proactive responses in remote Aboriginal communities makes recommendations likely to benefit people in remote areas, and more broadly.

This research report on remote Aboriginal weather warnings and responses has the core sustainability goal of effectively informing aware and prepared communities of developing major weather threats, to minimise the impacts of those threats. This is to minimise loss of life or injury to people and minimise damage to property – to get out of the way of destructive natural impacts, or properly prepare for and shelter from those impacts. People need to know about those threats in a timely *and palatable* form.

Consultation at 18 remote Aboriginal communities and inclusion of a further 12 JCU-based studies showed these communities generally had modern, climate appropriate housing, often with solar water heating. Houses were large, able to accommodate extended family. Most communities had about 150 – 200 residents. The research found caring and resilient communities, all using BoM information, nearly all checking the BoM internet weather site each day for the summer months each year.

Finding out what people want and need communicated, and then how that information may best be communicated has occupied the BoM since the early 1900s. This research has shown that the onset of the Wet – the first major rains – is a core weather issue in remote mainland Aboriginal communities. Knowing the nature – onset, duration and depth of floods is important. In the north of Australia, cyclones and rain are not greatly differentiated, knowing that strong wind warnings are difficult to deliver in time, unless the winds are cyclonic.

A main feature of the communities was reliance on diesel as the energy source for generating power to pump water and sewage, run refrigeration, lighting, televisions, air conditioning in administration buildings and electronic communications. Use of 1000 litres of fuel per day was common. The importance of predicting the start of the Wet, which stops ground transport, perhaps flooding roads for three months, becomes clear in the flat ancient lands, home to most visited communities. BoM may choose to devote more modelling resources to pinpoint the start of the Wet in Northern ‘weather regions’.

Refining ‘Plain English Weather Warnings’ remains a challenge for BoM, given the specialised features the warnings must describe. A collaborative project has begun between BoM and the Indigenous Radio Network to refine the ‘palatability’ of weather warnings as broadcast through a network of 150 radio transmitters from Mackay on the central Queensland coast to Broome in the west.

Recommendations include the full sharing of weather and flood data within and between agencies, within and across borders. Development of a new, visual standard of best/most effective practise for what amounts to a marketing exercise in warning of extreme weather impacts is strongly encouraged. This may involve Emergency Management Australia, and include development of computer simulations of major flood flowing across the real terrain under threat to trigger the desired response to take avoidance action.

Timely, targetted ‘call to action’ disruptive weather warnings, identified as applicable to remote Aboriginal communities, become as important to other remote communities, to other, more urban communities, so research targetting the marginalised becomes applicable to the mainstream. ‘Call to action’ warnings may be as relevant to a tourist, a shop keeper in Kununurra or pastoralists as they are to a community member at Mulan. Threat of flood means travel early, and then stay put, or just stay put in a dry, above-flood level place with adequate food, water and shelter.

Graphic ‘action’ signs or symbols should be developed for impending flood, fire or destructive wind warnings. The graphic for flood, placed as road signs at flood-prone bridges and used in BoM forecast messages – a car underwater in a flooded creek with a distressed person on top - will get a core message across.

The long standing BoM logo was identified as most effective to make people think of cyclones. Development of an image of a distressed person watching as their house is torn apart in flying debris is a suggested graphic to induce people to secure potential missiles, then take firm shelter before a major wind storm. These suggestions will be presented to Emergency Management Australia for development. As with these examples, the research outcomes draw heavily from members of the communities visited, on concepts from the Risk Communication literature, and from the current social philosophies of community empowerment and community safety.

From the 18 communities visited, and information drawn from another 12 in allied research, it is clear that the remote communities often use TV as their initial warning source that disruptive weather may be developing. A stronger, voluntary link between BoM and regional TV stations may wish to strengthen the content of local weather details for regional use. Learning about Perth Weather does not really interest people in the Tanami of the East Kimberley.

Experience in the communities showed that the core human aspirations are as strong in remote areas as anywhere. People enjoy TV, comfortable

houses, processed food and various comforts provided by electricity – refrigeration, lighting, town water, sewage pumping, office air conditioning and telecommunications. Shelter, relative security and belonging are gained with the physical isolation, separating residents from more sophisticated education, immediate healthcare and a broad range of employment. There is a high use of television, while children have full Web access, and access to culture.

The remote Aboriginal communities are different because of their often extreme isolation, their often very limited employment opportunities and the way many of the lads feel school is for kids after they go through ‘ceremony’ at about 14 years of age. Communities still rely heavily on traditional reading of the weather, and on bush foods, intimately related to the seasons and the season changes. They are different because outside help is not at hand in a hurry, except through the flying doctor service. If the generators go down, which is rare, the community becomes vulnerable quickly. The communities are all likely to survive, made up of people so strong-willed as to survive through prior hardship or isolation.

All people interviewed had a high regard for BoM and BoM products and services. BoM is well appreciated in remote communities. Making the wording and graphics of weather warnings more attractive and likely to engender preferred, safety-oriented responses is likely to be achieved, as recommendations from this research are developed and implemented.
Thanks go out and remain for all community members contributing to this research, and to all who helped make it happen.

Outline of recommendations

1. Develop ***Australian "Plain English weather warnings"*** with the Northern Indigenous radio network.
2. Develop ***Call-to-action warning graphics and action statements - 'Warning as a verb'***
3. Develop BoM forecasting to **pinpoint the start of the Wet** for regions of the North, liaising with regional communities and fuel suppliers. Sharpen predictive modelling to better pinpoint the exact onset of the Wet with about two weeks lead time.
4. **Develop simulations** of flood, wind or fire impact spread for media use. Start to develop crude simulations of major floods or destructive wind paths to attach to related extreme weather warnings (see rec. 18).
5. **Agencies to share and make public flood and other threat data,** irrespective of any state or territory borders. The BoM will ensure its warnings are directed to all people at risk and encourage other Agencies to do so.
6. **Drop the word "severe**" from weather warnings when directing potentially disruptive weather information to areas of more concentrated Aboriginal population.
7. **Modify the Beaufort Wind Scale to help depict wind speed in Australian *Plain English weather warnings*.**
8. **Explore incorporation of Indigenous weather forecasts into mainstream forecasting data.**
9. BoM to support efforts to develop one web-based road flood warning system, based on RACQ.
10. Consider developing a potentially commercially viable **board game** of '**Disruptive weather impact preparedness'.**
11. **Expand the *Indigenous Weather Knowledge* web site.** Put hyperlinks to Indigenous and weather radar links – Land Councils, radio centres, schools, Aboriginal art centres into the IWK portal map. Use relevant symbols to link the IWK site to radar, and other sites of interest, providing a drop-down key.
12. Promote community weather awareness through school competitions, using air pressure as the central weather indicator and barometers as the prizes. Create school competitions about air pressure and the weather – prizes – 5 barometers per school.
13. Make the BoM site and the locally detailed cloud, flood and rain web sites more widely known.
14. Automate sending of Disruptive Weather Warnings to the more remote settlements as a community service.
15. Explore expansion of public weather warning signals (cyclone siren).
16. Include more locational features on all radar base maps. Put landmarks – main roads, rivers and all settlements on all base BoM website maps. Explore developing a base map which can be magnified to bring up the full array of local place names and features, with locations hyperlinked to schools, communities, land councils and radar sites (see below).
17. Where available, incorporate Dreamtime stories of 'mega-floods' into estimations and illustration of Probable Maximum Floods.

18. Begin **negotiations with media** bodies and associations to become part of the formal warning process to target at-risk people.
19. Use IWK site to **offer training to remote Indigenous people** to use the BoM and IWK sites. External training funds to be sought.
20. Explore automatic translations into Plain English weather warnings for a place on IWK site.
21. Once the Australian Plain English weather warnings detail is advanced (about June 2004), post to IWK site for feedback.
22. Test warning graphics. Once warning graphics are in an advanced state test for feedback via posting to IWK site. Links to climate/ local radar/ satellite in IWK site on front, portal map.
23. Use IWK web site as the platform to test seasonal climate knowledge, anomalies and forecasts, soliciting input from community members on upcoming weather, and then comparing those predictions with BoM predictions. Possible outcomes – the uptake of Indigenous predictions into 'ensemble' modelling for weather forecasts.

With thanks to all involved

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Section 2
Aims and method of
JCU-BoM Indigenous weather warning research

The BoM operates under the *Meteorology Act 1995*. Section 6 of this Act sets out the functions of the Bureau. Of particular relevance is Section 6 (1) (c) which states that *"The functions of the Bureau are…the issue of warnings of gales, storms and other weather conditions likely to endanger life or property, including weather conditions likely to give rise to floods or bushfires.*

The most developed of all of the Bureau's warning systems is the Tropical Cyclone Warning System.

- Special arrangements with the media, including direct radio and television broadcasts by senior Bureau staff;
- Two level approach, a watch when the threat is between 24 and 48 hours away, a warning when the threat is under 24 hours away;

The Bureau also has a well developed service for fire weather. The main thrust of this service is in providing services to a group of special clients, the rural fire authorities."

The most recently introduced warning service is for severe thunderstorm. Warnings detailing the existence of storm cells and their expected movement will be issued close to the time at which they develop. A major problem with this service is, and will continue to be, the difficulty in getting the information to the communities at risk in time for them to take appropriate action, given that lead times are generally of the order of one hour or even less.

From:
Pierrehumbert C1992. (Superintendent Meteorologist, Severe weather Program Office, Bureau of Meteorology Melbourne). The Bureau and its warning roles. *The Macedon Digest*. The Australian Journal of Disaster Management V7: 2 p 11.

This research into remote Aboriginal communities aims to help minimise adverse weather impacts - loss of life or injury to people and damage to property - from major weather events by enhancing weather information delivery. The Centre for Disaster Studies, James Cook University, Townsville, set out with and for the Bureau of Meteorology to investigate the way important weather forecasts and warnings disseminate to and through Indigenous communities.

Researchers aimed to find out how best to deliver extreme weather warning information. This information should stimulate consideration of community needs and enhance the opportunity for community decision makers to develop informed decisions and appropriate defensive actions that maximise community safety.

The core research goals were to find out how: Indigenous communities learn of impending weather extremes, how that information passes through the community, how people respond to that information, what traditional indicators are known or used, and how to improve the information content, delivery, diffusion and responses. A research survey form guide was developed and used to help gather information on community and weather information (Appendix I & 2).

National research context

Research is vital for developing the capacity to identify and respond pro-actively to changing risk, and to provide the evidence base for best practice disaster management."

"**Information management and modern information technology**
Sound information underpins, or should underpin, emergency management… finding appropriate information, making use of it, disseminating it effectively to all who need or might need it….

From:
Emergency Management Australia 2002a. *Research agenda for Emergency Management.* EMA Research and development Strategy for "Safer Sustainable Communities", p 1 & 4)

The project followed detailed goals to learn how to most effectively warn aware and prepared communities of developing major weather threats, so that community members will avoid destructive natural impacts or properly shelter from those impacts. The research also sought to identify constraints and limitations of weather and warning messages to Indigenous communities and develop capacity enhancement of Bureau of Meteorology staff. Handmer (2001) asserts that the *detail* of the warning design is crucial, making sure to '… conceptualise the warning task as one based explicitly on the needs of those at risk." We need a "… culture of cooperation and learning among the many organisations involved" (Handmer 2001, p22). A further research goal was to develop capacity enhancement of members of Indigenous communities, along with contributing to the Indigenous Weather Knowledge website at BoM.

With those goals, objectives of the research included efforts to document current practices for weather and warning information for Indigenous communities and examples of Indigenous knowledge that helps understand and interpret weather and hazards, and to interpretation of Bureau delivered warnings and messages. Key objectives were to identify community needs for weather and warning information, and to assess the appropriateness or otherwise of current practices in the light of community needs.

The above goals and objectives were met by reviewing existing literature on the way weather forecast messages and warnings were passed to and through Indigenous communities. We collaborated with Moya Newman, Fire and Emergency Services (WA, FESA), Queensland Department of Emergency Services (QDES), BoM regional offices and Northern Territory University, and related research back to the Indigenous Weather Knowledge site managers at the Bureau of Meteorology.

Key Bureau of Meteorology staff, Fire and Emergency staff, and media practitioners provided information on current practices. The main method of information gathering was participatory fieldwork in Indigenous communities to gain understanding of their situations regarding delivery of weather and warning information. This involved phone conversations, then a contact letter (Appendix 1) to each community contact – CEO or Chairman, and then visits to each of the 18 case study communities. The research used qualitative open-ended interviews and discussions alongside a structured questionnaire (Appendix 2).

People at risk need to know how to minimize impacts from a threat. The task is how to deliver that information. As happened in this Indigenous weather knowledge research, Handmer (2001) suggests that it cannot be done properly “without consulting the people involved. Such consultation should be a two way process more akin to negotiation” (Handmer 2001, p 22). Community information was gathered from key residents of remote Aboriginal communities across much of northern Australia.

The Places

Case studies included Torres Strait islands of Thursday and Horn Islands, along with Injinoo, New Mapoon, Umagico, Seisia and Bamaga, of the Northern Peninsula Area. Palm Island (NQ), was visited for two days. Visits were paid to the East Kimberley communities of Ringer Soak, Mulan, Balgo, Billiluna, Halls Creek, Oombulgurri and Kalumburu; and also in north Queensland: Mornington Island, Old Mapoon and Yarrabah. Full reports are provided in Appendix 3 - 8. Institutional information was gathered in Darwin, Cairns, and Townsville.

Parallel research also allows the following report to draw on recent original work undertaken at Wujal Wujal (Bloomfield River, north of Cairns FNQ), Eidsvold (Central Southern Queensland, the Burnett Region SEQ), Cloncurry (central west Q); Broome and Port Hedland (NW WA), Normanton and Kurumba (NT), Giru and Townsville (NQ), Lake Nash (Far Eastern Central Northern Territory) Mount Isa (NW Qld) and Pormpuraaw (West Cape York, FNQ. Maps 4.1 - 4). Reports on all the communities are outlined in Section 4 .

Ongoing feedback
After sending copies of reports on each community back to the community for feedback or correction, a preliminary presentation of results was made to the Tropical Coastal Cyclone Impact Program workshop as part of the National Disaster Management Conference in Canberra in September 2003. Draft recommendations were put to 24 BoM staff over 2 hours via video conferencing from Melbourne to Darwin, Brisbane and Perth in late December 2003 for refinement and feedback. Results of this collaborative research will be presented at an Australian Meteorological and Oceanographic Society (AMOS) conference in early July 2004. Posted to the web in late May 2004, the (unlinked) web address will only be given to participant BoM staff, researchers and participating communities until all input is gained.

The people in the project
Research staff included Dr Douglas Goudie (Research Team Leader, Australia Research Council and BoM funded), Dr David King, Dr Alison Cottrell, Eddie McLachlan and Yetta Gurtner from the Centre for Disaster Studies, James Cook University, North Queensland, with contributions from the School of Indigenous Australian Studies, JCU, Townsville, Dr Jim Monaghan (Pormpuraaw) and Joanna Williams (Old Mapoon), with BoM staff participating on two field trips: Terry Hart to the East Kimberley, and Joanna Williams to Old Mapoon.

The East Kimberley outcomes owe much to Graeme Down, Fire and Emergency Service Authority, WA, without whom the trip would have been futile. BoM staff in Perth, Darwin, Brisbane, Melbourne and Townsville had input. Thanks go to the BoM field worker in Halls Creek who showed us the sophistication and painstaking care taken in each BoM weather station to get the data right. Thanks are repeated to all the participants from Palm Island to Kalumburu. Thanks all.

Research methodology lessons
Aiming to investigate the way weather forecast messages and warnings information were disseminated to and through remote Indigenous communities, initial reports from Yarrabah and portions of the Torres Strait showed that there was ‘interview fatigue’ in these communities.

Reports were sent out weekly for 12 weeks during the active fieldwork phase. Communities were sent drafts of the developing material for their information and to provide change if needed. There was no feedback from any of the 18 communities. Perhaps research fatigue again, or we got it right, or interviewees had moved on or lost interest.

Because of interview fatigue and a suspicion of interviewers, it is necessary in remote research to have a trusted ‘guide’. For instance, in the East Kimberley, we were fortunate to be helped by a resident of long standing, well known and respected in the communities.

Section 3
General background and results overview

Outcomes applicable to many

The research across a broad selection of remote Aboriginal communities shows similarities and differences. Ultimately, there are general needs that only those communities have, but those needs overlap with other more remote communities, from Mount Isa and Julia Creek to Halls Creek, Aboriginal or white dominated. Also, there are Indigenous issues shared by more and less remotely located, from Mulan to Eidsvold. In every case, we would all like to know with adequate warning what may adversely impact on us. We would like clear encouragement or support, if needed, to safely stay put though the extreme weather threat, or be able to safely move from the destructive or disruptive path of the impact.

Incorporating Indigenous knowledge into mainstream forecasting

Along with effective, palatable weather warnings which are likely to be noticed, and, if need be, acted on – prepare to stay safely or leave safely, in a timely manner, to a place of greater safety, this research considers the very sources of weather information used by the BoM. The BoM ability to wed different models, particularly for cyclone path and speed is impressive. Can or should Indigenous input to the predictive accuracy about the start of the wet or the extent of flooding be tested for incorporation into mainstream forecasting?

Teaching community members to use the BoM web site

Refining the weather warnings sent to remote Aboriginal Communities was a key aim of this research. Emergent issues include the recommendation that BoM provide training in the use of BoM sites to Community members, and that the language and graphics used in warning are first tested through the BoM Indigenous Weather Knowledge site.

Plain English Weather Warnings

As this research deals primarily with risk communication and responses in and through remote Aboriginal communities, this research recommends that that BoM purposefully use the network of Aboriginal radio stations and relay points, about 150 in all, which stretch from the mid north coast of Queensland across northern Australian to the North west coast of Western Australia, reaching inland to Alice Springs. This Broadcast to Remote Aboriginal Communities Services[1] is listened to through the remote areas of northern and central Australia - a perfect vehicle for broadcasting effective weather warnings. BRACS broadcasters tend to source weather information from the capital city BoM offices, perhaps via Townsville, Darwin, Broome and Alice Springs.

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[1] See http://www.curriculumsupport.nsw.edu.au/technology/CS_WEB/bracs_es.htm
http://www.teabba.com.au/thenetwork/map.htm
http://www.ion.unisa.edu.au/cgi-bin/newwindow.acgi?http://www.warlpiri.com.au/

As a direct result of this proactive research, BoM and the Townsville BRACS base have begun a collaborative venture to refine culturally appropriate disruptive weather forecasting language (Appendix 9).

Boundaries

Some state and territory border 'boundary effects' need attention. The research made clear some concerns about road and weather condition reports successfully reaching threatened communities across borders. Handmer (2001) reports that a failure to properly transmit relevant warnings across borders remains a problem in Europe. A more subtle problem to do with information about extreme weather impacts and the regional community's ability to respond is displayed by the Camooweal air strip, located about 150 km NW of Mount Isa, inland western Queensland. A Disaster Risk Management Study conducted by Goudie in 2003 (http://www.tesag.jcu.edu.au/CDS/reports/MountIsaDRMSReport1.pdf) found that the Camooweal air strip was deteriorating. The study found the Camooweal airstrip is often used by Royal Flying Doctor Service (RFDS), who were concerned about the landing surface. This airstrip is central to flood and medical emergency rescue ability for a wide surrounding area. Often the Camooweal four-wheel drive ambulance (Qld.) is dispatched to outlying stations, including Lake Nash Aboriginal Community in the NT.

As seen in the Northern Territory report in Section 4, there are prolonged adverse flood conditions impacting the Lake Nash settlement. This is mentioned here in the background to this report to remind readers who happen to be state, territory or national planners that these line-on-a-map borders can create unnecessary threat situations, born of adverse weather and avoidance of infrastructure provision or maintenance. The Camooweal story appears to have a positive outcome – the Local Government (Mount Isa) secured funding to resurface the strip. Work should proceed in April 2005.

Details and traditional weather stories

The following report considers the communities visited, both in the following section, where issues are detailed, and in Appendix 3 - 7, a highly detailed profile of each key community directly approached for this research.

To lend credibility to the deep oral tradition of the Aboriginal peoples, a fairly exhaustive compilation of traditional weather stories is given. Part of the motivation is to remind readers that, in extreme weather situations such as major flooding, people may drown. The key motivation for this research is to help minimise loss of property or life.

This document follows traditional stories of extreme weather impacts with more recent 'stories' – early European accounts of cyclones in the north, and fairly fine detail of the lessons from the 1974 Cyclone Tracy in Darwin, and the 1974 Brisbane floods. Following the wild weather year Australia experienced in 1974 – with major flooding right through Queensland and the NT, two years later there were massive wildfires in many of the same areas. Emergency managers slowly note that major floods often result in high fuel loads, which may easily translate into wildfires a couple of years after the large floods.

Attitudes and Sustainability policies

> Preparedness should be considered in at least two ways. Firstly, one can make the distinction between psychological and material preparedness. Then, one needs to acknowledge the difference between preparations made prior to onset and those which are made immediately before impact.
>
> From:
> Chamberlain ER, Hartshorn AE, Muggleston H, Short P, Svensson H & *Western JS. 1981.* Queensland flood report Australia Day 1974. *Australian Government Publishing Service, Canberra.* P 37.

Contemporary attitudes and policy responses are explored to place the remote Aboriginal weather warning concerns in the larger contemporary context of disaster prevention, preparedness, response and recovery. The greatest context is 'sustainability', and the precautionary principle. Handmer (2001) reports that in sections of Europe, managing natural hazards is being placed within the context of sustainable development, requiring strong civil defense organisations.

The 'precautionary' school in sustainability in emergency management is supported by the Economic Commission for Asia and the Pacific (1997), when they state: "The alerting of the community and its responsible authorities must begin, at least provisionally, as soon as the existence of a tropical cyclone over the seas bordering the country is known "(p16). Cyclones are so destructive over often large areas, people need to be warned toward mobilising responses as early in the cyclone threat as possible.

The warning challenge is less clear for predicted localised downpours and flash flooding – how much effort should be taken to warn – what is the message, how do you keep it to the affected area, and what do you want people to do? A report from the 2003 Emergency Management Australia Disasters conference (Canberra) in Section 8 helps place this study in the national and current world view on community preparedness and risk communication.

Responding to isolation

Within these broader issues, special concerns of remote Aboriginal communities are then explored. Isolation, fuel storage top-up before the start of the Wet and communication links are of central importance. Residents want detailed local weather information. The BoM web site is used extensively in almost every community visited. That web site helps greatly in risk communication, dealt with in Section 9. prescriptively, risk communication is largely about: content, clarity, understandability, consistency, accuracy, certainty, frequency, channel, credibility, public participation, ethnicity, age, gender, roles, responsibility, elements, sequencing, synopsis, prognosis, location, action, warning timing, and action statements (Salter et al, 1993) From detailed consideration of the risk

communication literature, it becomes clear that action statements, supported by emergency conferences and authors in other areas of disaster management, are central to the whole purpose of the disruptive weather warning.

A meeting in Melbourne of BoM staff and Goudie in December 2003 resulted in refinement of most of the recommendations flowing from this study. That meeting period and some interactions are briefly reported.

Making the existence of the BoM web site more widely know is a strong emergent recommendation of this study. People who used it liked it a lot. People who were first exposed to the site during field work were clearly pleased and impressed.

Field work meets literature review

The full weight of the field work and literature review, discussions and feedback from meetings and conference audiences all helped to synthesise the 23 recommendations which form the *action* part of this report. The recommendations were introduced in the prior section, but the detail is provided in Section 11 of this report.

Appendices include the survey form and letter of introduction, but mainly provide detailed reports on each visited community, giving demographic information, telecommunication resources, weather information sources, internal communication processes of weather threats, tradition weather signs, and ways to improve weather information.

Conclusions flagged

The conclusions reached in this report all centre on promoting implementation of the recommendations to help prepare individuals, family groups and communities to minimise the impacts of extreme weather events in their regions. Better pinpointing the start of each region's 'wet', more response-inducing weather warning signs or symbols, more 'culturally appropriate' use of warning words, better communication across state and territory borders are some of the more important research recommendations.

The communities are resilient and quintessentially Australian in their 'she'll be right' attitude about weather extremes, but are well informed, have good communication channels to warn of threats, and good and practiced procedures to warn others and take appropriate action. Community members have often suffered so much at the hand and policies of earlier whites, government and church, that the weather seems, to some, much less fickle, less unknowable, less threatening. An impression from the communities was of a people resting after a major trauma, often of generations. As living members of the oldest coherent culture on earth, with rapidly dying old 'weathermen', there is much we and BoM can still learn from remote Aboriginal relationships and knowledge of the ever-changing Australian weather. Young community members, we were repeatedly told 'were not interested'.

A 1997 conference on increasing disaster awareness in remote Indigenous communities identified the following issues:

- Pictures should be used instead of words to minimize problems of language and literacy
- Conference participants were unanimous that specific information targetted to remote Indigenous communities was critical to increased disaster awareness
- Service delivery should be based on long term relationships of trust and that timeframes may need to be flexible
- Disaster awareness activities could be coordinated across departments and agencies under a general heading of public safety. This could reduce costs and prevent competition for attention in communities.
- To develop a national communication plan it was recommended that animated videos, posters from those videos, associated playing cards, brochures and colouring books be developed and made available. Ideas to encourage *greater use of the Aboriginal radio networks* and using a "seasonal calendar" were also recommended to help people remain protected from natural hazards[2].
- A resource kit of such things as contact lists and items useful to weathering a natural disaster could be developed specifically for distribution and use by remote communities. For this to work communities would have to be actively involved in the development of the resources. School children and poster development could help overcome problems with literacy or as English as a Second Language[3]
- Use of performing arts was seen as a powerful tool to promote disaster awareness and education. Like many of these strategies individuals and institutions undertook to develop them.

Finally the conference members argued that it is logical to cooperate across agencies and to coordinate activities and visits.

From:
EMAI 1998. *Report of the strategic planning conference on the development of enhanced awareness education programs and materials for remote Aboriginal and Torres Strait Islander communities. Darwin, May 1997*. Conference Proceedings. EMA - Emergency Management Australia Information Service.

[2] These ideas fit in very well with the idea of the radio links, graphic warnings and board games recommended in this current work.

[3] In 1997 Peter May (Emergency Management Australia) undertook to coordinate development of a generic national resource kit. Is there any feedback on that undertaking by EMA? The recommendation to develop an educational seasonal calendar as an IDNDR project was put forward at the conference and is having partial implementation through the BoM Indigenous Weather Knowledge site. The strategy to use the Internet for information dissemination remains a compelling option.

Values and shifts

A final set of perspectives for this section is gained by considering some areas of political and commercial, perhaps even ideological differences and tensions which mean that sustainable and safe communities may be viewed through many different prisms, promoting less-than-coherent initiatives.

"The draft NSW *Floodplain Management Manual,* set to replace the *Floodplain Development Manual,* contains important revisions that are expected to promote such a reduction. First is a need to consider the full range of flood sizes, up to and including the Probable Maximum Flood (PMF). Second is a change of approach to existing developments, from a policy that stipulates 'the removal of unnecessary development and building controls' (NSW Government, 1986, p. 33) to one that encourages the use of those controls (NSW Government, 1999, p. A-1)."

"Moreover, messages did not make clear that the stated gauge heights referred to a different gauge than had previously been used (Opper, 1999). Though major improvements in the understanding of flood warning systems in Australia have been made since serious flooding in 1990 (Handmer *et al.,* 1990), there remains much scope for improved implementation of 'best-practice' guidelines. Inevitably, on many occasions it is a damaging flood that acts as trigger for greater implementation – as was the case after severe flooding of Moora (Figure 1) in 1999."

"An example of such an approach was the 'Macleay FloodSmart Week'. This commemorated the 50th anniversary of the 1949 Macleay River (Kempsey) flood, in which six people lost their lives, 35 houses were completely washed away and 2,000 people were rendered homeless. The commemoration involved the production of a video and newspaper supplement, public meetings, displays of memorabilia, distribution of flood safety brochures, and installation of flood markers, with positive media coverage (Dutton, 2000)."

"Several lessons have been highlighted in this review, dealing with various aspects of the risk management process. First is a need for improved measures to *prevent risk* through more rigorous floodplain management. A high degree of building exposure in many urban areas is a legacy of an inadequate knowledge of flood frequency and scant respect for a river's floodplain."

"Measures to *reduce risk* through preparedness have been encouraging, but the distinct nature of each flood at a given location points to continued opportunities for the improvement of flood warning systems. Efforts to educate flood-prone communities need to take heed of two maxims: that flood awareness wanes over time; and that flood awareness is as much an individual commodity as a community commodity, at least in the Australian context. The final lesson concerns *risk transfer.* The 1998 floods demonstrated how issues of insurance and relief can overwhelm consideration of risk prevention and reduction. To achieve genuine mitigation, insurers and governments need to develop tangible incentives for self-reduction of exposure, and disincentives for inaction. Regrettably, experience suggests that due to commercial and political competition, achieving this goal may prove elusive."

From:
Yeo, S 2002. Natural Hazards. Flooding in Australia: A review of events in 1998. 25: 177-191. Department of Physical Geography, Macquarie University, NSW.

Flagging some key results

Problems of emergency management in remote Aboriginal Communities are well understood (EMA 2002b http://www.ema.gov.au/ema/rwpattach.nsf/viewasattachmentPersonal/6988AD402E2B33BDCA256CC3000C356B/$file/Indigenous_Communities_1.pdf).

Knowing the start of the Wet is the most important piece of weather information communities need and not currently getting to the extent cyclone warnings are provided. Using words and 'call-to-action' symbols which convey meaning to community members can be developed. Warning mechanisms to remote communities can be streamlined by ensuring all data collection agencies share their rainfall, windspeed and flood data as they acquire it and that there are automatic mechanisms to relay relevant extreme weather or flood warnings to all community CEOs, police and SES.

The BoM web site is relied on in virtually all the remote communities visited, but there is near-zero use by Indigenous personnel.

The Broadcast to Remote Aboriginal Community Services (BRACS) is listened to in nearly all communities visited.

Most communities visited showed a high level of interest in the project and in the BoM Indigenous Weather Knowledge Web Site. The word "severe" causes polled Indigenous people to 'switch off'. 'Strong', or 'major', 'dangerous' or 'destructive' are stimulants to greater interest.

Credibility and trust in risk communication

From the 1980s credibility of the information and the risk communicators has been recognised as central to effective risk communication (Renn and Levine 1991). BoM has high credibility. A long identified core issue is that there are many groups competing for credibility in the communication process. Since the early 90s it has been seen that high credibility sources produce the most behavioural change. Status matters.

The more explicit (message-as-a-verb, the more 'persuasive intent') the better. People tend to respond to perceived fairness as much or more than they respond to apparent objectivity. Lending argument to other approaches is seen as more effective risk communication than just arguing for one line of response. If the goals of the communicator are seen to serve a common interest with high social values people are more likely to trust the embedded messages. In the end the sources don't necessarily have to be liked. It's the actual positive and understood outcomes of the communication message which matter the most (Renn and Levine 1991).

Recommendations for the design of effective warning systems: findings from the research literature (Handmer 2001)

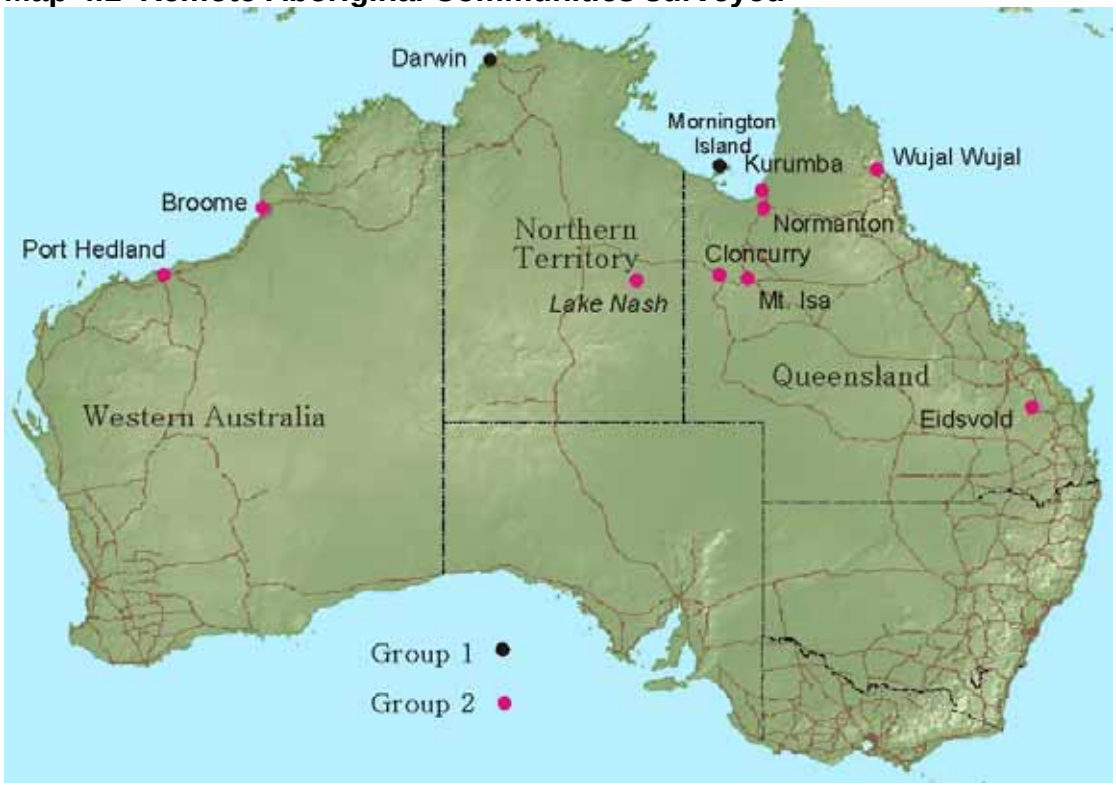
Warning messages should: be timely and reliable have local and individual meanings be forward looking suggest appropriate responses come from locally credible sources be reinforced socially (e.g. through personal networks) go to those at risk (usually a diverse group)
Warning systems should: make provision for easy confirmation and extra information use an appropriate range of message dissemination modes employ multiple channels for dissemination incorporate continuous learning and updating procedures

Section 4 Research outcomes –

Core disruptive weather issues in remote Indigenous communities

This section summarises research within 30 communities of northern Australia undertaken in 2003, seeking to understand remote Aboriginal communities, particularly in their relationship with weather forecasting; sources indicating disruptive weather, and responses to threats of disruptive weather.

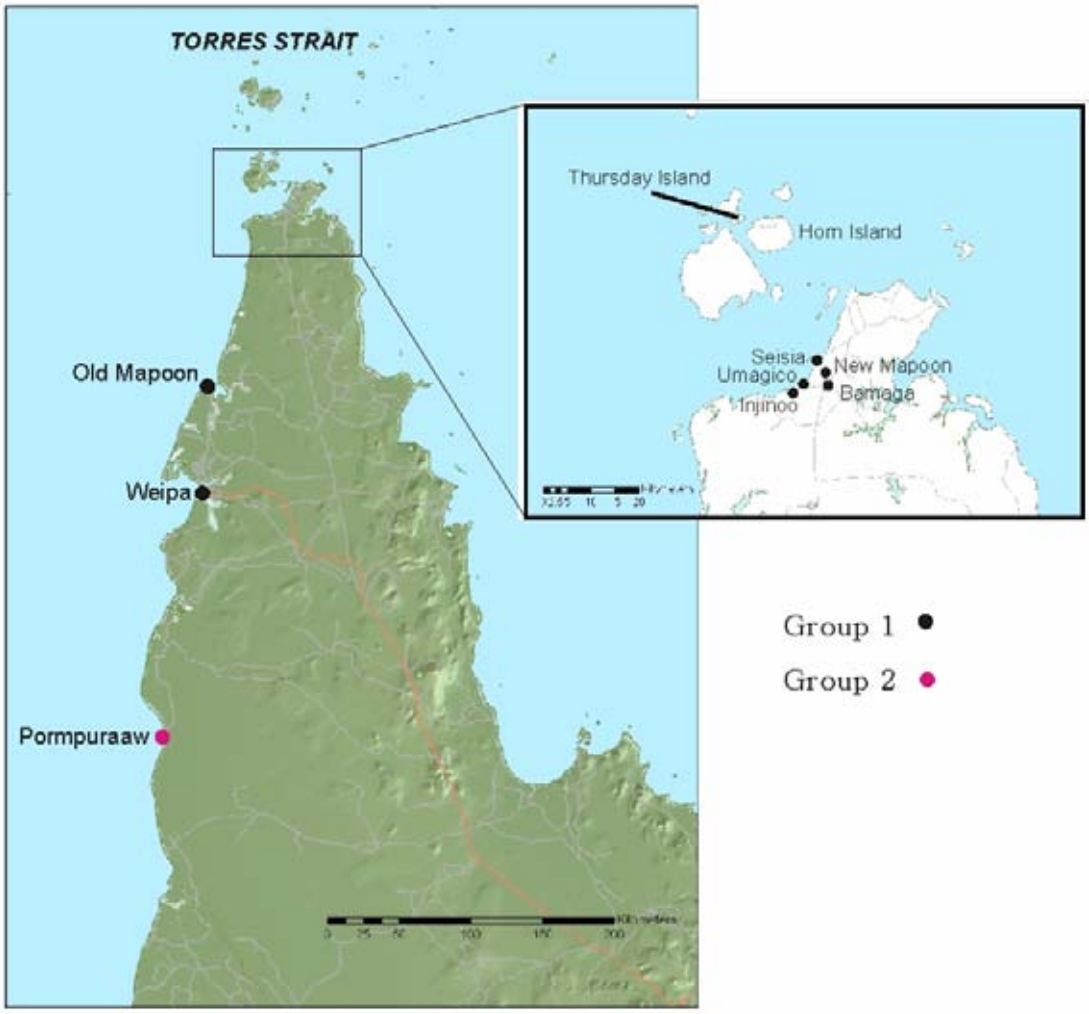
Map 4.1 Remote Aboriginal Communities surveyed



Key: Group 1 Surveyed for this study (see following maps for others),
Group 2 Independent research undertaken by CDS, used in this study.
Maps courtesy Adella Edwards, Cartographer, TESAG, JCU. Q 4811.

The evening TV news often provided the first alert of looming disruptive weather. In almost all communities (Maps 4.1 – 4.4), an Administrator or Store Manager consistently used the BoM web satellite and radar images. BoM faxes are also relied on during threats of extreme weather. In general, only the schools (nominally to year 10), medical centre, store keepers and Administrators have internet access. All communities have satellite phones and generally reliable Telstra connections.

Map 4.2 Cape York and Torres Strait communities surveyed

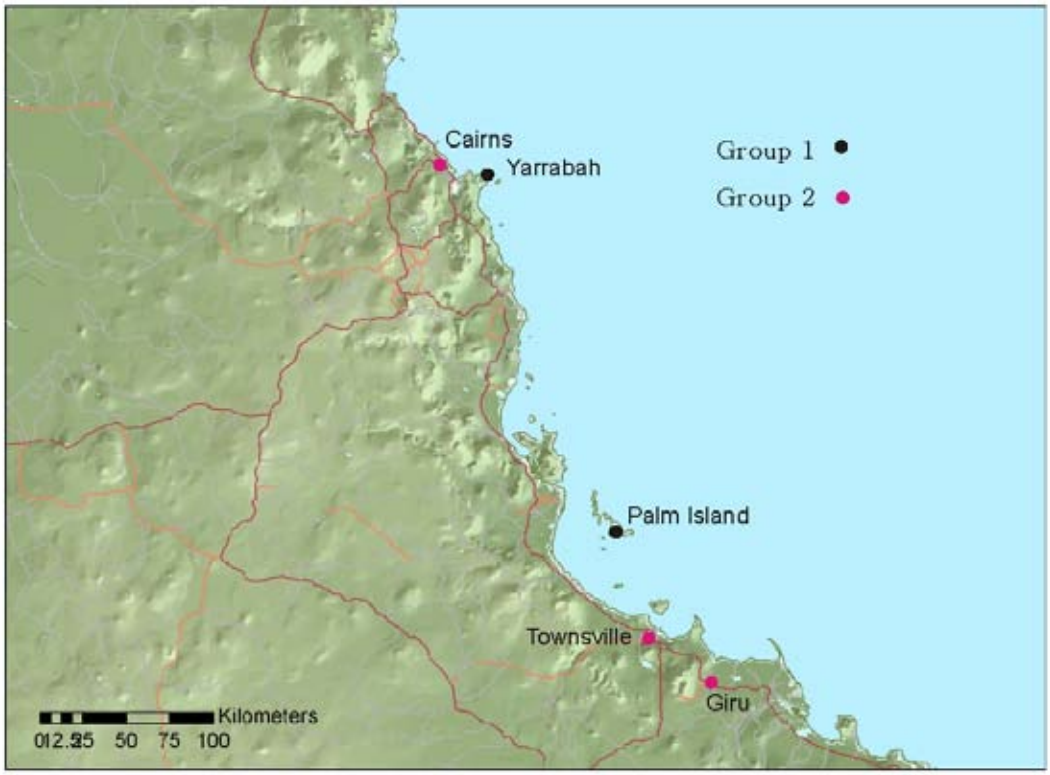


Key: Group 1 Surveyed for this study (see following maps for others),
Group 2 Independent research undertaken by CDS, used in this study.

This section takes the reader on a brief tour of five Torres Strait Island communities (Map 4.2), reports on 2003 contact with Lake Nash, Northern Territory (Map 4.1) and from the NT State Emergency Services. Yarrabah is near Cairns, Far North Queensland (Map 4.3). The Yarrabah report gives insights into a remote community located near a major population settlement. With frequent road flooding, isolation can still be an over-riding concern to community members.

Details from Mornington Island (Map 4.1) show a truly isolated community and gives insight into traditional weather forecasting and responses, setting the scene for reports from the five desert and two coastal Aboriginal communities of the East Kimberley, far NE of Western Australia (Map 4.4). Like other communities, residents of Old Mapoon, near Weipa, Cape York Peninsula, spoke of the hot, still conditions indicating 'the build-up to the Wet' that all north Australians know. Particular birds indicate 'big blows', and the height at which crocodiles build their nests indicate the likely upcoming annual flood level.

Map 4.3 Coastal northern Queensland communities surveyed



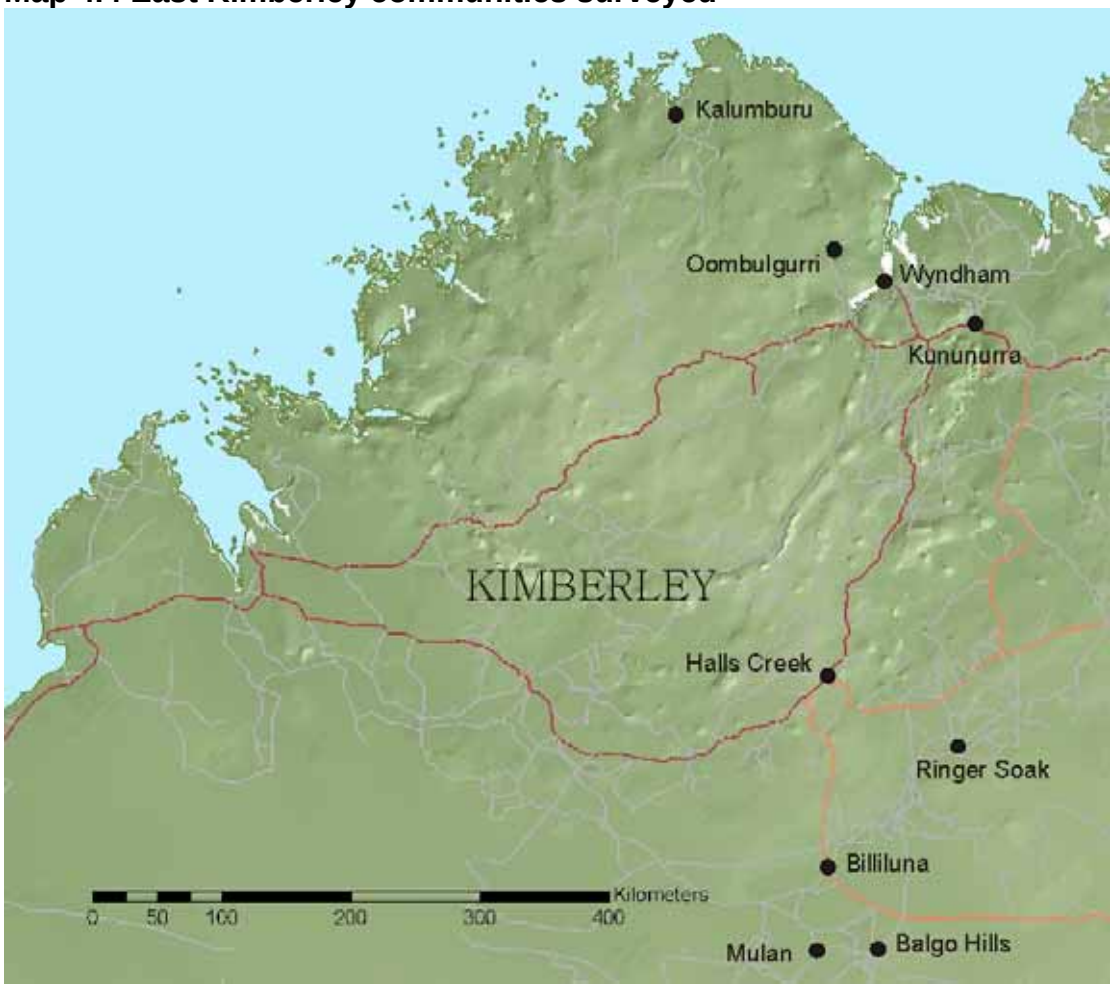
Key: Group 1 Surveyed for this study (see following maps for others),
Group 2 Independent research undertaken by CDS, used in this study.

The next report in this section considers the special issues faced by women in the monsoonal areas in 'the Wet', drawing on surveys in Broome and Port Hedland (WA) , Normanton and Kurumba (NT), Giru and Townsville (NQ) (Maps 4.1 and 4.3).

Including non-Aboriginal dominated communities, and larger population centres may provoke discussion over what constitutes 'remote'. An answer is that remote is relative, a state of mind. There are areas of Sydney which may be considered remote - from particular services, the beach, public transport, support nets. The 'Women in the Wet' report is included in this study to underline that most communities vulnerable to cyclonic impacts, flooding or wildfire have mainly shared options and shared preferred responses. The radio signal may be weak in Mapoon during flooding rains, but the power may go out in Townsville, leaving residents of both centres with shared issues of safety and a sense of isolation. Whether you are in Giru or Palm Island, the sound of a Category 4 cyclone or worse will still leave many psychologically damaged, as the terrific howl of Cyclone Tracy did to Darwin residents in 1974.

Even issues of linkage to land for Aboriginal people become blurred, both for repeatedly dispossessed and the relatively urbanised. Like many immigrant stock, most settled Aboriginal people appear to develop strong links to their new homes. To reinforce this, Scougall (2002) found that residents of Tkalka Boorda, an 'urban' Aboriginal settlement near Port Hedland, had a strong attachment to place.

Map 4.4 East Kimberley communities surveyed



Stocking up ahead of the Wet, making sure you have batteries for the transistor radio, containers for storing fresh water, warm clothing and staying out of the flood or cyclone surge zone in solid, dry shelter remain universals for community members everywhere threatened by more disruptive monsoonal or cyclonic effects. The main difference between centres in the 'Women in the Wet' study was that the services were expected to be restored within three days in the large centres, but longer for smaller, more 'isolated' settlements.

As with follow-up studies to Cyclone Tracy and the 1974 Brisbane floods (Section 6, following), the women's study found that support networks of friends and families were highly valued and relied on. This finding was universal to all communities visited, forging a foundation for community resilience.

A Disaster Risk Management Study for Mount Isa by Goudie in 2003 (http://www.tesag.jcu.edu.au/CDS/reports/MountIsaDRMSReport1.pdf) found that this was also the case in that 'remote' location. Indeed, one of the most commonly identified concerns expressed by local residents was for travellers and people living in the caravan parks *because those people did not have strong community support nets to help them before, during or after a major weather event.*

The reported meeting with Eidsvold (southern Queensland, Burnett Region, Map 4.1) Aboriginal elders brings out how some tradition weather indicators, though subtle, were widespread across Australia. Although integrated into a small, mixed rural township of about 700 people, the Elders had a strong sense of Aboriginal heritage, and often used traditional knowledge to predict the weather. This report is included in this larger compilation because it shows that, even outside the direct monsoonal influence, other parts of Australia are prone to disruptive summer flooding. Recent flood experiences (2003-4) in various centres on the east coast of Australia underline how many centres are flood prone. The difference for most of the remote settlements visited is that flooding may be virtually annual, and remain disruptive for months, not hours or days.

The final report in this section provides clear insight and overview to many of the core problems associated with isolated Aboriginal settlements – Pormpuraaw is about 500 km from the nearest main centre – Cairns, far North Queensland. Land tenure may be tenuous (like Palm Island, a DOGIT –Deed of Grant in Trust, not freehold; not capable of private ownership or subdivision). There are outstations (small, offshoot settlements), usually without any sophisticated communication system to aid in rapid warning about impending weather impacts. Often low literacy rates were noted, along with vulnerability to uncontrolled dry season bush fires.

The following series of reports aims to be a guide to the kinds of places; an introduction to the kinds of people who are the subjects and interviewed contributors to this research. We approached community elders or Administrators with the promise we would work to use the gathered information to help improve the quality of weather warnings into their community, so they can make decisions and promote action based on the best possible knowledge of impending threats. These report summaries show the amount of help they gave. Thanks, community members. Detailed information about the structures, communications and stories from each community targetted in this research is given in Appendix 3.

Torres Strait and the Northern Peninsula Area[1]

Report by Dr Alison Cottrell

Introduction

The data for this area was gathered from Thursday Island, and the communities in the Northern Peninsula Area (NPA) – Injinoo, New Mapoon, Umagico, Seisia and Bamaga. Interviews were conducted with the CEO's of the community councils, representatives of several government organizations, and various members of the community (15 people were consulted).

Generally, weather does not rate as an important issue in these communities, and that these communities are inundated with visiting government representatives, officials and researchers to the point where I suspect they really don't want to talk to anyone, and justifiably so.

Throughout the islands and the NPA, people use small boats, mainly motorised dinghies, as their primary means of transport.

The Communities

The Injinoo Community is an Aboriginal community and the traditional owners of the Northern Provincial Area. The population is about 500, comprised of about 90 families. There only about 10 non-Indigenous residents.

New Mapoon is an Aboriginal community which was forcibly removed to the area from Old Mapoon when bauxite mining was developed. The population is approximately 300 made up of approximately 70 families.

Umagico is an Aboriginal community, again, forcibly removed from their homelands in the Port Stewart area in the 1960s. Torres Strait and Cape York Creole are the dominant languages at Umagico. There are 200 residents, and 33 households, mainly Indigenous.

Seisia is a Torres Strait Islander community that moved into the region in the 1950s. The population is about 200, mainly Islanders. There are about 33 houses but some have 2 or 3 families living in each house.

Bamaga is predominantly a Torres Strait Islander community and serves as the main administrative centre for the Northern Provincial Area.

The Torres Strait Islands are complex, with many individual communities. The Torres Strait Regional Authority provides contact with each of the individual communities, and the Torres Shire Council oversees the remainder of the area not covered by Indigenous communities that lie to the north of the 10th parallel. The population of Thursday Island is approximately 1300. Thursday Island is where many regional meetings are held.

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[1] Note the following reports are abridged to focus on weather information and responses, and community structures.

Figure 4.1 A typical Thursday Island day

(Photo by Alison Cottrell – CDS)

Spokespeople presented as being sanguine about weather extremes – extremes come and go, people cope. There has often been forced relocation of communities. Mistrust of outsiders seems reasonable, no matter how 'positive' our purpose seems to us.

The main communication is via Telstra land lines. Also "radio and television are important sources of information and entertainment. There are 4 television stations that can be received in the region: ABC, Impaja (from the Northern Territory), 7 Central and SBS. Radio stations include: the local BRACS stations which operate varying hours depending on availability of staff and the Indigenous Radio station that operates out of Townsville, 4K1G.

Most of the councils have their own two-way radio networks. In the context of an emergency, the Queensland Police is usually the first agency to act. The Police would contact the councils and the councils would contact the community.

The community councils use the BRACS radio stations to communicate information, post notices on bulletin boards at frequently used places, rely on word of mouth and if necessary, doorknock to inform residents. In the NPA in particular, the communities are 2-300 in size and it is quite possible to achieve rapid communication by word of mouth.

The main impact of cyclones is whether the weekly barge from Cairns is delayed by cyclones in the Cairns region.

Some people were concerned about the legality of down-loading information from the website and passing it on.

… if there is a major weather issue like a cyclone, then the [TV] detail is sufficient for people to understand what is happening.

“You can get BoM map updated every 10 minutes but often the weather has passed by the time you read it.”

The radio weather reports were somewhat limited but many people reported listening anyway.

The operator of the Broadcast to Remote Aboriginal Communities Services (BRACS) station on Thursday Island was concerned that radio announcers were not well trained to understand either the weather maps or the real meaning of the BoM weather reports. They download the BoM information and ‘translate’ it as best they can, but don’t feel all that confident about it. The feeling was that a training session for radio operators to understand the information so they could ‘translate’ the reports into everyday language or even local languages would be very useful. Other people also felt that it would help for the BRACS announcers to be more fluent in reading meteorological information.

Members of the mainstream community who are not involved in boating or fishing, including media personnel are probably as likely to lack the necessary understanding of weather reports.

The BoM website however, was well used in the area.

Further, the BRACS Indigenous radio stations across northern Australia appear to have good listenership. This is an encouraging way to getting weather warnings heard. I met with the Chairperson of 4K1G (a Townville based high power transmitter Indigenous radio station, which broadcasts through many of the BRACS) early in this process and discussed this project with her. It is likely we can develop a co-operative arrangement with these local radio stations.

Reports provided from Yarrabah (following) and the very far north indicate people who, like mainstream communities, tend to be fairly relaxed about weather-related risks. Electronic media is available and used. There is diffusion, formal and informal, of information through communities, as there is with responses to weather threats.

Communication Systems

Telstra landline is the most common means of telephone. The extent of telephone use is not readily available. Aside from government departments (of which there are many) and businesses, it was not possible to estimate the use of private phones in the communities. CDMA phones are also starting to be used. There is good reception except at Seisia which seems to be in a bit of a ‘shadow’.

Most government departments and businesses (which tend to be owned by the councils on the NPA) have internet access. Some households also have internet access. There is an internet café at Umagico for $10 per month and at the Torres Strait Council offices, charged at $2.5O per 15 minutes of use.

At Umagico there were few telephones. Some people were purchasing CDMA phones. There were pay phones there.

In the region, radio and television are important sources of information and entertainment. There are 4 television stations that can be received in the region: ABC, Impaja (from the Northern Territory), 7 Central and SBS. Radio stations include: the local BRACS stations which operate varying hours depending on availability of staff, the Indigenous Radio station that operates out of Townsville, 4K1G.

Most of the Councils have their own two-way radio networks.

During Wet weather, the telephone systems often get patchy, but are usually fixed quite quickly. Power outages are more related to the age and maintenance of diesel generators, rather than weather issues.

Broadband would have made communications easier, but the Torres Strait and the NPA missed out on a Telstra remote community infrastructure grant. The feeling was that there was so much government infrastructure already there that this went against the area.

The Queensland Police is usually the first agency to act in an emergency. The Police contact the councils and the councils contact the community. The community councils use the BRACS radio stations to communicate information, post notices on bulletin boards at frequently used places, rely on word of mouth and if necessary, doorknock to inform residents. In the NPA in particular, the communities are 2-300 in size and it is quite possible to achieve rapid communication by word of mouth.

Weather Issues

“Locals listen to the weather reports, but trust their own judgement more.”

Apart from Injinoo which experiences some flooding of low lying areas in really heavy rains, the wet season is not viewed as a major issue. In 1998 Injinoo experienced flooding from a cyclone that came from the Northern Territory region. There was about $145,000 worth of damage with some rooves lifted off. The community was cut in half at the time, with the hospital and shipping companies being isolated. All the roads inside the areas where people live are bitumen and the view was that since they were covered with bitumen, any Wet season issues had diminished. Cyclones are generally not a common experience in the region. The main impact of cyclones is whether the weekly barge from Cairns is delayed by cyclones in the Cairns region.

