Flooding, public health – and the need for more emphasis on prevention

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Floods in Invercargill in 1984.
Source: Otago Daily Times

Recent flooding events in New Zealand should make us think about the adverse public health and economic impacts. This blog post considers these issues, and suggests that there may be scope for further preventive action by central and local government so as to better reduce the health and economic impacts of flooding disasters.

The recent flooding events in NZ (June 2015, lower North Island and Dunedin) remind us that this country is at relatively high risk of such disasters. Over the past two years similar events have occurred, including notably in Christchurch in March 2014. This risk is a consequence of high rainfall and the steepness of the hill and mountainous country (see this historical review in Te Ara). Furthermore, the impact of flooding may get worse in the future, with a mix of such factors as climate change and the expansion of towns and cities (if building continues to occur in flood risk areas). Floods are costly, with the Insurance Council of New Zealand estimating that insurance industry payments for flood damage

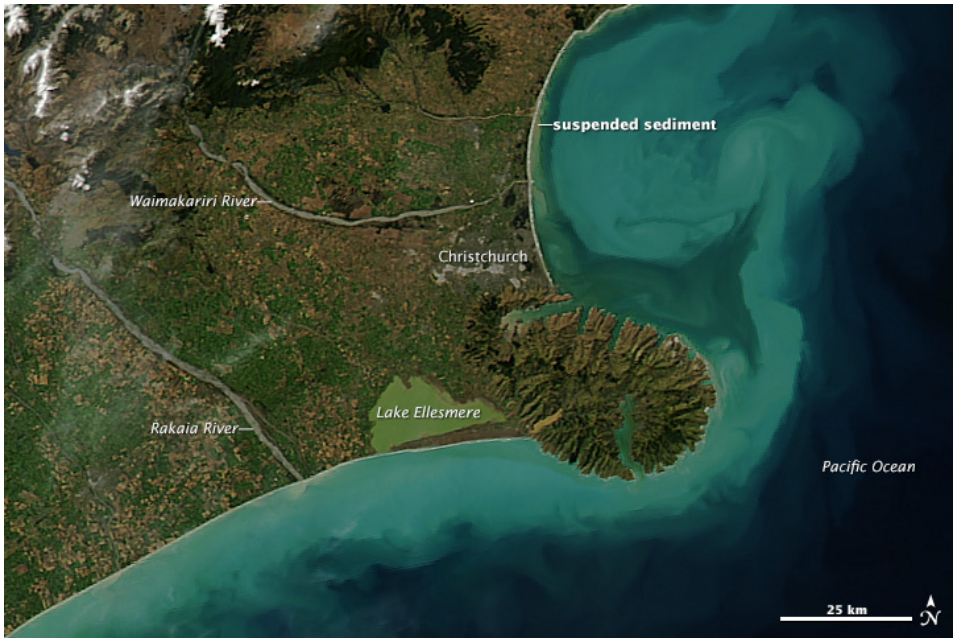
between 1976 and 2004 averaged $17 million per year (2004 dollars) (1). Furthermore, government expenditure on civil defence responses during flood emergencies alone averaged about $15 million per year over the same period. In addition, there is also the damage to uninsured property. For example, the storm and flooding event in the lower North Island in February 2004 was estimated to have cost around $380 million in total, while insurance costs were under a third of this at $121 million (2).

What are the direct and indirect health impacts of floods?

There is a modest direct death toll attributable to flooding events with three flood-related deaths and four storm-related deaths in the period 1993 to 2007 (2). But the total injury burden (including non-fatal injuries) is likely to be higher. Flooding events are also likely to have mental health impacts when they cause displacement from homes, ruin livelihoods and disrupt communities. For example, a systematic review reported that the prevalence of psychological distress in flood survivors was 9% to 53% at two years post-flood (3). Some NZ work has also considered the adverse mental health and community level impacts from the Manawatu floods in 2004 (4). This work also described damage to water supplies and to sewerage systems from these particular floods. The latter can also have adverse health impacts though any subsequent burden of enteric diseases can be difficult to detect with current surveillance systems (which rely on visits to doctors and laboratory testing). In another study around the 2004 Manawatu floods, we considered responses by the public in the post-flood period. Our survey found that while 73% of all respondents boiled water at some point as recommended, only 4% maintained boiling water or bottled water use for the necessary nine-week period (5).

