

A preliminary bioinventory of the butterflies of Talaroo Station in north Queensland's Einasleigh Uplands

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Abstract

There are few studies of the butterfly fauna of north Queensland's Einasleigh Uplands. We conducted a preliminary bioinventory of the butterflies of Talaroo Station which is 40 kilometres east of Georgetown on the western bank of the Einasleigh River. We detected 40 species, 37 during 26 spot surveys (½ to 3 hours each) and three incidentally. Pieridae, Nymphalidae and Lycaenidae were the best represented families. Records of twelve species represent westward extensions to known ranges into drier country, and three species represent other extensions to known range, confirming that the region is poorly surveyed. The larval food plants of five species are associated with semi-evergreen vine-thickets, small patches (mostly much less than 1 ha) of which occur among rocks in remote and largely inaccessible parts of Talaroo. Further surveys concentrating on these patches, particularly in the wet season, and also surveys of butterfly larvae are likely to yield more butterfly species.

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Introduction

Biodiversity inventories (*bioinventories*) are a key early stage in understanding, managing and conserving ecosystems (Dijkstra 2016). In north Queensland, the Wet Tropics and Cape York Peninsula rainforests have received considerable bioinventory attention (for butterflies, see for instance Moulds & d'Apice 1982; Hill *et al.* 1992; Braby 1995a; Dunn 2006) but the Einasleigh Uplands bioregion very much less so with butterflies an exemplar. Hill *et al.* (1992) recorded 45 species of butterfly in Forty Mile Scrub though the study was not designed to fully sample the area, and Braby (1995b) surveyed satyrine butterflies (Nymphalidae in part) in Queensland

including the Einasleigh Uplands with seven sites in the Georgetown – Mount Surprise area. In the course of a national-level review, collection records and incidental sightings were summarised and the more interesting enumerated by Braby (2000) and these incorporated into subsequent range maps (Braby 2004, 2016). In this paper we report on butterfly bioinventory surveys conducted on Talaroo Station between Georgetown and Mount Surprise in the years 2016 to 2019. We have previously reported the arrival of the Tawny Coster (*Acraea terpsicore*) on the Station (Franklin *et al.* 2017).

Methods

Talaroo Station (18°05'S, 143°52'E, Fig. 1) is a 31,500 hectare pastoral lease now de-stocked and run by the Ewamian Aboriginal Corporation. In 2014 it was formally declared a nature refuge under the *Nature Conservation Act 1992*. It comprises a 28 km frontage to the Einasleigh River with associated riparian vegetation, an undulating plain supporting woodland and open woodland (mostly eucalypt-dominated) on metamorphic, sandsheet and granitic substrates, and an elevated rhyolitic and granitic portion (part of the Newcastle Range) that supports low open eucalypt woodlands and *Acacia* and *Cochlospermum* shrublands. The property ranges from 340 to 500 m above sea level and has a hot, semi-arid tropical climate with a mean annual rainfall of c. 700 mm.

We conducted 26 spot surveys of flying adult butterflies on Talaroo Station and report incidental sightings of additional species. For the purpose of this study, a survey is defined as an attempt to

locate and identify all butterflies in a location on foot and with a butterfly net (to examine smaller, more difficult-to-identify species) lasting at least half an hour. One survey was conducted in May 2016, thirteen in February 2017, seven in March 2017, one in August 2017 and four in April 2019. Our efforts were thus strongly concentrated late in the wet season and early in the dry season at the time of year when we would expect – and general observation suggests – butterfly numbers and diversity to peak. Most were conducted in the heat of the day when butterflies were most active. Twelve surveys were undertaken by a single observer, eleven by two observers, two by three observers and one by five observers; DCF was present in every survey and SCM in twelve. Surveys were distributed widely across accessible parts of the property and the full range of habitats available, and on 16 March 2017 we conducted three surveys in remote areas on the Newcastle Range accessed by helicopter. At the conclusion of each survey we noted an estimate of the numbers



Figure 1. The Einasleigh River with Talaroo Station in the foreground and Van Lee station in the rear. Photo taken by Scott Morrison.

of each species seen in classes of 1–2, 3–5, 6–10, 11–50 and more than 50. Surveys lasted from ½ to about 3 hours (median 1.0 hour), with 3 to 24 species detected (mean 10.6, standard deviation 4.23) and summed abundance scores (see below) from 5 to 57 (mean 22.7, standard deviation 11.10). Unsurprisingly, both the number of species detected and summed abundance scores were positively and strongly correlated with the time spent surveying (for the 21 surveys with a precise measurement of time, Spearman's $r = 0.85$, 0.79 respectively, P both < 0.001).

