



Snow Gum dieback mapping in Kosciuszko National Park Thredbo, Perisher, Charlottes resorts

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Image: Thredbo dieback April 2017

Introduction

There has been a rapid expansion of dieback in alpine snow gums (*Eucalyptus niphophila*) across Kosciuszko National Park (KNP) in recent years, particularly between 1600 m and 1800 m. Other snow gum species *E. lacrimans* and *E. debeuzevillei* have also been impacted.

A scoping plan was formulated by the NSW National Parks & Wildlife Service (NPWS) to map dieback for all snow gum species, which occur within sub-alpine and alpine vegetation communities. Snow gum dieback presents considerable risks for ecological degradation, park visitor safety, water supply and energy generation.

NPWS sought assistance from the DPIE Science, Economics and Insights Division to map the severity of snow gum dieback using imagery and tools at their disposal.

This dataset was developed for Milestone 1 of the scoping plan: mapping of the current extent and severity of snow gum dieback within alpine resort areas of KNP that have not been impacted by the 2003 fires. Thredbo, Perisher and Charlottes resorts were mapped. Selwyn was not mapped due to severe fire damage in the 2019-20 fires.

Materials and Data Requirements

- ArcGIS mapping software
- Planar hardware and StereoAnalyst software for 3D mapping
- Aerometrex 10cm 2D imagery 27/04/2020
- ADS 3D imagery Kosciuszko 07/02/2011
- ADS 2D imagery Kosciuszko 07/02/2011, Jacobs River 23/02/2011
- 2003 fire boundaries – FireHistory_Group
- Alpine resort boundaries – SEPP_KosciuszkoNP_AlpineResorts2007
- Kosciusko vegetation types – KosciuszkoResortsVegAssessment2003

Method

Project Setup

Mapping was completed using both 2020 and 2011 imagery. This allowed comparison of dieback severity change over 9 years. Due to time constraints, mapping using pre-2000 imagery could not occur.

An ArcGIS project (mxd) was created in a 2D environment to allow viewing of 2D imagery, and all other layers described under data requirements. All data was managed, collated, and finalised in this mxd project.

An ArcGIS project was created in a 3D environment (Planar hardware, StereoAnalyst extension) to allow viewing of Kosciusko 2011 3D flightlines.

The Kosciuszko Resorts Vegetation Assessment 2003 layer (KRVA 2003) was used to construct the polygon vegetation footprint for Thredbo. Only vegetation types 1.2 and 18.0 were used as agreed with NPWS. The boundaries of the KRVA were found to be reasonably accurate for Thredbo. However, polygon creation from scratch needed to occur for Perisher and Charlottes vegetation as the KRVA was very inaccurate for these resorts and excluded considerable vegetation, especially high-altitude clumps.

Mapping

API mapping was completed in 3 separate ArcGIS geodatabase feature classes for each of the resort areas. Mapping was completed in GCS GDA 1994, projected in GDA 1994 Zone 55. Results were combined into a single unprojected shapefile for ease of sharing.

The following fields were created to record observations during API:

- Resort: Thredbo, Perisher, Charlottes
- Dieback severity classes Sev_2011 & Sev 2020: Nil, Iso, Mod, Sev, Fire
- Comments: additional observations including 2003 fire, regrowth, other species, vegetation absence/presence between imagery dates
- VerDate: date of completion of API mapping
- Area_Ha: area of each mapped polygon in hectares

Polygons were first created in a 3D environment using the 2011 imagery. This allowed greater precision to create an initial vegetation footprint due to the ability to perceive vegetation boundaries more clearly. Thredbo KRVA vegetation types 1.2 & 18.0 were edited where required to reflect vegetation boundaries in 2011 imagery, with addition and deletion of some polygons. Polygons were created from scratch for all visible tree vegetation in Perisher and Charlottes.

Attribution of polygons occurred first using the 2011 3D imagery and then using the 2020 2D imagery. Individual polygons were split if severity class varied between 2011 and 2020 imagery.

