Post-fire Restoration of Tasmanian Pencil Pines

Decision Support Tool

2023

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Photo by Ben French

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What are Pencil Pines?

The iconic conifer *Athrotaxis cupressoides* (pencil pine) is found only in the mountainous areas of central and western Tasmania. It is a palaeoendemic species; ancient, geographically restricted lineages typically found in small refugia. Pencil pines are of high conservation value due to their:

- Ability to illuminate evolutionary processes (living fossils)
- Strong aesthetic appeal and high cultural importance
- Long lifespan (1000+ years)
- Vulnerability to anthropogenic impacts (especially fire)

This document outlines interventions for post-fire recovery of pencil pines.

Developing a map of current pencil pine distribution in Tasmania will help determine where planting could be required after future fire events

1 Map the fire footprint and where pencil pines occur within it

Required immediately after fire occurs

Methods

- Satellite imagery
- Past vegetation mapping
- Aerial surveys
- Targeted field surveys

2 Evaluate fire kill of pencil pines at local scale[1]

Can be completed immediately after fire occurs, or many years later

Individual tree scale - canopy damage
(see page 4 for example images)

Visually assess tree (stems) in fire affected populations to determine:

- Percentage crown volume scorched (best predictor of a stem's fate)
- Whether any canopy is consumed (stem unlikely to survive)

Replanting required

3 Recovery preparation: Nursery stock and seedbanks

Need to be held in reserve

- Prepare nursery stock (and seedbanks) to enable prompt recovery efforts if fire occurs
- Will also allow an ongoing replanting program in areas of pencil pine lost in past fires (especially the extensive 1961 fires)
- Seed collection needs to be timed to take advantage of 'mass seeding' events to maintain seed banks
- Ideally use local material*, but non-local provenances can be used if necessary

Stock propagated from seed and cuttings are equally successful

4 Post-fire recovery - interventions

Replanting of pencil pine seedlings or cuttings

This can occur in areas burned decades previously

- Transplant nursery stock where pines once grew - replace dead stems

Conditions required for transplant survival

Pencil pines are slow-growing, and restoration will take many decades. Several factors need to be considered to give transplants the best chance of survival:

Long-term protection from herbivory

Transplants need protection until they escape the wallaby browse line (and possibly the deer browse line). This can be achieved using fences (which require ongoing maintenance and are unsuitable for some terrain) or tree guards

Microsite choice

During wet (La Niña) conditions, transplants survive (and grow) best in well-drained positions**

During wet growing seasons, *Sphagnum* microsites are good for survival, but growth is slower than in well-drained positions

Shrub cover

Provides some protection from herbivores (the 'nurse tree' effect) but increases fire risk. Localised shrub removal or trimming should be seriously considered to reduce risk to surviving or partially damaged stands

Direct seed sowing is not effective

$ Budget and resources

- Post-fire survey, nursery propagation, planting program and physical herbivore controls, measurement and data storage with recurrent survey and herbivore tree guard/fencing maintenance

* Currently no evidence of strong genetic differences

** Requires further evaluation - especially the effect of intense summer drought - in an ongoing planting program, which will expose transplants to a wide range of weather conditions

[1] Bliss et al., 2021

Photo credit: Aimee Bliss

Pencil pines

Pencil pine communities occupy about 24,000 ha across the state, primarily in the Tasmanian Central Highlands and Tasmanian Southern Ranges bioregions (Figure 1).

Healthy pencil pines

Photo by Aimee Bliss

Figure 1

Pencil pine locations in Tasmania, indicated by yellow dots. Locations are indicative, not reliable at a fine scale. Locations derived from TasVeg 4.0 categories RPF *Athrotaxis cupressoides - Nothofagus gunnii* short rainforest, RPP *Athrotaxis cupressoides* rainforest and RPW *Athrotaxis cupressoides* open woodland, produced by DPIPWE Tasmania.

Image: Grant Williamson

1

Aerial reconnaissance of burnt pencil pine stands

Aerial surveys may be used to identify burnt pencil pine stands, both from recent and historic fires. Follow up field surveys are required to assess fire severity in those stands identified.