We provide two measure of abundance for species: the number of surveys in which it was detected, and an abundance index. The index is the sum of abundance class scores from individual surveys numbered 1 to 5 corresponding to the abundance classes in the previous paragraph. These measures come, we freely acknowledge, with substantial caveats relating to the number and skills of observers, habitat, weather, time of day, time of year and year, of which time of year is likely to have the greatest impact.

The accumulation of species richness with the number of surveys was calculated with the order of surveys permuted, and the number of species that would be detected with an infinite number of surveys estimated with five standard non-parametric extrapolators in the software PRIMER v6 (Clarke & Gorley 2006).

Scientific and common names of butterflies follow Braby (2016), as does our checklist order.

Results

We identified 40 butterfly species, 37 during surveys and a further three only incidentally (Table 1). These comprised one species in HesperIIDae, three in Papilionidae, eleven in Pieridae, eleven in Nymphalidae and fourteen in Lycaenidae. Based on both the number of surveys detected and the abundance index, the most common species by a considerable margin were the Black-spotted Grass-blue and Common Crow, whilst other common species based on one measure or the other include Large Grass-yellow, Pale Pea-blue, Macleay's (Pink) Grass-yellow, Common Grass-blue, Clearwing Swallowtail and Caper White (Table 1, where scientific names are provided). The three species recorded only incidentally were Orchard Swallowtail, Copper Jewel and Northern Hairstreak, whilst a further four species (Two-

brand Crow, Blue Tiger, Narrow-winged Pearl-white and Speckled Line-blue) were detected only once (Table 1).

Within the frame of our 26 surveys, a species accumulation curve suggests that few species remain to be detected (Fig. 5), with species richness estimators predicting that from 40 (Chao1 and Chao2) to 43 (Jackknife1 and Jackknife2) species would be detected with comprehensive sampling by the same methods, three to six more than the 37 actually detected.

Discussion

The species accumulation curve (Fig. 5) suggests that few extra species remain to be detected by means of spot surveys of flying adults within our geographic scope. However, this does not mean that the butterfly fauna of Talaroo is completely or adequately surveyed. Additional species might be located outside our main sampling frame by: sampling at different times of the day and year, searching for larvae and pupae of species whose adults are cryptic (Northern Hairstreak was found incidentally solely by this means), and by more extensive sampling of vine-thickets. We anticipate that the last of these options might be particularly productive.

The appropriate term to describe partly deciduous 'forests' with floristic affinities to rainforest is vexed in Australia: we have persisted with the term 'vine-thicket'. On Talaroo they are fairly numerous in tiny patches (mostly much less than 1 ha) amongst granitic and rhyolitic boulders, in ravines and along rocky stream banks (DCF & SCM, personal observations) (Fig. 6). They are mostly in difficult-to-access parts of Talaroo in the Newcastle Range. That these vine-thicket patches might prove productive if surveyed thoroughly in the wet season is hinted by our observation of five butterfly species whose larval food plants occur only in vine-thickets (Table 2). Four of these butterflies were recorded only once, the exception being the Yellow Albatross in three surveys. The most extensive vine-thicket on Talaroo is a narrow band c. 1 km long along a boulder scree at the base of an andesite cliff created by the Einasleigh River in the north of the property. This has not been surveyed for butterflies (or floristically) and can only be accessed by vehicle with difficulty and in the dry season. In a brief visit to areas around it to survey adjacent riparian and woodland vegetation,

Table 1. Butterfly species observed on Talaroo Station.

See Methods and Results for more details of N surveys (there were 26), Abundance index (maximum possible 5 x 26 = 130) and context for Range extension.

