

HIGHLAND WILDLIFE PARK

BIODIVERSITY ACTION PLAN REPORT

2020-2025



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INTRODUCTION



“To restore stability to our planet
...we must restore its biodiversity,
the very thing we have removed.”

Sir David Attenborough



The Royal Zoological Society of Scotland (RZSS) is currently involved in over 30 conservation projects both internationally and in Scotland. The organisation’s work with native species includes conservation breeding and reintroduction programmes for critically endangered UK native species like wildcats (*Felis silvestris*) and pine hoverflies (*Blera fallax*), monitoring programmes for understudied species like the blood red longhorn beetle (*Anastrangalia sanguinolenta*), and veterinary health research on the globally Critically Endangered flapper skate (*Dipturus intermedius*).

Alongside this species conservation work, RZSS is also committed to improving the native biodiversity present at its Highland Wildlife Park (HWP) site via a comprehensive Biodiversity Action Plan (BAP).

Situated within the Cairngorms National Park, the largest national park in the UK, HWP benefits from diverse landscapes that support a wide range of ecosystems. The site covers over 200 hectares, with approximately one-third consisting of forested areas, including birch (*Betula spp.*) and Scots pine (*Pinus sylvestris*) woodlands. The remaining areas feature open grassland, peatland, and heath, providing habitat for a variety of native plant and animal species (Figure 1). This varied landscape makes HWP an important stepping stone site for species conservation and provides opportunities for ecological research in relation to the Cairngorms National Park.

RZSS secured funding from the National Lottery Heritage Fund (NLHF) to plan and deliver a

BAP at HWP as part of the Scotland’s Wildlife Discovery Centre project. Initial NLHF funding covered 2021-2023, with subsequent funding provided by the People’s Postcode Lottery through the Postcode Planet Trust, alongside The Natural and Cultural Heritage Fund, part funded by the European Development Fund, led by NatureScot. The BAP worked started with a comprehensive ecological site survey at HWP in May to December 2019, led by Dr Thomas Doherty-Bone. The survey assessed the state of biodiversity at HWP and identified areas where conservation efforts could be expanded or improved (see Conservation Action Plan for the RZSS Highland Wildlife Park 2020-25).

Building on the survey’s findings, a five-year BAP was developed to guide on-site conservation efforts at HWP. A BAP is a structured framework used to identify, protect, and enhance biodiversity within a specific area. It outlines clear objectives and management strategies to support native species and

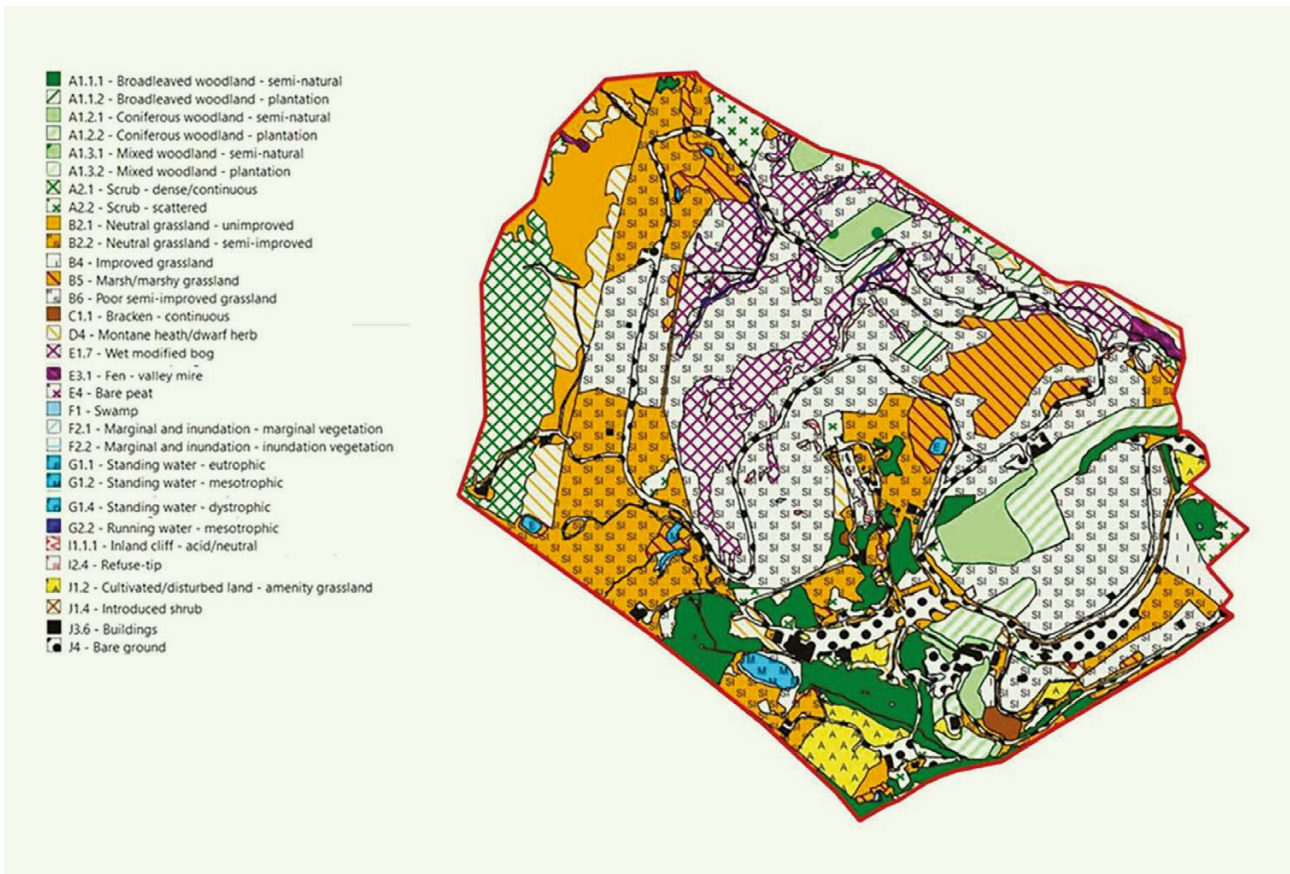


Figure 1: Preliminary habitat map of HWP based on the National Vegetation Classification (see Conservation Action Plan for the RZSS Highland Wildlife Park 2020-25).



