

## **A La Niña climate event-associated major wet season in Northern Australia raises the spectre of a surge in mosquito-borne viral diseases in tropical north Queensland.**

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### **Introduction**

A perfect storm is brewing for the forthcoming Australian summer to be a record season for mosquito numbers, and therefore potentially also for recorded cases of mosquito-transmitted viral ('arboviral') diseases. The reasons are multiple, involving early starting and sustained rainfall, indications of a La Niña climate effect in the region, combined with increased exposure due to people being outside during the southern hemisphere vacation period.

### **La Niña Prediction**

The Australian Bureau of Meteorology has just confirmed that the eastern tropical Pacific Ocean has finally reached La Niña levels [1]. This positive phase of the El Niño Southern Oscillation is associated with warmer-than-average waters north of Australia while, conversely, equatorial sea surface temperatures cool down. That helps to produce rising air, clouds and rainfall over, particularly, Northern Australia. This coupled ocean-atmosphere phenomenon is indicative of a good chance of a solid wet season for Northern Australia, with active monsoons, providing much needed rain for drought-affected areas of north and central Queensland and the Northern Territory. Widespread and intermittent heavy rain is predicted to last until late February 2018 and will intensify the wet season rain across areas north of the Tropic of Capricorn [2].

### **Tropical Cyclone Forecast**

The tropical cyclone season in Queensland also coincides with this window [3]. Cyclones form mostly from lows within the monsoon trough positioned over Northern Australia in the southern summer, between November and April. Tropical cyclones or tropical lows usually make landfall in the Gulf of Carpentaria, the shallow rectangular inlet of the Arafura Sea (the part of the Pacific Ocean that separates the northern coastline of Australia from Papua New Guinea). Moving overland, cyclones or lows can also cause widespread heavy rain over much of the state. Often the most significant impact is flooding.

### **Monsoonal Wet Season**

Typically in Northern Australia the period when mosquitoes are most common coincides with the summer months. This is to be expected as the tropical north generally experiences wet summers, characterised by high humidity, monsoonal rains and storms, and dry winters, distinguished by warm, sunny days and cool nights. Hot, humid environments are most amenable

to mosquito breeding and survival, so one may expect to see a winged adult any time between November and April [4]. In 2017, however, north and central Queensland has witnessed an unusually wet October with some regions registering the heaviest monthly rainfall on record [5]. This means that by late November mosquitoes were starting to be seen in very high numbers, which is much earlier than in years that experienced a drier spring.

### **Early Start to Mosquito Season**

If October was a prelude to a wet summer, then the prediction of it being 'the worst mosquito season in history' may be realised [6]. However, for predictions of prolonged swarms to be validated, plenty more rain during and after the Christmas and New Year holiday period will be required. Anywhere that has already experienced significant rain could potentially expect massive outbreaks of mosquitoes. As a general rule, drier regions, where there is less rainfall over the summer, will experience fewer mosquitoes and therefore will have less pest problems as well as a reduced risk of the diseases that they may carry.

### **Risk and Effects of Flooding**

Which regions experience worse outbreaks will depend on the pattern, volume and duration of rainfall. Land that is in a river basin catchment area will collect run-off water from areas further up-river, which may lead to an increased risk of flooding that is not related directly to the volume of rainfall that it has experienced [7]. Flooding certainly leads to problems since the slow drainage affords an opportunity for mosquitoes to lay eggs in places they might not otherwise. Most commonly, eggs are deposited in clusters – called rafts – on the surface of stagnant water in ponds, marshes, swamps and other wetland habitats [8]. However, eggs can hatch in as little as a couple of centimetres of standing water, thus including, for instance, inside empty cans, plant pots and roof guttering around domestic homes and gardens.

### **Mosquito-Transmitted Viral Infections**

While there are around 80 well-characterized species of mosquito that inhabit Australia and probably a couple of hundred more that have not been identified in any great detail, only a few may be anticipated to cause real problems this summer [8]. This is because only around a dozen are known to carry microbial pathogens, usually viruses such as Ross River, Barmah Forest, Murray Valley encephalitis and other less well documented so-

called neglected arboviruses that are indigenous to Australia, many of which can cause infection when passed to humans [9]. These may manifest as acute febrile illness, characterized by a fever and, typically, additional flu-like symptoms of headache, muscle and joint ache, with a possible rash. This can last up to a week but in rare instances debilitating symptoms may develop that involve arthritic symptoms and chronic fatigue. Full recovery can take months or even years.

### **Undiagnosed Febrile Illnesses**

While infection with Ross River, Barmah Forest, Murray Valley encephalitis viruses can now be tested routinely in pathology laboratories, for most of the other at least 75 known arboviruses that people can potentially contract, there are no commercially available tests to diagnose the infections [9]. If a patient presents with feverish symptoms the cause is not obvious and very often goes undiagnosed (recorded as an undifferentiated febrile illness). Treatment is therefore frequently managed poorly. Investment in a rigorous identification and screening program is warranted and could potentially reduce significant outbreaks of these viruses at a time when a population boom in Northern Australia is predicted due to government incentives to relocate to this historically underinvested location [10].

### **Mosquito Nuisance**

Irrespective of the species of mosquito – and whether or not each is capable of transmitting viral infections to a bitten person – there is a manifestly obvious irritant value, since almost all species bite with the aim of taking a blood meal. In fact, it is only females that feed on blood, in search of the protein which they need to produce eggs. They can lay up to 300 eggs at a time, while males are ‘tee-total’, usually feeding on plant sap and nectar only [8].

### **Preventive Measures**

As prevention is always better than cure, this leaves the pertinent question of how people can best protect themselves from being bitten this wet season and thereby avoid potentially contracting mosquito-borne diseases. There are several common sense personal protective measures that can be taken to reduce risk [11]. First and foremost, wearing clothing to fully cover arms and legs. Given the hot and humid climate, this is often impractical, in which case sensible precautions include correctly applying mosquito repellent to exposed skin, and if possible avoiding being outside at dawn and dusk when some mosquito species prefer to bite. For those planning a day out that may knowingly involve visiting a mosquito-infested area, such as when fishing or bush walking, it is a good idea to take the added precaution of opting for loose-fitting light clothing. Dark colours attract mosquitoes as they are drawn to heat and darker clothes retain more heat than does light-coloured clothing [12]. Those staying closer to home may be reassured to hear that mosquitoes are disturbed by air conditioning and fans because they like to settle to feed in still air, not a breeze.

### **Conclusion – A Take-Home Message**

The approaching summer in Northern Australia is predicted by meteorologists to be extremely wet and humid, a situation exacerbated this year by the effects of the latest La Niña

climate event in the southern hemisphere. This inclement weather is anticipated to bring a plague of mosquitoes that will potentially blight the holiday plans of millions of Australians. Moreover, importantly, some of these mosquitoes are vectors of transmission of potentially debilitating indigenous arboviral diseases. These cause febrile illnesses with symptoms of fatigue that often are undiagnosed and hence are poorly treated. Provision of community-focused public health information on how to restrict mosquito breeding and how to avoid being bitten should be prioritised by local and regional councils in order to reduce the number of infectious bites and thus to limit the prevalence of such arbovirus-associated febrile illnesses.

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