Species	Common name	N surveys	Abundance index	Range extension?	Notes
Papilionidae					
<i>Papilio aegaeus</i>	Orchard Swallowtail	0	0	yes	one sighting, 30 Aug. 2017
<i>Papilio demoleus</i>	Chequered Swallowtail	1	1		and incidental, 13 Apr. 2019
<i>Cressida cressida</i>	Clearwing Swallowtail	15	21	see Discus.	
Hesperiidae					
<i>Pelopidas lyelli</i>	Lyell's Swift	4	4	yes	
Pieridae					
<i>Catopsilia pyranthe</i>	White Migrant	2	2		
<i>Catopsilia pomona</i>	Lemon Migrant	11	18		
<i>Catopsilia scylla</i>	Orange Migrant	2	3		
<i>Eurema herla</i>	Macleay's Grass-yellow	13	36		
<i>Eurema smilax</i>	Small Grass-yellow	11	18		
<i>Eurema alitha</i>	Scalloped Grass-yellow	4	11	marginal	
<i>Eurema hecabe</i>	Large Grass-yellow	15	46		
<i>Elodina padusa</i>	Narrow-winged Pearl-white	1	1		
<i>Appias paulina</i>	Yellow Albatross	3	4	yes	
<i>Belenois java</i>	Caper White	14	25		
<i>Cepora perimale</i>	Caper Gull	4	6	yes	
Nymphalidae					
<i>Tirumala hamata</i>	Blue Tiger	1	1	yes	
<i>Danaus petilia</i>	Lesser Wanderer	12	15		
<i>Euploea sylvester</i>	Two-brand Crow	1	1		
<i>Euploea corinna</i>	Common Crow	22	66		
<i>Acraea andromacha</i>	Glasswing	9	14		
<i>Acraea terpsicore</i>	Tawny Coster	11	24	yes *	* see Discussion
<i>Junonia orithya</i>	Blue Argus	11	20		
<i>Junonia villida</i>	Meadow Argus	13	24		
<i>Junonia hedonia</i>	Chocolate Argus	1	1	yes	and incidental, 7 May 2016
<i>Hypolimnas bolina</i>	Varied Eggfly	11	17		
<i>Melanitis leda</i>	Evening Brown	2	2	marginal	and incidental, late April 2017
Lycaenidae					
<i>Hypochrysops apelles</i>	Copper Jewel	0	0	yes	incidental* ¹ (Fig. 2)
<i>Jalmenus eichhornii</i>	Northern Hairstreak	0	0	yes	incidental* ² (Fig. 3)
<i>Candalides erinus</i>	Small Dusky-blue	7	11	yes	
<i>Candalides heathi</i>	Rayed Blue	3	6	see Discus.	February & March 2017; Fig. 4
<i>Catopyrops florinda</i>	Speckled Line-blue	1	2		
<i>Theclinesthes miskini</i>	Wattle Blue	7	11	yes	
<i>Jamides phaseli</i>	Purple Cerulean	4	9		
<i>Catochrysops panormus</i>	Pale Pea-blue	15	39	yes	
<i>Lampides boeticus</i>	Long-tailed Pea-blue	3	4		
<i>Euchrysops cnejus</i>	Spotted Pea-blue	2	3	marginal	
<i>Zizeeria karsandra</i>	Spotted Grass-blue	2	2		
<i>Zizina otis</i>	Common Grass-blue	11	30		
<i>Zizula hylax</i>	Dainty Grass-blue	2	3	yes	
<i>Famegana alsulus</i>	Black-spotted Grass-blue	23	87	yes	

*¹ 25 May 2016 & 30 April 2017

*² caterpillar, 30 April 2017



Figure 2. Female Copper Jewel (*Hypochrysopes apelles*). Photographed at Talaroo, Scott Morrison.



Figure 3. Caterpillar (larva) of the Northern Hairstreak (*Jalmenus eichharnii*) on Umbellata Wattle (*Acacia umbellata*) attended by Northern Meat Ants (*Iridomyrmex sanguineus*).

Acacia umbellata is a new food plant record (cf Braby 2000) for the Northern Hairstreak – previous records are on other species of *Acacia*. Larva identified by Michael Braby (personal communication) as closely matching the species as photographed by him in Forty-mile Scrub (Braby 2016, p27). Although he has not seen the larva of the similar Stencilled Hairstreak (*J. ictinius*) in this area (it is known from Forty-mile Scrub), in southern Australia it is “much darker” whilst on the inland plains of New South Wales it is “green with broad red dorsal band”. Photographed at Talaroo by Scott Morrison.



