



# What Works in Conservation



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EDITED BY

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# 8. SHRUBLAND AND HEATHLAND CONSERVATION

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**Scope of assessment:** for the conservation of shrubland and heathland habitats (not specific species within these habitats).

**Assessed:** 2017.

**Effectiveness measure** is the median % score for effectiveness.

**Certainty measure** is the median % certainty of evidence, determined by the quantity and quality of the evidence in the synopsis.

**Harm measure** is the median % score for negative side-effects on the shrubland and heathland habitats of concern.

This book is meant as a guide to the evidence available for different conservation interventions and as a starting point in assessing their effectiveness. The assessments are based on the available evidence for the target habitat for each intervention. The assessment may therefore refer to different habitat to the one(s) you are considering. Before making any decisions about implementing interventions it is vital that you read the more detailed accounts of the evidence in order to assess their relevance for your study species or system.

Full details of the evidence are available at  
**[www.conservationevidence.com](http://www.conservationevidence.com)**

There may also be significant negative side-effects on the target habitats or other species or communities that have not been identified in this assessment.

A lack of evidence means that we have been unable to assess whether or not an intervention is effective or has any harmful impacts.

# 8.1 Threat: Residential and commercial development

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**Based on the collated evidence, what is the current assessment of the effectiveness of interventions for managing the impacts of residential and commercial development in shrublands and heathlands?**

**No evidence found (no assessment)**

- Remove residential or commercial development
- Maintain/create habitat corridors in developed areas

## **No evidence found (no assessment)**

We have captured no evidence for the following interventions:

- Remove residential or commercial development
- Maintain/create habitat corridors in developed areas.

## 8.2 Threat: Agriculture and aquaculture

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**Based on the collated evidence, what is the current assessment of the effectiveness of interventions for managing the impacts of agriculture and aquaculture in shrublands and heathlands?**

<b>Beneficial</b>	<ul style="list-style-type: none"><li>• Reduce number of livestock</li></ul>
<b>Likely to be beneficial</b>	<ul style="list-style-type: none"><li>• Use fences to exclude livestock from shrublands</li></ul>
<b>Unknown effectiveness (limited evidence)</b>	<ul style="list-style-type: none"><li>• Change type of livestock</li><li>• Shorten the period in which livestock can graze</li></ul>

### Beneficial

#### ● Reduce number of livestock

Two before-and-after trials in the UK and South Africa and one replicated, controlled study in the UK found that reducing or stopping grazing increased the abundance or cover of shrubs. Two site comparison studies in the UK found that cover of common heather declined in sites with high livestock density, but increased in sites with low livestock density. One site comparison study in the Netherlands found that dwarf shrub cover was higher in ungrazed sites. One replicated, randomized, before-and-after study in Spain found that reducing grazing increased the cover of western gorse. One randomized, controlled trial and one before-and-after trial in the USA found that stopping grazing did not increase shrub abundance. One site comparison study in France found that ungrazed sites had higher cover of ericaceous shrubs, but lower cover of non-ericaceous shrubs than grazed



sites. One site comparison study in the UK found that reducing grazing had mixed effects on shrub cover. One replicated, randomized, controlled study in the UK found that reducing grazing increased vegetation height. However, one replicated, controlled, paired, site comparison study in the UK found that reducing grazing led to a reduction in the height of heather plants. Two site comparison studies in France and the Netherlands found that ungrazed sites had a lower number of plant species than grazed sites. One replicated, controlled, paired, site comparison study in Namibia and South Africa found that reducing livestock numbers increased plant cover and the number of plant species. One controlled study in Israel found that reducing grazing increased plant biomass. However, one randomized, site comparison on the island of Gomera, Spain found that reducing grazing did not increase plant cover and one replicated, controlled study in the UK found that the number of plant species did not change. One replicated, controlled study in the UK found no change in the cover of rush or herbaceous species as a result of a reduction in grazing. Two site comparison studies in France and the Netherlands found that grass cover and sedge cover were lower in ungrazed sites than in grazed sites. One randomized, controlled study in the USA found a mixed effect of reducing grazing on grass cover. *Assessment: Beneficial (effectiveness 65%, certainty 70%, harms 10%).*

<https://www.conservationevidence.com/actions/1607>

## Likely to be beneficial

### ● Use fences to exclude livestock from shrublands

Two replicated, controlled, randomized studies (one of which was also a before-and-after trial) and one controlled before-and-after trial in the UK found that using fences to exclude livestock increased shrub cover or abundance. Two replicated, controlled, randomized studies in Germany and the UK found that using fences increased shrub biomass or the biomass and height of individual heather plants. Two controlled studies (one of which was a before-and-after study) in Denmark and the UK found that heather presence or cover was higher in fenced areas than in areas that were not fenced. However, one site comparison study in the USA found that using fences led to decreased cover of woody plants. Three replicated, controlled studies (one of which was a before and after study) in the USA and the UK found that fencing either had a mixed effect on shrub cover or did not alter shrub cover. One randomized, replicated, controlled, paired study in the

UK found that using fences to exclude livestock did not alter the number of plant species, but did increase vegetation height and biomass. One controlled, before-and-after study in the UK found that fenced areas had lower species richness than unfenced areas. One randomized, replicated, controlled, before-and-after trial in the UK and one site comparison study in the USA found that using fences to exclude livestock led to a decline in grass cover. However, four controlled studies (one of which a before-and-after trial) in the USA, the UK, and Finland found that using fences did not alter cover of grass species. One site comparison study in the USA and one replicated, controlled study in the UK recorded an increase in grass cover. One controlled study in Finland found that using fences to exclude livestock did not alter the abundance of herb species and one site comparison in the USA found no difference in forb cover between fenced and unfenced areas. One replicated, controlled study in the USA found fencing had a mixed effect on herb cover. *Assessment: likely to be beneficial (effectiveness 51%; certainty 60%; harms 10%).*

<https://www.conservationevidence.com/actions/1545>

## **Unknown effectiveness (limited evidence)**

### ● **Change type of livestock**

Two replicated, before-and-after studies and one controlled study in Spain and the UK found changing the type of livestock led to mixed effects on shrub cover. However, in two of these studies changing the type of livestock reduced the cover of herbaceous species. One replicated, controlled, before-and-after study in the UK found that grazing with both cattle and sheep, as opposed to grazing with sheep, reduced cover of purple moor grass, but had no effect on four other plant species. *Assessment: unknown effectiveness (effectiveness 40%; certainty 29%; harms 5%).*

<https://www.conservationevidence.com/actions/1608>

### ● **Shorten the period during which livestock can graze**

One replicated, controlled, before-and-after study in the UK found that shortening the period in which livestock can graze had mixed effects on heather, bilberry, crowberry, and grass cover. One replicated, randomized, controlled study in the UK found that grazing in only winter or summer did not affect the heather or grass height compared to year-round grazing. *Assessment: unknown effectiveness (effectiveness 32%; certainty 20%; harms 2%).*

<https://www.conservationevidence.com/actions/1609>

## 8.3 Threat: Energy production and mining

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**Based on the collated evidence, what is the current assessment of the effectiveness of interventions for managing the impacts of energy production and mining in shrublands and heathlands?**

**No evidence found  
(no assessment)**

- Maintain/create habitat corridors in areas of energy production or mining

### **No evidence found (no assessment)**

We have captured no evidence for the following interventions:

- Maintain/create habitat corridors in areas of energy production or mining.