There are two major weather patterns in the region. The winds that come from the SE for 7-9 months of the year (from March or April), and the winds that come from the NW (monsoons from November) for 2-3 months of the year. There is a quiet time in between (the doldrums) of varying lengths. It is windy most of the time.

There was a feeling that traditional information about the weather was being lost. Strong winds are normal in the region 20-35 knots. As well, the current can run up to 8 knots on a regular basis.

For people who fish, particularly for subsistence, knowledge of the weather is important. However, the general feeling is that locals who fish know about the weather. Of more concern to officials is that people are adequately equipped with supplies and fuel if bad weather conditions should suddenly arise. The feeling was that youngsters grow up travelling with their families on the water and fishing so they gradually acquire the knowledge about the sea and the weather. It is the younger ones who are much more urbanised who are lacking in this knowledge.

Some people were concerned about the legality of down-loading information from the website and passing it on. There was a feeling that if children could be involved in collection information about the weather it would be a positive step.

Some CEOs looked forward to the Wet season because there were fewer visitors and they could catch up on their real work. In some communities outdoor events such as tombstone openings and weddings might be delayed until after the Wet season.

Horn Island experiences flooding in the Wet season. The water table rises and there are consequent problems for the septic systems.

At New Mapoon, there is some beach erosion.

During the dry season fires can be an issue. The health impacts in terms of asthma were worse for older people. At Seisia, the community is downwind of most of the events to the north so that can be a problem for them. While there is some traditional fire management in the region, most grass fires are started by young teenagers some of whom it was considered should know better. On Thursday Island the local fire officers were rather pleased to have come through the school holidays without a grass fire, after having invested in an education program at the school.

Weather Reports

Whether or not people used BoM weather reports or listened to the radio varied. Most people found the television news to be useless. At best the television news comes from Brisbane and the Torres Strait and NPA are rarely even shown. However, if there is a major weather issue like a cyclone, then the detail is sufficient for people to understand what is happening.
“You can get BoM map updated every 10 minutes but often the weather has passed by the time you read it.”
The radio weather reports were somewhat limited but many people reported listening anyway. The local newspaper, the Torres Strait News would like to publish weather information, but as it is a weekly publication, by the time it gets published the information is out of date. The weather information also needs to come from a local who records the information because there is no

longer a weather station on Thursday Island, only one on Horn Island at the airport.

Of particular concern to people would be more detailed information about wind warnings, wave heights, depth visibility and the length of time that bad conditions are likely to persist.

The operator of the BRACS station on Thursday Island was concerned that radio announcers were not well trained to understand either the weather maps or the real meaning of the BoM weather reports. At the moment they download the BoM information and 'translate' it as best they can, but don't feel all that confident about it. The feeling was that a training session for radio operators to understand the information so they could 'translate' the reports into everyday language or even local languages would be very useful. Other people also felt that it would help for the BRACS announcers to be more fluent in reading meteorological information.
Members of the mainstream community who are not involved in boating or fishing, including media personnel are probably as likely to lack the necessary understanding of weather reports.

The BoM website however, was well used in the area. There are many government department offices which regularly download the information for the area. Government staff use the information to check travel arrangements and to anticipate bad weather conditions. Many people download information to check on the weather where their children are at school. The usefulness or relevance of the BoM information varied.
As well, it was felt that information from the BoM about how long really rough conditions were likely to last would be useful, so that people could plan fishing and other boating activities. This is particularly important for those people for whom fishing is a major subsistence or commercial activity. Because traditional weather information was felt to be being lost, people felt that a better understanding of the reports and maps was useful.

Discussions with members of Indigenous and mainstream communities suggest that there is in fact little difference in the usefulness or understanding of BoM weather reports. Both types of communities would benefit from their media operatives having a better understanding of weather data as well as perhaps a problem-based module for high school children. A High school teacher suggested that if the focus is on planning for fishing activities then it is not too difficult to interest high school students in understanding weather information.

Northern Territory
Report by Douglas Goudie

In the NT, the communities tend to be more fully self-governed, perhaps without the further Local Government support net. This may make a difference to how communities are able to respond to extreme weather alerts. Because of this administrative/governance difference, there may be some small differences with remote Aboriginal communities in the NT, although there was no indication of that in discussions by David King in Darwin in September 2003. An interview with the Administrator, David Ormrod, of the Lake Nash Aboriginal Settlement (eastern Northern Territory Map 4.1) showed that the Settlement houses, on average, about 700 mainly Aboriginal people. It is a 10 km^2 area excised from the Lake Nash station in 1985. Camooweal (NW Queensland) is the nearest regional airstrip.

Flood is seen as the only real natural extreme impact. There is no sealed airstrip, although the community has access to the Lake Nash Station strip. There are usually about 20 people on the Station. Their airstrip is unsealed, only good when the ground is not saturated. David reported that the relationship with the Station was sometimes tense.
At 6/3/03 they had not received mail (delivered by plane) for three weeks. Heavy rains swell the rivers, cutting all the roads. This whole region embraces vast distances of largely flat land. The settlement relies on stores, including meat, to be flown in via Camooweal.

David identified an all weather airstrip as the top priority for the community.

Northern Territory SES
Report by David King

From: Director Michael Bowman and Information Liaison Patrick Horner.

Evacuation orders from the SES are backed up by law. The police carry out emergency operations, with SES as part of the same affiliation of response organizations. The decision to evacuate is often initiated by communities themselves, sometimes early and sometimes late. The timing is more often a problem than the process. The most recently and most frequently evacuated communities are Daly River and Kalgaringi. Helicopters and buses are used with Bachelor serving as an evacuation centre. There are also evacuation centres in Darwin, including underground car parks. Small communities have also been evacuated into Darwin hotels. Pets are an issue but are generally tolerated because of problems with evacuation if they are left behind: people won't leave without them.

Media. Radio – there are ATSI, ABC and Imparja links to all communities, which stay on air. The internet is available extensively, but problems have been identified with people making their own weather forecasts based on radar and other images, thereby ignoring actual BoM warnings.

Yarrabah Community (near Cairns, Far North Queensland)

Report by Yetta Gunter

The Yarrabah results show the difficulties getting detailed data for communities with a long history of unfulfilling surveys – interview fatigue. With about 3,000 people and 350 houses, Cyclone Justine in 1997 was the only extreme weather event collectively remembered in Yarrabah. Usual monsoonal weather is seen as normal and acceptable. At such times, power failures and forced isolation are frequent. The community sees itself as reasonably prepared.

The community primarily relies on landlines operating through Telstra and Optus. While most households have private telephone facilities – usage is highly variable. Service is considered fairly reliable. There are 3 public telephones available in the community although operation and service is not consistent (vandalism, poor servicing etc). The remote household/settlements do not have telephone access.

Telstra has recently upgraded its services to the community to CDMA and both Telstra and Vodafone offer good mobile coverage (Optus has limited reception). Ownership of mobile phones is rapidly increasing (particularly amongst the youth) although mobile reception is generally less effective in bad weather.

There were 5 key informants. Generally most people approached seemed hesitant and almost unwilling to participate in interview process due to a long history of researchers coming to the community, with limited feedback/results. It is my belief that asking informants to fill in their own surveys (even with researcher assistance) would have achieved very limited success in Yarrabah. Additionally many were put-off by the formality, layout and wording of the survey. Greater response was achieved when questions were raised in a less formal context and response recorded in small field notebook.

With initial questions on the geography of the community, there was limited general knowledge and many “guesstimations” provided (even through the council office) – more reliable results would probably be available through census data or official government reports. All informants claimed there were no “outstations” connected to the community although there are in reality numerous fairly isolated settlements/homes without electricity, running water or telephone contact. Generalisations about the community did not take these places into account.

While informants could elaborate on major weather events that affected the community, recall and dates of any specific event was limited. It is generally believed that Yarrabah has not been struck by extreme weather or disaster since the early 1900s. Perceptions of what constitutes a disaster, tends to vary dramatically. Landslides, tree debris, tidal surges/flooding and power-outages as a result of bad weather seem to be the main concern. Council ‘clean-up’ reports may be able to provide specific details as required.

In regards to some questions, informants were also hesitant to make a pronouncement or generalisation on behalf of the community, ie. the problems and opportunities that occur as a result of the annual Wet season, or the most commonly listened-to radio station etc. In giving any such generalisation they expressed they would be leaving themselves open to be challenged. As a consequence they described things from their own perspective and habits – a random survey would probably produce broader and more accurate results.

Answers on the extent of television, radio, computer and telephone ownership/access produced non-specific responses like “most people”, “the majority”, “the rich ones” and “a few”. Telstra may be able to provide a better indication on telephone land-lines, however as non-payment of bills is commonplace, ownership of these amenities is not necessarily indicative of consistent reliable use. Questions on common/favourite internet sites received only blank stares.

Despite assurances, questions regarding natural indicators and Indigenous knowledge of weather events still raised concerns over intellectual property. Information given was relatively vague and not necessarily specific to the Yarrabah community group. Perceptions on reception, behaviour and response to weather forecast/warnings seemed dependant on the informant. Administrative/SES staff was content that everything proceeded smoothly, that all were well informed and acted in accord with existing safety plans/information/training. The elder informants were more cynical of the passage of information (“they only tell us what they want us to know”) and believed that the youth held little regard for any advice – weather or otherwise. The general consensus seemed to be that the word gets spread around and that people just cope.

Politics in Yarrabah is also considered a dirty word and any questions regarding the political structure or formal passage of information were generally ignored. Despite the formal organisational structure, family and cultural groups tend to dominate the interaction/functioning of the community, and there are definite divisions between the different factions. While information and warnings about serious hazards is disseminated, it would follow a very convoluted path.

With the exception of emphasising the “us and them” division between Cairns and Yarrabah on almost every issue – including emergency response and SES funding recommendations - suggestions and further comments were not made.

Mornington Island

Report by Eddie McLachlan

A flock of seagulls on the Mornington Island airstrip was part of the inspiration for a JCU study into how Indigenous communities cope with tropical cyclones. Eddie McLachlan is a PhD student at the Centre for Disaster Studies and School of Indigenous Australian Studies at JCU and is nearing the end of his thesis which he hopes will show how understanding Indigenous communities' coping mechanisms can be used to develop better future disaster management strategies.

"When authorities prepare disaster management plans for remote communities the main elements they tend to focus on are cyclone awareness, preparedness and vulnerability," Mr McLachlan said.

"I've found the reports and studies, and disaster management plans, do not contain the views of the Indigenous inhabitants.

"My paper argues that these studies exclude people as an important element in any disaster management plan."

Mr McLachlan has visited Mornington Island several times in the last three years and believes the views of local elders could improve relationships between authorities and Indigenous people.

During one trip to Mornington, a local Lardil Aboriginal elder was asked when he knew a cyclone was getting closer. "When I saw the seagulls all flying in and landing on the airstrip," he replied.

He explained that it meant conditions at sea and along the coast were so rough due to the approaching storm, the birds sought shelter inland.

"It's an example of how Indigenous people in these regions employ observations of nature to forecast events, a fact that may be overlooked by authorities responsible for planning disaster management strategies."

His interviews with some of Mornington's 1200 inhabitants also found "bad weather" was preceded by a sea bird seen to be flying around, as well as the sea becoming rough.

Also, when birds called manowar (various spelling), from an outlying station are observed flying over Mornington, islanders know there is a severe storm or cyclone approaching.

One resident told how on one occasion, they noticed that when they went down to the local fishing jetty, the seawater and the fish were unusually warm and the colour of the water was a deep green. Within days, the community was put on cyclone alert.

According to locals, another reliable natural indicator of impending rain is the flying ant which is attracted to lights at night, and comes out in swarms a few days before a cyclone.

"Reading nature's signs, people know there is going to be some change in the weather and people have passed down the stories of how their ancestors prepared and coped with cyclones," Mr McLachlan said.

"The capacity to adapt to the island's natural environment and the climatic conditions has been instilled in the Lardil lifestyle and this skill has been used to establish an environmental hazard strategy."
(JCU Outlook, 15:6, August 2003, p 3.)

East Kimberly Remote Aboriginal Communities
Report by Douglas Goudie

Four desert communities and Aboriginal residents in the Halls Creek area along with residents of two near-coastal Aboriginal communities (see Map 4.4 and Maps at : http://www.aad.wa.gov.au/Maps/) were interviewed using a prepared interview guide (Appendix 2).

The Kimberley, northwest Australia, is an ancient, tough landscape with a stark climate of monsoonal Wet and dry. The area often tops the daily temperature readings for Western Australia - Wyndham had 41^0C on 20/10/03. The east Kimberley is home to numerous Aboriginal groups, some bound by shared languages, stretching from the Tanami Desert to the coastal areas north of Kununurra and Wyndham. Communities typically have 100 – 400 people living in modern climate and culturally appropriate housing.
The study on weather information in and through remote Aboriginal communities was undertaken by Goudie (Senior Researcher, Centre for Disaster Studies, James Cook University, Townsville); Terry Hart, acting National Program Manager for Severe Weather Warning Services, Bureau of Meteorology (BoM, Melbourne) and Graeme Down, East Kimberley District Manager of West Australian Fire and Emergency Services Authority. Graeme has lived and worked in and with remote Aboriginal communities for many years, including 5 years in the first community visited: Ringer Soak. Along with Halls Creek (Map 4.4), we visited six remote communities during October 2003 - four desert and two coastal communities, driving in a loop to the former, and flying to the latter.

Bureau of Meteorology information into the communities

The evening TV news was the most common first source of Bureau of Meteorology (BoM) weather information to the communities, and to a lesser extent from the various radio stations, especially the linked aboriginal radio network (Broadcast to Remote Aboriginal Communities Service– BRACS).

Administrators of most communities seek BoM faxes with the approach or onset of the Wet season, copying and posting them at the administration building, the school and the medical clinic.

Some of the white people (Kartiya/Gardiya), such as the storekeeper at Mulan, regularly use the BoM satellite web site and the information from the web of the BoM Radar sites in the region. The core weather issue in the desert communities is guessing when floodwaters would cut them from re-

supply of diesel and foodstuffs. There were some community members who followed BoM information at the fine detail offered by the regional radar images (Figure 4.2); while others were barely aware BoM had a web site.

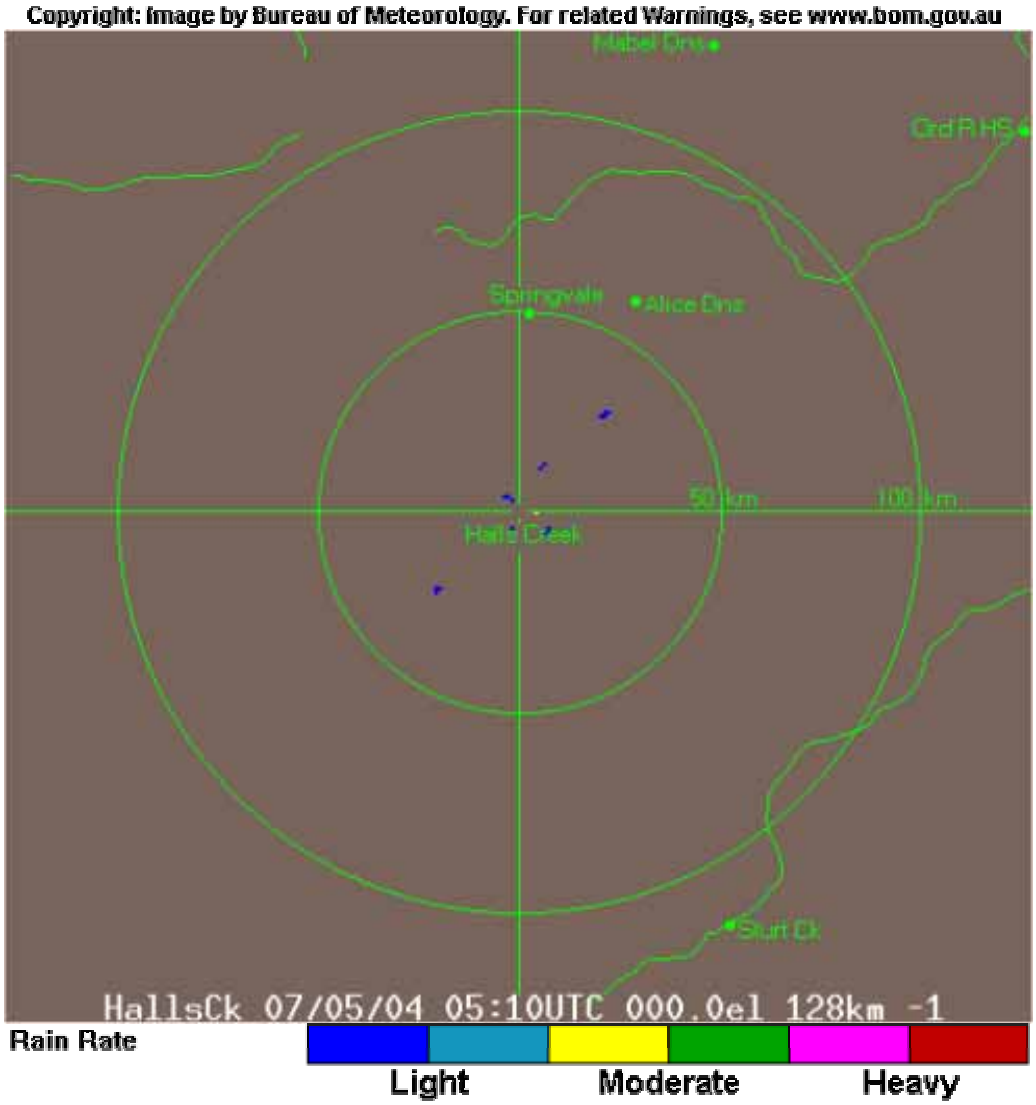
Figure 4.2 Showing the BoM site to Remote users – Halls Creek

Figure 4.3 Local radar images available via the web

128km Halls Creek Radar

WA Weather Warnings

Halls Creek 128km - Loop 256km - Loop



Received at: 05:13 UTC/GMT Fri 07 May 2004

EST	CST	WST
03:13pm	02:43pm	01:13pm
Friday	Friday	Friday

From http://mirror.bom.gov.au/products/IDR393.shtml

Communities averaged about 200 people, with access to about 8 web-linked computers. There is a high sophistication of web use by some individuals in all communities, with often strenuous school web-based learning. Part of our research included informing people of and guiding them into the local detail the BoM web site offers (Figure 4.2 and 3). Community members shown BoM sites showed a high level of interest.

All communities could get the four regional TV stations (if their transponders were working properly): GWN, ABC, SBS and WIN. GWN and WIN were perhaps watched the most, but people would watch all channels, often channel surfing. Sport, especially Australian Rules football, was very popular. The BRACS radio stations were popular, especially on Wednesday evening when Mary G is on. There may be more on Mary G, a confronting comic female aboriginal impersonator. Community members generally love her, although she alienates some.

The general report card on Telstra is good. There are occasional problems with the usual land line to a nearby exchange in the community and then to a microwave dish transceiver. There are few real telecommunication problems, even in the Wet. Ringer Soak had, perhaps, the most rain-impaired communications. All settlements had at least one satellite phone, often five or six, virtually guaranteeing continuous links with the outside world.

There is a colour-coded cyclone warning system in WA, the FESA Cyclone Community Alert System, based on blue-precaution, yellow-action, red-shelter and all clear with caution. These kinds of warnings could be adopted nationally *if they are understood and effective in WA cyclone warnings.* Also, there is a siren warning sound: the Standard Emergency Warning Signal, an electronic signal owned by BoM and used in conjunction with their Cyclone Warnings when destructive or very destructive winds (cat 2 or higher) are expected within 12 hours of the coast. BoM has made the signal available to Emergency Services to use preceding an emergency announcement, which is intended to instruct the population to take, or be prepared to take, specific action in order to protect life, property and/or the environment (thanks to Gary Gifford, FESA Regional Director Pilbara/Kimberley, State Emergency Service for the above detail). *If that is proving effective*, perhaps *the broadcast siren warning could be considered for all major impact weather threats.*

"Severe" is off-putting

The study found community members were happy with the nature and quality of the weather information provided by the BoM. However, detailed probing found the word "severe' was alien to community members. Various long discussions about this convinced Terry that "Dangerous" for road flooding rains or destructive winds is most appropriate to convey the message that preparation and care are needed, while "Major" is probably the best word to tell of further or prolonged rains.

The rains are welcome

The rains release bush foods – goanna, bush honey, fish, gelay (edible berries born on a small tree), sugarbag, bush potato and tomato, along with such fruits as mulberry and mango. The Wet also bringing relief from the build-up of heat and humidity.

Traditional weather information and information diffusion
Asking about traditional stories relating to extreme weather produced two stories – one explaining how soaks were formed around Ringer Soak, and the other describing how Lake Gregory, near Mulan, filled to overflowing. These stories were cleared for use by the storytellers.

Figure 4.4
The Sturt Creek, central to monsoonal flooding in the catchment

The Sturt Creek (Figure 4.4) was a central link for all the desert communities visited – if the initial floodwaters were a milky colour passing through the Balgo area, it means a major flooding rain north, about 5 days earlier, and the creek would probably stay up for months. If the water was red, it means local rains (from the smaller, near catchment), so the creek would probably go down again in a few days.

Weather information flows well within communities
There were no disenfranchised members of any communities – once a clear weather warning was seen on TV and a BoM fax requested, the warning was discussed through the community or posted or details were found on the web. Fax copies or word of mouth warned community members. The last to know were often the old men or, in the case of Halls Creek and Billiluna communities, the members of up to 50 outstations of 1 –20 people. They see the build-up to rain and generally come into the settlement without any formal notice.

With the above two exceptions, outstation residents were sparse, and all tended to come in to the main settlements ahead of the isolating rains by using traditional methods of reading the weather: the build-up of heat and humidity, the development of large clouds, often swirling high into the air. This clear warning is generally preceded by much higher activity of ants, from moving food to higher places day and night (Billiluna) to increased ant activity

in general, including building earth ‘tubes’ of about 75 mm above their holes, sealed off about a day before the rains start (Ringer Soak).

The lightning and rain wakes up the goannas from their holes, so communities soon get direct food benefit from the rains. If all goes well, the BoM information reinforces the more traditional signs of rain, allowing last minute preparations before wind and rain hit and the roads are closed down.

There were no major reported tensions within communities during an average two to three-month Wet season. People stay inside more, but communities remain reasonably relaxed. There is a lot of hunting and gathering. This includes harvesting bush tomato and yams. In Billiluna, Wet-season bush foods include witchetty grubs and a flavoursome type of tree gum.

The community populations tend to drop a little just before the Wet. Apart from stocking up, few of the desert communities do much preparation before the Wet. Only one community reported cleaning up old sheets of iron or other things that might fly around in strong winds.

The end of the Wet may be heralded by flowering of the Desert Sturt pea (Harold, Billiluna).

Community weather issues - food and diesel supply

The most important desert-community weather information was the exact date of the onset of the rains. Delaying delivery of the last 50,000 litres of diesel as long as possible is crucial to tiding the community over with power for perhaps three months while flooded in (photo, front cover). Acting to protect the rain-sodden roads from major damage done by vehicles to soft wet roads (as in many other parts of Australia), the Halls Creek Shire close all unsealed roads at the start of the Wet.

Figure 4.5
Power generator, Ringer Soak

Communities surveyed have robust power supplies, with rare and short-term blackouts. The power is dependent on diesel supply. In 1993 Mulan had more diesel flown in by army helicopter.

Residents at Balgo recalled that in 2001 they were without road access from Christmas to May 25. This stretches the pre-Wet organisation to the extreme, because all the communities use diesel to run their generators. That electricity then runs their water (bore) pumps, their sewage pumps, food freezers and cold storage.

Although many houses use solar water heaters and are generally very well designed for the intense inland tropical summer heat (about 20^{o} South), many houses have air conditioners. All these uses, along with normal household and community electricity use must be constrained as reserves of diesel drop during a prolonged Wet. The first major rains matter for supply to communities, ranging from about 150 to 800 people, with about 10 people per household.

Yates (1997) describes the inundation of Oombulgurri on 24 Feb 1997. Three hundred and seventy-four people camped overnight on a nearby ridge – cold and wet, then were evacuated to Wyndham and beyond the following day. Yates reports telephone services were subject to flooding, as was the access road. “The flooding impacted swiftly with little warning”. (p29).

By October 2003 there were higher buildings, better link to radar, assured fax warnings from Wyndham and Broome, and an investigation of a telemetric data transmitter upstream in the Forrest River to automatically notify the community of upstream flooding of the Forrest River.

Drawing together and presenting weather and flood data

Different states or territories (Regions as BoM would have it) have evolved different ways of collecting major weather event data and of making that data available to vulnerable residents and travellers. This can become a strength, now that there are moves to collate and standardise the web and media presentation of that data. Queensland has an excellent road condition web reporting system (www.racq.com.au), and a radio siren ahead of cyclone warning broadcast. WA has developed a colour–coded warning system.

It is recommended that weather, flood and fire agencies and researchers develop an email-based dialogue to share different major weather data collecting, collating and sharing systems, then dispassionately view how relevant *and graphic* (road and settlement flooding, likely destructive wind paths) information and forecasts can be made available through media and the web. Note that a spokesperson from Kalumburu said: “make the weather forecasts more pictorial”.

This will be a fruitful development of growth and recognition of best/most effective practise for what amounts to a marketing exercise, with the core shared sustainability goal of warning an aware and prepared community of developing major weather threats, to minimise the impacts of those threats. This is to minimise loss of life or injury to people and minimise damage to property – to get out of the way of destructive natural impacts, or properly prepare for and shelter from those impacts. People need to know about those threats in a timely *and palatable* form. This is core to this research.

Mapoon Aboriginal Community

Report by Joanna Williams

Between 2 - 5 September, I accompanied Mr Eddie McLachlan, a PhD Student from James Cook University (JCU) researching the dissemination of weather forecasting information for Indigenous Communities in Australia, on a field trip to the Mapoon Aboriginal Community. My role was primarily as an observer, assisting Mr McLachlan with specialised weather knowledge where required.

Mapoon is an Aboriginal Community of approximately 200 people located on Cape York Peninsula about 80 km north of Weipa. It is on the north-eastern side of a narrow land spit, with the Gulf of Carpentaria to the west and a wide shallow bay to the east. Access is via a mostly dirt/gravel road which can at times become impassable during the Wet season. Relay towers provide telephone, radio and television communications and a generator onsite provides power for the community.

Over four days, Mr McLachlan interviewed several members of the community, including Aboriginal Community Elders, Local Council members and School and Health Administration staff. A visual survey of the community and surrounding areas was also conducted.

Indigenous weather knowledge

Traditional signs or natural weather indicators used in the local area, differ little from other communities in northern Australia. A period of continuous really hot still conditions is the prelude to monsoonal rains or a cyclone. The Manahawk (Aboriginal name), a large black ocean going bird, seen in large numbers about the coast indicates a "big blow coming" (strong winds, possibly cyclonic are expected within 2 to 3 days). Crocodiles building their nests higher than usual above the high tide mark and long stalks on the mango fruit indicate that a "big Wet" (greater than average seasonal rainfall) is expected.

The Aboriginal Elders interviewed at Mapoon, believe that their knowledge of seasonal weather patterns, passed on from generation to generation, is becoming less reliable for season predictions and that the Australian weather patterns are changing.

The Mapoon Community is currently developing a local garden program where tropical fruit and vegetables are to be grown as a community project, with a future aim of it becoming a commercial venture. The use of traditional weather predictions is hoped to become an integral component of this program.

Weather influences for the Mapoon Community

Mapoon is located in the northern tropics where significant weather events that could impact on the community include tropical cyclones (Dec-Apr), thunderstorms (Nov-Apr), fire weather and strong wind warnings. Although Mapoon is a growing community, the majority of residents resettling there have previously lived in the tropics and so are familiar with the dangers and associated precautions of the various weather events that occur in the region.

Tropical cyclones pose the greatest threat to the community, although the area has not been subject to a significant cyclone impact since its resettlement in the 1970’s. Mapoon is located on an exposed low lying, narrow spit of land, with the shallow waters of the Gulf of Carpentaria to the west and a large shallow bay to the east. The community has little protection from storm surge, should a significant cyclone impact upon the area.

Despite pre cyclone season cleanups being conducted in the Mapoon Community, a significant problem of potential flying debris remains. New houses are being built beside the decaying remnants of the family’s previous home (shanty shacks) and due to sentimental attachments to these structures, they have not been removed. These buildings would provide little resistance against cyclonic winds and pose a significant hazard to the community in a cyclone.

Current practices for weather and warning information for the Mapoon Community

Being a small remote community, access to the latest weather and warning information is limited. Television (ABC and Impaja), one radio station (ABC), and the internet (only available at the school and local council) provide Mapoon with weather reports and warnings. Day to day weather information is not utilised significantly by Mapoon residents, who are primarily concerned with information on the onset of monsoonal rains and weather warnings (cyclones).

Amongst the community, television (ABC) is seen as the preferred source of information as pictures are easier to interpret, particularly for cyclone warnings. Radio is the next preferred source of information. As most households do not have Internet access, very few people access weather information through this medium. The local council and community school (primary only) have Internet access and this is the primary source of weather information for these groups.

Word of mouth, (neighbours talking to each other) is a major form of information dissemination for the community. In the event of a cyclone threatening Mapoon, residents would most likely be kept up to date of the local situation (current state of the access road, evacuations etc) via this means. The local council does not currently have a policy on the dissemination of local information during a significant weather event.

Community needs for weather and warning information

Due to the remoteness of Mapoon, the community relies completely on outside sources for forewarning of significant weather events. Rain not only at Mapoon, but anywhere between the community and Weipa interferes with television and radio signals rendering them ineffective as sources of weather warning information. Internet access relies upon telephone connection, which is regularly lost due to fallen lines (tree branches) during rain and wind. In a developing cyclone situation it would not be unrealistic for Mapoon to lose all sources of weather warning information well before a threat to the community existed.

It would seem to be crucial for not only Mapoon, but any remote community to have a comprehensive Community Emergency plan detailing the local councils' actions and responses in the event of a threat to the community. (fire, flood, cyclone etc.) A Council Emergency plan for Mapoon, in relationship to cyclones and particularly storm surge, would need to address the possible deficiency in availability of weather warning information to the community. At present the Mapoon Local Council does not have a Community Emergency Plan.

I appreciated the opportunity to be part of this visit to the Mapoon community, and gained valuable insight into the roles that the weather and meteorological information play in remote areas. As the Bureau of Meteorology continues to focus more on user requirements, the Bureau will be better able to provide

more tailored and relevant products, to meet the community's changing weather information needs.

Old Mapoon

Report by Eddie McLachlan

Old Mapoon is located approximately 100 kilometres north of the bauxite mining town of Weipa, on the western coast of the Cape York Peninsula. The population is about 200, made up of approximately 180 Indigenous and 20 non-Indigenous residents. Like many other Indigenous communities of the Cape region, Old Mapoon originated as a site for the establishment of a Christian mission. The present Indigenous residents consist of people who, as children, were part of the mission system, or, are descendents of those children.

In 1963, the mission was closed down by the Church, under pressure from the Queensland Government and mining companies interested in the bauxite deposits in the area. As a result, the Mapoon people were removed against their will, and shipped off to other places such as Weipa, New Mapoon, Normanton and Cairns. Those families who resisted, were forced out of their houses by the police, who then set fire to the homes, as well as the church, school and store. From the mid-1970s, a number of residents of the old mission have been gradually returning to Mapoon. In recent times the State Government has returned the land back to the Old Mapoon people and has funded the establishment of new community houses, health and educational facilities.

Facilities

The community has a number of essential and standard services in order to function as an independent remote township. Electricity is supplied by a power plant situated at the road entrance to the village. Phone, radio and television reception, are supplied via relay towers from Weipa. A tower is located about half way between Mapoon and Weipa, with receiving towers positioned near the community workshop. A council office is responsible for administration of community infrastructure services, such as road and vehicle maintenance, plumbing and power. Food and other goods are supplied by a small general store. There is a state health service centre, and a primary school with up to fifty students which teaches to grade 6. Fresh water is pumped from a bore within close range of the community, to two high tank towers where it is distributed via gravity feed, to all households.

Houses

There are about 55 residential houses in the community, with more being constructed annually, the numbers depending on budget. All residences are relatively new, most built within the last five years. Materials used in construction are concrete blocks, timber and steel frames, and masonite cladding for outside walls. Nearly every new residence is built in close proximity to the old shacks erected and occupied by early family members.

According to people interviewed, changes in the Mapoon population have been observed in recent times due to the improved condition of the road, and availability of services in the community. Numbers increase noticeably in the Christmas period, when family members arrive to visit for the holidays. Another factor that influences numbers is that most of the residents who own homes are elderly, so all generations of family members may visit at various times and stay for various periods, all year round. There are also three established camping grounds in the Mapoon area, which are frequented by tourists on 4 wheel drive vehicle excursions, and fishing trips, mainly during the dry winter months.

Mapoon Weather
Mapoon experiences normal northern Australian weather seasons, with November-April Wet summers, and May-October dry winters. As expected in such a coastal location, the community has experienced occasional severe storms and tidal surges. During winter months, the area is buffeted by strong south-easterly wind gusts.

Indigenous Weather Knowledge
Several elders state there are certain natural indicators for different types of weather events. The Wet season is heralded by a gradual build-up of clouds over weeks, high tides, and very hot conditions. When the “dry” winds start to blow from the south east, causing the grass to lose all moisture, turn brown and die off, winter is beginning. Perhaps the most important weather knowledge for Mapoon people to possess, in relation to survival, is the natural signs which predict cyclones.

All people spoken to, expressed belief that the behaviour of the “manahawk” bird is a good indication of impending “bad weather”. This is a term used in other Indigenous communities and can mean severe storms or a cyclone. In normal weather conditions, these birds can be seen circling in a group, high in the air along coastal areas. When conditions are extremely rough, in the case of an approaching storm or cyclone, they move inland to seek shelter, flying low to avoid wind gusts. People know from this, there is some form of hazard approaching. In the Mapoon area, indications are the bird may be a type of frigate.

Although Mapoon has not been directly impacted in recent decades, it has felt the effects of cyclones in the vicinity, such as floods, strong winds, erosion and tidal surges. Some people have recalled on various occasions personal experiences of cyclone-generated conditions, and the effects of severe storms. As in other remote communities, when recalling such major events, people regard time as a secondary factor to the actual event. In other words, they can remember details of what happened during the storm, such as where they sought shelter, who they were with, but when asked for the exact year, very few can answer with certainty. They also link events to their age at the time, saying they were children, teenagers or adults. It is not so much when it happened, but what the effects were on them, and the things important to them, e.g. family, their home, environment, etc. For instance, one elderly lady recalled how she sheltered in a tin shed beside a large tree during a cyclone,

and, despite watching wind gusts bending trunks, snapping and blowing branches and leaves away, it was the noise of the wind that scared her the most. Nevertheless, she felt safe when assured by her father that they were secure in their basic shelter, and would not be harmed.

Wet Season Problems for Old Mapoon

While the road link between Old Mapoon and Weipa is much improved, it is unsealed, so in places heavy rainfall can cause washouts and potholes. These circumstances make travelling uncomfortable, and in a life or death emergency may have dire consequences, due to the slow travelling time by vehicle. A far more serious problem for Mapoon residents in the Wet season, is the total breakdown of the telecommunication system. When there is substantial rainfall over Mapoon and between the community and Weipa, television and radio signals are completely blacked out. It is believed this is caused by deficiencies in the digital communication system used to relay the signals from Weipa. In cases of cyclone or severe storm conditions, this can create a potentially dangerous situation, because people would have no vital information as to where the cyclone/storm is, when it is going to impact, how strong it is etc. At present, this is the only warning system they have, so when it is incapacitated, the community is extremely vulnerable.

Mapoon Communications System

Information in the community is received by TV, radio, or telephone, and then if deemed relevant, is mostly generated by word of mouth. In such a closed community, people prefer to talk as a way of communicating, because as well as passing on, for example, a weather warning, they like to discuss other issues.

The community is connected with Weipa via a digital relay system, and about one in every five houses have working phones. There are three public phone booths at different locations in the township. Households that have phones installed, are connected via underground cables.
There is a limited 2-way radio system, with units connecting the health service vehicle and the centre, and the local ranger. However, this has a short range, and useful only in the immediate vicinity, for dispersing information and emergencies.

Residents receive weather forecasts via radio and TV in normal conditions. The council CEO also monitors daily weather updates by office computer using the BOM website. The community can pick up four television stations, ABC, Imparja, SBS and 7 Central. People can also receive radio stations ABC National, 4K1G, and Indigenous radio, 4AAA. Nearly all people spoken to, indicate they rely on ABC television and radio for weather reports.

Current Emergency and Hazard Practices for Mapoon

In the case of potential destructive winds caused by cyclones or severe storms, the person in charge of the power station shuts it down in anticipation of live lines coming down, endangering lives and buildings. The store and health centre, have portable generators on standby for such emergencies. Within the community, power is lost when trees, brought down by strong winds during storms or from bushfires, fall across lines, and it takes time to get repairs done, due to remoteness and availability of specialist personal. The public phones have been subjected to vandalism on occasions.

Residents are made aware by radio and television, when there is a weather hazard in the region, before telecommunications are blacked out, which happens when the hazard approaches. To ensure everyone is notified of an impending extreme hazard, staff from the council office phone relatives and friends, who pass the information on to those residents who may not have phones. As a further precaution, staff drive around the community to inform every one about what is happening. In such a small place, word of mouth is the main form of spreading news.

Mapoon and Bureau of Meteorology Weather Information

During the Wet season, the council CEO constantly accesses the BoM website for weather updates, in case of potential danger from cyclone or severe storm. The community also now has a website, which gives out local news items. More importantly, it also has a BoM site, which contains up to date regional weather data.

The school principal also keeps a constant watch on the BoM internet site in the summer. Most of the students have to be picked up daily by the school bus, so if a warning is received about a potential cyclone or extreme storm, the children have to be returned home. As well as teaching children how to access information off the web, staff make pupils aware of the BoM site. The school has also started a course for adults who want to learn how to operate computers. Hopefully, through their learning, they will show an interest in the kind of data that can be accessed from the BoM website, in particular, with regards to their local area.

In the course of the fieldwork, some people spoke about the changing weather patterns for the region in the last few years. In particular, they noticed there was not as much rain in the last two Wet seasons, compared with earlier times. Most residents were interested in long range forecasts, such as whether it was going to be a long drought or a good Wet season. As mentioned earlier, the elderly people also regard the BoM weather data supplied on ABC radio and television as valid, so do heed them when warnings are issued. However, they did express concern at understanding some of the terms used in radio and television weather bulletins. Particularly, the elderly residents conceptualise distances in miles, so have problems when they hear measurements given in kilometres.

Women and the Wet Season in Northern Australia

Report by Alison Cottrell & Linda Anderson-Berry

Aim

identification of the strategies undertaken by women as household managers to reduce the impact of the hazards of the northern Australian Wet season on their families.

Introduction

This project focuses on preparedness, response and recovery strategies used by women as community members to mitigate against the natural hazard of regular seasonal flooding and cyclones in northern Australia. The aim is to contribute to a reduction in community vulnerability to natural hazards by identifying strategies that women themselves identify as useful for mitigation.

Methodology

A grounded theory approach was taken to the research, using qualitative research methods. Initially the proposed research was to use only focus group discussions as the means of obtaining data. This proved somewhat difficult for a couple of reasons, lack of interest being the main issue. In itself, this would seem to confirm widely held views that people tend to be complacent about the Wet season in the region. The final data collection methods included focus group discussions, telephone surveys and individual interviews.

Results

There were essentially three different types of locations surveyed. The first were moderately sized regional towns where there was reasonable local government support systems in place (Broome and Port Hedland), the second were quite small townships with accordingly little local government support (Normanton, Kurumba and Giru) and a large regional urban centre (Townsville/Thuringowa).

There is little doubt that in the large urban centre of Townsville/Thuringowa the expectation of women was that services and supplies would be restored within about 3 days after a major weather event that led to cyclones or flooding. In the smaller centres there was the expectation that one could be without supplies for a little longer because they would need to come in from elsewhere. In the very small centres, the expectation was that the individual household needed to be well prepared for the Wet season. In general the women prepared for the Wet season by starting to stockpile essential items on a gradual basis from November or December.

The capacity for women to organise for the Wet season was to some extent a financial issue. Even though there was a low participation rate for low-income women in the survey, from key informants and from other women there was the recognition that women on very low incomes had very little capacity to stockpile supplies. This group of women included Indigenous women in remote communities. The women surveyed have provided a view of preparation for the Wet season as clearly being another task they need to add to already busy lives.

Support systems of extended family and friends were an important part of women's feelings of security about preparing for the Wet season. For a group of physically handicapped women who were interviewed, family and other support networks were of vital importance.

In the medium sized centres of Broome and Port Hedland, where the local governments have very obvious preparation campaigns in place, the clarity of procedures to people was obvious. In the smaller centres there was a greater tendency to be self-reliant and in the large centres of Townsville and Thuringowa, there was a level of confusion over interpretation of information and the procedures that might be in place.

In the remoter towns where weather reports on radio and television were not detailed enough for local conditions, the Bureau of Meteorology website was an important source of information. Even though not everyone would have access, the people who did have access would obtain the information and pass it on through friendship networks. In Giru in particular, the weather that caused most flooding in their region actually fell in a region to the west whereas the normally broadcasted weather reports were for the Townsville region. In this case the Bureau of Meteorology (BoM) website was essential for them to have a good understanding of weather risks. In the larger centres, the use of the BoM website tended to be more for individual interest. In Townsville/Thuringowa, the largest centre, the suggestion was that it tended to be mainly the husband/partner of the woman interviewed who used the website.

Study findings

- Women with dependents can provide practical and achievable strategies to prepare for the Wet season in northern Australia,
- Women's needs and capacities differ depending on the type of community in which they live, their income, and their capacity for independent action,
- There was a perception that in the main, the information people needed was out there in the public domain, a little refining is all that is necessary,
- Women's family and friendship networks figure strongly,
- Activities that do not require electricity need to be planned for children,
- The Bureau of Meteorology website is an important resource which is used in slightly different ways by rural and urban households,
- There is a view held by longer term residents that the risk of isolation from flooding has reduced over time as infrastructure has improved,
- There is a view that dependence on authorities has increased, particularly in the larger urban centres,
- There is a view that complacency had increased as a consequence of improved infrastructure, service provision and lack of major events,
- Information sessions and pamphlets seem to have been consulted irregularly, usually on initially moving to an area. The question remains as to how often people refresh that information,

- For all locations, but Queensland in particular, there was a general lack of understanding of weather information and warnings and the official procedures of response to a hazardous weather event.

Strategies Identified by the Women

Stocking up

- Regular, organised turnover of long-life items in pantry, and around November or December ensure there is enough of key items such as batteries, milk, medicines, drinking water/containers, and gas containers for at least three days. Make sure there are activities planned for children that do not require electricity. Ensure that medical supplies are backed up where possible so that if it is not possible to go out supplies are available,
- Around November start to prepare for Wet season and Christmas, buying in gradually,
- Respond to cyclone alerts, buying in goods like instant noodles, and other things the children will definitely eat.

Travelling

- Avoid travelling where possible,
- Always have water in the car, insect repellent, some snacks and something to keep children occupied.

For people with disabilities

- Ensure that all that is needed is together and easily usable, to remain as independent as possible.

For everyone

- Keep in touch with relatives/friends/neighbours to check on each-other's needs. Plan with those people most likely to be around.

Recommendations

- Information campaigns need to go beyond the generic and be tailored to suit different communities and different sub-sections of communities,
- Emphasise reference to family, friends and neighbours as support during hazardous weather events,
- Rank the resources that are recommended for people to accumulate, and suggest accumulation over time so as to reduce the financial impact on households and to prevent panic buying,
- Acknowledge that people may have different styles of preparation while emphasising the essentials,
- Emphasise the need for activities to keep children occupied,
- Discourage travel, but emphasise the need for water, food, insect repellent, and activities to keep children occupied,
- In conjunction with service agencies further develop programs targeted to people with disabilities.

Meeting with Aboriginal elders, Eidsvold
Report by Douglas Goudie

Eidsvold Shire is in the Wide Bay-Burnett region of Queensland, inland from Bundaberg, north of Gympie. Europeans first settled it in the 1850s, quickly leading to major gold strikes. Eidsvold occasionally suffers natural disasters. While fire is the most persistent impact, flood and destructive winds also cause concern.

Normal summer Wet seasons may involve a couple of days of summer flooding for the Eidsvold Shire region. Notable floods occurred in 1893 (highest), 1942, 1992 and February 2003. In 1999, there was 150mm of rain over Eidsvold around 10pm causing a flash flood in the town. These major floods averaged one every 30 years over the last 110 years. The main flood problem is cuts to road use, causing some disruption to travel and goods transport, while potentially posing problems for any medical evacuation.

Fire is a recurrent natural feature of the larger region from September to November, usually sparked by lightning or careless road users. The worst recent fires were in 1951 and 1994, placing great stress on local fire fighters. With infrequent major wildfires, reminders of fire care remain important.

Sudden and powerful 'land gales' (microbursts) have destroyed some property. Council has no special cyclone-standard building compliance, or awareness campaigns to minimise threats from flying debris. Awareness campaigns may mitigate the threats to life occasionally posed by these extreme winds.

Background
Eidsvold Township services the surrounding timber getting and farming communities, east toward Mundubbera, west into more mountainous country, and north toward Monto. The population is fairly stable at about 950 people (ABS, 2001).

With about 950 people in a Shire of about 4,800 square km, the town of Eidsvold is the main service centre. Eidsvold is 425 km north-west of Brisbane, 230 km west of Maryborough and 192 metres above sea-level. Beef and timber are the main industries. Once a thriving goldmining town, Eidsvold is in a protected valley, surrounded by lightly timbered grazing country, with extensive State timber forests to the west. (www.walkabout.com.au/locations/QLDEidsvold.shtml).

Interview record:
Flood
The Burnett River does not stay up for long and it is easy to get across the river at Eidsvold Station in a boat (my sister did). It only comes up for a couple of days.

Recent storms and weather predictions
We can normally tell when big storms are going to come. It gets that hot, and then we see all the cloud building up, we can tell by the 'horsetail' clouds (long thin streaks of high cloud) that it is going to rain. The 'horsetail' cloud comes in a couple of days before the rains come. A hot wind comes from the north before the rain. With the big storm last Friday (October 31 2003), a strong wind came along the ground. It hit my place. I thought it would knock it over.

There were strange clouds ahead of that storm. They were light and wispy. We can feel it. A green shows in the sky.

In the old days my family would group all the kids together to keep them safe ahead of the big, windy storms. Last week there was hail in the northern part of the town. The winds knocked a lot of trees over. One house in the town was damaged.

We hear about big storms on the wireless and the TV. People pass the word around. The BoM is good. We know which way the bad showers come from.

The new Weir road being built opens up the town for more bad wind – that is our spiritual wind – it will come down that hill and blow roofs off. (The Weir road comes toward the town centre down slope from a Westerly direction.)

With the weather we see misty streaks in the west late in the afternoon with the setting sun and that means there will be a lot of rain. The mists go up to the sky and they come back as rain.

Pormpuraaw Natural Disaster Risk Mitigation Plan - 2003 (http://www.eukarto.com/hazard.pdf)

Report by J Monaghan and J C Taylor

Executive Summary

This report comprises a summary of the development of the Natural Disaster Risk Mitigation Plan for Pormpuraaw and Strathgordon. The initial objectives were

Stage 1: the identification of natural disaster risks

Stage 2: an analysis and evaluation of risks, and

Stage 3: an emergency risk mitigation plan which looks at ways in which the Pormpuraaw community can reduce their vulnerability to natural hazards.

The report identifies the Wet and dry season natural hazards that are faced each year by people who live in the Pormpuraaw community and on the Strathgordon pastoral property. These communities are located about 60 kilometres apart on the west coast of Cape York Peninsula and they are approximately 500 kilometres north east of Cairns, the closest city. As in many other Aboriginal communities in north Australia, people in Pormpuraaw have two places of residence. One is in their household in the Pormpuraaw township. The other is in their traditional homeland country within the DOGIT or on Strathgordon. In recent years the homeland movement has led to the establishment of a number of outstation settlements.

Each outstation usually has space for between 10 and 20 residents . At present, most outstations are occupied only in the dry season. Several have been occupied during the Wet season. As well as its remoteness, and again like much of the rest of North Australia, Pormpuraaw is characterised by extreme seasonality. The Wet and dry seasons provide a distinct suite of natural hazards that may affect local people and their property, both in the townscape and the landscape. Potential Wet season hazards include flooding, tidal surge and cyclonic winds. Uncontrolled fires are the main dry season hazard. The study also identifies the risk mitigation strategies that are required to reduce the vulnerability of Pormpuraaw to any natural disaster.

The field component of the study took five months to complete over a period covering the late dry, Wet and early dry seasons between September 2001 and May 2002. It identified the risks that people and property and infrastructure face from natural hazards in the Pormpuraaw township, in fishing camps, at a State government correctional facility at Barr's Yard, which is also the centre of community cattle operations, and on the Strathgordon pastoral property and twelve outstations over an area of about 6000 square kilometers in the surrounding landscape.

The geographic scope of the study includes one of the most remote areas of Queensland and encompasses about 650 people of whom about 90% are Aboriginal. Most of these people have a material standard of living far below that of mainstream Australia, and display a consequent range of

vulnerabilities to the natural disasters that have been represented in this study, that are also probably integral to Natural Disaster Risk Mitigation in other Aboriginal communities.

The lack of scientific research in the region means that GIS-based analyses of satellite remotely sensed images and of digital topographic data provided the main source of information for the identification of natural hazards and of associated risks to people and property. These media were also used in visual form to overcome the wide range of literacies in spoken and written Plain English amongst local people to obtain more information on hazards; to ensure effective communication of the aims of the study; and, to obtain assessments of risk and points of view on appropriate risk mitigation strategies.

In addition, questionnaires were distributed, and meetings held with traditional owners either on their outstations or in Pormpuraaw. The community State Emergency Service (SES) volunteer group had a major role in developing the plan. The greatest risks identified by the community are as follows
• Extreme vulnerability of the township to a cyclone or tidal surge
• Extreme vulnerability of the fishing camps to Wet season flooding, or a cyclone or tidal surge
• High vulnerability of outstations and cattle operations and associated infrastructure to uncontrolled dry season bush fires.

The following main strategies are recommended
• A ‘shelter’ plan for the community to deal with the survival of people in town in the immediate aftermath of an extreme cyclone or tidal surge if evacuation is not possible
• Training and equipping of SES volunteers and community rangers to deal with natural hazards in the vicinity of the township
• A more effective fire permit system to control burning in the landscape
• Links between the local and regional SES to ensure continuity in this plan and in the monitoring of its effectiveness
• Use of the GIS outputs from this study in local planning of community housing, infrastructure and land use
• Closure of the fishing camps
The key issues to do with the implementation of these strategies and the future monitoring of natural hazards and planning are
• The high exposure of the community to natural hazards and the lack of any viable treatment options other than local human capacity to deal with them
• The difference in perceptions of risk from natural hazards between local people and the ‘Staff’ population. Local people are more accepting of these risks and of the ability of themselves, and the current capacity of the Council, the police and the SES to deal with them
• The high turnover of staff in Council, and in the school and hospital and it’s implications for the retention of disaster management skills in the community
• The maintenance of risk standards in future planning of community housing, infrastructure and land use
• The absence of a rate revenue base and the reliance on external funding for Council operations.

Information from BoM

From Alison Cottrell in the Torres Strait:
"Whether or not people used BoM weather reports or listened to the radio varied. Most people found the television news to be useless. At best the television news comes from Brisbane and the Torres Strait and NPA are rarely even shown. However, if there is a major weather issue like a cyclone, then the detail is sufficient for people to understand what is happening.
"You can get BoM map updated every 10 minutes but often the weather has passed by the time you read it."

The radio weather reports were somewhat limited but many people reported listening anyway. The local newspaper, the Torres Strait News would like to publish weather information, but as it is a weekly publication, by the time it gets published the information is out of date. The weather information also needs to come from a local who records the information because there is no longer a weather station on Thursday Island, only one on Horn Island at the airport.

Of particular concern to people would be more detailed information about wind warnings, wave heights, depth visibility and the length of time that bad conditions are likely to persist.

The operator of the BRACS station on Thursday Island was concerned that radio announcers were not well trained to understand either the weather maps or the real meaning of the BoM weather reports. At the moment they download the BoM information and 'translate' it as best they can, but don't feel all that confident about it. The feeling was that a training session for radio operators to understand the information so they could 'translate' the reports into everyday language or even local languages would be very useful. Other people also felt that it would help for the BRACS announcers to be more fluent in reading meteorological information.

Members of the mainstream community who are not involved in boating or fishing, including media personnel are probably as likely to lack the necessary understanding of weather reports.

The BoM website however, was well used in the area. There are many government department offices which regularly download the information for the area. Government staff use the information to check travel arrangements and to anticipate bad weather conditions. Many people download information to check on the weather where their children are at school. The usefulness or relevance of the BoM information varied.

As well, it was felt that information from the BoM about how long really rough conditions were likely to last would be useful, so that people could plan fishing and other boating activities. This is particularly important for those people for whom fishing is a major subsistence or commercial activity. Because traditional weather information was felt to be being lost, people felt that a better understanding of the reports and maps was useful."

Section 4.1
Traditional weather predictors and some modern issues

There was a feeling that traditional information about the weather was being lost in most of the settlements, partly through lack of interest of younger community members. There was also a repeated feeling that traditional weather patterns were changing, as described at the opening of this report. Traditional fire management is still often practiced in most regions, but now many grass fires are started out of boredom by young teenagers.

The following compilation of traditional weather predictors is based on three questions in the structured survey:

14. What natural indicators tell people that there is going to be, or likely to be, a bad or dangerous weather event (including bushfire, flood, severe storm, cyclone, surge, cold snap , drought etc.) ?
13. What are the natural indicators for the onset of the wet, and the dry season?

33. What kind of traditional ways do people have of recognising or predicting a change in the weather and an increase in a hazard?

Tradition weather warning signs from:

Yarrabah

- Insect behaviour – ants are more common indoors, and cockroach behaviour is erratic before the big wet.
- Certain plants and flowers are used to indicate seasonal changes (informant unable to provide/remember specifics).
- Cloud patterns and movements used as a natural indicator (unable to clearly express how).
- Behaviour of the *storm bird* is erratic – indication of bad weather coming.
- The *cyclone bird* flies low or circles in the sky and flies off in the direction of the coming cyclone just days/hours prior.
- Numerous crocodile tracks and drag marks heading up the mudflats/beach indicates that it is going to be rough out at sea for about the next week, possibly due to storm or cyclone.
- A dark, shadowy ring around the moon means that bad weather is coming.
- Unusually high tides means a storm is coming (conversely “blue” sea water close to shore is supposed to indicate good weather for the next couple of days).
- Obvious indicators like smoke on the horizon and animal movements are used for bushfires, while flora and fauna indicate signs of continued dry.

Palm Island

- Lots of cloud, fine mist. For major rain, red sunsets.
- Once I found a crab in my back yard. This was not normal. There was a cyclone warning after I saw the crab. It did not hit Palm hard.
- When you see birds gather in flocks and fly around fast.
- Cockroaches and ants become very active before bad weather. People just keep their eye on the wind.
- People who fish just watch the weather.
- The weather has gone hay-wire.
- When the black ant speed up, racing like buggery, you know there will be bad weather in about 3 days.
- You used to get clouds that looked like the whole end bit of a maidenhair fern. Wispy from a central area, spreading out in little runs. I have not seen these type of clouds since 1992. Before 1992, if you saw it in the morning when you were out in a boat, you knew you had 48 hours to get to shelter. If you saw it from 12 to 2, you would get bad SE winds within about 12 hours.
- There are now jet stream clouds in the summer. You never used to see them.
- There are some funny signs about now. Sometimes after the main crop, some mango trees flower again, but only on the north side, around Christmas.
- All the bush animals would breed up ahead of a good wet season, but they would not breed much if there was not going to be much of a wet.
- Birds clear out before a big storm. You know when you are in the path of a big storm because it all goes quiet – all the birds have left. So that kind of quiet will tell you where the worst of a cyclone is going to hit.
- With vegetation, with our traditional fruits – when all the trees had had their fruit, one tree may start to fruit again. People would know that something unusual was going to happen, that something different was coming up.