Figure 4. The Rayed Blue (*Candalides heathi*) was until recently known only from three locations in north Queensland (Braby 2004 cf Braby 2016). Photographed at Talaroo by Don Franklin.

we obtained our only (incidental) sighting at Talaroo of the Orchard Swallowtail. The nearest extensive vine-thickets to Talaroo are on limestone karsts at Chillagoe 120 km to the north-east (Gillieson 2016) and Forty Mile Scrub and Undara 80 to 100 km to the east. It seems likely to us that a number of the 18 butterfly species recorded by Hill *et al.* (1992) at Forty Mile Scrub but not by us at Talaroo, many of which are vine-thicket and/or rainforest specialists, might actually occur at Talaroo.

Vine thickets are neglected ecosystems (Tng *et al.* 2019) with a high level of endemism among plants (Fensham 1995) and a range of rainforest-allied and even endemic butterflies. Those at Talaroo occupy fire-refugial positions in the landscape but many are nevertheless exposed to high intensity fires (personal observations) which present a challenge for management. We believe conservation of these vine-thickets should be a high priority.

When surveying butterflies, there are a number of alternative and additional approaches to spot surveys of adults. Surveys along transects (the “Pollard Walk”; Pollard 1977) are an alternative that optimises comparability over time and space (e.g. Braby 1995a; Franklin 2011). However, they limit spatial coverage to a pre-defined area (our method allows us to ‘follow our nose’) and may restrict ability to net and identify species (Walpole & Sheldon 1999), so are not optimal for basic bioinventory. Baited traps are also often employed

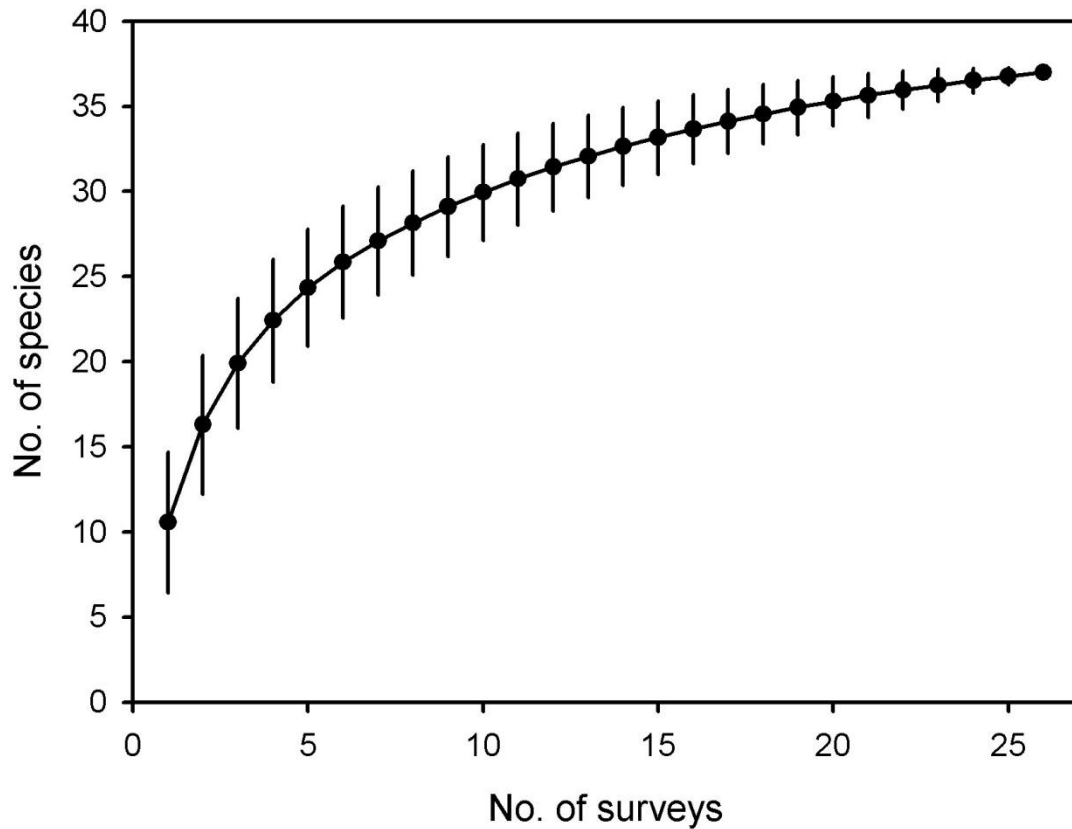


Figure 5. Accumulation curve for the number of species detected with number of surveys. Vertical bars are standard deviations.