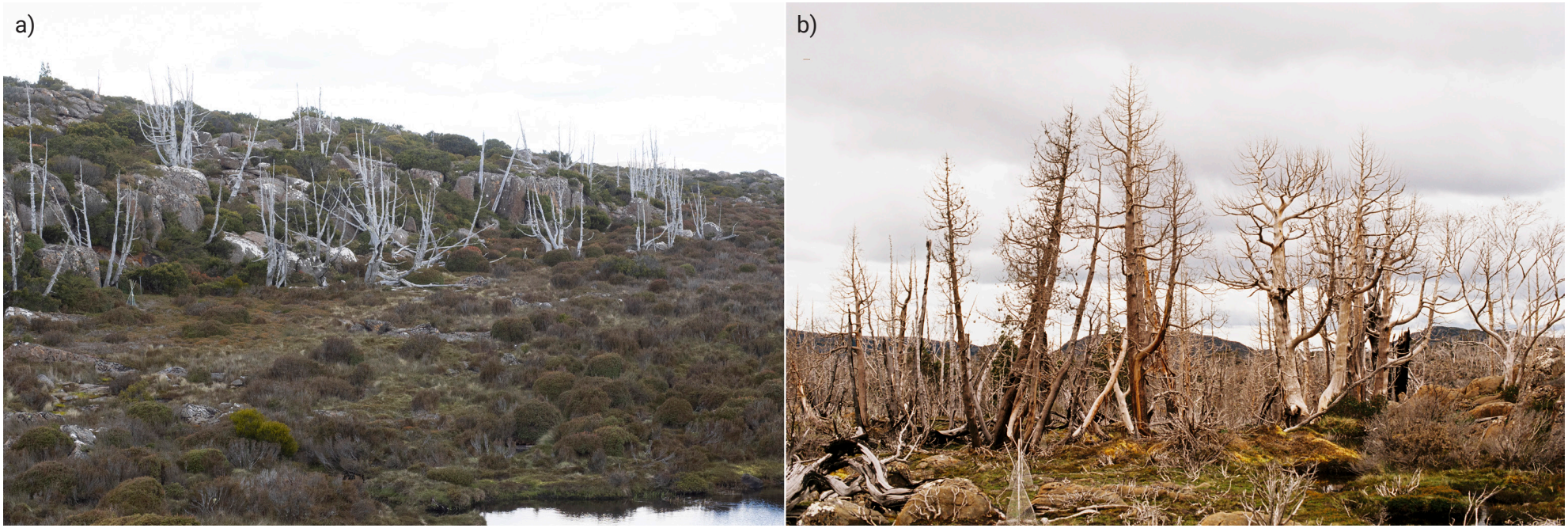

Figure 2

a) Pencil pines killed in the 1960's fires, but unburnt in 2016. These historically burnt stems lack bark and small branches. **b)** Pencil pines killed in the 2016 fires, on which bark remnants and small branches are present.
Photos by Andy Szollosi

2

Can be completed immediately after fire occurs, or many years later

Field classification of severity in pencil pines[1]

Stems with up to about 70% scorch have a good chance of survival, although recovery appears very slow. Stems with 100% canopy scorch, or with any canopy consumption, do not recover[1].

