TASMANIAN LAND CONSERVANCY

Annual Report

Five Rivers Reserve 2018-19

www.tasland.org.au

INTRODUCTION

The Tasmanian Land Conservancy (TLC) protects important natural areas as permanent reserves and aims to demonstrate excellence in reserve management for biodiversity conservation. The TLC has adopted an adaptive management framework – the Open Standards for the Practice of Conservation which comprises 5 key steps – planning, implementing, monitoring, reporting, review/adaptation and communication.

Five Rivers Reserve was acquired by the TLC in 2010 and protects over 11,113 ha of highland forests and marshlands on Tasmania's Central Plateau. The management of the Reserve is guided by the Five Rivers Reserve Management Plan, implemented by TLC staff through an annual Reserve Work Plan and Monitoring Plan. Details of ecological monitoring methods can be found in TLC's Ecological Monitoring Procedures Manual on www.tasland.org.au.

This report describes progress made towards delivery of the management plan in 2018-19, and is divided into three sections:

1. Reserve Scorecard – a table summarising the results of management effectiveness and ecological monitoring to date;
2. Ecological Monitoring Summary – providing details of the status of conservation targets and trends of key ecological indicators;
3. Management Effectiveness Summary – providing details of the implementation of key management strategies and making recommendations for plan improvement.

The recommendations made in this report are used to adapt and improve management of the Reserve, update the management plan, and revise work and monitoring plans for the coming year. Key findings of this report are communicated to TLC Board, supporters and other stakeholders.

KEY ACHIEVEMENTS 2018-19

- TLC staff responded to the Great Pine Tier fire which impacted the reserve in Jan-Feb 2019. Staff undertook fire suppression, dangerous tree assessments and other works as needed with TFS;
- Repeat monitoring was undertaken for vegetation, terrestrial fauna and acoustic species for the 6th consecutive year immediately post the Great Pine Tier fire event;
- The TLC Board visited the reserve during their annual Board Retreat to view the fire impact;
- Reserve staff continued maintenance of roads, drains and infrastructure during peak times and oversaw additional contract work as a result of the fire event;
- An assessment of Cider Gums at Serpentine instigated emergency protection post fire;
- A research project with UTAS investigating fallow deer browsing was commenced;
- The 9th consecutive year of Central Highlands Weed control work was completed aided by a great team of volunteers.

Cover image: 2019 Regeneration commences after the Great Pine Tier fire Jan 2019: Image Sally Bryant

FIVE RIVERS RESERVE SCORECARD 2018-19

ECOLOGICAL MONITORING

Target	Indicator	Status 2013-14	Status 2014-15	Status 2015-16	Status 2016-17	Status 2017-18	Status 2018-19	Trend
Highland Marshes	Floristic diversity	12.7 species/site	Not monitored	10.1 species/site	Not monitored	12.7 species/site	12.0 species/site	Decrease 2016 (drought), decreased 2019 (fire)
	Structural complexity	5.2 lifeforms/site	Not monitored	5.3 lifeforms/site	Not monitored	5.3 lifeforms/site	4.9 lifeforms/site	Decrease due to 2019 fires
	Miena cider gum recruitment	Stands mapped	Not monitored	Not monitored	Not monitored	Not monitored	Impacted by fire	Unknown - suspect major decline due to 2019 fires
	Sphagnum peatland extent	Unknown	Unknown	100.8 hectares	Unknown	+0.5 ha restoration	+ 0.5 ha restoration	Unknown
Streams and Wetlands	Macroinvertebrate diversity (Simpsons Index)	Not assessed	Not assessed	Not assessed	0.68	Not assessed	Not assessed	Unknown – re-measure in 2020
	Floristic diversity	11.6 species/site	Not monitored	9.6 species/site	Not monitored	11.5 species/site	12.6 species/site	Decrease 2016 (drought), increasing since
	Structural complexity	5.6 lifeforms/site	Not monitored	5.6 lifeforms/site	Not monitored	5.6 lifeforms/site	5.7 lifeforms/site	Stable
	Mawson pine pop'n size	Riparian stands identifed	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed	Unknown – requires mapping
Highland Forest and Woodland	Floristic diversity	12.3 species/site	Not monitored	10.6 species/site	Not monitored	12.6 species/site	11.7 species/site	Decrease 2016 (drought), recovered 2018, decreased 2019
	Structural complexity	7.5 lifeforms/site	Not monitored	7.6 lifeforms/site	Not monitored	7.6 lifeforms/site	6.8 lifeforms/site	Decrease due to 2019 fires
	Canopy recruitment	2.3 cohorts/site	Not monitored	2.3 cohorts/site	Not monitored	2.3 cohorts/site	2.1 cohorts/site	Decrease due to 2019 fires
	Eagle nest productivity	3 of 5 nests active	4 of 5 nests active	1 nest active	2 of 5 nests active	Not checked	2 of 5 nests active	Stable
	Forest cover change in reserve	Not monitored	Not monitored	Not monitored	9463	Not monitored	No Monitoring	No change 2000 - 2010
	Forest cover change - 20km	Not monitored	Not monitored	Not monitored	1721 ha (2011-2015)	Not monitored	Decline due to fire	Decline 2013 – 2019 due to fire
Terrestrial mammals	Species richness	10 native species 5 introduced sp	12 native species 4 introduced sp	12 native species 3 introduced sp	11 native species 4 introduced sp	12 native species 3 introduced sp	12 native species 5 introduced sp	Stable – natural fluctuation
	Proportion native sp	0.67	0.75	0.80	0.73	0.80	0.71	
	Native species diversity indices	Simpson 0.75 Shannon-Wiener 1.59	Simpson 0.77 Shannon-Wiener 1.64	Simpson 0.78 Shannon-Wiener 1.70	Simpson 0.76 Shannon-Wiener 1.63	Simpson 0.75 Shannon-Wiener 1.57	Simpson 0.78 Shannon-Wiener 1.69	

