Black-throated Finch habitat values promoted by patchy fire

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Abstract

Fire management is a significant factor in the management of the endangered Black-throated Finch (*Poephila cincta cincta*). Patchy burning soon after wet season rain in Townsville woodlands was found to promote the diversity of grasses and herbs and their seeding, which is thought to provide significant habitat benefits for Black-throated Finches.

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Introduction

The southern subspecies of the Black-throated Finch (*Poephila cincta cincta*) is listed as endangered at a state and national level. It is a granivorous bird, eating the seeds of grasses and herbs, and occasionally other plants such as eucalypts (Meyer & Agnew 2012; Rechetelo *et al.* 2016; Mula Laguna *et al.* 2019). It lives in eucalypt and tea tree woodlands in north and central Queensland, with home ranges typically focused within 15 ha (Rechetelo *et al.* 2016).

As a granivorous species, the Black-throated Finch requires an ongoing supply of grass and herb seeds. Black-throated Finches have been recorded feeding on the seeds of a broad range of grasses and herbs, including some exotic species (Mula Laguna *et al.* 2019). Appendix 1 provides a list of grasses that have been associated with Black-throated Finch presence. In the Townsville region, the finches were found to have a preference for sites with high grass species diversity (Rechetelo 2015). Fire regimes affect grass and herb diversity and the abundance of grass seed, so that information on the influence of burning on grass diversity will benefit the conservation of this species.

The purpose of this study was to evaluate the value of burning immediately after good wet season rain (February 2019) on the ground layer values in Black-throated Finch habitat. Specifically, this study evaluated the patchiness of burning, and plant responses to burning in terms of species richness and seed production. The patchiness of burns and the species richness were evaluated using 1 m^2 quadrats. The influence of burning on flowering and seeding was noted from qualitative observations.

Methods

Site location

The study was undertaken in the Townsville Ring Road Environmental Offset Reserve. This area has been set aside as a reserve because the woodland contains a viable population of Black-throated Finches. The site is located in the Bohle River flood plain, on the western side of Townsville, centred on 19.344° South, 146.663° East.

The site contains a mosaic of Narrow-leafed Ironbark (*Eucalyptus drepanophylla*), Broad-leaved Tea Tree (*Melaleuca viridiflora*) and Poplar Gum (*Eucalyptus platyphylla*) woodlands, dissected by watercourses dominated by Paperbark (*Melaleuca leucadendra)* and Northern Swamp Box (*Lophostemon grandiflorus*). Until recently, the property had been grazed by cattle for many years. It has a history of fairly regular wildfires, which probably explains the abundance of native grasses. Based on fire scar maps developed from satellite imagery (provided by North Australian Fire Information), part or all of the reserve has been burnt six times in twelve years: in 2009, 2011, 2015, 2017, 2019 and 2020.

A total of 964 mm of rain fell across Townsville in February 2019, primarily in the first week of the month, causing flooding in Townsville suburbs (Bureau of Meteorology). The average February rainfall in Townsville is 305 mm. In the last days of February, many small fires were purposely lit by spot ignition in the reserve to promote Black-throated Finch habitat values.

Survey and analyses

To evaluate the role of burning on species richness, visual estimates of the percentage cover of all species were recorded within 1 m^2 quadrats placed on the ground at regular intervals along 25 m and 50 m transects. Sixteen transects were surveyed in both 2017 and 2019, providing pre-burn data in 2017, with quadrats positioned in the same spot each survey to increase their capacity to detect changes. Each of these 16 transects was surveyed using twenty 1 m^2 quadrats. A further 12 transects were surveyed only in 2019. Nine of these 12 transects were surveyed using ten 1 m^2 quadrats, and three with twenty quadrats. Transect surveys were undertaken in May and June 2017 and between April and June 2019.

