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Spotting snow-gum dieback

Guide for recording incidental observations of snow-gums exhibiting dieback symptoms using the ArcGIS Survey123 application.

Manual reading time: ~15 minutes

Survey completion time: <5 minutes

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Background

Reports of tree deaths throughout the Australian Alps indicate that snow-gum are now in widespread decline. Snow-gum dieback is characterised by canopy decline, stem death and eventual death of affected trees and entire stands. Particularly severe outbreaks are now evident in several locations in sub-alpine and high-plains snow-gum stands in NSW, the ACT and Victoria.

Field observations and preliminary data indicate that this phenomenon (snow-gum dieback) is associated with outbreaks of native Cerambycid beetles belonging to the genus *Phoracantha*. These beetles are native wood-borers whose larvae feed on the cambium, outer xylem, and inner phloem of trees. In the case of snow-gum dieback, this feeding produces deep galleries that severely disrupts tree-level hydraulic function leading to the gradual decline and eventual death of affected trees.

Preliminary data indicate that snow-gum dieback is impacting upon a wide range of stand densities, tree size/age, disturbance histories and topographic positions. The phenomenon currently appears to be limited only by the geographic range of the affected snow-gum species, placing all high-elevation (1600-1900 m) and high-plains snow-gum forests across the Australian Alps at risk.

This guide outlines the process involved in recording observations of the presence/absence of *Phoracantha*-induced dieback of snow-gum throughout the Australian Alps within an app powered by the ArcGIS Survey123 platform. Access to the Survey123 app is free for both Apple and Android devices.

Recording data for the *Snow-gum dieback incidental observations* requires;

- a GPS-enabled personal device with an embedded camera (*i.e.*, smart-phone or tablet)
- familiarity with the key leaf and bark traits common to all of the relevant species within the snow-gum complex (*i.e.*, *Eucalyptus pauciflora*, *E. hedraia*, *E. acerina*, *E. debeuzevillei*, *E. niphophila*, and *E. lacrimans* and their sub-specific synonyms.)
- familiarity with the damage traits specific to *Phoracantha*-induced dieback.

This document briefly introduces the key species in the snow-gum complex and their recognition; describes the diagnosing damage traits associated with *Phoracantha*-induced dieback; and provides a step-by-step guide of how to enter observations within the ArcGIS Survey123 app.

Section 1: Identifying snow-gums

The snow-gum complex informally aggregates a closely-related and morphologically similar group of species that are distributed within each of the eastern and southern States and Territories. This survey is focused on a sub-set of that complex comprising species formerly recognised as sub-species of *Eucalyptus pauciflora* and a closely allied species – *E. lacrimans*

Species within this complex are readily distinguished from all other eucalypt species by easily observed and distinctive bark and leaf traits.

Snow gum are smooth barked trees that are easily distinguished from all rough-barked eucalypts such as the stringybarks and boxes. Snow-gum do not form bark ribbons in the upper branches, distinguishing them from other superficially similar smooth-barked eucalypts (Fig. 1).

At the leaf level, all snow-gum foliage forms leaf side-veins (i.e. veins either side of the midrib) that are distinctly parallel to the midrib (Fig. 2).



Figure 1. Snow-gum bark



Figure 2. Snow-gum leaves

Within NSW, Victoria, Queensland, South Australia, Tasmania and the ACT, the traits described above limit the range of possible species to *E. lacrimans*, and *E. pauciflora* and its allies (*E. acerina*, *E. debeuzevillei*, *E. hedraia*, *E. niphophila*), and *E. gregsoniana* and *E. moorei*.

The latter two species listed above are not of concern in snow-gum dieback surveys. Both are characterized by narrow leaves (typically <3 cm) that differ from the far wider (>5 cm) leaves of *E. lacrimans*, and *E. pauciflora*, *E. acerina*, *E. debeuzevillei*, *E. hedraia*, *E. niphophila*.

While it is possible to distinguish between the species of concern on the basis of fruit and leaf traits, species-level separation is not required for the survey described in this guide.