MANAGEMENT EFFECTIVENESS MONITORING

Strategy	Indicator	Status 2013-14	Status 2014-15	Status 2015-16	Status 2016-17	Status 2017-18	Status 2018-19	Trend
Access Management	Reportings / evidence of illegal entry	Declining	Low level	Low level	Low level	Low level	Low level	Illegal entry continuing at low levels and seasonal
Fire Management	Number of unplanned fires	1 – Jan 2014	0 unplanned fire	0 unplanned fire	0 unplanned fire	1 fire - Nov 2017	1 fire - Jan 2019	2018-19 fire more severe and larger area than previous fires
Threatened Species Protection	Projects improving knowledge on threatened species	1 – dwarf conifer climate change monitoring	2 – Bushblitz surveys, spagnum fire age	2 – CAP planning and TAFE course	2 – Miena jewel beetle, ptunnara buterfly surveys	3 - UTAS carnivores, jewel beetle, peat core	3 - Cider gum recruitment, deer browsing, sphagnum pollen analysis	Improving knowledge on threatened species
Clarence Galaxias Protection	Presence of Clarence galaxias / no brown trout	C Galaxias at 4 sites	Not monitored	Not monitored	C Galaxias at 4 sites	Not monitored	Not monitored – IFS to survey March 2020	Unknown

Category	Indicator							Status
Carnivorous Marsupial Conservation	Spotted-tailed quoll occupancy	0.02 (detected at 1 of 42 sites)	0.13 (detected at 4 of 32 sites)	0.11 (detected at 4 of 37 sites)	0.09 (detected at 3 of 34 sites)	0.13 (detected at 5 of 39 sites)	0.25 (detected at 11 of 44 sites)	Increasing/ stable – natural fluctuation
	activity	0.001 (1 detection, 1202 trap nights)	0.006 (7 detections, 1120 trap nights)	0.004 (5 detections, 1217 trap nights)	0.003 (3 detections, 1175 trap nights)	0.008 (9 detections, 1143 trap nights)	0.009 (14 detections, 1540 trap nights)	
	Eastern quoll occupancy	0.29 (detected at 12 of 42 sites)	0.47 (detected at 15 of 32 sites)	0.41 (detected at 15 of 37 sites)	0.38 (detected at 13 of 34 sites)	0.15 (detected at 6 of 39 sites)	0.61 (detected at 27 of 44 sites)	Generally stable – natural fluctuation. Decline in 2018 followed by recovery in 2019
	activity	0.03 (32 detections, 1202 trap nights)	0.06 (66 detections, 1120 trap nights)	0.03 (37 detections, 1217 trap nights)	0.07 (81 detections, 1143 trap nights)	0.015 (17 detections, 1143 trap nights)	0.06 (94 detections, 1540 trap nights)	
	Tasmanian devil occupancy	0.67 (detected at 28 of 42 sites)	0.97 (detected at 31 of 32 sites)	0.78 (detected at 29 of 37 sites)	0.76 (detected at 26 of 34 sites)	0.92 (detected at 36 of 39 sites)	0.98 (detected at 43 of 44 sites)	Increasing/ stable – natural fluctuation
	activity	0.11 (128 detections, 1202 trap nights)	0.21 (234 detections, 1120 trap nights)	0.14 (173 detections, 1217 trap nights)	0.16 (193 detections, 1143 trap nights)	0.32 (360 detections, 1143 trap nights)	0.34 (520 detections, 1540 trap nights)	
	DFTD status	Unknown	DFTD detected 13% of sites	DFTD e detected 3% of sites	DFTD detected 19% of sites	DFTD detected 10% of sites	DFTD detected 27% of sites	DFTD persisiting at high levels on the Reserve
Pest Animal Management	Feral cat occupancy	0.33 (detected at 14 of 42 sites)	0.50 (detected at 16 of 32 sites)	0.32 (detected at 12 of 37 sites)	0.38 (detected at 13 of 34 sites)	0.51 (detected at 20 of 39 sites)	0.41 (detected at 18 of 44 sites)	Stable
	activity	0.02 (30 detections, 1202 trap nights)	0.03 (29 detections, 1120 trap nights)	0.02 (27 detections, 1217 trap nights)	0.02 (23 detections, 1175 trap nights)	0.04 (47 detections, 1143 trap nights)	0.02 (34 detections, 1540 trap nights)	Stable
	Rabbit occupancy	0.33 (detected at 14 of 42 sites)	0.50 (detected at 16 of 32 sites)	0.32 (detected at 12 of 37 sites)	0.38 (detected at 13 of 34 sites)	0.13 (detected at 5 of 39 sites)	0.41 (detected at 18 of 44 sites)	Increasing - natural fluctuation
	activity	0.001 (1 detections, 1202 trap nights)	0.007 (8 detections, 1120 trap nights)	0.002 (2 detections, 1217 trap nights)	0.009 (11 detections, 1175 trap nights)	0.005 (6 detections, 1143 trap nights)	0.012 (18 detections, 1540 trap nights)	
	Fallow deer occupancy	0.07 (detected at 3 of 42 sites)	0.28 (detected at 9 of 32 sites)	0.14 (detected at 5 of 37 sites)	0.21 (detected at 7 of 34 sites)	0.31 (detected at 12 of 39 sites)	0.45 (detected at 20 of 44 sites)	Increase in deer occupancy and activity 2019 (post fire)
	activity	0.01 (11 detections, 1202 trap nights)	0.02 (22 detections, 1120 trap nights)	0.02 (27 detections, 1217 trap nights)	0.01 (15 detections, 1175 trap nights)	0.02 (21 detections, 1143 trap nights)	0.09 (131 detections, 1540 trap nights)	1 deer shot due to closure of reserve from fire
	deer shot	Unknown	9 deer shot	9 deer shot	16 deer shot	12 deer shot	1 deer shot	
	Stock access	Stock incursions	Stock incursions	Stock incursions	Stock incursions	No stock incursions	No stock incursions	No recent stock incursions
Weed Management	Weed extent	Weeds on roads and disturbed log landings	Weeds on roads and disturbed log landings	Weeds on roads and disturbed log landings	Weeds on roads and disturbed log landings	Weeds on roads and disturbed log landings	Weeds on roads and disturbed log landings	Weeds decreasing in density and extent
	Weed density	Very low	Very low	Very low	Very low	Very low	Very low	
	Treatment extent	100% of weeds (other than thistles)	100% of weeds (other than thistles)	100% of weeds (other than thistles)	100% of weeds (some thistles treated)	100% of weeds (some thistles treated)	100% of weeds (some thistles treated)	
Protecting Cultural Heritage	Cultural heritage sites mapped and protected	Not commenced	Not commenced	Not commenced	European heritage being documented.	European heritage being documented.	European heritage sites documented	European heritage better known but not yet managed
	Indigenous heritage better understood	Not commenced	Not commenced	Not commenced	Not commenced	Not commenced	Not commenced	Needs to be addressed
Enhance Ecosystem Services	Income generated from Reserve	Unknown	Unknown	Unknown	$80,870	$81,000 (>10%)	$79,000 (>10%)	Small decrease – no hunting fees
	TLC expenditure in local community	Unknown	Unknown	Unknown	No data collected	Data not assessed	No assessment	No assessments - Unknown