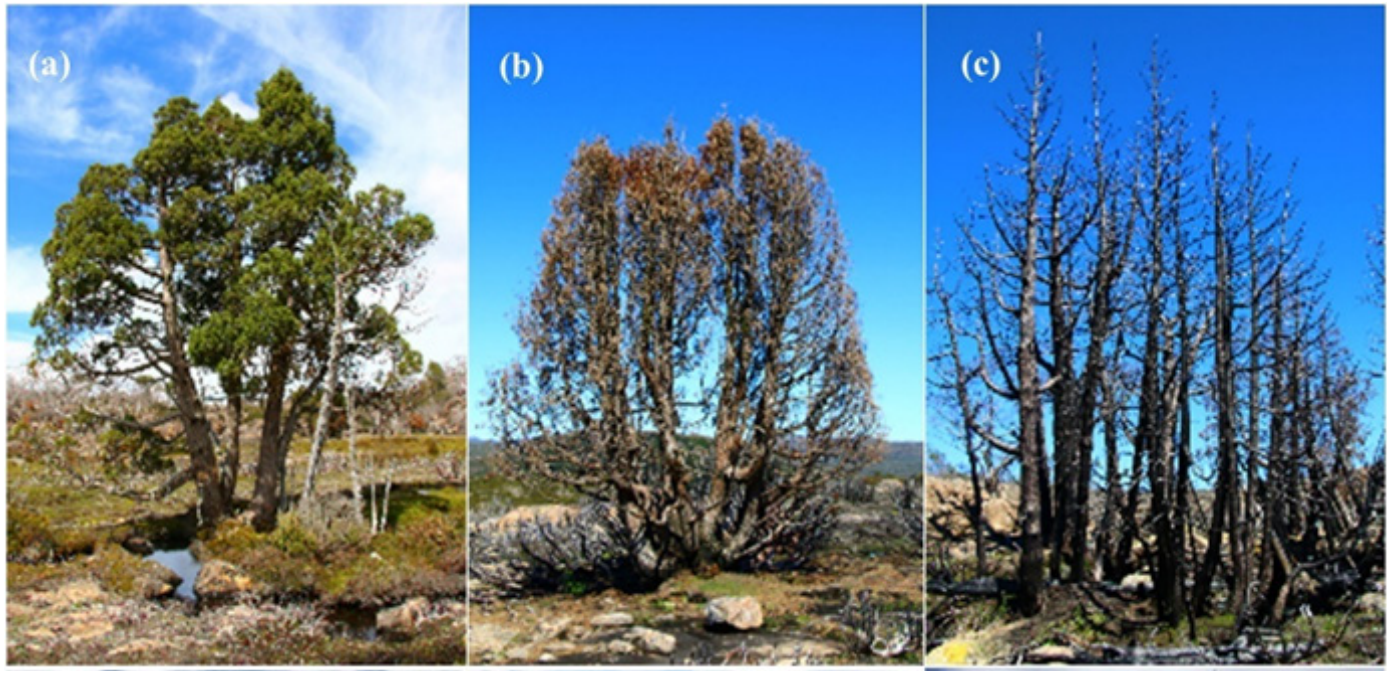

Figure 3

Canopy damage in *Athrotaxis cupressoides* **a)** no canopy damage **b)** entire canopy scorched, but much of it remains on the tree **c)** complete canopy consumption.
Photos by Aimee Bliss

3

Transplanting nursery stock[2,3]

Restoring burnt populations of pencil pine

- Transplanting nursery-grown tube stock, with herbivore protection is most effective
- Natural germinant less successful than planted trees. Inclusion in restoration optional if availability of nursery-grown stock is limited
- Can also use tree guards to protect natural germinants (where present)
- 20 months after planting, 56% of caged tube stock were classed as healthy
- Direct sowing not effective

Propagating tube stock

- Propogation best undertaken by nursery experienced with pencil pines
- Use either seed or cuttings
- Up to two years needed to grow tube stock
- Germinate seed outdoors

Figure 4

a) Natural germinants are often rare after fire, so **b)** transplanting nursery-grown tube stock offers the most reliable way of reintroducing pencil pines to fire-damaged stands.
Photos by Ben French (a) and Sinéad Nicholson (b)

4

Planting position[2,3]

- Target stands burnt either recently or in historic fires
- Well-drained and *Sphagnum* dominated areas most suitable (Box 1)
- Poorly drained non-*Sphagnum* areas less likely to succeed
- At the 0.5 m scale, runoff positions (hummocks, mounds and slopes) are preferable to run-on positions (hollows, pans, depressions and flats), particularly in wet areas

Box 1. Macrotopographic classes

Sphagnum

Sphagnum (live or dead) dominates the ground surface or is the main substrate. Low cover of both rock and bare soil.

Box 1. (continued)

Wet

Poorly drained positions not dominated by *Sphagnum*, e.g. areas with standing water, wet depressions, flats and gentle slopes. The substrate is usually peat.

