Relocating and Documenting the Caves and Karst of Western Kangaroo Island, Post the 2020 Bushfires

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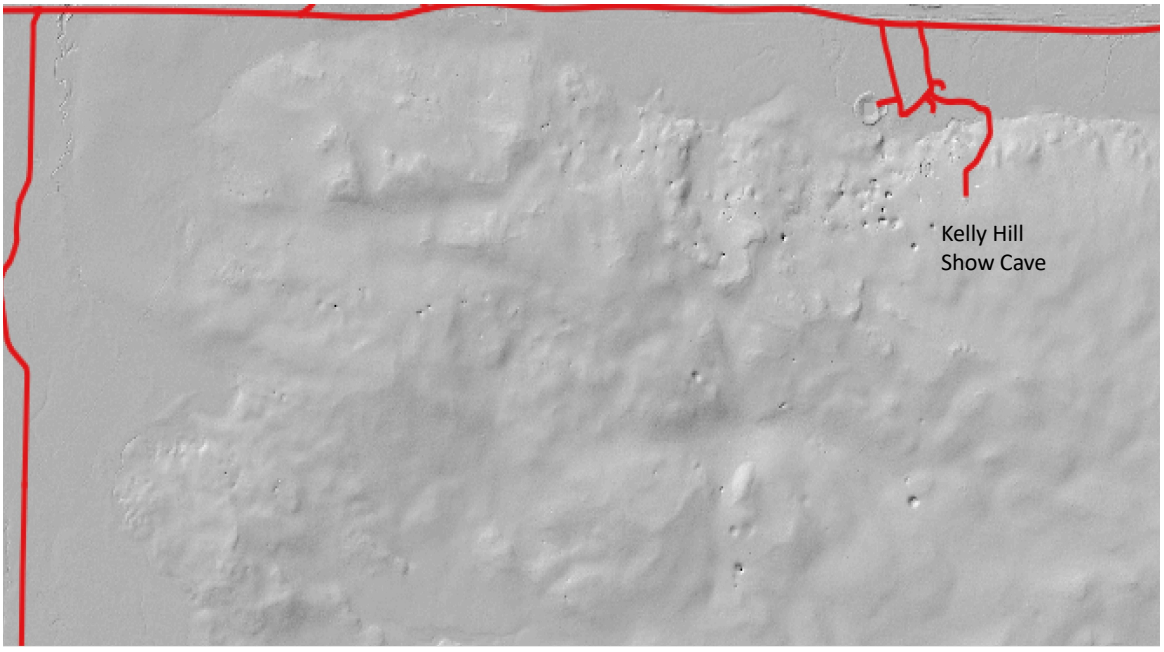
A Friends of Parks Small Grant of $5,500.00 was allocated to the South Australian Speleological Council Friends of Parks Group (SASCFOP), in late 2021 and field work relating to this grant was carried out over the course of 2022, 2023 and in April 2024. The project had three aims:

1) Relocate lost and incorrectly numbered caves and karst features, using aerial and LIDAR imagery, drones, and on-ground survey within the vicinity of the Kelly Hill Conservation Park, Flinders Chase National Park, and the Mount Taylor Conservation Park.
2) Training of the volunteers in ArcGIS integration and aerial imagery analysis.
3) The development of a geological trail app to explain the karst and other geological landforms of Kangaroo Island. This part of the project links into the Re-imagining of the Western Kangaroo Island parks and assists in developing best practice cave and karst management for the Kelly Hill CP.

Previous to the 2020 bushfires, 130 caves were known. The information concerning these caves had been documented, using a combination of cave descriptions, photos, in-cave and on-ground surveying methods. This information had been supplied to National Parks over the preceding decades and was stored at the Kelly Hill Caves office. Due to the impacts of the bushfires, which burnt the office to the ground, these records were lost. The request from National Parks was for the SASC FOP Group to relocate caves that it now had no data on and were on its estate.

Our group searched the Cave Exploration Group of South Australia (CEGSA), records for information on the known caves on Kangaroo Island. These records informed the basis of our work, further facilitated by the use of LIDAR and the purchase of ArcGIS software.

Figure 1: A LIDAR image of the area around Kelly Hill area. Red lines are roads/tracks.



The circular indentations shown could be caves, depressions, blind dolines, or simply a hole created by a burnt tree stump.

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The use of available LIDAR, flown late 2020, combined with little vegetation cover, provided both a significant amount of information for the group and ease of access for ground truthing. Hours were spent pouring over LIDAR images, which showed possible cave entrances, drainage, and numerous shadows, all of which had to be investigated.

