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Hazard Note

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Identifying water sources for aerial firefighting

About this project

The *Identifying water sources for aerial firefighting* project is a collaboration between the National Aerial Firefighting Centre at AFAC, Natural Hazards Research Australia, Geoscience Australia and FrontierSI. This Hazard Note summarises the first phase of this project, now complete, which is improving the reliability and clarity of information about waterbodies available to aerial firefighters. It is an extension of the Bushfire and Natural Hazards CRC's *Identifying water sources using satellite imagery* project.

The research team comprises researchers Dr Caitlin Adams, Madeleine Seehaber, Dr Fang Yuan and Roshni Sharma from FrontierSI, alongside key end-users Sandra Whight (AFAC) and project manager Anthony Gallacher (formerly from NAFC), and Norman Mueller and Bex Dunn from Geoscience Australia. Sam Ferguson from AFAC and Danielle Wright from the Country Fire Authority Victoria provided additional sector and technical advice.

Authors

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Learn more about this project online

naturalhazards.com.au/research/research-projects/identifying-water-sources-aerial-firefighting

Summary

During active bushfires, aerial firefighting units are dispatched by members of NAFC through an online system called Arena. NAFC members use a variety of data sources, available through Geoscience Australia's Digital Earth Australia Waterbodies product, to find suitable nearby water sources (called waterbodies) for firefighting helicopters and fixed-wing aircraft to access during bushfires. It is critical for effective decision making that the most current and accurate data about the location of water is available as quickly as possible.

The first phase of the *Identifying water sources for aerial firefighting* project, as summarised in this Hazard Note, has successfully identified and implemented user-driven improvements that can be adopted into the Digital Earth Australia Waterbodies product. Researchers at NAFC and FrontierSI have delivered a prototype workflow that augments the product's satellite-based data with the latest water availability information to meet the needs of aerial firefighters dispatched through NAFC's Arena system – specifically, by easily retrieving accurate data about when water was last seen and how much water is available. Whereas previously the data about nearby waterbodies might have been months or years old, now this information is able to be updated regularly and can be easily accessed.

This presents a significant improvement to the accuracy of agencies' knowledge about nearby water, providing critical support to disaster management planning to facilitate rapid and effective bushfire response. Implementation and deployment of this refined data improves the accuracy of location data for aerial firefighting and will help users plan the placement of aircraft for future fire seasons.

Above: This research is improving the accuracy of information used to direct aerial firefighters to suitable bodies of water during bushfire, such as this aerial firefighting helicopter in Tasmania. Photo: National Aerial Firefighting Centre.

Background

Up-to-date information on the presence of water in the landscape is valuable for emergency services planning, specifically, positioning of aircraft near a large waterbody and close to a high-risk bushfire area to be able to quickly access water for firefighting. The content of the Digital Earth Australia Waterbodies product, especially the record of how recently water was observed, is valuable for planning because if the aerial firefighting pilot is sent to a waterbody with insufficient water, the process begins again and wastes valuable time.

The current Digital Earth Australia Waterbodies product, accessible at www.dea.ga.gov.au/products/dea-waterbodies, captures the typical shape and historical presence of water for more than 300,000 waterbodies across the country. The product relies on data derived from surface reflectance measurements from the National Aeronautics and Space Administration (NASA) Landsat satellites, providing historical observations of water dating back to 1987. The processing time results in a two-week lag between when the satellite captures the data and when the DEA Waterbodies product is updated. Users access the waterbody geometries through a Web Feature Service and can then further query the historical water observations by downloading a CSV file for any given waterbody.

As such, the current product does not allow users to immediately find the information they are most interested in. Rather than being able to see this information directly through the

Web Feature Service, the user must download a CSV for each waterbody and manually open it. This is cumbersome for a single waterbody, let alone hundreds of waterbodies. It also cannot be easily integrated into existing NAFC and other emergency management agency planning systems, which are designed to consume and display the contents of Web Feature Services, but not individual CSV files. This research is resolving this issue.