Figure 2: Layout of animal enclosures (hatched polygons) and areas dedicated to habitat conservation (dotted polygons) at HWP (see Conservation Action Plan for the RZSS Highland Wildlife Park 2020-25).

ecosystems, ensuring that conservation actions were measurable and effective. The BAP was organised and run by the conservation field team, and its success was driven by a diverse mix of individuals who contributed their expertise and enthusiasm including RZSS staff, volunteers, and external contractors, all of whom played a role in collating data, sharing knowledge, and fostering engagement in biodiversity conservation at HWP.

This report details progress against the major work themes of the Conservation Action Plan for the RZSS Highland Wildlife Park 2020-25, discussing major achievements, challenges along the way, and providing a platform for continuation and development of the programme. Improving biodiversity at HWP requires a balancing act between the needs of native species, and the demands on the site as a zoo with a large collection of *ex-situ* animals (Figure 2) and high visitor footfall. With its unusual setting inside a national park, HWP is well-placed to provide a haven for native biodiversity and RZSS is committed to continual improvement of the habitat at HWP to ensure any native species making their home there are protected, valued, and loved.

OBJECTIVE PROGRESS TRACKER

Progress is assessed against the objectives set out in the BAP (see Conservation Action Plan for the RZSS Highland Wildlife Park 2020-25).

	BAP objectives achieved	Conservation outcome status
Woodland		↗
Grasslands		↗
Lichen		?
Fungi		→
Invertebrates		?
Small Scabious Mining Bee		↗
Wader & Ground Nesting Birds		↘
Invasive Species & Bracken Removal		↗

Green - All objectives for the workstream have been achieved or exceeded.

Amber - Over half of the objectives for the workstream have been achieved or exceeded, with remaining objectives either still in progress or no longer relevant.

Red - Fewer than half of the original objectives for the workstream have been achieved.

CONSERVATION OUTCOME STATUS

Progress is assessed against the baseline survey results set out in the BAP (see Conservation Action Plan for the RZSS Highland Wildlife Park 2020-25).

↗ Improving - Evidence indicates a measurable improvement in conservation condition, population status, or habitat quality relative to the baseline.

→ Maintained - Conservation condition has been maintained at or near baseline levels, with no clear evidence of improvement or decline.

↘ Declining - Evidence indicates a deterioration in conservation condition, population status, or habitat quality relative to the baseline.

? Unknown - Insufficient data or monitoring evidence is available to confidently determine conservation outcome.

WOODLAND MANAGEMENT



DESCRIPTION

The woodland within HWP covers approximately 25 hectares (Figure 3) and comprises a diverse mix of broadleaf and coniferous species (Figure 1). The broadleaf component includes several species of birch, aspen (*Populus tremula*), rowan (*Sorbus aucuparia*), and alder (*Alnus glutinosa*), which have either self-seeded or been planted as shelter belts. The coniferous species present are native Scots pine, alongside non-native Sitka spruce (*Picea sitchensis*) and noble fir (*Abies procera*) plantations.

Prior to the BAP, woodland management at HWP had been minimal, with interventions limited to the sporadic removal of dangerous, windthrown (trees blown over by the wind), or dead trees. HWP is situated within a wider landscape dominated by extensive Sitka spruce plantations, which almost surround it on three sides. Since Sitka spruce plantations

form dense, single-species stands that provide limited habitat for native biodiversity and are particularly vulnerable to wind damage (Quine *et al.*, 2007; Deal *et al.*, 2014; Pedley *et al.*, 2014; Cameron *et al.*, 2015), proactive woodland management within HWP is essential to increase habitat diversity, enhance resilience to extreme weather, and support a broader range of native species.

The woodland at HWP provides critical habitat for several important species, including the near-threatened red squirrel (*Sciurus vulgaris*), which relies on coniferous woodland for both food and shelter. Scots pine seeds serve as a key food source, while the varied woodland structure provides nesting opportunities (Trees for Life, 2020). Additionally, HWP supports a nationally rare lichen species, *Candelariella superdistans*, which is found on aspen. This lichen thrives in environments with clean air and stable ecological conditions, making the presence of mature aspen trees an important factor in its survival (Fungi of Great Britain and Ireland, 2025). However, without active