Moderate

Positions of intermediate drainage, including slopes, gently raised parts of flats and transition zones between dry and wet areas.

Dry

Well drained positions, including raised areas, moderate to steep slopes and rock scree. Range from grassy or shrubby to very rocky.

Photos by Ben French

4

Herbivore protection[2,3]

- Transplants must be protected from vertebrate herbivores, particularly macropods
- Individual tree guards good for rugged terrain
- Long-term protection required. See Box 2 for recommendations on materials

Box 2. Tree guard materials

Poles

Aluminium poles best. Poles were 10 mm diameter extruded tube, with 1.2 mm thick walls. Aluminium was purchased in 6.5 m lengths and cut to size (1.3 m lengths) using a drop saw.

Mesh

Three mesh types were trialled:

i. Stainless steel chicken wire
ii. *Longlife blue* galvanised chicken wire (a galvanised mesh protected with a thin polymer coating), and
iii. Black plastic mesh sleeves

All performed well, with no clear best choice. One option would be to use plastic sleeves (the cheapest but shortest lasting mesh) to protect transplants initially, then when the mesh begins to deteriorate, protect surviving plants with larger, more robust tree guards.

Pins and tie wire

Tree guards can be secured to the ground using 4-6 mild steel jute pins. Either stainless or galvanised tie wire can be used to secure mesh to poles.

Box 2. (continued)

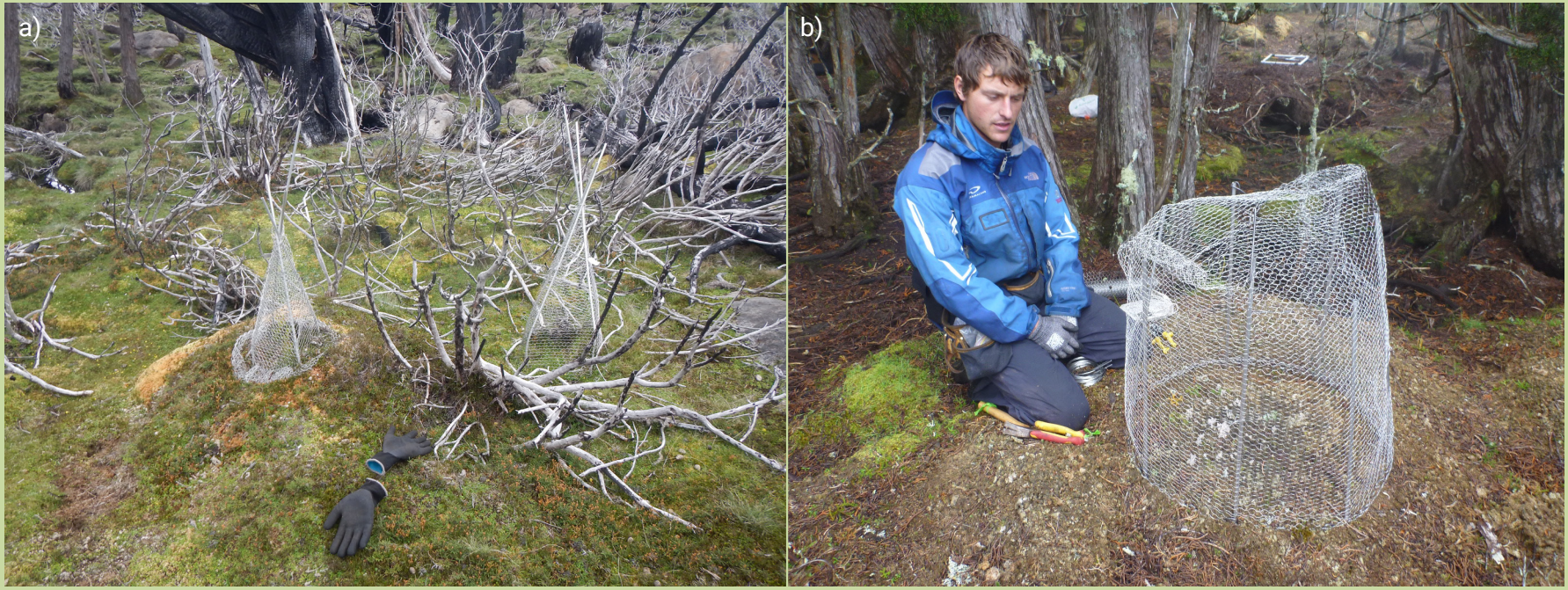

Figure 5

a) The robust tree guards that protected transplants from herbivory. **b)** Natural germinants can be opportunistically protected, but this requires tailored tree guard designs.
Photos by Ben French