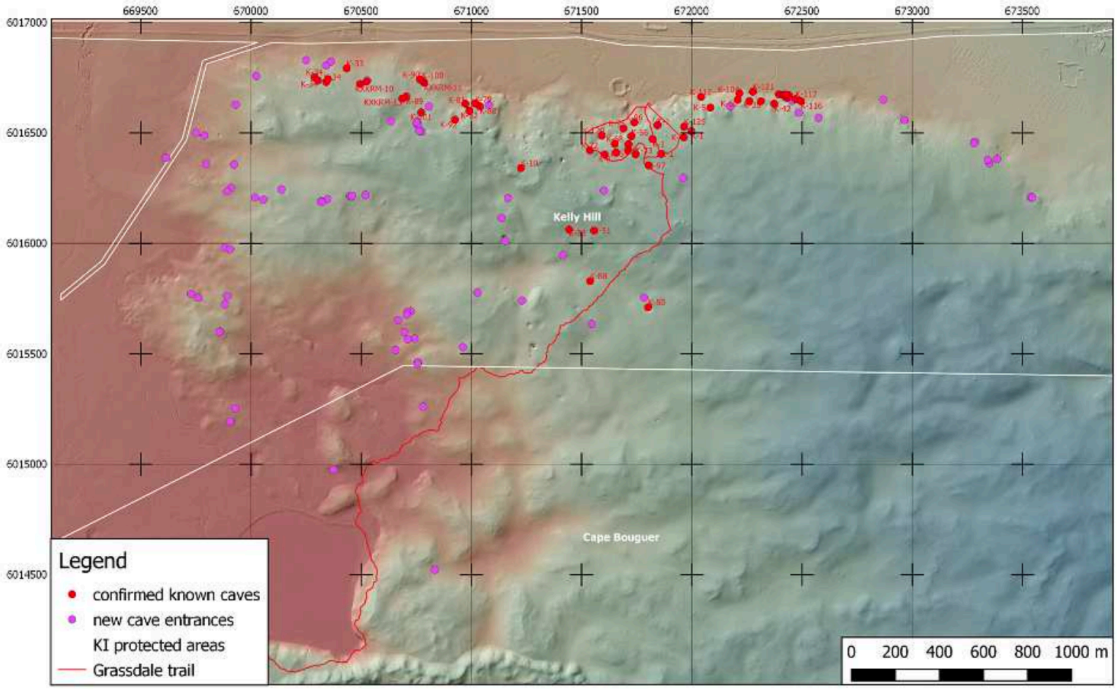
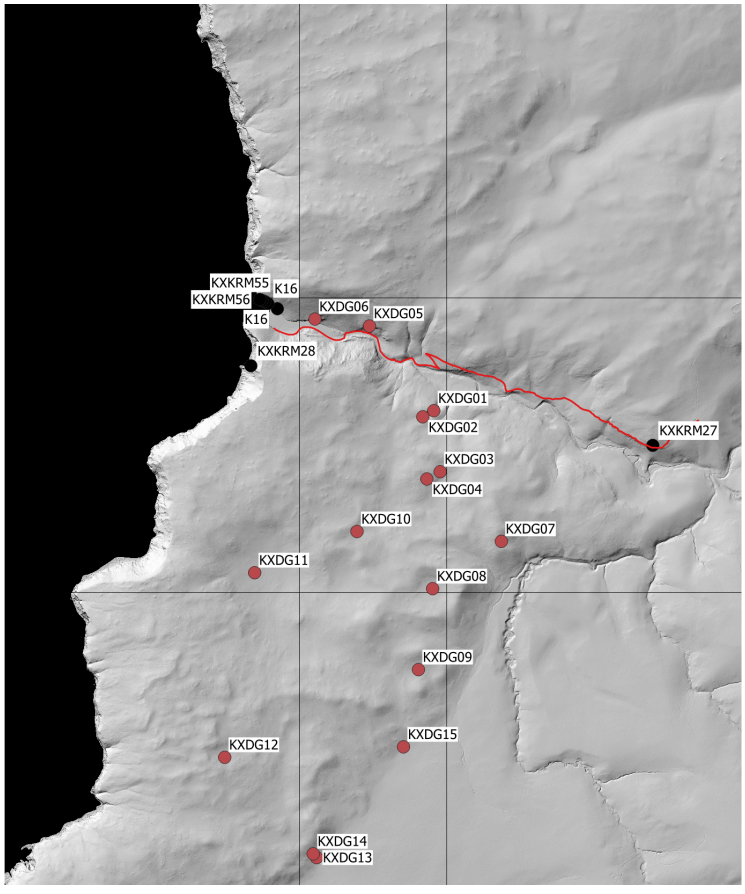


Figure 2: LIDAR image with identified features imposed over it for the Kelly Hill area.
Figure 3: LIDAR image of the Ravine des Casoars area with possible caves identified.