## 8.4 Threat: Biological resource use

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**Based on the collated evidence, what is the current assessment of the effectiveness of interventions for managing the impacts of biological resource use in shrublands and heathlands?**

**No evidence found (no assessment)**

- Legally protect plant species affected by gathering
- Place signs to deter gathering of shrubland species
- Reduce frequency of prescribed burning

### **No evidence found (no assessment)**

We have captured no evidence for the following interventions:

- Legally protect plant species affected by gathering
- Place signs to deter gathering of shrubland species
- Reduce the frequency of prescribed burning.

## 8.5 Threat: Transportation and service corridors

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**Based on the collated evidence, what is the current assessment of the effectiveness of interventions for managing the impacts of transportation and service corridors in shrublands and heathlands?**

**No evidence found (no assessment)**

- Maintain habitat corridors over or under roads and other transportation corridors
- Create buffer zones besides roads and other transportation corridors

### **No evidence found (no assessment)**

We have captured no evidence for the following interventions:

- Maintain habitat corridors over or under roads and other transportation corridors
- Create buffer zones besides roads and other transportation corridors.

## 8.6 Threat: Human intrusions and disturbance

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<b>Based on the collated evidence, what is the current assessment of the effectiveness of interventions for managing the impacts of human intrusions and disturbance in shrublands and heathlands?</b>	
<b>Unknown effectiveness (limited evidence)</b>	<ul style="list-style-type: none"> <li>• Re-route paths to reduce habitat disturbance</li> </ul>
<b>No evidence found (no assessment)</b>	<ul style="list-style-type: none"> <li>• Use signs and access restrictions to reduce disturbance</li> <li>• Plant spiny shrubs to act as barriers to people</li> </ul>

### Unknown effectiveness (limited evidence)

#### ● Re-route paths to reduce habitat disturbance

One before-and-after trial in Australia found that closing paths did not alter shrub cover, but did increase the number of plant species in an alpine shrubland. *Assessment: unknown effectiveness (effectiveness 30%; certainty 10%; harms 0%).*

<https://www.conservationevidence.com/actions/1619>

### No evidence found (no assessment)

We have captured no evidence for the following interventions:

- Use signs and access restrictions to reduce disturbance
- Plant spiny shrubs to act as barriers to people.

## 8.7 Threat: Natural system modifications

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### 8.7.1 Modified fire regime

<b>Based on the collated evidence, what is the current assessment of the effectiveness of interventions for managing the impacts of a modified fire regime in shrublands and heathlands?</b>	
<b>No evidence found (no assessment)</b>	<ul style="list-style-type: none"><li>• Use prescribed burning to mimic natural fire cycle</li><li>• Use prescribed burning to reduce the potential for large wild fires</li><li>• Cut strips of vegetation to reduce the spread of fire</li></ul>

#### **No evidence found (no assessment)**

We have captured no evidence for the following interventions:

- Use prescribed burning to mimic natural fire cycle
- Use prescribed burning to reduce the potential for large wild fires
- Cut strips of vegetation to reduce the spread of fire.

### 8.7.2 Modified vegetation management

<b>Based on the collated evidence, what is the current assessment of the effectiveness of interventions for managing the impacts of a modified vegetation management in shrublands and heathlands?</b>	
<b>Unknown effectiveness (limited evidence)</b>	<ul style="list-style-type: none"><li>• Reinststate the use of traditional burning practices</li><li>• Use cutting/mowing to mimic grazing</li><li>• Increase number of livestock</li></ul>

## Unknown effectiveness (limited evidence)

### ● Reinstating the use of traditional burning practices

One before and after study in the UK found that prescribed burning initially decreased the cover of most plant species, but that their cover subsequently increased. A systematic review of five studies from the UK found that prescribed burning did not alter species diversity. A replicated, controlled study in the UK found that regeneration of heather was similar in cut and burned areas. A systematic review of five studies, from Europe found that prescribed burning did not alter grass cover relative to heather cover. *Assessment: unknown effectiveness (effectiveness 40%; certainty 30%; harms 12%).*

<https://www.conservationevidence.com/actions/1625>

### ● Use cutting/mowing to mimic grazing

One systematic review of three studies in lowland heathland in North Western Europe found that mowing did not alter heather abundance relative to grass abundance. A site comparison in Italy found that mowing increased heather cover. Two replicated, randomized, before-and-after trials in Spain (one of which was controlled) found that using cutting to mimic grazing reduced heather cover. One replicated, randomized, controlled, before-and-after trial in Spain found that cutting increased the number of plant species. However, a replicated, randomized, before-and-after trial found that the number of plant species only increased in a minority of cases. One replicated, randomized, before-and-after trial in Spain found that cutting to mimic grazing increased grass cover. A site comparison in Italy found that mowing increased grass cover. One site comparison study in Italy found a reduction in tree cover. *Assessment: unknown effectiveness (effectiveness 30%; certainty 25%; harms 10%).*

<https://www.conservationevidence.com/actions/1627>

### ● Increase number of livestock

Two site comparison studies in the UK found that cover of common heather declined in sites with a high density of livestock. One site comparison in the Netherlands found that dwarf shrub cover was lower in grazed areas than in ungrazed areas. One before-and-after study in Belgium found that grazing increased cover of heather. One site comparison in France found that areas grazed by cattle had higher cover of non-ericaceous shrubs, but lower cover



of ericaceous shrubs. One before-and-after study in the Netherlands found that increasing the number of livestock resulted in an increase in the number of common heather and cross-leaved heath seedlings. One randomized, replicated, paired, controlled study in the USA found that increasing the number of livestock did not alter shrub cover. One replicated, site comparison study and one before-and-after study in the UK and Netherlands found that increasing grazing had mixed effects on shrub and heather cover. Three site comparisons in France, the Netherlands and Greece found that grazed areas had a higher number of plant species than ungrazed areas. One before-and-after study in Belgium found that the number of plant species did not change after the introduction of grazing. One replicated, before-and-after study in the Netherlands found a decrease in the number of plant species. One before-and-after study in the Netherlands found that increasing the number of livestock resulted in a decrease in vegetation height. One replicated, before-and-after trial in France found that grazing to control native woody species increased vegetation cover in one of five sites but did not increase vegetation cover in four of five sites. A systematic review of four studies in North Western Europe found that increased grazing intensity increased the cover of grass species, relative to heather species. One before-and-after study and two site comparisons in the Netherlands and France found areas with high livestock density had higher grass and sedge cover than ungrazed areas. One randomized, replicated, paired, controlled study in the USA found that increasing the number of livestock reduced grass and herb cover. One before-and-after study in Spain found that increasing the number of ponies in a heathland site reduced grass height. One replicated, site comparison in the UK and one replicated before-and-after study in the Netherlands found that increasing cattle had mixed effects on grass and herbaceous species. *Assessment: unknown effectiveness (effectiveness 30%; certainty 30%; harms 20%).*

<https://www.conservationevidence.com/actions/1628>

## 8.8 Threat: Invasive and other problematic species

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### 8.8.1 Problematic tree species