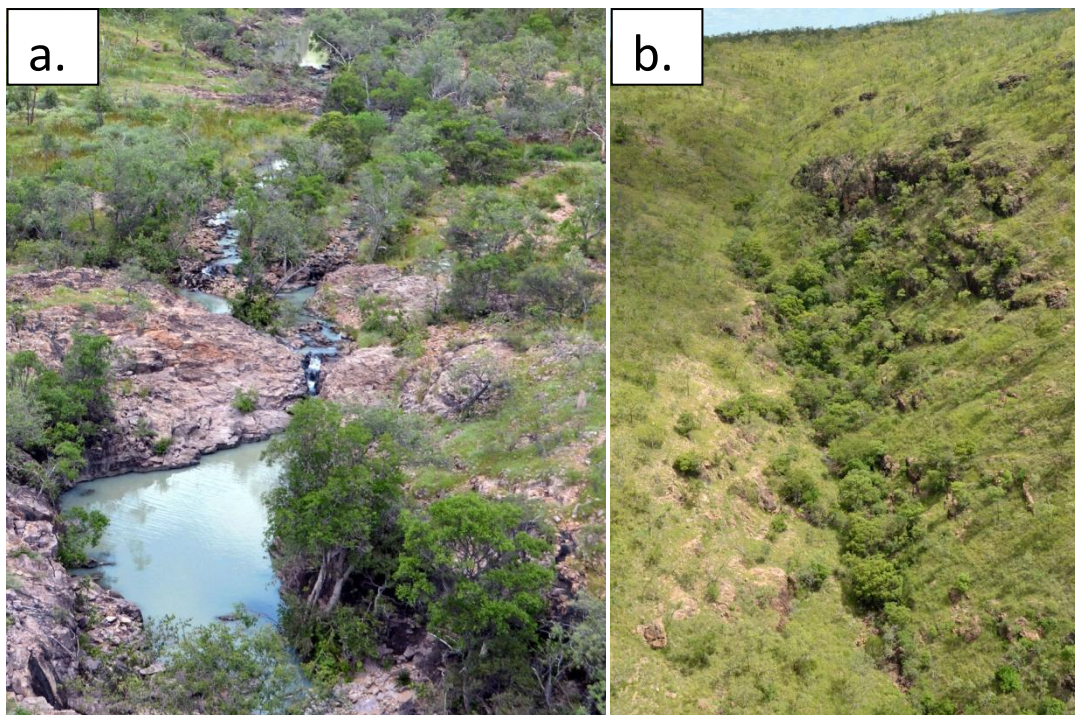


Figure 6. Tiny patches of semi-evergreen vine-thicket growing on rhyolite in the Newcastle Range, Talaroo Station: a. along a seasonal watercourse (photographed in the wet season); and b. in a dry, escarpment ravine. Photos taken by Don Franklin.

Table 2. Butterflies recorded on Talaroo Station that have vine-thicket associated caterpillar food plants.

Food plants are listed for the butterfly by Braby (2000) and recorded on Talaroo Station except as otherwise stated. Plant locations beyond Talaroo were identified using Australia's Virtual Herbarium (<https://avh.chah.org.au/>, checked 4 May 2019).

Butterfly species	Possible food plant at Talaroo
Orchard Swallowtail	None recorded on Talaroo, but a number of food plants occur in Einasleigh Uplands vine-thickets including <i>Flindersia collina</i> (Leopard Wood), <i>Geijera salicifolia</i> (Scrub Wilga) and <i>Zanthoxylum brachycanthum</i> (Thorny Yellowwood) so may well be present
Yellow Albatross	<i>Drypetes deplanchei</i> (Grey Boxwood)
Blue Tiger	None recorded on Talaroo, but <i>Secamone elliptica</i> (Corky Milk Vine) has been recorded in vine-thickets near Mount Surprise so may well be present
Two-brand Crow	<i>Ficus racemosa</i> (Cluster Fig). Further, <i>Marsdenia geminata</i> has been recorded in vine-thickets near Mount Surprise so may well be present
Speckled Line-blue	<i>Trema tomentosa</i> (Poison Peach)