From the Kimberley
Ringer Soak

- Just before the wet, bees gather pollen, then seal off their combs with wax, just leaving a tiny breathing hole.
- First there are rains, then there are the flying ants. If there are more flying ants there will be more rain. We get most of our weather from the North East.
- Can see the ants about 6 weeks before . They start building tubes up from the ground about 2 inches high. They close off the top of the tubes just before the rain starts – a day or two before.
- Bush trees start to flower after a cold snap.
- The Sturt Desert Pea stops flowering at the end of the wet. Budgerigars and goanna come out with the lightning and thunder near the start of the wet, while the budgies breed at the end of the wet.
- See the cloud.

Mulan

- Gets hotter before the rain, in October or November. We hear the cicadas. When there are big rain clouds, the goanna come out. There is a bit of rain, a dust storm, rain, then lightning strikes then the wet.

Balgo

- The ants store food night and day. That means there will be a big rain in about three days.
- We smell fire. Even lightning starts fires.
- The rain goes one way, on one side, and then there is lightning the other way. That can go back and forth, with the rain on one side and then the lightening on the other side.
- When we get the wind across the ground straight in front of you it means we will get the rain. So you've got the rain on one side and when the wind blows from where the lightning is, that means the rain will come across to us. The rain will then go across to where the lightning was.
- Jaum is the name of the rains that come after Christmas. The weather seems to follow a 4 or 5 year cycle. Clouds go round in circles just before the rains come.

Billiluna

- Ants, clouds. The build-up.

Halls Creek

Onset of the wet season

- Wet coming when the leaves have fallen off the trees and they've begun to grow back.
- Clouds building up, days getting hotter.
- Hot, dry wind blows.
- Boab trees will flower and when these flowers fall it means the rain will be coming soon.
- Porcupines will walk, looking for ants.
- Green frogs start making noise, before it starts raining
- Sugar bag is full of honey
- The tilt of the quarter moon, if the quarter is in it's back, not much rain. If the quarter is standing tall, it should be a good wet.
- Rings around the moon at night, the more rings the bigger the wet.

Onset of dry season

- Cockatoos and Blue Mountains (a type of parrot) lay eggs.
- Nights are getting colder.
- Flies are a major pest until it starts to get cold.
- Sugar bag flies come out and start laying eggs before honey.
- Sugar leaf grows on the leaves of trees.
- If there has just been a big wet, there more chance of having a colder winter.

Traditional ways of recognising or predicting weather change can be:

- Looking at the sky for clouds or lightning in the distance.
- Following the direction of the wind, especially if rain or lightning are near.
- Watching insects, birds and animals, they are known indicators of imminent rain
- and wind.
- The abundance of bush fruits and animals which should be in season is also a way of recognising the change in weather.

Oombulgurri

- You can smell it. That's all.
- The clouds. The wind. The smell. There are flowers before the wet, like the kapok and the gelay. Boabs shoot.
- You get the knock-down rain at the end of the wet. That's the one that knocks down all the dead grass stems right before the dry starts.
- Kalumburu
- Running (fast moving) cloud.

Kalumburu

- When the country is very hot. There is a build up.

Old Mapoon

Traditional signs or natural weather indicators used in the local area, differ little from other communities in northern Australia. A period of continuous really hot still conditions is the prelude to monsoonal rains or a cyclone. Several elders state there are certain natural indicators for different types of weather events. Perhaps the most important weather knowledge for Mapoon people to possess, in relation to survival, are the natural signs which predict cyclones.

- The Manahawk (Aboriginal name), a large black ocean going bird, seen in large numbers about the coast indicates a "Big blow coming" (strong winds, possibly cyclonic are expected within 2 to 3 days). All people spoken to, expressed belief that the behaviour of the "manahawk" bird is a good indication of impending "bad weather". This is a term used in other Indigenous communities and can mean severe storms or a cyclone. In normal weather conditions, these birds can be seen circling in a group, high in the air along coastal areas. When conditions are extremely rough, in the case of an approaching storm or cyclone, they move inland to seek shelter, flying low to avoid wind gusts. People know from this, there is some form of hazard approaching. In the Mapoon area, indications are the bird may be a type of frigate.
- Crocodiles building their nests higher than usual above the high tide mark and long stalks on the mango fruit indicate that a "big wet" (greater than average seasonal rainfall) is expected.
- The wet season is heralded by a gradual build-up of clouds over weeks, high tides, and very hot conditions.

- When the “dry” winds start to blow from the south east, causing the grass to lose all moisture, turn brown and die off, winter is beginning.

Observations, reflections and generalisations

There is an uncanny similarity to the build-up to the ‘Wet’ in Eidsvold in SE Queensland (Map 4.1) and the more traditional build-up to the classic monsoonal Wet of the Kimberley, as noted above. The summer ‘wet’ appears to be more than just a tropical event.

People were open to talking about the weather for this study. Hardly surprising, as most of us are somewhat expert on the weather, one of our most shared preoccupations and conversational themes.

Perhaps because of changing, more sedentary and indoor-oriented lifestyles, cultures generally are less interested in ‘reading’ the weather for ourselves. Among Michael Leunig’s most famous cartoon is a father and son sitting looking at the beautiful sunset on the television. The same sunset is seen to be happening out of their side window.

The repeated lament from old ‘weathermen’ that the young fellas just don’t care about the old knowledge is, perhaps, embedded in changed physical realities of reliable buildings and less of an imperative to rely on knowledge of hunter gatherer information and more esoteric skills. Across the globe languages, local skills and knowledge are rapidly fading. Detailed knowledge of weather reading in remote Aboriginal communities has no special claim to be different. The BoM Indigenous Weather Knowledge web site could help stabilise the loss of knowledge if that goal were fully embraced and properly resourced.

We have seen from Palm Island to Old Mapoon, from Town Aborigines and female residents of Townsville to considerations of outstation residents of Halls Creek that there are commonalities of responses to extreme weather threats; most commonly flooding in the more northern parts of Australia. We want to remain or become safe. Readers in the south may feel that flooding is generally the most common threat in Australia. The storms that lashed the Brisbane area on October 31 2003, or the microbuses in Melbourne in late December 2003 could, it seems, have happened nearly anywhere in Australia.

Ultimately, it is futile to define how different the needs are of remote communities in general, Aboriginal or white dominated, to isolated settlements in general, like Mount Isa, Camooweal, Lake Nash or Eidsvold. We would all like to know with adequate warning what may adversely impact on us.
This study is different in two ways. Firstly, it gathers together for the first time the information presented in this section and in Appendix 3 on selected remote Aboriginal communities and many of their weather issues. Secondly, this study is different because the recommendations (Section 11) include clear ways to provide weather warning information in a way most likely to induce the threatened audience of the weather warnings to respond personally to help ensure their own safety.

Some emergent issues from this study are that there is room for training in the use of BoM sites by community members, and that the language and graphics of warning can be refined (Figures 4.6 -.8) and made more likely to trigger safety-oriented responses, a key aim of this research.

Figure 4.6 Active warning image to accompany fire warning

Figure 4.7
Active warning image to accompany destructive wind warning

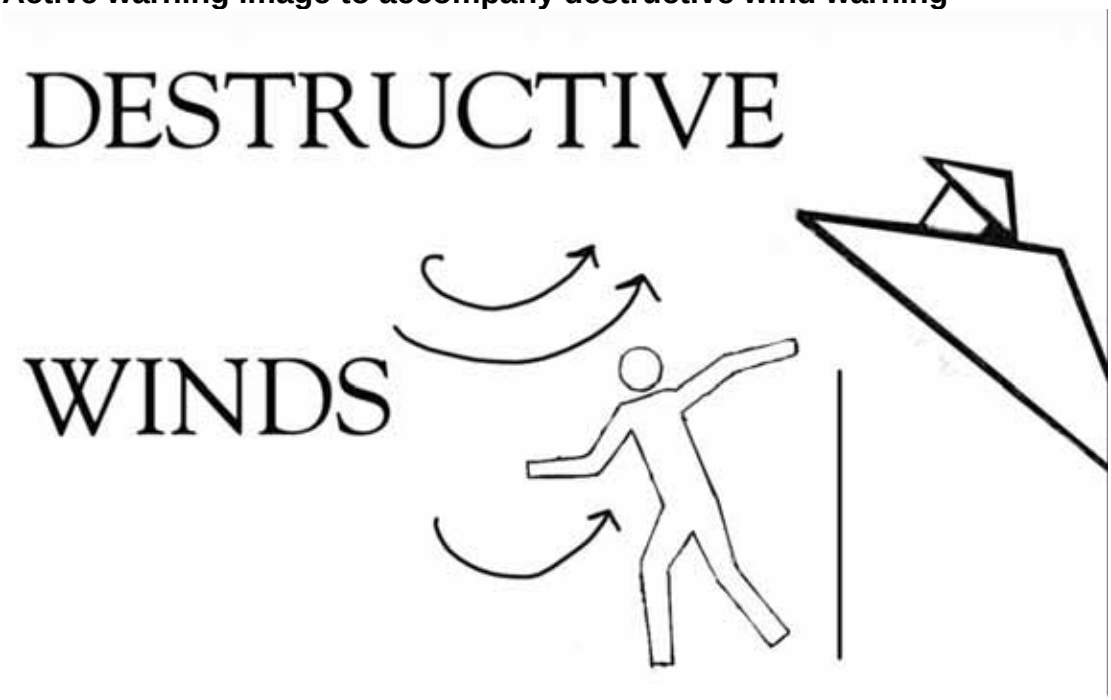


Figure 4.8 Active warning image to accompany flood warning

Defining exact wording, sounds and images to effectively warn people of extreme weather (and what you should or should not do) occupies Section 11 of this report. For instance, the word “severe” is a prime target for change – it made most surveyed people lose interest in whatever followed. Images of a car under water at a river crossing may carry the most potent personal meaning in flood warnings for most people.

It is time to imagine some communication changes, targeted to remote Aboriginal communities, perhaps aligned more closely with the BRACS radio network previously reported. Increased extreme weather preparedness and the active acceptance of evasive behaviour is embedded in our efforts.

The next Section presents a detailed exploration of the importance of language. This is followed by a compilation of traditional Aboriginal stories which relate to the weather, usually extreme weather. Most of these stories are to do with floods. In most cases, most people drown. New extreme impact stories lead to considerations of risk communication, followed by the detailed exposition of recommendations, finishing with some overarching observations about active weather warnings from the BoM.

Section 5
Definitions, language, cognition and behaviour

Because this research hinges on language use, it is important that all participants reasonably agree on word meanings. This section starts in the comfort zone of simple definitions, then considers semiotics (the way we put linked ideas, signs and symbols together), considers core issues of world views (paradigms), finishing with the uneasy realities of our knowledge base, our epistemological orientation (http://www.lycaeum.org/drugs.old/other/brain/, http://plato.stanford.edu/entries/descartes-epistemology/, http://en.wikipedia.org/wiki/Epistemology). For all 23 research recommendations to be fully considered for uptake, some of the underlying knowledge foundations of context, intent and behavioural motivation need to be considered – how humans construct, transfer, acquire and use knowledge.

Meteorologists have specialist knowledge and concepts based on their world view. Think: Hadley Cell, then try to transfer your knowledge of the Hadley Cell's impact on Australian weather to some-one, but with your hands behind your back.

Imparting meteorological knowledge to target audiences to engender safety-oriented responses is a complex exercise in social marketing, explored later. As the information promulgators, we should understand a little of *Perception* (the raw data from the outside world entering an organism via one of the five senses), *Cognition* (internal processing, analysing, information storage and processing), *Attitudes* (how we think and feel about particular issues, implying a predisposition to specific action), *Language use* and links to *Behaviour*.

It could be argued this research is a psychology exercise in social marketing (http://www.amazon.com/gp/reader/0761924345/ref=sib_dp_pt/103-2228664-4009451#reader-page).

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5.1 Language and symbols

Agreed word meanings
From
Kobb P 2000. *Emergency Risk Management*
Applications Guide Emergency Management Australia

Community
A group of people with a commonality of association and generally defined by location, shared experience, or function.

Emergency
An event, actual or imminent, which endangers or threatens to endanger life, property or the environment, and which requires a significant and coordinated response

Hazard
A source of potential harm or a situation with a potential to cause loss. (In emergency risk management – a situation or condition with potential for loss or harm to the community or environment.)

Prevention
Measures to eliminate or reduce the incidence or severity of emergencies.

Risk treatment options
Measures that modify the characteristics of hazards, communities and environments to reduce risk, e.g. prevention, preparedness, response and recovery.

Vulnerability
The susceptibility and resilience of the community and environment to hazards.

WORDS & IDEAS

From:
EMA 2000. Emergency Risk Management Applications Guide. The Australian Emergency Manuals Series. p4.

There is no national agreement on emergency management terms and definitions in Australia. This is because emergency management overlaps many other fields of endeavour, is influenced by European and American ideas and words, and is currently moving towards risk management.

'Hazard' is synonymous with 'source of risk'.
'Vulnerability' comprises 'resilience' and 'susceptibility'. 'Resilience' is related to 'existing controls' and the capacity to reduce or sustain harm. 'Susceptibility' is related to 'exposure'.

One strength of the English language is its rapid incorporation of new words, with their embedded new concepts. English, although fluid and adaptive, may not be the dominant world language within 50 years, overtaken by Arabic, or possibly Spanish or Hindi/Urdu, just by the weight of numbers of speakers (Graddol 2004). Words and word groups change over time.
Even having the right words or approaches in place *as policy* does not automatically guarantee community safety-oriented responses to disruptive warnings.

Since 1989 the Australian approach to cope with disasters has been prevention, preparedness, response and recovery training courses. Yates argues this all needs to be refined to make sure they are focused on issues from the relevant local communities. If locally delivered training courses do not contain local knowledge they may well be seen as remote and irrelevant to specific local regions. (Yates 1992 p12). Much of the problem of non response seems that 'the message' to take care does not effectively get through to the target. The signs, the words, the warnings may not have any impact. It is to do with communication, with signals sent, signals received, and their interpretation.

The types of received and interpreted messages are explored specifically in Section 9 on risk communication. This section develops the intellectual foundation to more fully understand that. We can consider that the world is full of signs we may interpret. Study of such things is called semiotics. The following two frames signpost the concepts and relevance of semiotics.

Semiotics - studying systems of signs or symbols

From:

http://www.aber.ac.uk/media/Documents/S4B/sem01.html

Semiotics could be anywhere. The shortest definition is that it is *the study of signs*. But that doesn't leave enquirers much wiser. 'What do you mean by a sign?' people usually ask next. The kinds of signs that are likely to spring immediately to mind are those which we routinely refer to as 'signs' in everyday life, such as road signs, pub signs and star signs. If you were to agree with them that semiotics can include the study of all these and more, people will probably assume that semiotics is about 'visual signs'. You would confirm their hunch if you said that signs can also be drawings, paintings and photographs, and by now they'd be keen to direct you to the art and photography sections. But if you are thick-skinned and tell them that it also includes words, sounds and 'body language' they may reasonably wonder what all these things have in common and how anyone could possibly study such disparate phenomena. If you get this far they've probably already 'read the signs' which suggest that you are either eccentric or insane and communication may have ceased.

Assuming that you are not one of those annoying people who keeps everyone waiting with your awkward question, if you are searching for books on semiotics you could do worse than by starting off in the *linguistics* section. It is … possible to conceive of a science *which studies the role of signs as part of social life*. It would form part of social psychology, and hence of general psychology. We shall call it *semiology* (from the Greek *semeîon*, 'sign'). It would investigate the nature of signs and the laws governing them. Since it does not yet exist, one cannot say for certain that it will exist. But it has a right to exist, a place ready for it in advance. Linguistics is only one branch of this general science. The laws which semiology will discover will be laws applicable in linguistics, and linguistics will thus be assigned to a clearly defined place in the field of human knowledge. (Saussure 1983, 15-16; Saussure 1974, 16)

From:
http://www.aber.ac.uk/media/Documents/S4B/sem12.html

Daniel Chandler
D.I.Y. Semiotic Analysis: Advice to My Own Students

Semiotics can be applied to anything which can be seen as signifying something - in other words, to everything which has meaning within a culture. Even within the context of the mass media you can apply semiotic analysis to any media texts (including television and radio programmes, films, cartoons, newspaper and magazine articles, posters and other ads) and to the practices involved in producing and interpreting such texts. Within the Saussurean tradition, the task of the semiotician is to look beyond the specific texts or practices to the systems of functional distinctions operating within them. The primary goal is to establish the underlying conventions, identifying significant differences and oppositions in an attempt to model the system of categories, relations (syntagmatic and paradigmatic), connotations, distinctions and rules of combination employed. For instance, 'What differentiates a polite from an impolite greeting, a fashionable from an unfashionable garment?' (Culler 1985, 93); the investigation of such practices involves trying to make explicit what is usually only implicit.

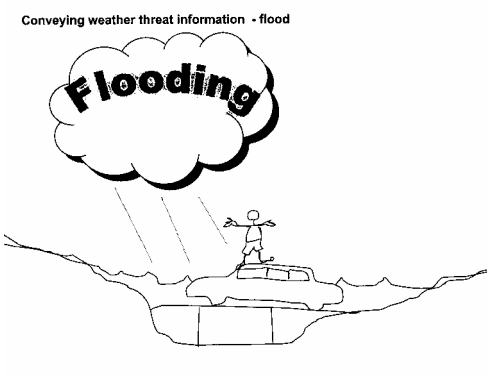
A 'text' (such as a printed advertisement, an animated cartoon or a radio news bulletin) is in itself a complex sign containing other signs. Your initial analytical task is to identify the signs within the text and the codes within which these signs have meaning (e.g. 'textual codes' such as camerawork or 'social codes' such as body language). Within these codes you need to identify paradigm sets (such as *shot size*: long shot, mid shot, close up). You also need to identify the structural relationships between the various signifiers (syntagms). Finally you need to discuss the ideological functions of the signs in the text and of the text as a whole. What sort of reality does the text construct and how does it do so? How does it seek to naturalize its own perspectives? What assumptions does it make about its readers?

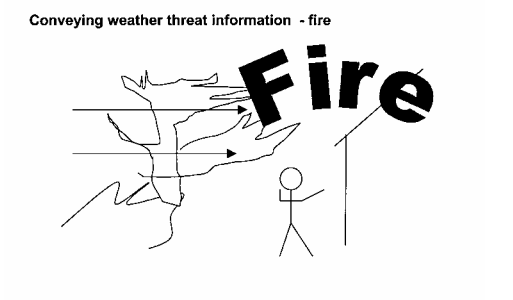
Within this intellectual frame of what is being represented and how, it becomes easier to understand how various authors on disasters approach the topic – what cultural signs and symbols they manipulate to try and get warnings of hazards and responses triggered.

The following 5 signs (Figure 5.1) have embedded meaning. In the right context they may trigger a behavioural response:

Figure 5.1 Signs for life

From WE Australian late 2003





From Townsville Bulletin, late April 2004

It has been acknowledged since the early 90's that discussions on disaster-related language that the terms used and that the meanings or interpretations attached to those words have a real influence on the way people think and act.

Disaster definitions

Even defining "disaster" is difficult (Salter 1992). Some definitions gleaned from other sources include 'extreme events located in time and space' …'extreme geophysical events greatly exceeding normal human expectations causing significant material damage and possible loss of life'…'any event which threatens people and requires extraordinary measures to protect life or property'…'the potential for damage that exists only in the presence of a vulnerable human community', or the more currently accepted definition of 'the interface between an extreme physical event and a vulnerable human population'.

A disaster may also be seen as a negative impact of a hazard on a community as measure of vulnerability. Vulnerability has certainly become a catch word as has hazard, preparedness, risk, response and recovery: all language of disaster impact mitigation evolved and practiced increasingly during the late 1990s (ie Zamecka and Buchanan 2000). Salter (1992) points out that risk has increased during the early 1990s. Risk is seen as a function of probability and consequence, related to exposure and the level of force embedded in the threatening hazard. Salter was brave enough to draw a chart categorizing ignorance from pure ignorance to acts of ignoring.

Boughton (1992) points out that natural disasters are usually extremely rare for the individuals concerned but they can cause massive impacts. Because Australia is so vast, overall there are reasonably frequent natural disasters. However, in most locations they are rare indeed. Boughton (1992) argues that a "natural disaster" is a natural event in which the community life is seriously and traumatically disrupted. Insightfully Boughton (1992) says "it appears that a key step in preventing natural disasters is to prevent building damage." (p 4).

Example of internal spaces in conflict: rains preceding cyclones
"Steady rain often precedes the arrival of a tropical cyclone so that soil profiles are saturated when the heavy rainfall occurs." Boughton (1992, p 5).

When I hear about a cyclone impact threat, I first consider flooding preceding the landfall (Goudie and King 1999) – it is part of my internal knowledge base, my internal reality or cognition. At conferences on such topics in the mid and late 1990s, it was difficult to convince emergency managers of this. It did not suit their semiotic landscape – it made their task too difficult. In the same way Aboriginal respondents 'turned off' when they heard 'severe' (because, seemingly, of the strong oral tradition and links back to the symbol-laden language of 'severe punishment' used consistently in the mono-cultural missions), emergency managers just did not want to know. It eventually took a '*Senior Expert from Canberra, from the Australian National University'* (multi-symbol laden) to convince the managers. External reality stayed the same, their internal reality, their screens and filters through which they saw and judged the world had changed.

This knowledge of pre-cyclone flooding, epistemologically born of studying the records, and consultation with flood experts rather than emergency managers, means that there is a special issue for disaster risk managers considering threats from coastal tropical cyclones - populations may be isolated by dangerous flood waters well before a cyclone landfall with its associated highly destructive winds, pounding debris and possible drowning cyclone surge. This sequence of entrapment in coastal areas before cyclone strike needs special precautionary evacuation considerations. Since the early 90s people like Boughton (1992) have suggested having drills/practice evacuations for schools and other institutions in readiness for possible earthquakes, cyclones or other hazards to which particular areas are vulnerable.

Use like examples of the threat from other instances

Boughton (1992, p6) argues that “awareness of hazards and disasters can also be fostered by drawing attention to media coverage of hazards in other places.” This recommendation has merit. Imagine if the large scale floods and evacuation in Holland in 1995 (Handmer 2000) had received widespread coverage in Australia, especially replayed at the beginning of necessary evacuation in some part of Australia. This could be done with the byline that there are large flood prone areas here where general evacuations are needed, or should be practiced, as a sensible response to an actual or simulated Maximum Possible Flood (MPF). The recent Dutch experience shows that the vast majority of evacuees – about 250,000 - were happy with that behaviour even though the worst of the threatening floodwaters did not inundate to the level feared.

Precautionary evacuations should be seen as wisdom within the context of Ecologically Sustainable Development; should be seen as good practices at the very least. An allied idea expounded by Boughton (1992) is that the media could give a high profile to success stories where communities successfully avoided disasters. Boughton quotes the 1989 example where tropical cyclone Orson just missed Karratha. Because only boats were damaged cyclone Orson was not a disaster.

Boughton makes the point that since 1974 when Darwin was largely destroyed by Tracy there have been major improvements in building construction thus enabling communities to be more resilient. The underlying point is that building construction and location may well be central to how capable a community is to endure an extreme natural event.

An issue of ‘attitude’ is shown in the inclination to hold practices, drills, especially on a broad scale. Inconvenience and possible insurance worries override the likely steep learning curve (epistemological development) associated with practices. One semi-desktop practice in Cairns in the late 1990s found that the Counter Disaster control centre was ‘flooded’ with fairly modest rainfall. In the exercise of moving computers and other equipment, pandemonium ensued. Practices are messy, but better than the real thing: wind, power outages and dark, to find failings with ‘the drill’. This is a matter of institutional attitude (see Figure 5.2, Stern et al., and the following to help comprehend sources of resistance to wide scale emergency practice drills).

Figure 5.2 Stern’s 1995 behavioural explanation model

Behaviour is explained by:
1. a person’s *position in a social structure*,
2. with *constraints and incentives* as generators of *values*, which lead to
3. general *beliefs*,
4. *world view*,
5. *specific beliefs and attitudes*, generating
6. *intent*, which helps explains
7. *behaviour*.

Developed from Stern *et al.,* (1995; 727)

Political ramifications: semiotics of real estate and vested interests
"A better informed public is more likely to make the right reaction to proposed legislation and guide politicians at all levels towards making sound decisions for community survival. In many of the hurricane-prone regions of the USA, evacuation plans have been devised to remove people from areas at risk of storm surge flooding. The plans are well publicised and the routes well marked. In Australia and other parts of the USA where the same problem exists, some plans have also been made but they are hidden away for various financial and political reasons. This is a case in which attitudinal changes on the part of those communities may change the priorities of the decision makers and promote the interests of the community." (Broughton 1992).

As early as the late 1970s, authors like Murray (1979) were expressing concern over issues like disparities where the poor often did not have equal access to resources: "…the poor do tend to suffer most when disaster strikes; here Bernhard Schaffer's concept of bureaucratic access strikes me as being very important: the poor don't know how to go about maximising the benefits to them of forms of aid that are made generally available, whereas the middle classes normally do have this know-how" (Murray, 1979, p2). Murray (1979) reported that the first international disaster research meeting was held in 1978, Sweden. Discussions and meetings have been held in a focused way for at least 25 years but there are still communication problems, including the disadvantaged, and having Councils ensure residential development does not occur in floodprone areas (QG 2003).

The media can help
The following from Handmer (1992) relates strongly to recommendation 18 of this research: begin negotiations with media bodies and associations to become part of the formal warning process to target at-risk people. Action from BoM, State SES and EMA.

From:
Handmer J 1992. Can we have too much warning time? A study of Rockhampton, Australia. *The Macedon Digest*. The Australian Journal of Disaster Management V7: 2 p8 -10.

"The Rockhampton flood warning system"
"The outstanding feature of flood warnings in Rockhampton is the amount of warning time available. A week before the flood peak reached the city, the BoM was able to specify the height and timing with reasonable accuracy. This is possible because of the size of the Fitzroy River catchment; but also owes much to the Bureau's ability to capture and process stream flow data for the entire catchment and beyond. However, even without the Bureau's involvement, accurate warnings of a few days are possible." (p8)

"As a result of data from the gauge readers and synoptic reports, by 7.30pm March 2 the Bureau was able to refine its forecast predicting a flood peak at Rockhampton "about next Thursday 10th March"." (p8)

Warning dissemination
"For example, forecasts are telexed from the Bureau's Brisbane Office to State emergency Services (SES) in Rockhampton, and then passed by hand to the local SES – the people actually combating flood. This appears clumsy but apparently works well in Rockhampton where time is not critical." (p9)

".. intense media interest can place added strain the emergency services, especially as some media organisations apparently telephoned the local SES every hour from 3am on. The absurdity of this is evident when we remind ourselves that the flood has over a week's lead time and a flat peak lasting a day or two." (p9)

By association, the hype may have reduced the credibility of local media. The reports also caused anxiety to out-of-town people with friends and relatives in Rockhampton. Many of whom telephoned the city to check on the situation, causing additional load on emergency workers and the telephone system." (p9)

"The flood warning literature emphasises the importance of avoiding this situation. But, it also appears that where multiple sources present the same story the result is powerful persuasion."

Conclusions
"As warning times increase, the official flood warning system is increasingly likely to find itself working in tandem with an unofficial system … One way around the problem of multiple sources is to provide a central credible accessible information source. In Rockhampton the Council and emergency services attempted to do this." (p10)

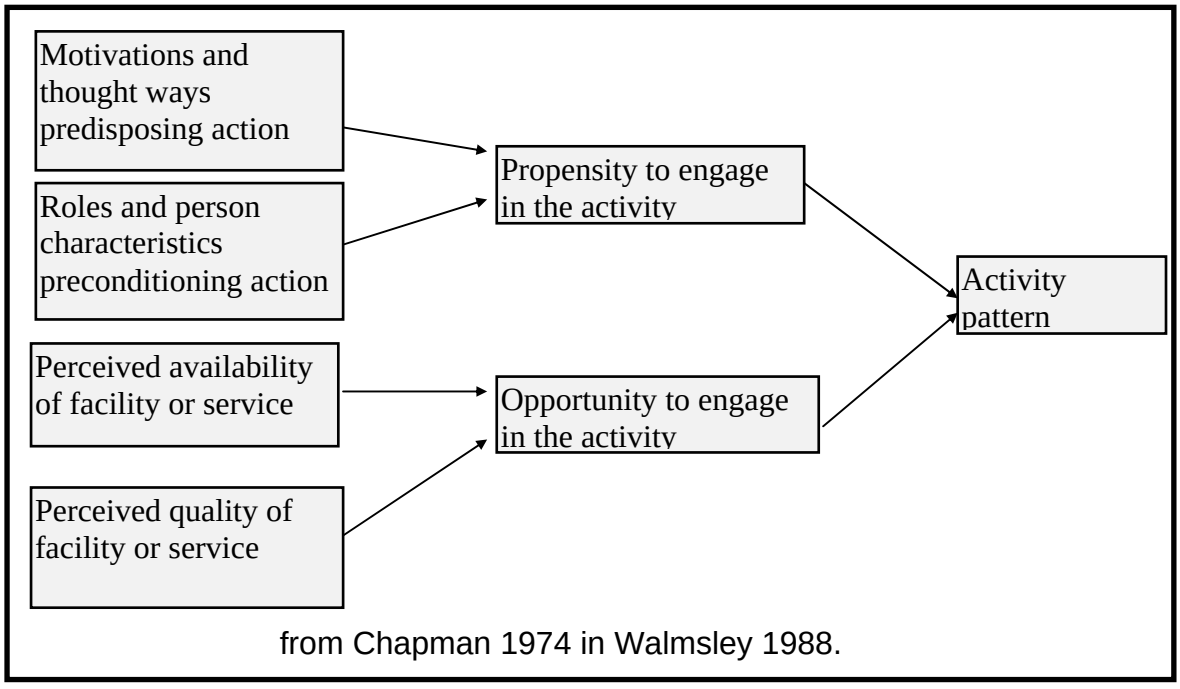
Meteorological language detail

Salter et al (1993) point out that the use of meteorological category systems such as 'minor', 'moderate' or 'major' carry unambiguous information about the level of disruption likely from a particular flood. However, this is not true with the categorization of fire hazard, e.g. in south east Australia a 'high' forest fire danger is common, as is 'very high', although it is only 'extreme' fire danger which needs to cause protective action. Salter et al (1993) point out that the jargon categories of 'high' and 'very high' carry different technical meanings but are difficult to distinguish by many members of the public. The point here is that the language used should not be used for the convenience of the warning agencies. Rather the language used should be for conveying clear unambiguous messages to the general public.

5.2 Why we do what we do

A behavioural model of causality to describe behaviour (Walmsley 1988; 94, Figure 5.3) may be used to infer relationships between reported attitudes and actual behaviour. However, a more recent and complex model proposed by Kitchin (1996, p74), with the strength of explicitly including social and environmental interactions may be used to understand why we do what we do: Kitchin's proposed model includes a person's 'working and long term' memory. Internal information is processed within 'real world' context, such as cost (Stern 1992), which may be processed within the 'it can't happen to me' frame, or considered against insurance payouts (see Canberra report, Section 7) as a processing cognitive or 'internal space' of subjective reality.

Figure 5.3 Possible determinants of activity patterns



from Chapman 1974 in Walmsley 1988.

Stern *et al.* (1995) have developed a simple and elegant model which includes a person's position in a social structure, considers constraints and incentives as generators of values. This in turn lead to general beliefs, world

view, specific beliefs and attitudes, generating intent, helping explains behaviour (Stern *et al.,* 1995; 727 - Figure 5.3). This model perhaps helps explain why there is such a strong sense of self-help in the remote communities – elders decide responses to threats, there are historic and immediate constraints, generating a value system where community members need to look out for each other (consider the traditional stories in the following section – the punishment when people do not look out for each other). General beliefs all must point to self help, including needs to ensure safety, and the intent to achieve community safety, leading to safety-centred behaviour.

Each community visited was not overly fussed by weather extreme (values) but each relied on and respected their tradition reading of threats, and information from BoM. The world view is that flooding or worse may happen, and that BoM will provide adequate warning. There are specific beliefs about what should be done in the face of threats. For instance, on Palm Island, SES persons use a motor boat to go out to every island camp if a destructive weather warning is posted by BoM. The community has the intent of protecting all its members.

The BoM gets it right often enough to take their warnings seriously. This is the correct behaviour of the Ecologically Sustainable Development (ESD) precautionary principle in action. In Oombulgurri, after devastating floods requiring evacuation in the late 1990s, the community has rebuilt on the same location it has occupied since its inception as a Mission in the 1930s (Figure 5.4), but all community buildings are now more than a metre higher, above the flood level. The proposed new youth and recreation centre is on higher ground, and purpose designed as a safe shelter from flood or cyclone.

Figure 5.4
The Oombulgurri settlement, near coastal East Kimberley, WA.

Paradigms

Human Geography attempts to "... understand how socially generated constraints influence virtually all forms of people-interactions ..." (Walmsley and Lewis 1993, p 6). From Federal Government initiatives in 1990, Australia has engaged in a public participation process, developing concepts and implications of ecologically sustainable development, and how to implement them.

Changing values and roles

In an attempt to understand why we support or ignore certain messages relevant to our safety, the following section considers paradigms, particularly the Dominant Social Paradigm and the New Environmental Paradigm.

Concepts of paradigms have been developed to help appreciate the societal values that underscore social choices. Exploration of paradigms is increasingly used in the literature, as outlined below, to help understand why we interface with nature the way we do, and how that interaction is conceptually changing the way we approach community wellbeing and community safety.

A paradigm may be defined as a clear and embracing pattern, a coherent world view, "a mental image of social reality that guides expectations in a society" (Dunlap and Van Liere, 1978, p10). "The DSP (dominant social paradigm) refers to the world view or ideology which has become entrenched as a result of the structures of power in a society. It is diffused through society by hegemonic values [structural values where gross imbalances of power and wealth are accepted as normal] between societys' members, institutions and social processes and, in turn, is maintained and reproduced by them" (Fien 1992, p23).

There is a chasm between the dominant social paradigm (expansionist or continual growth world view), the entrenched "structures of power in a society ... maintained and reproduced by them" (Fien 1993, p 23), and the new environmental paradigm.

Dominant Social Paradigm - values

Since development of mechanised power, growth and innovation has brought wealth and technological benefits to increasing numbers of people. Unfortunately, it is largely based on growth and exploitation. An alternative world view exists: the new environmental paradigm. This sustainable world view includes long-term ecological and resource considerations, and accepts the urgent need to reduce human impact on surrounding resources and ecosystems. Both these world views are coherent (Munro 1995). The dominant paradigm does not attempt to include all of the 'external' costs of any human endeavour, while the environmental paradigm does attempt to cost resource depletion, pollution, health effects, and all other costs which are attributable to a particular behaviour.

Ecologically sustainable development expresses a 'world view' or paradigm which is one of two major driving forces in our society. The philosophies of

ESD – equity, precaution, environmental and social responsibility, but mainly a long term view of what is most likely to work for us, are necessarily all part of one inseparable package. This is the full context of BoM seeking to improve effective responses to the weather information they gather, interpret and disseminate.

With this articulation of what are the underlying forces or philosophies at play, and the policy shift toward safe, self-helping communities, the goal becomes one of selling self-help techniques and information to communities. Social marketing is likely to be the most effective vehicle.

Social marketing

From
http://foundation.novartis.com/leprosy/social_marketing.htm

“Social marketing's product: ideas and practices
Social marketing is distinguished by its emphasis on so-called non-tangible products-ideas and practices-as opposed to the tangible products and services that are the focus of commercial marketing.
An integral part of ideas are beliefs regarding certain issues and the way they should be dealt with. These beliefs range from general world views (of religions, for example) to culture-specific notions (such as a "dowry system") or identification with a group ("we as employees of the Novartis Foundation"), to a person's self-image ("I as a committed environmentalist"). Ideas also include attitudes toward people, things, concepts, or events. Our approval or disapproval of them depends largely on our individual value premises.

Individual and societal behavior, exemplified by actions (as well as failures to act), is largely conditioned by whether we are pragmatic or act on the basis of values, tradition, or emotions. Pragmatic behavior considers the purpose, means, and consequences of a course of action or non-action, whereas value-oriented behavior rests on ethical, aesthetic, religious, or other considerations regarding the intrinsic value of a certain mode of conduct without regard to the consequences. The traditionalist acts in accordance with institutionalized norms and practices, while emotional behavior is shaped largely by moods. Therefore social change can best be effected by bringing about new ideas and beliefs and thereby behavior.”

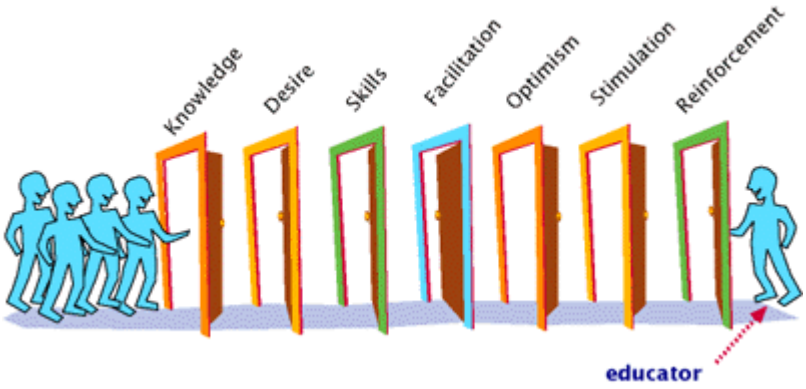
Figure 5.5 A graphic how-to of social marketing

From

http://media.socialchange.net.au/strategy/

7 steps to social change

Each one of these conditions is actually an *obstacle*, so you can think of this model as a set of 7 doors...



Notice how 'education strategy' is now about *clearing away obstacles* rather than awareness building.

Notice also that the educator or social marketer has the humble role of a door opener, rather than a font of ultimate truth.

This section provides some of the intellectual tools needed to solve problems relating to community safety in remote Aboriginal communities – definitions of ‘disaster management’, words used, and consideration of the importance of people’s ‘internal space’ as to how we see and are inclined to react to the external world. This section has explained, briefly, how we acquire knowledge (for us, knowledge about potentially disruptive weather), and the intellectual platform (social marketing and semiotics) to help influence the message content of predicted disruptive weather, flood or bushfire, aiming to stimulate a proactive response of flight or fight - leave early ahead of the predicted threat, or make sure you and yours are in a safe place.

Having gathered detailed research results from the thirty regional settlements polled for this study in the prior section, and now having considered definitions and language, Sections 6 and 7 provide some traditional and more recent extreme weather and flood stories. This report then explicitly explores the broad body of literature on risk communication, before closing on research outcomes and processes, leading to recommendations and conclusions.

Section 6
Extreme weather impacts - old

This section draws on collected Australian Aboriginal stories of extreme weather impacts -mainly floods- and contrasts the embedded lessons with detailed descriptions from two more recent Australian events in Section 7. This helps inform what might happen in populated regions which may experience Probable Maximum Floods anywhere in the Pacific.

In Dreamtime Australian Aboriginal stories, the recurrent theme is that nearly every-one drowns, while Section 7 details reports from Cyclone Tracy's physical and psychological impact on Darwin in 1974 and the Brisbane flood impacts of 1974. These two sections carry powerful messages for emergency planners in this third millennium. These Sections also detail third millennium approaches to disaster preparedness, response and recovery.

The messages are well developed in this major report on Indigenous weather issues: nurture aware and prepared communities to respond in a precautionary and active way to any likely threat. In more vulnerable communities, make sure residents are informed, and preferably practised in either staying safely or evacuating to safety early. Community safety is the umbrella under which we encourage all threatened individuals to shelter.

In the "Understanding community risk" session of the 2003 Australian Disaster Conference, an Emergency Management Australia (EMA) representative told us that we deal with very rare events, so values are important, that inputs need to be credible. How people manage their own lives, their relationship with their local environment and their own community become central to good risk reduction - very clear and current thinking. We need to make and encourage choices which are robust and produce legitimate outcomes.

Old stories from across Australia

The first two stories are included to help show the skeptical reader that Australian Aborigines have had and still have; a most powerful and accurate oral knowledge and skill which has travelled through many thousand years. Some of the following stories long predate the rise of Egyptian culture, before Rome existed, before China began its civilisation. The evidence of the first two stories is that detail of prior landscape and extreme events has transmitted accurately through many millennia. When it is repeatedly said that traditional Aboriginal culture had intimate links with their environment, like true geographers, this was so in space and time.

Some of the flood stories seem to illustrate how it is unwise to not respect and care for old people, others as chilling tales of what can happen if children disobey their parents, or tease animals.

First story group:
establishing the past for the present to admire and learn from

From:
Dixon RMW 1991. *Words Of Our Country. Stories, Place Names and Vocabulary in Yidiny, the Aboriginal Language of the Cairns-Yarrabah Region*. University of Queensland Press. 312 Pages. Pages 41 to 42 and 90 to 91

Text 3 – The Origin of Lake Eacham
"I first recorded an account of the origin of the three crater lakes on the Atherton Tableland (Lake Eacham, Lake Barrine and The Crater) from George Watson, in the Mamu dialect of Dyirbal. The story he told was very similar to the Yidiny one given here – how two newly-initiated men broke important taboos and so angered the rainbow-serpent. This spirit then caused the earth to erupt, bringing about the formation of several deep lakes. Both texts (Dyirbal and Yidiny) provide a plausible account of volcanic eruption.

After telling the story, in 1964, George Watson remarked that when this happened the country around the lakes was 'not jungle – just open scrub.' The volcanic eruptions that formed the lakes are said by scientists to have been at least 13,000 years in the past. George was saying that at this time there was no rain forest on the Atherton Tableland. In 1968 a dated pollen diagram from the organic sediments of Lake Euramoo by Peter Kershaw showed that the rain forest in that area is only about 7,600 years old. This suggests that the story of the volcanic eruptions may have been handed down from generation to generation for something like 13,000 years (which is not implausible, since Aborigines are known to have been in Australia for at least 40,000 years)."

Text 16 – How the Sea Level Rose
"They were particularly taken with a legend which must have been taken down by E.R.B Gribble between 1892 and 1909, while he was at Yarrabah, published on pages 56-7 of his *The Problem of the Australian Aboriginal* (Angus and Robertson, 1932) under the title 'The Great Barrier Reef':

'According to the natives on Cape Grafton, northern Queensland, the Barrier Reef was the original coastline of the country. Goonyah was the first man in that country. One day with his two wives, he went to the coast to catch fish. In some way he offended the Great Spirit Balore. It is said, that he caught and ate a certain kind of fish that was forbidden. Balore in anger caused the sea to rise in order to drown Goonyah and his women, but they fled to the mountains. The waters rose rapidly as the fugitives climbed to the heights of the Murray Prior range. This range is called by the aborigines "Wambilari" [Moses said that this must be a reference to Wumbilgay, a baldy-headed mountain]. The two women became very tired, and stopped running. Goonyah, well ahead of them, stopped on a huge boulder of granite, and called upon them to hurry. The natives took the author to this spot, and showed him the footprint of Goonyah. It is a patch of very dark stone in the granite about fifteen inches long and very wide. It is said that the mark was left by Goonyah's muddy foot. He must have been something of a giant.

They succeeded in reaching the top of the highest peak in the range, and there they made a fire, and heating large stones rolled them down the mountain side, and succeeded in checking the flood. The sea, however, never returned to its original limits. (Goonganjie tribe).'"

Although Moses had never previously heard a story about Gunya the theme was familiar to him – many Yidinyji stories are concerned with rising seas and what olden times people did to try to stop them.
Told by Dick Moses in the coastal dialect; recorded at Yarrabah on 22 August 1973 (duration 10 minutes).

Stories which may not fade

From:
'Old' Gordon with Carise Gordon at Ringer Soaks, East Kimberley, as told to Douglas Goudie October 2003.

Rainbow serpent and the water soaks
near the Community of Ringer Soak (Ring–o'-soaks),

The rainbow serpent would move all around here and form the cloud, and start to make the strong wind blow. The rainbow serpent is still here in the soaks. When a truck came here in the 1980s to drill for water, the drillers felt something moving down there at Banana Springs. They could feel it moving through their drill rig. From deep down they pulled up charcoal. That was from the Dreamtime burning. From the fire Dreaming. Peter Gordon can sing up the rain. When the drillers felt something moving, the old people thought it must be the rainbow serpent.
As told to Douglas Goudie

From: Old Gordon, Angela Gordon and daughter Carise Gordon at Ringer Soaks, East Kimberley, WA, as told to Douglas Goudie October 2003.

The soaks and the sisters

Two sisters were gathering wattle seed to grind one day, and they argued over which sort of seed to get. In the end, one sister got one sort; the other got a different sort. They ground their seeds and made a kind of damper, but when they put them in the fire, one exploded. That explosion made a big hole and made the soak there at Banana Springs, while the rainbow serpent woke and made other soaks in the area. The two sisters turned into trees, and those old trees are still there today.
This story was told to Douglas Goudie by Angella and Carice Gordon.

Two Dingoes and the flood

There were two emu up north from around Inverway Station, from Nungaroo Creek, who were chased by two dingo. A big distance away from Mulan at Nungaroo.

People were walking. The emus were in front. The people were singing and dancing, and they were in between the dingoes and the emus. There were floodwaters behind the dingoes.
When people were camping the flood would stop. There was one old man, he had a string line and he would cut the water while they camped. He would hold the waters back while they camped. While they would sing and dance. Where they camped the water was held up. That is where the billabongs in Sturt Creek are now. Like at Bindalaorro.
The black and white water bird, the one with the long legs, the little bird was with the people. Birds and other animals joined the people as they moved south, singing and dancing.

They were coming down, straight down to the lake on the Sturt River side. But the dingo chased the emu round the other side. Around to number 51 well (water bore) around to Gillang-gillam.

The dingo chased the emu back and forth on the main lake. One dingo was chasing one emu and the other dingo was chasing the second emu. Back and forth. Each dingo grabbed an emu when they passed but they each grabbed the wrong emu. They grabbed ‘em and killed ‘em and ate ‘em.

The people on the other edge of the lake, in the main channel, camped again. In that main camp they sung and danced, that was where we call Lera Yard.

When the two dingo’s were full they walked up the other channel to Mulan. There was a soak there and they dug in. They’re still there.

Then the water came in from both sides and all the people got drowned.

One old man walked off and sang them (he put a deadly curse on them all). They all drowned because they hadn’t shared some food with him. But when he walked off, another old man spat on him, cursed him, so that first old man who walked off died too.

From: Rex Johns, elder and founder of Mulan, Tanami Desert, East Kimberley, WA. as told to Douglas Goudie October 2003.

Commentary

there are variants on the story Rex Johns told of Lake Gregory and the story (below) *Law from the south meets law from the north.* They both, however, convey the message that there was flooding to the extent that Lake Gregory filled right up, something which has not happened in living experience.

Quite a few of the stories of major events seem to have a moral of either people not sharing food (a 'sin' for nomadic, subsistence peoples), or of children being disobedient and tormenting other 'animals'. The latter is the case in *Dumbi the owl.* Here, as is often the case, everyone drowns. In *Eye of the sea*, the vengeance of an old woman for her lost son seems to trigger a tsunami. Nearly everyone was drowned and she was speared to death.

The Introductory notes to Songs from Yarrabah shows that the very Skin or kin groups are categorised to wet and dry season groups of objects or animals. People on NE Coastal Queensland were absolutely steeped in weather as part of their spiritual existence.

The accounts in *The floodmakers of langu narnji* record the living culture of the Mornington Island area, where some individuals or groups were able to control storms. This was a source of intergroup power, but also retribution when a great flood, unsummoned, wreaked havoc on other groups, who then sought vengeance.

Eerie

In the story of the Owl-torment induced great flood of the Kimberley (Utemorrah, 2000), a section reads (p 7): "He got the dragon lizard to go out into the plain and wave his arms around to bring all the clouds. The dragon lizard did that. The rain and lightning came. That scared the children".

In a disaster risk management study in Eidsvold, inland from Gympie, southern Queensland (Map 4.4), I learned: Neville spent time with traditional men in the 1950s. He was shown a local lizard (moos moos in the Wakka Wakka language) slowly waving one 'arm', then the other on front of its face, while standing on a high piece of fallen old branch. These lizards are smooth skinned, not very common, and about 200 mm long. The old fellas said that meant there would be rains soon after. The younger blokes laughed and thought that was not going to happen. According to Neville, "Storms came from all over the place that night. It rained a lot."

From an ancient story of a prior major flood in the Kimberley to living oral traditional knowledge of reptile behaviour preceding flooding rains in southern Queensland, there would appear to be an early, observable warning/forecast of rain.

Can we step into a space that allows BoM to receive input on such behaviour to test, then possibly incorporate tradition knowledge and observation into 'mainstream' forecasting processes?

Weathermen
Rain making at Boulia, Roxburgh, Lake Nash and amongst Kalkadoons, and thunder and lightning making by Kalkadoons.

From:
Roth W. 1897. Ethnological Studies among the North West Central Queensland Aborigines. Queensland government, Brisbane & London.
Pages 167, 168, Chapter 12
Rainmaking, Thunder, and Lightning-Making

The miorli men at Springvale or the Diamantina Gates execute a dance and song to bring rain.
The rain stick (*koo-roo-mun-do*) is made of a thin piece of white wood about 400mm long. Three pieces of white quartz are glued on the end. Beard hair is added and further embellished. More than one stick may be used. Around midday the men go to a secluded water hole where preparations lead to the dance. When the rain falls the koo-roo-mun-do is removed. In the heavy floods of early 1895 the author was assured that all the rain and water was produced by the miorli men. The author notes a variance of this ceremony at Rosburgh at Headingly, Lake Nash Leichardt-Selwyn district.

From:
Roth E 1903. North Queensland Ethnography: Bulletin No. 5. The Northern Protector of Aboriginals, Queensland. Home Secretary's Department, Brisbane.

Superstition, magic, and medicine
Page 8, # 10.

Thunder, Lightning and Storms.

Thunder is the most potent agency known. Thunder and lightning made men and women. At Cape Bedford thunder can produce lightning by the rapid exposure of his generative organ. These stories from north Queensland show that the Aborigines in the early 1900's often believe that men can make thunder and lightning. On the Bloomfield River storms are made by killing a particular kind of lizard. There are other ways of interfering with nature which cause lightning and thunder. Storms can be started and stopped by men. This book has great detail about power and ceremony, but does not have stories of prior extreme events. If you are interested in ceremony, read this book.

People from the Cairns area
From:
Moyle AM. c1970. *Introductory Notes to Songs from Yarrabah*. Canberra: Australian Institute of Aboriginal Studies.

"People of the Kurakulu or Kuraminya moiety" (exogamous groups), "occupied the shores of Mission Bay (*mira wungala),* Palm Beach *(giriga)* and Turtle

Bay. To the Wet Season division belonged water, cloud, rain, thunder, shark, 'alligator' (crocodile), water snake, eel, wild duck, white timber, and other light-coloured things; to the Dry Season division belonged subjects such as rocks, clay, fire, grass, kangaroo, emu, pelican, sun, star and wind (McConnell, 1935)."

The power of the Mornington Island Weathermen

From:

Trezise P. 1993. *The floodmakers of langu narnji (Mornington Island)* in (Ed) P Trezise *Dream Road.* Allen & Unwin Pty Ltd. NSW.

Chapter 7

The floodmakers of langu narnji

This story is about the Lardil peoples of Mornington Island. The stories were gathered by the author in 1964.

"The tidal influences in the Gulf of Carpentaria are similar to those in the Gulf of Mexico, there being usually only one high and one low tide in each twenty-four hours. During certain phases of the moon the tide may 'double', and may also remain high or low for longer than the average period. Strong winds also have a marked effect on the tides; a strong persistent south-easter may create an abnormally low tide in southern reaches, whereas a strong northerly wind, usually associated with a cyclonic disturbance, may cause the tide to back up in southern reaches and cause extensive flooding in low-lying areas."

"The Lardil" of Mornington Island "have many legends of great floods that occurred in the past. One story relates that during one great flood only the trees on low ridges of Forsythe Island remained above water, and the Jungarl people survived by tying their rafts to the trees. On Langu Narnji only the top of a twenty-metre-high sand ridge could be seen.

In 1948 a tidal surge which rose three metres above king tide level was said to have been caused by Shilling, a Lurrumbanda man, who, after a quarrel with the missionary, had gone to Langu Narnji to make a flood in revenge."

"The Lurrumbanda say they were blamed by surrounding people for every flood which occurred, whether they had made the flood ceremony or not, and united war parties often came to attack the Lurrumbanda after disastrous floods. The Lurrumbanda exacted tribute from adjacent island and mainland clans by promising not to cause any more floods."

"The floodmakers do not speak as they rejoin their families to prepare for the coming flood."

"The flood may come in different ways, it may come as a giant tidal wave in clear weather, or as a series of tides, each mounting higher and higher; but it usually comes with a cyclone. The first sign from Dewallewul may be a large ring around the sun by day, and the moon at night.

Then the air becomes hot and still. The clouds become denser and darker, and the wind begins, soft and sighing at first then becoming stronger and more gusty by the hour. The rain commences and increases to a steady downpour. Gusting winds get stronger, then cease abruptly and the moaning roar of the next gust can be heard coming far off. Finally a distant roaring is heard, getting louder and louder until a powerful wind engulfs the whole island with horizontal rain and a thunderstorm roaring as it smashes all the trees. It may last for many hours and all the people can do is roll up in paperbark and huddle together on the ground until it is over.

Due to a much lower barometric pressure, the main flood surge is contained within the central eye of the cyclone, and if its arrival coincides with a king tide it produces a flood from which nightmares and legends stem.

When the people consider they have caused enough trouble they have a meeting and ask the flood men to stop the storm. They gather up stones on the beach, make a big fire and heat them. When the stones are very hot the flood men rake them out, and using bark to protect their hands, pick up the stones one at a time and run down the beach to cast it into the tunnel of a wave as it curls over to crash on the beach. They continue until all the stones are gone and the waves know they must go back."

There are or were many Aboriginal groups who could exercise control over the weather (ie Mornington Island), but the following story gives one of many spiritual or Dreamtime explanations of the weather, particularly heavy rain. With much time for contemplation, and the human desire to explain everything (the modern approach it through science), there are Aboriginal stories explaining just about everything:

Making humans, getting children and causing flooding rains
From:
Mowanjum. 1980. *Visions of Mowanjum: Aboriginal writings from the Kimberley.* Rigby Adelaide.

Elkin Umbagai
The Spirit Water P 77.
Wandjina, or Ngarjaia made the world and everything in it including man and woman whom he made from two of his own ribs, one large and one small, which he threw into two separate pools in which they were created. Man went back to the pools in his dreams to get children, to give to woman, to bring into the world.
"When a child is stolen from the pool, both the Snake," which protect the child spirits of the pools, "and Wandjina are angry, and the water is stirred up to form clouds. Then there are always big rains and floods during which Wandjina and Wundgudja, the Snake, think they might find the spirit child and bring it back to the pool."

Second story group – extreme impacts and older people

From:
Napurrurlarlu NO & Jakamarrarlu NP 1988. *Ngawarra-Kurlu*. The flood. Yuendumu B.R.D.U. Darwin. p19.

Ngawarra-kurlu
The Flood
In this story an old Aboriginal man has a dream of a big flood. He tells all his people of the dream and that they should not sleep in the creek but they don't listen to him. He leaves to escape the flood. When he comes back after the flood there is no one around. During the night it rained heavily a long way up river. When the flood waters reached the camp all the people in the creek bed had to run to higher ground in the middle of the night leaving all their belongings behind. If they had've listened to the old man they would not have lost all their stuff.

Tsunami?

From:
Utemorrah D & Clendon M. 2000. Maambulbarda. Eye-of-the-sea.
In (Ed) Kimberley Language Resource Centre*. Worrorra Lalai. Worrorra Dreamtime Stories*. Kimberley Language Resource Centre. 113.

Eye-of-the-sea Pp 95
A long time ago a woman lived in the Montgomery islands with only one son. She was persuaded to let her only son go fishing with others. The son was washed overboard in a storm and drowned. She was very distressed and sought vengeance. " 'Karraai! Karraai!' she cried. 'My only son, why did they let him die?' Then she thought, 'So what can I do to them?'"

There was an Eye-of-the-Sea which she decided to stab. At night when the others were all asleep she paddled out and, stabbing the eye, caused the sea to rise "boiling up after her."

She climbed a mountain while nearly all the others were drowned by the rising sea. Some escaped and climbed the mountain too. When it was all over they stabbed her with many spears. Then they left and she is still there, on top of Mt. Wundamarro.