Polygons which showed damage attributable to the 2003 fires and in close association with the 2003 fire boundary were excluded from attribution of severity class.

The final mapping was clipped to the resort boundaries and topology was checked for overlaps.

Attribution of Severity

A visual guide for the 5 levels of dieback severity (Appendix 1) was developed in consultation with NPWS staff and was used to calibrate mapping. The 5 levels of severity were sourced from the original 2019 NPWS scoping plan:

- Nil: little to no dieback observed
- Isolated: dieback of scattered and isolated snow gums, often amongst boulder fields
- Moderate: mix of dieback and some healthy trees, many branches with no leaves, only small numbers of trees with mostly full leaf cover
- Severe: most trees significantly impacted, most branches with few or no leaves, many dead trees.

Fieldwork

3 field sites were rapidly visually examined in Charlottes and Perisher.

Results

633 hectares of snow gum vegetation types were mapped over the 3 resort areas: Charlottes 49 hectares, Perisher 318 hectares and Thredbo 266 hectares.

The API mapping and severity classification was examined briefly at three rapidly photographed field sites, although no on ground measurement occurred. Refer Appendix 1 & 6.

All 3 resort areas showed large increases in dieback between 2011 and 2020. In 2011, dieback was present in Charlottes (30%), Perisher (36%) and Thredbo (49%), with most of the dieback being nil to isolated in severity. This changed dramatically in the 9 years to 2020 with Charlottes (86%), Perisher (98%) and Thredbo (97%) all showing large increases in dieback. The majority of dieback in 2020 in Thredbo and Perisher was moderate to severe whereas Charlottes was slightly less impacted with the majority being isolated to moderate. Across all resort areas by 2020, an average of 97% of the area suffered dieback, 75% of this dieback being moderate to severe. Refer Table 1, Appendix 2, 3 and 4.

Table 1

	Charlottes		Perisher		Thredbo	
	2011	2020	2011	2020	2011	2020
Nil Dieback	70.4%	13.6%	64.3%	2.0%	50.7%	2.6%
Isolated Dieback	29.0%	→ 43.4%	27.6%	25.3%	23.9%	13.2%
Moderate Dieback	0.0%	→ 37.0%	7.1%	→ 52.6%	18.4%	→ 51.2%
Severe Dieback	0.6%	6.1%	1.0%	→ 20.1%	6.9%	→ 33.0%

Appendix 5 shows mapped change of dieback severity between 2011 and 2020. Note the areas shaded in black which represent the 2003 fireground which was not included in the mapping.

15 hectares of seedling and crown regrowth following dieback were mapped in Perisher and Thredbo.

Additional observations made during mapping that may assist in understanding of dieback include the following:

- The dieback appears to occur randomly with no definite landscape effects that can be discerned other than noted below for Thredbo and Charlottes.
- In 2011 in Thredbo and Charlottes, there was more dieback at higher elevations. It appeared randomly distributed in Perisher. There may have been an altitude effect during the initial surge of dieback prior to 2011.
- Heavy regrowth is occurring in most 2003 burned areas. This regrowth appears to be healthy and unaffected by dieback.
- Many small, isolated clumps of trees appear not to have been affected by dieback, especially in Perisher. Refer Appendix 9.
- An unburned area of Perisher to the east of Perisher Ck Rd showed only low levels of trees in 1992 imagery. Healthy regrowth has appeared and matured since that time. Refer Appendix 10.

Discussion

Snow gum vegetation dieback in the 3 Kosciuszko resorts is extensive and has increased significantly in the 9 years between 2011 and 2020. The extent of dieback prior to 2011 is unknown and should be examined to determine longer term trends.

Charlottes did not exhibit the same high levels of moderate to severe dieback by 2020 as the other resorts. It is higher in altitude than the other resorts and the lower dieback result should be examined further.

The API and by extension the visual guide developed for assessing severity was briefly examined at three field sites and appeared to support the severity classes mapped. However further field inspection is required via a planned systematic inventory to validate API over the 3 resort areas.