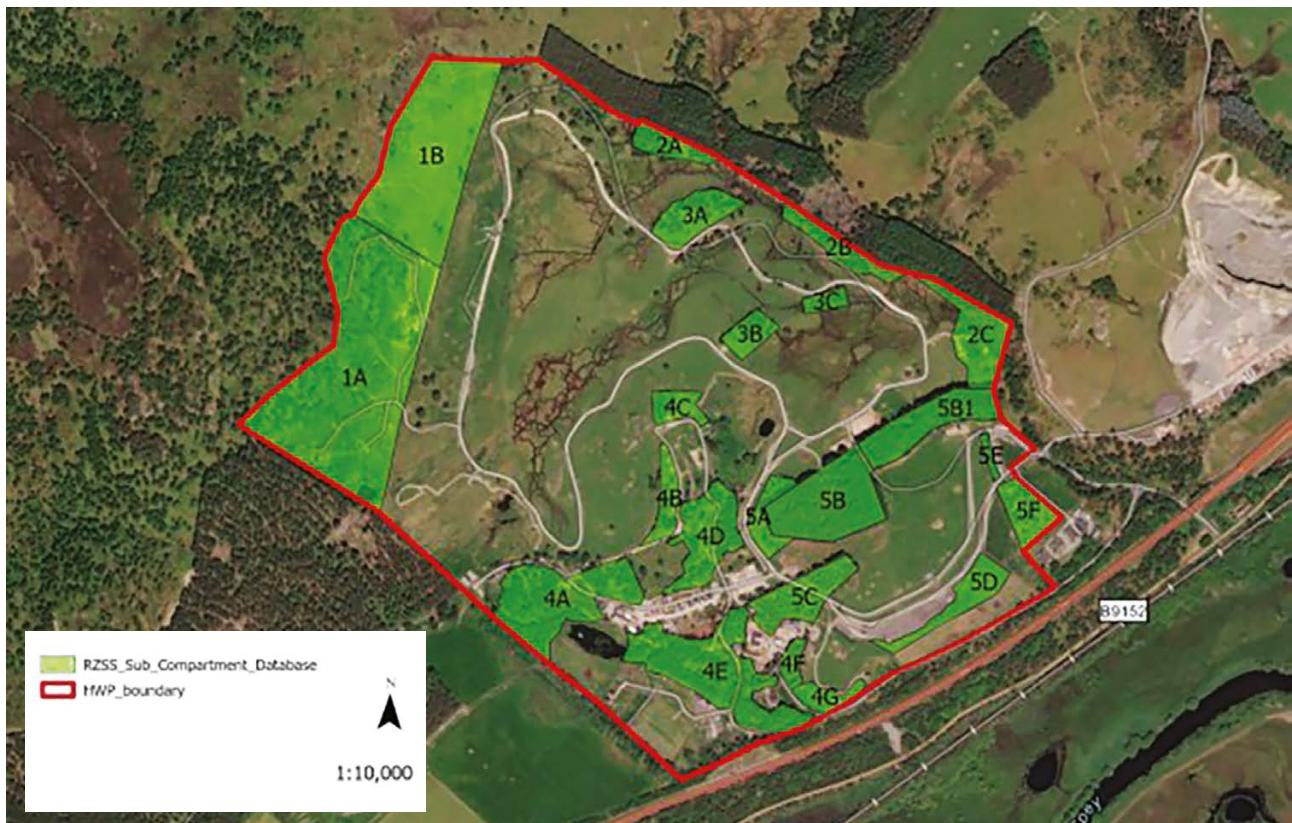


Figure 3: Woodland sub-compartments at HWP (see Royal Zoological Society of Scotland Highland Wildlife Park Forest Management Plan 2025 to 2030).



Figure 4: Impact of windthrow event in January 2022.

woodland management, the expansion of non-native conifers and changes to the woodland structure could threaten these specialist species by reducing the availability of suitable habitats and altering the microclimate (John Muir Trust, 2024).

A significant windthrow event in January 2022 impacted approximately two hectares of Sitka spruce plantation within HWP (Figure 4). This event highlighted the vulnerability of monoculture plantations to extreme weather and reinforced the necessity of a structured woodland management plan (Griess *et al.*, 2011).

OBJECTIVES

- Produce a Scottish Forestry approved Woodland Management Plan by Q3 2021, establishing a structured framework for the long-term improvement of woodland habitats at HWP.
- Increase aspen planting to enhance biodiversity and support species that depend on this habitat by Q4 2024.

- Remove non-native tree species across the site to restore and strengthen native woodland ecosystems by Q4 2024.
- Contribute to the Cairngorms National Park Authority (CNPA) woodland expansion and enhancement targets by improving woodland connectivity and ecological resilience at HWP by Q4 2024.

RATING

Amber 

Woodland management has been assigned an amber rating due to initial delays in securing a contractor to develop a management plan. The relatively small size of the woodland made it challenging to find a contractor willing to undertake the project, as many providers specialise in large-scale woodland management.

Progress was made in spring 2023 when BH Wildlife Consultancy was contracted to produce the woodland management plan for HWP. This was followed by a period of stakeholder

engagement in spring 2024, involving the landowner for the HWP site (Dunachton Estate), CNPA, and Highland Council. Stakeholder approval was secured by September 2024, after which the plan was submitted to Scottish Forestry for final approval. The plan was formally approved at the start of January 2025 (Figure 5).

The approved woodland management plan covers the period 2025 – 2035, providing a structured framework for conservation, biodiversity enhancement, and long-term resilience. The rating remains amber due to the delays encountered at the start of the process when securing a contractor proved challenging. While this was ultimately resolved, the time lost in the early stages delayed a more immediate implementation of management activities. Despite this, the completion and approval of the plan now provide a clear foundation for future woodland management efforts.

FUTURE

With the woodland management plan now approved by Scottish Forestry, the focus shifts to implementation over the next 10 years. Key actions will aim to improve the health, diversity, and resilience of the woodland within HWP.

