INQUIRY INTO RESPONSE TO MAJOR FLOODING ACROSS NEW SOUTH WALES IN 2022

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The floods in February 2022 were a combination of unique factors that are hard to forecast. An already wet catchment due to persistent La Nina conditions, was hit by high intensity rainfall from a deep East Coast Low. Due to already high-water levels downstream of Lismore, water from the upstream catchments simply had no-where to go. However, in the end, Lismore sits in a river valley at a confluence of multiple local creeks flowing into the Wilson River, which ultimately flows into the Richmond River. This complex network means that floods in Lismore are inevitable, and with increasing intense rainfall predicted under climate change, floods will continue to occur (even if they will be interspersed by long droughts).

There remains a need for more accurate flood forecasting and prediction. However, some of the difficulty is the uncertainty related to information from measurement gauges for rainfall and stream flow. DARE (https://darecentre.org.au) is an ARC Training Centre which includes five universities led by the University of Sydney and this Centre leads (inter alia) projects on quantifying uncertainty in water resource management, such as in flood observations and stream flow measurement. For example, the Centre has a current project with WaterNSW that explicitly quantifies the uncertainty in streamflow measurements. Quantified uncertainties will directly feed into better and more realistic forecasting of floods, where the upper uncertainty bound can serve as a specific safety boundary. Incorporating uncertainty in flood forecasting models will lead to more realistic risk estimates that can result in improved planning and disaster response planning. Therefore, uncertainties in flood risks should be "business as usual" for operational preparation and planning.

Spatial uncertainty analysis is also urgently needed, as this will identify information gaps in relation to where floods are observed. Better integration of rainfall radar data into flood early-warning systems can provide the spatial data to assess the ground monitoring network. Gaps in the observation network can lead to significant uncertainty in stream flow estimates with potentially disastrous consequences.

In addition, we have developed work on flood extent and volume quantification using satellite data, building on ongoing research over the last 10 years. Again, this mapping (in near real-time) will provide more accurate pre- and post flood analysis of the extent of flooding. This once again will improve planning and preparation for future floods.

A lot of focus after the February 2022 floods (and any other floods) is understandably on the human and community recovery. Addressing the immediate needs of shelter, food, communications and services should take precedence, followed by the clean-up.

However, given the location of Lismore as highlighted earlier and climate change predictions, for long term planning, it is better to design and plan for a rebuild city that is resilient and can "live with floods" even under the projected changes in flooding.

It is therefore important that the philosophy and concepts around "living with floods" (https://nccarf.edu.au/living-floods-key-lessons-australia-and-abroad/) and the associated concepts around "room for the river" should be taken into account in the rebuild and replanning of the Lismore area. The current devastation in Lismore creates a unique opportunity to redesign the catchment landscape and urban and peri-urban areas of Lismore. The concepts of living with floods focus on adaption of river corridor to create sufficient storage for flood water in the natural landscape. This is achieved by creating natural corridors and flood ways to allow the water to spill and this in the end will lower the flood peaks. Therefore, rebuilding the Lismore area should create room for the river in the city and outside the city to lower the local flood peaks. In addition, these concepts can also drive the redesign of housing in more outlying suburbs and townships, specifically in terms of how we use smart and strategic placement of levees, combined with creating more room for the river elsewhere to protect important assets.

Flood extent mapping based on satellite observations would provide significant input into these designs as we can now exactly track where the water goes. This should also incorporate local Aboriginal knowledge into the design of the waterways. In the long tradition there surely is knowledge about floods and safe places in the landscape, which can be incorporated within the redesign of the Lismore area.

A further possible important link is to bring in local efforts and support for regenerative agriculture in the upstream parts of the catchment. One of the outcomes of regenerative agriculture is that the land holds more water, is more resilient to erosion and therefore would further reduce flood peaks. Ongoing research in this area in Narrabri, focussed on quantifying the changes in the water balance under regenerative farming can inform the potential reduction in flooding through supporting the introduction of regenerative farming within the landscape.