Field checks may also be required to determine if Perisher and Charlottes mapping contain KRVA 2003 vegetation types 1.2 & 18.0 only. Other vegetation types other than 1.2 or 18.0 may have been mapped, as reference to an accurate KRVA layer was not possible, as it was for Thredbo.

Seedling and crown regrowth following dieback may need further examination. 15 hectares in Perisher and Thredbo were exhibiting some degree of regrowth. Whilst a small area, larger areas of regrowth may not be observable in API. Field inspection is recommended to verify processes at play.

The heavy and healthy regrowth noted in 2003 fire areas adjacent to unburned areas suffering from dieback should be examined. There may be an age or some other fire related effect at play regarding susceptibility to dieback.

Many small, isolated clumps of trees appear not to have been affected by dieback, especially in Perisher. This should be examined more closely.

An unburned area of Perisher to the east of Perisher Ck Rd has regrown and matured since 1992. It is unknown whether this area was historically cleared or naturally vegetation free. If the latter, it may represent colonisation by trees of a previously heath dominated vegetation type and may be of interest regarding climate change effects.

When the project extends to mapping outside of resort areas, where high quality KRVA 2003 vegetation polygons are not available, creating the footprint will be more than half of the mapping effort. It may be possible to use LiDAR to automate this process given snow gums typically appear in 2 layered strata i.e. trees and alpine heath. However rocky outcrops may create confusion in a LiDAR model.

Appendices

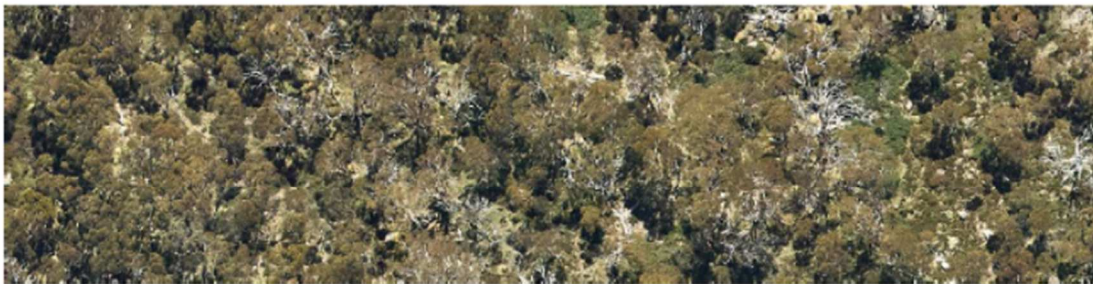
- 1 – visual guide for assessing dieback severity
- 2 – area (ha) and severity of dieback for each resort area 2011 to 2020
- 3 – area (ha) of snow gum dieback all resorts 2011 to 2020
- 4 – percentage snow gum dieback all resorts 2011 to 2020
- 5 – maps of dieback severity change for each resort area 2011 to 2020
- 6 – field check image of isolated dieback Charlottes
- 7 – field check image of moderate dieback Perisher
- 8 – field check image of severe dieback Perisher
- 9 – Perisher isolated clumps with no dieback
- 10 – Perisher Creek Road regrowth 1992 - 2020

Appendix 1 – visual guide for assessing dieback severity

- No impacts – little to no dieback observed



- Isolated – dieback of scattered and isolated snow gums, often in boulder fields



- Moderate impact – mix of dieback and some healthy trees, many branches with no leaves, only small numbers of trees with mostly full leaf cover