All survey transects described in this paper were located within a 1.5 km radius of a known Black-throated Finch population. The transects were set up as a rough grid to make sure of a spread across the area, with a few additional scattered transects within the area. The sixteen transects surveyed in both 2017 and 2019 were assessed for the effect of fire on changes in species richness between 2017 to 2019. An analysis of covariance was used to test for differences in species richness between the transects burnt in February 2019 and those that remained unburnt. The 2017 data were used as a covariate in the analysis. Using the 2017 data as a baseline allowed impacts of the fire to be distinguished from between-year variation. The analyses did not include a transect effect because the quadrats were deemed to be regularly spaced across the sampling area. No attempt was made to compare the percentage cover of species between recently burnt and unburnt sites because the surveys occurred soon after burning. All post-fire regenerating plants were naturally smaller than their pre-fire size.

An analysis of variance was used to test for differences between February 2019 burnt and unburnt woodland in the 12 transects surveyed only in 2019.

The patchiness of the February 2019 fires was evaluated using the proportion of 1 m^2 quadrats burnt along transects. We looked at patchiness in two ways: overall landscape patchiness and patchiness within burnt areas. The overall patchiness of the fires was calculated as the proportion of 1 m^2 quadrats burnt in all transects, including those with no fire. The patchiness within burnt areas was calculated as the percentage of quadrats burnt within only the transects that received some fire in February 2019. The latter provides an indication of the fine scale, within-burnt area patchiness.

Results

Species richness

Burning the woodlands in February 2019, following good rainfall, significantly increased the species richness at the 1 m^2 scale. The average species richness per 1 m^2 increased from the 2017 baseline in transects burnt in February 2019 to a significantly greater extent than transects that remained unburnt ($F_{1,256}$ = 40.1; P < 0.0001; Fig. 1). The pattern of significantly higher species richness

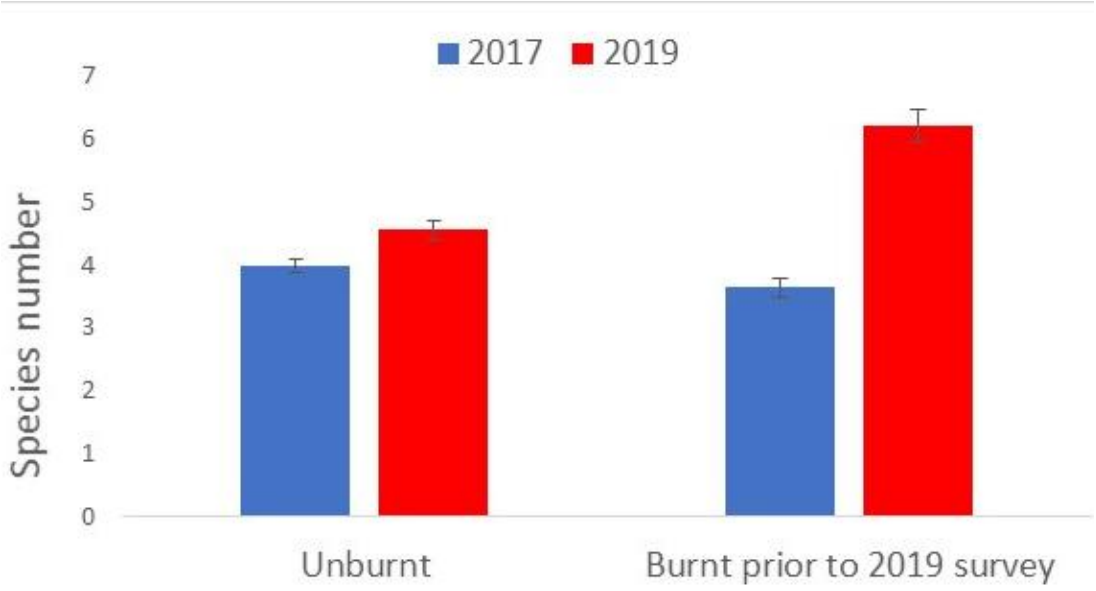

Figure 1. **The change in species richness from baseline surveys (2017) to follow up surveys (2019), between transects burnt prior to the 2019 surveys and those remaining unburnt.**

in recently burnt woodland was repeated in transects only surveyed in 2019 ($F_{1,147}$ = 58.87; P < 0.0001; Fig. 2).

