

Uplands for Juniper Survey – End of Project Report

Summary

The following is a summary of the key findings of the Uplands for Juniper Project.

- The Uplands for Juniper Survey looked at 256 juniper sites between April 2011 and February 2014. 100 of these were ‘new’ sites, not identified in the earlier Centre for Ecology and Hydrology (CEH) survey.
- Juniper populations exceeded 500 bushes at 66 sites and 81 stands measured more than 5 ha in extent, with the majority measuring less than 1 ha (99 sites).
- 186 juniper populations were categorised as expanding (1.6%), stable (38.2%), slow decline (34.4%), fast decline (23.7%), or extinct (2.2%).
- Declining populations (slow and fast combined) comprise 58% of all those analysed.
- The main causes of decline were sheep browsing (48%), shading (13%), and red deer browsing (11%). When sites which weren’t sheep grazed were excluded from the analysis, the proportion in the two declining categories increases to 76.7%, further illustrating the importance of sheep grazing to the health of Cumbrian juniper.

Introduction

The Uplands for Juniper Project began in April 2014, with an aim to survey the entire juniper resource in Cumbria and identify those populations most in need of restoration. Restoration work would then be carried out using Project funding, or by liaison with landowners and Natural England (NE) to complete the work under Higher Level Stewardship (HLS). The previous Cumbrian juniper survey carried out by Lena Ward of CEH (1969 – 1979) was used as a guide to the locations of juniper populations and would also form a potential comparison for the Uplands for Juniper survey.

Survey Design

The aims of the survey were to quantify the Cumbrian juniper resource, to judge the health of juniper populations and to provide a focus for conservation efforts through the identification of priority sites for restoration. Given the large number of sites in Cumbria, volunteer help was essential to the success of the survey, and fortunately 40 volunteers signed up within the first two months of the Project.

With such a large number of surveyors, careful survey design and survey training was essential to ensure that information was collected in a standardised way and so that errors were minimised. Alongside the identification of boundaries and estimates of bush numbers, we asked that additional variables were measured or documented which would allow us to gauge previous and current land management around the juniper and to assess the current health of the juniper population (see Appendix 1 for survey form). Key amongst these was an estimate of age classes present, and their proportions where possible, and a grazing impact assessment, which would assess damage to established bushes, but would also look at grazing impacts on the ground flora which could indicate the likelihood of successful juniper regeneration and establishment.

Given the difficulty of collecting such information, and the potential for observer differences in making estimates, each volunteer had to attend one days training before carrying out surveys independently. Training concentrated on how to identify stand boundaries and how to use handheld GPS to accurately map these boundaries, as well as how to assess bush numbers and to check the accuracy of estimates at different juniper stands. We also looked at how to classify ground flora habitats and plant communities within and around the juniper and how to estimate the age of juniper bushes.

The accuracy of many measurements and estimates would vary according to accessibility, the quality of vantage points, and the growth forms and density of bushes. The application of confidence ratings to estimates of bush numbers (low, medium or high) and to the accuracy of mapped boundaries (1 to 5, with 5 being high accuracy) aimed to make the results more usable and comparable with future and past surveys. Juniper survey guidelines were issued to each surveyor to help maintain good standards of data collection throughout the Project (see Appendix 2 for survey method).

There was little time left within the original training days to look at grazing impacts, so a course was designed and delivered (using Ptixis Ecology) in June 2012, which was attended by 27 volunteers. Grazing impact assessment relied largely upon visible grazing and browsing of a number of indicator species, all of which are relatively unpalatable to sheep and deer. Species included mat grass, *Nardus stricta*, heath rush, *Juncus squarrosus*, ericaceous species and juniper. The method (see Appendix 3) was an adaptation of those described by Macdonald et al (1998), and it's aims were not only to judge grazing impacts within a wider context, but also to provide guidance as to the likelihood of juniper regeneration or damage to established juniper under current grazing regimes.

Survey Results

A total of 256 site surveys were undertaken and given that four of these were null records this gives a total of 252 extant juniper sites in Cumbria. The combined area for these sites was 1773 ha, and the combined population estimates totalled 176961 bushes.