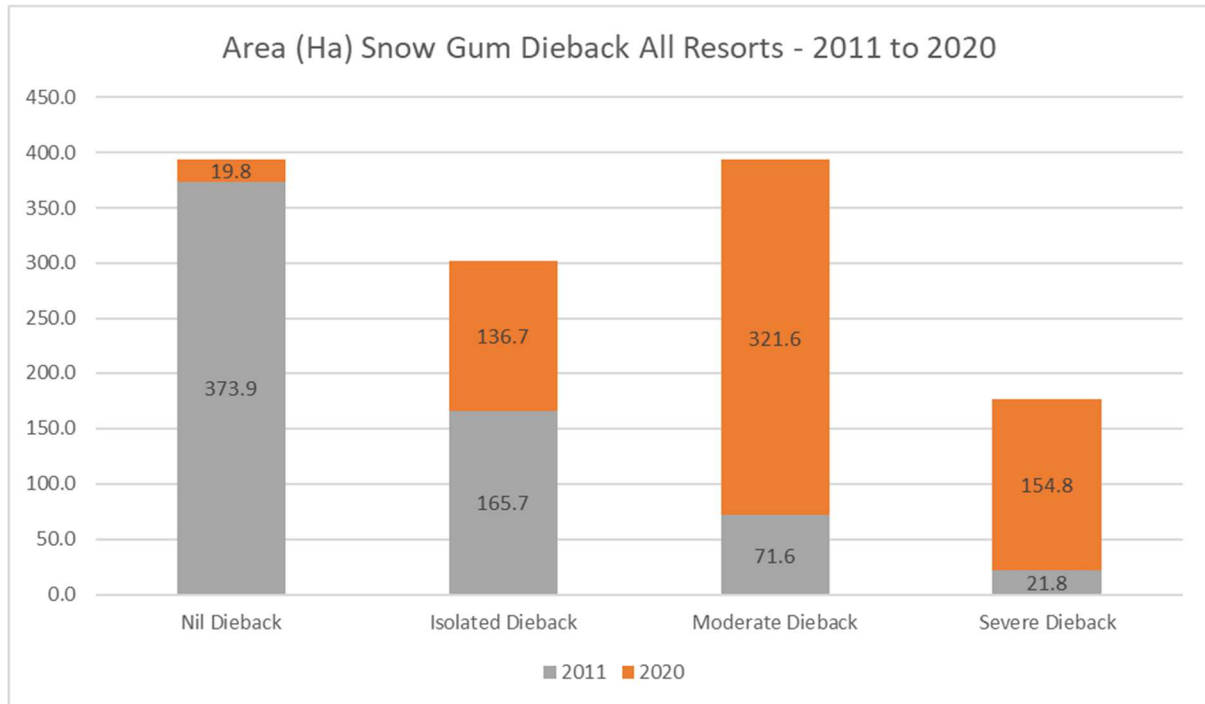
- Severe impact – most trees significantly impacted, most branches with few or no leaves, many dead trees



