

Passerines on Broughton Island

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Surveys on Broughton Island during 2012-2020 found that seven species of passerine were resident on the island or were regular visitors to it: Yellow-faced Honeyeater *Caligavis chrysops*, Australian Raven *Corvus coronoides*, Australasian Pipit *Anthus novaeseelandiae*, Golden-headed Cisticola *Cisticola exilis*, Tawny Grassbird *Cincloramphus timoriensis*, Welcome Swallow *Hirundo neoxena* and Silvereye *Zosterops lateralis*. There were multiple records for four other species, Little Wattlebird *Anthochaera chrysoptera*, Golden Whistler *Pachycephala pectoralis*, Willie Wagtail *Rhipidura leucophrys* and Grey Fantail *R. fuliginosa*, but their status on the island is less clear.

The population of Yellow-faced Honeyeater on the island has been increasing and its distribution has been expanding. The changes were found to be statistically significant at greater than 95% confidence level. In contrast, the population of Golden-headed Cisticola has decreased, with birds now absent or declining from areas where shrub cover has been displacing previous areas of grassland and heath. The changes were found to be statistically highly significant, at greater than 99% confidence level. The changes for both species were associated with an increase in shrub coverage on the island, whereby small to medium-sized shrubs such as Tree Broom Heath *Monotoca elliptica*, Coastal Wattle *Acacia longifolia* and Broad-leaved Paperbark *Melaleuca quinquenervia* have been displacing grasslands and heath.

INTRODUCTION

In 2011 Broughton Island was declared free of feral animals, following a successful program in 2009 to eradicate its populations of Black Rat *Rattus rattus* and Rabbit *Oryctolagus cuniculus* (Priddel *et al.* 2011, Fawcett *et al.* 2016). In mid-2012, a bird monitoring project was initiated jointly by Hunter Bird Observers Club (HBOC) and NSW National Parks and Wildlife Service (NPWS), with initial inputs also from members of the Broughton Island Conservation Society. The focus for the project was to monitor the island's terrestrial bird populations and identify any changes that might occur. In a separate study, NPWS is monitoring the island's seabird population.

Changes in bird populations on Broughton Island were considered likely to happen for two reasons. Black Rat was a known predator for eggs and nestlings; its eradication was expected to improve the success rate for the then-current breeding species and perhaps spur other species to breed. Secondly, in many parts of the island, changes in habitat were expected to occur post-eradication of Rabbit plus from the implementation of new fire management strategies. Such habitat changes were expected would affect bird populations.

The predictions about habitat change are proving to be correct. For example, the extent of shrub cover has increased substantially in the central parts of the island – the heights of small to medium-sized shrubs such as Tree Broom Heath *Monotoca elliptica*, Coastal Wattle *Acacia longifolia* and Broad-leaved Paperbark *Melaleuca quinquenervia* have increased, as has the size of the area with shrubs present (Stuart 2020).

An interim report presented baseline data from surveys carried out during 2012-2016 (Stuart *et al.* 2017). The baseline study identified five main passerine species on the island: Yellow-faced Honeyeater *Caligavis chrysops*, Golden-headed Cisticola *Cisticola exilis*, Tawny Grassbird *Cincloramphus timoriensis*, Welcome Swallow *Hirundo neoxena* and Silvereye *Zosterops lateralis*. In this report, I review the status of those five species and also consider other changes that may be occurring in Broughton Island's passerine populations.

METHODS

Broughton Island terrestrial bird monitoring project

Broughton Island (32° 37'S, 152° 19'E) is located 16 km northeast of the entrance to Port Stephens, and 3.5 km offshore from the adjacent coastline, on the New South Wales central coast (see inset to **Figure 1**). It is part of Myall Lakes National Park. Eleven sites on Broughton Island were surveyed regularly as part of the terrestrial bird monitoring project; however, two of those sites comprised predominantly coastal habitat and thus they were not considered for this report. Of the others, there were six sites with nominal area of 2 ha (sites BT1 to BT6) and three larger sites (BT7 to BT9). General descriptions of all the survey sites have been presented previously (Stuart *et al.* 2017). **Figure 1** shows the locations of the eleven survey sites and indicates the survey routes. From mid-2012 to 2016, the island was surveyed at approximately six-monthly intervals, and approximately quarterly since 2017. The most recent surveys were carried out in late November 2020.