ECOLOGICAL MONITORING SUMMARY

Highland Marshes	Status: Some decline

Key Objectives • Maintain or improve the floristic diversity of Highland Marshes • Maintain or improve the structural complexity of Highland Marshes • Maintain recruitment of Miena cider gum • Maintain the extent of Sphagnum Peatland • Maintain or improve the vertebrate fauna diversity	**Outcome: Fire impact**

Description

Highland marshes typically occur in valleys where impeded drainage and severe frosts restrict the growth of most tree species. Highland marshes include all forms of poorly drained vegetation communities, including peatland, heathland, *Eucalyptus rodwayi* and *E. gunnii* woodland, and *Poa* grassland. Highland marshes are floristically diverse, and perform important ecological functions, including filtering water runoff, and reducing erosion from, and the severity of, flooding events. The diverse shrubs flower for an extended period over summer and provide an important food resource for native insectivorous bird species in particular.

Mesh cages installed to prevent browsing of Cider gum 2019. Photo: Martin Walsh

Indicator	2013-14	2014-15	2015-16	2016-17	2017-18	Status 2018-19
Floristic diversity	12.7 species/site	Not monitored	10.1 species/site	Not monitored	12.7 species/site	12.0 species/site
Structural complexity	5.2 lifeforms/site	Not monitored	5.3 lifeforms/site	Not monitored	5.3 lifeforms/site	4.9 lifeforms/site
Miena cider gum recruitment	Stands mapped	Not monitored	Not monitored	Not monitored	Not monitored	Impacted by fire
Sphagnum peatland extent	Unknown	Unknown	100.8 ha	Unknown	+0.5 ha restoration	+ 0.5 ha restoration intact

Key Findings 2018-19
- Ecological monitoring was repeated in April 2019 immediately post the Great Pine Tier fire.
- Some marshes on Serpentine and Roscarborough were impacted by fire.
- 0.5ha Sphagnum restoration plot was intact post the fire and showing good signs of establishment.
- Data shows some decline in vegetation condition due to fire affected areas.
- Mature cider gums and regeneration on Serpentine have been severely impacted by fire. The installation of ~ 50 wire mesh cages on Serpentine to prevent browsing is planned for Aug.
- No changes detected in terrestrial native mammals through monitoring.
- Wombat mange data for 2017-18, 2018-19 has been analysed and will be reported from 2020

Recommendations
- Implement Fire Management Strategy, including the development of an operational fire management plan for the Reserve that identifies sensitive vegetation.
- Complete rehabilitation of Roscarborough Sphagnum bog and undertake monitoring.
- Protection of Miena Cider Gum regeneration is an urgent priority.
- Continue ptunarra brown butterfly extension surveys in Poa grasslands to id potential populations.
- Commence reporting on prevalence of wombat mange from 2020 onwards.
- Repeat long-term ecological monitoring in 2020 then every three years thereafter.

Streams and Wetlands	Status: Good

Key Objectives
- Maintain the diversity of aquatic biota
- Maintain or improve floristic diversity of streams and wetlands
- Maintain or improve structural complexity of streams and wetlands
- Maintain or improve vertebrate diversity in streams and wetlands
- Maintain populations of drooping pine *Pherosphaera hookeriana*

Outcome: More data required

Description

The Five Rivers Reserve is nestled between the Nive, Serpentine, Pine, Little and Little Pine Rivers and surrounded by Lake Ina, Clarence Lagoon, Kenneth Lagoon and Pine Tier Lagoon and their associated tributaries and creek systems. These water systems are invaluable ecosystems and corridors for a range of aquatic dependent and associated plants and animal species. The riparian vegetation is intact and is dominated by diverse native vegetation with no or few weeds occurring in this area.