Budget and resources[2,3*]

Materials

- Cost of tube stock propagation (Habitat Plants nursery, Liffey) - **$5 per plant (2022); slightly higher for cutting grown stock**
- Wire cages and stakes, 2 x design options: **(A)** Budget vs. **(B)** Longevity

(A) Limited budget, shorter-term (1.5-5 years max)

Will need to be replaced to provide longer term protection (ca. 25 years)

- GeoTas Black mesh tree guard (400 x 600 mm) - **$115 + GST per 50 pack**
- Aluminium extrusion (10 mm diameter) - **$9 per 6.5 m length** (x4 108 mm poles per guard)
- Ground staples (4 mm), steel sharpened tip, 200 mm 300 pins/box - **$68.20 + GST** (x4 per guard)

Cost per complete unit

Plant + mesh guard $14.20/unit

*Indicative costs based on the Lake Mackenzie trial conducted in 2019-20, materials re-quoted 2022

(B) Longer term (~20 years or until outgrown), higher cost

- Stainless Steel Wire and Mesh Pty Ltd
  - 12.7 Mesh 915 mm, 0.63 mm wire ST grade 316 Hexagonal Wire Netting 30 m roll - **$657 + GST** (800 mm per guard)
  - Aluminium extrusion (10 mm diameter) - **$9 per 6.5 m length** (x4 1300 mm poles per guard)
  - 0.5 mm stainless tie-wire (bound top and fasten close) (~500 mm length per unit) - **$65/280 m roll**
  - Ground staples 4 mm, steel sharpened tip, 200 mm 300 pins/box - **$68.20 + GST** (x4 per guard)

Cost per complete unit

Plant + stainless steel tee-pee style guard $30.45/unit

- Plot ID tags (if required for mapping and relocation). Aluminium tree tag 25 x 75 mm, punch numbered - approximately **$60 per 100 pack**

Large-scale rehabilitation work outside of deer browsing zones could consider the cost benefit of perimeter fencing for longer-term protection of pencil pines during establishment (~25 years); maintenance will be essential.

Labour

Planting tube stock and installing tree guards

Variable depending on ease of access, length and condition of field traverse, weather and ground condition.

Typical rehabilitation planting:

- Time to access the sites needs to be factored in
- Using standard 4 stake, mesh guard - varies with site conditions and ease of staking - Approximately **100 plants per day/2-person field team**
- Using tee-pee style 4 pole, wire guard - varies with site conditions, ease of staking and handling of materials - Approximately **4 plants per hour/person**. Consider time benefit of material preparation beforehand.

Resources

- Helicopter $2,637 per hour including standard insurance, additional organisation-specific insurance may be stipulated
- Permits submission and approval process
- Drone surveys
- Data management

Photo by Ben French

References

[1] Bliss A, Prior LD, Bowman DMJS (2021) Lack of reliable post-fire recovery mechanisms makes the iconic Tasmanian conifer *Athrotaxis cupressoides* susceptible to population decline. *Australian Journal of Botany* 69, 162-173. https://doi.org/10.1071/BT20117

[2] French BJ (2022) Evaluating post-fire restoration methods for Pencil Pines (*Athrotaxis cupressoides*): the Lake Mackenzie Field Trial. Establishment Report for the Lake Mackenzie Rehabilitation Trials. Department of Natural Resources and Environment Tasmania, Hobart.

[3] French BJ (*in preparation*) In situ conservation of the pencil pine (*Athrotaxis cupressoides*) under a changing climate; a post-fire restoration trial in Tasmania's Central Plateau. PhD Thesis Chapter, University of Tasmania.

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