The increase in species richness following the February 2019 fires included the native grasses *Chrysopogon fallax* and *Paspalidium rarum*, but was driven by the addition of many native herbs such as *Evolvulus alsinoides, Galactia tenuiflora, Murdannia graminea* and *Vigna lanceolata*. It was also noted that the exotic *Stylosanthes scabra* and *S. hamata* regenerated after fire only by seedlings, with pre-existing plants fire-killed.

It was observed that many of the grasses and herbs in the woodlands burnt in February 2019 were flowering and seeding during April to June (Table 1). This included *Alloteropsis semialata, Chrysopogon fallax* and *Themeda triandra*. These grasses are known seed food for Black-throated Finches (Appendix 1). Considerably less flowering and seeding was observed in unburnt areas, where almost none of the individual plants of the grasses were flowering or seeding.

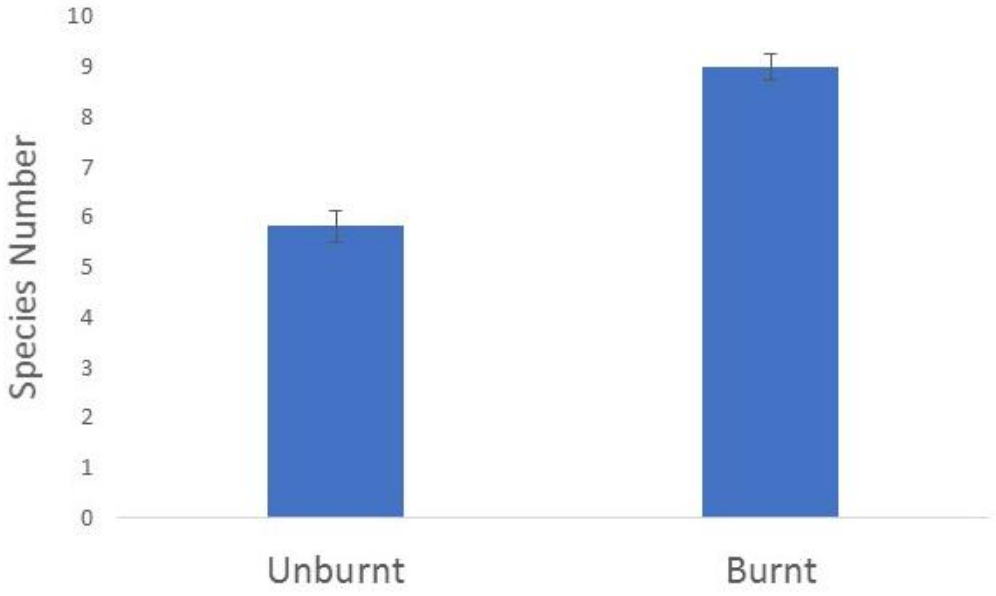

Figure 2. The difference in species richness between recently burnt and unburnt woodlands surveyed only in 2019.

Table 1. Grasses and herbs observed flowering or seeding during the Townsville surveys. * indicates exotic species

Grasses	Herbs
Alloteropsis semialata	*Afrohybanthus enneaspermus*
Aristida sp.	*Brunoniella acaulis*
Bothriochloa bladhii	*Chamaecrista mimosoides*
Chrysopogon fallax	*Commelina diffusa*
Eriachne armitii	*Corchorus aestuans*
Eremochloa bimaculata	*Desmodium gunnii*
Eulalia aurea	*Dianella caerulea*
Heteropogon contortus	*Evolvulus alsinoides*
Heteropogon triticeus	*Fimbristylis* spp.
Ischaemum australe	*Galactia tenuiflora*
*Melinis repens**	*Haemodorum coccineum*
Mnesithea formosa	*Heliotropium tenuifolium*
Panicum decompositum	*Hypericum gramineum*
Paspalidium rarum	*Murdannia graminea*
Pseudopogonatherum contortum	*Phyllanthus virgatus*
Schizachyrium fragile	*Pimelea linifolia*
Setaria surgens	*Polygala parviloba*
*Sporobolus fertilis**	*Rostellularia adscendens*
Themeda triandra	*Spermacoce brachystema*
	*Stylosanthes hamata**
	*Stylosanthes humilis**
	*Stylosanthes scabra**
	Tephrosia filipes
	Tephrosia juncea
	Tricoryne anceps
	Vigna lanceolata
	Waltheria indica
	Zornia dyctiocarpa

Patchiness of fires

Spot burning in February 2019 resulted in many small areas (typically < 2 ha) of woodland burnt, surrounded by unburnt woodland. The overall fire patchiness across the woodland, within a 1.5 km radius of the centre of the Black-throated Finch habitat, resulted in 33% of the ground layer being burnt. Within individual small fire areas, the patchiness was 74% burnt.