Sites BT1 to BT6 were surveyed using BirdLife Australia's 2-ha survey protocol, in which all species detected within a 20-minute timeframe are recorded (www.birdlife.org.au). Sites BT7 to BT9 were surveyed as 500 m-radius sites, where all species detected were recorded but the survey duration was not fixed and usually it was much longer than 20 minutes. In the Broughton Island monitoring project, the surveys of BT7-BT9 typically spanned 1-2 hours.

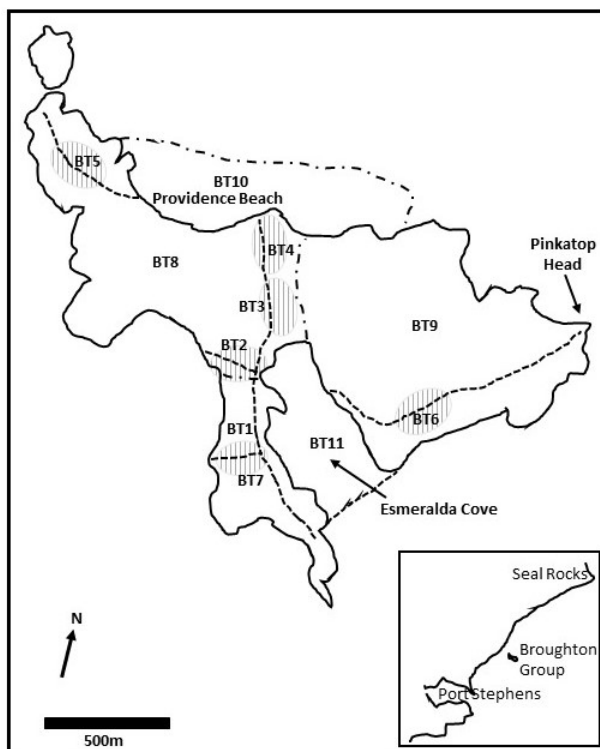


Figure 1. Broughton Island showing the survey areas and indicating the survey routes (Inset: location of the Broughton Group of islands). Modified from Stuart *et al.* (2017).

Data management and data analysis

The records from all surveys were entered into BirdLife Australia's Birddata portal (www.birddata.birdlife.org.au). In February 2021 I downloaded all the results and calculated the Reporting Rate (RR) for each of the five target species at each of the nine survey sites, for two time periods: 2012-2016 and 2017-2020. RR is the number of records for a species divided by number of surveys, expressed as a percentage. I also calculated the RRs for the six 2-ha sites collectively, and for the three 500-m radius sites collectively, for each of the two time periods. In addition, I analysed some subset combinations of sites, whenever that seemed warranted.

The two time periods, 2012-2016 and 2017-2020, were arbitrarily selected although many of the habitat changes began to become more obvious from 2017 onwards. The two time periods also correspond to the initial baseline study period and the start of the subsequent study period.

I used the Pearson's Chi-Square (Goodness-of-Fit) test (Fowler & Cohen 1994) to assess the statistical significance of any differences in the number of records for a species across the two time periods. Calculated Chi-Square values above 3.84 indicate a significant difference in the two data sets, to at least 95% confidence level, while Chi-Square values above 6.63 indicate that the difference is highly significant, to at least 99% confidence level (Fowler & Cohen 1994). Although in this report I usually refer to analysing changes in RR, the Chi-Square test uses raw data (number of surveys, number of records) because the size of the data set is an important factor in the evaluation of statistical significance.

Analysis of the status of Broughton Island's main passerine species has been assisted by including key findings from a bird banding project which commenced in mid-2017. A general description of the methods used in the banding project has been presented previously (Stuart 2020).

RESULTS

Species recorded

Twenty-five species of passerine were recorded on Broughton Island during the HBOC surveys in 2012-2020 (**Table 1**). No additional passerine species were recorded in any of the pre-2012 Birddata surveys. The five most commonly recorded passerines were Yellow-faced Honeyeater, Golden-headed Cisticola, Tawny Grassbird, Welcome Swallow and Silvereye. There also were many records for Australian Raven *Corvus coronoides* and Australasian Pipit *Anthus novaeseelandiae*. For four other species, there were fewer records and the status of each species on Broughton Island is unclear. Thirteen species were vagrants, with

usually only one or two records of them (Spangled Drongo *Dicrurus bracteatus* and Eastern Yellow Robin *Eopsaltria australis* each had three records

but in both cases the three records were from within the same three-day visit by HBOC members).