As with a further example about Lake Gregory, this is a version of the previous story, to show how the telling may be different, but the message is the same for oral history.
From:
Mowanjum. 1980. *Visions of Mowanjum: Aboriginal writings from the Kimberley.* Rigby Adelaide.

The Woman Who Destroyed the Old World
Near Montgomery Island, [generally north of Broome, Western Australia, now with a large Aboriginal Reserve on the mainland to both east and west], people could live all year round as there was plenty of food. An old woman and her people lived there hunting and fishing. Her husband would not share his food with her so she went to live alone vowing to "destroy these people, because they don't give me any of their meat."

She set out in her canoe. At two blow-holes on the reef "She picked up her wooden spear and stirred and poked the waters with it. Immediately the waters started to bubble and rise. She walked across the reef and climbed the highest hill she could see. The water rose and rose and flooded over the land.

Some of the men saw the woman on the hill and decided that she was causing all this trouble. They chased her with their spears and killed her. But they were too late - everyone was drowned.

And that is the story of the great flood. Even today our people are afraid to go near that place where the waters boil over."

Flood

From:
Robinson R 1968. *Aboriginal Myths and Legends*. Sun, Melbourne.

The Flood and the Bird-Men
Related by Kianoo Tjeemairee, Murinbata tribe. Pp 85.

"This Northern Territory narrative tells of the time called Kardoorair, which means 'at first all things were men'. It tells how a heavy and continuous rain fell day and night until the land was flooded by both the rain and the rising of the sea."

During Kardoorair, "a big rain began to fall. It fell all night, all day, all night, all day." It didn't stop and "covered all the country, the hills, the trees, everything. There was only water."

From:
Unaipon D. 2001. *The flood and its result.* Edited by Muecke S. & Shoemaker A. Legendary Tales of the Australian Aborigines. Melbourne University Press.

The flood and its result is a flood story of the Berrwerina people of Darling River.

The flood and its result
A long time ago there were so many families of animals they found it difficult to live together and so they had a great conference to try and address the situation. One particular tribe related to the reptiles had rainmaking abilities and their "totems were the elements Lightning, Thunder, Rain, Hail, and Wind. They were becoming important. They resolved that they would not consult anyone, but act as they pleased. This selfish family was the Frilled Lizard. They sent representatives to various parts of the country with the instruction: 'On days and evenings of the week preceding the new moon, let every Thunk cum bulli (Lizard) begin the singing of the Storm Song.'

And when the time arrived, they took their flint knives and cut the body, causing the blood, and then they smeared the body with fat and red ochre and daubed the face with pipe clay, and then began chanting their prayer song, pleading that the Great Spirit of the Lightning, Thunder, Rain, Hail, and Wind should grant this their humble request:
'Come oh Thildarrin (Lightning), come oh Rroararund (Thunder), Pa noondi and Miyundi, come with all thy force and destroy the Platypus family, they have become too numerous and they are more easily overtaken in the flood than any other tribe.'

And they sang and sang their song of the Storm until the last few days and evenings before the appearing of the new moon. Then great dark clouds began to mantle the clear sky, and out of the black cloud the lightning flashed and rent the darkened sky and earth, and struck terror into the hearts of the Animals, Birds, and Reptiles. And the thunder roared its reply to the angry lightning flash, and the winds came hurrying, all in response to the thunder's voice, tearing the limbs from the huge towering gum trees, uprooting smaller trees and shrubs, strewing them along its path, driving the rain and hail into every hiding place of Animal, Bird, and Reptile.

When the Bird tribe saw what was coming, they took to their wings, and mounted upon the wind, up and up, until they were far beyond cloud and storm, into lands beyond the sea. The Animals struggled into the blinding storm, seeking shelter up and up, dodging behind the trees and rock boulders of the mountain-side, until they reached the summit, seeking a place of safety. Thus ended the conference with no satisfaction but desolation and death.
It rained and rained. The valleys and low-lying countries were deluged, life living therein was nearly all destroyed in the great flood."

From:
Greene G., Tramacchi J. & Gill L. 1992. *Roughtail: the dreaming of the Roughtail Lizard and other stories told by the Kukatja*. Magabala Books, Broome.

Kalpartu the Dreamtime Snake

[From Billiluna country south of Halls Creek. Kalpartu the Dreamtime Snake is a flood story, recounted in English and Kukatja.]

"The Willy Wagtail man came for a visit but the people tried to keep him out of the dances. They teased him and made him feel unwelcome.
So Willy Wagtail man went for help to his cousin brothers, who were Dreamtime snakes.

You know what they did?

The snakes surrounded the dancers. They made a big flood, which killed all of the people except for one, who changed into a white corella. Now you can see these white corellas. They stay near the rockhole. They are the people who lived there in the Dreamtime."

Flooding of Sturt Creek and Lake Gregory

Compare the following 'Law from the south meets law from the north' with the oral version supplied to Goudie given at the beginning of this section.

From:
George Nunkiarry, Jara. 1996, Gurliliyin, gayiliyin mitim traibul lo -
Law from the south meets law from the north. In (Eds) Hunter A and Bin Salleh R, 1996. Moola *Bulla. In the shadow of the mountain.* Kimberley Language Resource Centre. Magabala Books, Broome WA. P 258.

"In the Dreamtime there came a huge flood from the east. It brought my ancestors from the east to Lake Gregory. It came downstream straight for where Inverway Station now stands. The flood came from Gulbulundu and headed down towards Birrindudu. It filled Sturt Creek to overflowing. Just the tips of the river gums along the bank stuck out of the water. White people, if they had seen it, would have said it was just like a tide coming in. From bank to bank it swept down to where Gordon Downs is today, to the south of the river. As it ran it met up with other floodwater from the north and west. That was where the crocodile and the goanna fought over their teeth.

The flood kept sweeping downstream and met smaller floods at Bindi Bindi or Sturt Creek Station. It filled up all the big waterholes along the river as it passed by Sturt Creek Station. As it went, the flood swept up birds of all kinds, ducks, guluyu – bush fowl, white people call them. It swept them all downstream towards Lake Gregory in the south, where two pelicans saw the flood and all these birds approaching. One of the pelicans said, 'I'll go north

and meet all these birds and bring them into the lake.' We say dabarunga but white people say pelican.

The two pelicans came up from the south and met the duck, and the bush fowl, and the brolga, and all the other birds caught in the flood. And that is how tribal laws from the south and the north met at Lake Gregory. In the Dreamtime the two pelicans brought all the birds together at Lake Gregory.

Billiluna used to be beside the lake; Billiluna old station, which we call Warngu. They moved Billiluna north to the higher ridges, and they built new houses. It used to be much closer to the lake. From Warngu, in the Dreamtime, two white dogs started to chase an emu. They chased it for along way to the west. White people might say they chased it for twenty or a hundred miles. We just say that they chased it for a long way west.

After some time, the emu started to swing around and run back the way it had come. Back towards the lake which is called Barugu. Finally, at the lakeside, the dogs caught the emu and cooked it and ate it. You have to remember in all these stories that the animals in those times were like people. After that the lake began to fill up from the south bank to the north. Barugu is huge. It might stretch as far as from Old Town to Palm Springs 1. To go around it is like going from Halls Creek to Fitzroy or perhaps to Wyndham.

Well, the whole lake started to fill up. White people would say it is like an ocean. We went round it once and it took us two nights camping to get around. My grandfather, grandmother and my father lived there and that is where they are buried.

The Sturt Creek is a central link for the desert communities in the East Kimberley. It is now common knowledge around Mulan that if the early floodwaters were a milky colour passing through the Balgo area, it means a major flooding rain north, about 5 days earlier, and the creek would probably stay up for months. If the water was red, it means local rains (from the smaller, near catchment), so the creek would probably go down again in a few days.

Floods and discipline lessons for children

From:
Mowanjum 1980. *Visions of Mowanjum: Aboriginal writings from the Kimberley.* Rigby Adelaide. Page 46, 47 and 48

How The People Were All Drowned

In Aboriginal Dreaming a tribe called Dillangari from NW Australia had huge dogs "as big as calves." Wandjina didn't want the dogs to talk and if they did he would drown everyone.

"So parents were very careful to tell their children never to tease a dog." The tribe went to hunt at a place with plenty of food, the men telling the women to make sure the children didn't tease the dogs, "and the women gathered the children together and warned them, 'First of all, you must not hit any special bird which belongs to Wandjina, such as Dumbi, the Owl. If you do, the Wandjina will send rain and storms and we all will be drowned. And the second thing is that you must not tease the dogs. Don't try to make them talk like us because Wandjina has told the dogs that they are only allowed to bark.'

The children asked why they couldn't play with the dogs, and the women answered, 'If you do, and a dog answers you, we will all be swallowed up by water. No one will survive. The Wandjina will cause the water to rise and drown us all.'"

Some of the women went to gather waterlillies leaving the children who began to tease the dogs. "Suddenly one of the dogs answered back, speaking like a human.

As soon as that happened, Wandjina caused the whole tribe to disappear under the ground and under the water. Only the Wandjina themselves were left."

From:
Utemorrah D and Clendon M, 2000. *Dumbi the owl*. In (Ed) Kimberley Language Resource Centre. *Worrorra Lalai. Worrorra Dreamtime Stories.* KLRC. Halls Creek WA Pp 113.

Dumbi the owl Pp 5

Young children were told not to torment the owl. One of the boys decided to kill the owl. Others tried to stop him but he climbed into the tree, grabbed the owl, pulled out all his feathers and threw him down. They stabbed the owl and tormented him in many ways. The Wandjina (spirit being) wanted to know from the owl what happened. When the Wandjina found out he decided to punish the children by getting rain. He got the dragon lizard to go out into the plain and wave his arms around to bring all the clouds. The dragon lizard did that. The rain and lightning came. That scared the children. Their parents

came back and asked, ‘What’s this rain doing,’ and figured out what had happened. The children said, ‘We were only playing with the owl.’

‘Well we told you and told you, when you see the owl you mustn’t hurt it. But you just wouldn’t believe us.’

The rain kept falling. The rain fell and lightening fell all around them. They swam about in the floodwaters, trying desperately to climb up into the highest hills. But the flood rose up higher and they all perished.” Only two children survived by climbing onto a kangaroo, but “the Wanddjina destroyed all the other people. They all drowned and the land was left empty”.

Lightning

From:
Ellis J. 1991. From the Dreamtime: Australian Aboriginal Legends. Collins Dove, Melbourne.

The lightning man
A lightning man called Wala-Unayua lived deep in a waterhole in the Liverpool River in Arnhem Land. Local people knew he was easily angered and would strike people down with lightning. “He was at his most dangerous, however, during the wet heat of the monsoon season. As soon as the monsoon rain began to fall, Wala-Unayua would fly into an uncontrollable rage. In that rage he would travel across the sky, hiding in thick clouds, and his angry voice would thunder, crashing and echoing across the land.

Flashing the lightning of his long arms and legs he would savagely attack the earth, throwing down the trees and leaving a stricken landscape in his path. As soon as the monsoon season came to an end he would gradually become calmer, eventually returning quietly to his own waterhole. There he would stay, always on the watch, ready to strike out again if anyone or anything dared disturb him.”

From:
Roe P. 1983. *Duegara* in (Ed) Muecke S. *Gularabulu: Stories from the West Kimberley.* Fremantle Arts Centre Press.

Duegara
“’All right that old man said no more he –
he don’t want any trouble –
no fight no nothing-
so you keep the woman’-
‘Aah all right’ he say –
but this man know too –‘”

“’oh big rain you know cloud coming up –
biig cloud –
biig cloud –
soon as he come close you know ooh lightnings

everywhere –
biig lightning –
strike everywhere –
“Oh we better rush back” these fellas said –
big rain comin’ they had lotta fish too –
they all run back this five man –
and five woman there too –‘”

“’so this lightning now –
rain rain rain rain rain jus’ pouring –
now ONE LIGHTNING COME –
he strike –
he strike right underneath this woman –
you know ah –
lift ‘im up –
chuck ‘im outside –
pieces and guts head –
oh liver heart everything –
aall pieces everywhere –
and this woman was in the middle –
this two –
four woman here you see they put ‘im in the middle –
but the lightning come from right underneath him –
lift ‘im up just chuck ‘im through the door in pieces and
finish – ‘”

Nearly all the above stories directly describe a major event of some type – flood, cyclone, tsunami, thunder or lightening. They too nearly all have a morality play or lesson attached, with death for the disobedient or those lacking in morals. They are included in this study as an anthology, a record, and to show that, along with clear geomorphologic evidence (ie Bryant and Nott 2001) about the realities of prior extreme events, the stories strongly support the idea that there will be more extremes – reinforcement of the ‘not if but when’ precautionary approach to preparing for impacts of extreme natural hazards.

The next Section moves into the period of recorded history in Australia, from the wild weather extremes of the Darwin area in the early 1800s, through the formation of BoM in 1908 to two highlights, and sets of lessons for planners and weather information managers from extreme events in the north during 1974.

Section 7
Extreme weather impacts - recent

The lessons from the following are developed though the remainder of the report. Since these documents were generated, by 2004 we have fantastic and reliable extreme weather information sources, giving us workable lead-times for physical responses on a community, family and personal level to ensure relative safety.

We learned much from the Brisbane floods of 1974. Much of our current procedures and approaches seem to stem from the national extremes of 1974, especially Cyclone Tracy. In reports there are themes of needing more knowledge about the vulnerable public, greater community awareness and involvement in the preparation of their own safety; of their own community's safety.

This resonated, as if news, at the National Disaster Conference in Canberra in 2003 - http://www.ema.gov.au/ema/emaInternet.nsf/AllDocs/RWPCF58C27A2F8961D3CA256CDF007BD1AC?OpenDocument . We are progressing into the realm of 'Safe, aware communities' more than indicated in 1981 by the surveys conducted after the 1974 Brisbane floods. However, when I surveyed post flood 'victims' in Cloncurry in early 1997 (King and Goudie 1998), the most common responses were that flooded residents thought '..the flood would not get me.' Most were aware of it, watching and drinking beer on the Saturday afternoon.

Emergency managers are vested with the responsibility of 'educating, preparing and helping', but BoM have the unique role of informing people of the likely severity of an extreme weather impact.

Major natural disasters cause major stress. The Cyclone Tracy report (below) shows that encouraging families to keep together should be part of the information in the blurry boundaries between where BoM have done their best to warn and inform, and the various SES are helping motivate people to act in a precautionary way with safety and wellbeing central to preferred behaviour.

The following gutsy reports of the 1800s and early 1900s, and development of BoM from then onward reminds us how timeless and devastating are the extremes of nature; how long we have been developing ways to 'read' and convey information about extreme weather.

Recorded history of cyclones in Northern Australia

From:
Larrakia 2001. *Saltwater People: Larrakia Stories from around Darwin.* Larrakia Nation Aboriginal Corporation, Casuarina, NT.

1897 Cyclone killed many Chinese and Aboriginal people in Darwin.
1905 landslide destroyed the Lameroo Beach camp.
1931 Reported from the S.A. Advertiser 31/3/31 the Larrakia theory of the cause of the earthquake. "At Casuarina is a large stone close to the sea. They believe this to be the King God, the first Aborigine and the creator of all others. Occasionally the tides reach up to the stone, and the aborigines state that the King God must have turned over in his sleep – 'big fish been bite um', thus causing the earthquake."
1973 cyclone destroyed Kahlin Aboriginal compound near Ludmilla Creek.
1942 Bombing resulted in the evacuation of 'mixed descent' Aboriginal people to SA and NSW and 'full descent' Aborigines to camps south of Darwin.
1974 Tracy. "The Larrakia say that this cyclone was made by the anger of Daribah Nungalinya or 'Old Man Rock'. He sits in the sea out from Casuarina Beach. No one should damage this rock in any way by chipping off shell fish, turning over stones or drilling holes. It is the body of a powerful ancestor."
Bunji January 1982.
Copy of text of Trevor Reid's and Lorna Talbot's stories of Tracy.

From:
Murphy K. 1984. *Big Blow Up North - A history of Tropical Cyclones in Australia's Northern Territory.* University Planning Authority, Darwin.

Chapter 1
First Experiences
In April 1827 a severe storm hit Melville Island. The following is an account of the aftermath by Major J. Campbell in a report to the Colonial Secretary.

"My returns of the 24th of March will show the then state of the gardens, but I am sorry to state that our exertions have been nearly all rendered vain by a very severe gale or tempest on the 2nd of April, accompanied with torrents of rain. It commenced a little after midnight on the first, and lasted without any abatement of its violence until after sunset on the 3rd. It threw down all our fences, either broke or rooted up mostly every fruit tree, destroyed a great part of our only present vegetable, the Bringit, completely destroyed all the corn that was planted in November and December, and unroofed all our huts and sheds. The sea rolled in with such violence that it swept away the wharf, foundered and deprived us of a new boat, and stove in the bottom of our only remaining one. I am happy to say that neither the Anne or Isabella sustained any injury, although the latter drove within a few yards of the rocks."

On 24th November 1839, just twelve months after the establishment of the township Victoria it was devastated by a severe tropical cyclone. "The wind was rising to a tremendous hurricane from the east, …the seas thundered,

…with the barometer plummeting to 965 millibars and the hurricane reaching its peak."

"The wind shifted to all parts of the compass before tearing in with renewed vigor from the north."

In November 1839 a similar event occurred at the Victoria Township of Port Essington when a severe tropical cyclone devastated the town killing 8 people.

"The scene ashore at the" Port Essington "settlement was one of complete devastation. Everywhere the trees had been either uprooted or stripped of their foliage. All the gardens lay in ruin, and many of the stores and provisions had been lost or rendered useless, including those previously salvaged from the wreck of the naval storeship *Orontes.* The cottages were either levelled to the ground or left uninhabitable by the tempest. The solidly built pier was totally destroyed, as was the newly erected church. The Government House, a sturdy building on stone piers, had been bodily removed about nine feet from its foundations. Most other buildings were demolished or badly damaged. The boathouses were gone, and of the twenty boats between the settlement and the ships-of-war, only the whaleboat and gig aboard *Britomart* remained."

In January 1882 at Palmerston another tropical cyclone passed by.

"..The barometer continued falling rapidly, and at three p.m. on Monday stood at 29.351, (994mb) the lowest we remember having seen it in the Territory. About this time the wind veered round to the west and west-southwest, and the gale reached its height, blowing with terrific squalls of almost hurricane force."
"The rainfall for the next three days was nearly nine inches."

Chapter 2
The Great Hurricane
In January 1897 Hugh Christie, the head lightkeeper of the Charles Point Lighthouse, near the town of Palmerston, Port Darwin, recalls the frightening events when the eye of a tropical cyclone passed over Charles Point.

"The wind however became stronger as the night advanced, and at 8pm the barometer was 29.20, at this time I went down to see the dinghy, but could see nothing, the tide being too high. At 10pm I attempted to go down again, but was fairly beaten back by the force of the wind, the glass had then fallen to 28.60, branches of trees were flying about and the houses as well as the lantern were wet with rain driving in."

And later "…when shortly before 3am the full force struck us, the front part of my roof with verandah was torn off and thrown over the cliff into the sea. The ridge of 2nd keepers cottage torn off and every house was filled with water.

Inside the house was a chaos of flying books, papers, photographic items etc. and outside was flying iron, stones and trees. I made for the lighthouse and had great difficulty in getting to it.

The 2nd keeper I found holding on to the lamp cylinder to prevent it being broken by the violent vibration of the structure. The way it oscillated was alarming, and our greatest anxiety was, that the Lens would shake out of their settings. However, I am glad to say, the lighthouse is not injured…."

And in the Northern Territory Gazette reporting on the same event it was written that: "The cyclone reached its highest pitch between 3.30 and 4.30, and in that hour it was impossible for human beings to stand erect against it. The crash of buildings and rattle of iron and timber falling about, combined with the blinding rain and roaring of the tempest, was an experience which those who underwent it will never forget to their dying day. Strongly built houses collapsed like houses of cards; roofs blew bodily away; lamp and telegraph posts were bent or torn up; immense beams of timber were hurled away like chaff; trees were uprooted; in many instances large houses were lifted bodily from their foundations and deposited ten and twelve feet away; and in short the night was one of terrifying destructiveness that made the stoutest heart quail. How it was that hundreds were not killed outright is one of those inscrutable mysteries which will never be explained..

When daylight broke on Thursday morning the scene presented was one of indescribable chaos and desolation. Words cannot do justice to the awful spectacle of ruin and devastation. Nothing but jumbled up heaps of broken and twisted material represented what the day before were comfortable and in some cases handsome buildings…."

In 12 hours "rain recorded was 11.670 inches (296 millimetres)….."

"The town of Palmerston lay in ruins," and in the days that followed, the towns' residents, due to being "homeless, and with poor hygiene and saturated clothing," "began to come down with fever."

Of the 28 people who lost their lives during the cyclone most were killed by the fever and 15 men died on the vessels that were sunk or stranded in the harbour.

Chapter 3
An Active Decade

"A significant event, in the context of this story, was the establishment by Act of Parliament of the Bureau of Meteorology in 1908. At this time the responsibility for matters meteorological in the Northern Territory was transferred from the Government Astronomer in Adelaide to the Commonwealth Meteorologist in Melbourne.

Reports of tropical cyclones during this decade are practically non-existent. However the next ten years, from 1910 to 1919, was a very active period. At least seven cyclones affected the Darwin region, and three severe cyclones came within 70 kilometres of the town. "

There are many accounts of cyclones.

Chapter 8 explores the evolution of a cyclone warning system. In the early 1900's there was little information that could be placed on weather maps. The use of radio during the 1920s meant that isolated communities could be linked through to the Bureau of Meteorology. Daily forecasts in Northern Australia began in 1925. The first flight between England and Australia in 1919 laid the foundations for much air travel including the development of the Royal Flying Doctor Service. This in turn generated the demand for improved weather services in the north.

More weather stations were steadily put in during the 1930s. during the second world war BoM came under the control of the RAAF, increasing their study of tropical weather systems. In 1958 the first weather radar was commissioned at Darwin Airport. In March 1963 the Northern Territory Division office was opened. In 1965 the Darwin Tropical Cyclone Warning Centre was established . The network has only grown since then.

Chapter 9 describes Cyclone Tracy in fine detail. About 70% of all homes suffered serious structural failure. In the northern suburbs all homes were destroyed. The book continues in fine detail to describe cyclone Kathy in 1984. Murphy notes that many cyclones have their genesis in the Gulf of Carpentaria.

Learning from Cyclone Tracy[1]

The following builds on the work already reported and considered above. The key issues were preparedness, effectiveness of information-sharing and warnings, effective and timely mobilisation of those likely to be threatened, and learning what has improved in the past thirty years. Now we have mobile phones, the internet, satellite and radar images accessible by 'the public'. We have high resolution predictive weather modelling. The key issues, however, remain in front of disaster managers in 2004 and beyond: 'information hoarding' by some Authorities and complacency by just about everyone remain as challenges.

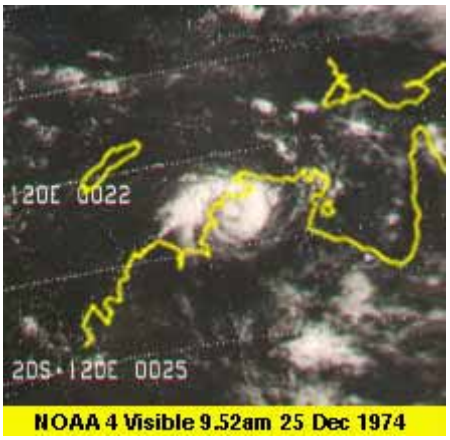
There are detailed web sites on Tracy; perhaps the most authoritative is from the Darwin library: http://www.ntlib.nt.gov.au/tracy/advanced/Cyc_Tracy.html With its iconic image of devastation:

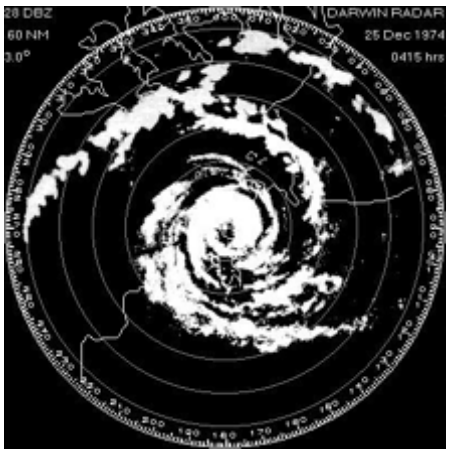
[1] **Vital Statistics of Cyclone Tracy**

Size	Gales extended to about 40 km from centre
Diameter of eye	About 12 km at Darwin
Maximum Wind Gust	217 km/h before anemometer ceased functioning
Central Pressure	950 hectopascals
Storm Surge	1.6 metres measured in harbour, 4 metres estimated at Casuarina Beach
Rainfall	255 mm in 12 hours overnight
Death Toll	65 people
Injuries	145 serious injuries, over 500 with minor injuries
Number of Houses Destroyed	About 70% of houses with serious structural failure
Total Damage Bill	Up to $800 million (1974 $s)

From: http://www.ntlib.nt.gov.au/tracy/advanced/Met/Stats.html

Figure 7.1 Darwin devastation – Cyclone Tracy





Cyclone Warning issued by the Darwin Tropical Cyclone Warning Centre at 2.30 am 25/12/74.

To understand something of the human impact of a major Cyclone, imagine being in Darwin on Christmas morning 1974:

'Galeforce winds commenced in Darwin around midnight, and increased to a peak after 3am. The last warning was issued at 2.30am before both radio stations ceased transmissions.

At 3.05am a peak wind gust of 217 kilometres per hour was recorded at Darwin Airport before the anemometer recording system failed. Between 3.50am and 4.25am the eye passed over the airport after which the wind resumed its previous intensity this time from the southwest. By 6am winds were abating in Darwin.

The last radar image before tracking ceased shows the eye overhead. The morning satellite picture shows Tracy overland near Humpty Doo.

Tropical cyclone Tracy was located by radar at 2 am CST 18 km west north west of Darwin moving east south east at 6 km/hr. The eye of the storm is expected to move over Darwin soon. Winds should become lighter to calm for

a period up to 1 and a half hr before rapidly strengthening to its previous intensity from the opposite direction'.

From - http://www.ntlib.nt.gov.au/tracy/advanced/Met/25am.html

Table 7.1 shows that the research headed by Chamberlain into the human impacts of Cyclone Tracy stratified interviews with over 400 people who were in Darwin on Christmas Eve 1974 into people who evacuated, never to return to live in Darwin, evacuees who did return, and those who stayed through the cyclone's fury. It also shows that most people only learned about the cyclone within 9 hours of landfall. The central task of this 2003/04 research is to see how to best convey warnings in a timely manner.

Given the brief nature of effective warning to most respondents, it is not surprising that about 30% of respondents made no special preparations (Table 7.2), although about the same percentage did at least some of the following: secured loose items, while about 16% attempted to improve the resilience of the building, and about 22% looked after their food and water needs. Generally, less that 10% had followed a set 'cyclone drill'. Given that 65 people died, over 700 were injured and the resultant state of much of Darwin (Figure 7.1), in this instance, the CDS model for 'threats with warnings" (Figure 7.2) would suggest that major evacuation would have been the safest action, but of course the key questions are always: evacuate how, and to where?

Table 7.3 shows what Goudie (King and Goudie 1998) and many others (ie McKenna 1993) find repeatedly in post-disaster studies: the "It will not happen to me" syndrome. In this devastating example, predictable disbelief mingled poorly with Christmas celebrations. Some survivors reporting that it was felt that no calamity could happen on Christmas day – a sacred day. It is interesting to note that the non returnees tended to have received warnings earlier and taken the most internal and structural precautions, while the returnees heard about the severity, prepared and reacted about midway of the three groups. The exception with the returnees is that they tended to be least subject to a false sense of security. Stayers tended to hear last, did the least and took least notice of the warnings. These are indicative generalisations from a fairly small sample. There are many unanswered questions about whether stayers were injured or killed more, if they were in strong houses, or in houses with more protective vegetation (see section of 'Canberra Conference' report, following, for recent research insight into cyclonic protection from trees around buildings).

From:
Chamberlain ER, Doube L, Milne G, Rolls M & Western JS. 1981. *The Experience of cyclone Tracy.* Australian Government Publishing Service Canberra.

Table 7.1:
Time at which respondents first became aware of Cyclone Tracy danger

	Percentage		
Time of Initial awareness	**Non-returned evacuees (n=219)**	**Returned evacuees (n=107)**	**Stayers (n=90)**
By noon December 24	31	27	21
Between noon and 6pm	34	37	42
Between 6pm and Midnight	18	20	12
Christmas Eve unspecified	11	6	10
Don't know for sure	6	9	14

Table 7.2
Extent and nature of precautions taken before onset of Cyclone Tracy

	Percentage		
Precautions	**Non-returned Evacuees (n=219)**	**Returned evacuees (n=107)**	**Stayers (n=90)**
No precautions taken	26	26	34
Internal precautions – loose items removed from walls, tied down	32	24	25
External precautions – loose items stored away, tied down	30	31	21
Structural precautions – Doors, windows taped, roof fixed	23	12	17
Water and food storage	24	24	20
'Cyclone Drill'	10	8	5

Table 7.3
Evaluation of reactions to warning and reasons for reactions (modified)

	Percentage		
Reaction to warnings	**Non-returned Evacuees (n=219)**	**Returned Evacuees (n=107)**	**Stayers (n=90)**
Warning taken seriously	27	22	10
Warnings not taken seriously enough because:			
Christmas Eve Celebrations	24	28	27
False sense of security – 'couldn't happen here'	22	15	24
Christmas preparations	8	9	10
Not Christmas celebrations but not certain of cause	13	18	18
Other reasons	6	4	5

"Summary and Implications for Policy"

"The most important direct contributor to stress was the disruption of a familiar valued social environment, or its complement, being separated from (often immediate) family and friends and from easy-going social and leisure activities which were such a valued part of life in Darwin before the cyclone. This pattern of results applied both to stayers and evacuees."

"The importance of family and friends in assisting affected persons to cope with disruption caused by natural hazards is well documented. [It is proposed that] the intensification of interaction amongst family members and friends occurs because people, disoriented by a natural hazard, will tenaciously seek out familiar elements in their physical and social environments, and these elements thus assume a greater importance than they had previously displayed."

"The third important group of variables which contributed to stress had to do with personal problems such as nervous complaints, children's behaviour disorders and physical injuries of both adults and children. This relationship highlights the importance of preventative training. Avoiding all physical injuries is almost impossible, but among groups and immediately afterwards, such injuries may be kept to a minimum. The extent of injuries dealt out by Cyclone Tracy was remarkably small, but nevertheless injuries were a significant predictor of stress."

"The analysis presented here did not address the problem of planning for the impact of a natural hazard. The data did not allow measurement of the stress-reducing possibilities for individuals or families of being well prepared, but it does suggest that respondents were not adequately prepared for the cyclone's impact or its consequences. Research elsewhere (e.g. Scanlon *et.al.* 1976) has suggested that preparation on an organizational level is essential for efficiently moving people from their homes, or carrying out an evacuation of an area in extreme circumstances."

"Nervous complaints and behaviour disorders are in part a product of the individual's psychological make-up, but perhaps they could be lessened if awareness of the characteristics of cyclones and their effects was increased."

"There is clear indication that training programs in cyclone-prone areas are needed to advise people of likely events, and of how to ensure the safety and emotional security of themselves and their families, both during and after a cyclone. The task of encouraging individuals and groups to take such a program seriously would be a difficult one since the belief that 'it just couldn't happen to me' is widespread."

"When Cyclone Tracy was imminent (several hours before it struck), only 69% of the sample respondents had heard any official cyclone warnings, although most others had heard of its coming by word of mouth. The cyclone struck in the early hours of Christmas morning, but by 6pm the night before at least 17% of the respondents had not heard that it was imminent. Further, nearly a

third (28%) of respondents said that they did not take any precautions once they had been alerted to the cyclone danger. Seventy-one per cent did not take the warnings seriously enough. Such findings highlight the difficulty of persuading people to treat a training program seriously when danger is not imminent."

"This Figure 7.2
Brisbane flood 1974

From
http://enc.slq.qld.gov.au/logicrouter/servlet/LogicRouter?OUTPUTXSL=object.xsl&pm_RC=PICTQLD&pm_OI=8197&api_2=GET_DESCDOC&pm_RC=PICTQLD&pm_OI=8197&api_2=RETRIEVEINFO&pm_RELAY=PICTQLD&pm_OI=8197&pm_TPX=500&pm_TPY=350&api_3=GET_OBJ&pm_RELAY=PICTQLD&api_4=GET_FILE_INFO&pm_RC=PICTQLD&pm_OI=8197&api_5=COLL_GET_PEERS&LCI=0&num_result=5&REFER=results

From: http://lookingback.slq.qld.gov.au/page.asp?ID=79
Both images © State Library of Queensland

Research suggests that planning for the post-cyclone period is at least as important as planning for the impact. As has been suggested, families and community groups should be kept together wherever possible, but if this is not possible, people need to have been prepared in advance for the effects of separation from family and friends. Maintaining contact, although difficult, should be considered of utmost importance for people who have been separated. When evacuation does not occur people need to be prepared for the social and community disruption which will occur after impact, and which was shown here to be an important contributor to stress."

Detail of the 1974 Brisbane floods[2]

From:
Chamberlain ER, Hartshorn AE, Muggleston H, Short P, Svensson H & Western JS. 1981. *Queensland flood report Australia Day 1974.* Australian Government Publishing Service, Canberra.

"The summer of 1973-74 was one of the wettest in Queensland for many years, and in some districts the January rainfalls were the highest ever recorded. Almost every river in the State had been in flood by the end of the month, and in certain areas, especially in the north-west and the Gulf country, the flooding was far more extensive and of longer duration than occurred in the south-east corner. Considerable losses and disruption to normal living resulted, and for some people in these regions the impact of the abnormal rainfall and the consequent flooding would certainly have been as devastating as was experienced when the floods struck the Moreton region in the south-east.

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[2] ***Record Flooding -*** By 26 January flooding was reported in the upper Brisbane Valley, with the nearby city of Ipswich on the Bremer River (Brisbane River tributary) experiencing major flood levels. In Brisbane, periods of intense rainfall flooded small creeks, drains and floodways. These local floods, when added to the rising Brisbane River, produced the highest flood levels to date this century, swamping one third of the city centre and 17 suburbs.

Human Toll and Damage - Tragically, 16 people died, 300 were injured and 8,000 made homeless as 56 homes were swept away and 1,600 largely submerged. In all, 13,000 buildings were affected with insurance claims totalling about $328 million (1997 values), but this figure reflected only 'rain damage' and special commercial cover as domestic flood insurance is not generally available. The total estimated damage cost was in fact $980 million, with road and bridge repairs alone costing $112 million (1997 values). At the height of the flood, even ships, including a large oil tanker, were torn from their moorings on the river and damaged. At the same time, throughout south-eastern Queensland and northern NSW where every river was in major flood, the total damage bill (including Brisbane) was a staggering $2,200 million (1997 values).

From:
http://www.ema.gov.au/ema/emaSchools.nsf/AllDocs/RWP8829DA52178627DECA256C5D000362C6?OpenDocument

However, the south-east corner is the most densely populated area in the State, and the number of people affected by the flooding in the Brisbane River system was far higher than in all other areas put together. Insofar as the magnitude of a disaster is measured by the number of people who suffer ill effects, it is therefore not surprising that attention focused far more on what was being experienced elsewhere. Some indication of the seriousness of the flooding in Brisbane may be seen in the extent to which it was reported overseas. In Britain it made headline news, and actually held one of the top places in BBC news reports for three consecutive days!

As already stated, the summer was an abnormally wet one, with extensive cyclonic depressions bringing flooding to many parts of Queensland, but it was not till late January that the Brisbane River system was affected, as a result of the activity of the tropical cyclone code-named Wanda. By Thursday 24 January, the cyclone had brought sufficient rain to the Stanley River catchment area to cause flooding in that river. This has officially been recognised as the beginning of the flood period in the Moreton region, though the actual disaster sequence evolved over the seven days which followed, i.e. Friday 25 January up to and including Thursday 31 January. The events of that week and of the immediate aftermath, in the first week of February, are outlined in ensuing paragraphs.

Friday 25 January. By Friday 25 January, there was saturation in the catchment areas of the Bremer and Upper Brisbane Rivers and in Lockyer Creek, accompanied by significant run-off in all three. On this day also the first flash flooding occurred both in Ipswich and in Brisbane. However, at this stage few people would have been aware of the likelihood of river flooding in these cities, or the extent of the potential threat to property and normal patterns of living.

Saturday 26 January. By Saturday 26 January, it was obvious that a major crisis was developing. The Bureau of Meteorology issued warnings of major flooding for the Bremer and Brisbane Rivers, and for Lockyer Creek, and a minor flood level reading was recorded on the gauge at the Brisbane Port Office, with the river height at 3.56m. (The maximum height on the Port Office gauge under normal conditions is 2m). There was further flash flooding in Ipswich and in Brisbane, with the Brisbane River seen to be rising fast. By this time, many people in the areas which were flooded during the next few days had become aware of the seriousness of the situation and thought that their own homes might be flooded. The 1974 household survey, which was conducted as part of this study, showed that, by some time on that day, over 70% of the Ipswich respondents had reached that conclusion. Many other people not directly affected by flooding or the threat of it had also begun to be aware of the serious problem which was facing the two cities, and had become involved in activities aimed at helping flood ‘victims’. Relief centres had started to function and the then Lord Mayor of Brisbane Alderman Clem Jones, announced that he was setting up a Lord Mayor’s Disaster Relief Fund.

Sunday 27 January – Thursday 29 January. The three days from 27 to 29 January cover the period in which the disaster built up to its peak. On Sunday 27 January there were further warnings from the Bureau of Meteorology of increasing rainfall, and major flood levels were recorded at the Brisbane Port Office. The Bremer River peaked at 9 a.m. on that day, but the Brisbane continued to rise rapidly to flood heights approaching those of 1893, the worst ever recorded. The peak came in Brisbane on 29 January, but on that day the Bremer started to fall noticeably. By then both cities had experienced substantial flooding. Many of their residents were in temporary accommodation, having been forced to evacuate their homes with whatever clothing and other possessions they had been able to take with them as they fled from the on-coming flood waters. It is estimated that almost 90% of flood-affected people had moved from their homes, most of them on their own initiative, with some assistance from neighbours, relatives and other people in their area.

In Brisbane at the height of the flood, inner city, near city and suburban areas were inundated and the extent of flooding in private homes and business, commercial and industrial premises was unprecedented. To add to the sense of crisis, transport and other communications such as telephone services were severely disrupted, and large areas were without electricity. There was also some anxiety about the likelihood of food shortages, due partly to the flooding of warehouses and other wholesale distributing points (such as the markets), and fresh pasteurised milk was in short supply.

Wednesday 30 – Thursday 31 January. By Wednesday 30 January the peak of the crisis had passed. Flood levels fell appreciably in both the Bremer and Brisbane Rivers, and inundated areas slowly emerged from the receding waters. The task of cleaning up property and assessing the extent of the damage now began. This was in itself a disagreeable and distressing process; but for many people the distress, which came from re-entering their homes and seeing the trail of havoc left by dirty water and debris of various kinds, was immeasurably heightened by the realization that their household insurance policies did not cover damage by flooding. This meant that they would face heavy costs for restoration and replacements, except insofar as they might be eligible for some kind of government assistance. As a result, considerable interest and attention was focused on government grants – their extent and availability, and which of the flood-affected persons might be eligible to receive them.

There was a good deal of bitterness directed at certain sections of the community who were held in some way to blame for the disaster, or for the severity of its impact on individuals. Among the scapegoats the insurance companies ranked high, as did land developers, who had sold much property in the flood prone areas in recent years.

The general functioning of the city on 30 January was still seriously disrupted. There was concern about the threat to public health and fears that there might be looting of flood-affected property. By Thursday 31 January a week had passed since the first effects of the flood had been felt, and it was clear that

the worst was now over. For the first time in days the river height at the Brisbane Port Office was below 3m, and the threat of further flooding had apparently gone. Attention was now beginning to turn away from the event itself and to focus on its consequences, particularly on the financial costs of recovery and on efforts to alleviate the problems of the people affected.

Government departments, both at Federal and State level, were mobilizing their resources, and a great deal of effort was being put into the running of the relief centres and the collection and distribution of money and goods needed for relief purposes.

CHAPTER 5: PERCEPTION, PREPAREDNESS AND WARNING
In a society such as Australian society at present, where technical knowledge is typically vested in the hands of small groups of specialists, adaptation to environmental hazards has two dimensions. To begin with, the technical experts will have a certain level of knowledge both of the hazard itself and also of the nature of technical adjustments available to deal with it.

When one begins the search for information on the flood problem in Brisbane and other areas in the Moreton region, it is obvious that there is a good deal of well-documented knowledge available, but this technical knowledge is often recorded only in confidential files in government departments. At best, though information may in theory be publicly available, it seems that it reaches only other technical experts who are able to understand and assess it. By and large, it has not filtered through to affected people who may not be experts and therefore neither possess nor have ready access to knowledge of the nature and extent of the hazards in their environment.

Perception of the Hazard
The survey finding on the level of knowledge of the flood hazard among people affected in 1974 indicated that it was very low indeed. In reply to the question ‘Did you know that flooding was likely to be a problem when you decided to move here?’ as few as 27 respondents out of a total of 530 in Brisbane and Ipswich (i.e. less than 6% of the sample) replied ‘Yes’.

Some 111 respondents (21% of the sample) reported having made a check on the possibility of flooding when they moved to the area. Only 23 (4.3%) stated clearly that they had been made aware as a result of this check that flooding might occur in the area. Eighty-one (15.3%) had been advised that their properties were safe from the threat of flood.

It appears that despite a significant flood risk, even in cases where severe flooding is a possibility, the level of knowledge of the problem among householders in the flood plain is low, which contrasts with what is known to be the case with technical specialists. It is evident also that the level of perception of flooding as a hazard is as low even among flood plain dwellers. When asked if they had ever thought of the possibility of being flooded, 77.5% categorically said ‘No’.

A further 8% said ‘No’ and gave reasons or qualified their response with remarks such as ‘We were told we were out of the flood area’. Twelve per cent said ‘Yes’, but many of these had dismissed the possibility as unlikely or unbelievable.

Pre-Threat Preparedness

Few flood-affected people were ‘prepared’ for the onset of flooding. This lack of preparedness was one of the most obvious factors about the January 1974 floods in Brisbane and Ipswich. The overwhelming consideration is infrequency of major floods. Even where flooding is relatively frequent, the extent of flooding in January 1974 was a very rare occurrence.

‘Preparedness’ should be considered in at least two ways. Firstly, one can make the distinction between psychological and material preparedness. Then, one needs to acknowledge the difference between preparations made prior to onset and those which are made immediately before impact.

In the psychological sense, flood-affected people were ill-prepared for the event and its consequences. Some 20% of respondents reported without prompting that they had feelings of ‘incredulity’ and ‘disbelief’. About 15% of the sample said they had been ‘frightened’, or, in a few cases, ‘panicky’. By contrast, many fewer (9%) said they had resigned themselves to the situation, were accepting of it, or accepted the fact that there was little that could be done after the flood had occurred. Clearly people had not expected such an abnormal event, and had little in their previous experience to assist them in dealing with it.

With little difference in knowledge among flood affected people and few variations in the perception of the flood hazard, one would expect little variation in the degree of ‘preparedness’ in a material sense prior to the flood. The data bear this out. As few as 39 respondents (7.3%) reported that they had taken some precautions to protect themselves and/or their property. In some cases, though these measures were contemplated prior to the flood in 1974, they were temporary measures which were to be taken only under immediate threat, for example, sandbagging or evacuation procedures. Very few properties were insured against flood damage and/or losses. Approximately 10% of respondents reported that their homes were insured, but the majority of these were people living in homes they were buying through the War Services Homes plan, in which case it was a requirement of the lending authority.

Post-threat Preparedness

This lack of pre-threat preparedness does not imply that people did not attempt to make suitable preparations in the post-threat period. For the majority of affected people the most significant preparation was to evacuate their homes; 88.3% of the sample reported doing this. Some took this step very early, before flood waters had even entered their property, and were able to leave their homes in their own cars, taking some possessions with them. For others, evacuating their homes was a final expedient undertaken only when safety demanded it. Some 12% of the sample reported that they had not

left until after the waters had entered the main living areas of their homes. They then left on foot or in boats.

About 67% of respondents were able to make preparations immediately before leaving home. Most commonly, apart from taking smaller portable items with them, evacuees stacked possessions above the level they expected the water to reach. Almost 22% of respondents said they made no preparations, mainly because the threat was not recognised in sufficient time.

Perception of the 1974 Threat

There was a good deal of variation amongst respondents with regard to the level of water at the time when they first thought their homes might be flooded. The fact that the physical environment was interpreted as threatening at varying water levels by different people points to the possibility that responses to the threat will also vary. If this is so, problems would surely arise for relief organisations which plan on the assumption that disaster occurs in distinct phases such as 'warning', 'threat', 'impact', 'rescue', 'repair and rehabilitation', which can be defined and recognised.

It should also be noted that the most common 'first flood indicator', mentioned by about 45% of respondents, was 'watching the water rising'. This means that, in the absence of any official warning, response to the threat depended upon a factor on which there is a great deal of variability. Furthermore, the distribution on other items shows that many were inexperienced in interpreting the 'warning' signs. Most commonly, when they sensed the threat, people stacked their belongings above the floodwater level they expected. Yet they listed amongst their major losses such things as soft furnishings, bedding, objects of sentimental value, tools, personal papers, business records – all items which would have been portable, hence able to be saved if a more accurate assessment of the threat could have been made.

Warning

The survey sought to determine whether receiving an official warning (1) made any difference to people's perception of the threat or to their post-threat preparedness.

The results show that, to begin with, only 23.8% of respondents in Brisbane and Ipswich reported receiving an official warning. About 19.4% of the total sample said that an official warning had been their first flood indicator. Most of those who received an official warning did, in the event, experience severe flooding, though they were not necessarily the most severely affected of the population.

Receiving an official warning does not; however, appear to make any difference to the likelihood of making preparations. Realizing the flood possibility and receiving an official warning appear to have occurred close together for most people. Clearly, some respondents realised that their houses would be flooded before they received an official warning, but there were also a few cases in which the respondent still thought the house would <u>not</u> be flooded despite such a warning, and a small number of cases (17),

where householders received an official warning, but floodwaters only entered the grounds and did not reach the floor of the house.

Having had previous flood experience in the same place has meant that people are more likely to have thought of taking some precautions than others who have had no previous experience or who had had flood experience only in another place, but even so, most of those who had been flooded previously had not thought of taking any precautions against flooding. Clearly, neither the known existence of a flood threat nor even personal experience of flooding is sufficient to induce people to take special precautions. Nor do the data suggest that either those who have experienced more frequent flooding in the past or the few who have experienced more severe flooding are necessarily more cautious.

Turning now to the relationships which appear to exist between these groups of factors and 'impact', two clear points emerge.

First, a late recognition of and response to the threat is in many cases associated with a greater personal displacement – longer periods in temporary accommodation, longer time off work, emotional strain and a greater likelihood of dissatisfaction with residential location afterwards. A general lack of knowledge and/or awareness of the problem is also associated with these outcomes. Secondly, in almost all cases, severe flooding (i.e. a very high water level at the peak) bears a noticeable relationship to these factors.

Conclusion

The relative infrequency of occurrence of floods of the magnitude and scope of those of January 1974 is a factor of major importance for planning. Measures for community flood protection seem to fall into the area of developing efficient forecasting and warning systems, since mitigation works to cope with floods of great magnitude are financially out of the question, especially in view of their infrequency. Virtually no one would suggest that such schemes should be undertaken.

The relatively low ratio of cost to benefit for a flood forecast and warning service makes it an ideal flood protection measure in many areas where physical means cannot be economically justified. (Heatherwick 1974)

The infrequency also means that for the threatened population, impact is an unfamiliar event, and they are unprepared both materially and psychologically. The importance of the infrequency factor was also pointed out by Irish and Falconer (1976). They wrote:

A significant difference was noted in the response of people who had experienced the 1974 flood and those who had not… (T)hose who had lived in the area in 1974 were quicker to act once they had accepted the likelihood of danger…(T)he experience of the 1974 flood and the warnings given resulted in these residents having a high degree of awareness and readiness to prepare for the consequent flooding…

The initial reaction of those residents who had not experienced the 1974 flood was to look at the height of the river or creek and suppose it could not rise sufficiently to cause flooding.

Repeated warnings by the Council, by radio and by frequent contact with friends were necessary to convince these people. Even then however they were unsure of what to do. They had no idea of what direction the water would come from or how high it could potentially rise in relation to their houses."

CHAPTER 19: RECOMMENDATIONS

"This study has not resulted in pin-pointing a simple pattern of need on the part of persons affected by disaster. Rather, flood-affected persons exhibited a variety of personal and social characteristics in the face of severe disorganisation. In view of the complexities of designing and providing appropriate and adequate post-impact relief services, it is important to stress the need for broader government responsibility for preventing or mitigating disasters. In addition, however, the fact that a high proportion of flood-affected persons found support in their normal social networks rather than through specially provided services suggests that emergency welfare planners need to find ways of providing services through such normal network channels.

The following recommendations are based on these premises,

1. Prevention

Because of the technical nature and enormous costs of schemes to prevent or mitigate natural disasters in relation to the infrequency of occurrence, it is not realistic to expect the individual householder to take major responsibility which must be seen to lie with public authorities. It is essential that relevant departments at all levels of government assume such responsibility and co-ordinate to provide the necessary funding and technical expertise.

In addition, there should be more stringent regulation and planning of land use, and consideration should be given to the introduction of compulsory, wide-ranging insurance schemes.

2. Preparation

2.1 Since precautions against very severe natural hazards would be prohibitive in cost, even if feasible, efficient forecast and warning systems should be maintained and, where possible, improved.

2.2 All information based on past experience, current knowledge and future projections relating to disaster-prone areas and conditions likely to maximize risk should be public. That is, they should be readily available to householders or intending purchasers of property in the areas concerned, and, more particularly, in the hands of relevant organisations expected to act

in response to disaster such as the Police Department, the State Emergency Services and the Natural Disasters Organisation."

This echoed, as if news, at the National Disaster Conference in Canberra in 2003. We are progressing into the realm of 'Safe, aware communities' more than indicated in 1981 of the surveys post flooded Brisbane in 1974. However, when I surveyed post flood 'victims' in Cloncurry (King D and Goudie D 1998. Breaking through the disbelief - the March 1997 floods at Cloncurry. Even the duck swam away. *Aust. J. Emergency Management.* 4:12 29-33), the most common responses were that flooded residents thought '..the flood would not get me.' Most were aware of it, watching and drinking beer on the Saturday afternoon.

Against this kind of complacency (often based on wrong information), the Tropical Cyclone Coastal Impacts Program Workshop and Safer Sustainable Communities. 2003 Australian Disaster Conference were held 30 years after the 1974 Brisbane floods.

Section 8
Third Millennium approach to hazards

The disasters workshop and conference held in Canberra in September 2003 focused on mitigating the impacts of extreme weather events. They set out to make clear how to best inform people of extreme events we can detect in advance, and how to best mobilise people to act to maximise their safety and minimise their losses. The workshop and conference demonstrated a slow but steady convergence among researchers, emergency management policy makers and practitioners to advocate minimising impacts of extreme weather events by maximising community preparedness. Australia and the Pacific have knowledge, expertise and innovation capacity to work with communities, making them more sustainable in the face of extreme weather threats.

Summary of main points

Broad issues

Cyclone tracking is improving with multiple/ensemble models developing greater resolution and predictive accuracy. Greenhouse gas effects will not necessarily bring more cyclones, but they will have greater intensity with more flooding. Debate over global warming will not cool, with retrospective analysis of 150 years of cyclone records in the US indicating cycles of more intense cyclones about every three decades rather than any recent increased intensity (Ananthaswamy 2003*).*

Jim Davidson put a 1.4m surge height (above MSL) as about a 1,000 year event at Trinity Beach, Cairns. This gives an indication of 'return times' for cyclone surge.

The power of the sea should be taken seriously, with clear evidence of massive inflows demolishing a series of sand dunes in the Port Hedland (NWA) area in cyclone surges of 1999 and 2000. Sand does not stop a seething ocean.

Building strength

Building vulnerability – beware inward openings, under secured rooves and the vacuum effect of cyclones on the upward and down-wind sides of buildings. Rain blowing under flashing into buildings can cause major repair costs from wet plaster and fittings. Exmouth WA was battered by wind gust speeds of 267 Kph during cyclone Vance in March 1999.

Connection strength is vital for cyclone resistant buildings. A building may be blown to pieces because the clips on the tiles were not bent down, or the latch on the door was too weak.

Debris and its impacts are crucial to human safety during a cyclone. Also, public shelters are a vexed issue: from the external fabric, consideration needs to be given to debris resistant openings and good management so these are not compromised. Indicative research from Darwin implies increased vegetation provided increased house protection, via increased surface 'roughness', debris adsorption and helping anchor rooves.

Warnings

Reinforced throughout this report, the workshop participants were told that weather warnings should 'provoke people into doing something', and that agencies need to know that the message is received, understood, believed and confirmed. The information should be personalised and aim to lead to a decision to action.

Remote Australian communities do use electronic media for information and appear well organised to inform other community members of impending extreme weather, then to respond in a careful way. Simplifying the weather information language is supported.

A way of conceptualising and responding to extreme events is shown in Table 8.1. Responses are: stay and 'safely weather out the threat', or head for greater safety, comfortably before the threat hits.

Table 8.1

CDS Evacuation matrix:

responses to threats with or without warnings

A. Threat with virtually no warning		
Land Slide	**Earth quake**	**Tsunami**
Stay in strong structure	Shelter in strong structure	Flee rapidly to higher ground at outflow of sea

B. Threat usually with some warning			
	Evacuation decision[1] – stay or leave[2]		
Threat > Considering V	**Major wind/ Cyclone**	**Fire**	**Flood**
Vulnerability of present environment	If in surge zone or weak shelter, must leave	Consider house material, surrounds, water available. If poor, leave early.	May be inundated, may be cut off
Vulnerability of individuals	Weakest leave earliest	Weak and young leave early	Judgements of flood height
Distance and safety to secure shelter	The further, the earlier	The further, the earlier	The further, the earlier

1 Along with physical safety, community support may alter the decision to leave or stay.

2 People evacuating need to be prepared with a strong knowledge of the escape route as it is likely to be under adverse conditions, and using transport means which are reliable and suitable to the transport task.

The 2003 Emergency Management Conference

Australia's Attorney General told us that Emergency Management of Australia is within the Attorney-General's Department, where it is believed that "foresight and teamwork" are needed for risk reduction, while using land properly and safely, leading to "safer, more sustainable communities".

There is an increased emphasis on 'self-responsibility' if people choose to live in highly vulnerable areas. This is coupled with the need for careful planning, linked with the new reality that our well developed natural disaster response mechanisms provide 'a good foundation' for response to any terrorist attack.

Salvano Briceno, Director, UN International Strategy for Disaster Reduction, told us disaster reduction fell under the heading of sustainable development, and pointed out that there was increased vulnerability with climate change and predicted more extreme events. He felt we should all consider misdirected development which may increase risk. The UN aims to make communities more resilient, shifting the culture from reacting to preventing.

There is the powerful point that if countries remain passive until impact, it shifts costs to post disaster relief from other countries. The inference seemed to be that 'aid' countries should seek mitigation works rather than response support – much the same philosophical shift well underway within Australia.

The UN is advocating that countries develop adaptation strategies for people likely to be impacted by climate change, developing "sustainable, resilient societies". Mitigation of climate change includes reduced carbon dioxide output, and that development and natural disaster risk needs to be re-linked. There is a new advocacy for partnerships, with the UN declaring 2005 – 2015 as the decade of UN "Millennium development goals". That is the kind of language we all need, with time frames to match. Ten years just to plan how we want the direction for the next few hundred to go. There are known forces at play, and predicable outcomes to certain directions. This forethought is to be supported (http://www.unisdr.org/dialogue/).

Salvano mentioned development of a board game, a bit like snakes and ladders, developed to help families with kids to work from "risk-land" to "Safeland" when faced with various possible natural disasters. This idea is incorporated into the recommendations section of this research.

An AusAid representative explained Australia's readiness to act in response to any disaster in our region, including having the RAAF on standby. Government officials spoke of partnerships, of safe, sustainable communities, with non-competitive cultures; that there was a growing realisation of the cost of disasters. We are beginning to take "whole of government approaches", adopting an "all hazard" approach, especially with planning for "large scale natural disasters and high impact terrorist incidents".