Edge of Kenneth Lagoon. Photo: D Sprod

Indicator	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Macroinvertebrate diversity (Simpsons Index)	Not assessed	Not assessed	Not assessed	0.68	Not assessed	Not assessed
Floristic diversity	11.6 species/site	No monitoring	9.6 species/site	No monitoring	11.5 species/site	12.6 species/site
Structural complexity	5.6 lifeforms/site	No monitoring	5.6 lifeforms/site	No monitoring	5.6 lifeforms/site	5.7 lifeforms/site
Mawson pine pop'n size	Riparian stands identifed	Not assessed	Not assessed	Not assessed	Not assessed	Not assessed

Key Findings 2018-19
- The floristic condition of riparian vegetation remains good but more data is needed on macroinvertebrates and Mawson (drooping) pine status
- Clarence galaxias targets are not being met and are discussed in the Clarence galaxias protection section

Recommendations
- Extension surveys for Mawson (drooping) pine along the Nive River remain a priority.
- Repeat ecological monitoring in 2020 post the 2019 fire.
- Improving knowledge on aquatic biota diversity is a priority

Highland Forest and Woodland	Status: Decline

Key Objectives
- Maintain or improve overall floristic diversity and structural complexity, and recruitment of canopy species
- Maintain Highland Forests and Woodlands forest cover within 2% of 2010 baseline
- Maintain or improve breeding success of the wedge-tailed eagle

Outcome: Monitor regeneration

Description

The highland forests and woodlands of the Five Rivers Reserve are a significant conservation feature of the landscape. Diverse eucalypt species occur as a mosaic, where dominance is determined by minor changes in topography, aspect, drainage and geology. The forests are floristically diverse and are structurally complex despite decades of forestry activities. Ongoing survey and assessment of eagles will ensure this shy nesting species is not disturbed during the breeding season and that breeding success and productivity is being maintained.

Eagle nest on Serpentine 2019 post fire: Pic S Bryant

Indicator	2013-2014	2014-2015	2015-2016	2016-2017	2017-2018	2018-19
Floristic diversity	12.3 species/site	No monitoring	10.6 species/site	No monitoring	12.6 species/site	11.7 species/site
Structural complexity	7.5 lifeforms/site	No monitoring	7.6 lifeforms/site	No monitoring	7.6 lifeforms/site	6.8 lifeforms/site
Canopy recruitment	2.3 cohorts/site	No monitoring	2.3 cohorts/site	Not monitored	2.3 cohorts/site	2.1 cohorts/site
Eagle nest productivity	3 of 5 nests active	4 of 5 nests active	1 nest active	2 of 5 nests active	Not checked	2 of 5 nests active
Forest cover change in reserve	No monitoring	No monitoring	Not monitored	9463	No monitoring	No monitoring
Forest cover change - 20km	No monitoring	No monitoring	Not monitored	1721 ha (2011-2015)	No monitoring	Decline due to fire
Terrestrial Mammals (across entire reserve)						
Species richness	10 native sp 5 introduced sp	12 native sp 4 introduced sp	12 native sp 3 introduced sp	11 native sp 4 introduced sp	12 native sp 3 introduced sp	12 native sp 5 introduced sp
Proportion native sp	0.67	0.75	0.80	0.73	0.80	0.71
Native species diversity indices	Simpson 0.75 Shannon-Wiener 1.59	Simpson 0.77 Shannon-Wiener 1.64	Simpson 0.78 Shannon-Wiener 1.70	Simpson 0.76 Shannon-Wiener 1.63	Simpson 0.75 Shannon-Wiener 1.57	Simpson 0.78 Shannon-Wiener 1.69

Key Findings 2018-19
- 5 wedge-tailed eagle nests were checked in Nov 2018 prior to the Great Pine Tier fire. Two nests were active: Serpentine #2447 with a new active nest id within 20m and Viormy nest#1687 one fluffy chick. Notes re nest #2447 were that two nests were found approx 20m apart. One smaller with newer nest material. The larger, at: 463770, 4344190 was in average condition with older nest material.
- In Feb 2019 Nest# 890 at McKenzies Tier was destroyed by fire.
- Monitoring has detected impact to highland forest vegetation due to fire.
- Boundary fencing was repaired post fire to prevent illegal firewood collection and access.

Recommendations
- Continue to implement and improve the Access Management Strategy, including monitoring for illegal timber harvesting and taking action to prevent illegal access when detected.
- Include assessment of new eagle nest near #2447 during 2019-20 annual eagle nest checks.