<b>Based on the collated evidence, what is the current assessment of the effectiveness of interventions for managing the impacts of invasive and other problematic tree species in shrublands and heathlands?</b>	
<b>Unknown effectiveness (limited evidence)</b>	<ul style="list-style-type: none"> <li>• Apply herbicide to trees</li> <li>• Cut trees</li> <li>• Cut trees and remove leaf litter</li> <li>• Cut trees and remove tree seedlings</li> <li>• Use prescribed burning to control trees</li> <li>• Use grazing to control trees</li> <li>• Cut trees and apply herbicide</li> <li>• Cut trees and use prescribed burning</li> <li>• Increase number of livestock and use prescribed burning to control trees</li> </ul>
<b>No evidence found (no assessment)</b>	<ul style="list-style-type: none"> <li>• Mow/cut shrubland to control trees</li> <li>• Cut trees and increase livestock numbers</li> </ul>

#### Unknown effectiveness (limited evidence)

##### ● Apply herbicide to trees

One replicated, controlled, before-and-after study in South Africa found that using herbicide to control trees increased plant diversity but did not increase shrub cover. One randomized, replicated, controlled study in the



UK found that herbicide treatment of trees increased the abundance of common heather seedlings. *Assessment: unknown effectiveness (effectiveness 40%; certainty 35%; harms 10%).*

<https://www.conservationevidence.com/actions/1629>

### ● **Cut trees**

One randomized, replicated, controlled study in the UK found that cutting birch trees increased density of heather seedlings but not that of mature common heather plants. One replicated, controlled study in South Africa found that cutting non-native trees increased herbaceous plant cover but did not increase cover of native woody plants. One site comparison study in South Africa found that cutting non-native Acacia trees reduced shrub and tree cover. *Assessment: unknown effectiveness (effectiveness 37%; certainty 30%; harms 3%).*

<https://www.conservationevidence.com/actions/1630>

### ● **Cut trees and remove leaf litter**

One before-and-after trial in the Netherlands found that cutting trees and removing the litter layer increased the cover of two heather species and of three grass species. *Assessment: unknown effectiveness (effectiveness 45%; certainty 10%; harms 3%).*

<https://www.conservationevidence.com/actions/1631>

### ● **Cut trees and remove seedlings**

A controlled, before-and-after study in South Africa found that cutting orange wattle trees and removing seedlings of the same species increased plant diversity and shrub cover. *Assessment: unknown effectiveness (effectiveness 62%; certainty 20%; harms 0%).*

<https://www.conservationevidence.com/actions/1632>

### ● **Use prescribed burning to control trees**

One randomized, replicated, controlled, before-and-after trial in the USA found that burning to control trees did not change cover of two of three grass species. One randomized, controlled study in Italy found that prescribed burning to control trees reduced cover of common heather, increased cover of purple moor grass, and had mixed effects on the basal area of trees. *Assessment: unknown effectiveness (effectiveness 10%; certainty 20%; harms 22%).*

<https://www.conservationevidence.com/actions/1721>

### ● **Use grazing to control trees**

One randomized, controlled, before-and-after study in Italy found that grazing to reduce tree cover reduced cover of common heather and the basal area of trees, but did not alter cover of purple moor grass. *Assessment: unknown effectiveness (effectiveness 20%; certainty 10%; harms 5%).*

<https://www.conservationevidence.com/actions/1634>

### ● **Cut trees and apply herbicide**

One controlled study in the UK found that cutting trees and applying herbicide increased the abundance of heather seedlings. However, one replicated, controlled study in the UK found that cutting silver birch trees and applying herbicide did not alter cover of common heather when compared to cutting alone. Two controlled studies (one of which was a before-and-after study) in South Africa found that cutting of trees and applying herbicide did not increase shrub cover. Two controlled studies in South Africa found that cutting trees and applying herbicide increased the total number of plant species and plant diversity. One replicated, controlled study in the UK found that cutting and applying herbicide reduced cover of silver birch trees. *Assessment: unknown effectiveness (effectiveness 45%; certainty 35%; harms 3%).*

<https://www.conservationevidence.com/actions/1636>

### ● **Cut trees and use prescribed burning**

One replicated, before-and-after trial in the USA found that cutting western juniper trees and using prescribed burning increased the cover of herbaceous plants. One replicated, randomized, controlled, before-and-after trial in the USA found that cutting western juniper trees and using prescribed burning increased cover of herbaceous plants but had no effect on the cover of most shrubs. One controlled study in South Africa found that cutting followed by prescribed burning reduced the cover of woody plants but did not alter herbaceous cover. *Assessment: unknown effectiveness (effectiveness 40%; certainty 35%; harms 5%).*

<https://www.conservationevidence.com/actions/1637>

### ● **Increase number of livestock and use prescribed burning to control trees**

One randomized, controlled, before-and-after study in Italy found that using prescribed burning and grazing to reduce tree cover reduced the cover of common heather and the basal area of trees. However, it did not alter the



cover of purple moor grass. *Assessment: unknown effectiveness (effectiveness 2%; certainty 12%; harms 12%).*

<https://www.conservationevidence.com/actions/1722>

### No evidence found (no assessment)

We have captured no evidence for the following interventions:

- Cut/mow shrubland to control trees
- Cut trees and increase livestock numbers.

## 8.8.2 Problematic grass species

Based on the collated evidence, what is the current assessment of the effectiveness of interventions for managing the impacts of invasive and other problematic grass species in shrublands and heathlands?	
<b>Unknown effectiveness (limited evidence)</b>	<ul style="list-style-type: none"> <li>• Cut/mow to control grass</li> <li>• Cut/mow to control grass and sow seed of shrubland plants</li> <li>• Rake to control grass</li> <li>• Cut/mow and rotovate to control grass</li> <li>• Apply herbicide and sow seeds of shrubland plants to control grass</li> <li>• Apply herbicide and remove plants to control grass</li> <li>• Use grazing to control grass</li> <li>• Use prescribed burning to control grass</li> <li>• Cut and use prescribed burning to control grass</li> <li>• Use herbicide and prescribed burning to control grass</li> <li>• Strip turf to control grass</li> <li>• Rotovate to control grass</li> <li>• Add mulch to control grass</li> <li>• Add mulch to control grass and sow seed</li> <li>• Cut/mow, rotovate and sow seed to control grass</li> </ul>
<b>Unlikely to be beneficial</b>	<ul style="list-style-type: none"> <li>• Use herbicide to control grass</li> </ul>

## Unknown effectiveness (limited evidence)

### ● **Cut/mow to control grass**

One controlled study in the UK found that mowing increased the number of heathland plants in one of two sites. The same study found that the presence of a small minority of heathland plants increased, but the presence of non-heathland plants did not change. Three replicated, controlled studies in the UK and the USA found that cutting to control grass did not alter cover of common heather or shrub seedling abundance. One replicated, controlled study in the UK found that cutting to control purple moor grass reduced vegetation height, had mixed effects on purple moor grass cover and the number of plant species, and did not alter cover of common heather. Two randomized, controlled studies in the USA found that mowing did not increase the cover of native forb species. Both studies found that mowing reduced grass cover but in one of these studies grass cover recovered over time. One replicated, controlled study in the UK found that mowing did not alter the abundance of wavy hair grass relative to rotovating or cutting turf. *Assessment: unknown effectiveness (effectiveness 22%; certainty 35%; harms 5%).*

<https://www.conservationevidence.com/actions/1638>

### ● **Cut/mow to control grass and sow seed of shrubland plants**

One randomized, replicated, controlled study in the USA found that the biomass of sagebrush plants in areas where grass was cut and seeds sown did not differ from areas where grass was not cut, but seeds were sown. One randomized controlled study in the USA found that cutting grass and sowing seeds increased shrub seedling abundance and reduced grass cover. One randomized, replicated, controlled study in the USA found that sowing seeds and mowing did not change the cover of non-native plants or the number of native plant species. *Assessment: unknown effectiveness (effectiveness 31%; certainty 20%; harms 0%).*

