HABITAT IMPACT ASSESSMENT

PRINCIPLES

Aim

The aim of this guide is to outline the reasons why deer managers should consider undertaking habitat impact assessment.
The guide explains what a baseline is and how it can be used to look at habitat trends over time. Habitat impact assessment also involves planning which areas should be measured and how many sample plots to set.

The guide Habitat Impact Assessment: Principles in Practice complements this guide by providing information on how to go about establishing a monitoring scheme for different habitats.

Introduction

Habitat impact assessment may be new and unfamiliar to some deer managers. However, there are four key reasons for assessing or understanding how to assess habitat impacts:

- ◆ Deer are dependent on the habitat as well as impacting on it. Like a farmer knowing about his soils, the deer manager should know something about the condition of the habitat. In order to manage deer sustainably,* a manager should have an understanding of how deer impact on the habitat over time, and how this effects habitat condition.

- ◆ By measuring and recording the impacts of deer on habitat condition, it makes it easier to monitor whether land management objectives are being achieved.

- ◆ There are also public objectives associated with land – whether designated sites or land where wider biodiversity responsibilities apply.** Government agencies are required

to assess and monitor habitat condition in relation to deer impacts in the context of public objectives.*** The more information deer managers have to hand the better able they will be to discuss habitat impacts with government agencies.

- ◆ Explaining to stalking guests about deer impacts, habitat assessment, condition and monitoring may increase the guests' understanding and enjoyment, adding value to the stalking day.****

While most of the methods described here are suitable for use by land and deer managers, it is recommended that appropriate professional advice should be sought where the habitats or issues involved are complex and/or where the assessments relate to designated sites of nature conservation value (SACs, SPAs and SSSIs). The Best Practice Guides (BPGs) on Habitat Impact Assessment aim to enable land managers to:

- ◆ Design, collect and interpret habitat data to inform deer management;

- ◆ Set up a baseline to allow changes in impacts to be measured over time;

- ◆ Understand the methods used by government agencies. These guides describe the methods used by DCS to monitor deer impacts. These methods are also a key part of how other agencies monitor deer impacts.

vegetation map — the colours indicate different vegetation types

How much?

Measuring and assessing deer impacts on habitats can be a complex, time consuming and expensive task. However, there is a minimum set of information that is essential and the BPGs explain how to collect and analyse this information. This takes account of the statistical requirements for obtaining meaningful and analysable information. The planning and establishment of the baseline will take some time. Thereafter annual monitoring should take a relatively short period of time and should fit easily into existing work programmes.
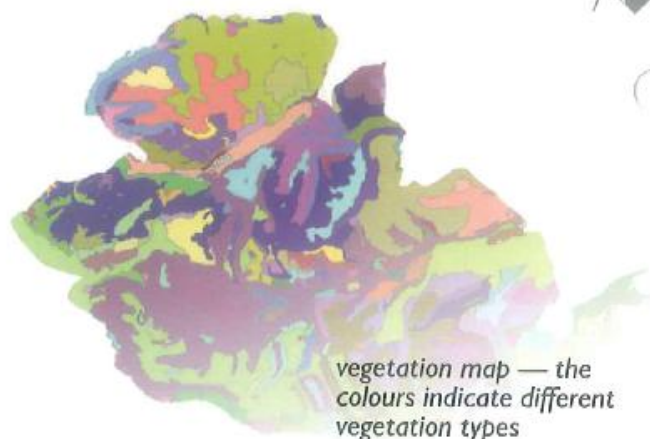
It is likely that deer managers will wish to know more than the minimum about the habitats for which they are responsible. Deer managers may also consider carrying out botanical surveys, biodiversity audits or detailed impact assessments for which grants may be available. There are many detailed field guides and methods available.[1]

If deer managers are unable to carry out minimum quantitative (measured) habitat impact monitoring, then they should at least record a qualitative (descriptive) record of change over time. This will allow crude or large scale changes to be monitored. This would be done through:

♦ Taking 'fixed point' photographs of important habitats or features (for example the edges between habitats) every year.

♦ Setting up deer-fenced exclosure plots to demonstrate the impact deer possibly and other herbivores are having.

Which areas should be measured?

Most land will contain more than one habitat. BPGs on what should be measured are available for the habitats that deer are most likely to have an impact on. Deciding which ones to assess will depend on the purpose of the assessment, for example if it is

an estate management objective, or in relation to a designated site where the features that make up the designation will be most important. In reality, deer managers will probably want to know about all of the habitats they manage but may be constrained to monitoring the most important ones.

The boundary of each habitat area will need to be defined. Existing information on vegetation and habitat types may be available (for example from SNH). For woodland (semi-natural and commercial) the habitat area will usually be a 'compartment'.

Planning

Planning the establishment of plots can take place at any time of year. This will involve:

♦ Defining habitat areas. Habitats may need to be further stratified (broken down), for example if specific parts of a habitat area are known to be particularly favoured by deer;

♦ Selecting random points within each habitat area – as a minimum 30 to 50 points within each habitat area (equivalent to 2 to 3 plots per 100 ha). This should be done on a map before going out to the field. It is important that points are random rather than deliberately selected to ensure statistical robustness;

♦ Organising equipment: posts, data sheets, tape measures, quadrats, cameras and so on;

♦ Setting plots out within each habitat.

[1] Guide to Upland Habitats, Surveying Land Management Impacts. Angus Macdonald, Penny Stevens, Helen Armstrong, Philip Immirzi and P Reynolds. 384 pages, 2 volume set, 50 col photos. Scottish Natural Heritage. See BP Contacts

bestPractice guidance

PRINCIPLES IN PRACTICE

the shaded squares indicate the quadrats to be used for sampling vegetation height

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

equipment needed for habitat assessment

wooden post

Aim

The aim of this guide is to outline how to go about establishing a habitat monitoring baseline. The guide describes what time of year is best for each habitat, how to establish plots and what other factors to consider. The guide Habitat Impact Assessment: Principles should be regarded as an essential introduction to this subject.

Example forms for recording habitat data can be found in the Reference section.

What to do

3 Establish the baseline by setting out the marked ('permanent') plots. Plots should be marked by wooden posts (approximately 5 x 5 x 20 cm) and their location recorded by GPS. Posts or tags should be small enough to minimise their attention by deer, hammered below vegetation height, or located at a fixed distance (e.g. 10m) from the plot.

Dwarf shrub heath Blanket bog, Tall herbs, Springs	Flushes	Woodland (all objectives)	Woodland (impacts to regeneration), Willow
Minimum of 30 random plots per habitat area. Each plot marked by a small wooden post, tagged and located by photograph and GPS. Each plot 2 x 2 m subdivided into sixteen 0.5 x 0.5 m quadrats.	Marker posts set away from the flush (located by GPS) and a compass bearing taken to the plot. At least one plot placed randomly on each flush. Each plot 1 x 4 m subdivided into sixteen 0.5 x 0.5 m quadrats.	Use Nearest Neighbour Method[1] to calculate number of points to assess per compartment – at least 20 sample points with 5 trees (100 trees). Each point marked by a wooden post and located by photograph and GPS. Each seedling is marked by a tag round its base.	Mark at least one seedling within each plot or randomly mark seedling willows to give a minimum of 30 per compartment. A post (10m from the seedling/willow) is located using GPS. In addition, a peg may be placed 1m from the seedling/willow. Each seedling/willow marked by a tag around it's base.

bearing recorded

1	2	3	4
5	6	7	8
9	10	11	12
13	14	15	16

POST

POST

bearing recorded

| 1 | 2 | 5 | 7 | 9 | 1013 | 14 |
| 3 | 4 | 6 | 8 | 11 | 12 15 | 16 |

bearing recorded

POST

PEG

plant

POST

remember to number each plot individually before taking a photograph to help future identification

Recommended months for measuring deer impacts

Habitat	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Dwarf shrub heath								acceptable	recommended	recommended	acceptable	
Blanket bog								acceptable	recommended	recommended		
Flushes & springs						acceptable	recommended	recommended	acceptable			
Native & commercial woodland				acceptable	recommended	recommended	acceptable					
Willow scrub					acceptable	recommended	recommended	acceptable				
Tall herbs					acceptable	recommended	recommended	acceptable				

◼ recommended ◼ acceptable ◻ not recommended

When?