MANAGEMENT EFFECTIVENESS SUMMARY

<table>
<tr>
<td colspan="2">Access Management</td>
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<tr>
<td>Key Objective
• Unauthorised access is reduced by 80% by 2020</td>
<td>Status 2018-19
Illegal access continuing</td>
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<tr>
<td>Strategy Description
Management of access points across the Reserve is required so that visitation causes minimal impact to Reserve natural values. Unauthorised and illegal access can negatively impact on values, through activities e.g. hunting, wood-hooking, campfires, dumping rubbish and off-road driving. A variety of mechanisms are used to regulate access including infrastructure e.g. fences and gates, signs, and direct communication with the local community and potential visitors. Infrastructure needs to be maintained to ensure it is safe to use, effective and does not impact on the Reserve values (e.g. erosion).</td>
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SKULLBONE PLAINS
FIVE RIVERS RESERVE

LAKE INA

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TASMANIAN LAND CONSERVANCY

New TLC signage installed</td>
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Indicator	Status 2017-18	Status 2018-19 Trend
Reportings / evidence of illegal entry	Continuing at low levels and seasonal	General decline but continuing at low levels and seasonal

Key Findings 2018-19
- In 2018-19 illegal access was observed and reported on several occasions, mostly associated with wood hooking post the Great Pine Tier fire. Gates are routinely checked and repaired immediately any damage is reported or observed. Fencing especially along the Marlborough Highway is continually checked and repaired trenches dug to block access to these areas.
- Accurate maps classifying all roads and tracks on Five Rivers Reserve are now being routinely used, with standards for maintenance developed for each road classification. There has been ongoing road maintenance, including management of road drainage to prevent erosion of roads, and rehabilitation of the surface of primary roads that were becoming degraded.
- Signage was upgraded last year to support visitor access to Skullbone Plains, including directional signage for vehicles and walking track signage to the Old Skullbone Plains Track.

Recommendations
- Continue the program of road, gate and trench maintenance especially in fire affected areas.
- Ensure that the right-of-ways for Sustainable Timber Tasmania are finalised prior to any further use by logging trucks and that usage/maintenance requirements are adhered to.
- Revise objective to be qualitative measurements as reported by TLC staff, as would the efficacy of barriers, gates and other access control methods.

Fire Management

| Key Objectives	Status 2018-19
• No unauthorised fires start on the reserve by 2020. • All reasonable measures are taken to prevent the spread of any fires originating on the reserve (ongoing)	**Status 2018-19** **On-track but review post 2019 fire**

Strategy Description

The aim of this strategy is to reduce the impact of unplanned fire, on the people and values of the Five Rivers region. Bronte Park is the largest community in the region and wildfire poses a significant risk to the community. While most of the natural values of the Reserve are relatively resilient to the impacts of fire, there are some significant natural values, such as sphagnum peatlands and populations of drooping pine that should be protected from fire as a priority and wherever possible.

Fire severity map Five Rivers 2019: TASFIRE
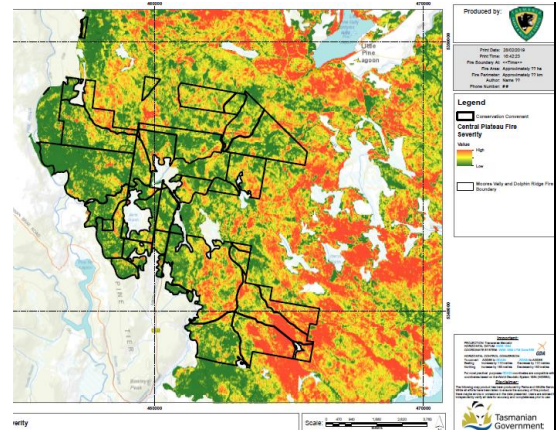
Indicator	2013-14	2014-15	2015-16	2016-17	2017-18	Status 2018-19 Trend
Number of unplanned fires	1 fire Jan 2014	0 fires	0 fires	0 fires	1 fire Nov 2017	1 fire Jan 2019 more severe and larger than previous fires

Key Findings 2018-19

- TLC staff provided emergency response during the Great Pine Tier fire in Jan 2019. Under the direction of TASFIRE, staff provided surveillance, suppression, mop-up and undertook hazardous tree assessments during the 1 month incident. It is estimated that ~ 6,000 ha of the reserve was burnt from medium – to high damage severity. Fences were destroyed and some key natural assets particularly cider gums and an eagle nest were lost.
- TLC continues to have staff trained in fire-fighting techniques and maintains fire suppression units for vehicles. Water points were maintained for use during fire-fighting.
- TLCs fire management policy including fuel stove only is being implemented.
- A whole-of-TLC fire management strategy has been developed to ensure all TLC properties are effectively managed from threats relating to fire, and that fire is used appropriately as a tool to manage the values of TLC properties. This will now be reviewed in light of the 2019 fire.

Recommendation

- Review strategy for fire management and active suppression for Five Rivers as a result of the 2019 fire.
- Continue annual ecological monitoring to measure recovery and identify assets that need management intervention.
- Continue to implement a fuel stove only policy for the Reserve and TLC's fire policy and procedures, including conducting an annual fire risk assessment across all TLC properties.
- Continue to maintain key roads and firefighting infrastructure inc. water points.

Threatened Species Protection

Key Objective	Status 2018-19
• Improved conservation outcomes for threatened species from 2016 onwards	**On-track**

Strategy Description	TLC staff preparing cider gum monitoring sites: S Bryant
There are a number of threatened species on the Five Rivers Reserve that are either poorly known or for which more information is required. Extension surveys are required to better understand the distribution and status of fauna species such as the Ptunarra brown butterfly, Miena jewel beetle, Masked owl and Grey goshawk, and threatened plants such as the grassland cupflower, claspleaf heath and small alpine leek orchid. Knowledge of these and other threatened species should be improved.	