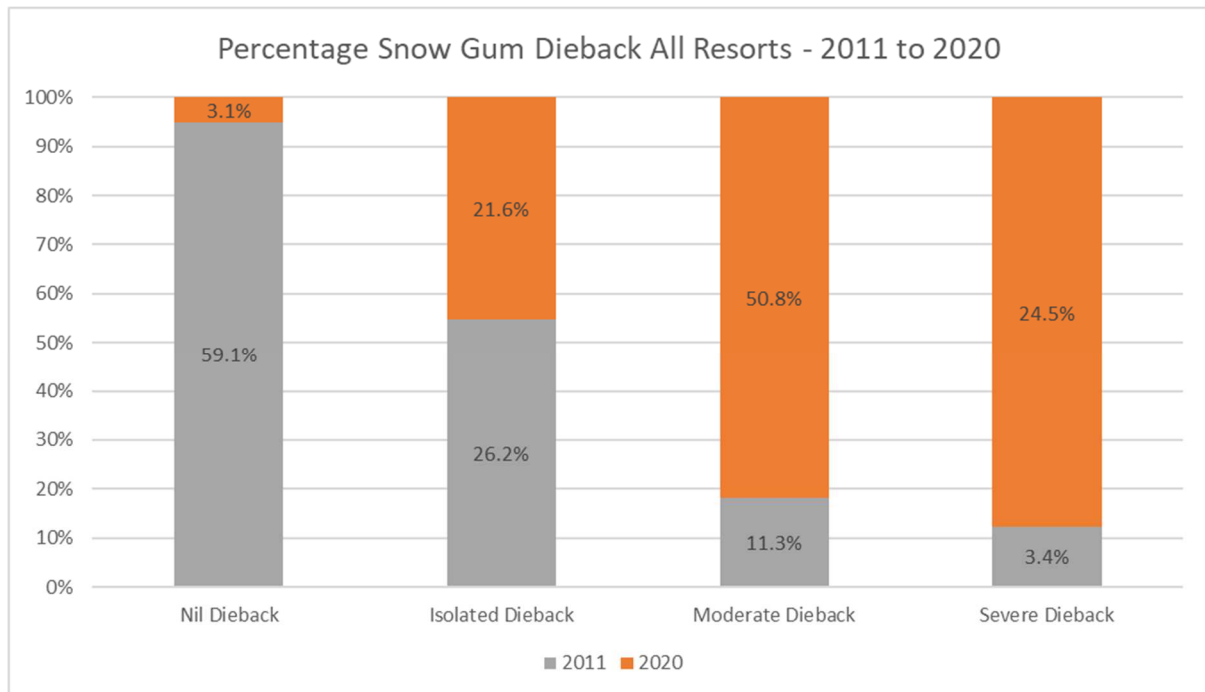
Appendix 2

Charlottes Dieback				
Severity	2011 ha	2020 ha	2011%	2020%
Nil Dieback	34	7	70%	14%
Isolated Dieback	14	21	29%	43%
Moderate Dieback		18	0%	37%
Severe Dieback	0	3	1%	6%
Total Vegetation Area	49	49		
All Dieback	14	42		
Percentage Dieback	30%	86%		
Perisher Dieback				
Severity	2011 ha	2020 ha	2011%	2020%
Nil Dieback	205	6	64%	2%
Isolated Dieback	88	81	28%	25%
Moderate Dieback	22	167	7%	53%
Severe Dieback	3	64	1%	20%
Total Vegetation Area	318	318		
All Dieback	114	312		
Percentage Dieback	36%	98%		
Thredbo Dieback				
Severity	2011 ha	2020 ha	2011%	2020%
Nil Dieback	135	7	51%	3%
Isolated Dieback	64	35	24%	13%
Moderate Dieback	49	136	18%	51%
Severe Dieback	18	88	7%	33%
Total Vegetation Area	266	266		
All Dieback	131	259		
Percentage Dieback	49%	97%		
All Resorts Dieback				
Severity	2011 ha	2020 ha	2011%	2020%
Nil Dieback	374	20	59%	3%
Isolated Dieback	166	137	26%	22%
Moderate Dieback	72	322	11%	51%
Severe Dieback	22	155	3%	24%
Total Vegetation Area	633	633		
All Dieback	259	613		
Percentage Dieback	41%	97%		