One of the first priorities will be clearing the entire windthrown Sitka spruce plantation area, which was created when storms Malik and Corrie, in January 2022, toppled approximately two hectares of trees. This work is planned for completion by the end of Q1 2026, removing all non-native trees from this area, both standing and fallen, and preparing the site for restoration. The cleared windthrown area will then be replanted in autumn 2028, after being left fallow for three summers to reduce competitive vegetation pressure, allow depletion of the soil seed bank, and improve establishment success of planted trees (Walker & del Moral, 2003). The new planting will aim to create a diverse mix of coniferous and broadleaf forest, improving structural diversity and making the woodland more resilient to future storms and pests.

Beyond the clearance of Sitka spruce plantation, a thinning programme across HWP will be carried out to create a more open canopy, allowing light to reach the forest floor. This will encourage natural regeneration and improve habitat quality for a range of species. To accelerate the process of diversifying the woodland, small saplings of native species will be planted in selected areas (aspen, scots pine, holly (*Ilex aquifolium*), oak (*Quercus spp.*), and rowan), helping to establish a more varied and resilient forest structure. Additionally, material from the thinning process will be used as browse for animals within the HWP *ex-situ* collection, ensuring a sustainable management approach that benefits both the woodland ecosystem, the wild animals that depend on it, and the *ex-situ* animals in RZSS' care.

A key focus of the management plan will be increasing the abundance of Scots pine and aspen. This will help secure habitat for red squirrels, which depend on Scots pine as a food source, and support the nationally rare lichen *Candelariella superdistans*, which relies on mature aspen.

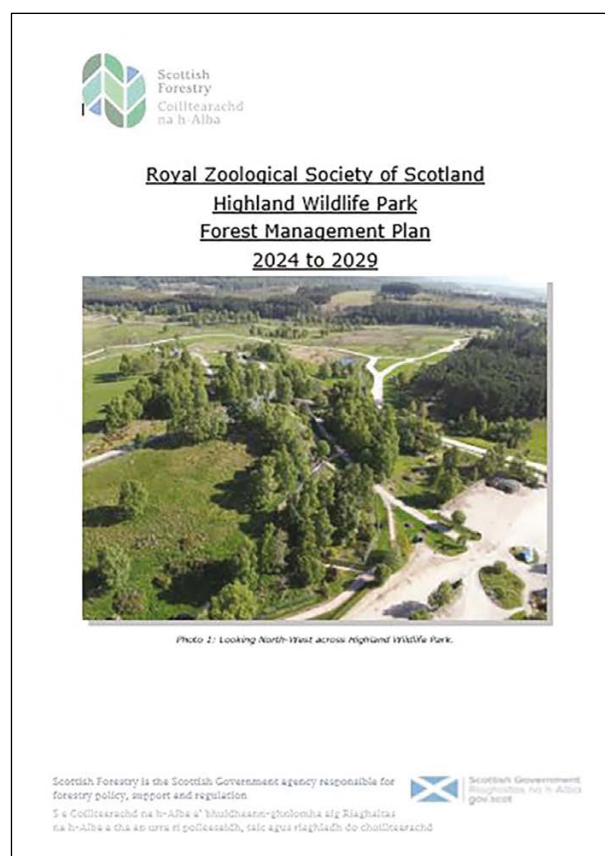


Figure 5: Approved woodland management plan for HWP.

GRASSLAND MANAGEMENT



DESCRIPTION

The grassland areas within HWP vary in size and shape, with many scattered throughout HWP (Figure 1). Historically, management of some of these areas was limited to regular mowing, which maintained short grass but did not provide broader ecological benefits.

With grassland areas previously managed primarily for maintenance rather than biodiversity, there was a significant opportunity to demonstrate how habitats could be effectively managed to enhance ecological value while still maintaining an aesthetically pleasing environment for visitors (Garbuzov, 2014). By shifting from annual mowing to a structured grassland management approach, HWP could showcase best practices in conservation and habitat restoration.

These grassland areas also offer a great opportunity to study and encourage the growth of plant species native to the Cairngorms National Park. Through targeted enhancement and careful implementation of the BAP, RZSS

could promote the establishment of native flora while simultaneously supporting the wider ecology of HWP.

As plant diversity improves, the abundance of invertebrates and small mammals is also expected to increase, strengthening the food web and directly benefiting a range of species, including birds, amphibians, reptiles, and larger mammals.

OBJECTIVES

- Establish trial wildflower areas by selecting and managing an initial site by summer 2021.
- Expand managed grassland areas annually to include more publicly visible locations.
- If necessary, enhance plant diversity by sowing locally sourced wildflower seed.
- Establish an annual plan for the cutting and raking of expanded grassland areas, ensuring long-term sustainability by end of funding.



Figure 6: Wildflower trial areas at HWP and the year each area was added.

RATING

Green

The development of grassland management under the BAP has been a success, with ongoing improvements leading to greater species diversity and habitat quality (Figure 6).

The process began in summer 2021 (Figure 6), when an area in front of the Mishmi takin (*Budorcas taxicolor taxicolor*) enclosure (Figure 2) was selected for a wildflower trial. In autumn 2021, the grass was mown and raked to remove the cuttings, preventing soil enrichment that would otherwise encourage further grass dominance. The area was then left uncut until autumn 2022. During the initial preparation, wild daffodil (*Narcissus pseudonarcissus*) bulbs were planted, and yellow rattle (*Rhinanthus minor*) seed was sown. Yellow rattle, which is hemiparasitic (attaches to the roots) on certain grasses (Levinsh, 2024), was introduced to reduce grass growth, allowing any existing wildflowers or seeds present in the soil that might previously have been suppressed by



Figure 7: Northern marsh orchid (*Dactylorhiza purpurella*) at HWP.

dense grass cover to germinate and grow. By spring and summer 2022, a variety of wildflowers had emerged, including Northern marsh orchid (*Dactylorhiza purpurella*), a species not previously recorded at HWP (Figure 7).