In the "Sustainability and Disaster Management" stream, similar language was used: the third millennium language of "Think risk management and the precautionary principle … all hazards approach.. integrated natural resource

management" and the need to understand volunteerism: the foundation of most large scale response. Groups ending in _'care' or _'watch' were probably composed of people predisposed to help their community. There are strong links, perhaps unacknowledged, between emergency management and natural resource management.

Generally, volunteers are getting older, with emergency response organisations possibly combining with fire and ambulance into one extended unit, reducing duplication. At the global level, disasters are now seen as part of human management, looking for a new development paradigm of care and self-help/self-reliance.

There are Socio-psychological strategies to reduce risk. For example, in the Victorian fireguard movement, people work together to enhance their own collective safety. This movement is a resident initiative of neighbours in fire-prone areas, and is supported by the Country Fire Authority. These people-oriented ways of reducing risk have a high likelihood of long term success, with other benefits of increased social cohesion.

Insurance

The Insurance Australia Group takes climate change seriously, with Australia deemed to be the most affected of all developed countries, likely to produce an erosion of insurance cover in vulnerable (coastal) areas. There will be hotter days and bush fires. The April 1999 hail storm in Sydney caused the largest insurance payout ever in Australia.

The IAG is moving to understand the implications of climate change, adapt to those changes, and to mitigate causes, both through education and behaviour of IAG employees, all working to reduce GHG emissions. There may be vehicle insurance based on km travelled, support for more energy efficient homes, reduced car fleet sizes and encouragement for more energy-efficient urban design. All very laudable directions. This indicates that 'the mainstream' is beginning to understand that impacts we each generate add up to an impact that may diminish all future lives. This is a very responsible direction for IAG to take: as responsible environmental leaders.

Insurance is seen by the Insurance industry as the ultimate community product, while withdrawing a 'friction cost'; the core purpose was to 'pay claims'. It is important to communicate to the community that climate change will bring increased sea temperature, and increased frequency and ferocity of storms. Councils need to make flood plains more transparent to developers.

IAG is setting out to "reduce our own environmental footprint" In 2003 they are reducing their paper and energy by use by 15%, and fuel by 5%.

Children educating others

Teaching disaster management to kids may be the best way to get the information out into the community – at least to households with kids. Puppets, posters and fridge magnets seem to help people to respond appropriately as a disaster looms. We are reminded that children are citizens of the present.

There are three outcomes of education for citizenship: social and moral responsibility, political literacy and community involvement. Impressive though this was, the following speaker, Neil Barker, primary school principal seconded by Emergency Management Australia (EMA) for school education was a masterful presenter. He is working with curriculum, using Victorian Education Inquiry Learning approaches: think about a topic in general, decide what you need to know, think about more information, make decisions and act on them. It is also called problem solving or discovery learning. It works on loops of: ask, investigate, create, discuss and reflect.

Disaster management education has problems – it is competing in an overcrowded curriculum scrum. Further, people see schools as the social hospitals that will fix all our ills – environmental protection, relationship repair, bike ed etc. It does fit into Studies of Society and the Environment, so there is hope for inclusion from the national down through the states. It, in turn, can at best become part of the knowledge explosion. So inquiry learning is real-world learning, and there are many resources (web) available. Disaster preparedness could be sold as a good 'Key" into real and relevant study for individuals, with a personal development focus.

Remote Indigenous communities

In the session on working with remote and Indigenous communities, Ken Granger showed how very sophisticated computer simulations were used to inform village residents near Port Vila, Vanuatu, about how a surge may impact on their landscape. This empowered the communities to take mitigation strategies, including waste disposal and water supply. Granger's work prompted Recommendation 4 to simulate floods across real landscape to show residents and travellers the predicted disruption of the flood.

Working on language, central to weather warnings, Indigenous residents of the Pilbara and West Kimberley Western Australia were reported as preferring the word "Danger" to "Risk". Cyclone, floods and storms basically have the same impact, according to residents of NW WA. The remote area radio broadcast group (BRACS) is listened to and used extensively. There are now pre-season preparations for cyclones and floods. The presentation showed many slides of flooded communities. Nearly always there was dry land quite near where houses sat in water.

Marketing preparedness
People act on repeated warnings, if there is a consistent message from an authoritative source or sources, reinforced by others, and can be discussed in a family or among friends. It does NOT help if they have had previous warnings and had no hazard materialise. People are also less likely to respond 'appropriately' if there is no material evidence of a likely hazard.

Community education aims to 'make people act more safely' and 'help people help themselves'. It was stressed we needed grass roots 'conversational' involvement and a 'continuous development of knowledge' – 'Don't fear the threat, but respect it' was one of many slogans aired.

The outstanding feature of this discussion session was how many people wanted to say that getting community response or involvement was essentially a marketing exercise, usually undertaken by emergency managers with no skills in marketing. We agreed we need community champions, that the more networking the better.

Volunteerism
Conference delegates were told that there are 600,000 unpaid workers – volunteers - supporting other Australians, that we have to increase warning and response capacity while there is decreased funding for volunteers. We must develop ways the broader community may help in mass emergencies, to develop 'prepared communities', to help the community end of community participation in developing 'safe communities'.

Where to
The 'emergency reduction industry' speaks, more or less over the last 30 years, with one voice: greater community involvement. The 'how' of that has to be found locally, with incentives and personal recruiting, based on neighbourhoods of informed people. This may be a great challenge, as major threats are often rare.

Handmer (2001) suggests that a flood, for instance is actually 'owned' by the communities at risk. Individuals and organisations within these communities actively seek out information and mobilize their personal networks for action. (Handmer 2001, p24). In this way of looking at the warning process, the warning specialists act as mediators between the threat and the threatened. Local knowledge is used and the whole response process remains focused on safety and loss-minimization.

Section 9
Risk communication

A rich literature on risk communication ranges from a fine body of theoretical and practical considerations about the nature of communicating risk to rather scathing and detailed attacks on the self-serving way the media has previously used disasters. The following literature review and extracts on risk communication require little comment. Recommendation 18 (Section 12) explores the media links in more detail, based on the recommendation that the 'risk communicators and managers' seek to formally work with the media as an exercise in social benefit.

The literature makes clear a questioned assumption that the communication process is intentional and that the flow of information from the communicator to the target audience is the core communication task; that desired behaviour will emerge from that successful communication, and that all that really matters is communication techniques (Kasperson & Stallen 1991). Humans tend to be irrational, optimistic and hear what they want to.

Communicating risks is old, researching that communication was seen as new in 1991 (Kasperson & Stallen 1991). From 1993 'action statements' (what the at-risk person, family or community should do to minimise damage) are seen as central to the whole purpose of the disruptive weather warning (Salter 1993. See recommendation 2 in Section 11).

Like many other sources, Salter et al (1993) details the issues of risk communication messages in terms of: content, clarity, understandability, consistency, accuracy, certainty, frequency, channel, credibility, public participation, ethnicity, age, gender, roles, responsibility, elements, sequencing, synopsis, prognosis, location, action, warning timing, and action statements.

To have any chance of 'success', warnings need to have meaning which is shared between those who draw them up and those for whom they are meant to inform. They must also appear relevant to the individual decision-maker. This is no easy task given the distinctions between scientific-technological organisations and the "public" (Handmer 2001). It is not a case of saying: "a category three cyclone will pass over coastal town X" It is more a case of making sure the members of town X hear that message, and feel moved to take risk-minimising actions.

A complete and probably final intellectual framework to risk communication is provided by Rohrmann, reproduced in the following Tables 9.1 - .4 (2000, http://www.massey.ac.nz/~trauma/issues/2000-2/rohrmann.htm). There are many more risk communication-focused web sites, some listed in the Appendix.

The following model (Figure 9.1) identifies a set of message features (e.g., content clarity and acceptance), person characteristics (e.g., prior experience, cognitive biases, attitudes), social influences (e.g. , peers, media) and context factors (e.g., societal safety culture) which determine whether, and if so, how a particular risk communication regarding a hazard (i.e., a health & safety threat) influences individual risk assessment and management (i.e., risk appraisal, decision for preventive action and actual risk behavior and disaster preparedness). Three overlapping processes need to be considered and linked: how people deal with hazards, how risk information is processed and evaluated and how accepted information affects risk perception, evaluation and behavior. As interactive risk communication is far more likely to be effective, two-way communication pathways are looked at as well.

A comprehensive model of the risk communication process is indispensable for several reasons: It may be utilized as a heuristic for designing respective programs, for measuring and assessing campaign outcomes, and for identifying barriers to risk awareness and attitude or behavior change. The presented framework can be elaborated and specified with regard to the problem type, the target audience, and the relevant attitudes and behaviors to be dealt with. It has proven useful in several studies about technological hazards as well as natural disasters. Further applications to different kinds of hazards and a variety of risk communication techniques would be worthwhile in order to explicate the soundness of the suggested socio-psychological approach to analyzing risk communication.

A socio-psychological model for analyzing risk communication processes

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1 - Facets of risk information and communication

1.1 - Tasks, types, means, situations

Communicating about hazards and the involved risks for humans and their assets is a commonplace activity which occurs in a multitude of 'arenas', ranging from systematic campaigns planned by authorities to informal exchanges in occupational or private contexts. The notion of *risk communication* (RC) refers to a social process by which people become informed about hazards, are influenced towards behavioral change and can participate in decision-making about risk issues. Usually this happens in a context where risk awareness and preparedness are to increase; however, sometimes the aim is to reduce concern about risks.

Main types of RC are listed in *Table 9.1.* The aims of RC involve information, communication, education and management tasks. Many different means and procedures are used, depending on the demands of the RC situation.

1.2 - Actors and audiences

Risk communication processes involve a variety of 'actors' which may be senders, audience, or both. In addition to various risk-exposed people (employees, residents, consumers) and public authorities, further actors in the RC 'arena' are to be considered (cf. bottom of table 1), such as industry, scientific institutions, and various types of media; this alone makes RC a complex process.

Informing and communicating about risks is more likely to succeed when treated as a two-way process, when participants are seen as legitimate partners, and when people's attitudes and 'worldviews' regarding environment and technology are respected. This is particularly true in the case of risk controversies. Acceptance of risks is not an information/ education issue, it results from a societal discourse (Cvetkovich & Lofstedt 1999, Susskind & Field 1996, Wiedemann & Schuetz 2000).

Table 9.1 Rohrmann's components of the Risk Communication process.

Primary types of risk communication aims
Identifying unknown/difficult/controversial risk aspects (inducing RC problems)
• Advancing/changing knowledge and attitudes regarding hazards & risk-taking • Modifying risk-related behavior of people exposed to hazards • Promoting community participation in hazard mitigation • Facilitating cooperation and joint conflict resolution regarding controversial risks • Developing disaster preparedness and emergency management
Communication means & channels
• Print material (e.g., fliers & brochures), distributed by institutions/agencies • Product information, machine operating instructions, etc • Public information services, 'hot lines', etc • Educational video/film/computer products • Info presented via broadcasting, television, newspapers, journals & the internet • Expert presentations (at meetings, public hearings, trainings, drills etc) • Warning sirens (or messages through mobile loudspeakers)
Situations/'arenas' in which RC occurs
• Information campaigns by authorities • Fulfilling 'right-to-know' legislation • Public hearings, conferences etc

- Judicial proceedings
- Counselling contacts, medical advice
- Safety training courses, tests, exercises
- Advice for handling disaster impacts
- Evacuation
- Private situations (e.g. in families)

Target audiences and actors

- Risk-exposed people
- Industry/manufacturers/companies
- Scientific institutions
- The general public
- Administrative/regulatory authorities
- Journalists/media

Table 9.2 Rohrmann's main components of the risk communication process

<A>	HAZARD	The hazard (situation, event or substance) to which the people targeted in a RC process are or might be exposed to (i.e., a threat to health and safety)
<B>	RISK APPRAISAL (OR RE-APPRAISAL)	Awareness of hazard and acknowledgement of personal exposure; risk perception and evaluation (assumed probability, duration, severity, proximity, immediacy etc of impacts)
<C>	DECISION FOR PREVENTIVE ACTION	Choice between: risk-reducing behavior, new information search, no action (based on retention of received info)
<D>	RISK-REDUCING BEHAVIOR	Avoiding exposure or getting prepared for impacts (individual behavior and/or participating in group/community programs)
<E>	RISK COMMUNICATION MESSAGE - CONTENT	Message characteristics: argument strength, relevance, accuracy, clarity, etc.; focus: knowledge/attitude/behavior-focussed
<F>	CONTEXT OF RC	RC Source: type of institution, expert status, credibility; features of information distribution; social process of RC; "channel" characteristics (eg, brochures, TV/radio, print media, videos, www, "hotlines", personal presentations); constraints of the acting agency; also, interference with other information sources
<G>	CONFIRMATION EFFORTS	If information received and noticed: attempts to cross-check & validate the RC content (via same or

		more likely other sources), dependent on individual information needs
<H>	APPROVAL OF HAZARD MESSAGE	Personal acceptance of the message regarding the nature of the hazard and the involved risk for oneself
<I>	JUDGING EXPECTED UTILITY OF PROPOSED ACTION	Assumed effectiveness of the proposed measure to mitigate the risk (based on perceived difficulty, feasibility, costs and availability of alternative means of protection)
<J>	COMMUNITY / SOCIAL ENVIRONMENT	J1: attitudes and behaviors of family members, friends, colleagues etc. J2: social influence or pressure within one's social/cultural/political context
<K>	PERSON: CONDITIONS OF EXPOSURE	Actual exposure (intensity/frequency); reasons for exposure (e.g., voluntary/non-voluntary or occupational/private); personal experience with hazard; vulnerability (person and/or assets)
<L>	PERSON: RISK-SPECIFIC BELIEFS	Mental model of hazard; personal relevance of risk issue; belief in controllability; optimism bias; perceived benefits of risk source; risk propensity/aversion
<M>	PERSON: GENERAL INDIVIDUAL CHARACTERISTICS	Age, sex, education, health, etc.; cognitive abilities; interests; resources (time, money)
<N>	PRIOR BELIEFS REGARDING MEASURES	Knowledge and acceptance of risk mitigation measures (cf. <I>) held by the RC addressees *before* the current RC process
<O>	PRIOR RISK PERCEPTION	Existing hazard perception and risk appraisal (cf. <B>) *before* current RC process
<X>	RISK/SAFETY 'CULTURE' OF SOCIETY	General views held in society about the significance of risks and relevance of individual health & safety
<Y>	INSTITUTIONS FOR RISK/SAFETY/HEALTH MANAGEMENT	Public authorities and/or companies responsible for the health & safety of people (residents, employees, consumers etc) and therefore dealing with risk management

Several conceptual distinctions are important:

- The core process, an individual's risk evaluation and safety management in response to a hazard <A>, is divided into three steps: risk appraisal <B>, decision for preventive action <C>, and risk-reducing behavior <D>. In terms of stress theories, this includes two considerations: threat appraisal and coping appraisal).
- The content of risk information <E> is distinguished from contextual factors <F> of risk communication campaigns (the RC source and its credibility being a particularly important context condition).
- Evaluating risk information involves two separate steps: Acceptance of information about the hazard (its features and the likelihood and severity of adverse impacts <H> versus the subjective utility of proposed preventive actions <I>).
- Usually people already hold views regarding the risk matter - thus prior beliefs regarding risk characteristics <N> and mitigation measures <O> and those after the campaign <B, H, I> need to be studied.

The full model is presented as *Figure 9.2*.

The proposed causal links between the variables are indicated on a global level only, that is, for sets of related aspects of the risk communication process. (Note that 'feedback loops' are assumed as well but not fully outlined here).

Figure 9.1 Rohrmann's risk communication model – process framework

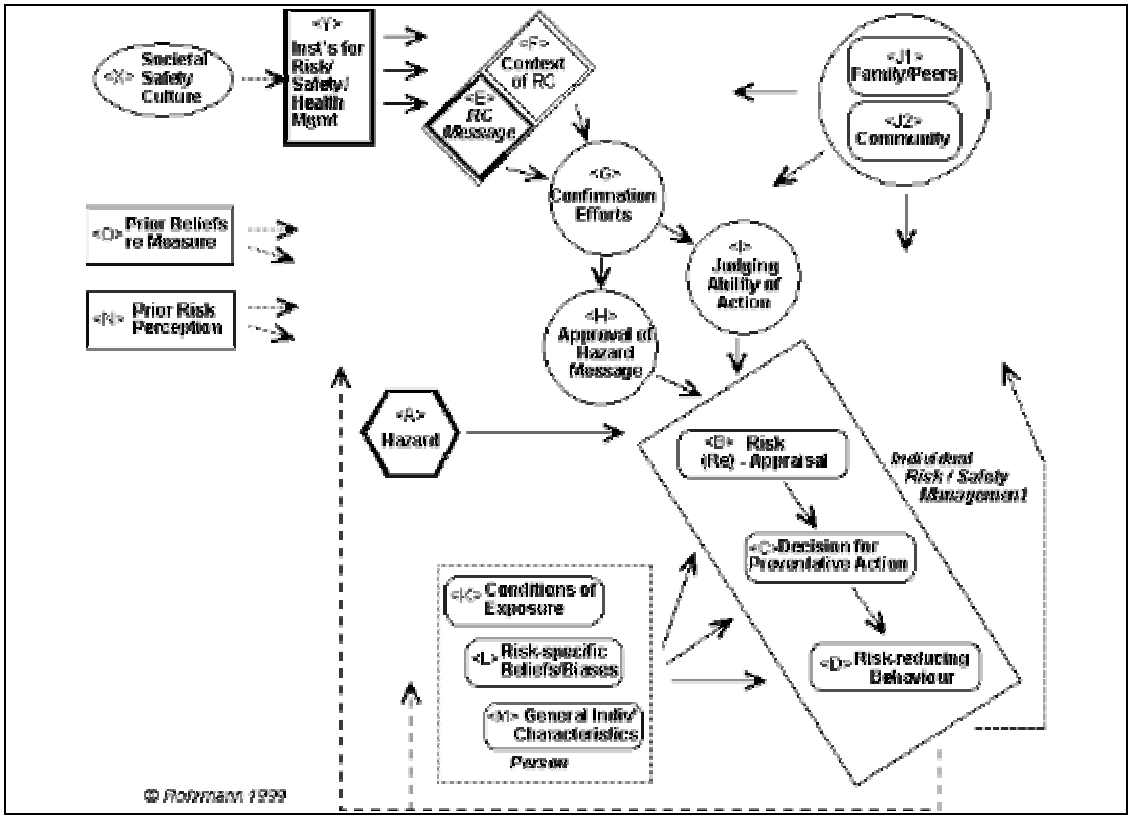
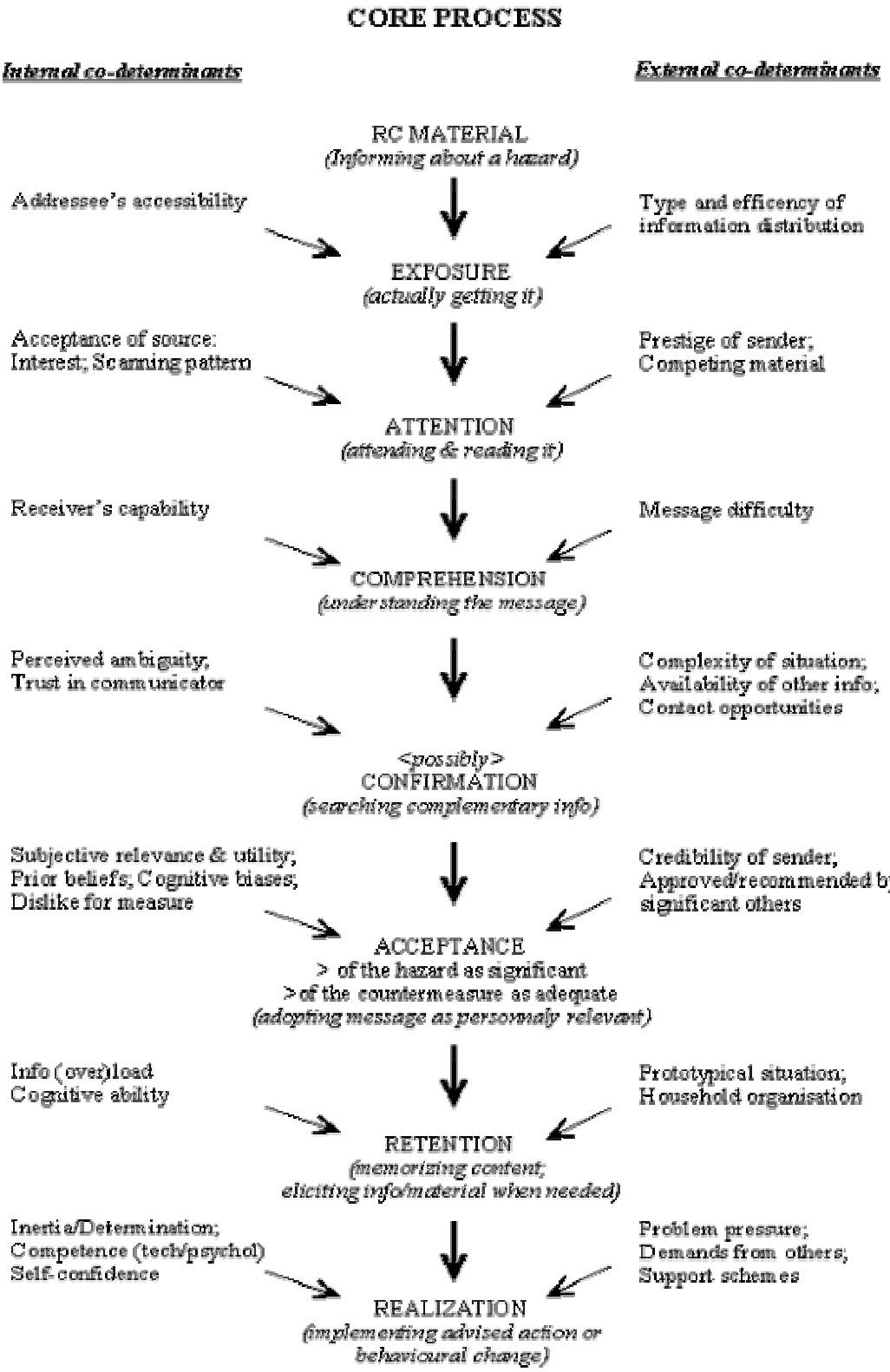


Figure 9. 2: Rohrmann's 'Informing about the risks from hazards: A framework for the information behaviour link'



From http://www.massey.ac.nz/~trauma/issues/2000-2/rohrmann.htm, Rohrmann 2000

Credibility and trust in risk communication

From the 1980s onward credibility of the information and the risk communicators has been seen as central to effective risk communication (Renn and Levine 1991). A long identified core issue is that there are many groups competing for credibility in the communication process. Since the early 90s it has been seen that high credibility sources produce the most behavioural change. Status matters.

The more explicit (message as a verb, the more 'persuasive intent') the better. People tend to respond to perceived fairness as much or more than they respond to apparent objectivity. Lending argument to other approaches is seen as more effective risk communication than just arguing for one line of response. If the goals of the communicator are seen to serve a common interest with high social values people are more likely to trust the embedded messages. In the end the sources don't necessarily have to be liked. It's the actual positive and understood outcomes of the communication message which matter the most (Renn and Levine 1991).

A pervasive and persuasive researcher and author, Handmer (following), particularly focused on flood warnings, makes in-depth links between different authority knowledge sources, impediments to effective warnings and the upgraded role the media can play as credible sources of information in risk communication. Handmer discusses some of the less obvious ways passively receiving a lucid warning may allow urban development in high-risk areas, and may encourage some high at risk people to ignore 'action warnings' in the hope of deriving insurance or other material benefits from being 'caught' in the hazard.

Effective warning

We should conceptualize a warning as a task focused only on the needs of people at risk. Flood detection and prediction systems are of no value if they do not result in appropriate action. So flood warnings are intended to signal those at risk to prepare for flooding both physically and psychologically.

Physical preparation would be to complete any travel to move flood sensitive equipment to safety and putting loved ones and pets in a flood free, safe environment. Psychological preparations may be triggering support networks and helping assure people where there is safe shelter and the likely limits to the flood water.

Informing all vulnerable people in a "total flood warning system" involves many groups and activities. Indeed there are many communities and many organisational groups. All of the groups need to work together to minimize damage and loss of life.

A flood warning turns a prediction or forecast into information in the form of an action statement. The purpose is to improve safety and reduce damages. They do this by communicating information to those at risk to take action to improve their safety and reduce damages: to enable "individuals and

communities to respond appropriately to a threat in order to reduce the risk of death, injury, property loss and damage." (BoM and AEMI, 1993).

Warnings provide an approach to risk management that allows the risk to be taken. Development may occur in flood prone areas or in areas subject to other periodic and predictable hazards because warnings will (or rather should) trigger appropriate safety and damage reducing behaviour[1].

A starting question for those designing and delivering warning messages is "what do those at risk need to know to reduce damages and improve their safety; and what is the best way of ensuring access to that information?" A detailed understanding of the community at risk and their warning needs as a prerequisite for implementation has long been a theme of the general risk communication literature (see eg Handmer and Penning-Rowsell, 1990; Vaughan, 1995).

It is difficult - if not impossible - to answer questions about local needs, priorities and access properly without consulting the people involved. The consultation should be a two-way process, more akin to negotiation, with the various stakeholders discussing their perspectives on the flood risk, and approaches to managing it.

In many areas local people may be unaware of the risk - a perception that will influence their response to warnings. The development of shared meaning through a negotiative process is consistent with the evolution of practice in risk communication generally towards the development of partnerships (Fischhoff, 1995). Fully shared meaning cannot be achieved without a thorough understanding of the population at risk.

From:

Handmer J. 2001. Improving flood warnings in Europe: a research and policy agenda. *Environmental hazards.* 3: 2001. 19-28. Pergamon.

Philosophy for policy review: Crying wolf or worse – applying the precautionary principle.

From the 1990s a strong issue of debate in risk communication has been “the right to know” (Barum 1991). Some disaster managers try to minimise alarm, claiming that by generating false alarms, there will be ‘concern fatigue’, and so they tend to delay alarm. Unfortunately, with long lead times and unpredictable weather, sometimes leaving things until it is clear there will be major human impacts may be too late to effectively act. Escape routes may be flooded, or too narrow to mass transport a panicking population (Goudie and King 1999).

[1] In contrast to the possibility that an efficient and reliable warning system may just be a clever way for Councils to allow urban development in vulnerable flood areas, the Queensland Government introduced a Planning Policy in 2003 (QG 2003) to specifically exclude development in flood or fire-prone areas.

The ‘precautionary’ approach is supported by the Economic Commission for Asia and the Pacific (ECAP), the World Meteorological Organisation and the Red Cross Societies. The alerting of the community and its responsible authorities must begin, at least provisionally, as soon as the existence of a tropical cyclone over the seas bordering the country is known“ (ECAP et al p16). According to ECAP et al (1997), the warning challenge is less clear for predicted localised downpours and flash flooding – how much effort should be taken to warn – what is the message, how do you keep it to the affected area, and what do you want people to do? These sorts of questions echo in Australia after the major hail damage in Sydney in April 1999, or the flash floods in Melbourne in December 2003.

Precautionary evacuations

Handmer (2001) reports an evacuation of 250,000 Dutch ahead of a flood threat in 1995. Eighty-eight percent of people surveyed in broad post-emergency surveys “believe that evacuation was appropriate.” (van Duin et al 1995 in Handmer 2001, p 24). In part this may be because of floods experienced two years prior. Good skills in dealing with the mass media appear to have helped in the effective precautionary evacuation.

Jargon or language detail

A recurrent problem in Europe is that warning messages are often written in jargon. For instance, in Britain colour coded warnings appear understood by few. If there are ambiguous official warnings people will seek informal information. That information may undermine the formal information implying that the informal information networks should be consciously used by warning managers. (Handmer 2001)

Salter et al (1993) points out that the use of meteorological category systems such as ‘minor’, ‘moderate’ or ‘major’ carry unambiguous information about the level of disruption likely from a particular flood. However, this is not true with the categorization of fire hazard e.g. in south east Australia a high forest fire danger is common as is very high although it is only ‘extreme’ fire danger which needs to cause protective action. Salter et al (1993) point out that the jargon categories of ‘high’ and ‘very high’ carry different technical meanings but are difficult to distinguish by many members of the public. Language used should not be for the convenience of the warning agencies. Its function is to convey clear unambiguous messages to the threatened public.

The politics of risk communication

Risk communication is often laden with values and political implications. For instance it has been argued that the reason for not having detailed local cyclone surge inundation maps made available at the corner store level in Cairns (Australia) is that such information may have a negative impact on local land prices. This is more a political decision than an attempt at effective risk communication.

Recommendations for the design of effective warning systems: findings from the research literature (Handmer 2001)

Warning messages should: be timely and reliable have local and individual meanings be forward looking suggest appropriate responses come from locally credible sources be reinforced socially (e.g. through personal networks) go to those at risk (usually a diverse group)
Warning systems should: make provision for easy confirmation and extra information use an appropriate range of message dissemination modes employ multiple channels for dissemination incorporate continuous learning and updating procedures

Warnings

People at risk need to know how to minimize impacts from a threat. The task is how to deliver that information. As has happened in the Indigenous weather knowledge research, it cannot be done properly "without consulting the people involved. Such consultation should be a two way process more akin to negotiation." (Handmer 2001, p 22)

The medium

Public address systems may be used where available either fixed in public institutions or in vehicles. These are most effective if used on populations without other ways of receiving the warning or during the night when most people are asleep. From moving vehicles it may be difficult to hear all the message (Sorenson and Mileti 1991).

The Media roles

The tension between what is newsworthy and what is 'reality' remains. Lichtenberg and MacLean (1991) argue that the press should never attempt to be a neutral transmitter but that the press should remain self aware.

Much is known, from systematic social science research done over the last 50 years, about the role and activity of the mass communication system (MCS) in natural and technological disasters. Among other things, studies have shown, first, that the MCS is a subworld of its own (with distinctive norms, values and beliefs not shared with the larger society), and second, that this system does not simply mirror or reflect the world.

News stories tend to be framed or structured in particular ways. For example, there is a strong tendency to frame stories in a conflict framework. Thus, a recent study showed that 30 per cent of all news stories present news through a combative lens (eg clear-cut conflicts, winners/losers, rivalry, etc

For most people, at least in societies where there is a very developed MC system, that system provides the most as well as the most salient information about risks, hazards and disasters. Individuals seldom acquire that

knowledge from personal experience. The MC system constructs that reality for most persons, including emergency managers, disaster planners and crises decision makers." (p 9)

Accompanying an ever increasing diversity of who and how, and also what is reported, is an ever increasing differentiation into specialized audiences. Part of this is the result of the existing ethnic and minority differences in American society, but some is the result of the growing diversity in that society, which in turn is the result of changes in lifestyles (eg among adolescents, who are split into many subgroups who expose themselves to rather different MC outlets). Overall, we are therefore faced in the future with ever more segmentation and differentiation, and basically a move toward ever more heterogeneity in MC systems (p 10).

…of 32 small radio stations, only 58 per cent pre-empted regular programming, as compared to 83 per cent of the large stations and 100 per cent of the 12 medium-sized stations. Furthermore, only 45 per cent of the small outlets and 50 per cent of the large stations increased their news staff in order to cover the disaster, while 91 per cent of the medium-sized stations had an increase in personnel. Finally, only 41 per cent of the small stations and 50 per cent of the large ones actually sent reporters into the field to report the disaster occasions, while 91 per cent of the medium-sized outlets did so" (p 12).

So unlike the handling of most news stories, news about disasters forces organisational change. Thus, this is an atypical situation for the reporting of news" (p 12).

"An earlier DRC study on radio stations suggested that gatekeeping is truncated during disasters, with news processing being simplified and some of the usual editing steps and stages skipped. The more recent research indicates that the previous finding of a truncated gatekeeping process is primarily true for the electronic organisations. In both radio and television stations there is considerable increase in the amount of live coverage during disaster occasions, with news stories not going through the everyday filtering process." "So the MC organisations not only change their structures during disasters, as we indicated earlier, but they also modify some of their central processes. The lessening of gatekeeping almost insures that there will be more factual errors and incomplete information in reports about disasters than in more routine time stories."

"Disaster coverage is massive. In one DRC study, local newspapers examined in nine communities struck by a disaster found the range of coverage was from 44 to 169 stories, with an average of almost 90 concerning the disaster in each newspaper. Of these news accounts, 33 per cent appeared on the front page and 55 per cent within the first three pages. In addition, a total of almost 700 photographs accompanied the 904 stories.

In another DRC study, which did not include all MC outlets, we examined the coverage of the radio and television stations in the community. The local

television stations produced a total of 175 reports during the first two days, or about 44 reports each day per station. In both cases normal programming was pre-empted, and the disaster was given very extensive coverage. Radio coverage, during the first two days, totaled 134 reports, or about 34 stories per station" (p 13).

"Radio in particular gets differentially involved. In fact, very typically, only a minority of stations provide special disaster coverage. One DRC study found that 19 per cent of all stations did not cover the disaster in their own community (either going off the air or continuing with normal programming). Another 30 percent never pre-empted local programming, and 28 per cent did not increase their normal allocation of time for news" (p 14).

"…citizen sources are employed more than usual, and used in different ways by newspapers and radio/television organisations" (p 15).

From:
Quarantelli E.L 2002. The role of the Mass Communication system in natural and technological disasters and possible extrapolation to terrorism situations. *Risk Management: An International Journal*. 4:4, 7 –21.

This section has shown that risk communication is complex, competing against many values, predispositions and distorting lenses. Rohrmann's fine explanations basically say that we may tell the target (at risk) population, but they may not hear. When they hear, their interpretation may be at odds with the intended content of the message. Authors like Handmer and Salter make clear that confused motives will produce confused outcomes, and many of the 'risk communication' authors explore ways the media could help, but often undermine the 'call-to-action' communication of the risk warning. Warnings are needed in Plain English, with clear graphics of the threat, embedding safety-oriented recommended behaviour from reliable, trusted sources. Warnings should be able to be discussed and reinforced with information from other sources. This is most likely to produce safety-oriented behaviour, with the constrained and clear assistance of the media.

Given the fraught nature of risk communication, the following Section 10 provides the discussion which helps develop the ensuing recommendations of Section 11, preceding some closing remarks.

Section 10
Discussion

This brief discussion summarizes and reflects on the methodology developed and tested in the research, and considers findings from the visited communities, and related literature on language and human understanding, including specific issues of risk communication. The research aims have been fully met, identifying 23 recommendations detailed and explored in the following Section 11 to help meet the identified weather warning needs of remote Aboriginal communities.

The methodology of asking target groups what they know and what they need to know should become core approaches to all applied social research. Representatives of Emergency Service organisations from two states have sought use of the developed research instrument and approach, implying a successful methodology.

Having sought feedback from the visited communities as community reports were finalised, the true test of this research will be the level to which the 23 recommendations are adapted and adopted by BoM and others. For instance, I am interested in the outcome of the brokered formal liaison between BoM and core broadcasters in the Aboriginal radio network across northern Australia, who are based in Townsville. This innovation, if successful, will produce more widely understood, Australian Plain English weather warnings. These more comprehensible warnings should be appreciated and responded to by a far larger audience than just remote Aboriginal peoples.

Along with the recommended development of Action Visual Warnings through BoM, Emergency Management Australia and others, outcomes of this research should have a wide application and role in minimising loss through extreme weather impacts across broad reaches of Australia.

Literature reviewed in this report shows that there has been a recognised need to improve risk communication and response in remote Aboriginal communities, and to some detailed extent, how to do this, since 1998 (EMAI 1998). Details of problems of great isolation, minimal populations, limited employment and massive costs for travel, transport, infrastructure and consumables associated with remote communities are also well understood (EMA 2002).

The 18 remote settlements visited to gather first-hand information provided clear feedback that BoM information was sought and appreciated. Apart from their own observations, the evening television news was the most likely first way that community members hear of looming weather threats. Residents would like more localised weather forecasts, and would like to see topographic detail on the radar and satellite images from BoM.

Details documented in the body of the report summarized some traditional extreme weather impact stories, while the two city impact in 1974 – Cyclone

Tracy, destroying much of Darwin and killing 65 people, and the Brisbane floods, killing 16, taught emergency planners much about the importance of effective warnings, sharing honest, complete and open information in a timely way to Emergency Managers, workers, and those at risk to ensure sound preparation and responses. The Australian natural disasters of 1974 (there was major flooding elsewhere in Australian in 1974) also reinforced the importance of community and family ties to get people through the often profound emotional trauma allied with major natural disasters.

Learning from practitioners and the past

The summary of the 2003 Disasters Conference held by EMA in Canberra (Section 8) shows that most of the 1974 lessons have been learned, but 30 years on, planners and emergency managers are still grappling with what social capital may mean, caught often between political concerns over unduly alarming people, including tourists with their dollars, and faced with warnings as a marketing exercise, in which they have no training.

The purpose of the research and this report is to improve the weather warning information into remote Aboriginal communities to minimise loss from flood, cyclone, windstorm or fire. The research found resourceful community members, usually with well developed counter disaster plans and warning procedure. With the uptake of the following recommendations, it is hoped the communities hear and see what they need to earlier than previously, and more clearly link warnings to their own need to respond to predicted threats.

Traditional weather warnings

Traditional weather warning signs included ant movement for looming flood, and general bird movement for strong winds, including cyclones. On Palm Island, when the birds and animals go quiet, it is a sure sign that a major storm may be on the way. The buildup to the wet is the universal experience of still, humid and hot conditions, continuing in intensity and cloud until the rains come.

Words and images

Word and image use are critical to effective communication. A newspaper graphic of 6/5/4 (Figure 10.1) conveys much about the world we now occupy. The image contains no words. The need for clear palatable messages which are most likely to provoke a precautionary response are supported both by communication and cognitive theory of Section 5, and the risk communication literature of Section 9. If this knowledge is melded to the research task, goals and feedback, clearer words and images will become the norm.

Figure 10.1 An image of terror in 2004

Time, perception and communication of risk

Risk communication is usually about attempts to prompt considered action by a person or community. Effective communication should make the future threat real present thinking. Alternative responses should be outlined, along with likely consequences. To further prompt a considered and active response to the 'action warning', the consequences of inaction or a range of defensive actions should be made lucid. 'Preferred' behaviour should seem reasonably attractive to 'target individuals' (Svenson 1991). The theoretical overview of risk communication in Section 9 explains why the message must be clear to the target audience. It needs to have some cognitive content (Section 5) to get people thinking about how it may impact on them, and what the alternative outcomes for them may be if the predicted impact strikes where they are. Stimulus and local risk simulations should be attempted to have risk groups properly think about the real threat, and to indicate to people what inaction may bring. A range of safety-oriented actions should also be presented.

Svenson and others make clear that it is not only what you may chose to do, but also when you do it. In the case of remote area warnings of flooding, for instance, when floodwaters may take a week to block down-catchment roads, travelling earlier than planned may be the best way to avoid the fate of the truck shown in Figure 10.2. Figure 10.2 may be used as an 'Active warning image', along with the image of the person standing on the car roof in the flooded road crossing to remind people to travel before or after expected flooding – not during the flood.

Figure 10.2 Nearly crossing a flooded road – Tully NQ 2004

From: Townsville Bulletin, 28/4/4.

Risk communication into and through communities

The model of hearing, understanding, believing and feeling that the information is personalized and that the respondent will indeed act has been well understood since the early 90s (Sorenson and Mileti 1991). The general issues of credibility (Renn and Devine1991) still apply. Efforts have been made since the 1960s to see how well people understood the hazard (Sorenson and Mileti 1991). These studies continue (Berry and King 1998). Studies reported by Sorenson and Mileti show increased knowledge as a result of risk communication efforts. People do become more aware of hazards and their personal place within the hazard threats. Unfortunately the link between knowledge and behaviour remains tenuous (Goudie 2001).

Overall, Sorenson and Mileti (1991) believe that increased credibility of the warning from its source means the warning will be more effective as a specific

warning. They also produce referenced evidence that the electronic mass media produced the most believable public warnings. This again underlines why development of formal links between all types and levels of media information about hazards and preparation, BoM and Emergency Managers, as developed in Recommendation 18, is so important. Having formal links with the media, coupled with 'real-terrain' simulations of the hazard will produce a powerful and effective 'active warning' regime. Knowing that the normal first warning of major disruptive weather comes via the evening TV news in remote settlements, simulations under the BoM logo will carry a high embedded likelihood of safety-oriented community response. BoM already has high community credibility. Other studies show that the print media is the most effective warning medium.

In line with current beliefs (Section 8) Sorenson and Mileti showed that the believability of warnings increases as people get more warnings from officials with high credibility. Women tend to believe emergency warnings more than men and people higher up the socioeconomic ladder tend to believe warnings more than their counterparts. Minority groups have lower than average belief in warnings while people with a high knowledge of the hazard tend to find warnings more credible.

Emergency personnel going door to door may be used in sparsely populated areas and have a high positive response. This happens from Palm Island and many of the other communities where outstations have no electronic media. In other remote Aboriginal communities, like Halls Creek, it was felt that the start of the wet was so obvious that people in outstations would come in when they thought 'the buildup to the wet' had gone on long enough.

Spreading the warning

Handmer (2001) recommends that the professional warning agencies should attempt to harness the "personal informational networks of individuals within formal communication systems, and by assuring that formal warning advice is consistent with local norms and behaviour" (Handmer 2001, p27). This largely happens in the remote communities. The Emergency Service or informal community networks generally provide systematic warnings to people unlikely to read or be otherwise told of the BoM posted warnings on the store and office doors from the BoM fax or web site provided by community administrators. Smaller settlements provide the best situations for door to door warnings to be effective.

With literature and research results discussed throughout this report, this brief discussion underlines the importance of local norms, and leads directly into the core report purpose of presenting and arguing for the following 23 recommendations. They all result from direct community input, observation, literature-based ideas or input from BoM staff. Each recommendation is either self-evident from the information presented in the report, or further argued and clarified. It is hoped they will be taken up, the ideas adapted and adopted by BoM and other agencies, trialled, further refined and fully implemented.

Section 11
Core research outcomes and recommendations on effective warnings of disruptive weather

To minimise impacts of threatening disruptive or destructive weather, the following research recommendations have the sustainability goal of warning and encouraging appropriate preparedness or mobilisation of aware and informed communities.

The goals are to minimise loss of life or injury to people in remote Aboriginal communities (and elsewhere) and minimise damage to property – to give people the information and impetus to properly prepare for and shelter from, or get out of the way of destructive natural impacts. The research shows people need to know about those threats in a timely and palatable form.

This implementation-oriented research recommends refining Australian 'Plain English weather warnings' (working title, suggestions welcome), developing a new, visual/graphics standard of best/most effective practice for what amounts to a marketing exercise in warning of extreme weather impacts in an attempt to stimulate relevant action. It is recommended that weather and flood data and warnings are fully shared within and between agencies then made public. This may involve development of computer simulations of, for example, major flood impacts across the terrain under threat.

Applied and inclusive research

This document was sent to a broad spectrum of Bureau of Meteorology (BoM) staff on 6/2/4 for responses and refinement, then, including such responses, to the broad array of participating Aboriginal communities or organisations. It is recommended that it is also posted to the BoM Indigenous Weather Knowledge site for deeper Aboriginal access and opportunity for response. The Internet allows for unprecedented and considered consultation with interested persons.

The implementation phase of this research is to help develop projects resulting from fieldwork by the author and others in 18 remote Aboriginal communities across northern Australia. A report of the six-month Indigenous Weather Information consultancy was presented and accepted via video-conferencing with a total of 24 BoM staff in Brisbane, Perth and Darwin from BoM Head Office in Melbourne in late December 2003. Discussions were also held with BoM staff responsible for the BoM Indigenous Weather Knowledge (IWK) Web Site.

Detail of the research fieldwork has been e-posted during 2003, included in this final report, made available through Centre for Disaster Studies (JCU) web site for participants in late May, then more broadly by late June 2004.

All email comments to this document are encouraged, and will be included and incorporated into further refinements. Douglas.Goudie@jcu.edu.au

Core Research outcome: receiving and using BoM information

The BoM web site was relied upon in virtually all the remote communities visited, but there is near-zero use by indigenous personnel. Most communities visited showed a high level of interest in the project and in the Indigenous Weather Information Web Site.

There were no negative views of BoM – people uniformly value the BoM information. Most value it highly. Table 11.1 shows high support for BoM. It records requests to reduce jargon and make forecasts as local as possible.

Table 11.1 Improving BoM forecasting

Community	Details
Ringer Soak	Want more detail on the TV.
Mulan	"What you get at the moment is brilliant" – Peter Shervington. We get good information. I check the satellite images every day.
Billiluna	Automate sending BoM faxes. The information in is good.
Halls Creek	More localised weather forecasts - living in the Kimberley, the forecast in Perth is quite irrelevant but most television forecasts are from Perth. The jargon used by the BoM can make forecasts difficult to understand. Forecasts in simple English will be easier to understand.
Oombulgurri	Broome Office rings. The police contact us. It would be good if the Broome Office, or Police, or somebody automatically sent us a fax when extreme conditions were threatening us.

Issues of effective warnings have involved the Bureau and others for centuries (Murphy 1984). Becoming focused on what and who the warning is really for has occupied much time and space. Independent of the realisation that warnings-as-a-verb was necessary, Handmer has been advocating the same, in places quoting Australia's highest warning authorities:

> A flood warning turns a prediction or forecast into information in the form of an action statement. The purpose is to improve safety and reduce damages. They do this by communicating information to those at risk to take action to improve their safety and reduce damages: to enable "individuals and communities to respond appropriately to a threat in order to reduce the risk of death, injury, property loss and damage." (BoM and AEMI, 1993).
> Source: Handmer 2000.

Recommendations from research in disruptive weather information into remote Aboriginal communities

Some of the later detailed recommendations are drawn from the 'Risk Communication' and other 'disaster' literature.

Read as: 'it is suggested that… or… it is recommended that…". as appropriate.

1. ***Australian "Plain English weather warnings"*** will be developed - Jim Davidson, Harvey Stern, Linda Anderson-Berry, Douglas G and TAIMA (Northern Indigenous radio network anchor).
2. An in-depth ***Call-to-action warning graphics and action statements – Warning as a verb*** project will proceed, liaising with EMA, SES and local communities. – Douglas G, Linda AB, Terry Hart.
3. Develop BoM forecasting to **pinpoint the start of the Wet** for regions of the North, liaising with regional communities and fuel suppliers. Sharpen predictive modelling to better pinpoint the exact onset of the wet with about two weeks lead time. TerryH.
4. **Develop simulations** of flood, wind or fire impact spread for media use. Start to develop crude simulations of major floods or destructive wind paths to attach to related extreme weather warnings (one year plan, see rec. 18). Feedback on likelihood/persons responsible?
5. **Agencies to share and make public flood and other threat data,** irrespective of any State or Territory borders. The BoM will ensure its warnings are directed to all people at risk and encourage other Agencies to do so. Terry Hart to encourage internal and external email dialogue to engender this – include copies to Goudie.
6. **Drop the word "severe**" from weather warnings when directing potentially disruptive weather information to areas of more concentrated Aboriginal population.
7. **Modify the Beaufort Wind Scale to help depict wind speed in Australian *Plain English weather language*.**
8. **Explore incorporation of Indigenous weather forecasts into mainstream forecasting data.** Terry H, Harvey S, Alisdair H.
9. BoM to support efforts to develop one web-based road flood warning system, based on the RACQ model.
10. A potentially commercially viable **board game** of ***Disruptive weather impact preparedness*** will be explored – Douglas G, Linda AB and Alan Sharp.
11. **Expand the Indigenous Weather Knowledge web site.** Put hyperlinks to Indigenous and weather radar links – Land Councils, Radio centres, Schools, Aboriginal art centres into the IWK front map. Use relevant symbols to link the IWK site to radar, and other sites of interest, providing a drop-down key. This will develop into a two-way interaction, hopefully leading; for example with schools, to kids developing local weather information back on to the IWK site. Lynette and Harvey.
12. Promote community weather awareness through **school competitions**, using air pressure as the central weather indicator and barometers as the prizes. Create school competitions about air

pressure and the weather – **prizes** – 5 barometers per school. Harvey. Once the hazard avoidance board game concept and detail is advanced (about April 2004), post to IWK site for feedback. Lyn, Harvey & Team.

13. **Make the BoM site** and the locally detailed cloud, flood and rain web sites **more widely known**.
14. **Automate** sending of Disruptive Weather Warnings to the more remote settlements as a **community service**.
15. Explore expansion of public weather warning signals (cyclone siren).
16. **Include more locational features on all radar base maps**. Put landmarks – main roads, rivers and all settlements on all base BoM website maps. Explore developing a base map which can be magnified to bring up the full array of local place names and features, with locations hyperlinked to schools, communities, land councils and radar sites (see below).
17. Where available, **incorporate Dreamtime stories** of extreme floods into estimations and illustration of Probable Maximum Floods.
18. Begin **negotiations with media bodies** and associations to become part of the formal warning process to target at-risk people. BoM, State SES and EMA (see rec. 4).
19. Use IWK site to offer **training** to remote Indigenous people to use the BoM and IWK sites. External training funds to be sought. Lyn and Harvey.
20. Explore **automatic translations** into Plain English weather warnings to place on IWK site. Harvey.
21. Australian Plain English weather warnings. Once the APEWW detail is advanced (about June 2004), post to IWK site for feedback. Team.
22. Test warning graphics. Once Warning graphics are in an advanced state (June 2004?), test for feedback via posting to IWK site. Links to climate/ local radar/ satellite in IWK site on front, portal map.
23. Use IWK web site as the platform to test Seasonal climate knowledge, anomalies and forecasts, soliciting input from community members on upcoming weather, and then comparing those predictions with BoM predictions. Possible outcomes – the uptake of Indigenous predictions into ‘ensemble’ modelling for weather forecasts. Harvey. Alistair Hainsworth showed real insight and interest in this innovative project. He is encouraged to collaborate with Harvey to bring it to testing and possible future incorporation into formal ensemble forecasting.

Detail of Research recommendations from weather information into remote Aboriginal communities

Some of the final detailed recommendations are drawn from the 'Risk Communication' and allied literature.

1. **Australian "*Plain English weather warnings"*** will be developed - Jim Davidson, Harvey Stern, Linda Anderson-Berry, Douglas G and TAIMA (Northern Indigenous radio network anchor).

If media material is developed, it will be important to use the local community as much as possible, and work with the local Bureau people and local media outlets, such as Sandy Dann at PRK Media at Halls Creek.

The language of risk communication is a well researched area. As with language development, and record of extreme events old and new, this and other recommendations only draw on enough referenced (and recently researched) material to convince the less willing that each recommendation is cost effective, inclusive and will help promote greater personal and community safety. They repeatedly refer to the core goals of BoM and EMA. The full report for June 2004 will display no such restraint.

Language detail

Salter *et al* 1993 points out that the use of meteorological category systems such as "minor", "moderate" or "major" carry unambiguous information about the level of disruption likely from a particular flood.

However, this is not true with the categorization of fire hazard e.g. in south east Australia a 'high' forest fire danger is common, as is 'very high' although it is only 'extreme' fire danger which needs to cause protective action. Salter *et al* 1993 states that the jargon categories of 'high' and 'very high' carry different technical meanings but are difficult to distinguish by many members of the public.

The point here is that the language used should not be used for the convenience of the warning agencies. Rather the language used should be for conveying clear unambiguous messages to the general public.
Source: Salter *et al* 1993, p 124.

"The jargon used by the Bureau of Meteorology can make forecasts difficult to understand. Putting more effort into presenting forecasts in simple English will make it easier to understand" (Halls Creek Informant).

Links between Townsville Aboriginal and Islander Media Association (TAIMA), BRACS, 4K1G, Townsville and BoM, to develop a fairer, more equitable warning language

Indigenous weather broadcasts

***Using Indigenous radio knowledge to refine weather warning language to remote Aboriginal Communities*.**

TAIMA has operated for 21 years and has 16 transmitters from Mackay to the Cape broadcasting 24 hours every day, while broadcasting through the National Indigenous Radio Service (NIRS) 29 hours per week. This covers all northern Australia, connected in and through remote communities via their BRACS transceivers. There are about 150 BRACS units across all of northern Australia, right through to the other anchor in Broome.

There are many listeners who would not know what a knot (of wind speed) means. Perhaps wind speeds can be translated into still, gentle, moderate, strong, very strong and extreme, with knot speed provided in brackets in print and visual media. Consider an adapted Beaufort Scale for conveying wind speeds.

There were concerns over using Latitude and Longitudes – but is there any other locational way?

Some of the forecasts cannot be understood by announcers – the forecasts are sometimes long-winded. Most are fine, in plain English, but some are long and difficult to understand. To get media language right, we draw on the knowledge of Aboriginal media practitioners.

The December BoM meetings reached agreement that BoM and TAIMA can develop a formal Liaison.

TAIMA has been invited and agreed to:
A. Refine BoM forecasts and warnings into effective and palatable information

Before weather information is issued each day, an Indigenous weather announcer in Townsville will make a clarified version if needed. This communication will be by email as mutually suitable, at least 40 times during the first two months of the Consultancy.

Radio announcers across the North will be encouraged by TAIMA to enter the '***Plain English weather warnings'*** project. They can help further translate and clarify the language to suit local idioms and cultural language.

B. Consequent interviews to spread the word as to the weather forecast broadcast wording changes (by about June 2004)

Goudie will conduct some interviews with Aboriginal and Islander listeners across the National Indigenous Radio Service (NIRS) to get feedback on the culturally appropriate language as it is developed.

Once the new "*Australian **Plain English weather warning***" word and symbol use are made clear, I will conduct media interviews with Terry Hart, community elders and local Townsville indigenous people on weather issues and weather language and with Mary G and emergency managers. This will help spread the word that BoM are listening, that the purpose of the warnings and forecasts is to inform and to stimulate listeners into responding if they or their community may be threatened by strong weather influences.

It is suggested that "From the Bush" Thursday, 12 – 2 (Qld time) or "Island Voice", Friday 3 – 5 would be good vehicles to introduce listeners in remote Aboriginal Communities to "Australian Plain English weather warnings"

C. Development costs

The proposal from TAIMA radio station includes invoiced milestone payments from BoM to develop a pilot and organise 'translations' from their deep media experience and listener feedback. The main milestones will be: the initial email exchange of 40 more complex forecasts or warnings (many of the forecasts are already very clear – any such sent can be noted, but it is the ones needing clarification which will forge a fairer, more inclusive weather language).

The December BoM meeting was told Andrew Turk (WA Murdoch Uni) has been conducting a project on delivering information into remote communities. This will be explored.

Automatic warning translations

Uptake of the emerging research outcomes may be timely, because an automatic translation of weather warnings is being developed. These warnings, already in *Australian Plain English weather language* could then be further automatically translated as broadcast through the local radio station broadcast areas, working with TAIMA to get the translation right. Automation can reasonably include Torres Straight Island Creole, and other regional language preferences.

2. An in-depth ***Call-to-action warning graphics – Active warning images*** project will proceed, liaising with EMA, SES and local communities. – Douglas G, Linda AB, Terry Hart.

Develop simple line drawings for disruptive weather systems or impacts for visual use in effective warnings (see Figure 11.2).

Disruptive weather warnings as a verb. Call-to-action warning graphics (simple graphics to stimulate a relevant action to a looming threat) are most clearly displayed in the image from Honolulu relating to a tsunami: a simple line drawing of two clearly enormous waves, with a simple cartoon figure dashing up a steep slope. This says, without one word of science or language: if you get a tsunami warning, get up-slope NOW!

"Make the weather forecasts more pictorial" (spokesperson from Kalumburu).

Another graphic example is:
Figure 11.1
Using a graphic to stimulate behaviour –cassowaries and cars.

(Image from Jeffrey, J. Australian WE Review Jan. 2004)

The crash graphic has embedded behavioural messages: slow down and look out.

We can find or create "Call-to-action warning graphics" for:
flood (do not drive into swollen waterways), wind (secure anything loose, then shelter) or fire (vacate early, or prepare and stay, but do not travel through the active fire zone).

Warnings for Flood: person on bonnet in flooded creek (see Figure 2), Fire: line edge of house, distressed person and fire; and Wind: debris flying. "In the usual manner of cyclones, considerable damage was caused by flying sheets of iron" (anon. 1980, p5), reporting on impacts on remote Australian Aboriginal communities on Mornington Island after Cyclone Ted.