Table 1. Passerine species recorded during surveys of Broughton Island during 2012-2020, grouped by Reporting Rate ranges (RRs are for 2-ha and 500-m surveys combined).

Status	Common name	Scientific name
Resident or regular visitor (RR above 10%)	Yellow-faced Honeyeater	<i>Caligavis chrysops</i>
	Australian Raven	<i>Corvus coronoides</i>
	Australasian Pipit	<i>Anthus novaeseelandiae</i>
	Tawny Grassbird	<i>Cincloramphus timoriensis</i>
	Golden-headed Cisticola	<i>Cisticola exilis</i>
	Welcome Swallow	<i>Hirundo neoxena</i>
	Silvereeye	<i>Zosterops lateralis</i>
Uncertain (RR 1-10%)	Little Wattlebird	<i>Anthochaera chrysoptera</i>
	Golden Whistler	<i>Pachycephala pectoralis</i>
	Willie Wagtail	<i>Rhipidura leucophrys</i>
	Grey Fantail	<i>Rhipidura fuliginosa</i>
Vagrant (RR below 1%)	Scarlet Honeyeater	<i>Myzomela sanguinolenta</i>
	White-cheeked Honeyeater	<i>Phylidonyris niger</i>
	Spotted Pardalote	<i>Pardalotus punctatus</i>
	White-throated Gerygone	<i>Gerygone olivacea</i>
	Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>
	Olive-backed Oriole	<i>Oriolus sagittatus</i>
	Dusky Woodswallow	<i>Artamus cyanopterus</i>
	Spangled Drongo	<i>Dicrurus bracteatus</i>
	Forest Raven	<i>Corvus tasmanicus</i>
	Rose Robin	<i>Petroica rosea</i>
	Eastern Yellow Robin	<i>Eopsaltria australis</i>
	Mistletoebird	<i>Dicaeum hirundinaceum</i>
	Brown Songlark	<i>Cincloramphus cruralis</i>
Tree Martin	<i>Petrochelidon nigricans</i>	

Comparison of results from the two time periods

Table 2 summarises the results from the surveys for each of the five main passerine species and shows the calculated Chi-Square (χ^2) value from the

comparison of the two time periods, 2012-2016 and 2017-2020. In **Table 2**, all six of the 2-ha sites BT1 to BT6 have been analysed collectively, and similarly all three of the 500-m radius sites BT7 to BT9 were grouped for analysis.

Table 2. The number of surveys and the number of records, and the Reporting Rates, for the five main passerine species on Broughton Island for two time periods, and the calculated Chi-Square values for the comparisons.

Species	Survey type	2012-2016			2017-2020			χ^2 Value
		Surveys	Records	RR (%)	Surveys	Records	RR (%)	
Yellow-faced Honeyeater	2-ha	140	36	25.7	103	23	22.3	0.16
	500-m	69	16	23.2	73	32	43.8	3.88
Golden-headed Cisticola	2-ha	140	115	82.1	103	51	49.5	8.78
	500-m	69	63	91.3	73	62	84.9	0.10
Tawny Grassbird	2-ha	140	109	77.9	103	73	70.9	0.30
	500-m	69	63	91.3	73	67	91.8	0.00
Welcome Swallow	2-ha	140	100	71.4	103	72	69.9	0.00
	500-m	69	55	79.7	73	61	83.6	0.03
Silvereeye	2-ha	140	85	60.7	103	67	65.0	0.12
	500-m	69	58	84.1	73	59	80.8	0.01

The results from the 2-ha surveys suggested that there may have been changes to the Golden-headed Cisticola population on Broughton Island. Thus, the data from the six 2-ha sites were examined

individually plus as grouped subsets of sites: BT1 and BT6; sites BT2 to BT5 collectively; sites BT2 and BT4-BT5 collectively (**Table 3**).

Table 3. The number of surveys and the number of records, and the Reporting Rates, for Golden-headed Cisticola on Broughton Island for two time periods, and the calculated Chi-Square values for the comparisons.