Building on this success, autumn 2022 saw an expansion of the managed grassland areas to include more publicly visible locations within HWP. These new areas underwent the same process of mowing, raking, and yellow rattle seeding as the initial trial site in autumn 2021.

A review of growth in spring and summer 2023 showed varied results. Some areas contained wildflowers from the existing seedbank and developed into rich, diverse habitats, while others had little more than the sown yellow rattle, indicating that the soil had contained fewer dormant wildflower plants or seeds. To improve these areas, locally sourced wildflower seed was purchased and sown in autumn 2023 after the autumn mowing.

In summer 2024, the programme was further expanded and brought under management, building on the success of previous work. Due to the increased workload involved in cutting and raking all managed grassland areas, AMW Partnership was contracted to undertake this work in autumn 2024.

Grassland management efforts were also extended to some woodland areas. In autumn 2023, the wildlife garden, a 0.2-hectare predominantly grassland area near the entrance to HWP (Figure 2), was incorporated into the BAP as an educational space to showcase different habitat types and wild garlic (*Allium ursinum*) bulbs planted in autumn 2023 (Figure 8).

The area was divided into three distinct sections, with paths running between them to facilitate visitor engagement.

- The first section features woodland habitat, where wild garlic has been planted to enhance biodiversity.
- The second section has been developed as a meadow area, with tree removal



Figure 8: Wild garlic (*Allium ursinum*) planted in wildlife garden with flags marking planting locations.

increasing light availability, to support wildflower growth. It is managed through the same annual mowing regime as other grassland areas at HWP.

- The final section has been left unmanaged, with thick, coarse grass providing valuable cover for small mammals, demonstrating the role of untouched grassland in supporting wildlife.

FUTURE

The maintenance and expansion of wildflower habitats at HWP will be the primary focus of future grassland management efforts. To ensure the long-term success of these areas, a contractor will continue to be appointed each year to carry out annual cutting and raking, preventing excessive grass growth and maintaining conditions that support diverse plant species.

In addition to managing existing grassland, the planting of native bulbs will continue across HWP, enhancing biodiversity and seasonal interest. The development of the wildlife

garden will also play a key role, providing an engaging space for visitors to learn about native plant species and the importance of habitat management. This will enhance educational opportunities, allowing visitors to see first-hand how conservation initiatives can benefit both wildlife and the landscape.

To further support habitat expansion, wild seeds collected on-site will be either sown in other areas at HWP or grown as plugs for future planting. This approach will ensure that species already thriving at HWP can be used to establish additional wildflower-rich habitats on site.

Engagement with visitors could be improved through the introduction of interpretative signage and information displays about the wildflower areas. This would provide insights into the importance of grassland habitats, the species they support, and the management techniques used to maintain them. By increasing awareness, RZSS aims to educate visitors on the significance of biodiversity-friendly practices and inspire them to apply similar techniques in their own gardens or local green spaces.

LICHEN



DESCRIPTION

Lichens play a crucial role in ecosystems, fixing carbon and nitrogen, serving as a food source for various animals including deer, birds, and rodents, providing nesting material for birds, and helping protect trees by shielding them from extreme weather conditions such as rain, wind, and snow. As a keystone species, lichens are vital for supporting biodiversity (Duran-Nebreda, 2023).

HWP is a managed visitor attraction with an *ex-situ* animal collection, and this land use influences lichen presence and diversity. Management activities associated with animal husbandry, visitor access, and habitat maintenance introduce varying levels of physical disturbance and nutrient enrichment, both of which are well-established drivers of lichen community composition (Ellis, 2012).

Physical disturbance occurs when external forces disrupt lichen growth and development. This includes mechanical abrasion, compression, or the removal of lichens from their substrate. Such disturbances can hinder lichen establishment, restrict reproduction, and alter natural growth patterns (Schweizer, 2021).

Nutrient enrichment occurs when rising nitrogen levels change lichen composition. Some species thrive in nitrogen-rich conditions, while others struggle to adapt and may decline or disappear. This process can result from atmospheric deposition, organic material accumulation, or other environmental factors that alter nutrient availability (Johansson *et al.*, 2011).

OBJECTIVES

- Conduct a baseline survey on lichen species throughout HWP by Q4 2022.

RATING

Green ?

A lichen survey was conducted at HWP in spring 2022 and provided valuable insights into the site's lichen biodiversity and the environmental factors influencing species composition. Lichenologist, Dr. Petra Vergunst, was contracted to conduct the survey and recorded 135 lichen species, highlighting the rich diversity within HWP. Her report guided the initial implementation of key recommendations for lichen conservation and management (see A Lichen Survey of The Highland Wildlife Park 2022 report).

The survey confirmed that physical disturbance plays a significant role in shaping lichen communities at HWP. The rubbing and scraping behaviours of zoo animals, along with visitor interactions with fences, rocks, and trees, have contributed to the removal of lichens from surfaces and hindered the establishment of some species. This has particularly affected lichens that rely on long periods of stability to grow and develop reproductive structures, which are essential for both their identification and natural dispersal.