Section 2: Identifying *Phoracantha* damage

The woodboring larvae of *Phoracantha* sp. beetles make distinctive frass-clearing holes and horizontal galleries across affected tree trunks. The stage of dieback progression of a particular tree can be determined by particular observed symptoms. *Phoracantha*-induced snow-gum dieback symptoms are documented below in order of increasing severity.

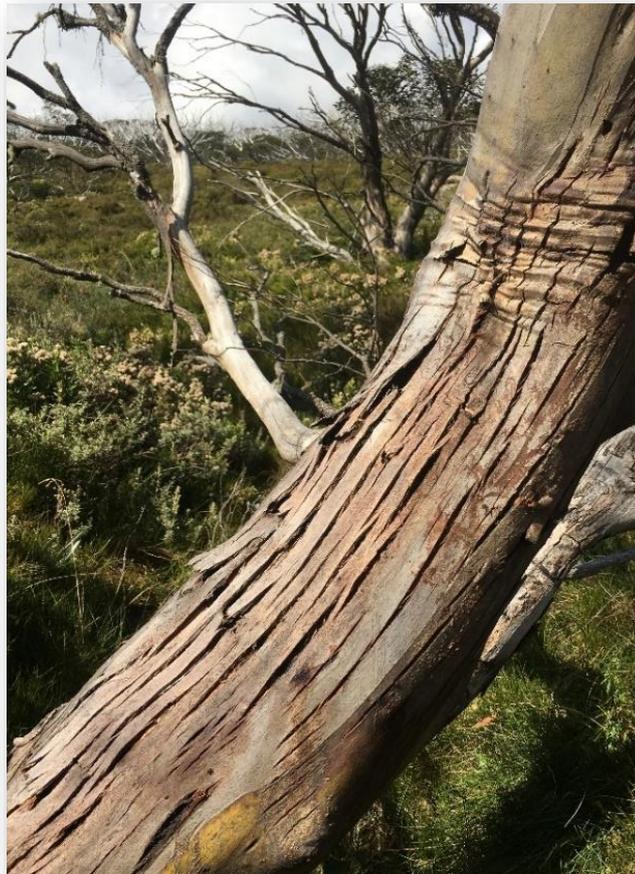


- Live stem, cracking and puckering of live bark - indicating insect damage. Red kino (sap) may be obvious





- Live stem, horizontal galleries visible below dead/dying bark





- Dead stem, horizontal galleries obvious, bark falling away



- Dead stem, horizontal galleries obvious, bark absent



- Dead stem, horizontal galleries obvious, bark absent, dendritic lichen present



Section 3: Using ArcGIS Survey123 to make dieback observations

Applying the survey

The *Spotting snow-gum dieback* survey supported by the ArcGIS Survey123 application is intended to provide data on both the presence and absence of *Phoracantha*-induced snow-gum dieback. Observations of both affected and unaffected trees and stands are of equal interest in developing an understanding of the landscape attributes and processes that may underpin variability in the severity of outbreaks.

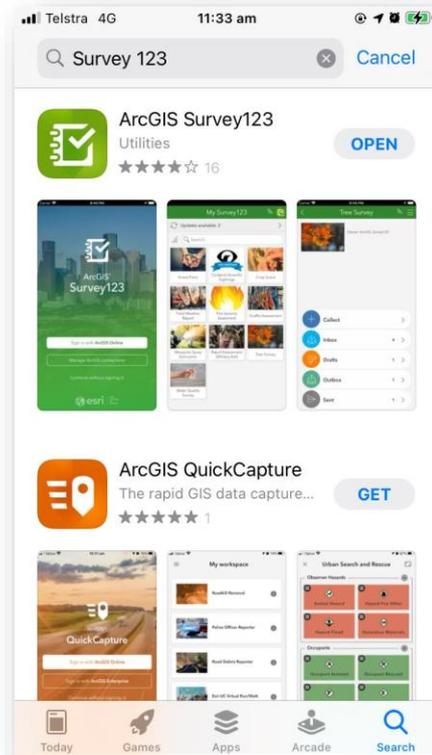
To date, observations have been made at 1-2 km intervals along vehicular-access roads passing through snow-gum stands. However, the resolution of observations may be adjusted—more or less frequent—depending of the mode of travel and time available.