(e.g. Martins *et al.* 2017) and may complement spot or transect surveys (Sparrow *et al.* 1994). Baited traps can be successful for species whose adults feed at soft fruit such as occur mainly in rainforests. However, baited traps are infrequently employed in Australia (see Sambhu *et al.* 2018 for an exception) as this guild of butterflies is not well represented here. Spot surveys for butterfly larvae (caterpillars) are a useful complement to spot surveys for adults but require additional levels of skill (which we do not have) and, often, the facility to raise larvae in captivity to identify subsequent-emerged adults.

Given relatively low and open vegetation, we believe spot surveys of flying adults are appropriate and optimal for preliminary bioinventory of butterflies in northern Australia's more remote pastoral areas. However, they would work much less well in dense or taller forest (Dunn 2006) and can be usefully complemented by surveys for larvae. To our knowledge, the method has no formal description, but detecting flying butterflies in a sample of the range of habitats present with a combination of sighting and netting are commonly employed either alone (e.g. Dunn 2006 in Australia; Mason 2015 in the USA) or in combination with other techniques (e.g. Martins *et al.* 2017 in Brazil).

With so little context available in other studies within the Einasleigh Uplands bioregion, it is

difficult to find useful comparisons to the Talaroo butterfly fauna. In its distribution among families, the butterfly fauna recorded by Hill *et al.* (1992) at Forty Mile Scrub is similar, with species concentrated in Lycaenidae, Nymphalidae and Pieridae. However, only 27 species were recorded in common, likely reflecting both different survey aims and approaches, and differences in habitat. Talaroo is 100 km west of Forty Mile Scrub, has a lower rainfall and is predominantly savanna, whereas Hill's survey was in extensive semi-evergreen vine-thicket. With the exception of the Rayed Blue (see next paragraph), all species we recorded also occur in moister areas to the east towards or on the coast of Queensland's Wet Tropics. However and with the exception of the Northern Hairstreak and Rayed Blue, the Talaroo butterfly fauna is a more substantial subset of that recorded in the tropical savanna region of north-western and northern Australia though not necessarily in the Gulf savannas in-between (Braby *et al.* 2018). The Northern Hairstreak is a species of higher-rainfall parts of Cape York Peninsula that is known south to Forty-mile Scrub (Braby 2000 and references therein).

By comparison with maps in Braby (2016), fourteen species we recorded are extensions to known range and three marginally so (Table 1). A further two species are extensions to known range shown in Braby (2004) but Talaroo is within or at the margin of ranges depicted in updated maps in

Braby (2016). Of the fourteen, twelve are likely to be westward extensions into drier country than previously reported, particularly at Forty Mile Scrub 100 km to the east (e.g. Braby 1997; Hill *et al.* 1992) and possibly also Undara (Peter Valentine, personal communication). Several of these species were common at Talaroo including the most abundant of all butterflies there, the Black-spotted Grass-blue. The exceptions to westward extension are the Tawny Coster and Wattle Blue. Since Braby's (2016) mapping, the Tawny Coster has moved rapidly eastward (Dunn & Petrie 2017; Dunn & Woodger 2017; Field 2017; Franklin *et al.* 2017). Talaroo lies between ranges depicted for subspecies of the Wattle Blue, but the subspecies we recorded could not be identified from a photo we took (Michael Braby, personal communication). As an illustration of a marginal extension to known range, Braby (1995b) reported the Evening Brown at Carpentaria Downs Station which is 80 km south-east of Talaroo and, perhaps not coincidentally, also on the Einasleigh River. Braby's (2016) map marginally includes Talaroo within the distribution of the Rayed Blue though this location is well outside that previously reported. This blue was common (est. 11-50 individuals) in one of our surveys and seen in two others (Fig. 4). One of its larval food plants, the woodland shrub *Eremophila longifolia* (Berrigan/Emu-bush), is widely though sparingly scattered at Talaroo. The other species covered by Braby's updated maps, the Clearwing Swallowtail, is common at Talaroo. Overall, the rate at and ease with which we identified extensions to known ranges demonstrates how poorly surveyed the Einasleigh Uplands are.

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