By showing warning graphics to Aboriginal people in some remote communities, it was made clear that initial cyclone warnings just need the standard cyclone symbol (the old BoM logo) to trigger whatever local issues are relevant – strong shelter, surge and floodwater avoidance, the emergency kit, drinking water, warm dry clothing). A stylised profile of cyclone (Skertchley and Skertchley 2000) was also seen as likely to stimulate concern and activity.

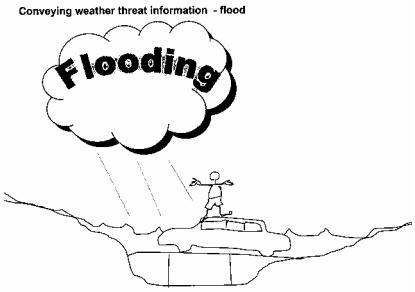
It may be difficult to understand why people need prompting to take evasive action against a broadcast threat. Why we need to try every way at our disposal when there is a major flood coming, and to travel or evacuate early. Although the literature all say that multiple and reliable sources help prompt safety-oriented responses, that warnings need to be in a form people can discuss, the prior evidence of inertia is stark:

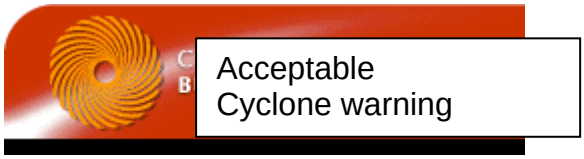
From:
Chamberlain ER, Hartshorn AE, Muggleston H, Short P, Svensson H *& Western JS. 1981.* Queensland flood report Australia Day 1974. *Australian Government Publishing Service, Canberra.* P 38

For the majority of affected people the most significant preparation was to evacuate their homes; 88.3% of the sample reported doing this. Some took this step very early, before flood waters had even entered their property, and were able to leave their homes in their own cars, taking some possessions with them. For others, evacuating their homes was a final expedient undertaken only when safety demanded it. Some 12% of the sample reported that they had not left until after the waters had entered the main living areas of their homes. They then left on foot or in boats.

About 67% of respondents were able to make preparations immediately before leaving home. Most commonly, apart from taking smaller portable items with them, evacuees stacked possessions above the level they expected the water to reach. Almost 22% of respondents said they made no preparations, mainly because the threat was not recognised in sufficient time.
.

Figure 11.2 Graphically conveying weather threat information – Active warning images





Wind and tin

"In the usual manner of cyclones, considerable damage was caused by flying sheets of iron" (Anon 1980, p5).

The use of the 'roofing iron being torn off" graphic for strong winds is a graphic call to pin poorly fixed iron down before the destructive wind *for the sake of the resident*, but also so that the loosened tin does not become a missile. Action statements should clarify the main dangers such as flying sheets of roofing iron, concentrate on what people should do in the available time, and use graphics that are appropriate. (Salter et al 1993 p124).

The World Meteorological Organisation (WMO) uses many icons, such as:

Figure 11.3 International weather information graphics

for Wet, Humid: and Windy, Squall, Stormy, Chill, Gale respectively.

The development of a range of images to increase people's predisposition for action attached to warnings of likely extreme weather should include SES, EMA and trial indigenous communities. The drawings or images (Figure 11.4) could perhaps be a series showing levels of preparedness or danger. They could (even should) be generalised, so as not to be just Indigenous community specific. Terry will ensure this *Warning graphics* project is developed to depth and breadth needed.

Figure 11.4 What storm-threatened residents need to consider

Photos courtesy Townsville City Council

Develop, test and refine graphics. Web-based weather warnings of Major weather events could be hyper-linked to other relevant sites, such as satellite weather images like: http://www.bom.gov.au/gms/IDE00005.latest.shtml - RACQ road condition reports (www.racq.com.au) and radar, such as Halls Creek: http://mirror.bom.gov.au/products/IDR393.shtml).

Outcomes of an "Enhanced awareness education programs and materials for remote Aboriginal and Torres Strait Islander communities" conference on increasing disaster awareness in remote indigenous communities during May 1997 identified the following issues, relevant to this graphic section, and showing continuity with other recommendations in this document, developed independently:

- Pictures should be used instead of words to minimize problems of language and literacy
- Conference attendees felt that "disaster awareness activities could be coordinated across departments and agencies under a general heading of public safety. This could reduce costs and prevent competition for attention in communities." (IDNDR Conference 1998, p4)
- To develop a national communication plan it was recommended that animated videos, posters from those videos, associated playing cards, brochures and colouring books be developed and made available. Ideas to encourage greater use of the aboriginal radio networks and using a "seasonal calendar" were also recommended to help people remain protected from natural hazards. These ideas fit in very well with the idea of the radio links, graphic warnings and board games recommended in this current work.
- A resource kit of such things as contact lists and items useful to weathering a natural disaster could be developed specifically for distribution and use by remote communities. For this to work communities would have to be actively involved in the development of the resources. School children and poster development could help overcome problems with literacy or as English as a Second Language. In 1997 Peter May (EMA) undertook to coordinate development a generic national resource kit. Is there any feedback on that undertaking by EMA? The recommendation to develop an educational

seasonal calendar as an IDNDR project was put forward at the conference and is having partial implementation through the BoM indigenous weather knowledge site.
- The strategy to use the Internet for information dissemination remains a compelling option.
- Use of performing arts was seen as a powerful tool to promote disaster awareness and education. Like many of these strategies individuals and institutions undertook to develop them.
- Finally the conference members argued that it is logical to cooperate across agencies and to coordinate activities and visits.

Source: EMAI 1998.

"Flood detection and prediction systems are of no value if they do not result in appropriate action. So flood warnings are intended to signal those at risk to prepare for flooding both physically and psychologically." (Handmer 2001, p 20)

Physical preparation would be to complete any travel to move flood sensitive equipment to safety and putting loved ones and pets in a flood free, safe environment. Psychological preparations may be triggering support networks and helping assure people where there is safe shelter and the likely limits to the flood water.
Source: Handmer 2001.

3. Develop BoM forecasting to pinpoint the start of the Wet for regions of the North, liaising with regional communities and fuel suppliers. Sharpen predictive modelling to better pinpoint the exact onset of the wet with about two weeks lead time. TerryH.

Pinpointing the start of the wet

Apart from well refined and accurate cyclone warnings, knowing the start of the wet is the most important piece of weather information communities need. This crucial information involved Community leaders for months each year in the build-up to the Wet. If the last load of diesel fuel in is stopped through boggy or flooded roads and the isolation goes more than the usual couple of months, the communities became stressed. On average, about 1000 litres of diesel is used each day to run the community generators – lighting, refrigeration, water supply, TV and air conditioning. Food preservation and lighting are seen as most important.

Hopefully these research recommendations will encourage the main fuel suppliers in the Kimberley, Australian Fuel Distributors, to work with BoM, Fire and Emergency Services Authority, WA (FESA) and Communities to co-ordinate last fuel runs before the rains.

4. Develop simulations of flood, wind or fire impact spread for media use. This is linked to Recommendation 18. Start to develop crude simulations of major floods or destructive wind paths to attach to related extreme weather warnings (one year plan).

A simulation of a cyclone surge by Granger's team in Vanuatu in 2003 prompted a sustained and focused development of infrastructure by local residents. There is great power in moving images of country you live in.

'Even the purported accuracy of warnings which tell predicted flood height at a known point, like a prominent local bridge may be misleading. To give this meaning it must be interpreted to relate to the water spread away from the river. Crucial advice on how flood water will actually affect people, and on appropriate action, is often minimalist or missing' (Handmer 2000).

5. Agencies to share and make public flood and other threat data, irrespective of any State or Territory borders. The BoM will ensure its warnings are directed to all people at risk and encourage other Agencies to do so. Terry Hart to encourage internal and external email dialogue to engender this – include copies to Goudie.

"Australians are entitled to live in a safe and healthy environment."

The National Health Strategy 1999. DoH. 2000.

Information sharing
Different states or territories have evolved different ways of collecting major weather event data and of making that data available to vulnerable residents and travellers. This can become a strength, now that there are moves to collate and standardise the web and media presentation of that data. For instance, Queensland has an excellent road condition web reporting system (www.racq.com.au). WA has developed a colour–coded warning system.

Weather, flood and fire agencies and researchers should develop an email-based dialogue to share different major weather data collecting, collating and sharing systems, then dispassionately view how relevant *and graphic* (road and settlement flooding, likely destructive wind paths) information and forecasts can be made available through media and the web.
Enter discussions with RACQ to use their road condition site as a model or template across Australia.

Sharing information between agencies

Cyclones and flood warning mechanisms to remote communities can be streamlined by ensuring all data collection agencies share their rainfall, wind

speed and flood data as they acquire it. Discussions with various people during my trip to the Kimberley made clear that there is a need for greater information sharing between BoM, and Western Australia's Main Roads, Waters and Rivers (now Dept of Environment) and the Agricultural Department.

A cultural shift of emphasis may be needed from some areas so that the NT/ WA border is not seen as a reason to limit the flow of weather and flood information to the people who need it most – people in the path of the disrupting influence.

Allied to this, if the tourism industry markets coming to the North in the "Green season", the need for easily accessible, real-time and reliable road-flood information is important. These are all issues for remote Aboriginal communities and extreme weather issues because such community members may have to find or shelter the ill-prepared for the vast and inhospitable distances involved in remote areas.

BoM can take a role to help coordinate the information of rainfall and flooding from all sources in and feeding into the Kimberley weather (and flood i.e., the Victoria River, which rises in the Northern Territory) systems so that community and road flooding is easily and uniformly accessible in real time from the BoM, Main Roads and other web sites. *Road flood warnings should not be hampered by borders between states and territories, nor between different Government rainfall and flood data-collecting groups.*

Across borders

Handmer (2001) reports that a failure to properly transmit relevant warnings across borders remains a problem in Europe. Some of this is so central as to reflect inadequate standing orders. "According to a Belgian official no contact was made from the Dutch side, and we did not call them. This is not one of our tasks. (Handmer 2002 from Rosenthal and t'Hart, 1998) in relation to a cross border flood. Handmer provides other like examples.

The problem is so deep "some national and regional agencies do not communicate well with different branches of the same agency even where they all deal with flood warnings." (Handmer 2001). This could be because of insufficient resources of one or more of the relevant agencies or sections. If a warning is to empower and guide people at risk at a local level the target people must remain central to the whole effective warning process.

Following an exhaustive analysis of information from the 1974 Brisbane floods, it was recommended:

All information based on past experience, current knowledge and future projections relating to disaster-prone areas and conditions likely to maximize risk should be public. That is, they should be readily available to householders or intending purchasers of property in the areas concerned, and, more particularly, in the hands of relevant organisations expected to act in response to disaster such as the Police Department, the State Emergency Services and the Natural Disasters Organisation (Chapter 8).
Source: Chamberlain *et al*. 1981.

One of the most challenging requirements of *risk communication* (Rohrmann 2000) is overcoming people's lack of belief that an extreme impact could happen to them (McKenna 1993). It is easy to understand why:

From analysis of information from the 1974 Brisbane floods -
Some 20% of respondents reported without prompting that they had feelings of 'incredulity' and 'disbelief'. About 15% of the sample said they had been 'frightened', or, in a few cases, 'panicky'. By contrast, many fewer (9%) said they had resigned themselves to the situation, were accepting of it, or accepted the fact that there was little that could be done after the flood had occurred. Clearly people had not expected such an abnormal event, and had little in their previous experience to assist them in dealing with it.
Source: Chamberlain *et al*. 1981.

Getting information about extreme natural hazards to the potentially vulnerable is difficult (Goudie and King 1999), especially against the inclination not to take threats from natural hazards seriously (King and Goudie 1998).

Many speakers at the 2003 Disasters Conference in Canberra emphasised that credible information needed to come, repeatedly from reliable sources, in a form that it was easy to discuss with local contacts. Agencies withholding hazard information from potential impact victims is unacceptable.

6. Drop the word 'severe' from weather warnings when directing weather information to areas of more concentrated Aboriginal population.

Language use

'Severe

The word 'severe' causes polled Indigenous people to 'switch off'. 'Strong', 'destructive' or 'major' are stimulants to greater interest.

The word 'Dangerous' is much preferred to 'Severe'. 'Severe' does not work as a trigger word to take notice, to perhaps take action (Rohrmann 2000). BoM commissioned this research to find out how to make weather information into remote Aboriginal communities more effective in mobilising safety-oriented responses. 'Severe' is a 'lose-interest" word for all the Aboriginal people asked in this research process. "Major, Damaging, or Extreme" are acceptable. It was finally revealed that in the Mission days (until 1967), "Severe Punishment" was often meted out to Aboriginal individuals who happened or dared to breach the strict cultural codes attempting to be imposed on them. The word 'severe', in a cultural group deep and rich in oral history still has very strong connotations of pain and loss.

Develop alternatives to the word "severe" for messages to Aboriginal communities, both through the indigenous weather information site (www.bom.gov.au.iwk) and through the BRACS network. "Severe" was a 'turn-off' for aboriginal communities from Palm Island to the East Kimberley.

There may be a BoM culture which will want to retain 'severe': 'it is used internationally … it would be hard to change …' Research feedback is most clearly to replace 'severe' with 'dangerous, damaging, extreme, disruptive' or 'major' to use in extreme weather warnings targeting northern Australia. The connotation of Severe is the silent 'punishment' which followed 'severe' on Missions across the North.

7. Modify the Beaufort Wind Scale to help depict wind speed in 'Australian Plain English weather warnings Language'.

Find 'everyday' events to depict wind speed – i.e. blow leaves across ground – a modified Beaufort Scale – See http://www.bom.gov.au/lam/glossary/beaufort.shtml .

8. Explore incorporation of Indigenous weather forecasts into mainstream forecasting data. Terry H, Harvey S, Alisdair H.

"I am impressed that people here can tell me when it is going to rain or not" – CEO Mark Suhule, Mulan. If the BoM Indigenous weather site is to gain relevance as a living tool for remote Aboriginal communities, it is worth encouraging a daily weather update tagged to each participating community. This should include daily 'traditional' weather predictions. It would then make an interesting study to check their accuracy, and compare that accuracy with TRADITIONAL BoM forecast accuracy. The challenge would then be to incorporate traditional forecasting into mainstream forecasting if it is comparable or better than the traditional BoM interpretations of data.

9. BoM to support efforts to develop one web-based road flood warning system, based on RACQ.

RACQ type maps

Although local downpours may confound the overall access across some streams, liaison with RACQ is promoted to encourage Australia-wide uptake of the RACQ-style road condition delivery because it is widely accessible through tourist haunts – roadhouses, motels, service stations and information centres. BoM (and perhaps EMA), as a national entity in the business of delivering timely weather-related warnings, should encourage state and territory uptake of this method of road flood information.

10. A potentially commercially viable board game of *Disruptive weather impact preparedness* will be explored – Douglas G, Linda AB and Alan Sharp.

Develop a 'Disaster Mitigation Board Game'. BoM to work with EMA to develop a board game to better prepare and have communities respond to extremes of nature.

Developing the board game idea from a snakes-and-ladder approach, Alan Sharp made suggestions, further developed: the game may have squares of green, red and orange and three decks of cards – green means you pick up from the green pack – you are preparing well for a thunderstorm, cyclone, destructive wind, major flood or threatening bush fire. The green cards will further advance you up the board. The red means you have ignored a warning or missed an opportunity to EITHER fully prepare, OR vacate the danger zone in a timely and precautionary way. We are promoting precautionary action as a 'trial run' rather that a 'cry wolf' if the threat veers away. The orange may be a 'down the board OR up the board' outcome.

Scoring most to finish the game, there are two winning areas at the top of the board – safe local shelter from the threat, or early, self-evacuation to safe shelter. The 'failure to act' area at the bottom of the board is where you have

drowned, been killed by flying debris or been burned fleeing in your car. This is just a conceptual frame. The finished game may be far subtler, or, as possible, far starker. This is a committee-developed game.
EMA need to be involved.

There was a 'disaster awareness' game developed in Tasmania. Linda and I can follow this up. Linda to contact Tasmanian developers. If we can define a possible game, it should be taken to *professional game developers* to refine and market. If we cannot sell it, it is probably not interesting enough for any one to play anyway.

11. Expand the Indigenous Weather Knowledge web site to hyperlink with remote schools, with indigenous radio stations, Land Councils, BoM radar and satellite images. School competitions will expand the interactive BoM/community links.

12. Promote community weather awareness through school competitions, using air pressure as the central weather indicator and barometers as the prizes.

Barometers

A strongly supported suggestion is to develop community and school competitions as a means to distribute barometers into the community (with instruction). This will provide real-time and accurate indicators of fully local conditions.

"With regard to education, preparedness in the young can reflect the attitudes of parents to some degree. The question therefore arises as to how well prepared, or how aware are children at school, about the dangers that can arise during the cyclone season. There appear to be no particular regional emphases in syllabuses for Northern Australia, where certain specific hazards are present. The view appears to be taken that these aspects of life are better left to the family, or left to the family by default. It would be worth giving attention to systems of learning about hazards as a normal part of the school curriculum."

Source: Raggett *et al.* 1993.

- To develop a national communication plan it was recommended that animated videos, posters from those videos, associated playing cards, brochures and colouring books be developed and made available. Ideas to encourage greater use of the aboriginal radio networks and using a "seasonal calendar" were also recommended to help people remain protected from natural hazards. These ideas fit in very well with the idea of the radio links, graphic warnings and board games recommended in this current work.
- A resource kit of such things as contact lists and items useful to weathering a natural disaster could be developed specifically for distribution and use by remote communities. For this to work communities would have to be actively involved in the development of

the resources. School children and poster development could help overcome problems with literacy or as English as a Second Language. In 1997 Peter May (EMA) undertook to coordinate development a generic national resource kit. Is there any feedback on that undertaking by EMA? The recommendation to develop an educational seasonal calendar as an IDNDR project was put forward at the conference and is having partial implementation through the BoM indigenous weather knowledge site.
Source: EMAI 1998.

13. Make the BoM site and the locally detailed cloud, flood and rain web sites more widely known.

14. Automate sending of Disruptive weather warnings to the more remote settlements

Many Northern Queensland Councils have regularly updated phone-in message services to provide information about the threat. This could be adopted more broadly, and include major flooding, fire or wind threats.

Trying to get phone information about current flooding from Police is often futile in more remote areas – the one Officer is too busy to keep upgrading their recorded message.

Communities can be automatically subscribed to BoM Weather Warnings. It is recommended BoM contact remote communities with this knowledge, explaining cost, service provided and specificity of faxes (no-one wants to be flooded with needless information). Or could this specific target be privatised as a value-adding service to remote residents, or provided free to remote centres as a community service?

Ensure there are automatic mechanisms to relay relevant extreme weather of flood warnings to community CEOs, police and SES, and that communities know automatic warnings are available.

15. Explore expansion of public weather warning signals (cyclone siren).

Warning signals

There is a Fire and Emergency Services Authority (FESA) Cyclone Community Alert System in WA, based on blue = precaution, yellow = action, red = shelter and all clear with caution.

A recurrent problem in Europe is that warning messages are often written in jargon. For instance, in Britain colour coded warnings appear understood by few. If there are ambiguous official warnings people will seek informal information. That information may undermine the formal information implying that the informal information networks should be consciously used by warning managers.
Source: Handmer 2001.

There is also a Standard Emergency Warning Signal, which is an electronic signal owned by BoM and used in conjunction with their Cyclone Warnings when destructive or very destructive winds (cat 2 or higher) are expected within 12 hours of the coast. It is also used preceding an emergency announcement, which is intended to instruct the population to take, or be prepared to take, specific action in order to protect life, property and/or the environment.
Explore adopting the use of colour-coded warnings nationally *if they are understood and effective in WA cyclone warnings.*

16. Include more locational features on radar base maps. Put landmarks – main roads, rivers and all settlements on all base BoM website maps.

Local features on base radar maps
It is strongly recommended to improve the BoM web sites by placing main roads, rivers and communities on the usual base layer of satellite and radar maps.

17. Where available, incorporate Dreamtime stories of mega-floods into estimated of Probable Maximum Floods.

The Dreamtime stories describing ancient extreme floods have great merit in reminding us there are 1 in 1,000 year (.1%) floods, and, although low in likelihood at any time, they have happened and they will happen. In nearly all the ‘megaflood’ stories, everybody drowned. My view is to plan against the worst case. In that way, anything less will seem more manageable. Our goal increasingly seems to be to do all in our power to encourage aware, informed and self-help oriented communities; prepared to act consistently in a precautionary way, in the spirit of ‘a good practise run’ if the major impact veers away or does not materialise.

Dreamtime stories of extreme floods

We should be able to learn from Dreamtime stories of extreme floods. The described floods should tell us about Probable Maximum Floods, with the embedded message of possible large-scale evacuations or drownings. A clear example is the Dreamtime story of the flooding of the Sturt Creek into Lake Gregory (Nunkiarry 1996), in considering evacuation of Mulan ahead of major predicted flooding.

Mulan Dreamtime story

There were two emu up north from around Inverway Station, from Nungaroo Creek who were chased by two dingo. A big distance away at Nungaroo.

People were walking. The emus were in front. The people were singing and dancing, and they were in between the dingos and the emus. There were floodwaters behind the dingos.
When people were camping the flood would stop. There was one old man, he had a string line and he would cut the water while they camped. He would hold the waters back while they camped. While they would sing and dance. Where they camped the water was held up. That is where the billabongs in Sturt Creek are now. Like at Bindalaorro.
The black and white water bird, the one with the long legs, the little bird was with the people. Birds and other animals joined the people as they moved south, singing and dancing.

They were coming down, straight down to the lake on the Sturt River side. But the dingo chased the emu round the other side. Around to number 51 well (water bore) around to Gillang-gillam.

The dingo chased the emu back and forth on the main lake. One dingo was chasing one emu and the other dingo was chasing the second emu. Back and forth. Each dingo grabbed an emu when they passed but they each grabbed the wrong emu. They grabbed ‘em and killed ‘em and ate ‘em.

The people on the other edge of the lake, in the main channel, camped again. In that main camp they sung and danced, that was where we call Lera Yard.

When the two dingos were full they walked up the other channel to Mulan. There was a soak there and they dug in. They’re still there.

Then the water came in from both sides and all the people got drowned.

One old man walked off and sang them (he put a deadly curse on them all). They all drowned because they hadn’t shared some food with him. But when he walked off, another old man spat on him, cursed him, so that first old man who walked off died too.

Told to Douglas Goudie by Rex Johns,

Mulan elder and Founder

The Sturt Creek was a central link for all the desert communities visited. It is common knowledge now that if the initial floodwaters were a milky colour passing through the Balgo area, it means a major flooding rain north, about 5 days earlier, and the creek would probably stay up for months. If the water was red, it means local rains (from the smaller, near catchment), so the creek would probably go down again in a few days.

The point of the Lake Gregory Flooding story is that, apart from the Dreamtime story, the lake has never overflowed in living memory. The megaflood Dreamtime story tells us it did flood, that it can flood. And that every-one drowned.

Modellers develop a Probable Maximum Flood for catchments of interest. "The Probable Maximum Flood (PMF) is the largest flood that could physically occur at the location of interest. It is an extremely rare event which is associated with a Probable Maximum Precipitation (PMP). Due to its rare nature it is difficult to undertake a meaningful economic analysis of a PMF event" (http://www.smec.com.au/technical/water/dams/pmfe.htm).

The PMF, presumably, would reflect the mega flood levels of old flood stories. Relating to flood *depth*, PMF is perhaps more meaningful language than 1:1,000 years, (or .1%); but the numeric scale implies a likelihood of the PMF in any one year. Language use is vexing and exact. Much of this research is about language. The extent of the Dreamtime PMF information will be developed in the final Disruptive Weather Warning report.

18. Begin negotiations with **media bodies and associations to become part of the formal warning process** to target at-risk people. BoM, State SES and EMA. (Handmer 2001)

The media is often central to what people hear of warnings. The quality of their information will colour many people's response (Handmer 1992),

The media are usually too busy pointing to the failings of the government agencies to examine their own performance in passing on warning messages. (Handmer 2001)

From
http://www.annenberg.nwu.edu/pubs/disas/disas3.htm

Principles and Recommendations of the Roundtable on the Media, Scientific Information and Disasters

Principles

1. Media throughout the world play a vital role in educating the public about disasters, warning of hazards, gathering and transmitting information about affected areas, alerting government officials, relief organizations, and the public to specific needs, and facilitating discussions about disaster preparedness and response.

2. Timely, accurate and sensitive communications in the face of natural hazards are demonstrated, cost-effective means of saving lives, reducing property damage, and increasing public understanding. Such communications can educate, warn, inform, and empower people to take practical steps to protect themselves from natural hazards.

Recommendations

3. Scientific and disaster mitigation organizations should seek to develop working relationships with the media based on mutual trust and the recognition of differing characteristics, goals, and needs. Regular, effective communication among these disparate groups, before, during, and after disaster "events" can greatly enhance those relationships.

4. Disaster mitigation organizations should seek to provide reliable information to the media, as early as possible, in a concise and readily understandable form, and linked, where possible, to newsworthy events.

5. Disaster mitigation organizations should seek to identify and communicate specific themes and messages, both through the mass media and in other alternative forms of communication.

6. Media and disaster mitigation organizations should take advantage of opportunities to work together, to provide relevant training for reporters and field personnel to enhance both disaster preparedness, mitigation and relief efforts and the timeliness, quality, and accuracy of reporting about natural hazards.

7. Media organizations should address disaster prevention and reduction in coverage relating to disasters. Disaster mitigation organizations and the media should identify and communicate to the public specific measures that have either succeeded or failed to reduce the impact of natural hazards.

8. Media organizations are encouraged to evaluate their reporting about natural hazards and disaster preparedness, and, where appropriate, to work with disaster mitigation organizations to improve the quality, accuracy, and thoroughness of such reporting

9. The IDNDR Secretariat should communicate the outcome of the Conference to the International Telecommunication Union and support ITU s efforts to develop an international Convention on Disaster Communications.

Even though the mass media is a key element in most warning systems, it is very rarely legally obligated or tied into a warning system and little research attention has been devoted to it. Although the relevant research literature is large the bulk of work is on the details of message design and factors important in individual response. This is not to say that other areas do not receive attention, only that research is skewed towards the technocratic side and highly skewed towards official networks - rather than the informal communication channels used everyday by everyone (Parker and Handmer, 1998, in Handmer 2000).

Radio is often the major channel of risk communication. For localised use having a “tone alert” radio which can be remotely activated to provide a warning signal up to 50kms radio range can be useful in warning against destructive weather. Television is used. It has the problem of having a very broad coverage and thus very localized hazards may be seen as too small to justify the television station making the risk broadcast. They also prove to be a poor communication means during sleeping hours.

Television is very good warning medium for slowly developing and broad scale events like cyclones. It is technically possible to have an override on cable television. This could be explored in Australia as a means of informing people of impending destructive weather impacts. This approach could be further investigated for warnings targeted to remote indigenous communities because there is a reasonably high audience for cable TV.

A further technological intervention open for consideration is to have automatic diallers activated simultaneously across many thousands of exchanges using automatic switching equipment to transmit an emergency message. Sirens or alarms may be used. The problem is that listeners must know what the siren means. Sorenson and Mileti (1991) list these and further physical techniques to broadcast to have warnings widely heard.

End users through the communities were unhappy at the time lags and remoteness of media information to their local needs. BoM staff were unable to exert any great influence over how the media handled any warning information. Experience in Northern Queensland is that the local media plays a very active and co-operative role in helping in the whole gamut of general preparedness through to providing ongoing detail. It does not necessarily prevent the uninformed or overly brave to be swept off flooded roads in places like Mount Isa (Townsville Bulletin, 27/01/04), but there is a high level of co-operation. Formalising the co-operation is a mammoth step, tempting only to the brave. However, Memoranda of Understanding about levels of accuracy, detail and timeliness would provide the public with another ‘trusted’ information source.

Further recommendations, outside the range of BoM influence, but perhaps likely to strike a chord in some readers, include that insurance companies should offer incentives to make building owners highly aware of natural

hazards in each region and how to ensure that buildings are best constructed to avoid destructive impacts.

Warnings

People at risk need to know how to minimize impacts from a threat. The task is how to deliver that information. As has happened in the indigenous weather knowledge research. Handmer (2001) suggests that it cannot be done properly "without consulting the people involved. Such consultation should be a two way process more akin to negotiation." (Handmer 2001, p 22)

"We need more localised weather forecasts. Living in the Kimberley, the forecast in Perth is quite irrelevant but most television forecasts are from Perth". (Halls Creek Informant).

Along with all forms of personal and media electronic communication – the Internet, CDMA and satellite phones and faxes, most community members reported they usually learned of upcoming weather from the six o'clock news. The role of the media unclear, but leadership direction is clear:

Information management and modern information technology
Sound information underpins, or should underpin, emergency management… finding appropriate information, making use of it, disseminating it effectively to all who need or might need it…."
Source: EMA 2002.

The role of the media is a vexed issue. From things like the nuclear accident at 3 Mile Island in 1979 to reporting wars to a clear and calming reportage of natural hazard threats the media has been something of an untamed force (Lichtenberg and MacLean 1991).
Lichtenberg and MacLean (1991) point out that the media's questionable accuracy in their portrayal of reality tends to have a direct influence on public opinion, and in terms of trying to communicate risk in a way most likely to engender a considered and defensive response may either alarm people or lull them into a false sense of security. It is widely accepted that journalists must exercise discretion in "lopping off large chunks of reality." The problem for disaster managers and risk communicators is that journalists must "lop off" the wrong lumps.
Source: Lichtenberg and MacLean 1991.

This is why Recommendation 18 suggests that formal liaison and relationships be developed between the risk communicators (BoM, local SES controllers and Counter Disaster Committee personnel) and the local media. This discussion is not exhaustive, but the report in full is, leading to the following conclusions in Section 12.

Section 12
Conclusions

Securing guides and permission was crucial to the success of this research into weather information in and through remote Aboriginal communities. The resultant 23 recommendations all seek to reinforce weather warning information which was embraced and responded to by members of remote Aboriginal communities.

The clarified goal of the Australian Bureau of Meteorology as hazard informers is now seen to include a role as response stimulators - to do all in our power to encourage aware, informed and self-help oriented communities to act in the best interest of their safety.

Clear 'action' messages: words and images are needed to support people in remaining prepared to act in a precautionary way by being fully prepared to either staying in maximised safety, or moving out of the impact path to a place of greater safety in a timely way. Any response to a major threat should be in the spirit of 'a good practise run.' If the major impact veers away or does not materialise, it should be viewed as a learning experience rather than a failure in the accuracy of the information.

Most of the visited communities have good levels of preparation and inclination to act in a safe and precautionary way. Getting weather warnings to outstation members remains a challenge for community members – most of the small satellite settlements do not have any modern communication systems.

We know from old and relatively recent stories that parts of Australia may be subject to extreme weather impacts. The 1974 Darwin and Brisbane experiences show how most residents were poorly prepared and informed. The current, more 'self help' oriented approach to disaster mitigation accepts that prevention; preparation, response and recovery should all be embraced by an informed and interested public. Getting the right information to the right people remains the task.

The improvement from 1974 to 2004 is that now all government policy is based on sustainability principles, and agrees all Australians have a right to live in safety. Our communication systems are now very robust and immediate, our electronic information and predictive ability ever improving. This research has shown people of the north want more focus on when the wet is most likely to start in each major weather and drainage system. A greater understanding of warnings is likely using TV stations to broadcast simulations of extreme weather impacts of flood, fire or destructive winds. Developing and using 'action' warning images, from a reliable source like BoM and the Emergency Services is likely to stimulate safety-oriented behaviour.

This research showed strongly that the BoM has a high level of community respect. BoM information is sought after and relied on in remote Aboriginal communities. A synthesis of Indigenous traditional weather predictions into

the new generation of ‘ensemble’ predictive weather modelling is a tantalising and far-reaching possible outcome of this research. Pinpointing the regional start of the wet, using the BoM Indigenous weather information web site for day-to-day weather information sharing, actively using the Broadcast to Remote Aboriginal Communities Service radio network of about 150 transmitters during disruptive weather, working with communities and Emergency Management Australia to develop a ‘hazard response board game’; all these recommendations will help build self-helping, resilient communities. Clarifying language and images, developing simulations of threats and encouraging greater awareness of the existence and local usefulness of the BoM web information are all highly encouraged as a direct result of this research

Nurturing links between Aboriginal media and BoM should have very positive outcomes for all, and some of the language changes and warning graphics developed from this research may be adopted more widely than the remote Indigenous target group.

Finally, I thank BoM, JCU, and the Australian Research Council for the opportunity to conduct such unrestricted and socially useful research, with permanent thanks to all participating community members, fellow researchers and guides. May the communities benefit.

Douglas Goudie, JCU Townsville,
May 2004.

Remote Indigenous communities weather warning references

Ananthaswamy A 2003. "Historic storms live again" *New Scientist 179:2414, 14-15*

Annon. 1980. Viewpoints. After Cyclone Ted on Mornington Island: the accumulation of Physical and Social Impacts on remote Australian Aboriginal communities. *Disasters* 4:1, 3–10. Pergamon Press. GB.

Baram, M 1991. *Rights and duties concerning the availability of environmental risk information to the public*. In (Ed) RE Kasperson and PJM Stallen. *Communicating Risks to the Public - International Perspectives*. Kluwer Academic Publishers. Dordrecht, Boston, London. P 481.

Berry L and King D 1998. Tropical cyclone awareness and education issues for far north Queensland school students - Storm Watchers *Australian Journal of Emergency Management* Vol. 13: 6

Boughton, GN 1992. Education on Natural Hazards. *The Macedon Digest*. The Australian Journal of Disaster Management V7: 2 p 4 – 7

Bryant, E. A. and Nott, J. F. 2001. Geological indicators of large tsunami in Australia. *Natural Hazards, 24, 231-249*.

http://www.tesag.jcu.edu.au/staff/jnott/abstracts/Geolindicatorstsunami.htm

Chamberlain ER, Doube L, Milne G, Rolls M & Western JS 1981. *The Experience of cyclone Tracy.* Australian Government Publishing Service Canberra. (P150+).

Chamberlain ER, Hartshorn AE, Muggleston H, Short P, Svensson H &

Western JS 1981. Queensland flood report Australia Day 1974. *Australian Government Publishing Service, Canberra.*

Dixon RMW 1991. Words of Our Country. Stories, Place Names and Vocabulary in Yidiny, the Aboriginal Language of the Cairns-Yarrabah Region. by University of Queensland Press. 312 Pages.

DoH 2000. *The National Environmental Health Strategy Implementation Plan.* Federal Australian Department of Health, enHealth Council.

Drabek TE 1994. *Disaster evacuation and the tourist industry,* Program on environment and behaviour. Monograph 57, University of Colorado.

Dunlap RE & Van Liere KD 1978. The 'new environmental paradigm' : a proposed measuring instrument and preliminary results*. J. of Envtl. Ed.* 9:4, 10 -19.

Ellis J 1991. From the Dreamtime: Australian Aboriginal Legends. Collins Dove, Melbourne. Pp105

ECAP Economic Commission for Asia and the Pacific, the World Meteorological Organisation and the Red Cross Societies 1997. *Guidelines for disaster prevention and preparedness in tropical cyclone areas.* Geneva/Bangkok. 125.

EMA 2000. Emergency Risk Management Applications Guide. The Australian Emergency Manuals Series.

EMA 2002a. *Research agenda for Emergency Management*. March. EMA Research and development Strategy for “Safer Sustainable Communities”.

EMA 2002b. Indigenous Communities and Emergency Management. P22.

EMAI 1998. Emergency Management Australia Information Service. Report of the strategic planning conference on the development of enhanced awareness education programs and materials for remote Aboriginal and Torres Strait Islander communities. Darwin, May 1997. Conference Proceedings. EMA.

Felluga D 2004. "Modules on Greimas: On the Semiotic Square." *Introductory Guide to Critical Theory*. http://www.purdue.edu/guidetotheory/narratology/modules/greimassquare.html.

Fien J 1993. *Education for the environment- critical curriculum theorising and environmental education*. Deakin University.

Goudie D & King D 1999. Cyclone surge and community preparedness. *Austn. J. of Emergency management.* 13:1, 454-60.

http://www.ema.gov.au/ema/rwpattach.nsf/viewasattachmentPersonal/C99C42AA745F81C9CA256CC200343F1D/$file/Cyclone_surge_and_community_preparedness.pdf

Goudie DD 1996. Early evacuation to billets in Cairns above 10 metres, ahead of land-based and cyclone tide flooding. In (Ed) King D*. Flood management workshop proceedings*. Centre for Disaster Studies, JCU. NQ.

Graddol 2004. The future of language. *Science.* 303:5662. 1329-1130.

Greene G, Tramacchi J & Gill L 1992. *Roughtail: the dreaming of the Roughtail Lizard and other stories told by the Kukatja*. Magabala Books, Broome.

Handmer J 1992. Can we have too much warning time? A study of Rockhampton, Australia. *The Macedon Digest*. The Australian Journal of Disaster Management V7: 2 p 8 – 10.

Handmer J 1994. Special Issues, 1990-2000, International Decade for Natural Disaster Reduction, the Australian Focus. *The Macedon Digest*. 9:3. Spring 1994.

Handmer J 1997. Flood warnings: issues and practice in total system design. Flood Hazard Research Centre. Middlesex University pp 199.

Handmer J 2000. Are Flood Warnings Futile? *Risk Communication in emergencies.* Volume : 2000 – 2, Pages (e) 1 – 14. http://www.massey.ac.nz/~trauma/issues/2000-2/handmer.htm. (e) 14 pages.

Handmer J 2001. Improving flood warnings in Europe: a research and policy agenda. *Environmental hazards.* 3: 2001. 19-28. Pergamon.

Hopley D & Harvey N 1974. *Report of the storm surge associated with tropical cyclone Zoe, Queensland, March 1974.* Department of Geography, James Cook University of North Queensland.

Hunter A & Bin Salleh R 1996. Moola *Bulla. In the shadow of the mountain.* Kimberley Language Resource Centre. Magabala Books, Broome WA. P 258.

Junchaya A 1999. *They laughed at Noah.* Kellye A. Medcap, Clifton, New Jersey. 271.

King D & Goudie D 1998. Breaking through the disbelief - the March 1997 floods at Cloncurry. Even the duck swam away. *Aust. J. Emergency Management.* 4:12 29-33.

Kasperson R E & Stallen Pieter J M 1991. *Communicating Risks to the Public International Perspectives*. Kluwer Academic Publishers.

Kitchin RM 1996. Increasing the integrity of cognitive mapping research: appraising conceptual schemata of environment-behaviour interaction*. Progress in human geography*. 20:1. 56 - 84.

Kobb P 2000. Emergency Risk Management Applications Guide. Emergency Management Australia.

Larrakia 2001. *Saltwater People: Larrakia Stories from around Darwin.* Larrakia Nation Aboriginal Corporation, Casuarina, NT.

Lichtenberg J & Maclean D 1991. The role of the media in risk communication. In (Ed) RE Kasperson and PJM Stallen. *Communicating Risks to the Public - International Perspectives*. Kluwer Academic Publishers. Dordrecht, Boston, London. P 481.

McKenna F 1993. It won't happen to me: Unrealistic optimism or illusion of control. *Brit. J. Psych.* 84 39-50.

Mowanjum 1980. *Visions of Mowanjum: Aboriginal writings from the Kimberley.* Rigby Adelaide.

Moyle AM c1970. *Introductory Notes to Songs from Yarrabah*. Canberra: Australian Institute of Aboriginal Studies.

Munro DA 1995. *Ecologically sustainable development - is it possible? How will we recognise it?* In (Ed) M Sivakumar and J Messer. *Protecting the future - ESD in action.* Futureworld. Wollongong.

Murphy K 1984. *Big Blow Up North -A history of Tropical Cyclones in Australia's Northern Territory.* University Planning Authority, Darwin.

Murray I 1979. *Beyond Impact. A review of the effect of disasters and natural hazards in the Australian situation*. Centre for information and Research on Disasters and Natural Hazards. Caulfield Institute of technology. 2-7

Napurrurlarlu NO & Jakamarrarlu NP 1988. *Ngawarra-Kurlu*. Yuendumu B.R.D.U. Darwin. 19.

Nunkiarry G 1996. *Gurliliyin, gayiliyin mitim traibul lo - Law from the south meets law from the north*. In (Eds) Hunter A and Bin Salleh R, 1996. Moola *Bulla. In the shadow of the mountain.* Kimberley Language Resource Centre. Magabala Books, Broome WA. P 258.

Phillips TP 1998. Reviews Easter Floods 1998: Final report of the independent review team to the board of the environment agency. Volume

1. In (Ed) P Bye and M Horner Bristol: Environment Agency. *Risk Management: An International Journal.* Vol 2: No.3. P 83.

Pierrehumbert C 1992. The Bureau and its warning roles. *The Macedon Digest*. The Australian Journal of Disaster Management V7: 2 p 11.

QG 2003. *State Planning Policy. Mitigating the adverse impacts of flood, bushfire and landslide*. State planning policy 1/03. Dept Local Government and planning, & Dept of Emergency Services. p20.

Quarantelli EL 2002. The role of the Mass Communication system in natural and technological disasters and possible extrapolation to terrorism situations. *Risk Management: An International Journal.* 4: 4, 7 –21.

Raggatt P, Butterworth E & Morrissey S 1993. Issues in Natural Disaster Management: Community Response to the Threat of Tropical Cyclones in Australia*. Disaster Prevention and Management*. 2:3, 12-21.

Renn O & Levine D 1991. Credibility and trust in risk communication. In (Ed) RE Kasperson and PJM Stallen. *Communicating Risks to the Public - International Perspectives*. Kluwer Academic Publishers. Dordrecht, Boston, London. P 481.

Robinson R 1968. Aboriginal Myths and Legends. Sun, Melbourne.

Roe P 1983. Duegara In (Ed) Muecke S. Gularabulu: *Stories from the West Kimberley*. Fremantle Arts Centre Press.

Rohrmann B 2000. A socio-psychological model for analysing risk communication processes. *The Australasian Journal of Disaster and Trauma Studies* Volume: 2000-2. http://www.massey.ac.nz/~trauma/issues/2000-2/rohrmann.htm

Roth W 1897. Ethnological Studies among the North West Central Queensland Aborigines. Queensland government, Brisbane & London.

Roth W 1903. North Queensland Ethnography: Bulletin No. 5. The Northern Protector of Aboriginals, Queensland. Home Secretary's Department, Brisbane.

Salter J 1992. The Nature of the disaster – more than just the meanings of words: Some reflections on definitions, doctrine and concepts. *The Macedon Digest*. The Australian Journal of Disaster Management V7: 2 p 1 – 3.

Salter J, Bally J, Elliott J and Packham D 1993. *Natural disasters: protecting vulnerable communities*. In (Eds) Merriman PA and Browitt CW. *Proceedings of the conference held in London, 13-15 October 1993.*

Scougall J 2002. Away from the Wadjelas: the significance of urban place to the Tkalka Boorda Aboriginal Community. Urban Plicy and Research, 20:1. 57 – 72. Carfax Publishing.

Skertchly A & Skertchly K 2000. *Message Sticks –Hazard Mitigation Visual Language*. EMA, ACT.

Smith DI & Handmer JW 1986. *Flood warning in Australia - Policies, Institutions and Technology.* Centre for resource and environmental studies Canberra. P 310.

Sorenson J & Mileti D 1991. Risk communication in emergencies. In (Ed) RE Kasperson & PJM Stallen. *Communicating Risks to the Public - International Perspectives*. Kluwer Academic Publishers. Dordrecht, Boston, London. P 481.

Stern P 1992. Psychological dimensions of global environmental change. *Annu. Rev. Psychol.* 43, 269 - 302.

Stern PC, Dietz T & Guagnano GA 1995. The new ecological paradigm in social-psychological context. *Environment and behaviour*. 27:6, 723 - 743.

Svenson O 1991. The time dimension in perception and communication of risk. In (Ed) RE Kasperson and PJM Stallen. *Communicating Risks to the Public - International Perspectives*. Kluwer Academic Publishers. Dordrecht, Boston, London. P 481.

Trezise P 1993. The floodmakers of langu narnji (Mornington Island) in (ED) P Trezise *Dream Road.* Allen & Unwin Pty Ltd. NSW.

Umbagai E 1980. The Spirit Water. In (ED) Mowanjum. *Visions of Mowanjum: Aboriginal writings from the Kimberley*. Rigby Adelaide.

Unaipon D 2001. *The flood and its Result.* Edited by Muecke S. & Shoemaker A. Legendary Tales of the Australian Aborigines. Melbourne University Press.

Utemorrah D 1980. How The People Were All Drowned. In (ED) Mowanjum. *Visions of Mowanjum: Aboriginal writings from the Kimberley*. Rigby Adelaide.

Utemorrah D & Clendon M. 2000. *Maambulbarda. Eye-of-the-sea.*

In (Ed) Kimberley Language Resource Centre. *Worrorra Lalai. Worrorra Dreamtime Stories*. Kimberley Language Resource Centre. 113.

Utemorrah D & Clendon M 2000. *Dumbi the owl*. In (Ed) Kimberley Language Resource Centre. *Worrorra Lalai. Worrorra Dreamtime Stories.* KLRC. Halls Creek WA Pp 113. Utemorrah D & Clendon M. 2000. Maambulbarda, Eye-of-the-sea

Walmsley DJ 1988. *Urban living, the individual in the city*. Longman scientific and technical.

Walmsley DJ & Lewis GJ 1993. *People and the environment. Behavioural approaches in human geography.* 2nd Ed. Longman.

Yates J 1992. Senior Planning Officer, WA SES. Assisting the community to plan: A pilot program in Western Australia. *The Macedon Digest*. The Australian Journal of Disaster Management V7: 2 p 12

Yates J 1997 Federalism and disaster mitigation in remote Aboriginal communities in Western Australia. Spring. *AJEM.* 25 – 32.

Yeo S 2002. *Natural Hazards. Flooding in Australia: A review of events in 1998*. 25: 177-191. Department of Physical Geography, Macquarie University, NSW.

Zamecka A & Buchanan G 2000. *Disaster risk management.* Queensland Department of Emergency Services. 115.

Further resources to consider (from Associate Professor David King, Director, Centre for Disaster Studies, JCU.

Cole C 1977. Winds of Fury. Rigby, Adelaide.

Eglitis Anna 2000. *Contemporary Aboriginal and Torres Strait Islander Art: New days – Early days Art Works and legends.* Central Queensland University Press, Rockhampton. ISBN 18799833 0/1875998721.

Great art and legends: -

Zane Saunders (Kuranda) the Rainbow Serpent Flood

Bindur Bullin (Paul Borg) Legend of the Boulders. Earthquake and Tsunami, the Babinda Boulders.

Obtainable from:

PO Box 1615, Rockhampton, 4700

d.myers@cqu.edu.au

www.outbackbooks.com

Jakamarrarlu, Nelson Peters & Napurrurlarlu, Nancy Oldfield. 1988. **Ngawarra-Kurlu**. Yuendumu BRDU, Darwin.

Flood story.

Mountford C & Roberts A 1973. **The Dreamtime Book, Australian Aboriginal Myths**. Rigby, Adelaide.

Myths relate to most natural phenomena, including thunder, drought, maltreatment of the willy wagtail bringing severe storms, and the Uluru myth.

Pickup G 1978. **Natural Hazards Management in Northern Australia**. NARU, Darwin.

Roth Walter. 1903. *Superstition, Magic and Medicine.* **North Queensland Ethnography: Bulletin No.5.** Home Secretary's Department, Brisbane.

Appendix

Appendix 1.1 Letter of introduction to remote communities

CDS, JCU Townsville 4811

Centre for Disaster Studies, School of Indigenous Australian Studies, James Cook University, Commonwealth Bureau of Meteorology

RE: Weather Warnings and Hazardous Weather Knowledge in Indigenous Communities.

Dear ……..

I seek permission to conduct a survey of issues surrounding extreme weather information and weather related responses of your community.

We are researching how weather forecasts and warnings get to remote indigenous communities and how it is shared and used. The goal is to improve that, to maximise the safety of all community members from the impact of cyclones, storm surges, strong winds, floods, severe storms or bushfire.

We want to record:

- how weather and warning information gets to and through your community
- how your community (i) uses traditional knowledge to understand and interpret pending extreme weather and hazards and
  (ii) uses broadcast warnings and messages
- your community needs for weather and warning information; and
- how well current practices meet your community needs.

I have included a questionnaire guide so you can see what we want to learn about. We hope a range of community leaders, elders and workers will provide information on behalf of the whole community.
The survey is basically an inventory of information. If you have any questions about this survey please phone David King on 0747814430 or Douglas Goudie, 0419726384; Centre for Disaster Studies, James Cook University, Townsville, Q4811, or email Douglas.Goudie@jcu.edu.au. We will send the form ahead of the visit.

Yours truly,

Douglas Goudie, Researcher,
Research team leader
Communicating Disaster Risks
for BoM, CDS, James Cook University.

PERMISSION GIVEN BY …… DATE ……

PRINTED ……
POSITION……..

Appendix 2 A3

A3

CDS, JCU Townsville 4811

Centre for Disaster Studies, School of Indigenous Australian Studies, James Cook University, Commonwealth Bureau of Meteorology

October, 2003

Weather Information Survey Form
Kimberly

Weather Warnings and Hazardous Weather Knowledge in Indigenous Communities

We are researching how weather forecasts and warnings get to remote indigenous communities and how it is shared and used. The goal is to improve that, to maximise the safety of all community members from the impact of cyclones, storm surges, strong winds, floods, severe storms or bushfire.

We want to record:

- how weather and warning information gets to and through your community
- how your community (i) uses traditional knowledge to understand and interpret pending extreme weather and hazards and (ii) uses broadcast warnings and messages
- your community needs for weather and warning information; and
- how well current practices meet your community needs.

With these aims in mind please fill in the information that we are seeking for the whole community. We expect information will come from range of people: community leaders, elders and workers.

If you have any questions about this survey please phone David King on 0747814430. If posting the completed survey please send it to Dr Douglas Goudie, TESAG, James Cook University, Townsville, Q4811, fax it to 0747814020, or emailed (if you ask for e-copy) to Douglas.Goudie@jcu.edu.au

PERMISSION

I…… (print)…….

Of……
Give my permission for this survey to be conducted

Date ……. Community position held……

Signature……

JCU – BoM 2003 Weather Information Survey Form

1. Name of Community

2. Name of Interviewer

3. Please list all the outstations connected to this community

Name of outstation	Distance from community	Number of people staying there

4. For each Outstation please list the following:

Outstation name	Number of buildings there	When do people stay there?	What is the condition of the road out there and when is it not accessible?	What forms of communication are at the outstation?

5. For the community as a whole, including outstations, about how many people live here

indigenous - non-indigenous -

6. About how many households are there in this community?

7. Does the population in this community change much during the year?
Why, when and how many?

8. What kinds of major weather events do you get?

9. Has this community been struck by extreme weather or a disaster in the past?

10. What kinds of Events have occurred? Please supply details and times.

JCU – BoM 2003 Weather Information Survey Form

11. What happens to this community during the wet season? Please describe problems and opportunities that occur as a result of the annual wet season: - isolation, health issues, social problems, festivals or events, particular activities etc.

12. The previous questions will help us understand your community. Please give us more comments about your unique community in relation to weather or fire extremes, community functions, information flows and seasonal knowledge.

The following questions ask about weather events, information that is received about them and knowledge of weather in the community. Please add as much information as you can, including examples and accounts of specific events.

13. What are the natural indicators for the onset of the wet, and the dry season?
14. What natural indicators tell people that there is going to be, or likely to be, a bad or dangerous weather event (including bushfire, flood, severe storm, cyclone, surge, cold snap , drought etc.) ? (use note paper for all details)
15. When bad or extreme weather or fire threatens the community, what do people do to prepare? How do people change their behaviour? When the bad weather, or hazard, hits the community what do people do to protect themselves and others? Please use examples and specific hazards to illustrate what happens and how people cope. (notes)
16. What radio stations do people listen to in this community?
17. Do all households in this community have and use the radio? How many might not have a radio?
18. What TV stations are received in this community?
19. How many households have a TV?

JCU – BoM 2003 Weather Information Survey Form

20. How many computers are there in this community that have internet access, and where are they situated? Who has access to these computers?
21. For each of the following please list the favourites or the most frequently used.
Radio station(s)
TV station(s)
Internet Site(s)
22. What sort of telephone system does the community use? About how many households have working phones? How many public phones are there? What problems does the phone system experience?
23. Are there any 2 way radios in the community? Where are these, who has access to them, what system/network are they on, and how reliable are they?
24. How does this community receive weather forecasts?
25. When there is bad weather of any kind what happens to the community's power supply?
26. When there is bad weather of any kind what happens to the community's telecommunications?
27. If the community is threatened by some kind of natural weather generated hazard, how would members of this community find out in advance, and how would they be warned? Are there any individuals who have responsibility for spreading warnings and organising people? (notes)
28. Generally, how does information flow through this community? How do people collect information and spread it? (notes)

JCU – BoM 2003 Weather Information Survey Form

29. Are there sub sections of the community who are not as well informed or as involved as other sections of the community? As part of this response please give an outline of political divisions within the community. (notes)
30. To what extent do people, community leaders, public servants etc. in this community pay any attention to weather forecasts and warnings from the Bureau of Meteorology?
31. If the previous response was relatively negative, why is it that weather forecasts don't mean much to peoples' lives here?
32. What could be done to improve existing Weather Bureau forecasts and warnings of bad weather or dangerous hazards? (notes)
33. What kind of traditional ways do people have of recognising or predicting a change in the weather and an increase in a hazard? (This might have been answered in an earlier question). (notes)
34. For research ethical reasons we will not record sensitive indigenous knowledge. However, we are interested in traditional stories and legends that relate to weather and major hazard events. If community members have such stories, what are they about? Can we visit people who know these stories? (notes and follow-up)
35. Many traditional stories have already been written down and may exist in a published form. Can you give us reference details or copy of stories that related to weather, seasons and hazardous events. (notes)
36. Please write/tell us any further information or comments that you think will be useful for this study. (notes)
END. Your community will be sent a copy of the write-up of this visit. Send to …….. ……..(email)……

Appendix 3
Torres Strait and the Northern Peninsula Area of Cape York

The Torres Strait community of Thursday Island (Figure 1) and the communities in the Northern Peninsula Area (NPA) – Injinoo, New Mapoon, Umagico, Seisia, Bamaga were surveyed by Dr Alison Cottrell. Alison found the same overload of prior officials or academics who come, then go, leaving a some-what jaundiced view of such behaviour among the communities.

Figure 1 A typical TI day

Photo Alison Cottrell

Spokespeople presented as being fairly sanguine about weather extremes – extremes came and go, people cope. The brief history given speaks of often forced re-location of communities. Mistrust of outsiders seems reasonable, no matter how 'positive' our purpose seems to us.

Like Yarrabah, the main communication is via Telstra land lines. Also "radio and television are important sources of information and entertainment. There are 4 television stations that can be received in the region: ABC, Impaja (from the Northern Territory), 7 Central and SBS. Radio stations include: the local BRACS stations which operate varying hours depending on availability of staff and the Indigenous Radio station that operates out of Townsville, 4K1G.

Most of the councils have their own two-way radio networks. In the context of an emergency, the Queensland Police is usually the first agency to act. The Police would contact the councils and the councils would contact the community.

The Community councils use the BRACS radio stations to communicate information, post notices on bulletin boards at frequently used places, rely on word of mouth and if necessary, doorknock to inform residents. In the NPA in particular, the communities are 2-300 in size and it is quite possible to achieve rapid communication by word of mouth.

The main impact of cyclones is whether the weekly barge from Cairns is delayed by cyclones in the Cairns region.

Some people were concerned about the legality of down-loading information from the website and passing it on.

… if there is a major weather issue like a cyclone, then the [TV] detail is sufficient for people to understand what is happening.
"You can get BoM map updated every 10 minutes but often the weather has passed by the time you read it."

The radio weather reports were somewhat limited but many people reported listening anyway.

The operator of the BRACS station on Thursday Island was concerned that radio announcers were not well trained to understand either the weather maps or the real meaning of the BoM weather reports. At the moment they download the BoM information and 'translate' it as best they can, but don't feel all that confident about it. The feeling was that a training session for radio operators to understand the information so they could 'translate' the reports into everyday language or even local languages would be very useful. Other people also felt that it would help for the BRACS announcers to be more fluent in reading meteorological information.

Members of the mainstream community who are not involved in boating or fishing, including media personnel are probably as likely to lack the necessary understanding of weather reports.