3 The impact assessment itself should be done at the time of year indicated in the table. Outwith this period plants are less easy to identify and impacts less easy to measure.

When establishing plots

3 Be aware of ground nesting birds. Avoid placing plots where birds are showing alarm behaviour. Avoid any disturbance of ground nesting birds during wet or windy conditions.

- ♦ Minimise trampling. Try not to cause more impact than what you are measuring!

- ♦ If conducting impact assessment on designated sites consult SNH.

Identifying plants and impacts

The BPGs on habitat impact assessment illustrate the key plant species and impacts required in each guide. It is recommended that additional plant field guides are used to help in species identification. Similarly, for impacts the SNH field guide[2] provides a more detailed description of assessing current and historic impacts e.g. 'normal, carpet, topiary and drumstick' growth forms of heather.

Interpreting results

Is it deer?

Other herbivores may also be present and causing impacts – insects, birds, sheep, hares, rabbits and goats.* Three things can help determine which animals are likely to be having the biggest effect:

recording the compass bearing from a marked post

- ♦ Presence of dung (note difficulties in separating sheep dung from deer dung);

- ♦ Browsing signs on plants measured;

- ♦ Relative numbers from counts etc.

Is it damage?

Deer are herbivores, herbivores eat vegetation, therefore deer will always have an impact on their habitat. The BPGs describe how to measure grazing and trampling impacts by deer. Assessing the measured impacts against the objectives (private or public) for the habitat area will determine whether the impacts are 'damaging'.** The effect of continuing the current impacts on the habitat also need to be considered – are they sustainable or will they lead to damage or deterioration?

Impacts are also likely to be interpreted as 'damage' if:

- ♦ Unpalatable plants (i.e. which deer do not normally eat) are being browsed;

- ♦ Heavy or high impacts are widely found.

How to analyse

Initially, impacts measured will form a baseline. Subsequent monitoring in relation to objectives will determine whether impacts are sustainable or potentially damaging.***

[1] Nearest Neighbour Method for Quantifying Wildlife Damage to Trees in Woodland. Forestry Commission Practice Note. See BP Contacts
[2] Guide to Upland Habitats, Surveying Land Management Impacts. Angus Macdonald, Penny Stevens, Helen Armstrong, Philip Immirzi and P Reynolds. 384 pages, 2 volume set, 50 col photos. Scottish Natural Heritage. See BP Contacts

* BPG Woodland Damage:Recognition of Cause
** DCS Guide Damage: Definition & Assessment
*** BPG Habitat Impact Assessment: Analysis & Interpretation

ANALYSIS

Aim
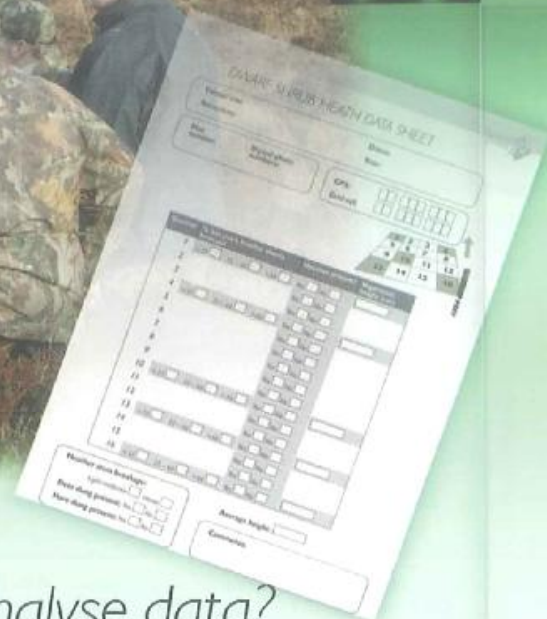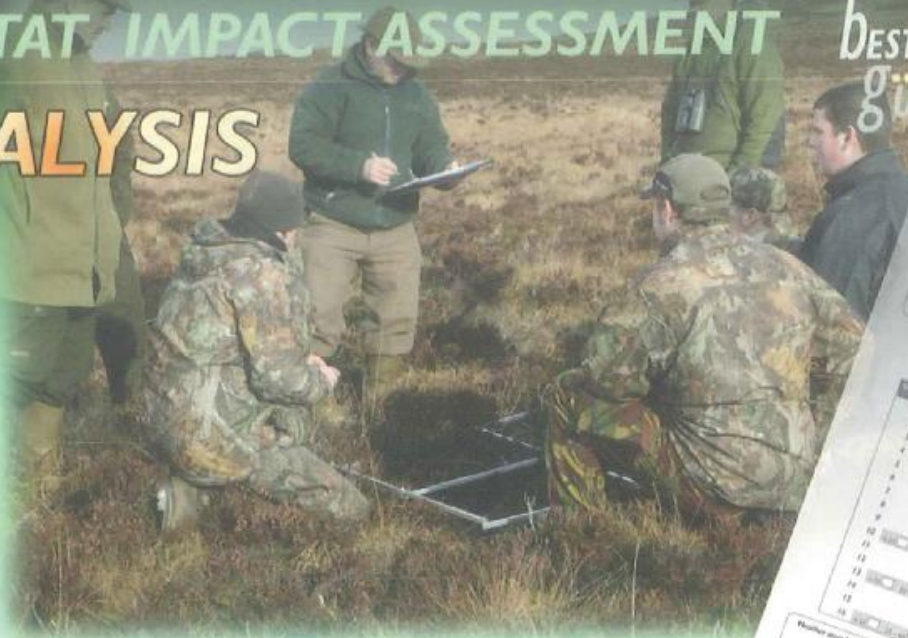
The aim of this guide is to describe how to go about analysing and interpreting the data collected from habitat impact assessment. Interpretation will depend on objectives but a clear trend will indicate which way the habitat is 'going'.

The guides 'Habitat Impact Assessment: Principles' and 'Habitat Impact Assessment: Principles in Practice' should be regarded as essential introductions to this subject.

Why analyse data?

To assess:
1. Whether any impacts are changing over time;
2. What changes mean in relation to the objectives for the habitat.*

Averaging the frequency

Example of averaging the frequency of quadrats with heather present within a plot

Habitat area (site) has minimum of 30 random plots. Each plot (2m x 2m) is subdivided into sixteen 0.5m x 0.5m quadrats. For this example, only 3 plots have been used for simplicity

Step 1: *For each plot calculate the frequency of quadrats with heather. That is*
Plot 1: 4/16 = 0.25
Plot 2: 5/16 = 0.31
Plot 3 3/16 = 0.19

Step 2: *Average the frequency of quadrats with heather for all plots. That is*
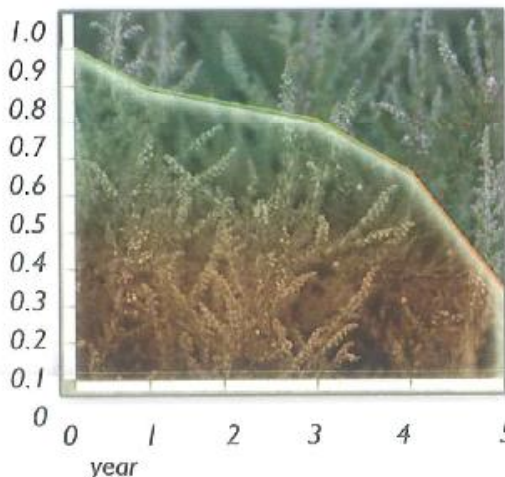*(0.25 + 0.31 + 0.19) ÷3 = 0.25*