Indicator	2013-14	2014-15	2015-16	2016-17	2017-18	Status 2018-19 Trend
Projects improving knowledge on threatened species	1 – conifer climate change monitoring	2 – Bushblitz, spagnum fire age	2 – CAP planning and TAFE course	2 – Miena jewel beetle, ptunnara buterfly surveys	3 - UTAS carnivores, jewel beetle, peat core	3 - Cider gum recruitment, deer browsing, sphagnum pollen analysis. Improving knowledge on threatened species

Key Findings 2018-19

- Additional 30cm surface peat core sample was collected by J Whinam and S Bryant in May 2019 from original Sphagnum site on Skullbone Plains for Geoffrey Hope (ANU) to improve the Skullbone pollen diagram in the top 40 cm. His publication is pending.
- Updated information on devils and quolls from UTAS Hons project by Liam Thompson
- Research commenced on fallow deer browsing by UTAS PhD student Tom Guy.
- Cider gum regeneration post 2019 fire will be monitored.
- Castiarina insculpta recommended in 2019 for downlisting by DPIPWE. Threatened Species Section (2018). Castiarina insculpta *(Miena Jewel Beetle): Species Management Profile for Tasmania's Threatened Species Link*. https://www.threatenedspecieslink.tas.gov.au/Pages/Miena-Jewel-Beetle.aspx. Department of Primary Industries, Parks, Water and Environment, Tasmania. Accessed on 2/10/2018. https://www.threatenedspecieslink.tas.gov.au/Pages/Miena-Jewel-Beetle.aspx

Recommendations

- Progress extension surveys on poorly known or recorded threatened species.
- Expand Miena jewel beetle surveys during peak *O. hookeri* flowering periods in Jan/Feb.
- Improve knowledge on swift parrot distribution on the reserve.
- Continue extension surveys for ptunarra brown butterflies in Poa grasslands.
- Contract surveys for Mawson pine in riparian vegetation on the Nive section of the Reserve.
- Update threatened species mapping to incorporate jewel beetle data collected in 2017.

Clarence Galaxias Protection

Key Objective
- No introductions or expansion of brown trout on the reserve

Status 2018-19
Awaiting IFS assessment

Strategy Description
The strategy aims to prevent the expansion and establishment of Brown Trout in areas where Clarence galaxias occurs. Brown trout have the potential to cause extinction of this species. Access control and the encouragement of responsible fishing practices are some of the ways this risk can be reduced.

A secondary aim is to work with partners particularly the Inland Fisheries Service to investigate the potential to eradicate trout from other small water bodies to expand area of occupancy of Clarence galaxias as specified in the species recovery plan.

small galvanised culvets
GDA94 MGA55 : 444221E, 5345381N

C. Galaxias site to check in 2019. Map R Freeman

Indicator	2013-14	2014-15	2015-16	2016-17	2017-18	Status 2018-19 Trend
Presence of Clarence galaxias / no brown trout	C Galaxias at 4 sites	Not monitored	Not monitored	C Galaxias at 4 sites	Not monitored	Not monitored – IFS to survey March 2020

Key Findings 2018-19
- Potential relocation site to fire dam on Serpentine needs to be reassessed post GP Tier fire.
- Access controlled to improve likelihood that trout do not spread into galaxias habitat.
- Contacted R Freeman from IFS on 13/8/2019 for survey results. They reported April 2015 was the last year IFS monitored Skullbone Plains but planning surveys for March 2020. TLC staff can check the Skullbone culverts near last gateway in September 2019 and report status back to IFS (map above). Rob reported that surveys in Feb 2019 on nearby locations yielded mixed results due to the very dry season: Tibbs Plains (almost dry and none detected), Dyes Marsh (none detected) and Wentworth Hills Lagoon (good numbers).

Recommendations
- Maintain contact with IFS to ensure monitoring work undertaken in 2019-20. If none proposed then offer to undertake work internally.
- Assess water quality and food availability in the Serpentine fire dam post the 2019 GPT fire.

Carnivorous Marsupial Conservation	

Key Objective
- Maintain wild, free ranging populations of carnivorous marsupials

Strategy Description

The Bronte region is one of the few areas in Tasmania that retains an intact guild of large carnivorous marsupials, the Tasmanian devil, spotted-tail quoll and eastern quoll. All three species are threatened under state and federal environmental legislation. The mosaic of open areas, woodland and forest supports high population densities of prey species such as wallabies and possum and large fallen trees and rocky areas provide abundant den sites.

Tasmanian devil at FIRI111 in 2019. Photo: TLC

Indicator	2013-14	2014-15	2015-16	2016-17	2017-18	Status 2018-19 Trend
Spotted-tailed quoll occupancy	0.02 (detected at 1 of 42 sites)	0.13 (detected at 4 of 32 sites)	0.11 (detected at 4 of 37 sites)	0.09 (detected at 3 of 34 sites)	0.13 (detected at 5 of 39 sites)	0.25 (detected at 11 of 44 sites)
S-t activity	0.001 (1 detection, 1202 trap nights)	0.006 (7 detections, 1120 trap nights)	0.004 (5 detections, 1217 trap nights)	0.003 (3 detections, 1175 trap nights)	0.008 (9 detections, 1143 trap nights)	0.009 (14 detections, 1540 trap nights)
Eastern quoll occupancy	0.29 (detected at 12 of 42 sites)	0.47 (detected at 15 of 32 sites)	0.41 (detected at 15 of 37 sites)	0.38 (detected at 13 of 34 sites)	0.15 (detected at 6 of 39 sites)	0.61 (detected at 27 of 44 sites)
Eq activity	0.03 (32 detections, 1202 trap nights)	0.06 (66 detections, 1120 trap nights)	0.03 (37 detections, 1217 trap nights)	0.07 (81 detections, 1143 trap nights)	0.015 (17 detections, 1143 trap nights)	0.06 (94 detections, 1540 trap nights)
Tasmanian devil occupancy	0.67 (detected at 28 of 42 sites)	0.97 (detected at 31 of 32 sites)	0.78 (detected at 29 of 37 sites)	0.76 (detected at 26 of 34 sites)	0.92 (detected at 36 of 39 sites)	0.98 (detected at 43 of 44 sites)
Devil activity	0.11 (128 detections, 1202 trap nights)	0.21 (234 detections, 1120 trap nights)	0.14 (173 detections, 1217 trap nights)	0.16 (193 detections, 1143 trap nights)	0.32 (360 detections, 1143 trap nights)	0.34 (520 detections, 1540 trap nights)
DFTD status	Unknown	DFTD detected 13% of sites	DFTD detected 3% of sites	DFTD detected 19% of sites	DFTD detected 10% of sites	DFTD detected 27% of sites