<https://www.conservationevidence.com/actions/1639>

### ● **Rake to control grass**

A randomized, replicated, controlled, paired study in the USA found that cover of both invasive and native grasses, as well as forbs was lower in areas that were raked than in areas that were not raked, but that the number of annual



plants species did not differ. *Assessment: unknown effectiveness (effectiveness 30%; certainty 20%; harms 12%).*

<https://www.conservationevidence.com/actions/1640>

### ● **Cut/mow and rotovate to control grass**

One controlled study in the UK found that mowing followed by rotovating increased the number of heathland plant species in one of two sites. The same study found that the presence of a minority of heathland and non-heathland species increased. *Assessment: unknown effectiveness (effectiveness 22%; certainty 15%; harms 7%).*

<https://www.conservationevidence.com/actions/1641>

### ● **Apply herbicide and sow seeds of shrubland plants to control grass**

One randomized, controlled study in the USA found that areas where herbicide was sprayed and seeds of shrubland species were sown had more shrub seedlings than areas that were not sprayed or sown with seeds. One randomized, replicated, controlled study in the USA found that spraying with herbicide and sowing seeds of shrubland species did not increase the cover of native plant species, but did increase the number of native plant species. One of two studies in the USA found that spraying with herbicide and sowing seeds of shrubland species reduced non-native grass cover. One study in the USA found that applying herbicide and sowing seeds of shrubland species did not reduce the cover of non-native grasses. *Assessment: unknown effectiveness (effectiveness 35%; certainty 30%; harms 0%).*

<https://www.conservationevidence.com/actions/1644>

### ● **Apply herbicide and remove plants to control grass**

One randomized, replicated, controlled, paired study in the USA found that areas sprayed with herbicide and weeded to control non-native grass cover had higher cover of native grasses and forbs than areas that were not sprayed or weeded, but not a higher number of native plant species. The same study found that spraying with herbicide and weeding reduced non-native grass cover. *Assessment: unknown effectiveness (effectiveness 42%; certainty 20%; harms 2%).*

<https://www.conservationevidence.com/actions/1645>

● **Use grazing to control grass**

One replicated, controlled, before-and-after study in the Netherlands found that grazing to reduce grass cover had mixed effects on cover of common heather and cross-leaved heath. One replicated, controlled, before-and-after study in the Netherlands found that cover of wavy-hair grass increased and one before-and-after study in Spain found a reduction in grass height. *Assessment: unknown effectiveness (effectiveness 32%; certainty 17%; harms 10%).*

<https://www.conservationevidence.com/actions/1646>

● **Use prescribed burning to control grass**

One replicated controlled, paired, before-and-after study in the UK found that prescribed burning to reduce the cover of purple moor grass, did not reduce its cover but did reduce the cover of common heather. One randomized, replicated, controlled study in the UK found that prescribed burning initially reduced vegetation height, but this recovered over time. *Assessment: unknown effectiveness (effectiveness 0%; certainty 20%; harms 15%).*

<https://www.conservationevidence.com/actions/1723>

● **Cut and use prescribed burning to control grass**

One randomized, replicated, controlled, paired, before-and-after study in the UK found that burning and cutting to reduce the cover of purple moor grass reduced cover of common heather but did not reduce cover of purple moor grass. *Assessment: unknown effectiveness (effectiveness 0%; certainty 10%; harms 10%).*

<https://www.conservationevidence.com/actions/1724>

● **Use herbicide and prescribed burning to control grass**

One randomized, replicated, controlled, paired, before-and-after study in the UK found that burning and applying herbicide to reduce the cover of purple moor grass reduced cover of common heather but did not reduce cover of purple moor grass. *Assessment: unknown effectiveness (effectiveness 0%; certainty 10%; harms 20%).*

<https://www.conservationevidence.com/actions/1725>

● **Strip turf to control grass**

One controlled study in the UK found that cutting and removing turf increased the number of heathland plants. The same study found that the presence of a



small number of heathland plants increased, and that the presence of a small number of non-heathland plants decreased. One replicated, controlled study in the UK found that presence of heather was similar in areas where turf was cut and areas that were mown or rotovated. One replicated, controlled study in the UK found that the presence of wavy hair grass was similar in areas where turf was cut and those that were mown or rotovated. *Assessment: unknown effectiveness (effectiveness 32%; certainty 25%; harms 2%).*

<https://www.conservationevidence.com/actions/1647>

### ● **Rotovate to control grass**

One replicated, controlled study in the UK found that rotovating did not alter the presence of heather compared to mowing or cutting. The same study found that wavy hair grass presence was not altered by rotovating, relative to areas that were mown or cut. *Assessment: unknown effectiveness (effectiveness 0%; certainty 5%; harms 0%).*

<https://www.conservationevidence.com/actions/1648>

### ● **Add mulch to control grass**

One randomized, controlled study in the USA found that areas where mulch was used to control grass cover had a similar number of shrub seedlings to areas where mulch was not applied. The same study found that mulch application did not reduce grass cover. *Assessment: unknown effectiveness (effectiveness 0%; certainty 10%; harms 0%).*

<https://www.conservationevidence.com/actions/1649>

### ● **Add mulch to control grass and sow seed**

One randomized, controlled study in the USA found that adding mulch, followed by seeding with shrub seeds, increased the seedling abundance of one of seven shrub species but did not reduce grass cover. *Assessment: unknown effectiveness (effectiveness 5%; certainty 7%; harms 0%).*

<https://www.conservationevidence.com/actions/1650>

### ● **Cut/mow, rotovate and sow seeds to control grass**

One replicated, controlled study in the UK found that rotovating did not alter the presence of heather compared to mowing or cutting. The same study found that wavy hair grass presence was not altered by rotovating,

relative to areas that were mown or cut. *Assessment: unknown effectiveness (effectiveness 50%; certainty 12%; harms 1%).*

<https://www.conservationevidence.com/actions/1651>

## Unlikely to be beneficial

### ● Use herbicide to control grass

Two randomized, controlled studies in the UK and the USA found that spraying with herbicide did not affect the number of shrub or heathland plant seedlings. One of these studies found that applying herbicide increased the abundance of one of four heathland plants, but reduced the abundance of one heathland species. However, one randomized, controlled study in the UK found that applying herbicide increased cover of heathland species. One randomized, replicated, controlled study in the UK reported no effect on the cover of common heather. One randomized, replicated study in the UK reported mixed effects of herbicide application on shrub cover. Two randomized, controlled studies in the USA and the UK found that herbicide application did not change the cover of forb species. However, one randomized, controlled, study in the USA found that herbicide application increased native forb cover. Four of five controlled studies (two of which were replicated) in the USA found that grass cover or non-native grass cover were lower in areas where herbicides were used to control grass than areas where herbicide was not used. Two randomized, replicated, controlled studies in the UK found that herbicide reduced cover of purple moor grass, but not cover of three grass/reed species. Two randomized, controlled studies in the UK found that herbicide application did not reduce grass cover. *Assessment: unlikely to be beneficial (effectiveness 32%; certainty 40%; harms 7%).*