Nutrient enrichment was also found to be a major factor influencing lichen composition at HWP. The survey identified that areas closest to enclosures showed signs of nitrogen enrichment, likely resulting from zoo animal waste and emissions. The high density of corvids on site, attracted to the enclosures due to bones and scraps of meat from feeding the zoo animals, contribute further to localised nutrient increases through their droppings. In these areas, some lichen species that thrive in nitrogen-rich environments were found to be abundant, whereas those that prefer nutrient-poor conditions were less common.

Interestingly, visitor activity was also identified as an additional source of nutrient input, with vehicle emissions contributing to atmospheric nitrogen levels, and dust from foot traffic

settling on trees and rocks, further influencing lichen growth and species composition.

A particularly important finding from the survey was the identification of several rare lichen species within HWP. This included one nationally rare species, *Candelariella superdistans* (Figure 9), as well as three nationally scarce species: *Lecanora populicola*, *Melanohalea septentrionalis*, and *Porpidia melinodes*.

Dr. Vergunst also led lichen tours for HWP staff, which were well-attended and highly successful. These sessions enhanced staff engagement and understanding, increasing awareness of the importance of lichens within HWP's ecosystem.

FUTURE

Lichen conservation at HWP will focus on implementing key recommendations from the lichen report, ensuring that habitats are actively managed to support and enhance lichen diversity.

A key strategy will be to increase the diversity of broadleaf trees within HWP, with aspen, birch, alder, and oak planted in selected areas. These species provide important surfaces for lichen colonisation and will help create a more varied woodland structure, benefiting both lichen

communities and the wider ecosystem (FLS, 2014).

To further support lichen dispersal, small, protected zones will be created around old trees, where natural lichen populations are already established. These areas will be left undisturbed, allowing spores to spread naturally and enabling lichens to colonise new surfaces over time. Additionally, deadwood will be left in place wherever possible, as it provides a valuable habitat for certain lichen species, contributing to overall biodiversity (Hämäläinen, 2023).

Efforts will also be made to improve conditions for lichen growth on rocky surfaces. Accumulated debris such as mud and droppings can prevent lichens from establishing (Armstrong, 1994), so targeted removal of this material will be carried out in specific areas, ensuring that lichen colonies have a greater opportunity to spread and develop.

Interpretative signage and information displays could be introduced to provide insights into the importance of lichens, their ecological roles, and the management techniques used to protect them. By raising awareness, RZSS aims to educate visitors on the significance of lichen conservation, fostering a greater appreciation for these unique organisms and their role in ecosystems.

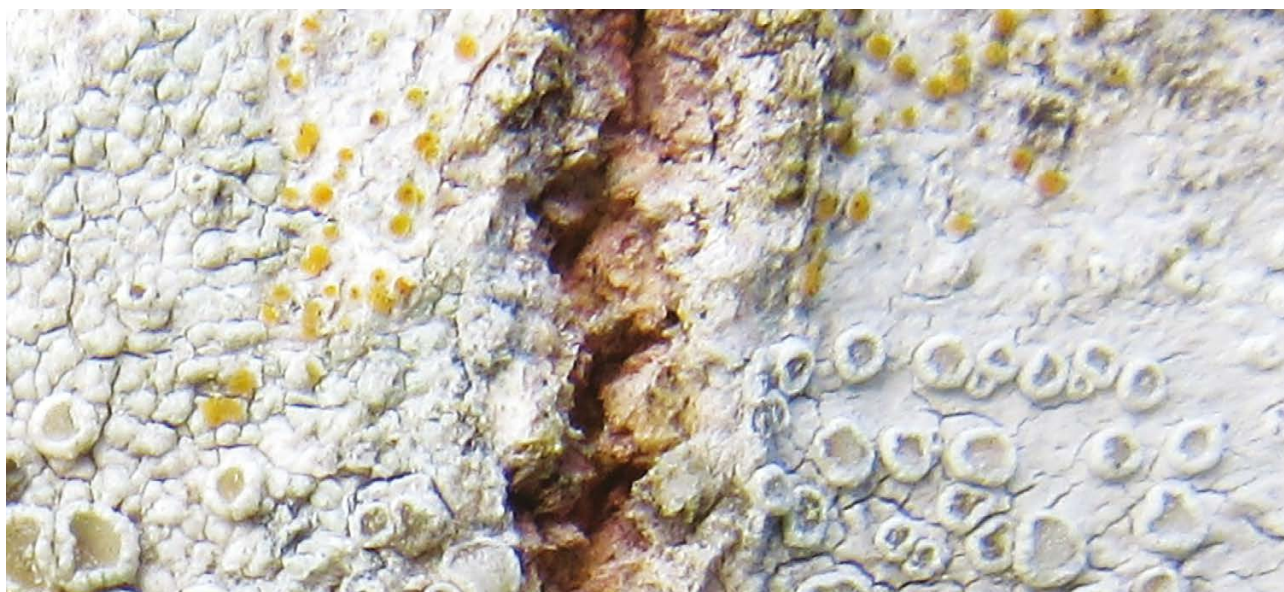


Figure 9: *Candelariella superdistans* growing parasitically on *Lecanora populicola* on aspen near the wolf enclosure.

FUNGI



DESCRIPTION

Fungi help break down organic matter and recycle essential nutrients that plants rely on for growth. This decomposition process maintains healthy soils, supporting both plant and animal life. By returning nutrients to the soil, fungi prevent the buildup of organic debris, such as fallen trees and animal remains, which would otherwise deplete soil fertility. Their presence is critical to sustaining balanced ecosystems, making them a key component of ecological health (Powell, 2018).