Plot 1: heather present in 4 quadrats

Plot 2: heather present in 5 quadrats

Plot 3: heather present in 3 quadrats

POST 01
POST 02
POST 03
POST

average frequency of heather present

How to analyse

For each habitat:

1. Average the frequency of each impact (see an example for heather overleaf);

2. Look at the trend in the averages over time (i.e. is the impact increasing, decreasing or staying the same?).

Interpretation

1. Compare changes against the objectives for the habitat (see example table below).

2. Consider other relevant data (for example, deer count information, sheep numbers).

3. Take into account timescale and likely impact of changes recorded (for example, in woodland: are sufficient seedlings escaping browsing to replace existing trees?). Normally habitat change is quite slow. A series of measures over 3 – 5 years will probably be needed.

4. Note that it is not just trends that need to be taken account of but the level of impact. For example if Moderate or High impacts (greater than 33% shoots browsed**) are recorded on heather year after year (but no change in trend) then they are likely to lead to a loss of heather.

What next?

Depending on the trends and the objectives – public or private, may need to:

1. Consider changing deer management, for example increasing cull;

2. Look at incentives available i.e. grants to improve habitat.

Example of how BPG Habitat Impact Assessment trend data may be interpreted in relation to objectives

Public interests and deer management objectives for dwarf shrub heath	Specific definition of 'damage'	Who determines 'damage'?
Authorisation (prevent serious damage) ***	Heavier impact recorded than owner willing to accept.	DCS
Section7 control agreement (prevent serious damage)****	Deterioration from baseline in either extent or integrity.	DCS
Good Agricultural and Environmental Condition	Clear evidence that growth, quality or species composition of the vegetation is deteriorating to a measurable extent.	SGRPID (Scottish Government Rural Payments and Inspections Department)
SSSI interests *****	Measurable decline in the area of the feature or deterioration in condition.	SNH DCS SGRPID FCS
Natura interests*****	Extent, structure and function of impacted habitat threatened. Negative consequences for typical species.	SNH DCS SGRPID FCS
Occupier rights to shoot in close season[1]	Heavier impact recorded than required.	owner/ occupier
Owner/ occupier objectives (open season)	Habitat not in condition required.	owner/ occupier

* See BPG Habitat Impact Assessment: Principles ** See BPG Habitat Impact Assessment: Dwarf Shrub Heath *** See DCSG Approvals & Authorisations **** See DCSG Section 7 Control Agreements ***** See DCSG Natural Heritage Statutory Designations

[1] (Section 26(1) of Deer Scotland Act 1996)

WOODLAND

Habitat description

Native semi natural woodland includes a range of woodlands dominated by native species such as Scots pine, silver and downy birch, sessile oak and ash (see species list overleaf). Other tree species found in these woods may include aspen, rowan and juniper. Scottish woodlands are 'semi' natural because they have been subject to a range of management (felling, burning and planting) over time. More 'ancient' woodlands tend to contain richer associated lichens, mosses and characteristic flora. Where more commercial species or objectives exist (for example to establish trees to specific density or to maintain a set proportion of un-forked leaders), additional impacts may be measured.

(below left) signs of high impact: growth of rowan restricted due to browsing pressure and (below right) signs of low impact: seedling growth above that of vegetation

Key indicators

The key impacts that deer can have are browsing on seedlings, fraying on saplings and bark stripping of mature trees. In addition, browsing can affect the structure and composition of groundcover such as blaeberry. Information on the age, structure and condition of the woodland will indicate the timescale over which seedlings are needed to replace existing mature trees. A direct measure of deer browsing can be made on seedlings or saplings below deer browse height (approximately 1.3 m).

Other impacts

Herbivores other than deer browse seedlings, particularly insects, rabbits, hares and voles. Factors other than herbivores (such as soils or seed viability) may also impede regeneration.

Birch
Tree. Height to 25m. Leaves 5-7cm x 2-2.5cm

Oak
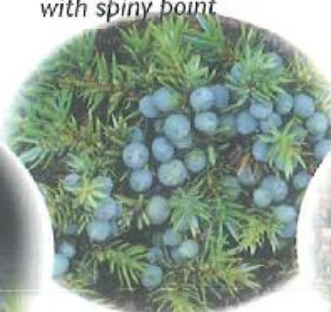*Large deciduous tree. Height to 30m. Leaves 5-12cm*

Juniper
Shrub. Height: small tree to 10m. Leaves: whorls of 3, 5-19mm with spiny point
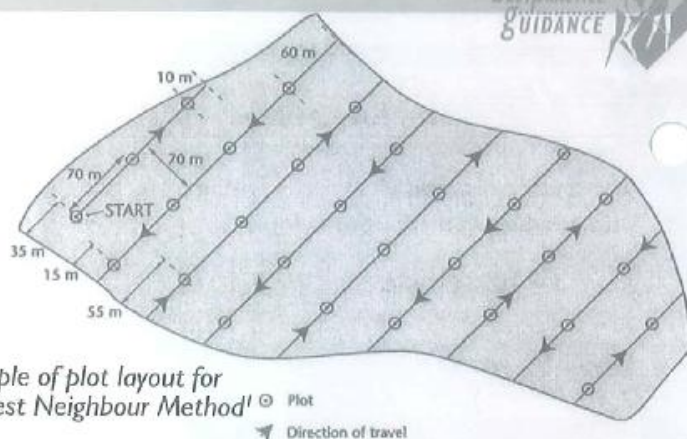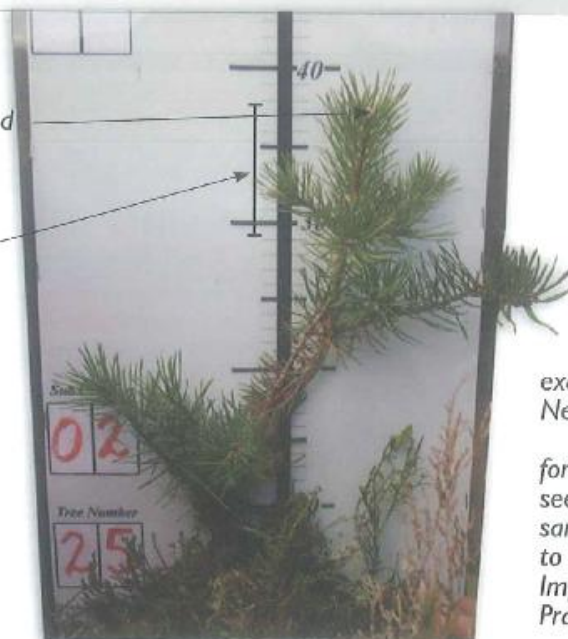
Scots Pine
Tree. Height to 30m. Leaves 2 on each short shoot, 3-8cm x 1-2mm

Rowan
Slender tree. Height to 15m. Leaves 10-25cm

apical
(terminal) bud

length of
leader

example of plot layout for
Nearest Neighbour Method[1] ⊙ Plot
🡒 Direction of travel

for information on how many
seedlings, trees and plots to
sample and what time of year
to measure, see BPG Habitat
Impact Assessment: Principles in
Practice