Always check the weather forecast when venturing into subalpine or alpine environments, conditions can change quickly. For further safety information relevant to conducting activities in alpine environments, see www.snowsafes.org.au.

Downloading ArcGIS Survey123

ArcGIS Survey123 is available for both Apple and Android devices. Screen captures shown in this guide are taken from an Apple device—screen imagery may differ slightly for Android devices.

- Within the iTunes or Android app store, search for and download ArcGIS Survey123



Downloading the *Spotting snow-gum dieback survey 2021*

- After the app has downloaded, tap on the *Survey123* icon, then select “*Continue without signing in*”



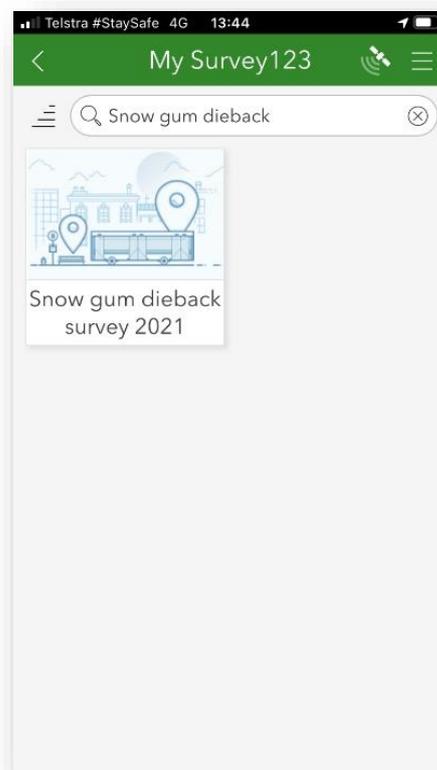
- Select the QR code symbol in top right of app interface



- Scan the code shown right. *Survey123* will locate and download *Snow gum dieback survey 2021*

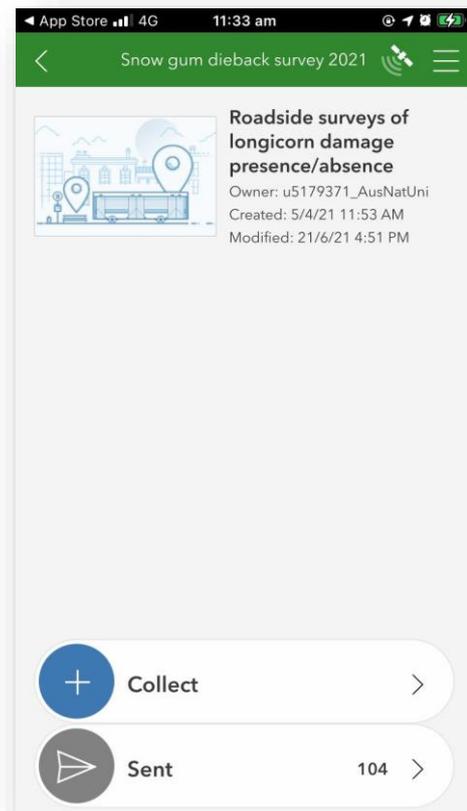


- *Survey123* will locate and download *Snow gum dieback survey 2021* (see right). The survey will now be automatically available when you open *Survey123*