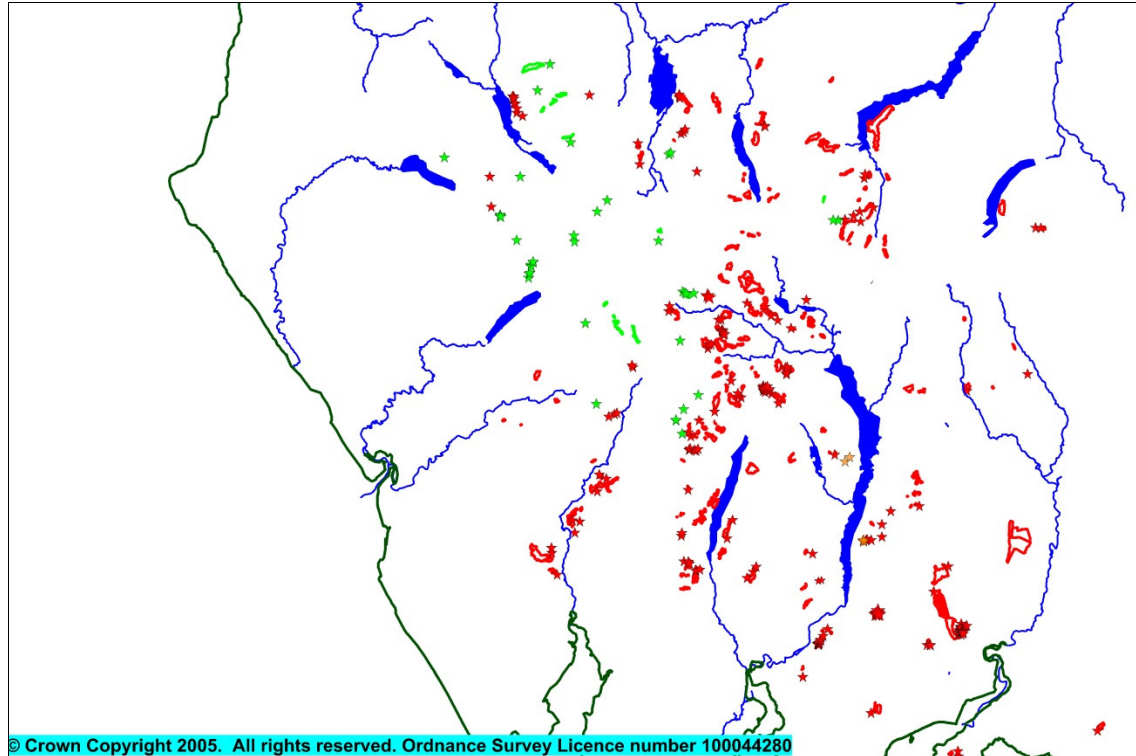
Table 1 shows the proportions of stands within different size categories.

Table 1

Size category	Frequency
<1 ha	94
1 – 5ha	73
5 – 10ha	37
10 – 20ha	25
20 – 50ha	11
50 – 150ha	8
Total	248

The largest surveyed juniper population was at Birk Fell (Ullswater), and at 113.9ha, this may be the biggest continuous area of juniper scrub in England. Most of the larger stands are strung out from Ullswater in the NE Lake District down to Coniston in the SW of the lake District.

Figure 1, Distribution of Cumbrian Juniper.