<https://www.conservationevidence.com/actions/1643>



### 8.8.3 Bracken

Based on the collated evidence, what is the current assessment of the effectiveness of interventions for managing the impacts of bracken in shrublands and heathlands?	
<b>Unknown effectiveness (limited evidence)</b>	<ul style="list-style-type: none"> <li>• Use herbicide to control bracken</li> <li>• Cut to control bracken</li> <li>• Cut and apply herbicide to control bracken</li> <li>• Cut bracken and rotovate</li> <li>• Use 'bracken bruiser' to control bracken</li> <li>• Use herbicide and remove leaf litter to control bracken</li> </ul>
<b>No evidence found (no assessment)</b>	<ul style="list-style-type: none"> <li>• Cut and burn bracken</li> <li>• Use herbicide and sow seed of shrubland plants to control bracken</li> <li>• Increase grazing intensity to control bracken</li> <li>• Use herbicide and increase livestock numbers to control bracken</li> </ul>

#### Unknown effectiveness (limited evidence)

##### ● Use herbicide to control bracken

One controlled, before-and-after trial in the UK found that applying herbicide to control bracken increased the number of heather seedlings. However, two randomized, controlled studies in the UK found that spraying with herbicide did not increase heather cover. One randomized, controlled study in the UK found that applying herbicide to control bracken increased heather biomass. One replicated, randomized, controlled study in the UK found that the application of herbicide increased the number of plant species in a heathland site. However, one replicated, randomized, controlled study in the UK found that spraying bracken with herbicide had no effect on species richness or diversity. One randomized, controlled study in the UK found that applying herbicide to control bracken increased the cover of wavy hair-grass and sheep's fescue. One controlled study in the UK found that applying herbicide to control bracken increased the cover of gorse and the

abundance of common cow-wheat. One controlled, before-and-after trial in the UK found that the application of herbicide reduced the abundance of bracken but increased the number of silver birch seedlings. Three randomized, controlled studies in the UK found that the application of herbicide reduced the biomass or cover of bracken. However, one controlled study in the UK found that applying herbicide did not change the abundance of bracken. *Assessment: unknown effectiveness (effectiveness 50%; certainty 35%; harms 10%).*

<https://www.conservationevidence.com/actions/1652>

### ● **Cut to control bracken**

One randomized, controlled, before-and-after trial in Norway and one randomized, controlled study in the UK found that cutting bracken increased the cover or biomass of heather. However, two randomized, replicated, controlled studies in the UK found that cutting bracken did not increase heather cover or abundance of heather seedlings. One randomized, replicated, controlled study in the UK found that cutting to control bracken increased the species richness of heathland plant species. However, another randomized, replicated, controlled study in the UK found that cutting to control bracken did not alter species richness but did increase species diversity. One randomized, replicated, controlled study in the UK found that cutting bracken increased cover of wavy hair-grass and sheep's fescue. One controlled study in the UK found that cutting bracken did not increase the abundance of gorse or common cow-wheat. One randomized, controlled, before-and-after trial in Norway and two randomized, controlled studies in the UK found that cutting bracken reduced bracken cover or biomass. One randomized, replicated, controlled, paired study the UK found that cutting had mixed effects on bracken cover. However, one controlled study in the UK found that cutting bracken did not decrease the abundance of bracken. *Assessment: unknown effectiveness (effectiveness 50%; certainty 35%; harms 2%).*

<https://www.conservationevidence.com/actions/1653>

### ● **Cut and apply herbicide to control bracken**

One randomized, controlled study in the UK found that cutting and applying herbicide to control bracken did not alter heather biomass. One randomized, controlled, before-and-after trial in Norway found that cutting and applying herbicide increased heather cover. One randomized, replicated, controlled, paired study in the UK found that cutting and using herbicide had no significant effect on the cover of seven plant species. One replicated, randomized,



controlled study in the UK found that cutting bracken followed by applying herbicide increased plant species richness when compared with applying herbicide followed by cutting. Three randomized, controlled studies (one also a before-and-after trial, and one of which was a paired study) in the UK and Norway found that cutting and applying herbicide reduced bracken biomass or cover. *Assessment: unknown effectiveness (effectiveness 30%; certainty 30%; harms 4%).*

<https://www.conservationevidence.com/actions/1654>

### ● **Cut bracken and rotovate**

One controlled study in the UK found that cutting followed by rotovating to control bracken did not increase total plant biomass or biomass of heather. *Assessment: unknown effectiveness (effectiveness 0%; certainty 10%; harms 0%).*

<https://www.conservationevidence.com/actions/1656>

### ● **Use 'bracken bruiser' to control bracken**

One randomized, replicated, controlled, before-and-after, paired study in the UK found that bracken bruising increased bracken cover, though bracken cover also increased in areas where bracken bruising was not done. There was no effect on the number of plant species or plant diversity. *Assessment: unknown effectiveness (effectiveness 0%; certainty 10%; harms 7%).*

<https://www.conservationevidence.com/actions/1726>

### ● **Use herbicide and remove leaf litter to control bracken**

One randomized, controlled study in the UK found that using herbicide and removing leaf litter did not increase total plant biomass after eight years. The same study found that for three of six years, heather biomass was higher in areas where herbicide was sprayed and leaf litter was removed than in areas that were sprayed with herbicide. *Assessment: unknown effectiveness (effectiveness 27%; certainty 12%; harms 2%).*

<https://www.conservationevidence.com/actions/1660>

## **No evidence found (no assessment)**

We have captured no evidence for the following interventions:

- Cut and burn bracken
- Use herbicide and sow seed of shrubland plants to control bracken

- Increase grazing intensity to control bracken
- Use herbicide and increase livestock numbers to control bracken.

## 8.8.4 Problematic animals

<b>Based on the collated evidence, what is the current assessment of the effectiveness of interventions for managing the impacts of problematic animals in shrublands and heathlands?</b>	
<b>Unknown effectiveness (limited evidence)</b>	<ul style="list-style-type: none"><li>• Use fences to exclude large herbivores</li><li>• Reduce numbers of large herbivores</li></ul>
<b>No evidence found (no assessment)</b>	<ul style="list-style-type: none"><li>• Use biological control to reduce the number of problematic invertebrates</li></ul>

### Unknown effectiveness (limited evidence)

#### ● Use fences to exclude large herbivores

One controlled study in the USA found that using fences to exclude deer increased the height of shrubs, but not shrub cover. *Assessment: unknown effectiveness (effectiveness 7%; certainty 10%; harms 0%).*

<https://www.conservationevidence.com/actions/1662>

#### ● Reduce numbers of large herbivores

One before-and-after trial in the USA found that removing feral sheep, cattle and horses increased shrub cover and reduced grass cover. One replicated study in the UK found that reducing grazing pressure by red deer increased the cover and height of common heather. *Assessment: unknown effectiveness (effectiveness 70%; certainty 30%; harms 0%).*

<https://www.conservationevidence.com/actions/1663>

### No evidence found (no assessment)

We have captured no evidence for the following interventions:

- Use biological control to reduce the number of problematic invertebrates.

