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A GIS-based technology response to an avian influenza outbreak in South Africa

Lauren Lyn Williams [a]*

[a] *Department of Forestry, Fisheries and the Environment, PO Box 52126, V&A Waterfront, Cape Town, 8002, South Africa, lwilliams@dffe.gov.za*

* Corresponding author

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Abstract:

In August 2021, the Western Cape Government (WCG) veterinary services noted a new strain of avian influenza (AI) affecting coastal bird colonies, resulting in mass fatalities. While it was not declared a disaster, the Provincial Disaster Management Centre (PDMC) was activated in September 2021 to coordinate the response, in the interest of public health and safety. Between October and November 2021, approximately 18,388 birds had died as a result of the AI outbreak. Of these mortalities, 17,926 were Cape Cormorants *Phalacrocorax capensis*, an Endangered species that is endemic to Southern Africa.

The multitude of stakeholders suddenly engaged in response activities resulted in the initial reporting mechanisms being uncoordinated, with information received in various formats such as text messages, spreadsheets, social media or telephonic reports. There was thus a need to formalise a coherent reporting structure that could incorporate locational information to monitor the spread of the outbreak. While a summary of the technological response is provided in Kirkman et al. (2022), this work further reflects on the benefits of such coordination.

For stakeholders to be receptive to new technologies, it is important that their needs are directly addressed, and the process of data storage and management is transparent with their data being both safeguarded and accessible. The Department of Forestry, Fisheries and the Environment (DFFE), thorough its Oceans and Coastal Information Management System (OCIMS) readily undertakes the development of online publicly accessible decision-support tools and were therefore equipped with rapid development, deployment and data management capabilities. In this context, a collaboration effort between the DFFE, WCG PDMC and WCG Department of Agriculture (DoA) was established to capitalise on the available technologies to support the AI response management. Stakeholder 'groups' with similar technological needs were subsequently identified, namely (1) data capturers, (2) data analysts and (3) event management, which guided product development. All subsequent training was provided online due to the Covid-19 pandemic lockdown restrictions.

Guided by the WCG DoA, a data capture form using ESRI's Survey123 platform was developed to provide information to better manage the current event and serve as a technology pilot for improved management of future events. The platform creates and stores data in a cloud-hosted geodatabase comprised of spatially enabled homogenous groupings of features with standardised attributes. The primary attributes include the bird species, time, date, location, condition of the affected bird(s), interventions, and images where available. Between 1 October 2021 and 31 January 2022, the app was used by delegated trained officials to report multiple affected bird species found during 297 individual coastal monitoring patrols. To facilitate the data capture process, the forms are accessible through a simple graphical user interface on the user's mobile device (Figure 1).

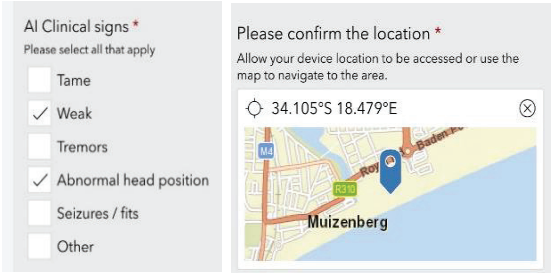

Figure 1. An example of data capture through the interface on a smartphone.

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Geodatabases are spatially enabled, allowing data to be seamlessly integrated into various visualisation applications. Thus, an interactive webmap was developed and hosted in DFFE's ArcGIS Online cloud to support the data analysts who were responsible for advising on the status quo, interventions, and mitigation. The map updates in real time and allows universal access to a single source of (downloadable) data at any given time. In addition, the time-enabled data provided an animated visual depiction of the spread of the outbreak, based on the date, time and location of observations, illustrating hotspots through point clustering (Figure 2).

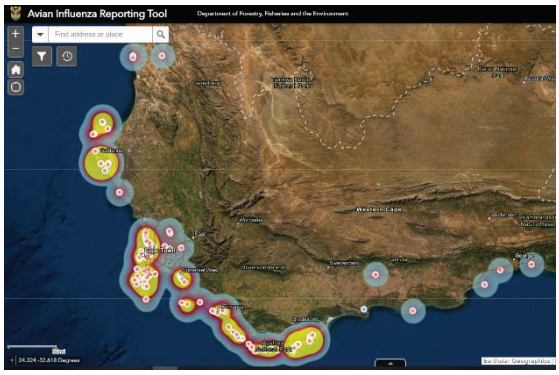

Figure 2. Online webmap interface with red dots indicating where affected birds were found, and blue dots showing where patrols occurred, but no birds were found. The hotspot intensity radius (red margins with yellow fill) depicts the total number of birds found per site, relative to other sites (a greater radius indicates a higher number of affected birds).

The final stakeholder group was focussed on management activities and data interactions, requiring the ability to filter, summarise data and report on progress, in this context, a coherent dashboard was developed and hosted in ArcGIS Online. As per the webmap, data was also updated in real time. Filtering options to accommodate the different reporting sectors included date, local municipalities, protected areas, bird species and data capturing organisations. Visually, people can immediately see the total number of affected birds recorded as an index, table, map, graph, and photos (where available) (Figure 3).

Figure 3. Online dashboard user interface

Through this data management approach, coordination across sectors was improved as data were received in real time and data formats were standardised and readily available for analysis and/or reporting. The time-enabled function afforded authorities the ability to visually monitor the spread of the outbreak, consider hotspots, and determine the deployment of resources. Through combined local knowledge, regular stakeholder engagements and embracing technological solutions, the overall response efforts to monitor and curb the progression of the outbreak were improved. Furthermore, there has been positive stakeholder feedback with consideration given to expanding the approach into citizen science/reporting initiatives. The lessons learnt through this experience were invaluable and can be applied to future extreme events.

Acknowledgements

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