Method	What to measure	What to analyse
Plot based approach.	The number, size and location of plots is based on area and distribution of mature trees.[1] Plots are circular with an area of between 0.01 and 0.05 ha (i.e. using a string of 5-12 m from the central post). The centre of each plot is marked by a post and co-ordinates recorded by GPS.	Summarise the frequency of seedlings/ saplings, trees damaged by deer for each compartment.[2] Graph the age profile of all mature trees for each compartment.
	Within each plot, record: a. Number and species of all seedlings / saplings less than 1.3 m tall and or less than 7 cm diameter at breast height); b. Number and species of all trees greater than 1.3 m tall and or greater than 7 cm diameter at breast height); c. Number of seedlings / saplings with deer damage;* d. Number of trees with deer damage; e. Number of standing dead, fallen dead and tree stumps; f. 'Age class' of all mature trees.	Calculate the frequency** of leaders browsed for each species of seedling / sapling for each compartment. Calculate the frequency of other shoots browsed for each species of seedling / sapling for each compartment.
	Assess whether saplings have been frayed by deer.*	Average the number of saplings frayed per species per compartment.
	Assess whether trees have been bark stripped by deer.*	Average the number of saplings frayed per species per compartment.
Marked seedlings approach.	Mark at least one seedling / sapling within each plot OR randomly select a minimum of 30 seedlings within each compartment. Measure seedling / sapling height (straight vertical distance from ground to highest point on the seedling without lifting or stretching — see illustration above. Assess whether the leader and other shoots on each seedling are browsed by deer (based on clean cut/ragged cut).*	Average the height of seedling for each compartment. Summarise the number of seedlings/ saplings, trees and dead trees per compartment.

* BPG Woodland
Damage:
Recognition of Cause
** BPG Habitat
Impact Assessment:
Analysis

[1] Nearest Neighbour Method
for Quantifying Wildlife Damage
to Trees in Woodland. Forestry
Commission Practice Note. See
BP Contacts [2] A 'compartment'
is a unit within the forest,
demarcated (for administrative
purposes) by permanent features
e.g. roads and streams.

Woodland species:

Scots pine/ Pinus sylvestris
Juniper/ Juniperus communis
Birch/ Betula pendula
Rowan/ Sorbus aucuparia
Aspen/ Populus tremula

Oak/ Quercus robur
Hazel/ Corylus avellana
Holly/ Ilex spp.
Hawthorn/ Crataegus spp.
Bird-cherry/ Prunus padus
Willow/ Salix spp.
Ash/ Fraxinus spp.

HABITAT IMPACT ASSESSMENT

DWARF SHRUB HEATH

(below left) signs of high impact: browsing restricted heather growth form and (below right) signs of low impact: few long shoots browsed, vigorous growth forms

Aim

The aim of this guide is to describe methods of assessing Dwarf Shrub Heath relevant to deer managers.*

Habitat description

Heather moorland or dwarf shrub heath is made up of a mix of 'dwarf shrubs' (heathers, blaeberry, cowberry and so on) with some grasses (such as purple moor-grass and deer grass — see species list overleaf). The exact mix depends on the soil type and amount of rainfall on the area, as well as the history of burning and browsing. Heather moorland has two types: 'dry heath' mainly in the east with 'wet heath' (with more cross-leaved heath) more frequent in the west.

Key indicators

The main impacts that deer have on dwarf shrub heath are browsing and trampling.[1] Browsing is measured by looking at the percentage of 'long shoots' of heather browsed (see illustration overleaf). This indicates the 'off-take'. If unpalatable species such as cross-leaved heath show signs of browsing this indicates heavy impact likely to cause a deterioration in habitat condition.

Other impacts

The following factors may also have an impact on heather moorland:
◆ Burning (which affects age structure[2]);
◆ Heather beetle or mapgpie moth;
◆ Other herbivores – sheep, hares, rabbits.

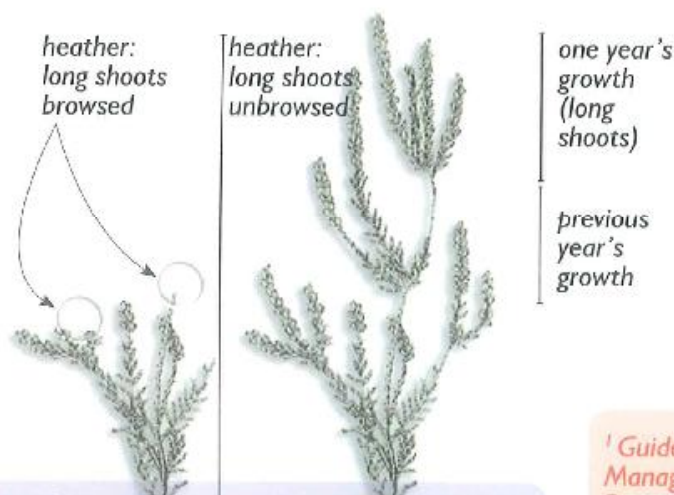| **Bell heather**	**Cross-leaved heath**	**Ling heather**	**Purple moor-grass**	**Blaeberry**	**Deer grass**
Shrub. Height to 60cm. Leaves 5-7mm	Dwarf shrub. Height to 60cm. Leaves 2-4mm	Evergreen shrub. Height to 60cm (rarely to 1m). Leaves 1-2mm	Wiry perennial often forming tussocks. Height 15-150cm. Long narrow purple spikelets 4-9mm	Deciduous shrub. Height up to 60cm. Leaves 1-3cm	Densely tufted perennial. Height 5-35cm. Spikelet 3-6mm

BEST PRACTICE
GUIDANCE

measuring vegetation height in selected quadrats. For information on the number and size of plots and what time of year to measure, see BPG Habitat Impact Assessment: Principles in Practice

What to measure	How to analyse
For **browsing** look at three or four handfuls of ling heather within each of quadrats 1, 4, 10, 13 and 16 as shown in the diagram in BPG Habitat Impact Assessment: Principles in Practice. If ling not present then use blaeberry. Look at the browsing on the long shoots and classify as: • LIGHT: less than 33% of long shoots in the sample browsed; • MODERATE: 33 – 66% long shoots browsed; • HEAVY: greater than 66% long shoots browsed.	For each plot, summarise the frequency** of quadrats in each class (for example: 3/5 quadrats LIGHT; 2/5 quadrats MODERATE; 0/5 quadrats HEAVY browsing. In this example, the plot would be described as having LIGHT browsing as this was the class with the highest frequency. For each site, summarise the frequency of plots in each class (for example, in a site with 30 plots: 25/30 plots LIGHT; 3/30 plots MODERATE; 2/30 plots HEAVY browsing.
For **trampling**, if plots are > 50 m away from a supplementary feeding site, assess the amount of heather stem breakage as a result of trampling and assign as classes for the whole plot: • LIGHT / MODERATE: inconspicuous; • HEAVY: conspicuous.	For each site, summarise the frequency of plots in each class (for example, in a site with 30 plots, 14/30 plots LIGHT/ MODERATE, 16/30 plots HEAVY heather stem breakage.
For **heather distribution**, record presence or absence of heather (or blaeberry) within each of the 16 quadrats.	For each plot, summarise the frequency of quadrats with presence or absence of heather (or blaeberry) (for example: 5/16 quadrats, heather PRESENT; 11/16 quadrats, heather ABSENT). For each site, summarise the frequency of quadrats with heather (or blaeberry) present or absent (for example, in a site with 10 plots (a total of 10 x 16 quadrats): 60/160 quadrats, heather PRESENT; 100/160 quadrats, heather ABSENT).
For **vegetation height** take three or four measurements with a tape measure within each of quadrats 1, 4, 10, 13 and 16.	For each plot average the height of the vegetation. Average the vegetation height for all plots.
Record presence of deer and/or hare dung in each plot.	For each site, summarise the frequency of quadrats with deer dung present or absent. For example, in a site with 10 plots: 80/160 quadrats deer dung PRESENT; 80/160 quadrats, deer dung ABSENT. Repeat exercise for hare dung.
Take digital photo of whole plot from fixed point.	Will enable detection of changes in heather distribution over time.