There is also a need to consider the indirect health costs to populations arising from economic, ecologic and other damage. The scale of the damage can be graphically seen in this satellite photo of sediment going into the ocean from the floods around Christchurch on 4 March 2014. This sediment means lost topsoil and destroyed marine life, on top of the other more direct damage. Conversely the economic, health and other benefits to people from maintaining healthy forest and other natural ecosystems are probably high, although notoriously difficult to estimate (6).

Flooding from the Waimakariri, Rakaia, Heathcote, and Avon,
March 2014 (7)



Prevention of flooding impacts – upstream

Internationally there is evidence that forests play a major role in flood protection, though the extent of this depends on many factors including: climate, forest type and condition, soil type and ground conditions. A key study of this relationship used data from 56 countries (8), and it reported that a decrease of 10% in natural forest area increased flood frequency between 4% and 28% among the countries studied. Similar evidence comes from a study of 28 water basins in Europe (9), and there is also experimental work on how tree planting reduces water run-off (10). Research in NZ has reported that annual water yield and peak flooding levels decline when water catchments are planted with trees or are allowed to revert (11). Historically in NZ, the perceived impacts of possums, deer and goats on forests and flooding risk, were a major factor in controls of these animals via extensive hunting as early as 1930 (12). So what can be done now in NZ? Some options that could be evaluated further include the following:

Do more to protect native bush from degradation by introduced pest species – Such work is already being done by the Department of Conservation, councils and individual land owners. Possum control (mainly to reduce bovine tuberculosis) is also extensively funded by local and central government and industries in the agricultural sector (see here for details). However, in flood-prone regions of the country the control efforts appear to need intensification – and to include more comprehensive control of the full range of introduced pest species, including goats, deer and pigs (which reduce vegetative biomass in hill country and may also damage the soil structure). Indeed, given the elimination of feral goats on large islands (13), it is probably now technically feasible to eradicate these pests at a national level. Enhanced pest control may well be fairly cost-effective, given the total annual output losses from “animal and invertebrate” pests has been estimated at $635 million for the agriculture sector and $227 million for the forestry sector (for 2008) (14).

Re-vegetation of more hill country with a wider range of plantation forestry – Central government could do more to promote plantation forestry in the hill country – which is probably highly desirable anyway to help sequester carbon dioxide as part of the country’s response to climate change. There are a range of ways to incentivise tree planting, from the establishment of a more realistic price on greenhouse gas emissions to

funding for farm forestry research and education. Regional government in flood-prone regions could also do more to encourage the shift to such forests in the hill country, through tighter land-use regulation. It could also perhaps use disincentives – such as higher rates charged for un-forested high country pasture land.

Re-vegetation to native forests – In some areas converting hill country pasture land to plantation forests might not be economically that viable. So perhaps it is then best to allow it to revert to native bush for the benefits of flood protection, erosion control and even for water quality reasons (e.g., where the water supply catchment comes from the area under consideration). Improved pest control (as discussed above) might facilitate the speed of such conversions. Further policy changes could build on the hard-won native forest protection gains to 2000 (15).

Prevention of flooding impacts – downstream

There has been considerable work around NZ to build flood banks and to try to control building in flood-prone areas. Some of the areas at highest flood risk are creatively utilised for parks, sports fields and other open space uses – with relatively few buildings on them. Nevertheless, such flood protection can be expensive and it sometimes fails. So such interventions are possibly not as cost-effective as reducing run-off from hill country land as detailed above. Nevertheless, they are undoubtedly worth a further look – especially in coastal regions where rising sea-levels from climate change pose an additional risk of damage.

Summary

In summary, the impact of flooding on public health and the NZ economy suggest that more attention to preventive measures is probably well worthwhile. Fortunately there are a range of options for central and local government to consider.

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