Green points and polygons = *J.c.nana*. Red points and polygons = *J.c.comm.*

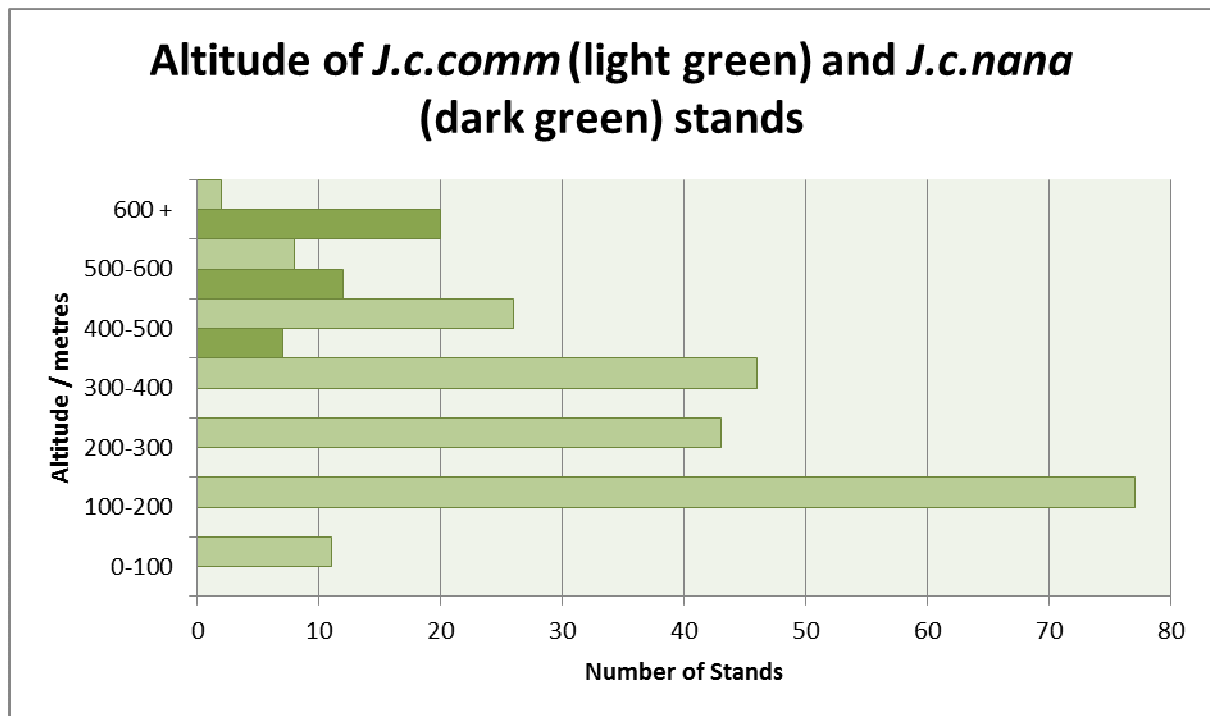
Juniper stands outside of this southwest to northeast band are generally smaller and more distant from neighbouring populations. Some exceptions are the large stands found on outcrops of Morecambe Bay Limestone at Whitbarrow and Scout Scar, with 20000 and 5000 bushes at these sites respectively.

Most of the points shown to the west and north of the main band of juniper are either very small populations of common or tree juniper, *Juniperus communis*, or stands of dwarf juniper, *Juniperus communis nana* (Stands in Green, Figure 1). Some of the latter have substantial numbers of bushes, such as Whiteside (1635 individuals) and the strip of populations from Scar Craggs to Whiteless Edge (700 individuals), forming important outliers of this internationally rare habitat (H15 *Calluna vulgaris-Juniperus communis ssp.nana* heath) outside of its Scottish stronghold (Averis et al, 2004).

Juniper's ability to grow well at high altitudes is illustrated by some stands, such as the rapidly expanding Blea Cove (Glenridding) population, with some young and seedling *J.c.communis* establishing beyond the 660m contour, and some recent regeneration at Stang End (Glenridding) at 580m altitude.