heather: long shoots browsed

heather: long shoots unbrowsed

one year's growth (long shoots)

previous year's growth

Dwarf Shrub Heath species:

Ling heather/ Calluna vulgaris
Cross-leaved heath/ Erica tetralix
Bearberry/ Arctostaphylos uva-ursi
Blaeberry/ Vaccinium myrtillus
Cowberry/ Vaccinium vitis-idaea
Crowberry/ Empetrum nigrum
Purple moor-grass/ Molinia caerulea
Deer grass/ Tricophorum cespitosum
Bell heather/ Erica cinerea

* The guides Habitat Impact Assessment: Principles and Habitat Impact Assessment: Principles in Practice should be regarded as essential introductions to this subject ** BPG Habitat Impact Assessment: Analysis

HABITAT IMPACT ASSESSMENT

BLANKET BOG

(below) signs of high impact: bare soil with deer hoof prints and (below right)signs of low impact: presence of flowering bog cotton

Aim

The aim of this guide is to describe methods of assessing Blanket Bog habitat relevant to deer managers.*

Habitat description

Blanket bogs are a vegetative 'skin' of mosses, cotton grass and dwarf shrub species over a layer of peat, usually more than 50 cm deep (see species list overleaf). They occur in areas of heavy rainfall where drainage is poor. The surface of blanket bogs can have hummocks, ridges, moss lawns, wet hollows and pools.

Key indicators

The main impacts that deer have on blanket bog are trampling and browsing.[1] Trampling, by breaking through the vegetative skin, may lead to areas of exposed bare peat and subsequently erosion. Once exposed, the area of bare peat can increase with time and the bare peat can erode away. At the same time other areas may be naturally re-vegetating. Direct deer trampling is assessed by the presence of bare soil with deer hoof prints visible. Browsing is measured by looking at the percentage of heather 'long shoots' browsed. This indicates the 'off-take' on the heather. If unpalatable species such as cross-leaved heath show signs of browsing this indicates heavy impact.

Other impacts

Care needs to be taken to distinguish between what originally caused the breaking of the vegetative skin and what is preventing re-vegetation. Climatic effects particularly 'drying out' may also cause erosion. Other impacts include:

♦ Burning

♦ Other herbivores – particularly sheep.

Bog moss
Colours vary with species. Forms large cushions or clumps

Cotton-grass
(1) Tussock forming perennial. Height 30-60cm. Leaves up to 1mm wide

Cotton-grass
(2) Tussock forming perennial. Height 30-60cm. Leaves up to 1mm wide

Deer Grass
Densely tufted perennial. Height 5–35cm. Spikelet 3-6mm

Cowberry
Evergreen shrub. Height to 30cm. Leaves 1-3cm

Bearberry
Evergreen shrub with long rooting branches often forming mats. Leaves 1-2cm

For information on the number and size of plots
and what time of year to measure, see BPG Habitat
Impact Assessment: Principles in Practice.

What to measure	How to analyse
For trampling, record whether bare soil with a deer hoof print is present or not in each of the 16 quadrats.	For each plot, summarise the frequency** of quadrats with presence or absence of deer hoof prints in bare soil (for example: 5/16 quadrats, hoof prints PRESENT; 11/16 quadrats, hoof prints ABSENT). For each site, summarise the frequency of quadrats with deer hoof prints present or absent (for example, in a site with 10 plots (a total of 10 x 16 quadrats): 60/160 quadrats, hoof prints PRESENT; 100/160 quadrats, hoof prints ABSENT).
For browsing look at three or four handfuls of heather within each of quadrats 1, 4, 10, 13 and 16 as shown in the diagram in BPG Habitat Impact Assessment: Principles in Practice. If none of the heather species are present then use cowberry. Look at the browsing on the long shoots and classify as: • LIGHT: less than 33% of long shoots in the sample browsed; • MODERATE: 33 – 66% long shoots browsed; • HEAVY: greater than 66% long shoots browsed.	For each plot, summarise the frequency of quadrats in each class (for example: 3/5 quadrats LIGHT; 2/5 quadrats MODERATE; 0/5 quadrats HEAVY browsing. In this example, the plot would be described as having LIGHT browsing as this was the class with the highest frequency. For each site, summarise the frequency of plots in each class (for example, in a site with 30 plots: 25/30 plots LIGHT; 3/30 plots MODERATE; 2/30 plots HEAVY browsing.
For bog mosses, record their presence or absence within each of the 16 quadrats.	For each plot, summarise the frequency of quadrats with presence or absence of bog mosses (for example: 7/16 quadrats, bog mosses PRESENT; 9/16 quadrats, bog mosses ABSENT). For each site, summarise the frequency of quadrats with bog mosses present or absent (for example, in a site with 10 plots (a total of 10 x 16 quadrats): 60/160 quadrats, bog mosses PRESENT; 100/160 quadrats, bog mosses ABSENT).
For vegetation height take four measurements with a tape measure within each of quadrats 1, 4, 10, 13 and 16.	For each plot average the height of the vegetation. Average the vegetation height for all plots.
Record presence of deer or hare dung in each plot.	For each site, summarise the frequency of quadrats with deer dung present or absent. For example, in a site with 10 plots: 80/160 quadrats, deer, dung PRESENT; 80/160 quadrats, deer dung ABSENT. Repeat exercise for hare dung.
Take digital photo of whole plot from fixed point.	Will enable detection of changes in erosion or re-vegetation over time.

Browsing of unpalatable species such as cross-leaved heath indicates heavy impact.
Cross-leaved heath

Blanket Bog *species:*

Cowberry/ *Vaccinium vitis-idaea*
Cotton-grass/ *Eriophorum vaginatum*
Cotton-grass/ *Eriophorum augustofilium*
Crow berry/ *Empetrum nigrum*
Bog moss/ *Sphagnum species*
Bear berry/ *Arctostaphylos uva-ursi*
Deer grass/*Trichophorum cespitosum*
Cross-leaved heath/ *Erica tetralix*
Ling heather / *Calluna vulgaris*
Bell heather/*Erica cinerea*

* The guides Habitat Impact Assessment: Principles and
Habitat Impact Assessment: Principles in Practice should
be regarded as essential introductions to this subject
** See BPG Habitat Impact Assessment: Analysis

Guide to Upland Habitats, Surveying Land
Management Impacts. Angus Macdonald, Penny
Stevens, Helen Armstrong, Philip Immirzi and P
Reynolds. 384 pages, 2 volume set, 50 col photos.
Scottish Natural Heritage. See BP Contacts

FLUSHES & SPRINGS

(below left) signs of high impact: hoof print in bare soil. (below right) signs of low impact: spring showing few signs of trampling

Aim

To describe methods of assessing Flushes and Springs habitat relevant to deer managers.*

Habitat description

Flushes and springs are where ground water seeps or springs from a hillside. Some are acid and some are 'base rich' (that is, rich in minerals such as lime). Flushes and springs support a number of rare small plants: sedges, rushes, herbs, liverworts and mosses (see species list overleaf). Where the water is very lime rich deposits of tufa (porous rock) may form with associated mosses. Springs are usually large enough for a square (2m x 2m) plot. Flushes are generally narrower, requiring a 1m x 4m plot.

Key indicators

The main impact that deer have on flushes is trampling.[1] Direct deer trampling is assessed by the presence of bare soil with deer hoof prints visible.

Other impacts

Flooding may cause flushes to be washed out. Other herbivores such as sheep may also cause trampling impacts.