The diverse range of habitats at HWP supports a relatively diverse range of fungi. Before HWP was established, the area consisted of birch woodland, conifer plantations, and old croft land used for grazing. Over time, changes in land management have shaped the landscape, leading to extensive short-sward grassland grazed by zoo animals, as well as small patches of birch-dominated broadleaf woodland, an alder patch, and a small conifer plantation. These varied habitats create diverse conditions for fungal growth, supporting species that thrive in grassland, woodland, and decomposing organic material.

Despite their ecological importance, fungi are challenging to study and monitor. Unlike plants and animals, fungi spend most of their life cycle hidden within their substrate, such as soil, dead wood, or living plants. They only become visible when producing fruiting bodies or spores, which occurs irregularly and often unpredictably. Even when fruiting bodies appear, they may only last for a few days and are not necessarily produced every year. As a result, many fungal species remain under-recorded and difficult to assess, with knowledge of their distribution and abundance primarily based on sporadic fruiting body observations (van der Linde, 2012).

Understanding fungal diversity at HWP is crucial for evaluating its ecological health. As knowledge of fungal populations improves, so too will the ability to manage habitats effectively,

ensuring that fungi continue to play their essential role in nutrient cycling and ecosystem stability.

OBJECTIVES

- Deliver waxcap identification training to all staff by end of Q4 2022, enhancing awareness and improving survey capabilities.
- Establish an annual fungi survey programme, to ensure long-term monitoring of fungal diversity at HWP by Q4 2022.
- Implement habitat management actions to support fungal conservation, particularly for waxcaps and other grassland-associated species by Q4 2024.

RATING

Green 

In 2022, RZSS contracted mycologist Liz Holden to conduct a two-day fungal survey at HWP. Recognising the importance of continued monitoring and the need for expertise to achieve this, Holden was contracted again in 2023 and 2024, with a one-day survey each year. The reduced number of survey days in these later years reflected Holden's increased familiarity with HWP's habitats, allowing for more targeted and efficient data collection (see Fungal Survey for the Royal Zoological Society of Scotland (RZSS) 2022, 2023 and 2024 reports).

In addition to these formal surveys, an additional day each year from 2022 onward was dedicated to staff walkabouts, during which Holden showed staff the fungi found within HWP (Figure 10). These sessions proved extremely popular, with over 20 staff attending, enhancing staff engagement and understanding of the ecological role of fungi at HWP and more widely.



Figure 10: Liz Holden identifying fungi will staff at HWP.

Across three years of surveying, a total of 176 fungi species were identified at HWP, including 19 waxcap species. Waxcaps are of particular conservation significance, as they are listed as priority taxa in the Cairngorms Nature Action Plan (2019–2024). Their presence is an indicator of nutrient-poor soils and unimproved grassland (NatureScot, 2024), reinforcing the importance of HWP’s grassland management in maintaining suitable fungal habitats.

HWP has also been assessed using the CHEG scoring system; a widely used framework for evaluating the ecological quality of grassland fungi communities. It categorises fungi into four key groups (Lyness, 2021):

- C – Clavarioid fungi (club and coral fungi)
- H – Hygrocybes (waxcaps)
- E – Entolomas (pinkgills)
- G – Geoglossaceae (earthtongues)

and scores each based on the number of species detected in that category. HWP received a score of 5-15-18-2. A higher CHEG score generally indicates a more ecologically valuable and diverse fungal grassland habitat (Caboň, 2021). The presence of 15 Hygrocybe and 18

Entoloma species suggests that HWP’s grasslands have conservation value for fungi, supporting a diverse range of fungi typically associated with low-nutrient, semi-natural habitats.

FUTURE

Following three consecutive years of annual fungi surveys, RZSS will transition to a biannual survey pattern from 2025 onwards. This approach will ensure that monitoring continues in an economically viable manner while allowing for a longer-term assessment of trends in fungal diversity at HWP.

A key priority will be to protect and sustain existing mature woodland, ensuring that trees can complete their natural life cycle. This approach will benefit fungi involved in decomposition, soil health, and nutrient cycling. Where possible, small woodland patches will be connected or expanded, enhancing the conditions necessary for fungal networks to thrive.

To further support fungal diversity, maintaining and expanding tree planting efforts with locally

appropriate species will be explored. In addition, deadwood will be retained within woodland areas, as it provides an important habitat for wood-recycling fungi. Wood from browsed branches may also be relocated to sheltered, humid areas, where conditions will encourage the natural breakdown of material and support the growth of fungal communities.

Grassland areas will continue to be managed to prevent excessive nitrogen buildup, ensuring the low-nutrient conditions essential for fungi such

as waxcaps and other CHEG species. Dung removal will remain a priority in waxcap-rich areas to reduce nitrogen accumulation.

Visitor engagement could be enhanced through the introduction of interpretative signage and educational displays about fungi. These will highlight the ecological importance of fungi, their role in nutrient cycling and ecosystem health, and the conservation measures in place at HWP.



Figure 11: Slimy waxcap (*Gliophorus irrigates*) that was found in 2024 in the vicuna enclosure and was a new species found at HWP.

INVERTEBRATES



DESCRIPTION

Invertebrates inhabit a wide range of environments, from terrestrial habitats to rivers, lochs, and seas. However, human-driven activities, including habitat loss, pollution, and pesticide use, pose significant threats to their long-term survival. As a result, many invertebrate populations are in decline, which can have far-reaching ecological consequences for ecosystems locally and globally (Miličić, 2020).