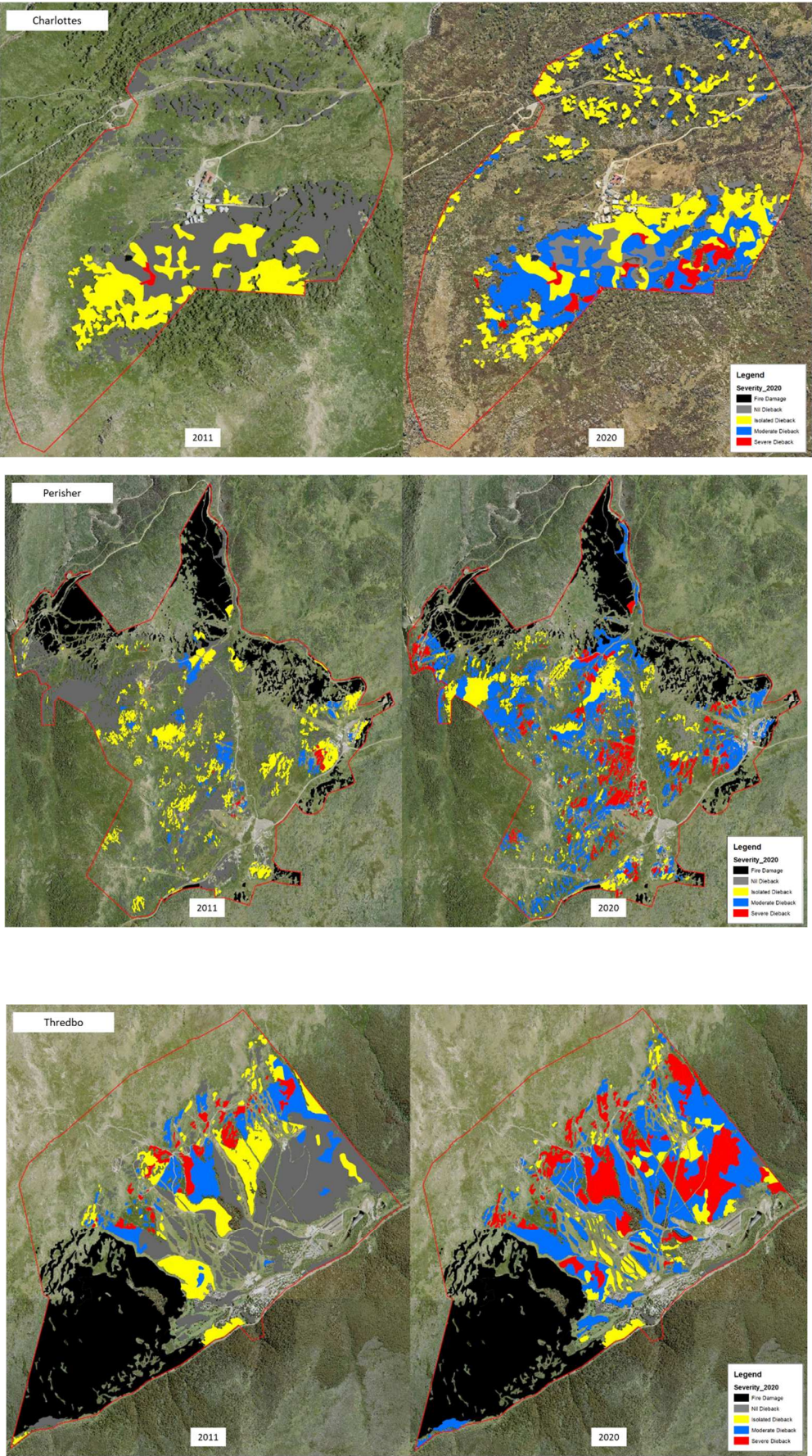
Appendix 3



Appendix 4



Appendix 5



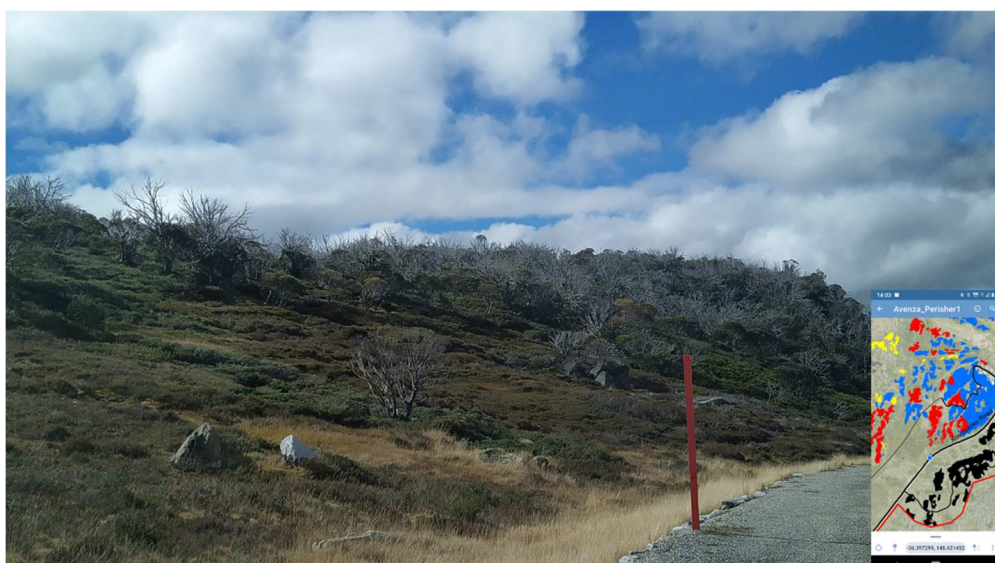
Appendix 6 – isolated dieback Charlottes