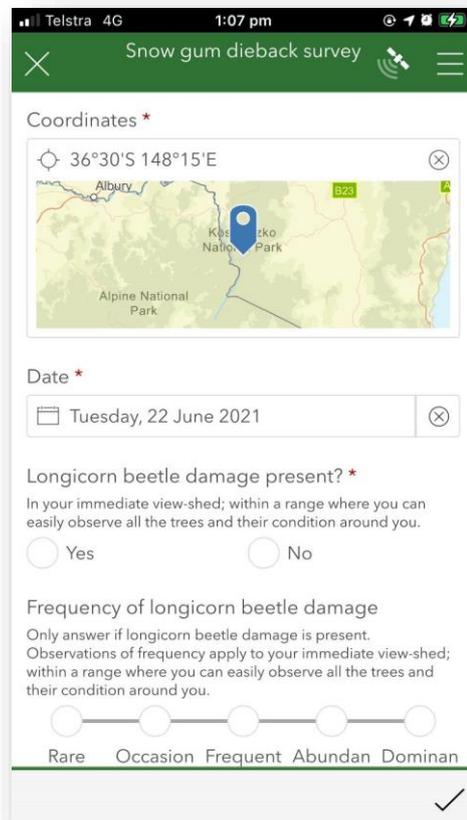


Recording an observation

- Open *Survey123*
- Select “*Continue without signing in*”
- Select the *Snow gum dieback survey 2021*
- Select the “*Collect*” button



- Depending on whether you have mobile-network coverage, your device will use either network- or satellite-based (GPS) positioning to auto-fill the coordinates of your location (adjust your location if the app if it is incorrectly displayed by clicking on the map and moving the map relative to the positioning cross-hair).
- The “*Date*” field will also auto-fill (correct the date if it is shown incorrectly by clicking on the field and selecting the correct date).



- Record whether evidence of longicorn damage is visible or not in the trees/stand in your viewshed
- Record the percentage frequency of affected trees in your viewshed



Longicorn beetle damage present? *
In your immediate view-shed; within a range where you can easily observe all the trees and their condition around you.

Yes No

Frequency of longicorn beetle damage
Only answer if longicorn beetle damage is present. Observations of frequency apply to your immediate view-shed; within a range where you can easily observe all the trees and their condition around you.

Rare (<10%) Occasional (11-40%) Frequent (41-60%) Abundant (61-90%) Dominant (91%+)

Stem symptoms
Only answer if longicorn damage is present. Select all that are visible. These observations indicate progression of the attack.

Live stem, cracking and puckering bark, red kino may be obvious

Live stem, galleries visible below dead bark

Dead stem, galleries obvious, bark falling away

Dead stem, galleries obvious, bark absent

Dead stem, galleries obvious, bark absent,

- Record the symptoms associated with dieback evident in your viewshed (see Section 2 for descriptions and sample images of symptoms).



Stem symptoms
Only answer if longicorn damage is present. Select all that are visible. These observations indicate progression of the attack.

Live stem, cracking and puckering bark, red kino may be obvious

Live stem, galleries visible below dead bark

Dead stem, galleries obvious, bark falling away

Dead stem, galleries obvious, bark absent

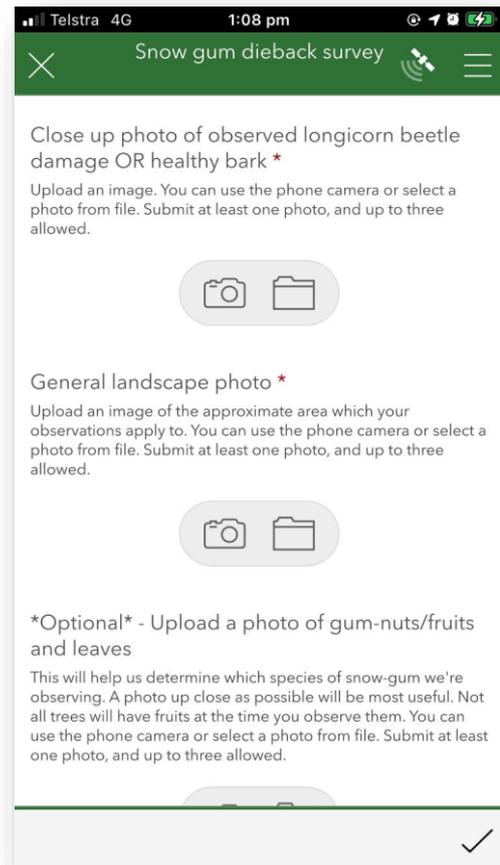
Dead stem, galleries obvious, bark absent, dendritic lichen present

Close up photo of observed longicorn beetle damage OR healthy bark *
Upload an image. You can use the phone camera or select a photo from file. Submit at least one photo, and up to three allowed.