Similar work was also undertaken for West Bay in Ravine des Casoars, where sea caves were identified, and a number of smaller caves tagged over the course of 2022/3.

Achievements:
Over the course of 2021-3 the team of cavers involved, around 30 people, discovered another unknown 163 karst features, in addition to the known 130, making a total of 293 for all of Kangaroo Island. From these 198 cave entrances in the Kelly Hill Conservation Park were tagged. Tagging involved: photographing the entrance, recording the GPS location for each cave and associated entrances, tagging it with a steel disk and finally physically surveying the cave.

Figure 4: Cave tagging method

Our group followed the Australian Speleological Federation's established, national protocols for recording cave entrances and tagging caves. The figure below shows an example. The white board records: feature/cave number, camera owner, date the photo was recorded, distance and angle the photo was taken from. This method is critical as it allows for historical records of cave entrances to be made from the same angle. GPS coordinates are taken at the cave entrance itself or, if not possible, they are surveyed back to the entrance.

A brief survey and/or sketch of the cave entrance was made, and other prominent features recorded, such as: if the cave is accessible to humans, water egress, the presence of vertebrate, or invertebrate fauna, (in the Kelly Hill area that is tiger snakes and bees), and air flow.

To facilitate data recording methods, the team involved spent a considerable amount of time setting up protocols and templates for ground surveying methods, cave surveying methods and cave identification schema so as to streamline data processing, mapping, and fauna surveying.

The purchase of ArcGIS Pro software for the grant's activities, was pivotal to the success of this data management. In particular the license allowed those working on ArcGIS as part of the project to:

Produce surface maps vital to both planning pre-trip, as well as to those in the field.

Manipulate complex data sets, such as LIDAR and Digital Elevation Models.

Overlay the cave survey data collected to assist in understanding how the various cave systems interact.

The purchase of the licence gave us access to *ArcGIS Online,* which allowed maps to be shared between team members without them needing to have the skills associated with using ArcGIS Pro.

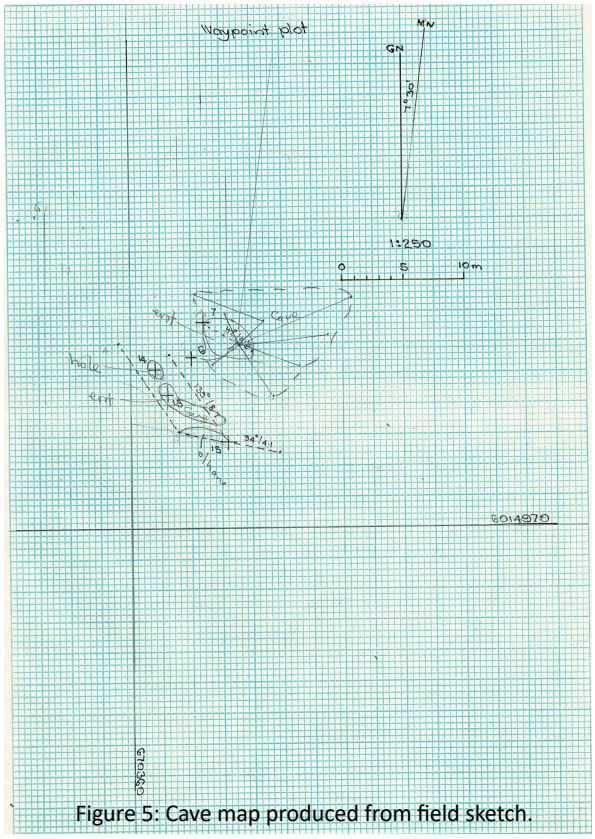


Figure 5: Cave map produced from field sketch.

Importantly the licensing gave access to *Field Maps*, a mobile application that allowed our members to view, collect and edit information in the field on their mobile phone. This limited transcription errors as data did not have to be transferred from paper to computers.