Site/s	2012-2016			2017-2020			χ^2 Value
	Surveys	Records	RR (%)	Surveys	Records	RR (%)	
BT1	26	20	76.9	21	15	71.4	0.00
BT2	26	21	80.8	18	7	38.9	2.31
BT3	25	19	76.0	18	4	22.2	4.70
BT4	26	23	88.5	17	8	47.1	1.90
BT5	20	17	85.0	13	5	38.5	1.91
BT6	17	15	88.2	16	12	75.0	0.05
BT1, BT6	43	35	81.4	37	27	73.0	0.09
BT2-BT5	97	80	82.5	66	24	36.4	12.38
BT2, BT4, BT5	72	61	84.7	48	20	41.7	7.28

Similarly, the results from the 500-m radius surveys suggested that there may have been changes to the Yellow-faced Honeyeater population on Broughton Island. Thus, the data from the three 500-m sites

were examined individually plus as a grouped subset of sites BT7 and BT8 collectively. The details are reported in **Table 4**.

Table 4. The number of surveys and the number of records, and the Reporting Rates, for Yellow-faced Honeyeater on Broughton Island for two time periods, and the calculated Chi-Square values for the comparisons.

Site/s	2012-2016			2017-2020			χ^2 Value
	Surveys	Records	RR (%)	Surveys	Records	RR (%)	
BT7	23	0	0.0	24	5	20.8	3.03
BT8	27	11	40.7	29	24	82.8	3.31
BT9	19	5	26.3	20	3	15.0	0.18
BT7 and BT8	50	11	22.0	53	29	54.7	6.27

DISCUSSION

The most obvious habitat change on Broughton Island has been the increase in shrub cover in the more-sheltered central parts of the island, particularly within site BT8 and the northern section of BT7. Four of the 2-ha sites have been similarly affected: sites BT2 to BT5. The habitats within the two other 2-ha sites, BT1 and BT6, have not substantially changed from when the surveys started in 2012, except that areas of grassland and heath within them have grown slightly taller and/or denser. Similarly, the habitat within the 500-m site BT9 seems not to have substantially changed. All three sites are more exposed to the prevailing winds and the vegetation within them is affected by wind shear.

The habitat changes that have occurred at some of the survey sites, and the lack of substantial change at other sites, seems to have been an important factor affecting changes in the distribution of some

passerine populations on the island, as discussed below.

Yellow-faced Honeyeater

Some Yellow-faced Honeyeater were present on Broughton Island during the inaugural set of HBOC surveys in August 2012 (Stuart *et al.* 2017). At the time, that was understood to be the first record of the species on the island. However, the Birddata archives reveal that two birds were recorded in April 2009 (www.birddata.birdlife.org.au). There are 13 Broughton Island surveys in Birddata for the period 1999 to mid-2012; Yellow-faced Honeyeater was only recorded in the one survey in 2009, which was during the known migration period for this species (Higgins *et al.* 2001).

Since 2012, Yellow-faced Honeyeater has been recorded in every visit by HBOC to Broughton Island for bird surveys and there have been breeding records. The usual estimates have been of a total of

5-10 birds present; however, by June 2020 19 different individuals had been trapped in a bird-banding program which was established in mid-2017, with a 42% re-trap ratio (Stuart 2020). The re-trap ratio suggests a population of 40-50 birds if the entire population was resident on the island. Although the overall numbers have increased in recent years, that size of population of Yellow-faced Honeyeater seems not to be permanently present, based on the estimates of numbers made for each visit. This implies that at least some of the birds move between the island and the mainland. The one-off record in 2009 is a further indication that birds may move to and from the mainland.

The Yellow-faced Honeyeater is a long-distance migratory species (Higgins *et al.* 2001); the journey of a few kilometres between the mainland and Broughton Island would not present a challenge for it.

Initially, Yellow-faced Honeyeater was only recorded in the area immediately adjacent to a large Coastal Banksia *Banksia integrifolia* located within the 2-ha site BT3. The Coastal Banksia also lies within the 500-m radius site BT8. There is clear evidence that the species now uses a larger part of the island than formerly. The RRs in both BT7 and BT8 have increased substantially. Although the changes were not statistically significant at 95% confidence level when the results for each 500-m radius site were considered separately (Chi-Square values of 3.0-3.3), that was largely because of the limited sizes of the data sets. When the results from BT7 and BT8 were analysed together, there was a statistically significant increase in RR for Yellow-faced Honeyeater for the 2017-2020 period, at approximately 98% confident level (Chi-Square 6.27).

