CoastAdapt

Snapshot

Controlling mosquito-borne disease in Cairns

Summary

Cairns is a regional city in Far North Queensland that has a tropical climate with hot and humid summers and mild, dry winters. This climate is highly favourable for mosquitoes. When conditions are right, Cairns experiences outbreaks of the mosquito-borne disease, Ross River virus. It is not clearly understood how climate change may affect these outbreaks in this region.

The Cairns Regional Council (CRC) is responsible for a 90 km landscape of wetlands, flood plains and flat coastal lands (see Figure 1). It is also responsible for managing mosquitoes. The CRC undertook a CoastAdapt test case project to learn more about how climate change may be expected to influence the risk of Ross River virus and to improve virus management.

Keywords

Ross River virus, issues identification, risk screening, mapping, mosquito control, test case

Ross River virus is a painful disease caused by a virus that is contracted when an infected mosquito bites a person. In 2015, there was an outbreak of Ross River virus in Australia with almost 10,000 reported cases: this was the largest annual number of cases ever reported and almost a doubling of the 2014 numbers (Royal Australasian College of Physicians 2016). Most cases occurred in Queensland.

Climate change is likely to alter the epidemiology of this and other vector-borne diseases but the potential changes are not well understood.

To better understand potential changes in epidemiology for Ross River virus in a changing climate, the Cairns Regional Council (CRC) used CoastAdapt to help inform its Mosquito Management Plan. Through a series of meetings, CoastAdapt was used to identify risk areas, conduct a risk assessment, and review the mapping available for wetlands and mosquito breeding areas.

Figure 1: Aerial view of Cairns Regional Council. Source: © Cairns Regional Council.

Ross River virus

Ross River virus is spread to humans, mostly by the following three mosquitoes:

- *Culex annulirostris* which breeds in permanent bodies of fresh water
- *Aedes vigilax* (see Figure 2) which breeds in salty pools in mangroves and salt marshes after inundation by spring tides
- *Aedes notoscriptus* which breeds in containers (often in urban areas, close to homes and other human fixtures) such as bird baths, pot plant saucers and any containers that could trap water.

Figure 2: Aedes vigilax. Source: © Stephen Doggett, Medical Entomology, Westmean Hospital, Sydney, Australia.

During wet conditions and following very high tides, large numbers of mosquitoes emerge and fly in most areas of coastal Far North Queensland. They cause an extensive biting nuisance and potentially disease if they are carrying Ross River virus. These outbreak events often result in numerous complaints to the CRC, and complaints often include requests for chemical fogging activity to be carried out by the Council Vector Control Unit.

In recent years, notifications of Ross River virus for the Cairns and Hinterland Health Services area have ranged from 161 in 2012 to 382 in 2015 (Table 1). There is a concern that future climate change may result in more breeding locations for mosquitoes, leading to higher rates of Ross River virus among the population. The possible implications are of interest to the CRC and the Vector Control Unit, which is already involved in a mosquito control program.

Table 1: Ross River virus notifications - Annual totals for Cairns and Hinterland Health Services. Source: https://www.health.qld.gov.au/clinical-practice/guidelines-procedures/diseases-infection/surveillance/reports/notifiable/weekly.

Year	2016	2015	2014	2013	2012
Annual Total	185	382	213	240	161

There is limited information available to assist councils in identifying RRV transmission locations which could better direct mosquito control efforts.

Activities of the Vector Control Unit

The role of the Cairns Regional Council's Vector Control Unit is to monitor, inspect and chemically treat known breeding areas to prevent the emergence of adult mosquitoes. This unit has limited resources and must carry out chemical fogging where the best returns can be expected. Together with Queensland Health, the Dengue Action Response Team (DART) and Eliminate Dengue, the Vector Control Unit has developed successful activities to help address the risk of dengue.

As part of its overall planning process for mosquito control, the Vector Control Unit used CoastAdapt to identify hazards and risks and prioritise activities associated with controlling the risk of Ross River virus under emerging climate change scenarios.

During a series of meetings to work through the test case, CoastAdapt was used to estimate how hazards will exacerbate breeding sites under a high emissions scenario (RCP 8.5) for 2030. The six-step tool C-CADS was introduced, with a particular focus on Step 1) *Identifying challenges*, and Step 2) *Assessing risks and vulnerabilities*. First past risk screening was conducted and inundation mapping tools from CoastAdapt and the Department of Environment and Heritage Protection (DEHP) were examined.

Although the 2050 and 2100 scenarios are likely to be of concern, it was considered that a twenty-year planning horizon is the most relevant timeframe for the CRC purposes and the application of a revised Mosquito Management Plan.

The meetings with the test case working group found that, within this timeframe, incidences of Ross River virus may be linked to the following anticipated changes:

Coastal hazards around beaches and estuaries
An increase in the size of mosquito breeding areas is likely to lead to an increase in mosquito populations, biting nuisance complaints to the CRC, and an increased risk of mosquitoes and mammals carrying Ross River virus in the local environment. Habitat disturbance, with storm events and salt-water intrusion, is likely to cause changes to mosquito species at breeding sites.

Heat-related hazards
An expected increase in average temperature throughout the year, together with additional heatwaves, means that there is likely to be a longer period of favourable conditions for mosquito breeding including those potentially carrying Ross River virus. This will likely correlate with additional complaints of nuisance biting.

Rainfall-related hazards
The fresh water mosquito *Culex annulirostris* is one of the primary vectors in Queensland. An increase in freshwater pools is likely to expand its habitat, leading to increased mosquito populations and risk of Ross River virus (see Figure 3).

The best short term management response, based on considerations arising from the test case meetings and from CoastAdapt, is for aspects of the first pass risk screening, wetland mapping and projected storm-surge and flood modelling to be addressed through the review of the Mosquito Management Plan. Further consideration of the risk of Ross River virus and emerging vectors in timelines beyond 2030 will be considered through the CRC Coastal Hazard Adaptation Strategy.

Figure 3: Saltmarsh and mangroves provide an ideal breeding ground for mosquitoes. Source: © Cairns Airport.

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Further reading

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