Key Findings 2018-19
- 2018-19 monitoring shows relatively stable populations of native carnivores despite annual fluctuations occurring on the reserve. DFTD is persisting in devils at relatively high levels which reflects state-wide findings. Monitoring post fire in 2020 will be important to detect whether devils are stressed due to changes in food supply.
- Eastern quoll declines noted in previous years have improved this year which is re-assuring the species persists on the reserve.
- Spotted-tailed quoll occupancy and activity is steadily improving and the Tasmanian devil continues to be commonly detected.

Recommendations
- Continue monitoring in 2020 to determine impacts of fire

Pest Animal Management

Key Objective
- By 2016 distributions of key feral species have been mapped and management strategies identified.

Status 2018-19 On-track

Strategy Description
The aim of this strategy is to better understand and minimise the impact of pest animals on the natural values of the Reserve. Five Rivers Reserve is bordered by pastoral properties where stock can have negative impacts on wetlands and other sensitive vegetation if unmanaged. Targeted monitoring using camera traps and other methods will identify a baseline measure of population trends and need for control measures. A Feral Animal Management Plan will be prepared to reduce populations of cats, deer and rabbits and also European wasps. This will require input from key organisations including DPIPWE and others.

Fallow deer scat Serpentine 2019. Photo S Bryant

Indicator	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Feral cat occupancy	0.33 (detected at 14 of 42 sites)	0.50 (detected at 16 of 32 sites)	0.32 (detected at 12 of 37 sites)	0.38 (detected at 13 of 34 sites)	0.51 (detected at 20 of 39 sites)	0.41 (detected at 18 of 44 sites)
Cat activity	0.02 (30 detections, 1202 trap nights)	0.03 (29 detections, 1120 trap nights)	0.02 (27 detections, 1217 trap nights)	0.02 (23 detections, 1175 trap nights)	0.04 (47 detections, 1143 trap nights)	0.02 (34 detections, 1540 trap nights)
Rabbit occupancy	0.33 (detected at 14 of 42 sites)	0.50 (detected at 16 of 32 sites)	0.32 (detected at 12 of 37 sites)	0.38 (detected at 13 of 34 sites)	0.13 (detected at 5 of 39 sites)	0.41 (detected at 18 of 44 sites)
Rabbit activity	0.001 (1 detections, 1202 trap nights)	0.007 (8 detections, 1120 trap nights)	0.002 (2 detections, 1217 trap nights)	0.009 (11 detections, 1175 trap nights)	0.005 (6 detections, 1143 trap nights)	0.012 (18 detections, 1540 trap nights)
Fallow deer occupancy	0.07 (detected at 3 of 42 sites)	0.28 (detected at 9 of 32 sites)	0.14 (detected at 5 of 37 sites)	0.21 (detected at 7 of 34 sites)	0.31 (detected at 12 of 39 sites)	0.45 (detected at 20 of 44 sites)
Deer activity	0.01 (11 detections, 1202 trap nights)	0.02 (22 detections, 1120 trap nights)	0.02 (27 detections, 1217 trap nights)	0.01 (15 detections, 1175 trap nights)	0.02 (21 detections, 1143 trap nights)	0.09 (131 detections, 1540 trap nights)
Deer shot	Unknown	9 deer shot	9 deer shot	16 deer shot	12 deer shot	1 deer shot
Stock access	Stock incursions	Stock incursions	Stock incursions	Stock incursions	No stock incursions	No stock incursions

Key Findings 2018-19
- Deer control was not undertaken this year as the reserve was closed due to fire and hazardous trees. Deer management continues in partnership with the Bronte Deer Stalkers but this requires review due to the mis-match in reported numbers and monitoring data. Fallow deer numbers continue to increase annually and high densities were noted immediately post fire on the Serpentine sector near cider gum sites.
- Feral cat monitoring has continued, and trends remain stable with small changes observed.
- We commenced work with UTAS on an ARC linkage grant for a deer management research into browsing and a large number of browsing exclosures have been installed across Five Rivers and Silver Plains.
- James Hattam has joined the DPIPWE Game Management Advisory Group

Recommendations
- Continue to obtain deer tags for Five Rivers Reserve for the 2019-20 season but deer numbers reduced must be managed in relation to experimental data being collected by UTAS.
- Continue monitoring pest species for the 2019-20 season

Weed Management

Key Objective	Status 2018-19
• Existing infestations of weeds are eradicated from the Reserve by 2017	**On-track**

Strategy Description

The aim of this strategy is to control existing infestations of priority weeds on the Five Rivers Reserve. Weed mapping and control has been ongoing since 2010 and is continuing. A weed management strategy has been prepared for TLC's Central Highland properties to ensure that weed management is effective. Monitoring and follow-up control are a key part of the weed management strategy, along with co-operating with neighbours to encourage management of weeds at a regional scale. Hygiene procedures are also critical so no new weed species are introduced to the Reserve.