Research methodology

The project aimed to identify additional attributes to add value to the existing Digital Earth Australia Waterbodies product for users in the emergency management sector and create the associated framework for implementation by Geoscience Australia. As such, the methodology had two main components: a user needs workshop and a series of development sprints. Researchers conducted the user needs workshop with representatives from several fire and emergency service organisations to gain insight into their potential uses for the DEA Waterbodies product and allow users to identify waterbody attributes that they felt would be valuable to their work, including firefighting planning approaches.

After identifying which waterbody attributes needed further development, researchers completed three development sprints; each sprint consisted of two weeks of development, with one week for providing feedback. This sprint structure allowed for project stakeholders to see regular progress, provide feedback and have input into the priorities of the following sprint.

Once the development sprints were completed, the improvements were tested with users at NAFC and Geoscience Australia to ensure accurate representation of their needs within the new workflow.

Research findings

The user needs workshop:

- identified information about waterbodies that is of value to end-users, such as when water was last seen, the size of the waterbody and how much water is currently available
- created a prototype workflow to demonstrate that these valuable waterbody properties could be directly calculated from the existing timeseries data created by the Digital Earth Australia product and easily served as part of a Web Feature Service
- established that NAFC (as an end-user) can run a local version of the workflow for immediate use
- identified next steps for Geoscience Australia to operationalise the workflow developed in the project
- documented and published the workflow as open-source software on FrontierSI's GitHub repository (see Further Reading).

Outcomes of the user needs workshop included the collection of additional attributes that could add to the usability of the existing dataset. Attributes fell into four different categories: waterbody features, dataset currency, surrounding waterbody environment and biosecurity risk. The full list of attributes can be found in the final report (see Further Reading), including feasibility for development as part of this project.

A localised prototype workflow, which implements and updates these new attributes, was developed with the intention that it could be implementable by Geoscience Australia. This prototype would allow waterbodies to be directly calculated from the existing timeseries data created by the Digital Earth Australia Waterbodies dataset and easily serve as part of a Web Feature Service.

The findings established that NAFC, as an end-user, can run a local version of the workflow for immediate use. The identification of next steps for Geoscience Australia to operationalise the workflow were developed and included in the project's final report (see Further Reading).

Research impact

The methodology produced in this project has developed a way forward for further adaptation of national waterbodies datasets to make water availability information more accessible for a range of uses in the emergency management sector and beyond.

In particular, the NAFC Aviation Coverage Model utilises a waterbodies layer to run aerial firebombing coverage scenarios for fleet allocation planning. This new methodology will enhance the development of the model, shifting from a static waterbody layer to one that is more dynamic, with suitable date attributes and currency.

The results provide a pathway forward for NAFC to develop a waterbodies solution internally, to suit the needs of NAFC and sector agencies. Additionally, the results equip Geoscience Australia with recommendations and a prototype workflow, for wider application of the Digital Earth Australia Waterbodies dataset, which provides exciting opportunities for the sector to harness this data.

Beyond fire and emergency services, there are potential utilisation opportunities if Geoscience Australia implement the full workflow over time into the Digital Earth Australia Waterbodies dataset. This includes for the agriculture sector, where dam monitoring in the time of drought may inform hardship and water allocations. Additionally, environmental and catchment land management health monitoring may benefit from satellite detected water currency at the landscape scale.

End-user statement

Sandra Whight, Manager Research and Evaluation – National Aerial Firefighting Centre, AFAC.

"Not only do these results provide a pathway forward for NAFC to develop improved waterbodies information to support decision making for aerial firefighting by sector agencies, but they also equip Geoscience Australia with recommendations and a prototype workflow for wider application, which provides exciting opportunities for the sector and beyond to harness this data."

Further reading

Adams C, Seehaber M, Yuan F & Sharma R (2023) *Identifying water sources for aerial firefighting*, final report, Natural Hazards Research Australia, accessible at www.naturalhazards.com.au/resources/publications/report/identifying-water-sources-aerial-firefighting-final-report.

FrontierSI's GitHub repository, waterbodies demo, accessible at https://github.com/frontiersi/waterbodies-demo.

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