The spread of Yellow-faced Honeyeater across a wider area of the island, and the probable rise in its total numbers, seems to be linked with the increased extent of shrub cover in BT8 and the northern section of BT7. In contrast, there has been no significant difference in RR for site BT9, where the habitat has not substantially changed since 2012.

Golden-headed Cisticola

During 2012-2016, the Golden-headed Cisticola was considered to be a common bird of Broughton Island, with an estimated population of 200-400 birds (Stuart *et al.* 2017). There is strong evidence that the population has declined although it remains a common species in large parts of the island. The RRs within four of the 2-ha survey sites have

decreased substantially. The biggest decline has been in site BT3, where the RR dropped from 76.0% for 2012-2016 to 22.2% for 2017-2020. The change is statistically significant, at greater than 95% confidence level (Chi-Square value 4.70). Furthermore, there have been no recent records from BT3; a single bird was recorded there during an October 2019 survey, but in the five subsequent visits to the island for surveys, no Golden-headed Cisticola have been detected in BT3.

Analysing the RR results for the five other 2-ha sites more closely, there is no evidence for substantial changes having occurred in sites BT1 and BT6, both of which largely have retained the habitats that were present in 2012. For sites BT2, BT4 and BT5, the RRs at each site have decreased. Although the changes were not statistically significant at 95% confidence level when the results for each site were considered separately (Chi-Square values of 1.9-2.3), that was largely because of the limited sizes of the data sets. When the results from the three 2-ha sites were analysed together, the RR was found to have dropped from 84.7% to 41.7%; that change was statistically highly significant (Chi-Square value 7.28).

The Golden-headed Cisticola population on Broughton Island has declined in areas where much of the grassland and heath habitat has been overgrown by shrub cover.

Tawny Grassbird

Although, like the Golden-headed Cisticola, the Tawny Grassbird prefers grassland and heath habitat (Higgins *et al.* 2006), there is no evidence for any population change. The RRs in the 500-m radius sites and the 2-ha sites have been stable or perhaps have decreased slightly; however, none of the changes were statistically significant (the Chi-Square values were 0.0-0.3).

Despite the extent of shrub cover having increased in several of the survey sites, the habitat that remains within those sites is a mix of shrubs and grasses/heath. It seems that the Tawny Grassbird is able to sustain in such habitat mixes. In the banding program, almost 40 individuals have been trapped, with many re-traps. That has included regular re-traps of adult birds in and around site BT3.

There is no evidence that the Tawny Grassbird population on Broughton Island has changed or is beginning to change. However, it will be interesting to see what happens in future, if the extent of shrub coverage continues to increase.

Silvereye

From the 2012-2016 surveys, the Silvereye population on Broughton Island was estimated to be 50-100 birds (Stuart *et al.* 2017). It is quite possible that the species had not long arrived on Broughton Island when the HBOC surveys commenced in mid-2012. Of the 13 Broughton Island surveys in Birdata for the period before mid-2012, Silvereye was only recorded twice – in November 2011 and May 2012 (www.birdata.birdlife.org.au). As a generally very active and vocal species, it seems unlikely that it would have been overlooked in the surveys before November 2011 if it were present.

The Silvereye is now the most common species on Broughton Island. Around 550 individual birds have been banded on the island since 2017, with many re-traps (Little *et al.* 2020; Stuart 2020; G. Little pers. comm.). There is a resident or regularly visiting population of subspecies *cornwalli* which swells because of an autumn/winter influx of migratory *westernensis* and *lateralis* subspecies birds and then a spring influx of locally nomadic *cornwalli* birds (Little *et al.* 2020; Stuart 2020). Images taken on Broughton Island of the three Silvereye subspecies are presented in **Figure 2**.



Figure 2. The three Silvereye subspecies on Broughton Island: (Left) *cornwalli* (yellow throat, pale-buff flanks) (Middle) *westernensis* (grey-yellow throat, buff flanks) (Right) *lateralis* (grey throat, deep buff flanks).