Further, the purchase of ArcGIS enabled the layering of data and ultimately showed how tagged (and later fully surveyed) caves related to each other. Coupled with the cave surveying programme *Survex,* the data is showing depths of caves at Kelly Hill and how they relate to the hydrology that is intersected by the South Coast Road, then sinks underground, re-surfacing on the coast, a considerable distance from the caves at Kelly Hill.[1]

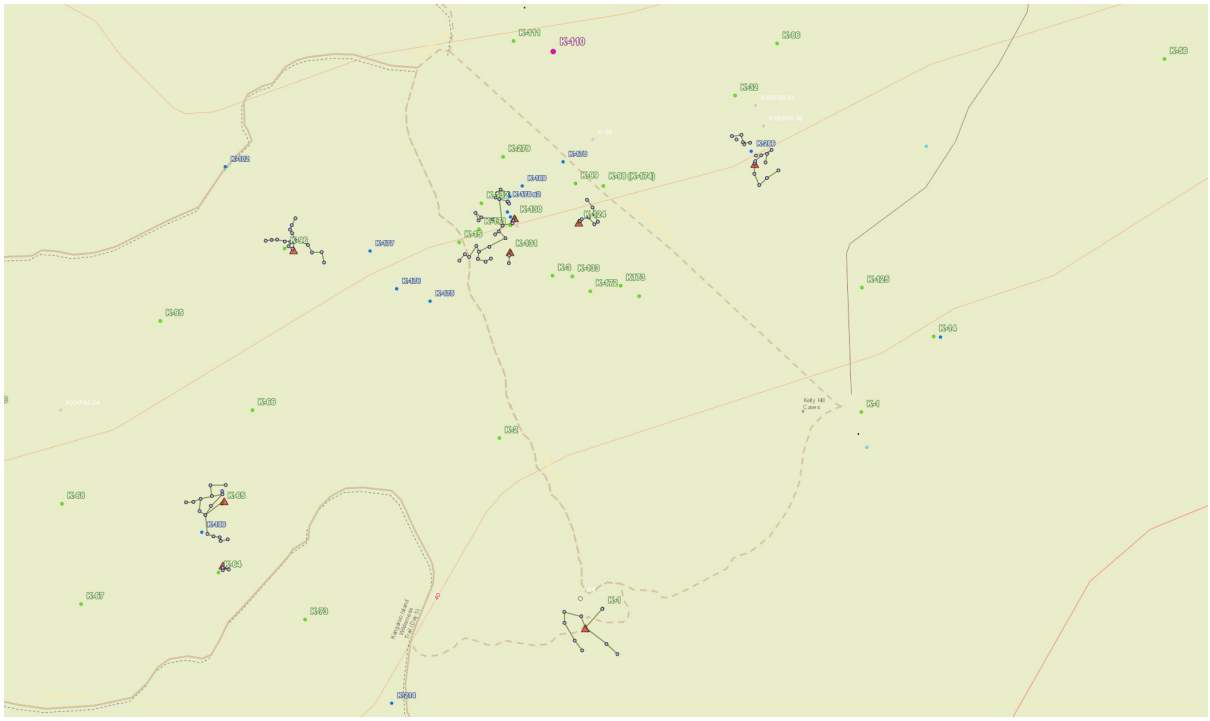


Figure 6: Data processed using ArcGIS showing the relational positions of ground-truthed, tagged and surveyed caves near the Kelly Hill show cave. Produced by Matt Smith. August 2023.

The work of the group coincided with the redevelopment of the show cave and associated infrastructure at Kelly Hill. Two members of the team, Clare Buswell and David Gillieson, were involved with the development of the new signage that now adorns the walk up to the show cave.

Importantly this involvement helped us with the geo-heritage trail development that was part of the grant. Although the app was initially conceived as a way of promoting the karst of the western end of Kangaroo Island, it has long been understood that the geology found on Kangaroo Island is both complex and fascinating. It is thus deserving of a guide dedicated to explaining its complexity in simple terms to tourists and school groups alike.

David Gillieson worked on both the imagery, and text for the guide. He completed it late 2023, and Heiko Maurer translated it into German. Both editions are available for download from: http://sasc.info/kangaroo-island/

[1] Gillieson, D. Maurer H. and Crowley G., 'Karst and cave development at Kelly Hill Conservation Park'. Conference Proceedings. *Cave and Karst Management in Australasia Conference 23.* Tākaka, New Zealand, 2023. pp 25-32. Australian Cave and Karst Management Association.

The our work coincided with the International Year/s of Caves and Karst. This International Year, set up and promoted by the International Union of Speleology, aimed to bring to the world's attention the values of caves, karst hydrology and karst conservation. As such the SASCFOP group promoted the work on Relocating and Documenting the Caves and Karst of Western Kangaroo Island, post the 2020 Bushfires, on the International Year of Caves and Karst website. It was the only scientific programme from Australia promoted at this level.