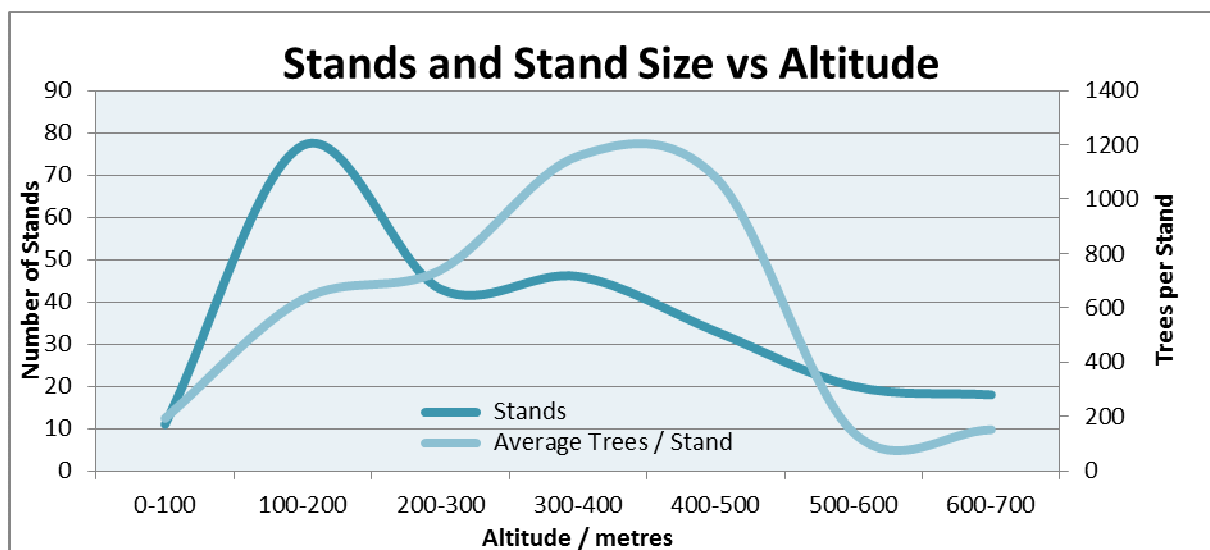
Many Cumbrian populations exist well below their maximum altitudinal limit in the county, with the majority falling within the 100m to 200m band (see Figure 2), illustrating strong dependence on grazing for their continued existence, and possibly for their original establishment.

Figure 2, Average Altitude of juniper stands:



This may be a mis-representation of where Cumbria’s juniper resource lies though, as the larger stands with more trees tend to be at higher altitudes, with a peak in number of bushes per stand between 300m and 500m (see Figure 3). The large number of small stands between 100m and 200m have roughly half the number of trees of the higher altitude stands.

Figure 3, Average No. of bushes vs Altitude:



Aspect:

Figure 4 suggests that aspect of slope is not a strong determinant of juniper presence, as there are a number of juniper stands within each aspect category. There are strong peaks at some aspects though, particularly to the east and south-east. This trend is stronger still when looking at bush numbers rather than stand frequencies against altitude. Figure 5 shows that a large proportion of bushes face between NE and SE. These graphs rely on just half of all bushes counted though, due to the difficulty of assigning a dominant aspect to some stands, and the presence of huge populations on the level plateaus of Scout Scar and Whitbarrow. The spike to the west is partly explained by the influence of the Birk Fell (Ullswater) stand with its 12500 bushes on slopes with a predominant aspect of 270°.

Figure 4:

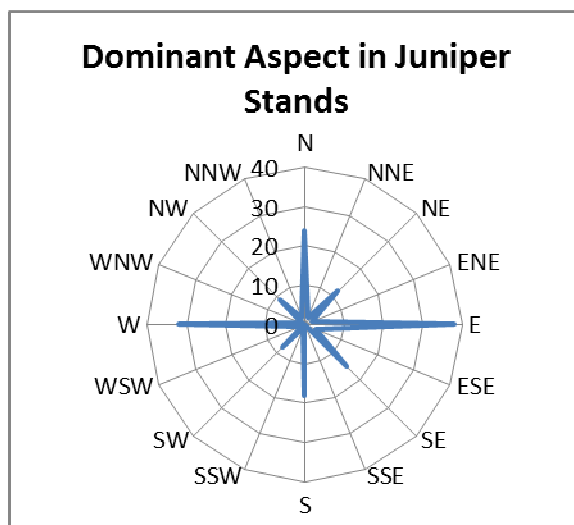
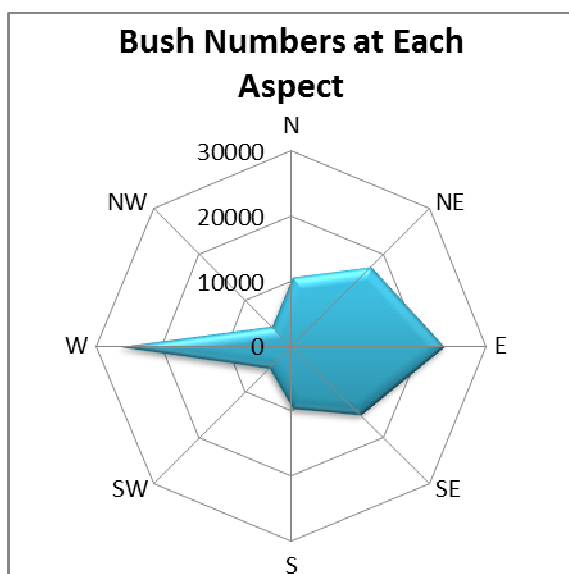


Figure 5:



The easterly bias in juniper stands may be an artefact of the fact that the majority of crags and steeper ground occur on east facing slopes in the Lake District (Pearsall and Pennington, 1973). Such steep slopes host a large proportion of Cumbrian juniper stands, which may be due to partial protection from browsing, burning and harvesting in these locations.

Age classes and Natural Regeneration

Table 2, No. of sites where given age class was recorded.

Age / cond	seedling	young	mature	old	Ill
Number of sites found	82	119	172	191	85

*Note – not all sites were assessed for age classes

The large number of sites with seedlings is surprising given the results of our condition assessment (shown below) but multiple visits to some sites revealed that most seedlings did

not survive the winter due to grazing or uprooting. On a positive note, Cumbrian juniper stands obviously have the ability to expand given suitable grazing regimes.

Additional Survey Observations

The Uplands for Juniper Survey provided an opportunity to look at juniper's palatability relative to other woody species in sheep grazed areas. While other woody species such as heather, bog myrtle, holly, hawthorn and blackthorn were often heavily browsed and pruned, neighbouring juniper were often un-touched until the winter period. A good example of this periodicity in juniper browsing was seen at a Duddon Valley site, where juniper was unbrowsed in January 2013, but had 100% of accessible shoots removed two months later. Livestock's avoidance of established juniper has made it the ideal nursery for other scrub and tree species and at some sites, such as at Whitbarrow and at Ulpha, where the vast majority of tree regeneration was within the protection of old juniper bushes.

Juniper Health

One of the original aims of the Uplands for Juniper Project was to compare recent population estimates with those made by L. Ward (CEH) in the 1960's and 1970's. In reality this was not possible due to differences in methodology which meant that the more recent survey counted many more bushes at stands which were counted from the roadside (using binoculars) in the earlier survey. At many of these stands there was an obvious lack of regeneration in the last 50 years or more, illustrating that observed 'increases' had not occurred during the period between the two surveys.

The information gathered in the Uplands for Juniper survey does allow for an assessment of historical and current conditions and how these have affected regeneration though. 'Age classes present' (and their proportions in a population) is perhaps the most useful information in understanding past and present fortunes of a particular stand, while grazing impact assessment illustrates present conditions and can show whether past trends in a population are likely to change or remain the same.

The following criteria were used to allocate juniper stands to one of five health categories:

Expanding: Populations where both seedling and young juniper are present, showing that the stand has experienced regeneration over a sustained period. These age classes combined make up at least 20% of the population. Grazing impact is 'light,' showing that damaging browsing of seedlings or established bushes is highly unlikely. The proportion of dead and dying trees does not exceed 5%.

Stable: A variety of age classes including seedlings are present showing that bouts of regeneration have occurred over a long period OR seedling and young trees make up at least 10% of the total, due to an improvement in conditions in recent decades. Grazing impact assessment reveals 'light' impacts showing that damaging browsing of seedlings or established bushes is unlikely. The proportion of dead and dying trees does not exceed that of bushes being recruited to the population.