Appendix 7 – moderate dieback Perisher

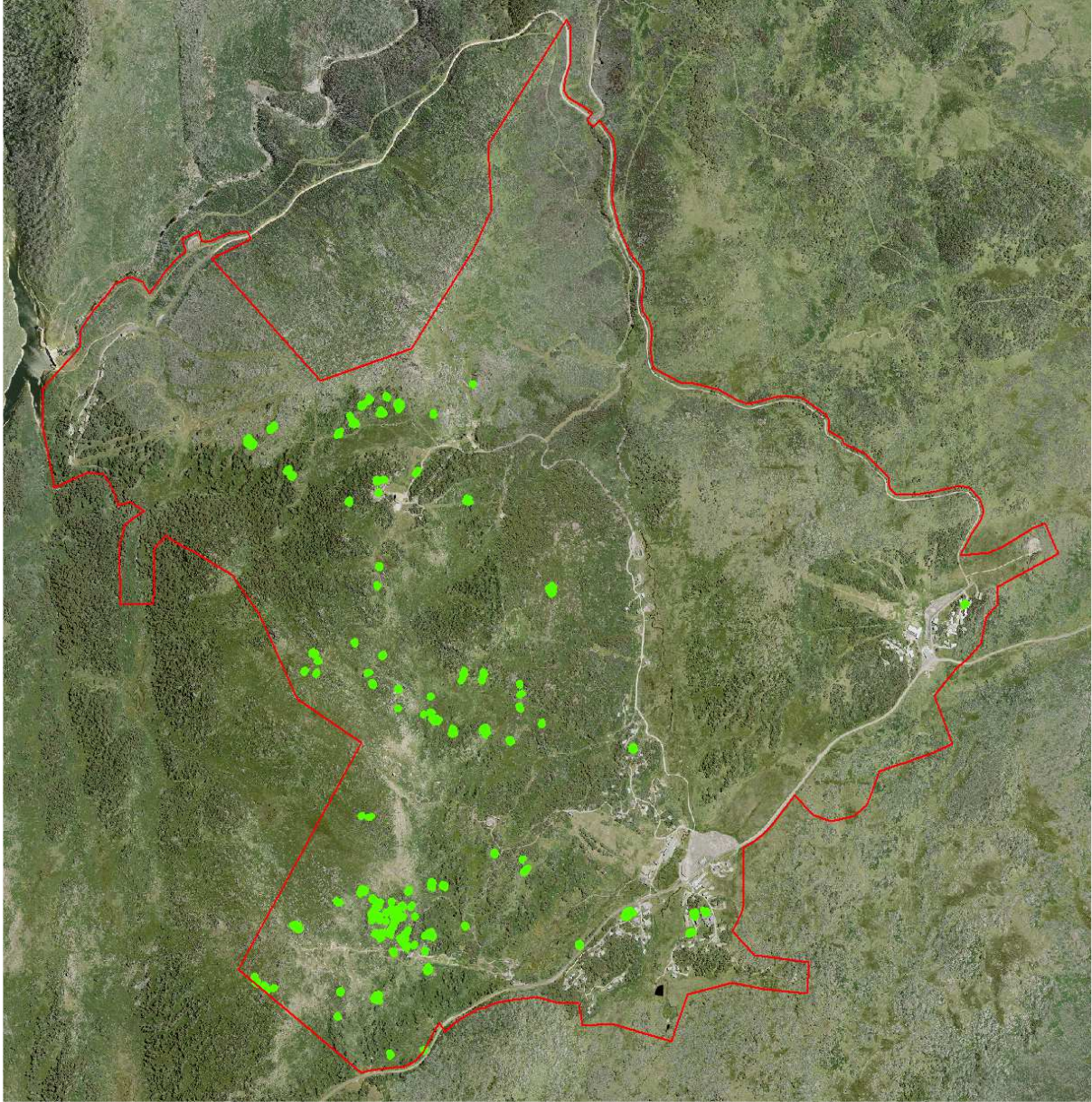


Appendix 8 – severe dieback Perisher



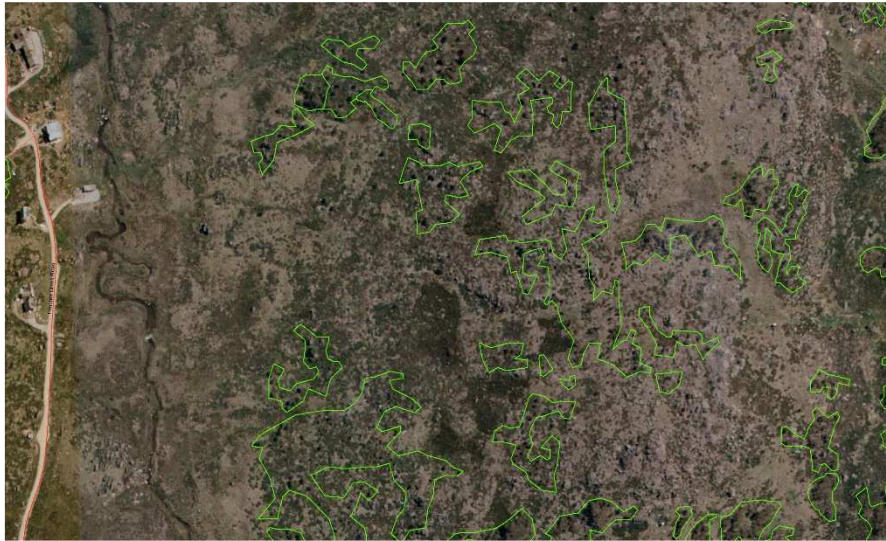
Appendix 9 – Perisher isolated clumps with no dieback