5 Rivers weeding map 2018. Photo: Phil Laroche

Indicator	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Weed extent	Weeds on roads and disturbed log landings	Weeds on roads and disturbed log landings	Weeds on roads and disturbed log landings	Weeds on roads and disturbed log landings	Weeds on roads and disturbed log landings	Weeds on roads and disturbed log landings
Weed density	Very low	Very low	Very low	Very low	Very low	Very low
Treatment extent	100% of weeds (other than thistles)	100% of weeds (other than thistles)	100% of weeds (other than thistles)	100% of weeds (some thistles treated)	100% of weeds (some thistles treated)	100% of weeds (some thistles treated)

Key Findings 2018-19

- The TLC's Central Highlands weed management strategy has been implemented annually since 2010. This plan encompasses all of the TLC's properties in the Central Highlands, including the Five Rivers Reserve. Annual weed maps and a report of the weed control project were updated in 2018, and shared with key stakeholders (Derwent Catchment NRM and neighbours).
- 3 TLC staff and 11 volunteers completed an 8th consecutive year of weed control across the Five Rivers Reserve in February 2019.
- Overall decrease in quantity of priority weeds (ragwort/mignonette/mullein) found, using numbers of individual observed/treated as the indicator.
- Thistles (Californian and spear) were treated at Skullbone Plains for the fourth consecutive year, and at Viormy West for the second consecutive year, with thistle numbers markedly decreased from previous years.
- Machinery used for road maintenance was cleaned prior to bringing on to the Reserve, ensuring no new weeds were brought into the Reserve.

Recommendations

- Annually update weed mapping and reporting to include the previous season of weed control.
- Continue with annual weed control.
- Revise goal - current goal is overly ambitious and does not prioritise weed species – some weed species do not pose a particular threat to conservation targets or are so established in the region that eradication is not viable or feasible. The TLC's Central Highlands Weed Management Strategy prioritises weed species and sets out goals for management.
- Revise objective and indicators – they are hard to measure at present. Update and revise according to the weeding plan.

Protecting Cultural Heritage

Key Objective

• By 2016, cultural heritage sites are documented and a protection strategy planned.

Strategy Description

Cultural heritage values are an important feature of the landscape, and TLC's management objectives for cultural heritage values are consistent with the Burra Charter. Sites of indigenous cultural significance, and sites and structures from early European settlement are widespread on the Five Rivers Reserve. Features of cultural significance include Aboriginal stone tool scatters, the remnants of trapper's and shepherd's huts, and the remains of old fences. Landscape surveys by cultural heritage officers will increase our knowledge of these values on the Reserve. The remoteness of most sites means that they remain in a relatively undisturbed condition. A range of shepherd huts, boundary fences, cairns and oral histories of the early pioneering days are in various stages of being documented.

Bruce Hay with Five River's original boundary marker lost in the 2019 fire. Photo: S Bryant

Indicator	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Cultural heritage sites mapped and protected	Not commenced	Not commenced	Not commenced	European heritage being documented.	European heritage being documented.	European heritage sites documented
Indigenous heritage better understood	Not commenced	Not commenced	Not commenced	Not commenced	Not commenced	Not commenced

Key Findings 2018-19

• UTAS student project in 2017 recorded an oral history of the changes to the area from key people, including Bruce Hay and David Hean. Mapping is still in progress.

• TLC maintains a good working relationship with the Aboriginal Land Council of Tasmania, the Tasmanian Aboriginal Centre and other Aboriginal groups and seeks to improve our understanding and protection of aboriginal sites.

Recommendations

• Continue to systematically map and document European heritage sites, including finalising mapping of European heritage values, as per Bruce Hay's documents.

• Work with indigenous groups to document and/or protect indigenous heritage values.

• Establish a process to preserve knowledge of the landscape.

• Support the collection of more oral histories in relation to past use and changes in the landscape.

• Support the use of the reserve as a cultural landscape by the Aboriginal community.

Enhance Ecosystem Services

Key Objective	Status: 2018-19
• Ecosystem service derived income supplements reserve costs by 10% annually and our activities are contributing to the local Bronte community	**On-Track**

Strategy Description

Through its activities TLC generates economic benefits to the local Bronte community to enhance its long term vision to support healthy communities underpin healthy landscapes. An ecosystem services framework has been used by TLC as a way to structure thinking around income generation from reserves. By annually recording expenditure related to on-reserve activities (e.g. purchase of food, fuel, accommodation and hire of local contractors) and revenue generated in the local area, we can measure our financial contribution from conservation activities to the local community.

Carbon stocks will need reassessment post the 2019 fire.

Indicator	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19
Income generated from Reserve	Unknown	Unknown	Unknown	$80,870	$81,000 (>10%)	$79,000 (>10%)
TLC expenditure in local community	Unknown	Unknown	Unknown	No data collected	Data not assessed	No assessment

Key Findings 2018-19

• Income derived for Five Rivers Reserve included the sale of carbon credits and commercial use licenses – no deer fees were collected as the reserve was closed due to fires (total $79,000).
• Carbon stocks will need reassessment post the Great Pine Tier fire.
• TLC activities including house rental at Bradys Lakes, fuel and provisions from Bronte and Miena Store, TAFE courses, supporter trips, discovery days and reserve management trips continue to generate economic activity in the Bronte community but no specific measurement is in place as yet.
• TLC activities secured ~ 10% of all of TLC's reserve management costs for this reserve.

Recommendations

• Re-assess carbon stocks post 2019 fire and reporting requirements for carbon credits.
• Continue ecosystem service programs to support management and the local community.