Slow decline: Regeneration is not sufficient to maintain the population. Although young and seedling juniper may be present these do not attain estimable proportions (5%) and grazing impact assessment suggests that small individuals are likely to be damaged or uprooted during winter/ peak grazing periods. Mature bushes are present as well as old, showing some variety in age classes, and the proportion of dead and dying bushes does not

exceed 15% showing that the population could recover if conditions becomes more favourable.

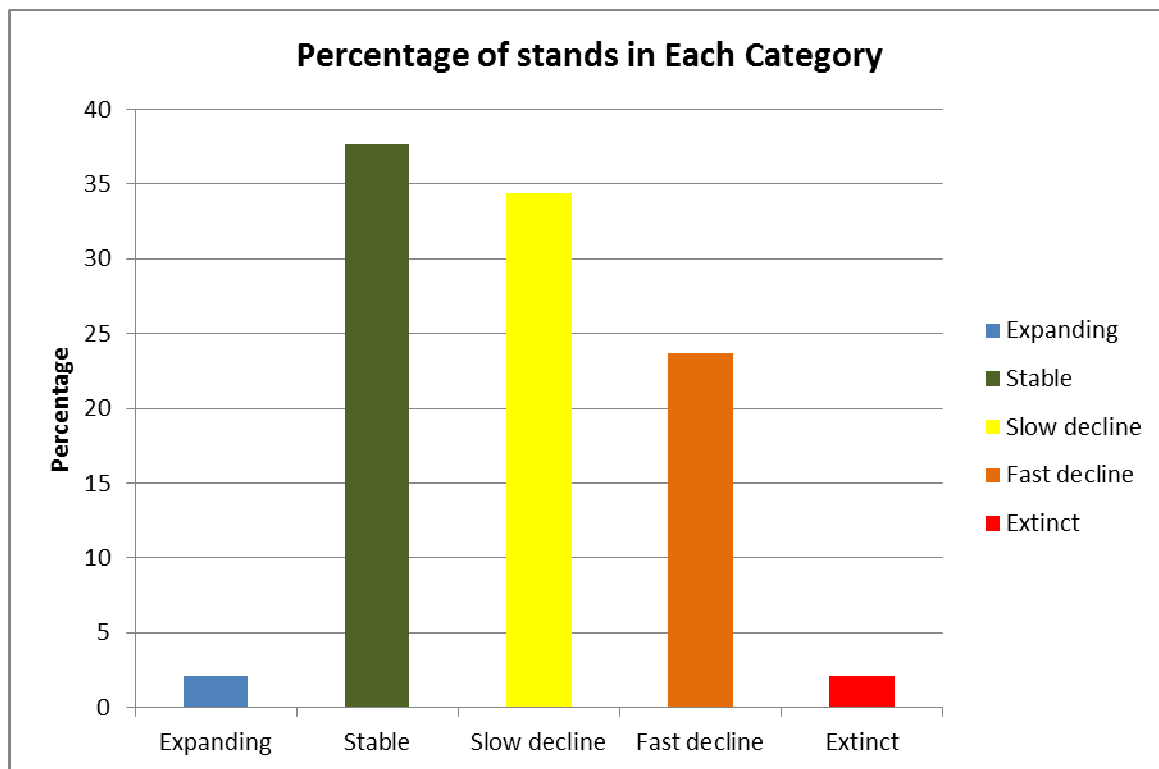
Fast Decline: Very little regeneration within at least the last sixty years and current land management unlikely to result in any change OR despite regeneration within the last 60 years, recent and current impacts high to severe, such that further regeneration is unlikely, and established trees are so badly affected that degeneration occurs and / or reduced reproductive output results.

Causes of decline were then ascertained for the two declining categories.

Health Analysis Results

186 surveyed juniper stands had sufficient data for analysis, and this included most of the larger populations in Cumbria, the results are shown in Figure 6.