## 8.9 Threat: Pollution

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<b>Based on the collated evidence, what is the current assessment of the effectiveness of interventions for managing the impacts of pollution in shrublands and heathlands?</b>	
<b>Unknown effectiveness (limited evidence)</b>	<ul style="list-style-type: none"> <li>• Mow shrubland to reduce impacts of pollutants</li> <li>• Burn shrublands to reduce impacts of pollutants</li> </ul>
<b>No evidence found (no assessment)</b>	<ul style="list-style-type: none"> <li>• Plant vegetation to act as a buffer to exclude vegetation</li> <li>• Reduce pesticide use on nearby agricultural/forestry land</li> <li>• Reduce herbicide use on nearby agricultural/forestry land</li> <li>• Reduce fertilizer use on nearby agricultural/forestry land</li> <li>• Add lime to shrubland to reduce the impacts of sulphur dioxide pollution</li> </ul>

### Unknown effectiveness (limited evidence)

#### ● Mow shrubland to reduce impact of pollutants

One randomized, replicated, controlled study in the UK found that mowing to reduce the impact of nitrogen deposition did not alter shoot length of common heather or the number of purple moor grass seedlings. One controlled study in the UK found that mowing a heathland affected by nitrogen pollution did not alter the cover or shoot length of heather compared to areas where prescribed burning was used. *Assessment: unknown effectiveness (effectiveness 0%; certainty 17%; harms 0%).*

<https://www.conservationevidence.com/actions/1669>

### ● **Burn shrublands to reduce impacts of pollutants**

One randomized, replicated, controlled study in the UK found that prescribed burning to reduce the impact of nitrogen deposition did not alter the shoot length of common heather or the number of purple moor grass seedlings compared to mowing. A controlled study in the UK found that burning to reduce the concentration of pollutants in a heathland affected by nitrogen pollution did not alter the cover or shoot length of heather relative to areas that were mowed. *Assessment: unknown effectiveness (effectiveness 0%; certainty 17%; harms 0%).*

<https://www.conservationevidence.com/actions/1670>

### **No evidence found (no assessment)**

We have captured no evidence for the following interventions:

- Plant vegetation to act as a buffer to exclude vegetation
- Reduce pesticide use on nearby agricultural/forestry land
- Reduce herbicide use on nearby agricultural/forestry land
- Reduce fertilizer use on nearby agricultural/forestry land
- Add lime to shrubland to reduce the impacts of sulphur dioxide pollution.

## 8.10 Threat: Climate change and severe weather

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**Based on the collated evidence, what is the current assessment of the effectiveness of interventions for managing the impacts of climate change and severe weather in shrublands and heathlands?**

**No evidence found (no assessment)**

- Restore habitat in area predicted to have suitable habitat for shrubland species in the future
- Improve connectivity between areas of shrubland to allow species movements and habitat shifts in response to climate change

### **No evidence found (no assessment)**

We have captured no evidence for the following interventions:

- Restore habitat in area predicted to have suitable habitat for shrubland species in the future
- Improve connectivity between areas of shrubland to allow species movements and habitat shifts in response to climate change.

## 8.11 Threat: Habitat protection

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**Based on the collated evidence, what is the current assessment of the effectiveness of interventions for habitat protection in shrublands and heathlands?**

**No evidence found  
(no assessment)**

- Legally protect shrubland
- Legally protect habitat around shrubland

### **No evidence found (no assessment)**

We have captured no evidence for the following interventions:

- Legally protect shrubland
- Legally protect habitat around shrubland.

# 8.12 Habitat restoration and creation

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## 8.12.1 General restoration

<b>Based on the collated evidence, what is the current assessment of the effectiveness of interventions for general restoration of shrubland and heathland habitats?</b>	
<b>Likely to be beneficial</b>	<ul style="list-style-type: none"><li>• Allow shrubland to regenerate without active management</li></ul>
<b>No evidence found (no assessment)</b>	<ul style="list-style-type: none"><li>• Restore/create connectivity between shrublands</li></ul>

### Likely to be beneficial

#### ● Allow shrubland to regenerate without active management

Five before-and-after trials (two of which were replicated) in the USA, UK, and Norway, found that allowing shrubland to recover after fire without any active management increased shrub cover or biomass. One replicated, paired, site comparison in the USA found that sites that were allowed to recover without active restoration had similar shrub cover to unburned areas. One controlled, before-and-after trial in the USA found no increase in shrub cover. One before-and-after trial in Norway found an increase in heather height. One before-and-after trial in Spain found that there was an increase in seedlings for one of three shrub species. Two replicated, randomized, controlled, before-and-after trials in Spain and Portugal found that there was an increase in the cover of woody plant species. One before-and-after

study in Spain found that cover of woody plants increased, but the number of woody plant species did not. One replicated, before-and-after study in South Africa found that the height of three protea species increased after recovery from fire. One before-and-after trial in South Africa found that there was an increase in vegetation cover, but not in the number of plant species. One before-and-after trial in South Africa found an increase in a minority of plant species. Two before-and-after trials in the USA and UK found that allowing shrubland to recover after fire without active management resulted in a decrease in grass cover or biomass. One controlled, before-and-after trial in the USA found an increase in the cover of a minority of grass species. One before-and-after study in Spain found that cover of herbaceous species declined. One replicated, before-and-after study in the UK found mixed effects on cover of wavy hair grass. One controlled, before-and-after trial in the USA found no increase in forb cover. One replicated, randomized, controlled before-and-after trial in Spain found that herb cover declined after allowing recovery of shrubland after fire. *Assessment: likely to be beneficial (effectiveness 62%; certainty 60%; harms 0%).*

<https://www.conservationevidence.com/actions/1679>

## No evidence found (no assessment)

We have captured no evidence for the following interventions:

- Restore/create connectivity between shrublands.

## 8.12.2 Modify physical habitat

<b>Based on the collated evidence, what is the current assessment of the effectiveness of interventions for restoring shrubland and heathland habitats by modifying the physical habitat?</b>	
<b>Likely to be beneficial</b>	<ul style="list-style-type: none"> <li>• Add topsoil</li> </ul>
<b>Unknown effectiveness (limited evidence)</b>	<ul style="list-style-type: none"> <li>• Disturb vegetation</li> <li>• Strip topsoil</li> <li>• Remove leaf litter</li> <li>• Add sulphur to soil</li> </ul>



	<ul style="list-style-type: none"> <li>• Use erosion blankets/mats to aid plant establishment</li> <li>• Add mulch and fertilizer to soil</li> <li>• Add manure to soil</li> <li>• Irrigate degraded shrublands</li> </ul>
<b>No evidence found (no assessment)</b>	<ul style="list-style-type: none"> <li>• Remove trees/crops to restore shrubland structure</li> <li>• Remove trees, leaf litter and topsoil</li> <li>• Add peat to soil</li> <li>• Burn leaf litter</li> </ul>

### Likely to be beneficial

#### ● Add topsoil

Two randomized, controlled studies in the UK found that the addition of topsoil increased the cover or abundance of heathland plant species. One replicated, site comparison in Spain found an increase in the abundance of woody plants. One randomized, controlled study in the UK found an increase in the number of seedlings for a majority of heathland plants. One controlled study in Namibia found that addition of topsoil increased plant cover and the number of plant species, but that these were lower than at a nearby undisturbed site. One randomized, controlled study in the UK found an increase in the cover of forbs but a reduction in the cover of grasses. *Assessment: likely to be beneficial (effectiveness 67%; certainty 45%; harms 0%).*

<https://www.conservationevidence.com/actions/1686>

### Unknown effectiveness (limited evidence)

#### ● Disturb vegetation

One randomized, replicated, controlled study in the UK found that vegetation disturbance did not increase the abundance or species richness of specialist plants but increased the abundance of generalist plants. *Assessment: unknown effectiveness (effectiveness 0%; certainty 10%; harms 7%).*