Scorched alpine-sedge	Mossy saxifrage	Scottish asphodel	Yellow saxifrage	Starry saxifrage
A creeping perennial. Height 5-35cm. Leaves 2-5mm wide	Perennial herb. Height 5-20cm. Leaves up to 1cm	Height to 20cm. Basal leaves 1.5-4cm x 1-2cm, stem leaves smaller	Perennial herb. Height 5-20cm. Leaves 1-2cm	Perennial herb with short stock. Leaves 0.5-3cm

an overview photo of the spring and surrounding features will help to relocate the location for repeat monitoring. For information on the number and size of plots and what time of year to measure, see BPG Habitat Impact Assessment: Principles in Practice

What to measure	How to analyse
For trampling, record bare soil (for flushes) or mosses (for springs) with a deer hoof print in each of the 16 quadrats.	For each plot, summarise the frequency** of quadrats with presence or absence of deer hoof prints (for example: 5/16 quadrats, hoof prints PRESENT; 11/16 quadrats, hoof prints ABSENT). For each site, summarise the frequency of quadrats with deer hoof prints present or absent (for example, in a site with 10 plots (a total of 10 x 16 quadrats): 60/160 quadrats, hoof prints PRESENT; 100/160 quadrats, hoof prints ABSENT).
Record presence of pulled-up mosses and other plants in each of the 16 quadrats.	For each plot, summarise the frequency of quadrats with presence or absence of pulled-up mosses/plants (for example: 7/16 quadrats, pulled-up mosses/plants PRESENT; 9/16 quadrats, pulled-up mosses/plants ABSENT). For each site, summarise the frequency of quadrats with pulled-up mosses/plants present or absent (for example, in a site with 10 plots (a total of 10 x 16 quadrats): 60/160 quadrats, pulled-up mosses/plants PRESENT; 100/160 quadrats, pulled-up mosses/plants ABSENT).
Take digital photo of whole plot from fixed point (see illustration below).	Will enable detection of changes in vegetation distribution over time.

a fixed point photo of a 1m x 4m flush plot running down a flush

Flushes & Springs species:

Bristle sedge/ *Carex microglochin*
Sheathed sedge/ *Carex vaginata,*
Mountain scurvygrass/ *Cochlearia micacea*
Two-flowered rush/ *J. biglumis*
Chestnut rush/*J. castaneus*
Three-flowered rush/ *J. triglumis*
False sedge/ *Kobresia simpliciuscula*
Iceland purslane/ *Koenigia islandica*
Scorched alpine-sedge/ *Carex atrofusca*
Alpine rush/ *Juncus alpinoarticulatus*
Scottish asphodel/ *Tofieldia pusilla*
Cratoneuron/ *Cratoneuron spp*
Purple saxifrage/ *Saxifraga oppositifolia*
Mossy saxifrage/ *S. hypnoides*
Yellow saxifrage/ *S. aizoides*
Alpine saxifrage/ *S. nivalis*
Starry saxifrage/ *S. stellaris*

HABITAT IMPACT ASSESSMENT
WILLOW SCRUB

Aim

The aim of this guide is to describe methods of assessing Willow Scrub habitat relevant to deer managers.*

(below left): high impact browsing on shoots and (below right): low impact with little signs of browsing

Photographs courtesy of the Scottish Montane Willow Research Group

Habitat description

Willow scrub is a rare plant community in Scotland and consists of small fragmentary stands of sub-arctic or alpine willow species (downy, woolly, mountain and whortle-leaved willows — see species list overleaf) on steep slopes and cliff ledges, usually between altitudes of 600-900 m. This represents the top edge of 'natural tree line' habitat and the willows tend to be short and scrubby small plants or bushes as opposed to trees.

woolly
Gnarled, many-branched shrub. Height up to 1m. Leaves 3.5-7cm x 3-6.5cm

whortle leaved
Shrub. Height up to 0.5m. Leaves 1.5-7cm x 0.5-2.5cm

mountain
Shrub. Height up to 0.7m. Leaves 1.5-3cm x 1-1.5cm

downy
Much-branched shrub. Height 0.2-1m. Leaves 1.5-7cm x 1-2.5cm

numbered photograph of tagged willow to show
changes in plant size and shape over time

Key indicators

The main impact that deer have on willows is
browsing. Direct deer browsing impacts are assessed
by measuring the shoots browsed by deer and the
frequency of flowering.

Other impacts

Other herbivores, particularly goats and hares,
may also gain access to and browse willows. For
information on what time of year to measure,
see BPG Habitat Impact Assessment: Principles in
Practice.

What to measure	How to analyse
Record the number of shoots browsed on each willow plant by deer (based on the angle of cut). **	Average the number of shoots browsed per willow.
Record whether willow plant is flowering or not.	For each site, summarise the frequency*** of flowering willow plants (for example: 2/16 willow plants, flowering; 14/16 willow plants not flowering).
Record height of each willow plant: straight vertical distance from the ground to the highest point on the plant WITHOUT lifting or stretching the plant.	Average the height of all willows.
Record the annual growth by measuring the shoot extension to last year's node on five random shoots on each willow (see illustration below).	Average the annual shoot growth of all willows.
Take digital photo of each willow from fixed point (see illustration above).	Will enable detection of gross changes in willow size and shape over time.

willow in flower
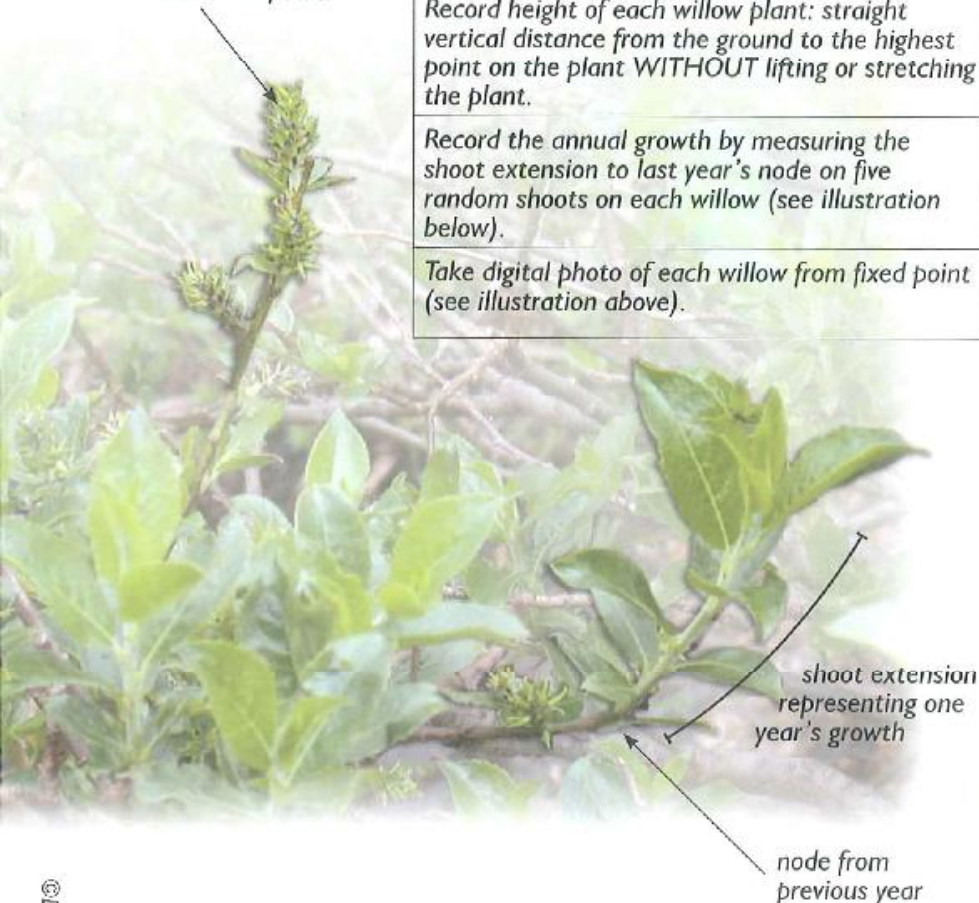
shoot extension
representing one
year's growth

node from
previous year

Willow Scrub *species:*

Downy willow/ *Salix Lapponum*

Woolly willow/ *Salix Lanata*

Mountain willow/ *Salix Arbuscula*

Whortle-leaved willow/ *Salix Myrsinites*

* The guides Habitat Impact Assessment: Principles and Habitat Impact Assessment: Principles in Practice should
be regarded as essential introductions to this subject Other linked guides are Habitat Impact Assessment: Analysis
** See BPG Woodland Damage: Recognition of Cause *** See BPG Habitat Impact Assessment: Analysis