Discussion

Patch-burning Black-throated Finch woodland habitat in the Townsville floodplains soon after the first wet season rains increased the diversity of grasses and herbs. This mirrors other studies showing similar trends in other tropical woodlands (e.g. Williams *et al*. 2003). Rechetelo (2015) indicated that Black-throated Finch populations appeared to be attracted to areas of greater grass and herb diversity. This makes sense, as a greater range of ground layer plants is likely to provide more seed. Indeed, it was evident that grasses and herbs were flowering and seeding in the recently burnt woodland but very limited seed was available in nearby unburnt woodland.

Other finches of northern Australia, such as the Gouldian, Masked and Long-tailed Finches, are known to eat seeds of some of the same grasses, such as *Alloteropsis semialata* and *Chrysopogon fallax* (Garnett & Crowley 1994; Dostine & Franklin 2002). Finches of the Northern Territory also take advantage of the greater abundance of seeds from *Sorghum* spp. (Dostine & Franklin 2002); while the greater abundance of annual *Schizachyrium* spp. are important food sources on Cape York Peninsula (Crowley & Garnett 1999).

It has been noticed in other studies that granivorous birds of northern Australia are drawn to foraging in recently burnt areas (Crowley & Garnett 1999). Presumably this is because low intensity late wet and early dry season fires do not consume all grass seeds, while allowing easier access to seed fallen to the ground.

This study also highlights the value of burning soon after wet season rain to promote a patchily burnt landscape. It is recommended that burning for granivorous bird habitat include considerable post-wet season patchy burning, using spot ignition.

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Appendix 1. **Grass species positively associated with foraging Black-throated Finches (BTF).** Negative associations also noted. * indicates an exotic species. † indicates a direct feeding observation. Source: 1, T. Grice personal observation (2019); 2, Mitchell (1996); 3, Rechetelo *et al.* (2016); 4, K. McMahon personal observation (2019).

Scientific name	Common name	Notes	Source
Alloteropsis cimicina			1
Alloteropsis semialata	Cockatoo Grass		1
Aristida spp.	Wiregrasses		1
Bothriochloa spp.	Bluegrasses		1
Chloris spp.	Windmill grasses		1
Dactyloctenium spp.	Button Grass		1
Dichanthium spp.	Bluegrasses		1
Digitaria ciliaris	Summer Grass		2
Digitaria spp.			1
Echinochloa spp.*			1
Echinopogon sp.			1
Eleusine sp.*	Crow's-foot Grass		1
Enteropogon sp.	Curly windmill Grass		1
Eragrostis spp.	Love grasses		1
Eremochloa sp.			1
Eriachne sp.	Wanderrie Grass		1
Eulalia spp.	Silky Browntop		1
Heteropogon contortus	Black Speargrass		1
Ischaemum australe?			1
Ischaemum rugosum			1
*Melinis repens**†	Red Natal Grass	Direct foraging observation	3
Oryza australiensis			1
Panicum spp.*	Panic grasses		1
Paspalidium sp.			1
Paspalum sp.	Paspalum		1
Pseudoraphis spinescens†	Spiny Mud Grass	Direct foraging observation	4
Schizachyrium spp.	Fire Grass		1
Setaria apiculata			1
Setaria surgens	Pigeon Grass		1
Sporobolus spp.			1
*Themeda quadrivalvis**†	Grader Grass	Negatively associated with BTF abundance	3
Themeda triandra	Kangaroo Grass		1
Triodia spp.?	Spinifex		1
*Urochloa mosambicensis**	Sabi Grass		2
Urochloa spp.*			1