The BoM website however, was well used in the area."

Weather Issues in Indigenous Communities

Dr Alison Cottrell

Torres Strait and the Northern Peninsula Area

Introduction

The data for this area was gathered from Thursday Island, and the communities in the Northern Peninsula Area (NPA) – Injinoo, New Mapoon, Umagico, Seisia, Bamaga. At these locations interviews were conducted with the CEO's of the community councils, representatives of several government organizations, and various members of the community (15 people were consulted).

In general, it must be acknowledged that weather does not rate as an important issue in these communities. It must also be acknowledged that these communities are inundated with visiting government representatives, officials and researchers to the point where I suspect they really don't want to talk to anyone, and justifiably so. Throughout the islands and the NPA, people use small boats, mainly motorised dinghies, as their primary means of transport

At the time, there had been recent discussions about fires services in the region.
Some SES teams were operative, others not.

The Communities

The Injinoo Community is an Aboriginal community and the traditional owners of the Northern Provincial Area. The population is about 500, comprised of about 90 families. There would be only 10 non-indigenous residents.

New Mapoon is an Aboriginal community which was forcibly removed to the area from Old Mapoon when bauxite mining was developed. The population is approximately 300 made up of approximately 70 families.

Umagico is an Aboriginal Community, again, forcibly removed from their homelands in the Port Stewart area in the 1960s. Torres Strait and Cape York Creole are the dominant languages at Umagico. There are 200 residents, and 33 households, mainly Indigenous. For traditional information Charles Woosup is the contact.

Seisia is a Torres Strait Islander Community that moved into the region in the 1950s. The population is about 200, mainly Islanders. There are about 33 houses but some have 2 or 3 families living there.

Bamaga is predominantly a Torres Strait Islander community and serves as the main administrative centre for the Northern Provincial Area.

The Torres Strait Islands are complex, with many individual communities. The Torres Strait Regional Authority provides contact with each of the individual communities, and the Torres Shire Council oversees the remainder of the area not covered by indigenous communities that lie to the north of the 10^{th} parallel. The population of Thursday Island is approximately 1300. Thursday Island is where many regional meetings are held.

Contacts for Aboriginal Communities can be found on the internet. A recent list of Islander contacts was provided by TSRA. If the issue of traditional stories is to be pursued for the Bureau of Meteorology website then I suggest that councils be formally approached in writing, checking on the appropriate contact closer to the time. Communication should be addressed to the whole council, not just the CEO. The CEO is primarily a financial administrator.
It would be most appropriate to contact libraries and the various anthropology departments that might have been involved in the area prior to writing to communities. As a matter of courtesy, it would also be best then to seek permission from the communities to have their stories placed on the website, even if they are available in published documents.

Ephraim Bani is willing to be contacted about the traditional stories of the Torres Strait. Ephraim is an elder in the community as well as having a Masters Degree in Linguistics and knows the Islander traditional stories of the area (address attached).

The library at Bamaga also houses an amount of relevant information.

Communication Systems

Telstra landline is the most common means of telephone. The extent of telephone use is not readily available. Aside from government departments (of which there are many) and businesses, it was not possible to estimate the use of private phones in the communities. CDMA phones are also starting to be used. There is good reception except at Seisia which seems to be in a bit of a ‘shadow”.

Most government departments and businesses (which tend to be owned by the councils on the NPA) have internet access. Some households also have internet access. There is an internet café at Umagico for $10 per month and at the Torres Strait Council offices, charged at $2.5O per 15 minutes of use. At Umagico there were few telephones. Some people were purchasing CDMA phones. There were pay phones there.

In the region, radio and television are important sources of information and entertainment. There are 4 television stations that can be received in the region: ABC, Impaja (from the Northern Territory), 7 Central and SBS. Radio stations include: the local BRACS stations which operate varying hours depending on availability of staff, the Indigenous Radio station that operates out of Townsville 4K1G,

Most of the councils have their own two-way radio networks.

During wet weather, the telephone systems often get patchy, but are usually fixed quite quickly. Power outages are more related to the age and maintenance of diesel generators, rather than weather issues.

Broadband would have made communications easier, but the Torres Strait and the NPA missed out on a Telstra remote community infrastructure grant. The feeling was that there was so much government infrastructure already there that this went against the area.
In the context of an emergency, the Queensland Police is usually the first agency to act. The Police would contact the councils and the councils would contact the community. The Community councils use the BRACS radio stations to communicate information, post notices on bulletin boards at frequently used places, rely on word of mouth and if necessary, doorknock to inform residents. In the NPA in particular, the communities are 2-300 in size and it is quite possible to achieve rapid communication by word of mouth.

Weather Issues

“Locals listen to the weather reports, but trust their own judgement more.”

It must be acknowledged, that weather issues are not a high priority in the region. Apart from Injinoo which experiences some flooding of low lying areas

in really heavy rains, the wet season is not viewed as a major issue. In 1998 Injinoo experienced flooding from a cyclone that came from the Northern Territory region there was about $145,000 worth of damage with some rooves being lifted off. The community was cut in half at the time, with the hospital and shipping companies being isolated. All the roads inside the areas where people live are bitumen and the view was that since they were covered with bitumen, any wet season issues had diminished. Cyclones are generally not a common experience in the region. The main impact of cyclones is whether the weekly barge from Cairns is delayed by cyclones in the Cairns region.

There are two major weather patterns in the region. The winds that come from the SE for 7-9 months of the year (from March April), and the winds that come from the NW (monsoons from November) for 2-3 months of the year. There is a quiet time in between (the doldrums) of varying lengths. It is windy most of the time.

There was a feeling that traditional information about the weather was being lost. Strong winds are normal in the region 20-35knots. As well, the current can run up to 8 knots on a regular basis.

For People who fish, particularly for subsistence, knowledge of the weather is important. However, the general feeling is that locals who fish know about the weather. Of more concern to officials is that people are adequately equipped with supplies and fuel if bad weather conditions should suddenly arise. The feeling was that youngsters grow up travelling with their families on the water and fishing so they gradually acquire the knowledge about the sea and the weather. It is the younger ones who are much more urbanised who are lacking in this knowledge.

Some people were concerned about the legality of down-loading information from the website and passing it on. There was a feeling that if children could be involved in collection information about the weather it would be a positive step.

Some CEOs looked forward to the wet season because there were fewer visitors and they could catch up on their real work. In some communities outdoor events such as tombstone openings and weddings might be delayed until after the wet season.

Horn Island experiences flooding in the wet season. The water table rises and there are consequent problems for the septic systems.

At New Mapoon, there is some beach erosion.

During the dry season fires can be an issue. The health impacts in terms of asthma were worse for older people. At Seisia, the community is downwind of most of the events to the north so that can be a problem for them. While there is some traditional fire management in the region, most grass fires are started by young teenagers some of whom it was considered should know better. On Thursday Island the local fire officers were rather pleased to have

come through the school holidays without a grass fire, after having invested in an education program at the school.

Weather Reports

Whether or not people used BoM weather reports or listened to the radio varied. Most people found the television news to be useless. At best the television news comes from Brisbane and the Torres Strait and NPA are rarely even shown. However, if there is a major weather issue like a cyclone, then the detail is sufficient for people to understand what is happening.
"You can get BoM map updated every 10 minutes but often the weather has passed by the time you read it."
The radio weather reports were somewhat limited but many people reported listening anyway. The local newspaper, the Torres Strait News would like to publish weather information, but as it is a weekly publication, by the time it gets published the information is out of date. The weather information also needs to come from a local who records the information because there is no longer a weather station on Thursday Island, only one on Horn Island at the airport.

Of particular concern to people would be more detailed information about wind warnings, wave heights, depth visibility and the length of time that bad conditions are likely to persist.

The operator of the BRACS station on Thursday Island was concerned that radio announcers were not well trained to understand either the weather maps or the real meaning of the BoM weather reports. At the moment they download the BoM information and 'translate' it as best they can, but don't feel all that confident about it. The feeling was that a training session for radio operators to understand the information so they could 'translate' the reports into everyday language or even local languages would be very useful. Other people also felt that it would help for the BRACS announcers to be more fluent in reading meteorological information.
Members of the mainstream community who are not involved in boating or fishing, including media personnel are probably as likely to lack the necessary understanding of weather reports.
The BoM website however, was well used in the area. There are many government department offices which regularly download the information for the area. Government staff use the information to check travel arrangements and to anticipate bad weather conditions. Many people download information to check on the weather where their children are at school. The usefulness or relevance of the BoM information varied.
As well, it was felt that information from the BoM about how long really rough conditions were likely to last would be useful, so that people could plan fishing and other boating activities. This is particularly important for those people for whom fishing is a major subsistence or commercial activity. Because traditional weather information was felt to be being lost, people felt that a better understanding of the reports and maps was useful.

Discussions with members of indigenous and mainstream communities suggests that there is in fact little difference in the usefulness or understanding of BoM weather reports. Both types of communities would benefit from their media operatives having a better understanding of weather data as well as perhaps a problem-based module for high school children. A High school teacher suggested that if the focus is on planning for fishing activities then it is not too difficult to interest high school students in understanding weather information.

Recommendations

- Provide a training program in reading weather reports and maps for BRACS announcers. This could be achieved using the Video Digital Network. This method was suggested by Florence Onus who teaches in media studies in the School of Indigenous Australian Studies at James Cook University. There is a TAFE College facility which could be used for the purpose. Five or six places can be linked at once. The BRACS operators should be contacted to organise a mutually convenient time.
- From existing programs refine a module for high school students in understanding weather reports and maps, using a problem-based approach.
- It may even be possible to run a 'Reading the weather' report in the Torres News which has a good and wide readership in the area. You would need to contact the editor for this.

Acknowledgements

I'd like to acknowledge that this report is from information provided by the following people who generously provided their time:

Edward Natera – Injinoo, Sylvia Tabuai - TSIMA, Mike Marriott - Queensland Marine Safety, Chris Foord – Bamaga, Arthur Wong – Seisia Janelle Menzies – Umagico' Mervyn Bond – New Mapoon
Chris Mosby - Torres Strait Regional Authority, Paul Shuth – Torres Shire Council, Florence Onus – James Cook University, Mark Bousen – Editor, Torres News (torresnews@bigpond.com), As well as anonymous members of the community.

Appendix 4
Yarrabah

The Yarrabah results show just how difficult it is to derive detailed data for communities with a long history of unfulfilling provision of survey information. Yetta Gurtner has done a remarkable job to gather the information presented. A link with Yetta's father and some-one from the community helped with the success of data-gathering in Yarrabah.

With about 3,000 people and 350 houses, Cyclone Justine in 1997 was the only extreme weather event collectively remembered. Usual monsoonal activity is seen as normal and acceptable. At such times, power failures and forced isolation are frequent. See Answer 15 in Attachment 3 in particular for details of community information and preparation.

Also, from Q 22: "The community primarily relies on land-lines operating through Telstra and Optus. While most households have private telephone facilities – usage is highly variable. Service is considered fairly reliable. There are approximately 3 public telephones available in the community although operation and service is not consistent (vandalism, poor servicing etc). The remote household/settlements do not have telephone access.

Telstra has recently upgraded it services to the community to CDMA and both Telstra and Vodafone offer good mobile coverage (Optus has limited reception). Ownership of mobile phones is rapidly increasing (particularly amongst the youth) although mobile reception is generally less effective in bad weather."

1. Name of Community **Yarrabah – July 28-29, 2003**				
2. Name of Consultant **Amalgam of responses from 5 key informants – names withheld on request** **Interviewer: Yetta Gurtner**				
3. Please list all the outstations connected to this community **Yarrabah has no official outstations although there are numerous households and smaller family groups living outside the community area – accessible only by dirt road with no running water, electricity or telephone contact. Numbers were not available.**				
Name of outstation	Distance from community	Number of people staying there		
N.A.				
4. For each Outstation please list the following				
Outstation	Number of	When do	What is	What forms of

name	buildings there	people stay there?	Condition of the road out there and when is it not accessible?	communication are at the outstation?
N.A.				

5. For the community as a whole,
including outstations, how many people live here – Indigenous - non-Indigenous

Exact figures are difficult to gauge – even census details are believed to be inaccurate. Approximations place the population between 2700 – 3100. Over 95% of these people are indigenous.

6. How many households are there in this community?

There are over 300 council houses and 50+ private houses in the immediate Yarrabah community area; although new houses are being built to replace the old and occupancy rates tend to be variable. As there are no requirements for rates collection in this area, exact numbers are unavailable. There is limited information on the number and location of the more remote households/settlements.

7. Does the population in this community change much during the year? Why, when and how many?

The Yarrabah population is believed to be in a constant state of flux although with limited effect on overall numbers. Christmas generally sees an increase in numbers by about 200-300. All informants mentioned the numerous babies born as contributing to the Yarrabah community.

8. What are the kinds of major weather events that occur here?

Cyclones
Flooding
Tidal surges/king tides
Heavy rain/wind/storms
Bush fires
Dry
Dust storms

Secondary effects – landslides, fallen debris, power outage, flooding/storm surge, rising creek waters (cutting road and bridge access), destruction/obstruction of road access

9. Has this community been struck by extreme weather or a disaster in the past?

Although there has been cyclone damage, tidal surges and storm damage the general perception is that Yarrabah has not been struck by severe weather since the early 1900s – beyond the memory of all informants. These other events are considered common place and simply part of the monsoonal pattern. Cyclone Justin (March 1997) was the only specific weather event mentioned (although informants could not remember dates or times). Cyclone Winifred (February 1986) also caused significant physical damage to the area.

10. What kinds of Events have occurred? Please supply details and times

N.A.

11. What happens to this community during the wet season? Please describe problems and opportunities that occur as a result of the annual wet season: - isolation, health issues, social problems, festivals or events, particular activities etc.

The most common problems associated with the wet season in Yarrabah is the power failures and road cut offs. When caused by bad weather it may take 2-3 days to re-establish normal conditions. Despite being only 45 minutes drive from Cairns this can cause a sense of isolation. Frustration over such conditions may be exacerbated over the Christmas period – where access and food spoilage becomes a greater issue. Ownership of private generators is not common in the community and access to Cairns by boat is limited. Four wheel drive vehicles are common and help overcome some restrictions – and improvements have recently been made to the road.

Health has become a greater issue (although not directly related to weather) since the 15 bed hospital facility was closed over 2 years ago, without even an operational pharmacy. All serious illnesses and injuries must be transported to Cairns by vehicle or helicopter. The helicopter landing platform has been raised to be above any anticipated rising water levels – however the service is inoperable in strong winds or severe weather.

In addition to Christmas/New Year festivities the only annual community event is "Survival Day" held January 26 (also know as Australia Day). Other public events during the wet season are often subject to weather conditions.

12. The previous questions and prompts are to help us to visualise some basic features of the community. Please add any additional comments, descriptions or notes about the community that will help us to contextualise

how the community functions in relation to information flows and seasonal knowledge.

Yarrabah is located 45 minutes drive south of Cairns, accessible by a single road, boat (except at low tide) or helicopter. Much of the road to the area runs along the coastline (often directly exposed) and passes primarily through cane fields and rainforest. Although it is currently undergoing improvements, some areas of this road are narrow and at times very steep. There are also numerous bridges over local creeks.

The community itself is relatively spread out, with a dirt road extending past Reeves Creek out towards Cape Grafton and Deception (Woongoo) Point. There are numerous households/family groups living in settlements in this area without direct access to modern amenities. The primary settlement is located in the more sheltered Mission Bay area with many houses and buildings having direct water frontage – to both the beach and mud flats (Yarrabah Beach). The remainder of households, businesses, facilities and amenities are linked by bitumen road access. The majority of land surrounding the community has remained as swamp land and extends to the bottom of the mountains of the Murray Prior Range.

Direct telephone and power access have been established through overhead lines over the mountain range and as such remain exposed to interruptions due to bad weather and falling debris. Similarly the road is prone to landslides, boulders, debris and fallen trees; complete wash-away also occurs. While a combination of high tides and heavy rain fall can cause the rivers/creeks to rise above bridge levels this normally subsides within a couple of hours. During the wet season access on the dirt road is often limited to 4 wheel drive vehicles only.

The remainder of the questions and prompts are concerned with weather events, information that is received about them and knowledge of weather in the community. Please add as much information as you can including examples and accounts of specific events.

13. What are the natural indicators for the onset of the wet, and the dry season?

Insect behaviour – ants are more common indoors, and cockroach behaviour is erratic before the big wet
Certain plants and flowers are used to indicate seasonal changes (informant unable to provide/remember specifics)
Cloud patterns and movements used as a natural indicator (unable to clearly express how)

14. What natural indicators tell people that there is going to be, or likely to be, a bad or dangerous weather event (including bushfire, flood, severe storm, cyclone, surge, cold snap , drought etc.) ?

Behaviour of the *storm bird* is erratic – indication of bad weather coming
The *cyclone bird* flies low or circles in the sky and flies off in the direction of the coming cyclone just days/hours prior
Numerous crocodile tracks and drag marks heading up the mudflats/beach indicates that it is going to be rough out at sea for about the next week, possibly due to storm or cyclone
A dark, shadowy ring around the moon means that bad weather is coming
Unusually high tides means a storm is coming (conversely "blue" sea water close to shore is supposed to indicate good weather for the next couple of days)

Obvious indicators like smoke on the horizon and animal movements are used for bushfires, while flora and fauna indicate signs of continued dry.

15. When bad weather, or a hazardous weather event threatens the community, what do people do to prepare? How do people change their behaviour? When the bad weather, or hazard, hits the community what do people do to protect themselves and others? Please use examples and specific hazards to illustrate what happens and how people cope.

Response patterns tend to be dependant on the individual or household group. In addition to warnings provided by the media, in threatening conditions the Cairns SES will contact their Yarrabah liaison and the council. It is here that an appropriate course of action and community response is determined. The relevant information is then disseminated from this point – primarily on an oral basis although signs and "door-knocks" to remote areas may also be employed. Individuals desiring further knowledge talk to the appointed representatives or will access the BoM telephone hotline for updates. While most seemed satisfied with the way this system operates, some remain cynical about the level and extent of information passed on.

As individuals and families make their own preparations, the SES conducts an additional inventory of resources and attempts to anticipate and prepare for the community's requirements. If a cyclone or severe winds are forecast, the public works/council will organise a local "garbage" pick-up encouraging residents to remove all loose objects from their yards and surrounding area. While some (particularly the elders) may make efforts to stock pile food, tape windows and prepare emergency kits it was believed that the youth have a very relaxed attitude – almost a flagrant disregard for any forecast conditions. It was noted that during the winds and rain of Cyclone Justin some of the younger families remained in their houses directly facing the beach front with all windows open, allowing nature to take its course. Similarly some of the younger members of the community have been caught out at sea during dangerous weather despite adequate forecasts.

Emergency shelter and an evacuation plan have been established for

the community yet knowledge of both tends to be verbal. Few of the key informants were able to provide more than a vague description of how these were supposed to operate in an emergency, however all were insistent that a "strong community spirit" existed in such situations and all would help each other. As many of the bushfires are believed to be initiated by community members there is rarely any concern over their occurrence. It was also proposed that the more relaxed attitude of the Yarrabah residents to weather events was due to the lesser importance of material possessions/economics to these people and an acceptance of the natural wet/dry season dynamics (the low incidence of insurance policy ownership was cited as evidence).
16. What radio stations do people listen to in this community? **All the commercial AM/FM radio stations are received from Cairns and the surrounding region although the most commonly identified were 98.7FM (an indigenous station), ABC National, 4CA and SEAFM**
17. Do all households in this community have and use the radio? How many might not have a radio? **The majority of households are believed to have a radio – although ownership is not indicative of use. While batteries are available for purchase not all households have consistent access to a power supply (where available), either due to non-payment of bills, failure to connect or power outages. As the more remote household/settlements don't have power it is unknown whether they may or may not have radios.**
18. What TV stations are received in this community? **In addition to Austar by antennae, all the regional television stations are available in Yarrabah – quality of reception depends on location of house. These include WIN, Sunshine, QTV, ABC and SBS.**
19. How many households have a TV? **The majority of households are also believed to have televisions although circumstances are consistent with that of radios.**
20. How many computers are there in this community that have internet access, and where are they situated? Who has access to these computers?
It is unknown how many computers are in the Yarrabah community. Private ownership is estimated at approximately 5% while all official government/community administrative buildings have at least one. This includes the Council office, Public Works/SES, Museum, Library, Primary and High School, Police Station and Centrelink.
21. For each of the following please list the favourites or the most frequently used.

Radio station **Informant responses include 98.7FM,ABC National, 4CA and SEAFM**
TV station **Days of Our Lives apparently has a bit of a cult following but QTV and WIN were regularly identified as reliable sources of news content**
Internet Sites **Highly variable**
22. What sort of telephone system does the community use? How many households have working phones? How many public phones are there? What problems does the phone system experience? **The community primarily relies on land-lines operating through Telstra and Optus. While most households have private telephone facilities – usage is highly variable. Service is considered fairly reliable. There are approximately 3 public telephones available in the community although operation and service is not consistent (vandalism, poor servicing etc). The remote household/settlements do not have telephone access.** **Telstra has recently upgraded it services to the community to CDMA and both Telstra and Vodafone offer good mobile coverage (Optus has limited reception). Ownership of mobile phones is rapidly increasing (particularly amongst the youth) although mobile reception is generally less effective in bad weather.**
23. Are there any 2 way radios in the community? Where are these, who has access to them, what system/network are they on, and how reliable are they? **The Public Works/SES and council all have access to 2 way radios; both hand held and in vehicles, however due to misuse and abuse they are generally considered unreliable and telephones are more commonly used in an emergency threat/situation.**
24. How does this community receive weather forecasts? **Weather forecasts are generally received through the media (primarily radio and TV). In a threatening situation contact with the council will also be initiated by the BoM and SES. This information is then dispersed verbally to the community.**
25. When there is bad weather of any kind what happens to the community's power supply?

The power supply is generally cut to the community during bad weather. Depending on the cause and access to the problem, it may take anywhere from a couple hours to a couple of days for the electricity to be re-established. Most people do not own a private generator.
26. When there is bad weather of any kind what happens to the community's telecommunications? **The Telstra land-lines have remained operational over the majority of recent weather events in and around the Yarrabah community and are considered fairly reliable. Mobile coverage has been effected by bad weather, particularly the Vodafone network, while the new CDMA network is yet to be tested.**
27. If the community is threatened by some kind of natural weather generated hazard, how would members of this community find out in advance, and how would they be warned? Are there any individuals who have responsibility for spreading warnings and organising people? **Very few use or rely on traditional indicators of forthcoming weather events, as much of this knowledge is now forgotten or not passed on. The majority of people rely on media warnings/forecasts and the information provided by the council/SES. It is these organisations that are also responsible for ensuring all are provided advance warnings and are aware of the appropriate precautions/actions to take.**
28. Generally how does information flow through this community? How do people collect information and spread it? **While the majority of "official" information for Yarrabah is passed from the council down through the community, the relatively small population facilitates the quick spread of news. Much of this travels through the structure of family and cultural group affiliations. The church also had a strong presence in the community. Most information is collected and spread verbally.**
29. Are there sub sections of the community who are not as well informed or as involved as other sections of the community? As part of this response please give an outline of political divisions within the community. **The more remote households beyond Reeves Creek have an almost self-imposed isolation due to lack of amenities and dirt road access, however many of these people are still considered active members of the community. Others opt for almost complete hermitage. Political divisions in Yarrabah are complex and sensitive, and beyond the scope of a simple survey. Most divisions centre around traditional familial and cultural groups although the issue of "stolen generation" and forced relocations have created an additional element to the dynamics.**
30. To what extent do people, community leaders, public servants etc. in this

community pay any attention to weather forecasts and warnings from the Bureau of Meteorology? **Those in a position of authority, with delegated responsibilities pay the appropriate amount of attention to weather forecast and warnings issued by the BoM. Each event is assessed and treated in accordance with recommended standards for the community. There does seem to be some discrepancies about whether these Standard Operating Procedures are backed by appropriate training, personnel and resources.** **Individuals and families tend to take their own prescribed course of action, although most are believed to maintain common sense.**
31. If the previous response was relatively negative, why is it that weather forecasts don't mean much to peoples' lives here? **N.A.**
32. What could be done to improve existing Weather Bureau forecasts and warnings of bad weather or dangerous hazards? **N.A.**
33. What kind of traditional ways do people have of recognising or predicting a change in the weather and an increase in a hazard? (This might have been answered in an earlier question). **Refer Q.s 13 & 14**
34. For research ethical reasons we do not wish, in a short factual survey of this kind, to record sensitive Indigenous knowledge. However, we should be grateful if you can tell us whether any members of the community have knowledge of traditional stories and legends that relate to weather phenomena and major hazardous events. Please indicate approximately what sort of stories exist, and if possible the name of a contact person to whom we can return to seek permission to record stories at a later time. **Intellectual property is still a very sensitive issue in the Yarrabah community – particularly due to previous less ethical researchers. Although some informants were aware of members of the community that may possess traditional stories and legends they were unwilling to provide names and suggested simply "asking around" – especially at the aged care facility. One informant believed he could provide further information however he expressed doubts as he was not originally from the Yarrabah community – contact details have been recorded.**
35. Many traditional stories have already been written down and may exist in a published form. We should be grateful if you can supply reference details or copy for this survey any stories that related to weather, seasons and

hazardous events. **No published stories were recommended – see attached for excerpts from a relevant book that is considered controversial for intellectual property reasons:** **Dixon, R.M.W (1991) *Words of Our Country: Stories, place names and vocabulary in Yidiny, the Aboriginal language of the Cairns-Yarrabah region*. Queensland: University of Queensland Press.**
36. Please write any further information or comments that you think will be useful for this study. **N.A.**

Appendix 5 Full Report, Palm Island

The key emergent issues from this survey experience are that BoM should put out hourly bulletins in the areas where extreme weather is imminent or impacting, that the ‘pictograms’ from ‘The Message Stick’ can form the basis for simplified weather warning impact and responses, and that the humble barometer should have a renaissance to enable people to closely monitor their own local changing weather conditions – something that TV cannot do. Radio can only partly do this, and; until BoM can start generating hourly updates (with isobar figures) BoM can only partly do.

Providing barometers as prizes for weather-related community and school competitions, and how to use them may be an elegant and simple way to achieve some research goals – a means of increased community awareness of weather threats, a greater sense of community autonomy, and a way of getting very accurate and ongoing information about any deterioration of threatening weather.

A further issue may be the re-introduction of cyclone tracking maps to phone books in the cyclone prone regions of Australia.

Reflectively-
Considering concepts of community capacity-building, there are two interesting ‘meta’ issues at play on Palm, considering nearly all peoples there are descendents from forced re-locations of 1918, 1923 and beyond:

Many of the places – The Community, The Mission, The Creek, The Farm, The football Field, The Hall do not have individualised names.

Nearly all the kids ‘go away’ from yr 8 to 12, to the mainland and boarding school. This is slightly eerie against the background of the ‘stolen generations’.

The following report details interviews held on Palm Island on 1 and 2 September 2003.

Map A5.1 General location of Palm Islands

from: http://www.queensland-australia.com/100172.php

My Special Thanks go to the unstinting and generous support of Murray Holm, director of TAFE, Palm Island, who was my guide and introduction card – this could not have happened without his and other support from TAFE, and from the Community. Palm is a very attractive place. The people I interviewed were all very clear and helpful. Thanks.

Palm Island was listed as having 2,376 people at Census 2001 (ABS) although other sources put the figure at anything up to 4,000 people. It is a very pretty place (Figure 1)

Figure A5.1 Palm Island… Beautiful one day…….

Alan Lane, with CES
Alan suggested that people with boats keep a close eye on the weather. They may ring up the Coast guard, or BoM. People tend to watch TV rather than listen to radio. People particularly watch the Channel 7 or 9 news at 6pm for the local weather. Council may listen to the radio to keep getting weather information if it seems a bit bad. There is a big listenership of the Aboriginal radio station (based in Townsville – 4K1G – 'too deadly'). People tend to go fishing in the late afternoon.

Merle Robertson, Home and Community Care (HACC)
Once Merle learns about a cyclone warning, she will ring BoM to get a fax map of the current situation.
She then looked in the phone book to show me the cyclone-tracking map, with the BoM number, but could not find it. She was disappointed – "It used to be in the front, in the white pages. They used to have a full map. If you don't have a fax, you can check off the lat. and long. given in the map".
With TVs, the reception is very patchy, even from one street to the next. Some places only get one channel, some get all, and some get Cairns stations.

Once there is a warning, Parks and Wildlife Rangers run off weather maps and hand them around.

When there is a cyclone warning, Merle will run around and tie down everything and cover with tarps. She likes to be careful. Merle believes you should take all cyclones seriously.

If there is a big cyclone, the rangers will go out to warn every-one. People tend to all come to the Mission before a big cyclone.

After a big dry, ants move eggs and have a lot of activity, which means there will be a big rain soon.

People and vulnerability
There is a caravan park at Butler Bay (see Figure 2) with about 15 people. They are highly vulnerable because it is in low country next to the sea.

Figure A5.2 Butlers Bay, Palm Island

There is a need to put out education pamphlets to schools and through other organisations before the wet season. Things like warnings about dangers of lightning strike if you go out walking in electrical storms. There should be pamphlets to describe what the BoM severe weather warnings actually mean and what people should do to stay safe. More education will make people more aware.

Bwgcolman (Book-gl-man, Bull-go-man - means Many Tribes) are the “historic owners”, while Manbarra are the traditional owners of Palm Island. It seems there is only one family of traditional owners still living on Palm Island, of about 10 people; the other traditional owners live on the mainland. There are deep problems with Palm Island in relation to land ownership. The Palm Island group is currently a DOGIT – Deed of Grant In Trust.

Because there is no private land ownership the entrepreneurial results of home ownership and development in general seem to be held back a little.

Heath Prior – Ranger
Before the cyclone season the SES likes to do an evacuation plan. If there is a cyclone warning we go to every island to warn everyone that is camped there and to all the outlying communities to tell them about the cyclone warning. We have a 5 metre half cab 115hp Evinrude powered boat. We do a full count of each camp before the cyclone season.

We have a counter disaster plan so that if we think a house is unsafe we get the occupants to move somewhere safer. We have police backup if needed.

Gail Barry - Acting Palm Island Council secretary
Gail will encourage Councillors to fill out the survey form.

Ili Debea SES
Ili will take the whole survey form to the Council meeting on Monday 8th September so the whole community can talk it through.

Eric Bunn (76 year old, ex controller of SES, ex fire surveillance officer, ex backup ambulance driver, ex search and rescue)
There was a cyclone surge with the 1940 cyclone – it threw little boats high above the high water mark. In 1971 (Althea), it came through on a low tide, but the sea came up to the high water mark.

If there is a big blow, we would take our boats to Francis Creek (toward the Farm). A cyclone wind might come from the south, then, after the eye, from the north. The weather bureau can only do so much. People should start preparing as soon as there is a warning.

If the telecommunications tower on the beachfront goes there will be trouble.
The store gets in durable supplies before each wet – tinned flour, tinned sugar – all in tins.
There is a problem dealing with all the different groups on the Island - there are the European types, the halfways like me, right through to the Aboriginals in the bush.

There were a lot of close calls with cyclones in the 1980s. We are used to cyclones threatening us.
Eric would like to see a lot more weather awareness. Eric watches his barometer very closely. This inspired the idea that we (BoM) could hold competitions about weather awareness, with prizes being good quality barometers (and how to use them) going to the communities who send in a good entry. The result of having legible barometers in the settlements will be that people will be able to closely monitor their own local changing weather conditions – something that TV cannot do. Radio can only partly do, and; until BoM can start generating hourly updates (with isobar figures) BoM can only partly do. This may be an elegant way to achieve a few of the research goals all at once – a means of increased community awareness of weather threats, a greater sense of autonomy, and a way of getting very accurate, localised and ongoing information about any deterioration of threatening weather.

The following information is set to the survey format.

Permission – J Ling, CEO.

1. Name of Community
Palm Island

2. Name of Interviewer
DG - note – **ALL INFORMATION APPROXIMATE**

3. Please list all the outstations connected to this community

Name of outstation	Distance from community (Km)	Number of people staying there
Saw Mill Bay	3	30
Butler Bay (full settlement)	7	500
Mundy Bay	12	~30
Onion Bay	15	5
Pencil Bay	12	2
Wallaby Point	15	50

4. For each Outstation please list the following:

Outstation name	Number of buildings there	When do people stay there?	What is the condition of the road out there and when is it not accessible?	What forms of communication are at the outstation?
Saw Mill Bay	5	Off and on	Fair	None
Butler Bay (full settlement)	60	Permanent	Very good (sealed)	mainstream
Mundy Bay	3	Off and on	4 WD	none
Onion Bay	1	Off and on	Poor track	None
Pencil Bay	1	Off and on	Fair	None
Wallaby Point	8	Off and on	Poor 4 WD	None
Other islands of the greater Palm Group	0	Off and on	boat	None, perhaps marine frequencies at times

5. For the community as a whole, including outstations, about how many people live here

indigenous - 3000 non-indigenous - 70 – School, Q-build, Hospital

6. About how many households are there in this community?
300

7. Does the population in this community change much during the year?
In the School holidays – nearly all the year 8 – 12 students come home (no proper 8 – 1
Island.
Why, when and how many?
By Ferry, a few by plane.

8. What kinds of major weather events do you get?
Cyclones, some big storms. Mainly cyclones

9. Has this community been struck by extreme weather or a disaster in the past? Cyclones in 1940, 1958 and 1971, and a major flood in 2001.

Heath – In the 2001 flood the SES building had 100mm of water over the floor. There were about 6 houses on the back road that were quite badly flooded. (see Figure 3). In 2001 there was a prior warning of the storm so that people could evacuate before their houses were flooded. If anyone is worried about the weather they can ring the BoM and have it faxed to the Council with the weather map.

Figure A5.3 Flood-prone area of the 'Back road, "the Mission" Palm Island.

10. What kinds of Events have occurred? Please supply details and times. Cyclones, Electrical storms in June, July, and at start of wet.

11. What happens to this community during the wet season? Please describe problems and opportunities that occur as a result of the annual wet season: - isolation, health issues, social problems, festivals or events, particular activities etc.

Merle - Normally just rain for a couple of days. It is hard for planes to land. Every-one comes outside when there is a big flood on. The link bridge (in the Community) goes under for a couple of hours. We can lose some beach or road near the sea. There are two separate old hermits who live near a creek to the north of the Community, they got flooded out in the big flood in 2000.

There are no fires in the community, just up in the scrub.

12. The previous questions will help us understand your community. Please give us more comments about your unique community in relation to weather or fire extremes, community functions, information flows and seasonal knowledge.

13. What are the natural indicators for the onset of the wet, and the dry season?

Merle – Lots of cloud, fine mist. For major rain, red sunsets.

14. What natural indicators tell people that there is going to be, or likely to be, a bad or dangerous weather event (including bushfire, flood, severe storm, cyclone, surge, cold snap , drought etc.) ?

Merle – Once I found a crab in my back yard. This was not normal. There was a cyclone warning after I saw the crab. It did not hit Palm hard.

When you see birds gather in flocks and fly around fast.

15. When bad or extreme weather or fire threatens the community, what do people do to prepare?

Prepare before the event – pretty organised

Merle – Stock up on supplies. All Outstation people come in. We call the evacuation centres “safe places”. They are: the Day Care Centre, the Community Development Employment Centre (CDEP) buildings, the Ranger Station and the Hospital. In 1988 there was a cyclone threat. We all moved into the hall (which is now burned out). It was very crowded with every-one in there. The SES assists people with a warning sheet and with a procedures (what to do) sheet.

15. Eric said that the counter disaster committee would meet and look at the issue (when there was an extreme weather warning) and the number of people they would have available in the SES. Eric had real concerns about the safety of buildings. He was concerned that sometimes the houses that the SES insist people leave may be safer than the evacuation centres that they are strongly advised to go to.

Before any major flood or cyclone people responsible for the earth moving machinery, for the sewage and the electricity would meet and would decide how to be best prepared. They would leave some plant at Butlers Bay and some in the Community to make the clean-ups easier if the creek stayed flooded.

There would be three or four meetings before a cyclone to get everything in place. In 1940 the eye of the cyclone went over Palm and into Lucinda. It took the roof off the boys home where Eric and many others crouched huddled in a corner. Eric was very scared. The building was shaking. Eric lived through the 1958 cyclone which blew away all of the war igloos in Garbutt, Townsville that the US air force had used. Eric well remembers the power of cyclone Althea in 1971.

16. What radio stations do people listen to in this community?
4K1G, 4T0

17. Do all households in this community have and use the radio? - Most
How many might not have a radio? – few

18. What TV stations are received in this community?
All – TV and, often, Cairns.

19. How many households have a TV?
Nearly all.

19 Eric – All.
20. How many computers are there in this community that have internet access, and where are they situated? Who has access to these computers? Merle – Hospital, TAFE (accessible to about 200 students) Police, Schools. There are about 10 in private homes, at Coolgaree Youth Centre and CDEP and the Ranger station. The state school has an Internet café on a Wednesday night. That has not been going long, and is getting more popular. The first place to look for the BoM cyclone tracking weather map and phone number is in the phone book. It isn't in this year's book.
21. For each of the following please list the favourites or the most frequently used. . Merle – TV reception is patchy and variable. At the Top End people only get one channel. There are 4 communications towers – The Farm, The Mission, Butler Bay and Pencil Bay. Some people get the ABC, SBS, Win, Ten and Sunshine. Some people get some of the Cairns channels as well.
Radio station(s) 4K1G, 106.3 MIX FM 4TO
TV station(s) Win
Internet Site(s) BoM, M&S music
22. What sort of telephone system does the community use? Normal. CDMA just introduced. STD costs just to ring the mainland. About how many households have working phones? 100 How many public phones are there? 3 or 4 Merle – Telstra will only come across to Palm if there are a few jobs so that most of the time most of the public telephones are vandalised. What problems does the phone system experience? All the public phones only use phone card and sometimes the store runs out.
23. Are there any 2 way radios in the community? Yes Where are these, who has access to them, Rangers, SES, Police, Hospital, five homes, five private cars, Boats with marine radios + ~ 6. ?what system/network are they on, and how reliable are they? Fairly. It depends where you are.
24. How does this community receive weather forecasts? TV, Radio, Newspaper (about 30 come over each day), phone to BoM, Fax
25. When there is bad weather of any kind what happens to the community's power supply? Were some black-outs
26. When there is bad weather of any kind what happens to the community's telecommunications? Electrical storms – people do not touch phones. Clouds can block reception for people with Austar.

Merle – There is a relay shack for Telstra on the beach front in The Mission.
27. If the community is threatened by some kind of natural weather generated hazard, how would members of this community find out in advance, and how would they be warned? Are there any individuals who have responsibility for spreading warnings and organising people? Merle – Rangers, Police, and Council, House – to – house notices
28. Generally, how does information flow through this community? Merle – word of mouth but not just relying on informal network

29. Are there sub sections of the community who are not as well informed or as involved as other sections of the community? Merle – more remote but here on the radio
30. To what extent do people, community leaders, public servants etc. in this community pay any attention to weather forecasts and warnings from the Bureau of Meteorology? Merle – people will react and respond. The hospital and Council assign cars for emergency vehicles during natural disasters
32. What could be done to improve existing Weather Bureau forecasts and warnings of bad weather or dangerous hazards? Merle – There is a need for more pamphlets. Merle puts together the package for frail-aged and disabled younger people and their carers. She would like to see more public education pamphlets on cyclone and flood responses to be able to put into those packages. In the health department there is a code green to signify responses and issues relating to natural disasters. Gail – more public awareness and education especially in the schools. There should be big public signs. There is lightning between the mainland and the Island just before and during the wet. There is lightning in June and July as well. We need our own radio station through BRACC. Palm Island community needs to be treated separately to the Townsville Aboriginal community especially in relation to funding. We are a very separate group. Gail remembers Cyclone Althea in December 1971. She had just finished high school and was stranded in Townsville for many days because the ferry couldn't run. Gail believes that with fire education people like the BoM should think and give messages to do with real situations so that people would think "what would I do?" This is especially true for schools and school kids. Gail believes that the community needs practices in fire drills and in evacuation procedures. It is easy to be complacent. We need a weather station here at the community. Sometimes in winter here the winds are too strong to get the ferry service.

32. Eric would like to keep using nautical miles when describing the location and movement of a cyclone eye because:-
Nautical miles is the international unit of measure for sea distances but more subtly, and importantly, Eric argues that if you tell people that the eye is 100 km's away they will be more complacent than if you tell them it is, say 40 nautical miles away. They are more likely to get moving with the final preparations- they will be less complacent.

Anything on the TV news on the ABC weather should have the hectapascals with the highs or lows (the actual numeric value) on the map. We rely on the actual numbers to know how bad the low is. Without those actual figures it's just an interesting drawing.

33. What kind of traditional ways do people have of recognising or predicting a change in the weather and an increase in a hazard?
Ili - Cockroaches and ants become very active before bad weather. People just keep their eye on the wind. People who fish just watch the weather.

Eric - Traditional weather warnings
The weather has gone hey-wire.
When the black ant speed up, racing like buggery, you know there will be bad weather in about 3 days.
You used to get clouds that looked like the whole end bit of a maidenhair fern. Wispy from a central area, spreading out in little runs. I have not seen these type of clouds since 1992. Before 1992, if you saw it in the morning when you were out in a boat, you knew you had 48 hours to get to shelter. If you saw it from 12 to 2, you would get bad SE winds within about 12 hours.

There are now jet stream clouds in the summer. You never used to see them.

There are some funny signs about now. Sometimes after the main crop, some mango trees flower again, but only on the north side, around Christmas.

All the bush animals would breed up ahead of a good wet season, but they would not breed much if there was not going to be much of a wet.

Birds clear out before a big storm. You know when you are in the path of a big storm because it all goes quiet – all the birds have left. So that kind of quiet will tell you where the worst of a cyclone is going to hit.

With vegetation, with our traditional fruits – when all the trees had had their fruit, one tree may start to fruit again. People would know that something unusual was going to happen, that something different was coming up.

Appendix 6
Full report the Kimberley communities

Aim
Minimise adverse weather impacts - loss of life or injury to people and damage to property - from major weather events by enhancing weather information delivery.

Goal
To learn how to most effectively warn aware and prepared communities of developing major weather threats so that community members will avoid destructive natural impacts or properly shelter from those impacts.

Method
Survey key residents of remote Aboriginal communities in the east Kimberley. We were fortunate to be helped by a resident of long standing, well known and respected in the communities. Without Graeme Down to properly introduce us, the project would have been most difficult.

Four desert communities and Aboriginal residents in the Halls Creek area (see Map 1 – Maps and photos will be posted to our WEB site later), along with residents of two near-coastal Aboriginal communities were interviewed using a prepared interview guide (Appendix 1).

The communities

The Kimberley, northwest Australia, is an ancient, tough landscape with a stark climate of monsoonal wet and dry. The area often tops the daily temperature readings for Western Australia - Wyndham had 41^0C on 20/10/3. The east Kimberley is home to numerous Aboriginal groups, some bound by shared languages, stretching from the Tanami Desert to the coastal areas north of Kununurra and Wyndham. Communities typically have 100 – 400 people living in modern climate and culturally appropriate housing.
The study on weather information in and through remote aboriginal communities was undertaken by Dr Douglas Goudie (Senior Researcher, Centre for Disaster Studies, James Cook University, Townsville); Terry Hart, acting National Program Manager for Severe Weather Warning Services, Bureau of Meteorology (BoM, Melbourne) and Graeme Down, East Kimberley District Manager of West Australian Fire and Emergency Services Authority. Graeme has lived and worked in and with remote aboriginal communities for many years, including 5 years in the first community we visited: Ringer Soak. We visited six remote communities during October 2003 - four desert and two coastal communities, driving in a loop to the former, and flying to the latter (see Map 4.4).

Bureau of Meteorology information into the communities

The evening TV news was the most common first source of Bureau of Meteorology (BoM) weather information to the Communities, and to a lesser extent from the various radio stations, especially the linked aboriginal radio network (Broadcast Remote Aboriginal Communities Services – BRACS).

Administrators of most communities seek BoM faxes with the approach or onset of the wet season, copying and posting them at the administration building, the school and the medical clinic.

Some of the white people (Kartiya/Gardiya), such as the storekeeper at Mulan, regularly use the BoM satellite web site and the information from the web of the BoM Radar sites in the region. The core weather issue in the desert communities is guessing when floodwaters would cut them from re-supply of diesel and foodstuffs. There were some community members who followed BoM information at the fine detail offered by the regional radar images (Figure 4.3); while others were barely aware BoM had a web site.

Communities averaged about 200 people, with access to about 8 web-linked computers. There is a high sophistication of web use by some individuals in all communities, with often strenuous school web-based learning. Part of our research included informing people of and guiding them into the local detail the BoM web site offers (Figure 4.2). Community members shown BoM sites showed a high level of interest.

All communities could get the four regional TV stations (if their transponders were working properly): GWN, ABC, SBS and WIN. GWN and WIN were perhaps watched the most, but people would watch all channels, often channel surfing. Sport, especially Australian Rules football, was very popular. The BRACs radio stations were popular, especially on Wednesday evening when Mary G is on. There may be more on Mary G, a confronting comic female aboriginal impersonator. Community members generally love her, although she alienates some.

The general report card on Telstra is good. There are occasional problems with the usual land line to a nearby exchange in the community and then to a microwave dish transceiver. There are few real telecommunication problems, even in the wet. Ringer Soak had, perhaps, the most rain-impaired communications. All settlements had at least one satellite phone, often five or six, virtually guaranteeing continuous links with the outside world.

There is a colour-coded cyclone warning system in WA, the FESA Cyclone Community Alert System, based on blue-precaution, yellow-action, red-shelter and all clear with caution. These kinds of warnings could be adopted nationally *if they are understood and effective in WA cyclone warnings.* Also, there is a siren warning sound: the Standard Emergency Warning Signal, an electronic signal owned by BoM and used in conjunction with their Cyclone Warnings when destructive or very destructive winds (cat 2 or higher) are expected within 12 hours of the coast. BoM has made the signal available to Emergency Services to use preceding an emergency announcement, which is

intended to instruct the population to take, or be prepared to take, specific action in order to protect life, property and/or the environment (thanks to Gary Gifford, FESA Regional Director
Pilbara/Kimberley, State Emergency Service for the above detail). *If that is proving effective*, perhaps *the broadcast siren warning could be considered for all major impact weather threats.*

'Severe' is off-putting

The study found community members were very happy with the nature and quality of the weather information provided by the BoM. However, detailed probing found the word "severe' was alien to community members. Various long discussions about this appeared to convince Terry that 'Dangerous' for road flooding rains or destructive winds is most appropriate to convey the message that preparation and care are needed, while 'Major' is probably the best word to tell of further or prolonged rains. The rains are seen as good; as releasing the bush foods – goanna, bush honey, fish, gelay – edible berries born on a small tree -, sugarbag bush potato and tomato, along with such fruits as mulberry and mango. The wet also bringing relief from the build-up of heat and humidity leading to the wet.

Traditional weather information and information diffusion

Asking about traditional stories relating to extreme weather produced two stories – one explaining how soaks were formed around Ringer Soak, and the other describing how Lake Gregory, near Mulan, filled to overflowing. These stories will be cleared in my written form by the storytellers or the community before they are further reported. This is true of much of the detail collected during the two week field trip, which included camping out and spending five days in the Tanami Desert.

The Sturt Creek was a central link for all the desert communities visited – if the initial floodwaters were a milky colour passing through the Balgo area, it means a major flooding rain north, about 5 days earlier, and the creek would probably stay up for months. If the water was red, it means local rains (from the smaller, near catchment), so the creek would probably go down again in a few days.

There were no disenfranchised members of any communities – once a clear weather warning was seen on TV and a BoM fax requested, the warning was discussed through the community or posted or details were found on the web. Fax copies or word of mouth warned community members. The last to know were often the old men or, in the case of Halls Creek and Billiluna communities, the members of up to 50 outstations of 1 –20 people. They see the build-up to rain and generally come into the settlement without any formal notice.

With the above two exceptions, outstation residents were sparse, and all tended to come in to the main settlements ahead of the isolating rains by using traditional methods of reading the weather: the build-up of heat and humidity, the development of large clouds, often swirling high into the air.

This clear warning is generally preceded by much higher activity of ants, from moving food to higher places day and night (Billiluna) to increased ant activity in general, including building earth 'tubes' of about 75 mm above their holes, sealed off about a day before the rains start (Ringer Soak).

The lightning and rain wakes up the goannas from their holes, so communities soon get direct food benefit from the rains. If all goes well, the BoM information reinforces the more traditional signs of rain, allowing last minute preparations before wind and rain hit and the roads are closed down.

There were no major reported tensions within communities during an average two to three-month wet season. People stay inside more, but communities remain reasonably relaxed. There is a lot of hunting and gathering. This includes harvesting bush tomato (see Photo 5) and yams. In Billiluna, wet-season bush foods include witchetty grubs and a flavoursome type of tree gum.

The community populations tend to drop a little just before the wet. Apart from stocking up, few of the desert communities do much preparation before the wet. Only one community reported cleaning up old sheets of iron or other things that might fly around in strong winds.

The end of the wet may be heralded by flowering of the Sturt Desert pea (Harold, Billiluna).

Community weather issues - food and diesel supply

The most important desert-community weather information was the exact date of the onset of the rains. Delaying delivery of the last 50,000 litres of diesel as long as possible is crucial to tiding the community over with power for perhaps three months while flooded in. Protective of the major damage done by vehicles to soft, rain-sodden roads (as in many other parts of Australia), the Halls Creek Shire close all unsealed roads at the start of the wet.

Communities surveyed have robust power supplies, with rare and short-term blackouts. The power is dependent on diesel supply. In 1993 Mulan had more diesel flown in by army helicopter.

Residents at Balgo recalled that in 2001 they were without road access from Christmas to May 25. This stretches the pre-wet organisation to the extreme, because all the communities use diesel to run their generators (see Photo 6). That electricity then runs their water (bore) pumps, their sewage pumps, food freezers and cold storage.

Although many houses use solar water heaters and are generally very well designed for the intense inland tropical summer heat (about 20^{o} South), many houses have air conditioners (see Photo 7). All these uses, along with normal household and community electricity use must be constrained as reserves of diesel drop during a prolonged wet. The first major rains matter for the supply

of communities, ranging from about 150 to 800 people, with about 10 people per household.

Drawing together and presenting weather and flood data

Different states or territories (Regions as BoM would have it) have evolved different ways of collecting major weather event data and of making that data available to vulnerable residents and travellers. This can become a strength, now that there are moves to collate and standardise the web and media presentation of that data. Queensland has an excellent road condition web reporting system (www.racq.com.au), and a radio siren ahead of cyclone warning broadcast. WA has developed a colour–coded warning system.

It is recommended the different regions/states/territories develop an email-based dialogue to share different major weather data collecting, collating and sharing systems, then dispassionately view how relevant *and graphic* (road and settlement flooding, likely destructive wind paths) information and forecasts can be made available through media and the web.

This will be a fruitful development of growth and recognition of best/most effective practice for what amounts to a marketing exercise, with the core shared sustainability goal of warning an aware and prepared community of developing major weather threats, to minimise the impacts of those threats. This is to minimise loss of life or injury to people and minimise damage to property – to get out of the way of destructive natural impacts, or properly prepare for and shelter from those impacts. People need to know about those threats in a timely *and palatable* form. This is core to this research.

'Severe' again

Finally, the word 'Dangerous' is much preferred to 'Severe'. 'Severe' does not work as a trigger word to take notice, to perhaps take action (Rohmann 2000 - A socio-psychological model for analyzing risk communication processes The Australasian Journal of Disaster and Trauma Studies Volume: 2000-2). It is important for BoM to adsorb this as it commissioned this research to find out how to make weather information into remote Aboriginal communities more effective in mobilising safety-oriented responses. "Severe" is a 'lose-interest" word for all the Aboriginal people asked in this research process. "Major" is acceptable.

I have discussed this with a number of senior Regional and national BoM personnel. It is clear there is a culture which wants to retain "severe" (.. 'it is used internationally … it would be hard to change …). If this research is to be of use as undertaken, ways to use "dangerous" or "major" need to be developed for weather warnings targeted to northern Australia.

Perhaps "severe" does not raise a sense of a "call to action" among others in our northern population either. Because floods are seen as a good thing overall to local residents (food, rejuvenation of the bush, cooling) it is suggested the word "Major" is used if the forecast is for the "normal" rains of the wet.

Key recommendations

- Make the BoM site and the locally detailed cloud, flood and rain web sites more widely known.
- Put landmarks – main roads, rivers and all settlements on all base BoM website maps.
- Sharpen predictive modelling to better pinpoint the exact onset of the wet with about two weeks lead time.
- Start to develop crude simulations of major floods or destructive wind paths to attach to related extreme weather warnings (one year plan)
- Develop alternatives to "severe" for messages to Aboriginal communities, both through the indigenous weather information site (www.bom.gov.au.iwk) and through the BRACs network. "Severe" was a 'turn-off' for aboriginal communities from Palm Island to the East Kimberly. "Dangerous" and "Major" were seen as far more likely to trigger closer attention than 'severe', which sounds alien and off-putting to a wide range of Aboriginal spokespeople in remote communities.
- Further develop, test and refine the attached graphic depiction of major weather events - Cat 2+ cyclones, and flooding likely to make roads impassable (see satellite: http://www.bom.gov.au/gms/IDE00005.latest.shtml - RACQ and radar, such as Halls Creek: http://mirror.bom.gov.au/products/IDR393.shtml).
- Enter discussions with RACQ to use their road condition site as a model or template.
- Help coordinate the information of rainfall and flooding from all sources in and feeding into the Kimberley weather (and flood ie, the Victoria River, which rises in the Northern Territory) systems so that community and road flooding is easily and uniformly accessible in real time from the BoM, Main Roads and other web sites. *Road flood warnings should not be hampered by borders between states and territories, nor between different Government rainfall and flood data-collecting departments.*
- Explore adopting the use of colour coded warnings nationally *if they are understood and effective in WA cyclone warnings.*

Secondary recommendations

- Encourage the main fuel suppliers, Australian Fuel Distributors, to work with BoM and Communities to co-ordinate last fuel runs before the rains.
- "I am impressed that people here can tell me when it is going to rain or not" – CEO Mark Suhule, Mulan. If the BoM Indigenous weather site is to gain relevance as a living tool for remote Aboriginal communities, it is worth encouraging a daily weather update tagged to each participating community. This should include daily 'traditional' weather predictions. It would then make an interesting study to check their accuracy, and compare that accuracy with TRADITIONAL BoM forecast accuracy. The challenge would then be to incorporate

traditional forecasting into mainstream forecasting if it is comparable or better than the traditional BoM interpretations of data.

East Kimberley report detail

Methodologically, Graeme Down[1] (East Kimberley Fire and Emergency Services Authority), well respected and long known to community members, sent a copy of the survey form (Appendix 1) to each community about three weeks before our visit date (12 – 21/10/03). These visits coincided with Graeme's annual trip to ensure stores and other preparations for the cyclone season were being fully addressed. This itself is a good example of mitigation planning.

An authoritative member of each community signed a survey consent form.

Before any detail (below) has been released for wider consumption (on 5/12/03), copies were emailed to each community on 31/10 and 19/11 for interviewees to review, edit if needed, and approved. There were no amendments. Permission was gained for any photos or video taken. Further use of any such material is strictly by written permission of JCU CDS only, who will seek further permission from those depicted if deemed necessary. The two Dreamtime stories recorded here also have strict embargo on any unauthorised further use.

[If media material is developed, it will be important to use the local community as much as possible, and work with the local bureau people and local media outlets, such as Sandy Dann at PRK Media at Halls Creek..

It is strongly recommended to improve the BoM web sites by placing main roads, rivers and communities on the base maps for satellite and radar maps.]

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[1] **From Graeme Down**

BRACS is Broadcast to Remote Aboriginal Communities Services.
Mary G is Broome-based and has been used in public education warning messages and video. GWN TV stands for Golden West.
There is a media section of FESA in Perth. Jenelle Provost {(08) 9323 9331} [jprovost@fesa.wa.gov.au] heads the FESA media section which has responsibility for preparing and issuing media statements before, during and after major incidents. The media section also prepares public information for major campaigns such as "Storm Safe", "Fire Safe" and Cyclone Season. Much of this work is developed by the Community safety section headed by Barry Hamilton {(08) 9323 9560} [bhamilton@fesa.wa.gov.au] The SES media person is Belinda Gordon {(08) 93239549} [bgordon@fesa.wa.gov.au] She has the responsibility for SES media matters both campaign and operational.

