**Can we use native plants to predict floods?**

By:Matt Prescott | February-9-2011

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Ecologist Dr Matt Prescott describes how native plants can be harbingers for extreme weather events.

An acacia plant (a wattle species) flowers in the Red Centre. (Photo: Mitch Reardon)

**IT WAS IMPOSSIBLE TO** watch the devastating floods that recently hit Queensland, New South Wales and Victoria without wondering what could be done to prevent the same thing happening again.

As an ecologist, I believe that Australia's native plants and animals could provide some of our most useful and reliable allies. The flowering patterns of native plants offer a valuable early warning system for detecting changes in the weather, while their roots and leaves could be used to build a network of 'green dams', which would reduce Australia's vulnerability to the disastrous effects of extreme floods and droughts.

Native plants possess unique abilities to detect and signal changes in the weather, thousands of years of experience of coping with the extreme climate change and a track record of stabilising soils, water tables and communities over millions of years.

Most importantly, native plants such as the acacia are grandmasters of safely storing water when it is available and controlling water when it is in flood. The techniques they use to manage the environment might be difficult to see, but are powerful and have much to teach us, if we are willing to learn.

**Acacia species' suprising adaption in La Niña**

In 1999, I arrived in Australia in the middle of a major disaster caused by the La Niña weather phenomenon. I was studying the pollination of Australian acacia for a PhD at Oxford University and had arrived in the WA wheat belt to study three critically endangered acacia species, just as a catastrophic 1-in-250-year flood hit the area. A few weeks later, a further 1-in-100-year flood hit the same area.

I was shocked by the scale of destruction. Most surprisingly, each of the critically endangered acacia species I studied appeared to be thriving on the roadside verges they called home, and perfectly adapted to make the best use of such extreme and erratic weather conditions.

Their flower buds were quickly swollen by the rain and gradually flowered a month or so after the first flood, once the immediate danger to the flowers and pollinators had passed. The various pollinators the acacia needed in order to reproduce also appeared once the acacia flowers were ready, as if on cue.

It was obvious that within their local environment, each acacia species had evolved multiple, overlapping survival strategies to allow them to cope with both massive and sudden change, as well as the more predictable conditions that usually prevailed. This level of flexibility is invaluable, given that Australia is exposed not only to the annual changes associated with the sun tracking north and south, but also to the experiences the disruptive effects of La Niña and El Niño.

**Acacias an early warning system for dramatic weather changes**

The fact that Australia is located on the boundary between the sub-tropics in the north and the more temperate zone in the south could also prove hugely significant over the years ahead. This is because we know the distributions of individual acacia species have changed enormously in the past, in response to natural episodes of climate change and weather variation.

For example, when the world cooled for 5000 years, roughly 20,000 years ago, many acacia species were able to advance both northwards and into the cooler, wetter interior. Many species were then forced back towards the south and the continent's coasts when the world, and the interior of Australia, subsequently warmed approximately 14,000 years ago.

Successive waves of such movement, over vast amounts of time, have constantly allowed new combinations of acacia to come into contact and to become trapped on the islands of soil that best met their needs, sometimes for thousands of years. This explains why Australia has accumulated so many acacia species (950) and means that their existing distribution patterns offer all sorts of useful clues about what changes have occurred in the past and could, potentially, happen in the future.

The majority of Australian acacia species only live for 10 to 15 years and this means that they tend to avoid producing unnecessary flower buds during drought years and instead concentrate on mass flowering during wetter years. As a result, their flowering seasons can help us to see changes in the seasons much earlier and more clearly.

By studying the budding and flowering patterns of many different acacia species across Australia, we could obtain useful clues about both annual and longer term shifts in the seasons, and gain far more ecological information than rainfall data alone can provide.

All of this means that the flowering patterns of native plants, such as the acacia, could act as a natural early warning system for La Niña and El Niño years, help us to monitor the ecological impacts of annual rainfall patterns and tell us more about both the state of water tables and the relative health of ecosystems.

**Plants act as a green dam to mitigate flood and drought**

This information would be extremely valuable because the majority of Australia's continental plate is an ancient seabed, which has been raised above sea level. A side-effect is that the country's sandy soils still contain billions of tonnes of salt, much of which has slowly been washed deep into the ground by millions of years of rain.

Fortunately, the deep roots of native plants, such as the acacia also act to keep this ancient salt out of harm's way. They do this by tapping water from far enough down to prevent the sun from pulling water tables up towards the soil surface, where evaporation could steadily concentrate dissolved salts to toxic levels.

By preventing water tables from rising too high and soils from becoming waterlogged, under normal conditions, native plants also provide the soil conditions required to slow down run-off, increase the absorption of rain and steadily release fresh water during droughts.

**Australia's native plants an important asset**

In these ways native plants already play an important role in stabilising water tables and managing floods.  It is even likely that if they were appropriately replanted, on a large scale, they could also allow the entire landscape to act as a self-sustaining form of Green Dam.
In ways that indigenous Australians came to understand over 50,000 years the acacia, and other native plants, are able to detect and signal changes in the weather, control the flow of water, keep salt away from their roots and sustain life. All of these abilities could now be of great assistance to both rural and urban Australia.

To date, we have rarely turned to our natural allies for help but I hope that we might give them a chance to work with us to protect the country we all love.

*Dr Matt Prescott's PhD research on acacia plants was funded by the Australian Geographic Society. He is based in Oxford, UK.*