The main areas used by Silvereye on Broughton Island are BT8 and the northern parts of BT7, where the extent of shrub coverage has increased the most. However, it is a very mobile species and small flocks have regularly been seen flying to various parts of the island, landing in any available shrubs to rest or to forage. The Chi-Square test suggests there has been no statistically significant change at any of the 2-ha or 500-m sites on the island. Importantly though, the test was based on presence/absence and did not take numbers of birds into account. Although in every survey there is an estimate made of the numbers of birds present, such estimates are very approximate; also, they are subject to variations in observer skill and observer effort (including, differences in the number of

observers). Thus, it is difficult, from the bird surveys alone, to assemble conclusive evidence of an increased population of Silvereye. The bird banding program, which since June 2017 has operated in parallel with the bird surveys, offers important insights. Silvereye have been caught every visit, usually many birds. The re-trap ratio has been modest, which suggests that the size of any resident population must be small. Nevertheless, there have been many re-trapped birds (Stuart 2020).

The Silvereye population on Broughton Island, including resident birds and birds visiting regularly or nomadically, seems to have increased substantially since 2012 and it is now the most common bird species on the island.

Welcome Swallow

The Welcome Swallow has been a common species on Broughton Island over 2012-2021, and with many breeding records. Birds have been recorded regularly in every 2-ha and 500-m terrestrial survey site (i.e. sites BT1 to BT9). There is no evidence to suggest any substantial change in its population. The RRs for the 2-ha sites and the 500-m radius sites have scarcely changed across the two study periods, 2012-2016 and 2017-2020. For such a mobile species which forages aerially, i.e. more or less independently of the habitat below, it seems unsurprising that it has been little impacted from the habitat changes that have been occurring on Broughton Island.

Other passerine species

Australasian Pipit and Australian Raven were recorded in almost every visit and there have been some breeding records. Both species are considered to be resident on Broughton Island, but they have only ever been present in low numbers (estimated at 4-6 birds each) and there were insufficient data for meaningful analysis for changes in their populations. However, both populations appear to be stable.

The Little Wattlebird *Anthochaera chrysoptera* was first recorded on the island in March 2014. There were regular records of 2-4 birds in visits during 2014-2018, and since autumn 2019. However, only one bird was confirmed to be present in January 2019 when conditions on the island were dry and there have not been any breeding records (although evidence of breeding has not been specifically sought). It may be that the Little Wattlebird moves between the mainland and Broughton Island in

response to local conditions. The Little Wattlebird is a common species in coastal heath on the mainland directly opposite Broughton Island (Williams 2020).

Although there have been many records of Willie Wagtail *Rhipidura leucophrys* on Broughton Island over 2012-2020 (and, from before 2012), there also have been frequent absences. This species seems to move between the mainland and the island in response to local conditions.

The first record of a Golden Whistler *Pachycephala pectoralis* on the island was in April 2016. One to two birds were recorded in six of the subsequent field trips but there were several other visits with no records. For example, in 2020 Golden Whistler was only recorded in one of the five field trips, and in only two of the four visits in 2019. There have not been any summer records (in field trips spanning the months November to February). Three of the field trips with records were autumn ones but there have also been two winter records and two records from spring visits. It would be easy to overlook a Golden Whistler if it were inhabiting the dense shrubs in the central parts of the island and not calling. It is unclear as yet whether this species has colonised Broughton Island or if it makes occasional visits from the mainland.

The first records of Grey Fantail *Rhipidura fuliginosa* were in April and September 2013, the only two field trips in that year. There were no more records until April 2016. Since then, 1-2 birds were recorded in six of the subsequent field trips, all of those being autumn or winter ones. It would be easy to overlook a Grey Fantail if it were inhabiting the dense shrubs in the central parts of the island and not calling. It is unclear as yet whether this species has colonised Broughton Island or if it makes occasional visits from the mainland.

CONCLUSIONS

Of the 25 passerine species recorded on Broughton Island, seven species are resident or are regular visitors. An additional four species are often present, but it is not clear whether they are resident on the island or whether they make occasional visits from the mainland.

The population of Yellow-faced Honeyeater on the island has been increasing and its distribution has been expanding. In contrast, the population of

Golden-headed Cisticola has decreased, with birds now absent or declining from some parts of the island. Both of these changes are associated with small to medium-sized shrubs displacing grasslands and heath.

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