TALL HERBS

Aim

The aim of this guide is to describe methods of assessing Tall Herbs habitat relevant to deer managers.*

Habitat description

Tall herb habitats consist of lush mixtures of flowering plants associated with areas protected from grazing (e.g. cliff ledges). The main indicator species are meadowsweet, water avens and globe flower. Where soils are acidic, lush mixtures of dwarf-shrubs, ferns (other than bracken) and greater woodrush are typically present.

(left) signs of high impact: no flowering woodrush (and/or key species) present
(right) signs of low impact: flowering woodrush and/or flowering key species

Key indicators

The main impact that deer have on tall herbs is grazing.[1] The presence and frequency of flowering of indicator species will give an indication of the level of impact.

Other impacts

Other herbivores such as sheep, goats and hares may cause impacts.*

Greater woodrush
A tall robust perennial forming bright green mats or tussocks. Height: flowering stems 30-80cm.[#]

Meadow sweet
Perennial herb. Height 60-120cm. Leaves 30-60cm

Water avens
Perennial herb. Height 20-60cm. Leaflets 2-20mm long with terminal leaflet 2-5cm

Globe flower
Perennial herb with short woody stock and leafy shoot. Height 10-60cm

numbered photograph of plot from fixed point. For information on the number and size of plots and what time of year to measure, see BPG Habitat Impact Assessment: Principles in Practice.

What to measure	How to analyse
Record presence or absence of tall herb species in each quadrat.	For each plot, summarise the frequency* of quadrats with presence or absence of tall herbs (for example: 6/16 quadrats, tall herbs PRESENT; 10/16 quadrats, tall herbs ABSENT). For each site, summarise the frequency of quadrats with tall herbs present or absent, in a site with 10 plots (a total of 10 x 16 quadrats): 50/160 quadrats, tall herbs PRESENT; 110/160 quadrats, tall herbs ABSENT).
Record whether tall herb species are flowering or not in each of the 16 quadrats.	For each plot, summarise the frequency* of quadrats with presence or absence of flowering tall herbs (for example: 2/16 quadrats, flowering tall herbs PRESENT; 14/16 quadrats, flowering tall herbs ABSENT). For each site, summarise the frequency of quadrats with flowering tall herbs present or absent (for example, in a site with 10 plots (a total of 10 x 16 quadrats): 20/160 quadrats, flowering tall herbs PRESENT; 140/160 quadrats, flowering tall herbs ABSENT).
Record presence of deer or hare dung in each plot.	For each site, summarise the frequency of quadrats with deer dung present or absent (for example, in a site with 10 plots: 80/160 quadrats deer, dung PRESENT; 80/160 quadrats, deer dung ABSENT). Repeat exercise for hare dung.
Take digital photo of whole plot from fixed point (see illustration above).	Will enable detection of changes in tall herb distribution over time.

TALL HERBS DATA SHEET

Dates:
Years:
Estate/ site:
Recorders:
Digital photo numbers:
GPS:
Grid ref:
Plot number:

Quadrat | Tall herbs species present? | Tall herb species flowering?

Tall Herbs species:

Greater woodrush/ Luzula sylvatica

Meadow sweet/ Filipendula ulmaria

Water avens/ Geum rivale

Globe flower/ Trollius europaeus

Angelica/ Angelica sylvestris

Roseroot/ Sedum rosea

Wood crane's bill/ Geranium sylvaticum

Holly fern/ Polystichum lonchitis

#(Greater woodrush) Leaves 10-30cm x 6-12mm. Leaf has white hairs that distinguish a woodrush (Luzula) from a rush (Juncus)

* The guides Habitat Impact Assessment: Principles and Habitat Impact Assessment: Principles in Practice should be regarded as essential introductions to this subject

[1] Guide to Upland Habitats, Surveying Land Management Impacts. Angus Macdonald, Penny Stevens, Helen Armstrong, Philip Immirzi and P Reynolds. 384 pages, 2 volume set, 50 col photos. Scottish Natural Heritage. See BP Contacts

WOODLAND DAMAGE
RECOGNITION OF CAUSE(1)

key:

effects of damage type to woodland

- no effect
- no significant losses
- can cause significant economic loss but woodland can survive
- can cause complete loss of woodland

Aim

Woodlands may be susceptible to a number of damaging agents. Identifying the cause of damage at an early stage is important, before the impacts become an expensive or ecological problem. The aim of this guide is to provide information to help with the identification process.

Recognising causes of damage

The following steps may help in assessing damage:

A. Read the signs. In most cases the causes will be apparent on close examination. Some knowledge of site history will be useful.

B. If in doubt, use the questions below to help identify potential causes.

C. Check the individual descriptions to confirm damage type and assess the potential extent of the effects of the damage depending on the age class of tree (i.e. seedling, sapling, mature).

No.	Question	Go to
1	How big are the trees?	
	• Seedling (young tree, below 1m high).	▶2
	• Sapling (young tree, 1–3 m high).	▶13
	• Mature (all older trees).	▶21

Seedlings

No.	Question	Y/N	Go to
2	Is seedling foliage brown, yellow or shrivelled ?	Y:	▶environmental
		N:	▶3
3	Has bark been removed?	Y:	▶4
		N:	▶8
4	Are teeth marks visible on close inspection?	Y:	▶5
		N:	▶6
5	Size of teeth marks 1-2 mm	▶voles	
	Size of teeth marks 3-4 mm	▶rabbits	

Environmental damage

frost damage

fungus
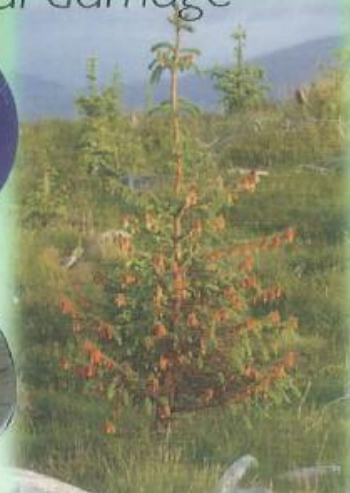
Signs: Trees may be damaged or stressed by a range of environmental factors including water-logging, nutrient deficiency, frost damage, lightning strikes and drought.

Insect damage

pine weevil

winter moth larva

Signs: Main species affecting trees are large pine weevil on restocking sites, common weevil on ex farmland planting sites, aphids and moth larvae. Can all cause damage usually by defoliation.