7. Fluctuating population	
Community	**Details**
Ringer Soak	Most people in at Christmas. Mainly go away after Christmas. Kids boarding at high school come back each holiday.
Mulan	People move out a fair bit after the wet. One large family has left the Community.
Balgo	Population fluctuates
Billiluna	Population fluctuates from 2 – 300. Most people are here before Christmas. The number of people drops at the start of the wet. There is tribal law here during November and December.
Halls Creek	The population of Halls Creek is fairly steady. The town is the nearest major centre for numerous Aboriginal communities from the desert region of the Kimberley. The population can increase depending on any events happening in the town, such as funerals, rodeos etc.
Oombulgurri	The minimum population is just before the wet. If there is a funeral somewhere the population might go down a lot. The road to Ombulgurri is rarely used and we had real trouble is the 1997 flood.
Kalumburu	Top End fluctuates due to cultural and climatic conditions. Evacuated in 1999. Outstations come in. The most tourists come in July. There are permanent traditional owners and tourists. The tourists are mainly Australian. Only about 5% are from overseas. They mainly come as adventure backpackers and tag-along tours (this is where there are experienced guides and up to 9 other vehicles). There is accommodation at the mission and camping. The tourists are mainly retired and in off-road caravans and pop-top vans. About 1 in 1000 are Brits or hire-van. We want to have a set air charter on Monday, Wednesday and Friday to Kununurra to make sure the service providers come on site and stay for two nights to get something done.

8. Major weather events	
Community	**Details**
Ringer Soak	Cyclones (about 80 Km to the coast???) Flood (250mm in average rainfall year) Lightning strike Destructive winds
Mulan	Wet. Some major winds. Dust storms. IN Christmas 2000 there were some cyclone effects.
Balgo	Heavy rains. Sometimes remnants of a cyclone that brings winds or rain.
Billiluna	Wurly-Wurly's – a Hurly-Burly blew the toilet block over. Strong dust storms. There is a lot of rain with cyclones, and strong winds. In 2001 cyclone Rosita blew down many trees.
Halls Creek	The major weather types are - cold weather, dry season and v weather. At the end of the dry season before the wet can be extended periods of heat. During the wet, there can be floodi mainly affecting the roads.
Oombulgurri	We get cyclones, flood, lightning, thunderstorms, wind. No cyclones in the last one hundred years.
Kalumburu	Flood, cyclones, electrical storms. Major weather events. Flood in 2001 and 2003 was a very poor flood. Even dryer than before. BoM 3 years ago said there would be five cyclones. There were only one or two weak ones. There were other floods in 1997 1998. We couldn't get to the airport. Tourists were stranded. Not many tourists get stuck. People come in long before the wet now. In about 1952 there was the biggest flood I ever saw. It flooded the airport road. the biggest cyclone was in about 1987. It started from Darwin and then went across to Kalumburu. We were in the centre of the cyclone. Everyone was frightened. We all went into the office for shelter. Some people, about 12, got flown out by helicopter to Wyndham for a few days. Fire – If kids start fire it can cause trouble. Kids lit a fire a couple of weeks ago. It damaged the communities main water supply. We have some fire breaks but not a lot. We don't get any bursts of wind but we do get strong winds. The community never floods.

9 + 10. Detail of major weather events	
Community	**Details**
Ringer Soak	There was a cyclone more than 10 years ago. In about 1998 the Sturt Creek flooded. It was about 8 Km wide. For 5 months it was impassable. There was another flood in about 1999. The Sturt in 1998 rose rapidly over about 3 days. 1960 big wet – needed evacuation. Big rain around the late 60s. 1975 major rains 1994 major wind and rain 1996 sudden blast of wind (microburst) tore the roof off the playground area.
Mulan	1999 floods and through 2000. The Lake shore came to within 5 Km of the settlement in 2001 – it is normally about 12 Km away. The roads were cut at Billiluna, at Sturt Creek from February to May. The airstrip goes out for a couple of days in major wets. Usually it dries out the next day after short rain spells.
Balgo	The remnants of Cyclone Rosita. Can get high winds. We had high winds around Easter this year. Cut off through Sturt Creek. We were cut off from Christmas until May 25th. When that happens the least flood prone route into Balgo is through to Alice Springs.
Billiluna	In 1992 there were strong winds and a big flood
Halls Creek	Other than the extreme heat before the wet season, Halls creek is not prone to extreme weather conditions. The most recent event was major flooding in the town and flooding of local creeks and rivers. In 1952 there was a drought after a low wet season, killing herds of cattle and horses on nearby pastoral stations. Roads to Halls Creek are cut due to flooded creeks and rivers, which have low level crossings. The crossings can be up for days and can cut supplies to the town. The most recent event was major flooding in the town. This occurred 20 years ago, when the creek on the bottom edge of the town burst it's banks. No major structural damage occurred.
Oombulgurri	In 1998 it was threatening and in 1997 we had bad weather. There was one flood in the 1980's. There was a cyclone threatening Wyndham. There is a good level of flood preparedness. Since the 1997 flood houses have been raised and one main floor of the

	store has been raised. We are planning a new multi-purpose centre and it's in a high place in the community. The floor level there will be raised as well. We are making part of that building reasonably cyclone proof. After the 1997 floods we have raised our electrical fittings, however the generator is still flood prone. The airport is about 1km away from the settlement and the connecting road is highly flood vulnerable.
Kalumburu	1998 cyclone and flooding. Major No problem with fires. Plenty of fire breaks. Apart from a cyclone in 2001 there weren't any others for a long time. Although there was a big flood in about 1998 but it was no threat to buildings. In the 60's we had floods every 10 years but now there's no more rain.

11. Impacts of wet on the Community	
Community	**Details**
Ringer Soak	You can fly out on the mail 'plane each Thursday. It costs $100 each way. The store stocks up before the wet. The isolation does not matter. We fish more, but there are more mozzies. The Community can store 57,000 li of fuel, enough for 80 days. Air con uses a lot of fuel. We try to predict the onset of the wet to top up the diesel
Mulan	During the wet you can generally get out. Floodwaters seem to build up over years, and connected with cyclones. There are lots of bogged vehicles which cause trouble.
Balgo	Impassable roads. Sturt Creek floods. Air transport is the only means of contact.
Billiluna	The community gets on well. In 1992 fuel and food were brought in by army chopper.
Halls Creek	People living on outstations, especially the sick and elderly are encouraged to move to town. Roads are cut with flooding of creeks and wet black soil plains make roads impassable for weeks. Flooded roads are impassable for trucks and delays occur with the delivery of food and other supplies There is an increase of skin infections like boils ear infection and sore eyes due to swimming, gastroenteritis because of worms and the damp ground. The wet season is seen as holiday time and people get together for lore ceremonies, hunting, swimming and fishing. The weather is a very topical subject in the community. The elders of the community are regarded as weather

	forecasters with other people asking them what the forecast is. During the build up before the wet, when it is most hot, people will want to know when there will be rain for their relief. Holidays are planned, so as not to get caught up in any floods and not to travel when it is most hot.
Oombulgurri	The floods clean out the river. After the first rains the whole river gets flushed out. Rain greens up the country and brings out the bush food. The gelay (a smallish tree with delicious berries) is a green berry. We also get the coonga berry. It is another bush food, another green berry. There is prickly gargardo, and there is another one that is leafy and that you peel off the outer layers to get to the food inside. We get the water lilly tuber, ducks and geese, wild turkey, goanna, and geese eggs during the wet. We get sugar bag which is a kind of sweet sap. Honey. Mulberry. Black bream, barra – once the wet has fully set in we get fresh water barra. We can feel isolated when the airstrip is out. We get wash-aways in our roads which make them impassable. The wet can create some tension. It won't stop.
Kalumburu	Isolated by road. The barge service operates. The road to the airport is a bit iffy. We have diesel storage for 300 000 litres. People go a bit stir crazy. We are working on a covered basketball court and a disco in the evening. We are doing as many diversionary things for our youth as we can. Diesel. We get it for about $1.30 per litre. We have 5 full tanks. Use of air-conditioners has increased our diesel use. There is an education process for air-conditioner use. That goes for the school and the mission as well. The school, mission and administration all have electricity metres but the community houses just pay a fixed amount for rent and for power. There is only one tribal group in Kalumburu. There are four language groups and eleven family groups. There is some tension. There was only one group here before the second world war and there was an influx of other family groups toward the end of the second world war. The mission in Oombulgurri was abandoned in 1967 by the US Missionaries. In 1967 there was self determination for Aboriginal people, that's when the outstation movement began.

	The missionary here at Kalumburu consists of two nuns (both about 75 and one brother about 75 and another brother who's about 65). He's been here for 42 years. There is one priest who has been here for about ten years, he is about 70. The links between the mission and the community are weak. The mission leases about 80 hectares from the Aboriginal Land Trust Lease. The missionaries are Spanish/catholic.

12. Fire threats	
Community	**Details**
Ringer Soak	Fires no real trouble. There is a good firebreak around the powerhouse.
Mulan	Locals have lots of small patchy burns. Two years ago a fire threatened the power station but one of the trad ional owners took the grader over and cut a good fire break.
Balgo	No fire problem – low fuel load in desert.
Billiluna	Fire is a problem, but we have a good fire break. During fires the main problem is the smoke.
Halls Creek	No real fire problem.
Oombulgurri	No fire problem.
Kalumburu	No big fire problem.

13 + 14. Natural indicators of major weather events, fire or seasonal change	
Community	**Details**
Ringer Soak	Just before the wet, bees gather pollen, then seal off their combs with wax, just leaving a tiny breathing hole. First there are rains, then there are the flying ants. If there are more flying ants there will be more rain. We get most of our weather from the North East. Can see the ants about 6 weeks before . They start building tubes up from the ground about 2 inches high. They close off the top of the tubes just before the rain starts – a day or two before.
Mulan	Gets hotter before the rain, in October or November. We hear the cicadas. When there are big rain clouds, the goanna come out. There is a bit of rain, a dust storm, rain, then lightning strikes then the wet.
Balgo	

Billiluna	The ants store food night and day. That means there will be a big rain in about three days. We smell fire even lightning starts fires. The rain goes one way, on one side, and then there is lightning the other way. That can go back and forth, with the rain on one side and then the lightning on the other side. When we get the wind across the ground straight in front of you it means we will get the rain. So you've got the rain on one side and when the wind blows from where the lightning is, that means the rain will come across to us. The rain will then go across to where the lightning was.
Halls Creek	Onset of the wet season Wet coming when the leaves have fallen off the trees and they've begun to grow back. Clouds building up, days getting hotter. Hot, dry wind blows. Boab trees will flower and when these flowers fall it means the rain will be coming soon. Porcupines will walk, looking for ants. Green frogs start making noise, before it starts raining Sugar bag is full of honey Onset of dry season Cockatoos and Blue Mountains (a type of parrot) lay eggs. Nights are getting colder Flies are a major pest until it starts to get cold. Sugar bag flies come out and start laying eggs before honey. Sugar leaf grows on the leaves of trees. The tilt of the quarter moon, if the quarter is in it's back, not much rain. If the quarter is standing tall, it should be a good wet. Rings around the moon at night, the more rings the bigger the wet. If there has just been a big wet, there more chance of having a colder winter.
Oombulgurri	You can smell it. That's all. The clouds. The wind. The smell. There are flowers before the wet, like the kapok and the gelay. Boabs shoot. You get the knock-down rain at the end of the wet. That's the one that knocks down all the dead grass stems right before the dry starts.
Kalumburu	Running (fast moving) cloud.

15. Preparation for major weather events

Community	Details
Ringer Soak	We get all the supplies in early. We fill up the diesel and wait for the rain. There is more food then. More goanna, fish, and other bush food. We sleep in more. There is nothing special. We care for the power plant. Our rooves are well anchored.
Mulan	Use FESA's system. Make sure the community is prepared with provisions. We have stocks for three months. After that we will get government help. SES will drop off drums of fuel if needed. With FESA's overview, the level of preparedness is supported and appreciated. We try to help ourselves – we ferried out our own staff across the creek. We have fruit and veg flown in every two weeks if needed. A problem in preparedness is that we have to pay up front , although we should have those funds if the community is functioning properly. We are now arranging to pay the bulk purchase off over three months. The overarching control of the store and the managers is from Perth – Aboriginal United Buying. We inspect the airstrip once the rains start. We place a large cross on the strip for pilots if the surface is too soft. If the airstrip is closed for more than 24 hours I fax all charter companies and send a fax to all the other Mulan agencies - the school, clinic, parish, store that the strip is closed. Gardiya (kartyia-white person) may not be taken seriously by the aboriginal people in this community. If it is very windy or dusty or hot people will stay in their homes. At the start of the wet people may try to do the last fishing trip or go out to check the road and get bogged. In the winter the wind from the south east are quite strong.
Balgo	Balgo does not do a lot of pre-wet preparation except for getting in supplies of food and diesel. People don't change their behaviour much at all. Winds may loosen some rooves. The schools stock up before the wet. Fire is not a problem.

	There are no real preparations. In about 1998 at Easter there were exceptionally strong winds and rain. Derelict buildings may blow apart.
Billiluna	Tidy everything up. We tie up the loose iron. We go hunting especially for goanna. We go to Lake Stretch to fish. We gather yams, witchetty grubs and the gum, the nice tasting sap, from one of the local trees. Tie everything down.
Halls Creek	Sick and elderly people from outstations are advised to come into town. Take extra precaution when crossing of low level crossings with high or rising waters. People living on outstations stock up with extra food and fuel.
Oombulgurri	We have a big clean-up day. We put away loose stuff. First of all we have a supervisors meeting. We talk to the store manager about diesel. Our diesel comes in by barge and each shipment lasts about one month. We now have an extra big freezer with the store. We can store up to 90,000 litres and we get about 17000 litres each top-up. That's about all the barge can carry. We use an average of 1000 litres per day. It goes up in summer because of the airconditioning. The school is high and in the past we have used that as our evacuation centre but in the 1997 flood the water came down on top of the king tide (tidal range of 7 – 8 m) We were flooded up for about six hours and the water went about 300mm's over the floor of the school. Most of our flooding depends on the tide. In 1998 we had flooding and a high tide but it was not a king tide so we didn't have any real problems. When there is a flood or cyclone threat we stay inside more. Our new building will act as an evacuation centre. The school is used now. It has strong walls.
Kalumburu	Stay at home. Everyone gets told. Clean up. Lights for cyclone warning are green, yellow and red. We check the siren. We have a cyclone clean up every October. We conduct patchy burns. There is a program in savannah burn education – we do little burns – a perimeter road (fire break around the community). We do look at some fire damage, the kids often light fires – they don't know what they are doing. That's why we need diversionary activities.

	We contact the Wyndham police and we check at a regional level. All our preparation procedures are under review and we are developing a counter disaster plan. Kalumburu is developing a team spirit. We are increasingly involved with Nor-force – it's a northern reserve army. They're looking to develop a cadet group.

16. Radio stations people get and listen to	
Community	**Details**
Ringer Soak	CAMA from Alice Springs, Warenjerry (Kununurra)
Mulan	PACUM. Don't get BRACs. ABC regional earlier, then ABC FM. WA FM.
Balgo	PAKAM network
Billiluna	The ABC, FM, BRACs from Broome, from Halls Creek and from Kununurra. Everybody listens to Mary G each Wednesday night. We are setting up a tele centre. That means that we will be able to join in on the BRACs network, and possibly broadcast from here. It also means that if we want to play a video through to the whole community we can do that from the tele centre. We will have web-linked computers in there too, I think.
Halls Creek	ABC Regional radio, broadcasting from Broome PRK, local Indigenous radio station.
Oombulgurri	Kununurra, BRACs, Broome. CAAMA (Central Australian Aboriginal Media Association Alice Springs). We want our own training for media practice. We could go to Broome and Galarie Media Centre. They give funding for training and for repairs. It would be good for our community to have people who could speak on the radio and work in different media.
Kalumburu	Mary G, Pacam FM from Port Headland or Broome or ABC. We have our own BRACs station. We broadcast for one hour on Tuesday and Friday's.

17. Radio home ownership and regular use	
Community	**Details**
Ringer Soak	Most 2
Mulan	Few listen to the radio much
Balgo	All

Billiluna	Not a lot. Not many.
Halls Creek	Most households would have radio and use it. There may be a handful of households that don't have a radio but many people are known to go to friends or relatives houses to listen to the radio.
Oombulgurri	Not much. We all listen to Mary G.
Kalumburu	Most.

18. TV stations received	
Community	**Details**
Ringer Soak	GWN, WIN, ABC, SBS.
Mulan	GWN region, WIN, ABC, SBS.
Balgo	All
Billiluna	All
Halls Creek	ABC from Perth WIN from Perth Golden West Network from Bunbury SBS
Oombulgurri	GWN, WIN. Our decoder is broken, otherwise we would get SBS and ABC as well.
Kalumburu	GWN, Impaja, ABC, Message Stick and SBS. We can use a VCR to broadcast videos to all the TV's in the community.

19. Household TV ownership	
Community	**Details**
Ringer Soak	All 26
Mulan	All 30
Balgo	Most.
Billiluna	40
Halls Creek	Nearly all
Oombulgurri	All.
Kalumburu	All.

20. Number of web-linked computers[2]						
Community	**Details**					
	Administration	School	Store	Medical Clinic	Houses	Total
Ringer Soak	2	6	1	-	-	9
Mulan	2	5	1	1	4	13
Balgo	2	12	1	2	None	17
Billiluna	2 Weak connection with the web.	15	1	2	5	25
Halls Creek	There is a tele centre in the town where people can pay to use a computer with internet access.					
Oombulgurri	3	5	1	1	2	12
Kalumburu	6 1 - Mission	13	1	1	20	42
TOTAL						

21. Favourite Radio and TV stations and web sites			
Community	**Details**		
	Radio	**TV**	**Web site**
Ringer Soak	CARMA	WIN, GWN	-
Mulan			BoM
Balgo	-	WIN, GWN	-
Billiluna	Broome BRACs	Channel Hop	-
Halls Creek	ABC Regional radio, Broome PRK, local Indigenous radio station Spirit radio, commercial radio station in Karratha	Golden West Network – WA's regional television network SBS ABC WIN	Bureau of Meteorology site with the satellite photos are frequently used. The pictures are displayed at the Halls Creek Post Office, Shire of Halls Creek office and Police Station.
Oombulgurri	Mary G	WIN – AFL	BoM
Kalumburu	BRACs	WIN	Sport

[2] **IMPORTANT NOTE**: like all statistics provided, these values are, at best, indicative.

22. Telephone system			
All communities have phone lines to a Telstra exchange, linked to a microwave dish. Halls Creek has normal landlines, with a 10 Km radius mobile range.			
Community	**Details**		
	Households with working phones	Working public phones/ Public phones	Problems
Ringer Soak	5	1.75/2	Goes out in wet
Mulan	0	2/3. Problem of vandalism.	Almost always reliable.
Balgo	3	2	Good
Billiluna	4	3	Phones pretty right - good
Halls Creek	Less than 300.	4	
Oombulgurri	8	2 - one not working	Sometimes water gets into the pits. Phones are reliable.
Kalumburu	6	2	Good

23. Two way radios and satellite phones		
Community	**Details**	
	Two way radio	**Satellite phone**
Ringer Soak	None	2
Mulan	None. One VHF handheld will be installed to outstations. There is one in admin and one in airport.	10
Balgo	8 are reliable	2
Billiluna	4 UHF – Handheld for roadworkers.	1
Halls Creek	Outstations use landlines or satellite phones. There are a very few 2 way radio in this community - outstations and cattle stations for school of the air; cattle stations using them to keep in contact with workers that are way from the station businesses like contractors and the local Shire, who need to keep in contact with employees away from base.	
Oombulgurri	6 UHF used by the store and essential services. There is a high frequency phone at the store and the clinic	-

Kalumburu	None Hand held communication – 7km range for middle administration and for night wardens	-

24. Receiving forecasts	
Community	**Details**
Ringer Soak	TV. BoM fax each day during build –up and wet.
Mulan	Satellite images from BoM. Local knowledge, especially the build-up of clouds. TV. Contact with other communities. The store keeper at Mulan is a great BoM fan. He starts each day once the wet is imminent with the satellite image of northern Australia, then scans through the following radar images from the BoM web site: Wyndham, Broome, Halls Creek, Kununurra, Darwin and Catherine. He reckons "the graphics are brilliant".
Balgo	People are often on the internet and on the radar. But the circles are not broad enough. They only go out to 256km's. We would like to see greater radar coverage. Radio, TV. The office may access weather information through the aviation information.
Billiluna	Watch for cyclone conditions around Darwin. Watch TV Ants, clouds. Get BoM to fax weather to administration. They post the forecasts in the administration building.
Halls Creek	Weather forecasts are heard over the radio, television or on the internet. Looking up at the sky and looking around at the plants and animals.
Oombulgurri	TV. We get a phone call from FESA Broome. We dial up BoM and get a fax. Once we get that fax we all look at it. On the web we get the radar at Wyndham, and we get the satellite from northern Australia. We would like to have a wider coverage than 250km's for the radar images. We would like to be able to see through to Broome. If there is a cyclone warning we track the cyclone course.
Kalumburu	TV, cyclone watch, three day old newspapers.

25. Continuity of power supply	
Community	**Details**
Ringer Soak	Lightning may blow power supply. Like the other communities, power is distributed above ground via steel power poles. Repair crews come from Broome. There is a large trailer-borne back-up generator to keep the store going.
Mulan	Fairly weather-proof. We have 3 gen sets, but a lot of aircon. KRISP look after electricity and water – they do a real good job. The local electrician flies his own plane.
Balgo	The power is maintained. There are occasional blackouts. They are seen as problems. One blackout went for two days, but there was some backup.
Billiluna	Good.
Halls Creek	Lightning hitting power lines and trees falling over onto power lines will cause blackouts to our power supply.
Oombulgurri	Lightning strikes take out the power, our technician Smokey can repair most things. If Smokey can't repair it we get KRSP in Broome to help. They are good. If we've got floods we switch off the generators for safety. The store has a back-up generator. The store and our main back-up generator are above the flood levels. We have fairly recently raised both our water and sewage pumps.
Kalumburu	Robust – recently upgraded – a mains and two backups.

26. Continuity of telephone link	
Community	**Details**
Ringer Soak	Goes out in wet. Always have satellite phone link.
Mulan	No real problems. Functions well. Early this year a regional repeater station had battery failure.
Balgo	Resilient. There were problems during Rosita. Recent wets were above average
Billiluna	Good
Halls Creek	Lightning striking power lines are the major problems caused by bad weather that affect telephones and satellite internet.
Oombulgurri	Good.
Kalumburu	Robust.

27. Knowing about looming major rains or destructive winds	
Community	**Details**
Ringer Soak	See on TV only. Welcome wet. Welcome cold weather. See big 'drifties' then know there will be rain.
Mulan	Radio, TV, FESA, talk to elders and they spread the word. See A24. News spreads very quickly, but the detail may distort or dilute. We have two hand-held satellite phones. "Satellite phones work."
Balgo	Some people still have a sense of the weather and we use radio and TV. The community does not access the facts.
Billiluna	Word of mouth.
Halls Creek	The Bureau of meteorology notifies the Police Department and the Shire of Halls Creek of the impending weather hazard. To warn the community of approaching hazards the Police Department and FESA (mainly volunteers) use loudspeakers in the streets. Warnings over the radio and text messages across television screens are also used.
Oombulgurri	We get our information straight from administration, then we hold a meeting of the wardens and then we mobilise the whole community.
Kalumburu	The "town cryer" goes around and tells everyone. Chalari Jangara is with the family safety project and so he warns everybody. The outstations come in before the rain starts.

28. Weather information flow through the community	
Community	**Details**
Ringer Soak	Don't talk about it much. People hear. We see the TV or the fax or just know.
Mulan	Via elders. The community is good at spreading information. Responsible people would check throughout the community.
Balgo	Word of mouth. People know if it is going to rain. Rosita caught people by surprise. There was a problem with the roads. When Sturt Creek is milky it means there is a big flood. When it is a reddy colour it means that there is only local rain and it means the creek will be up and down quickly. Sturt Creek near Billiluna two lives were lost there two weeks ago. The crossing needs to be safer.

Billiluna	Well.
Halls Creek	Many of the residents have trouble with speaking and reading standard English so information is usually passed through the community by word of mouth. The agencies wanting their information to be dispersed use the local radio station or go out to the people and speak to them directly. Information is collected by consulting with people directly rather than filling out forms and having big formal meetings.
Oombulgurri	Very well.
Kalumburu	We would hold a heads of agency meeting. A problem is that the satellite reception for the TV is interrupted so we sometimes don't hear about the bad weather. We would ring Broome or the Wyndham police. Our procedures are open for review. We do need to upgrade our risk management practices.

29. Making sure everyone knows
There were no disenfranchised individuals or groups In any of the visited communities. There may be one or more families "on the outer, but every-one knows everything that is going on" – Mulan. Sometimes the old men (often quite ill) would be the last to know, but all community members are cared for. Mulan. Older people are less exposed to the mass media. It is a very close knit community.
Billiluna. Some people are deaf
Halls Creek: Information is easily circulated throughout the community. Many people are aware where to find this information. The people who don't have access to the technical information rely on their knowledge of reading the weather that was passed down to them. What information they may have received technically, would be complementary to what they would have forecast themselves. The only divisions that exist, is the fact that there are people in this community who are more educated than others but the knowledge that these people bring to this community is not considered to be useless.
Oombulgurri. We are all together. We are all fairly meticulous.

30. Taking notice of BoM warnings	
Community	**Details**
Ringer Soak	We take notice. We hope they are reliable
Mulan	They certainly react. We take great heed – we watch the weather. I see an increased use of the bureau of meteorology site. Eg to look at the cloud and rain from the radar images to get the best idea of how available the airstrip might be.

	I would like to have more instrumentation on the Sturt Creek.
Balgo	Fax notices would be put up in the office and the school and in the clinic. The office manager uses the BoM site. Brother Michael feels it would be good to let more people know that the full BoM site is available.
Billiluna	People take notice.
Halls Creek	Weather forecasts are an important piece of information, the satellite pictures are displayed in various offices around the town. People know where to go, to find weather forecasts and other information like road condition reports especially before travelling. Most agencies would check forecasts before allowing staff to travel during the wet.
Oombulgurri	We take a great deal of notice.
Kalumburu	The buzz goes around. Les French the chair makes sure about that. The community is involved in customs watch.

31. Negative views of BoM
There were no negative views expressed about BoM or BoM information. We treat it seriously.

32. Improving BoM forecasting	
Community	**Details**
Ringer Soak	Want more detail on the TV.
Mulan	"What you get at the moment is brilliant" – Peter Shervington. We get good information. I check the satellite images every day.
Balgo	The school is closed down from December to March. People still look at the weather during that time, they will look for the detail of the weather
Billiluna	
Halls Creek	More localised weather forecasts, living in the Kimberley, the forecast in Perth is quite irrelevant but most television forecasts are from Perth. The jargon used by the bureau meteorology can make forecasts difficult to understand. If more effort was put into presenting a forecast in simple English, making it easier to understand.
Oombulgurri	Broome Office rings. The police contact us. It would be good if the Broome Office, or Police, or somebody automatically sent us a fax when extreme

	conditions were threatening us.
Kalumburu	The community would use different forms of learning about extreme weather.

33. Traditional ways of forecasting the weather	
Community	**Details**
Ringer Soak	Bush trees start to flower after a cold snap. The Sturt Desert Pea stops flowering at the end of the wet. Budgerigars and goanna come out with the lightning and thunder near the start of the wet, while the budgies breed at the end of the wet. See the cloud.
Mulan	
Balgo	Jaum is the name of the rains that come after Christmas. The weather seems to follow a 4 or 5 year cycle. Clouds go round in circles just before the rains come.
Billiluna	Ants, clouds. The build-up.
Halls Creek	Traditional ways of recognising or predicting weather change can be; Looking at the sky for clouds or lightning in the distance. Following the direction of the wind, especially if rain or lightning are near. Watching insects, birds and animals, they are known indicators of imminent rain and wind. The abundance of bush fruits and animals which should be in season is also a way of recognising the change in weather.
Oombulgurri	-
Kalumburu	When the country is very hot. There is a build up.

34. Sharing Dreamtime stories of the weather	
Community	**Details**
Ringer Soak	Development of the soaks surrounding “Ring of Soaks” (see below). Old Robert is the weatherman but he was crook. There is a story about the rainstones and how they can be thrown into the water to make it rain. Some kids took the stones and threw them in the water, but Rosie (a living elder) got them back. Rosie was pretty shy about talking about those rain stones, and did not really want to say where they were now. We got the impression she knew a lot more than she wanted to tell us, or any-one.

Mulan	Story of the emus, the group of singing and dancing people the two dingos and how Sturt Creek and Lake Gregory (Paraku) were formed. This indicates a massive past flood.
Billiluna	The Rainbow Serpent brings the clouds and makes it rain. The Rainbow Snake travels with the water. He brings the water. We like the rain. The Rainbow Snake brings more rain. Then we go to fish at Mulan. When we forget the Rainbow Serpent it will not rain again.
Halls Creek	The Kimberley Language Resource Centre does have stories about weather, we are currently updating our database and are unable to provide details of the exact stories, at this stage.
Oombulgurri	Forest River is part of the Rainbow Snake. This is a story from Old Dudley (about 70 years old). We have had plenty of wind and plenty of rain. We go fishing and swimming and we used to put the nets out. The creeks come into the river. The winds don't touch the main river. The winds may be very rough. They will wait until the river goes down a bit. Once the river goes down then we will get fish, we will get young crocs. We get salt water crocs. In the old days my father's father's father and my father used to be crocodile hunters. To catch them they would go up and touch them and poke them with a stick. When they moved we would turn them over on their back. That was when they went to turn around. Then my father would turn those crocodiles on their back. He would turn them over. He learned from his great grandfather. He learned from him long before I was born. He would cut the crocodiles throat. My mother told me one was 18 feet long. He would cut up the crocodile for the whole group to eat. A big crocodile like that would feed a lot of people.
Kalumburu	When people travel from a long way away. In the old days we would light a fire to tell people that we were coming. Now we use two way radio

34. Ringer soak stories – Water that falls down here comes from the snow country, from Dreamtime water, from Kallibima.

The rainbow serpent would move all around here and form the cloud, and start to make the strong wind blow. The rainbow serpent is still here in the soaks. When a truck came here in the 1980s to drill for water, the drillers felt something moving down there at Banana Springs. They could feel it moving through their drill rig. From deep down they pulled up charcoal. That was from the Dreamtime burning. From the fire Dreaming. Peter Gordon can sing up the rain. When the drillers felt something moving, the old people thought it must be the rainbow serpent.

The soaks and the sisters
Two sisters were gathering wattle seed to grind one day, and they argued over which sort of seed to get. In the end, one sister got one sort; the other got a different sort. They ground their seeds and made a kind of damper, but when they put them in the fire, one exploded. That explosion made a big hole and made the soak there at Banana Springs, while the rainbow serpent woke and made other soaks in the area. The two sisters turned into trees, and those old trees are still there today.

This story was told by Angela Gordon and daughter Carice Gordon.

34. Mulan Dreamtime story
There were two emu up north from around Inverway Station, from Nungaroo Creek who were chased by two dingo. A big distance away at Nungaroo.

People were walking. The emus were in front. The people were singing and dancing, and they were in between the dingoes and the emus. There were floodwaters behind the dingoes.
When people were camping the flood would stop. There was one old man, he had a string line and he would cut the water while they camped. He would hold the waters back while they camped. While they would sing and dance. Where they camped the water was held up. That is where the billabongs in Sturt Creek are now. Like at Bindalaorro.
The black and white water bird, the one with the long legs, the little bird was with the people. Birds and other animals joined the people as they moved south, singing and dancing.

They were coming down, straight down to the lake on the Sturt River side. But the dingo chased the emu round the other side. Around to number 51 well (water bore) around to Gillang-gillam.

The dingo chased the emu back and forth on the main lake. One dingo was chasing one emu and the other dingo was chasing the second emu. Back and forth. Each dingo grabbed an emu when they passed but they each grabbed the wrong emu. They grabbed ‘em and killed ‘em and ate ‘em.

The people on the other edge of the lake, in the main channel, camped again. In that main camp they sung and danced, that was where we call Lera Yard.

When the two dingo’s were full they walked up the other channel to Mulan. There was a soak there and they dug in. They’re still there.

Then the water came in from both sides and all the people got drowned.

One old man walked off and sang them (he put a deadly curse on them all). They all drowned because they hadn’t shared some food with him. But

when he walked off, another old man spat on him, cursed him, so that first old man who walked off died too.

35. External references given
No external references to existing publications were given from any community except Halls Creek: . The Kimberley Language Resource Centre is publishing a book, Wanyjina – Rain maker, a story from the Northern Kimberley. Introduction to the Kija language can give you the seasons.

36. Further comments	
Community	**Details**
Ringer Soak	BoM predictions are good. There is a lot of learning at school on the web. BoM could provide more detail for local areas. The radar images out of Kununurra and Catherine are useful. It would be good to tell more people about the web page address, especially for Administration and teachers. It should be emailed to all the remote schools, councils and administrators. "Severe" is a real turn-off Side view graphic of a cyclone is best Having a car bogged at a creek crossing would be good for flood picture. Fire should be shown as threatening. Alan supports the idea of being prepared early "Big" flood is good.
Mulan	We are only interested in the airstrip and Sturt Creek. We get enough information. People want GWNT TV. "I am impressed that people here can tell me when it is going to rain or not. I use the cyclone tracking site." I am totally supportive of what BoM is doing. I would like a local weather station. We need to record details of this at Lake Gregory (Paraku). We would like to get the detail of the radar to 256 Km, and want to get out to 512 Km. The radar scans give a good feel of weather in the area.
Balgo	It would be good to give more information of the BoM websites so that people know what is available.
Billiluna	We would like to have fire warnings that use the words low, medium and high. Just like the UV ratings on the TV of low, medium and high. I'm not sure how the BoM would use those kind of ratings. Could you use those kind of ratings eg. for cyclones?
Halls Creek	Vicki Butters liked the BoM symbol for the cyclone. This was generally most popular, although a side view of a cyclone (Skertchly 2000) is also considered to have high visual impact. The word "Dangerous" is much preferred to "severe". Severe does not work as a trigger word to take

	notice. It is important for BoM to absorb this as it commissioned this research to find out how to make weather information into remote Aboriginal communities more effective in mobilising safety-oriented responses. "Severe" is a 'lose interest" word for all the Aboriginal people asked in this research process. "Major" is acceptable.
Oombulgurri	We have meetings in Wyndham from July to November each year. This is mainly to define or understand the roles of the different departments in any extreme weather event and to revise or upgrade the counter-disaster plan.
Kalumburu	For Impaja - make the weather forecasts more pictorial.

RECOMMENDATIONS	
Community	**Details**
Ringer Soak	1. BoM could provide more detail for local areas. The radar images out of Kununurra and Catherine are useful. 2. It would be good to tell more people about the web page address, especially for Administration and teachers. 3. It should be emailed to all the remote schools, councils and administrators.

Oombulgurri
Old Dudley said that that was where a lot of the old people used to live – on a raised bank above the Forrest River, on higher ground past the fringe of the main settlement of about 70 houses and 250 –400 people, derived from a Mission begun in about 1930.

Along with Graeme Down and Graham Ezzy I attended a Local Emergency Management Committee (LEMC) meeting 3.30 – 4.30 in Wyndham, north of Kununurra. The issues raised in the predominantly non-Indigenous town were familiar – not sure of suitability of designated cyclone shelters, people were not all that interested in preparedness until a major event was imminent, and a general feeling that we will cope when we have to. These attitudes, not well liked by LEMC attendees, are very human, very Australian. I suppose we need the cultural shift from "She'll be right" to "We'll be prepared" is happening. Information, and possible computer simulation may lead people into considered and timely precautionary responses. Contact: christopher.fox@police.wa.gov.au

Sharing information between agencies
Discussions with various people during my trip to the Kimberley – and thanks every-one who helped make it a great success – made clear to me that there is a need for greater information sharing between BoM, and Western Australia's Main Roads, Waters and Rivers (now Dept of Environment) and the Agricultural Department.

It appears that a cultural shift of emphasis is needed from some areas so that the NT/ WA border is not seen as a reason to limit the logical flow of weather and flood information to the people who need it most – farmers and other residents of the Kimberley, along with tourists. Indeed, if the tourism industry is planning to market coming to the North in the "Green Season", the need for easily accessible, real-time and reliable road crossing information is as important as making clear to all tourists how harsh and sparse is the landscape. This should be particularly pursued through the vehicle hire firms – perhaps an orientation course for tourists should be mandated. There are some very disturbing stories of tourists in isolated, near death situations.

These are all issues for remote aboriginal communities and extreme weather issues because such community members may have to find or shelter the ill prepared for the vast and inhospitable distances involved in this eerily beautiful part of our ancient land.

Comments on Community details of the East Kimberley
News of threatening weather is transmitted through communities differently, apparently based on size. Halls Creek is a large, mainly indigenous settlement of about 3,600 Indigenous and 630 non-Indigenous. "In Halls Creek, BoM notifies the Police Department and the Shire of Halls Creek of the impending weather hazard. To warn the community of approaching hazards the Police Department and FESA (mainly volunteers) use loudspeakers in the streets. Warnings over the radio and text messages across television screens are also used." (Viki Butters, Halls Creek Weather Information surveyor). Indicative of the smaller communities, Kalumburu caries this sort of information through the community in the following way: the "town cryer" goes around and tells everyone. He warns everybody. The outstations come in before the rain starts. Another small community just relies on word of mouth.

An excellent outcome of this research for the BoM is that Question 31 asked: (paraphrased) if the view of weather forecasts and warnings from the Bureau of Meteorology was negative, why? There was not one negative response – people uniformly value the BoM information. Most, like the store keeper at Balgo, value it highly. Having said that, note the Halls Creek comments:

"Need more localised weather forecasts, living in the Kimberley's, the forecast in Perth is quite irrelevant but most television forecasts are from Perth.

The jargon used by BoM can make forecasts difficult to understand. If more effort was put into presenting a forecast in simple English, making it easier to understand".

Drawing together and presenting weather and flood data

Finally, summarising some of the main issues raised, some initial recommendations have emerged. They are against a backdrop of general reliance on and satisfaction with the BoM information and it's forms of delivery. Some words could be placed in plain English (this was a recurrent response); some landmarks placed on weather maps. Perhaps reintroduce the Millibar figures for the media-presented maps. The BoM site is relied on. If the northern meteorologists can develop a multi predictive hybrid modelling system for the first main annual rains, based on the system now used with good effect for detailed cyclone predictions, everyone would benefit.

Appendix 7
Full reports from Mapoon

Report by Joanna Williams (Bureau of Meteorology)
on the visit to the Mapoon Aboriginal Community 2 - 5 September 2003 accompanying Mr Eddie McLachlan (James Cook University)

Between 2 - 5 September, I accompanied Mr Eddie McLachlan, a PhD Student from James Cook University (JCU) researching the dissemination of weather forecasting information for Indigenous Communities in Australia, on a field trip to the Mapoon Aboriginal Community. My role was primarily as an observer, assisting Mr McLachlan with specialised weather knowledge where required.

Mapoon is an Aboriginal Community of approximately 200 people located on Cape York Peninsula about 80 km north of Weipa. It is on the northeastern side of a narrow land spit, with the Gulf of Carpentaria to the west and a wide shallow bay to the east. Access is via a mostly dirt/gravel road which can at times become impassable during the wet season. Relay towers provide telephone, radio and television communications and a generator onsite provides power for the community.

Over four days, Mr McLachlan interviewed several members of the community, including Aboriginal Community Elders, Local Council members and School and Health Administration staff. A visual survey of the community and surrounding areas was also conducted.

Indigenous weather knowledge
Traditional signs or natural weather indicators used in the local area, differ little from other communities in northern Australia. A period of continuous really hot still conditions is the prelude to monsoonal rains or a cyclone. The Manahawk (Aboriginal name), a large black ocean going bird, seen in large numbers about the coast indicates a "Big blow coming" (strong winds, possibly cyclonic are expected within 2 to 3 days). Crocodiles building their nests higher than usual above the high tide mark and long stalks on the mango fruit indicate that a "big wet" (greater than average seasonal rainfall) is expected.

The Aboriginal Elders interviewed at Mapoon, believe that their knowledge of seasonal weather patterns, passed on from generation to generation, is becoming less reliable for season predictions and that the Australian weather patterns are changing.

The Mapoon Community is currently developing a local garden program where tropical fruit and vegetables are to be grown as a community project, with a future aim of it becoming a commercial venture. The use of traditional weather predictions is hoped to become an integral component of this program.

Weather Influences for the Mapoon Community

Mapoon is located in the northern tropics where significant weather events that could impact on the community include Tropical Cyclones (Dec-Apr), thunderstorms (Nov-Apr), fire weather and strong winds. Although Mapoon is a growing community, the majority of residents resettling there have previously lived in the tropics and so are familiar with the dangers and associated precautions of the various weather events that occur in the region.

Tropical cyclones pose the greatest threat to the community, although the area has not been subject to a significant cyclone impact since its resettlement in the 1970's. Mapoon is located on an exposed low lying, narrow spit of land, with the shallow waters of the Gulf of Carpentaria to the west and a large shallow bay to the east. The community has little protection from storm surge, should a significant cyclone impact upon the area.

Despite pre cyclone season cleanups being conducted in the Mapoon Community, a significant problem of potential flying debris remains. New houses are being built beside the decaying remnants of the family's previous home (shanty shacks) and due to sentimental attachments to these structures, they have not been removed. These buildings would provide little resistance against cyclonic winds and pose a significant hazard to the community in a cyclone.

Current practices for weather and warning information for the Mapoon Community

Being a small remote community, access to the latest weather and warning information is limited. Television (ABC and Impajar), one radio station (ABC), and the internet (only available at the School and Local Council) provide Mapoon with weather reports and warnings. Day to day weather information is not utilised significantly by Mapoon residents, who are primarily concerned with information on the onset of monsoonal rains and weather warnings (cyclones).

Amongst the community, television (ABC) is seen as the preferred source of information as pictures are easier to interpret, particularly for cyclone warnings. Radio is the next preferred source of information. As most households do not have Internet access, very few people access weather information through this medium. The local council and community school (primary only) have Internet access and this is the primary source of weather information for these groups.

Word of mouth, (neighbours talking to each other) is a major form of information dissemination for the community. In the event of a cyclone threatening Mapoon, residents would most likely be kept up to date of the local situation (current state of the access road, evacuations etc) via this means. The local council does not currently have a policy on the dissemination of local information during a significant weather event.

Community needs for weather and warning information
Due to the remoteness of Mapoon, the community relies completely on outside sources for forewarning of significant weather events. Rain not only at Mapoon, but anywhere between the community and Weipa interferes with television and radio signals rendering them ineffective as sources of weather warning information. Internet access relies upon telephone connection, which is regularly lost due to fallen lines (tree branches) during rain and wind. In a developing cyclone situation it would not be unrealistic for Mapoon to lose all sources of weather warning information well before a threat to the community existed.

It would seem to be crucial for not only Mapoon, but any remote Community to have a comprehensive Community Emergency plan detailing the Local Councils actions and responses in the event of a threat to the community. (fire, flood, cyclone etc.) A Council Emergency plan for Mapoon, in relationship to cyclones and particularly storm surge, would need to address the possible deficiency in availability of weather warning information to the community. At present the Mapoon Local council does not have a Community Emergency plan.

I appreciated the opportunity to be part of this visit to the Mapoon community, and gained valuable insight into the roles that the weather and meteorological information play in remote areas. As the Bureau Of Meteorology continues to focus more on user requirements, the Bureau will be better able to provide more tailored and relevant products, to meet the community's changing weather information needs.

Media signals weak in stormy weather – sat phones, BoM fax info?

Old knowledge may be less relevant as elders as the climate changes.

Standing emergency plans are suggested. They would need to be very simple.

Cyclone effects on remote communities
Report on Old Mapoon field trip

August – September 2003

Study conducted by Eddie McLachlan (JCU) and Joanna Williams (BOM)
Centre for Disaster Studies, School of Indigenous Australian Studies
James Cook University, September 2003

This study was conducted as a joint project involving the James Cook University Centre for Disaster Studies, and the Commonwealth Bureau of Meteorology. The project is part of a national venture by the Commonwealth Bureau of Meteorology, to investigate the way weather forecast messages and warnings information are disseminated to, and throughout Australian indigenous communities. The fieldwork participants were PhD candidate, Eddie McLachlan from the Centre for Disasters Study at JCU, and BOM forecaster, Joanna Williams, who is based in Cairns.

Old Mapoon

The community selected for the fieldwork was Old Mapoon, which is located approximately 100 kilometres north of the bauxite mining town of Weipa, on the western coast of the Cape York Peninsula. The population is about 200, made up of approximately 180 indigenous and 20 non-indigenous residents. Like many other indigenous communities of the Cape region, Old Mapoon originated as a site for the establishment of a Christian mission. The present indigenous residents consist of people who, as children, were part of the mission system, or, are descendents of those children.

In 1963, the mission was closed down by the Church, under pressure from the Queensland Government and mining companies interested in the bauxite deposits in the area. As a result, the Mapoon people were removed against their will, and shipped off to other places such as Weipa, New Mapoon, Normanton and Cairns. Those families who resisted, were forced out of their houses by the police, who then set fire to the homes, as well as the church, school and store. From the mid-1970s, a number of residents of the old mission have been gradually returning to Mapoon. In recent times the State Government has returned the land back to the Old Mapoon people and has funded the establishment of new community houses, health and educational facilities.

Facilities

The community has a number of essential and standard services in order to function as an independent remote township. Electricity is supplied by a power plant situated at the road entrance to the village. Phone, radio and television reception, are supplied via relay towers from Weipa. A tower is located about half way between Mapoon and Weipa, with receiving towers positioned near the community workshop. A council office is responsible for administration of community infrastructure services, such as road and vehicle maintenance, plumbing and power. Food and other goods are supplied by a small general store. There is a state health service centre, and a primary school with up to fifty students which teaches to grade 6. Fresh water is

pumped from a bore within close range of the community, to two high tank towers where it is distributed via gravity feed, to all households.

Houses

There are about 55 residential houses in the community, with more being constructed annually, the numbers depending on budget. All residences are relatively new, most built within the last five years. Materials used in construction are concrete blocks, timber and steel frames, and masonite cladding for outside walls. Nearly every new residence is built in close proximity to the old shacks erected and occupied by early family members. According to people interviewed, changes in the Mapoon population have been observed in recent times due to the improved condition of the road, and availability of services in the community. Numbers increase noticeably in the Christmas period, when family members arrive to visit for the holidays. Another factor that influences numbers is that most of the residents who own homes are elderly, so all generations of family members may visit at various times and stay for various periods, all year round. There are also three established camping grounds in the Mapoon area, which are frequented by tourists on 4 wheel drive vehicle excursions, and fishing trips, mainly during the dry winter months.

Mapoon Weather

Mapoon experiences normal northern Australian weather seasons, with November-April wet summers, and May-October dry winters. As expected in such a coastal location, the community has experienced occasional severe storms and tidal surges. During winter months, the area is buffeted by strong south-easterly wind gusts.

Indigenous Weather Knowledge

Several elders state there are certain natural indicators for different types of weather events. The wet season is heralded by a gradual build-up of clouds over weeks, high tides, and very hot conditions. When the “dry” winds start to blow from the south east, causing the grass to lose all moisture, turn brown and die off, winter is beginning. Perhaps the most important weather knowledge for Mapoon people to possess, in relation to survival, are the natural signs which predict cyclones.

All people spoken to, expressed belief that the behaviour of the “manahawk” bird is a good indication of impending “bad weather”. This is a term used in other indigenous communities and can mean severe storms or a cyclone. In normal weather conditions, these birds can be seen circling in a group, high in the air along coastal areas. When conditions are extremely rough, in the case of an approaching storm or cyclone, they move inland to seek shelter, flying low to avoid wind gusts. People know from this, there is some form of hazard approaching. In the Mapoon area, indications are the bird may be a type of frigate.

Although Mapoon has not been directly impacted in recent decades, it has felt the effects of cyclones in the vicinity, such as floods, strong winds, erosion and tidal surges. Some people have recalled on various occasions personal experiences of cyclone-generated conditions, and the effects of severe storms. As in other remote communities, when recalling such major events, people regard time as a secondary factor to the actual event. In other words, they can remember details of what happened during the storm, such as where they sought shelter, who they were with, but when asked for the exact year, very few can answer with certainty. They also link events to their age at the time, saying they were children, teenagers or adults. It is not so much when it happened, but what the effects were on them, and the things important to them, e.g. family, their home, environment, etc. For instance, one elderly lady recalled how she sheltered in a tin shed beside a large tree during a cyclone, and, despite watching wind gusts bending trunks, snapping and blowing branches and leaves away, it was the noise of the wind that scared her the most. Nevertheless, she felt safe when assured by her father that they were secure in their basic shelter, and would not be harmed.

Wet Season Problems for Old Mapoon

While the road link between Old Mapoon and Weipa is much improved, it is unsealed, so in places heavy rainfall can cause washouts and potholes. These circumstances make travelling uncomfortable, and in a life or death emergency may have dire consequences, due to the slow travelling time by vehicle. A far more serious problem for Mapoon residents in the wet season, is the total breakdown of the telecommunication system. When there is substantial rainfall over Mapoon and between the community and Weipa, television and radio signals are completely blacked out. It is believed this is caused by deficiencies in the digital communication system used to relay the signals from Weipa. In cases of cyclone or severe storm conditions, this can create a potentially dangerous situation, because people would have no vital information as to where the cyclone/storm is, when it is going to impact, how strong it is etc. At present, this is the only warning system they have, so when it is incapacitated, the community is extremely vulnerable.

Mapoon Communications System

Information in the community is received by TV, radio, or telephone, and then if deemed relevant, is mostly generated by word of mouth. In such a closed community, people prefer to talk as a way of communicating, because as well as passing on a for example, a weather warning, they like to discuss other issues. The community is connected with Weipa via a digital relay system, and about one in every five houses have working phones. There are three public phone booths at different locations in the township. Households that have phones installed, are connected via underground cables.

There is a limited 2-way radio system, with units connecting the health service vehicle and the centre, and the local ranger. However, this has a short range, and useful only in the immediate vicinity, for dispersing information and emergencies. Residents receive weather forecasts via radio and TV in normal conditions. The council CEO also monitors daily weather updates by office computer using the BoM website.

The community can pick up four television stations, ABC, Imparja, SBS and 7

Central. People can also receive radio stations ABC National, 4K1G, and indigenous radio, 4AAA. Nearly all people spoken to, indicate they rely on ABC television and radio for weather reports.

Current Emergency and Hazard Practices for Mapoon

In the case of potential destructive winds caused by cyclones or severe storms, the person in charge of the power station shuts it down in anticipation of live lines coming down, endangering lives and buildings. The store and health centre have portable generators on standby for such emergencies.

Within the community, power is lost when trees, brought down by strong winds during storms or from bushfires, fall across lines, and it takes time to get repairs done, due to remoteness and availability of specialist personal. The public phones have been subjected to vandalism on occasions.

Residents are made aware by radio and television, when there is a weather hazard in the region, before telecommunications are blacked out, which happens when the hazard approaches. To ensure everyone is notified of an impending extreme hazard, staff from the council office phone relatives and friends, who pass the information on to those residents who may not have phones. As a further precaution, staff drive around the community to inform every one about what is happening. In such a small place, word of mouth is the main form of spreading news.

Mapoon and Bureau of Meteorology Weather Information

During the wet season, the council CEO constantly accesses the BOM website for weather updates, in case of potential danger from cyclone or severe storm. The community also now has a website, which gives out local news items. More importantly, it also has a BoM site, which contains up to date regional weather data.

The school principal also keeps a constant watch on the BoM internet site in the summer. Most of the students have to be picked up daily by the school bus, so if a warning is received about a potential cyclone or extreme storm, the children have to be returned home. As well as teaching children how to access information off the web, staff make pupils aware of the BoM site. The school has also started a course for adults who want to learn how to operate computers. Hopefully, through their learning, they will show an interest in the kind of data that can be accessed from the BoM website, in particular, with regards to their local area.

In the course of the fieldwork, some people spoke about the changing weather patterns for the region in the last few years. In particular, they noticed there was not as much rain in the last two wet seasons, compared to earlier times. Most residents were interested in long range forecasts, such as whether it was going to be a long drought or a good wet season. As mentioned earlier, the elderly people also regard the BoM weather data supplied on ABC radio and television as valid, so do heed them when warnings are issued. However, they did express concern at understanding some of the terms used in radio and television weather bulletins. Particularly, the elderly residents conceptualise distances in miles, so have problems when they hear measurements given in kilometres.

Appendix 8 Further Web resources

Guidelines for disaster managers on preparing and disseminating effective health messages.
http://www.disaster-info.net/carib/communication.htm
http://www.gisdevelopment.net/application/natural_hazards/overview/nho0004.htm

The media and disaster reduction:
Roundtable on the Media, Scientific Information and Disasters at the United Nations World Conference on Natural Disaster Reduction.
http://www.annenberg.nwu.edu/pubs/disas/disas3.htm

Special focus: emergency and humanitarian action
Disaster situation in the Western Pacific Region 1990-1999
http://www.wpro.who.int/themes_focuses/theme3/special/themes3_speciala.asp

Natural disaster reduction in the twenty-first century:
Science and technology can make the difference
http://www.wmo.ch/web/Press/Press637.html

Prevention begins with information!
http://www.unisdr.org/unisdr/docs/1998camp/kit1.htm

International Day for Natural Disaster Reduction 9 October 2002
Links to UN and UN System sites
http://www.un.org/depts/dhl/disaster/

Natural Disaster Reduction (ndr96) Conference Proceedings
http://www.ema.gov.au/ema/emaInternet.nsf/AllDocs/RWPF54E437AD69A060CCA256C88003BFC2E?OpenDocument

Hazards and risk virtual library - by management - disaster ...
... Palm Beach Post's guide to preparing for the 1995 hurricane season
Complete Record
Details International Decade for Natural Disaster Reduction Description
http://life.csu.edu.au/hazards/0DisasterMitigation.html

Australasian disaster and hazard research directory
http://www.es.mq.edu.au/NHRC/ema.html

http://www.edna.edu.au/discover/?queryText=storms&sector=3830#resulttab

Natural disaster mitigation and cultural heritage:
http://life.csu.edu.au/~dspennem/Disaster_SFO/SFO_Course.html

The media and disaster reduction:
http://www.annenberg.nwu.edu/pubs/disas/disas3.htm

Improving bushfire preparedness through effective risk communication
www.annenberg.nwu.edu/pubs/disas/disas3.htm - 10k - 8 Jul 2003 -
http://www.psych.unimelb.edu.au/staff/br/ibp.html
www.psych.unimelb.edu.au/staff/br/braim.pdf -
http://www.massey.ac.nz/~trauma/issues/1999-1/rohrmann.html
http://www.psych.unimelb.edu.au/staff/rohrmann.html
www.unisdr.org/unisdr/ISDRInf%201.pdf

Emergency Management Australia - speeches - 1999
www.mcdem.govt.nz/MEMWebsite.nsf/Files/ tephra96/$file/tephra96.pdf
http://www.ema.gov.au/ema/emaInternet.nsf/AllDocs/RWP6D41E19526A385
87CA256C860000AA64?OpenDocument

Emergency Management Australia – Indigenous Communities
http://www.ema.gov.au/ema/emaInternet.nsf/AllDocs/RWPA6C073905FEC03
0BCA256CB30017FEC4?OpenDocument

Natural Disaster Risk Management Study
www.ema.gov.au/ema/emaInternet.nsf/AllDocs/
RWPA6C073905FEC030BCA256CB30017FEC4?OpenDocument -
www.premiers.qld.gov.au/sectorwide/ april2003/page9.html -
http://www.science.org.au/academy/media/habitat3.htm

A socio-psychological model for analyzing risk communication processes
http://www.massey.ac.nz/~trauma/issues/2000-2/rohrmann.htm

Natural disasters and sustainable development
www.unisdr.org/unisdr/docs/1998camp/kit4.htm
http://www.undp.org/dpa/index.html
http://www.undp.org/dpa/frontpagearchive/september00/26sept00/
www.disaster.qld.gov.au/publications/ pdf/Planning_for_LG_Brochure.pdf
http://www.gisdevelopment.net/application/natural_hazards/floods/nhcy0001.h
tm