Figure 6:



Although 38% (70 stands) of juniper populations fall into the stable category, less than 3% (4 stands) are expanding and 58% (108 stands) fall into the two declining categories (see Table 2).

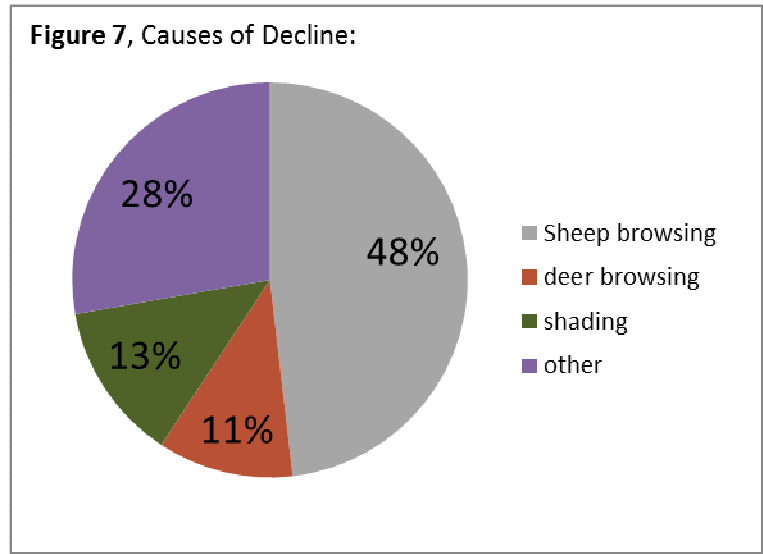
Table 3, No. of stands within each health category:

	Expanding	Stable	Slow decline	Fast decline	Extinct	Total
No. of stands	4	70	64	44	4	186
Percentage	2.15%	37.63%	34.41%	23.66%	2.15%	

The 108 declining stands represent 762.97ha of juniper, or almost 75000 bushes which will require a change of management in coming decades if they are to persist.

Causes of Decline

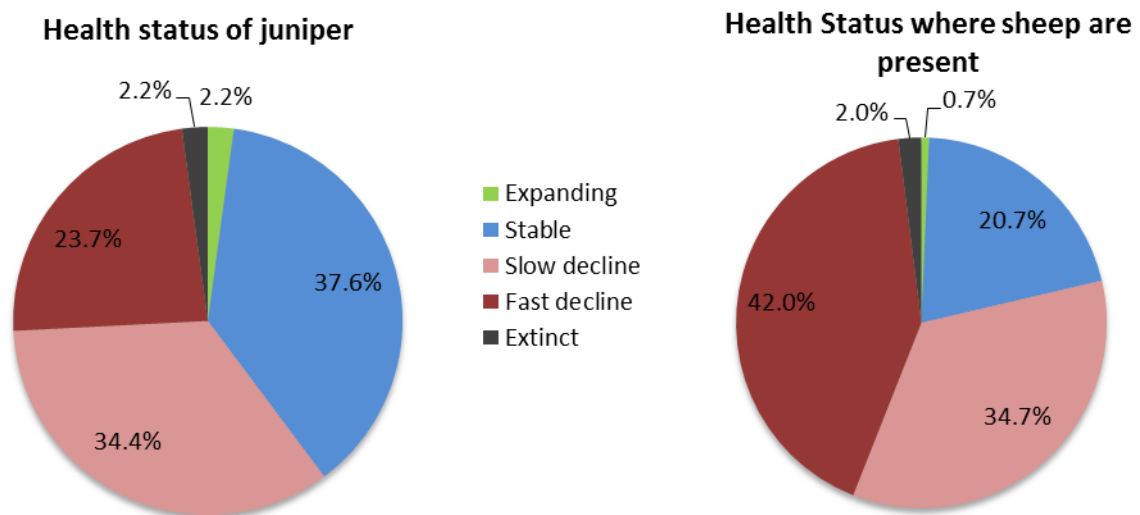
Sheep browsing is the main factor at declining stands in Cumbria, with 48% of stands affected predominantly by sheep. Red deer browsing, affecting 11% of declining stands is a problem for a number of populations, most of which are in the Eastern Lakes, while shading, which is the main factor at 13% of declining stands is predominantly seen in the South Lakes. The large proportion of stands falling into the 'other' category is due to either insufficient data to attribute a cause of decline, or due to a number of different factors being present at the stands in question, with none emerging as more important than the others.