No.	Question	Y/N	Go to
6	Has bark been rubbed off ?	Y:	▶deer
		N:	▶7
7	Has bark been removed without any marks on underlying wood?	Y:	▶insects (large pine weevil)
		N:	other signs?
8	Have leaves and small shoots been eaten?	Y:	▶9
		N:	▶12
9	Are severed ends at a sharp angle and clean cut?	Y:	▶10
		N:	▶11
10	Have severed shoots been left uneaten?	Y:	▶hares
		N:	▶rabbits
11	Do severed shoots have a ragged end?	Y:	▶large herbivore
		N:	▶other signs?
12	Have only needles or leaves been eaten?	Y:	▶normally insects
		N:	▶birds

Field vole

Signs: Vole runs can be seen when grass is cut or after snow has melted.

Damage description: Removes bark of young trees and shrubs below level of surrounding vegetation. May cause damage higher up stem when snow provides cover.

Squirrels

Damage description: Can strip bark at a range of heights. Damage at base of tree can be similar to rabbits. Bark removed higher up stem will tend to be 1-2cm wide and several cm long.

Rabbits

Signs: Rounded and fibrous droppings, often deposited in latrine areas in high numbers. Burrows and freshly dug earth often visible.

Damage description: Browses young trees – stems cut cleanly at a sharp angle. Bark stripping on young trees and on thin barked mature trees. Damage usually no more than 0.5m high but can be higher if snow cover allows higher access.

Hares

Signs: Rounded and fibrous droppings larger than rabbit droppings. **Damage description**: Browses young trees – stems cut cleanly at a sharp angle. Cut stem usually left uneaten.

WOODLAND DAMAGE
RECOGNITION OF CAUSE(2)

Saplings

continued from Woodland Damage Recognition(1)

No.	Question	Y/N	Go to
13	Has bark been removed?	Y:	▶14
		N:	▶19
14	Are teeth marks visible on close inspection?	Y:	▶15
		N:	▶18
15	Size of teeth marks: 1-2mm		▶voles
	1.5mm		▶squirrels
	3-4mm		▶rabbits
	more than 4mm	Y:	▶16
16	Which direction do teeth marks run? Vertically	Y:	▶deer (see over)
	Diagonally	Y:	▶17
17	What height does damage extend to? 1.5m		▶sheep or goats
	2m		▶cattle or horses
	2.5m		▶horses
18	Has bark been rubbed off? between 0 and 0.5m?		▶ roe deer (likely)
	above 1m?		▶ deer (see over)
19	Have lower branches been browsed?	Y:	▶20
20	Height to which branches are browsed		
	0.6m		▶rabbits
	1.1m		▶roe
	1.5m		▶goats or sheep
	1.8m		▶red, sika, fallow
	2m		▶cattle/horses
	2.5m		▶horses

Bird damage

capercaillie

Signs: Droppings, local bird-expert knowledge. **Damage description**: May shear off top of shoots and pick out buds. Leader damage by nesting birds e.g. pigeons in conifer plantations.
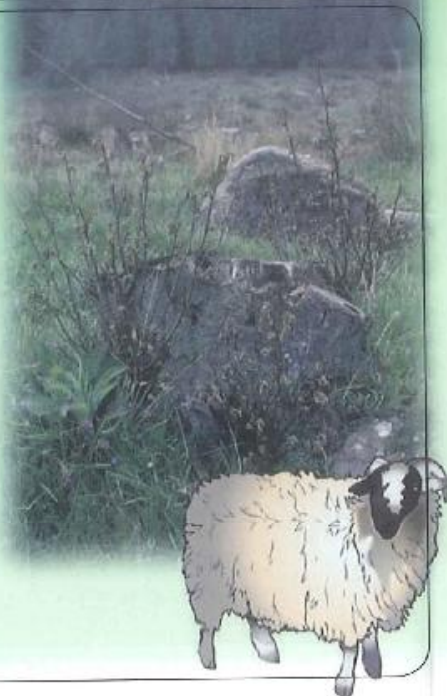
Sheep damage

Signs: Wool attached to coarse vegetation. Tracks are easily distinguished from deer tracks. **Damage description**: Browses seedlings and saplings. Cut end is usually flat across stem and a ragged end left. Bark can be stripped of stems.

Cattle, horse, goat damage

Signs: Footprints, presence of dung. The smell of goats usually confirms their presence. **Damage description**: Bark stripping and browsing can be severe to all stages of growth. Damage can appear at higher levels as goats can and do climb. When cattle are present, soft ground may be poached causing waterlogging of roots as well as root damage.
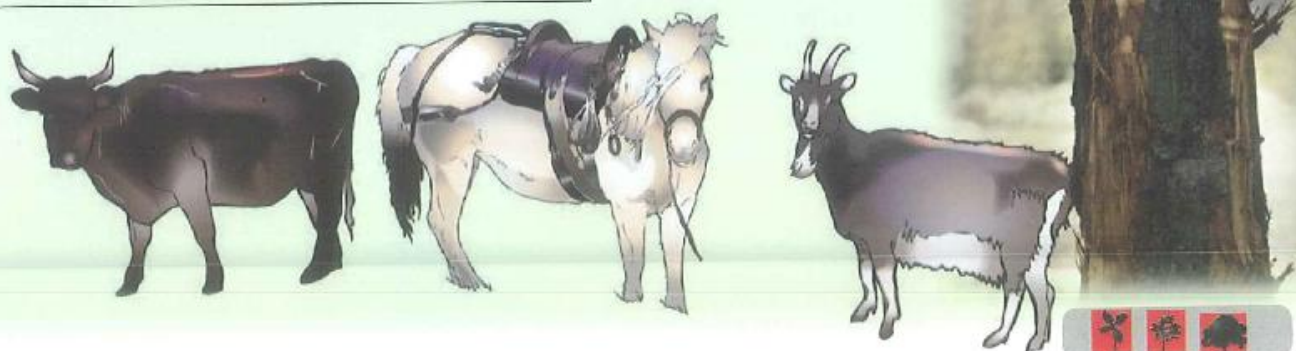
Mature

No.	Question	Y/N	Go to
21	Has bark been removed?	Y:	▶22
		N:	▶27
22	Are tooth marks visible on close inspection?	Y:	▶23
		N:	▶26
23	Size of teeth marks 1.5mm 3-4mm		▶squirrels ▶rabbits
	Size of teeth marks more than 4mm	Y:	▶24
24	Which direction do teeth marks run? vertically?	Y:	▶deer (refer below)
	diagonally?	Y:	▶25
25	What height does damage extend to? 1.5m 2m 2.5m		▶sheep/goats ▶cattle/horses ▶horses
26	Has bark been rubbed off between 0 and 0.5m?	Y:	▶roe deer (likely)
	above 1m	Y:	▶deer species
27	Have lower branches been browsed?	Y:	▶28
28	Height to which branches are browsed 0.6mm 1.1m 1.5m 1.8m 2m 2.5mm		▶rabbits ▶roe deer ▶sheep/goats ▶red/sika/fallow ▶cattle/horses ▶horses
29	Is ground heavily poached?	Y:	▶cattle (likely)

Roe damage

Signs: Tracks distinguishable from other deer. Droppings are cylindrical with rounded ends. **Damage description**: Bark frayed from stems and branches by buck will leave a smooth white wound with shreds of bark hanging from it and is often accompanied by a v shaped scrape on the ground at the base of the tree. Browsing damage similar to sheep.

Fallow, sika & red damage

Signs: Tracks of red similar to sika and fallow deer. Red use wallows around the autumn rut. **Damage description**: Can strip bark up to 3 m above the ground from saplings up to mature trees. Browsing damage similar to sheep. Fraying from cleaning antlers can cause significant damage to saplings. Mature trees can also be damaged by rubbing antlers. Can cause poaching in soft ground when numbers are high. 'Bole scoring' damage (associated with sika) is deep scoring or gouging of bark by antlers resulting in resin bleeding.