<https://www.conservationevidence.com/actions/1727>

### ● **Strip topsoil**

Two randomized, replicated, controlled studies in the UK found that removal of topsoil did not increase heather cover or cover of heathland species. However, one controlled study in the UK found an increase in heather cover. One randomized, replicated, controlled study in the UK found that removing topsoil increased the cover of both specialist and generalist plant species, but did not increase species richness. One randomized, replicated, paired, controlled study in the UK found that removal of topsoil increased cover of annual grasses but led to a decrease in the cover of perennial grasses. One controlled study in the UK found that removal of turf reduced cover of wavy hair grass. One controlled, before-and-after trial in the UK found that stripping surface layers of soil increased the cover of gorse and sheep's sorrel as well as the number of plant species. *Assessment: unknown effectiveness (effectiveness 30%; certainty 25%; harms 3%).*

<https://www.conservationevidence.com/actions/1685>

### ● **Remove leaf litter**

One randomized, controlled study in the UK found that removing leaf litter did not alter the presence of heather. *Assessment: unknown effectiveness (effectiveness 0%; certainty 10%; harms 0%).*

<https://www.conservationevidence.com/actions/1688>

### ● **Add sulphur to soil**

One randomized, replicated, controlled study in the UK found that adding sulphur to the soil of a former agricultural field did not increase the number of heather seedlings in five of six cases. *Assessment: unknown effectiveness (effectiveness 2%; certainty 10%; harms 0%).*

<https://www.conservationevidence.com/actions/1691>

### ● **Use erosion blankets/mats to aid plant establishment**

One replicated, randomized, controlled study in the USA found that using an erosion control blanket increased the height of two shrub species. One replicated, randomized, controlled study in the USA did not find an increase in the number of shrub species, but one controlled study in China did find an increase in plant diversity following the use of erosion control blankets. The same study found an increase in plant biomass and cover. *Assessment: unknown effectiveness (effectiveness 30%; certainty 20%; harms 0%).*

<https://www.conservationevidence.com/actions/1692>



### ● Add mulch and fertilizer to soil

One randomized, controlled study in the USA found that adding mulch and fertilizer did not increase the seedling abundance of seven shrub species. The same study also reported no change in grass cover. *Assessment: unknown effectiveness (effectiveness 0%; certainty 10%; harms 0%).*

<https://www.conservationevidence.com/actions/1694>

### ● Add manure to soil

One replicated, randomized, controlled study in South Africa found that adding manure increased plant cover and the number of plant species. *Assessment: unknown effectiveness (effectiveness 30%; certainty 10%; harms 0%).*

<https://www.conservationevidence.com/actions/1695>

### ● Irrigate degraded shrublands

One replicated, randomized, controlled study at two sites in USA found that temporary irrigation increased shrub cover. *Assessment: unknown effectiveness (effectiveness 30%; certainty 10%; harms 0%).*

<https://www.conservationevidence.com/actions/1696>

## No evidence found (no assessment)

We have captured no evidence for the following interventions:

- Remove trees/crops to restore shrubland structure
- Remove trees, leaf litter and topsoil
- Add peat to soil
- Burn leaf litter.

### 8.12.3 Introduce vegetation or seeds

<b>Based on the collated evidence, what is the current assessment of the effectiveness of interventions for restoring shrubland and heathland habitats by introducing vegetation or seeds?</b>	
<b>Beneficial</b>	<ul style="list-style-type: none"> <li>• Sow seeds</li> </ul>
<b>Unknown effectiveness (limited evidence)</b>	<ul style="list-style-type: none"> <li>• Plant individual plants</li> <li>• Sow seeds and plant individual plants</li> </ul>

	<ul style="list-style-type: none"><li>• Spread clippings</li><li>• Build bird perches to encourage colonization by plants</li><li>• Plant turf</li></ul>
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## Beneficial

### ● Sow seeds

Five of six studies (including three replicated, randomized, controlled studies, one site comparison study and one controlled study) in the UK, South Africa, and the USA found that sowing seeds of shrubland species increased shrub cover. One of six studies in the UK found no increase in shrub cover. One replicated site comparison in the USA found in sites where seed containing Wyoming big sagebrush was sown the abundance of the plant was higher than in sites where it was not sown. One replicated, randomized, controlled study in the USA found that shrub seedling abundance increased after seeds were sown. One study in the USA found very low germination of hackberry seeds when they were sown. One replicated, randomized, controlled study in the USA found that the community composition of shrublands where seeds were sown was similar to that found in undisturbed shrublands. One randomized, controlled study in the UK found an increase in the cover of heathland plants when seeds were sown. One replicated, randomized, controlled study in South Africa found that sowing seeds increased plant cover. One replicated, randomized, controlled study in the USA found that areas where seeds were sown did not differ significantly in native cover compared to areas where shrubland plants had been planted. One controlled study in the USA found higher plant diversity in areas where seeds were sown by hand than in areas where they were sown using a seed drill. Two of three studies (one of which was a replicated, randomized, controlled study) in the USA found that sowing seeds of shrubland species resulted in an increase in grass cover. One randomized, controlled study in the UK found no changes in the cover of grasses or forbs. *Assessment: beneficial (effectiveness 70%; certainty 60%; harms 0%).*

<https://www.conservationevidence.com/actions/1698>



## Unknown effectiveness (limited evidence)

### ● Plant individual plants

One replicated, randomized, controlled study in the USA found that planting California sagebrush plants did not increase the cover of native plant species compared to sowing of seeds or a combination of planting and sowing seeds. One replicated, randomized, controlled study in South Africa found that planting *Brownanthus pseudoschlichtianus* plants increased plant cover, but not the number of plant species. One study in the USA found that a majority of planted plants survived after one year. *Assessment: unknown effectiveness (effectiveness 40%; certainty 20%; harms 0%).*

<https://www.conservationevidence.com/actions/1697>

### ● Sow seeds and plant individual plants

One replicated, controlled study in the USA found that planting California sagebrush and sowing of seeds did not increase cover of native plant species compared to sowing of seeds, or planting alone. *Assessment: unknown effectiveness (effectiveness 10%; certainty 10%; harms 0%).*

<https://www.conservationevidence.com/actions/1700>

### ● Spread clippings

One randomized, controlled study in the UK found that the addition of shoots and seeds of heathland plants did not increase the abundance of mature plants for half of plant species. One randomized, controlled study in the UK found that the frequency of heather plants was not significantly different in areas where heather clippings had been spread and areas where they were not spread. One replicated, randomized, controlled study in the UK found an increase in the number of heather seedlings, but not of other heathland species. One randomized, controlled study in the UK found that the addition of shoots and seeds increased the number of seedlings for a minority of species. One replicated, randomized, controlled study in South Africa found that plant cover and the number of plant species did not differ significantly between areas where branches had been spread and those where branches had not been spread. *Assessment: unknown effectiveness (effectiveness 30%; certainty 32%; harms 0%).*

<https://www.conservationevidence.com/actions/1701>

● **Build bird perches to encourage colonization by plants**

One replicated, controlled study in South Africa found that building artificial bird perches increased the number of seeds at two sites, but no shrubs became established at either of these sites. *Assessment: unknown effectiveness (effectiveness 10%; certainty 10%; harms 0%).*