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The importance of sheep in the fortunes of juniper populations is illustrated by the values shown in the pie charts in figure 8. When only those stands open to sheep grazing are assessed, the proportion of stands in the fast decline category jumps from 23.7% to 42%.

Figure 8:



Discussion

The Uplands for Juniper survey has shown that juniper is still an important feature of the Cumbrian Lake District and of some Morecambe Bay limestone sites. The decline of many sites, documented by Lena Ward in the late 1970's (Ward, unpublished) has continued though, despite recent reductions in sheep numbers in The Lake District.

The number of large populations present in the Lake District is unusual in English terms (Ward, 2007), pointing to favourable conditions for this species in previous centuries. One theory for the abundance of juniper sites in the county is that juniper experienced bursts of regeneration during bouts of mining activity, as a result of a temporary reduction in sheep stocking rates (Gilbert, 1980). Our observations suggest that such drastic changes in stocking levels may not have been necessary for regeneration to occur, as the seedlings seen at many sites were likely to survive in the absence of winter browsing. The off-wintering of sheep was more common in previous centuries (Rodgers et al, 2012), and this lack of winter sheep grazing, when combined with a very localised distribution of red deer (Pearsall and Pennington, 1973) in the Lake District would have allowed juniper to thrive in many locations.

The large number of sites with seedlings was surprising given the largely negative condition assessment from our survey data, and given the worries about junipers' powers of regeneration in other parts of the country (Ward, 2007). Cumbria's larger and more densely packed juniper populations are unlikely to be suffering the same pressures as those in southern England, where an observed lack of viable seeds may be due to poor pollination, less frequent cold winters and aging individuals.

Seedlings seen by the author tended to be concentrated around established female bushes, with a 'halo' of seedlings up to ten metres from the berry bearing bush at the most actively regenerating sites. This suggests that birds are the causal agent. Flocks of thrushes seen feeding at juniper during the peak ripening period of late September to mid-October could be important in this respect, and given their ability to cover ground quickly, seedlings may come from parent plants distant from the juniper stand in which they are found.

Other results from the Uplands for Juniper Survey - illustrating that juniper is a livestock resistant species with an ability to grow on slopes of all aspects from near sea level to altitudes of more than 600 metres, raise questions about why juniper is absent from many apparently suitable sites and concerning the decline of many stands. The year round presence of sheep over many decades in the latter half of the twentieth century appears to be a strong factor (Pearsall and Pennington, 1973), and even though stocking rates have reduced in the last two decades (Clothier and Finch, 2010) juniper regeneration is still prevented in many locations.

Our observations of juniper's resistance to browsing and of its value as a nursery for other trees suggest that juniper should figure high on the species list when designing upland scrub and tree planting schemes, as a plant that can thrive and expand alongside more extensive sheep grazing. Such positive land management is now underway in many areas, with juniper planting and sheep stocking reductions resulting from new Higher Level Stewardship (HLS) agreements. Some areas will see complete off-wintering of sheep for a period of ten years, which is likely to result in a burst of regeneration for juniper, as will complete stock exclusion at higher altitudes. The planting of thousands of juniper by the Wild Ennerdale Project and tens of thousands by United Utilities in the Thirlmere and Haweswater

catchments should provide a welcome boost to juniper populations and will create new juniper sites, aiding connectivity between existing stands and juniper dependant fauna.

At this point in time it is difficult to predict how successful HLS will be in countering the decline of juniper, or on the other hand to judge how serious a problem *Phytophthora austrocedrae* could become in the county. The lack of uptake of HLS on the larger Commons in the Lake District could be a problem though, and unless management changes occur soon, important juniper sites could be lost from the central and south-western Lakes in coming decades.

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