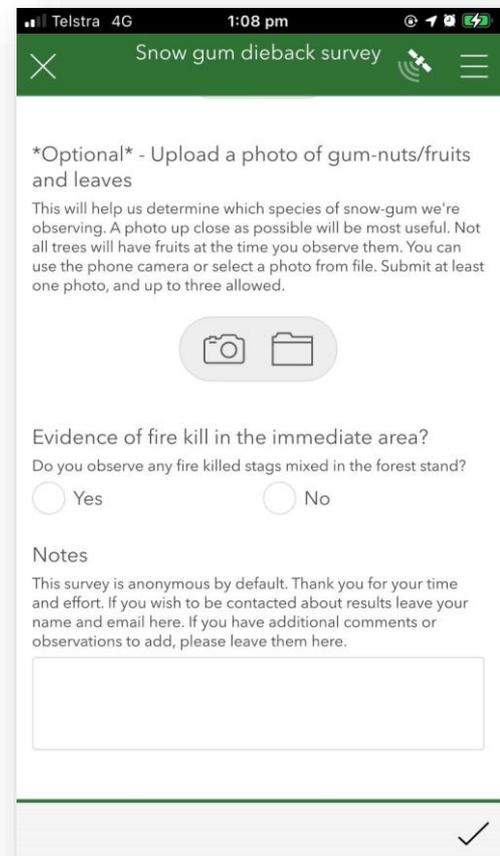
General landscape photo *
Upload an image of the approximate area which your observations apply to. You can use the phone camera or select a photo from file. Submit at least one photo, and up to three

- Photograph and upload a clear close-up of the observed damage (symptoms) OR the healthy bark if the tree is unaffected.
- Photograph and upload an image of the stand/landscape conditions associated with the observation (photographs should aim to represent the site)

By submitting your photos to this survey you surrender your copyright of them to us. We may use or distribute photos you have submitted for research and education purposes. Do not submit photos of you or others that may be identifiable. Identifiable photos will be destroyed if they are submitted.



- Photograph and upload a clear close-up of any gumnuts or flowers that the tree you are observing is bearing. Photograph these features alongside whole adult leaves. This will help us identify which species of snow gum you are observing. This question is optional as not all trees will be bearing gumnuts or fruits at the time of observation.



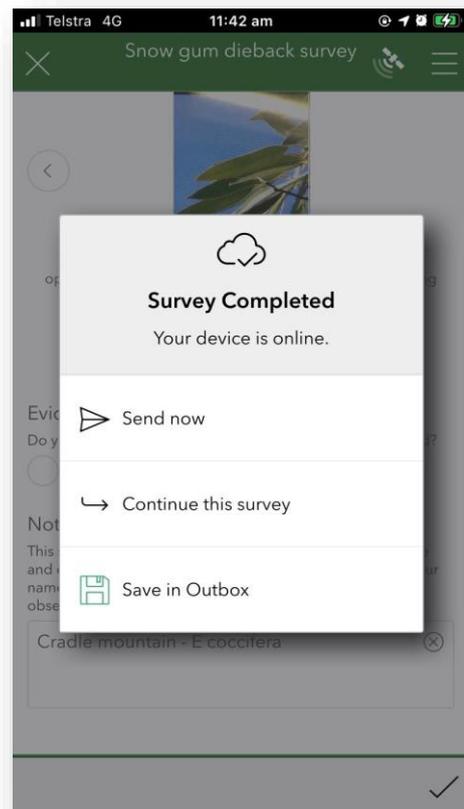
- Record whether there is evidence of fire killed trees or not in the trees/stand in your viewshed.
- Add any notes you wish to associate with your observation (optional), including your name and/or email if you wish to be contacted about this specific observation.



- To complete your observation, select the tick mark at the lower right of the app interface.



- If you are within phone signal select 'Send now'. If you are out of phone signal the observation will save in your 'Outbox'.



- When you get back into an area with phone signal. Open your 'Outbox' and select 'Send' so all your observations upload to the online portal and can be added to the dataset.