Note: clumps not actual size and have been buffered to allow them to be visible at small scale

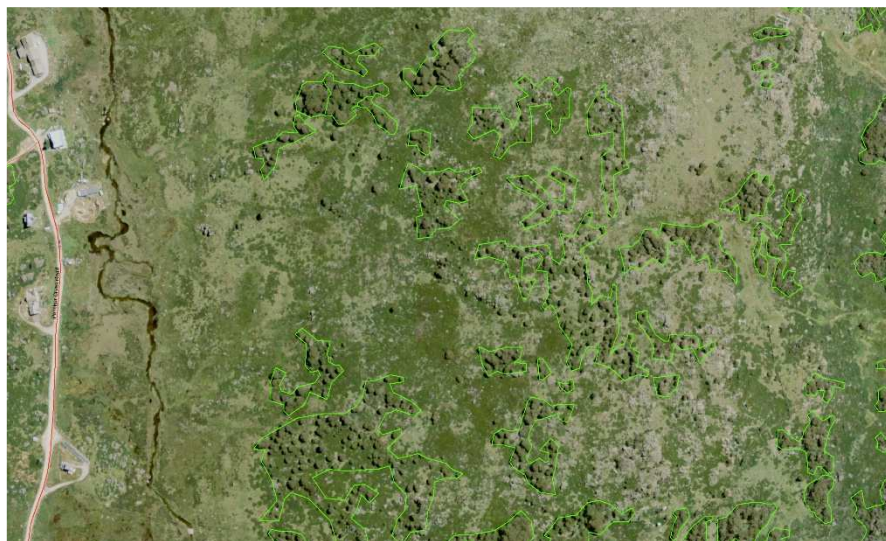


Appendix 10 – Perisher Creek Road regrowth 1992 to 2020

1992



2011



2020