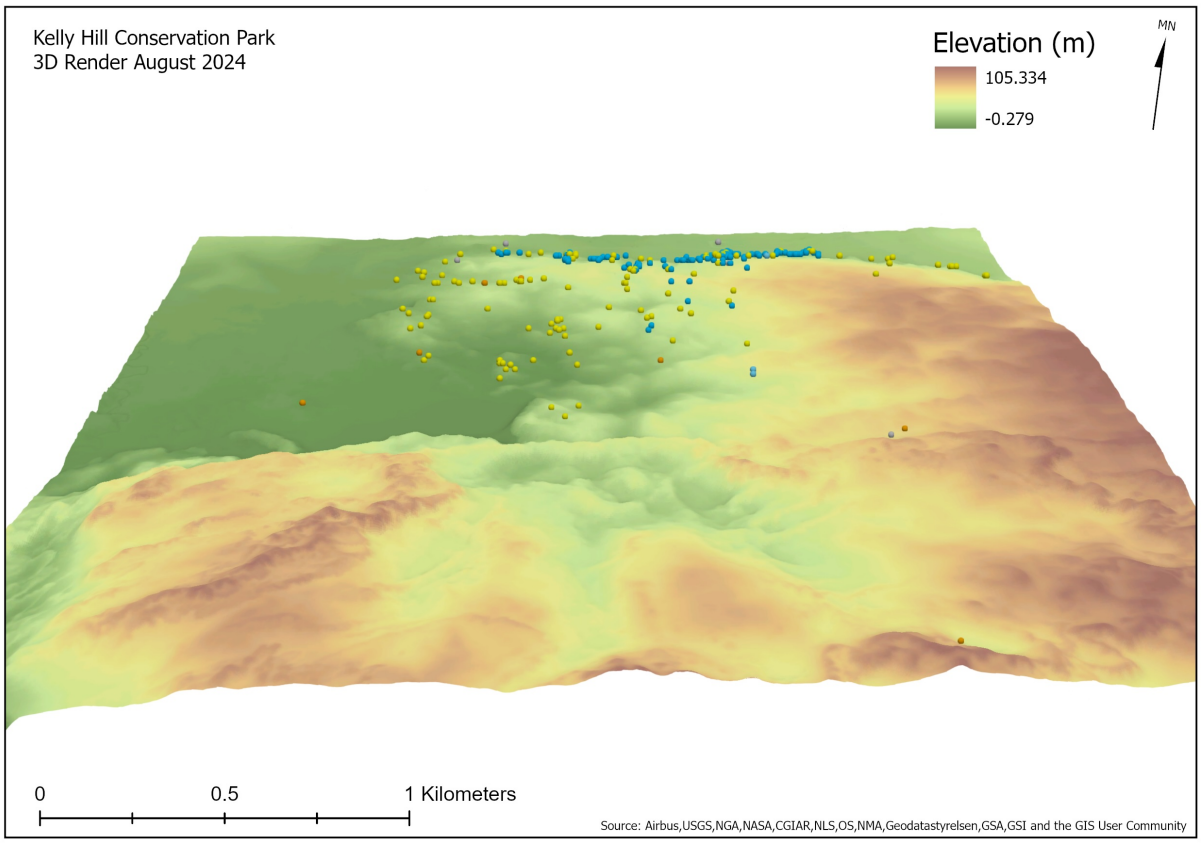


Figure 7: Generated with LIDAR and cave locations. Diagram: Matt Smith.
Blue dots known caves as of June 2021, yellow dots ground-truthed caves and or features, as of March 2024.

In conclusion.
The grant from Friends and Parks, allowed members of the SASC FOP Group to travel to Kangaroo Island to ground truth cave and karst features on the Western End of the Island, concentrating around the Kelly Hill Conservation Park and the Ravine des Casoars area of Flinders Chase.

A dedicated group of seven worked the behind the scenes facilitating trip coordination, protocol development, data processing, learning the dark arts of ArcGIS, and promoting the project nationally. We calculate the behind the scenes activity contributed $18,720.00 of volunteer labour time, (one day a week of 8 hours = 416hrs x $45.00/hr), with the field work contributing about $32,400.00 There have been conference papers presented, and articles published in both local and national caving journals.

New LIDAR flown in 2023, has kept the group busy ground-truthing more sites on the Vivonne Bay side of Kelly Hill in early 2024. Thus the work of cave tagging continues. It is slow work as the famous Kangaroo Island *Acacia Paradoxa* is back, along with the rest of the post-bushfire enabled scrub. We welcome the continued involvement of caves around the country in this project.