<https://www.conservationevidence.com/actions/1702>

● **Plant turf**

Two randomized, controlled studies in the UK found that planting turf from intact heathland sites increased the abundance or cover of heathland species. One of these studies also found that planting turf increased the seedling abundance for a majority of heathland plant species. One randomized, controlled study in the UK found that planting turf increased forb cover, and reduced grass cover. One randomized, replicated, controlled study in Iceland found that planting large turves from intact heathland sites increased the number of plant species, but smaller turves did not. *Assessment: unknown effectiveness (effectiveness 62%; certainty 30%; harms 0%).*

<https://www.conservationevidence.com/actions/1703>

## 8.13 Actions to benefit introduced vegetation

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<b>Based on the collated evidence, what is the current assessment of the effectiveness of interventions to benefit introduced vegetation in shrubland heathland habitats?</b>	
<b>Unknown effectiveness (limited evidence)</b>	<ul style="list-style-type: none"><li>• Add fertilizer to soil (alongside planting/seeding)</li><li>• Add peat to soil (alongside planting/seeding)</li><li>• Add mulch and fertilizer to soil (alongside planting/seeding)</li><li>• Add gypsum to soil (alongside planting/seeding)</li><li>• Add sulphur to soil (alongside planting/seeding)</li><li>• Strip/disturb topsoil (alongside planting/seeding)</li><li>• Add topsoil (alongside planting/seeding)</li><li>• Plant seed balls</li><li>• Plant/sow seeds of nurse plants alongside focal plants</li><li>• Plant/seed under established vegetation</li><li>• Plant shrubs in clusters</li><li>• Add root associated bacteria/fungi to introduced plants</li></ul>

### **Unknown effectiveness (limited evidence)**

#### **● Add fertilizer to soil (alongside planting/seeding)**

A replicated, controlled study in Iceland found that adding fertilizer and sowing seeds increased cover of shrubs and trees in a majority of cases. The same study showed an increase in vegetation cover in two of three cases.

One controlled study in the USA found that adding fertilizer increased the biomass of four-wing saltbush in a majority of cases. *Assessment: unknown effectiveness (effectiveness 45%; certainty 25%; harms 0%).*

<https://www.conservationevidence.com/actions/1704>

● **Add peat to soil (alongside planting/seeding)**

One replicated, randomized, controlled study in the UK found that adding peat to soil and sowing seed increased the cover of common heather in the majority of cases, compared to seeding alone. One replicated, randomized, controlled study in the UK found that adding peat to soil and sowing seed increased the density of heather seedlings, and led to larger heather plants than seeding alone, but that no seedlings survived after two years. *Assessment: unknown effectiveness (effectiveness 42%; certainty 20%; harms 0%).*

<https://www.conservationevidence.com/actions/1705>

● **Add mulch and fertilizer to soil (alongside planting/seeding)**

A randomized, controlled study in the USA found that adding mulch and fertilizer, followed by sowing of seeds increased the abundance of seedlings for a minority of shrub species. The same study found that adding mulch and fertilizer, followed by sowing seeds had no significant effect on grass cover. *Assessment: unknown effectiveness (effectiveness 35%; certainty 15%; harms 0%).*

<https://www.conservationevidence.com/actions/1707>

● **Add gypsum to soil (alongside planting/seeding)**

One randomized, controlled study in South Africa found that adding gypsum to soils and sowing seeds increased survival of seedlings for one of two species. *Assessment: unknown effectiveness (effectiveness 30%; certainty 10%; harms 0%).*

<https://www.conservationevidence.com/actions/1708>

● **Add sulphur to soil (alongside planting/seeding)**

A randomized, replicated, controlled study in the UK found that adding sulphur to soil alongside sowing seeds did not increase heather cover in a majority of cases. One replicated, controlled study in the UK found that adding sulphur and spreading heathland clippings had mixed effects on cover of common heather, perennial rye-grass, and common bent. One randomized, controlled study in the UK found that adding sulphur to soil alongside planting of heather seedlings increased their survival, though

after two years survival was very low. *Assessment: unknown effectiveness (effectiveness 20%; certainty 30%; harms 0%).*

<https://www.conservationevidence.com/actions/1710>

### ● **Strip/disturb topsoil (alongside planting/seeding)**

Two replicated, controlled studies in the UK found that removal of topsoil and addition seed/clippings increased cover of heathland plants or cover of heather and gorse. One controlled study in the UK found that soil disturbance using a rotovator and spreading clippings of heathland plants (alongside mowing) increased the number of heathland plants. One replicated, controlled study in the UK found that stripping the surface layers of soil and adding seed reduced the cover of perennial rye-grass. One randomized, replicated, paired, and controlled study in the UK found that removal of topsoil and addition of the clippings of heathland plants did not alter the cover of annual grasses but led to a decrease in cover of perennial grasses. *Assessment: unknown effectiveness (effectiveness 60%; certainty 35%; harms 0%).*

<https://www.conservationevidence.com/actions/1711>

### ● **Add topsoil (alongside planting/seeding)**

One randomized, replicated, paired, controlled study in the USA found that addition of topsoil alongside sowing of seed increased the biomass of grasses but reduced the biomass of forbs in comparison to addition of topsoil alone. *Assessment: unknown effectiveness (effectiveness 0%; certainty 10%; harms 0%).*

<https://www.conservationevidence.com/actions/1857>

### ● **Plant seed balls**

A randomized, replicated, controlled study in the USA found that planting seed balls resulted in lower seedling numbers than sowing seed. *Assessment: unknown effectiveness (effectiveness 0%; certainty 10%; harms 0%).*

<https://www.conservationevidence.com/actions/1712>

### ● **Plant/sow seeds of nurse plants alongside focal plants**

A randomized, replicated, controlled study in the UK found that sowing seeds of nurse plants and heathland plants did not increase the cover of common heather. One replicated, randomized, controlled study in the USA found that sowing seeds of nurse plants and California sagebrush seeds together reduced survival of shrubs in more than half of cases. The same study found that California sagebrush biomass was also reduced when its

seeds were sown with those of nurse plants. *Assessment: unknown effectiveness (effectiveness 0%; certainty 20%; harms 10%).*

<https://www.conservationevidence.com/actions/1713>

● **Plant/seed under established vegetation**

A replicated, randomized, controlled study in the USA found that sowing seed under established shrubs had mixed effects on blackbrush seedling emergence. *Assessment: unknown effectiveness (effectiveness 20%; certainty 10%; harms 0%).*

<https://www.conservationevidence.com/actions/1714>

● **Plant shrubs in clusters**

A randomized, controlled study in South Africa found that when shrubs were planted in clumps more of them died than when they were planted alone. *Assessment: unknown effectiveness (effectiveness 0%; certainty 15%; harms 1%).*

<https://www.conservationevidence.com/actions/1715>

● **Add root associated bacteria/fungi to introduced plants**

Two controlled studies (one of which was randomized) in Spain found that adding rhizobacteria to soil increased the biomass of shrubs. One of these studies also found an increase in shrub height. *Assessment: unknown effectiveness (effectiveness 60%; certainty 15%; harms 0%).*

<https://www.conservationevidence.com/actions/1716>

## 8.14 Education and awareness

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**Based on the collated evidence, what is the current assessment of the effectiveness of interventions for education and awareness of shrubland and heathland habitats?**

**No evidence found (no assessment)**

- Raise awareness amongst the general public
- Provide education programmes about shrublands

### **No evidence found (no assessment)**

We have captured no evidence for the following interventions:

- Raise awareness amongst the general public
- Provide education programmes about shrublands.