Invertebrates play roles as pollinators and waste recyclers, supporting the growth of crops and wildflowers, which in turn sustain a wide variety of plant and animal species. Invertebrates also serve as both predators and prey, playing a vital role in food webs (Eisenhauer & Hines, 2021).

The HWP BAP recognised the importance of improving RZSS staff knowledge of invertebrates - particularly those listed as priority species in the CNPA action plan (2019-2024). These invertebrates may not currently

be present at HWP (and, indeed the site may never be suitable for some of these species). However, helping staff become more confident in identifying these species was felt to be important to i) improve engagement around invertebrate identification and surveys in general; ii) allow for early detection in case any of these species did appear at HWP; iii) to spread the benefits of the BAP beyond the site's boundaries (Figure 12).

OBJECTIVES

- Complete staff training in and survey for key invertebrate species by Q4 2022, covering:
 - Northern damselfly (*Coenagrion hastulatum*)
 - Northern February red stonefly (*Brachyptera putata*)
 - Kentish glory moth (*Endromis versicolora*)
 - Dark-bordered beauty moth (*Epione vespertaria*)



Figure 12: Aspen hoverfly (*Hammerschmidia ferruginea*), a species not recorded at HWP, but an important species to be able to identify in the wider environment.



Figure 13: Classroom and fieldwork based invertebrate identification sessions for staff at HWP.

- Pine hoverfly (*Blera fallax*)
- Aspen hoverfly (*Hammerschmidtia ferruginea*)
- Shining guest ant (*Formicoxenus nitidulus*)
- Wood ant (*Formica spp.*)
- Small scabious mining bee
- Pinewood mason bee (*Osmia uncinata*)

skills, knowledge of where to look for the focal invertebrate species, and an understanding of habitat requirements for a variety of rare invertebrates. These sessions covered all the species in the objective list above. Each session included a half-hour presentation, followed by a field survey to search for the targeted species (Figure 13).

Since 2022, monthly moth trapping has taken place at HWP between May and August, helping to build a clearer picture of moth diversity on site. So far, 61 moth species have been recorded, including four species listed on the Scottish Biodiversity List: minor shoulder-knot moth (*Brachylomia viminalis*), white ermine moth (*Spilosoma lubricipeda*), buff ermine moth (*Spilosoma luteum*), and cinnabar moth (*Tyria jacobaeae*). A Nationally Scarce moth, the heath rivulet moth (*Perizoma minorata*), has also been recorded.

In total, 297 invertebrate species have been identified at HWP, reflecting the diversity of habitats and the success of monitoring efforts.

RATING

Green ?

Significant progress has been made in improving staff knowledge and monitoring of invertebrates at HWP, going well beyond the original objective set out in the BAP. A series of training sessions in summer 2022, led by Genevieve Tompkins, the Rare Invertebrates in the Cairngorms (RIC) project officer, provided over 30 HWP staff with valuable identification

Staff training has also extended to dung beetle identification, recognising HWP's unique opportunity to study dung-associated species due to the presence of large grazing animals in the *ex-situ* collection. Additionally, a biodiversity WhatsApp group has been created for HWP staff, encouraging all 48 group members to share invertebrate and other wildlife sightings on site. This has been extremely successful, proving to be an effective knowledge-sharing tool that fosters engagement and enthusiasm for invertebrate conservation across RZSS.

FUTURE

Invertebrate conservation at HWP will focus on ongoing species recording throughout the year, ensuring that invertebrate populations are monitored and better understood. This will involve moth trapping, dung examination, and bumblebee surveys, allowing for a broader assessment of the invertebrate diversity at HWP.

The highly successful staff biodiversity WhatsApp group will remain a key tool in fostering enthusiasm and engagement among staff. By encouraging the sharing of sightings and observations, this platform will continue to

enhance collective knowledge and awareness of invertebrate species across HWP. Additionally, future training days will be organised, covering topics such as bumblebee and grasshopper identification, building on previously successful invertebrate training sessions.

The ongoing woodland and wildflower management plans will further enhance habitats for invertebrates. These efforts will not only protect existing habitats but also create new ones, increasing the likelihood of previously unrecorded invertebrate species establishing themselves within HWP. Through continuous habitat development and targeted monitoring, RZSS aims to ensure that invertebrate populations remain diverse and resilient for the future at HWP.

Public engagement could be expanded through the development of signage and pop-up displays, offering visitors insight into the invertebrates found at HWP and their ecological importance. Additionally, learning presentations will continue, discussing the invertebrates of HWP and the wider Cairngorm National Park, further educating visitors about the role these species play in local ecosystems and the conservation efforts being undertaken to support them.

SMALL SCABIOUS MINING BEE



DESCRIPTION

The small scabious mining bee (*Andrena marginata*) is one of Scotland's rarest bees (Figure 14). It is classified as Nationally Scarce in Britain, is on the Scottish Biodiversity List, and is recognised as a priority species in the Cairngorms Nature Action Plan (2019-2024). Its distribution in Scotland is highly fragmented and restricted, with localised populations found in Glen Moriston, the Spey Valley around Aviemore and near Daviot, southeast of Inverness. Declines in this species are most likely driven by habitat loss, fragmentation, and habitat deterioration resulting from over-grazing, poorly timed grass cutting, and scrub encroachment. The permanent loss of suitable habitat to development also represents a significant ongoing threat. (Buglife, 2019). We are lucky enough to have this species naturally present at HWP and it has become one of the hero species for our BAP work.

The SSMB was first recorded at HWP during the initial ecological site surveys for the BAP in 2019. Its presence has significant conservation implications, as it falls between known SSMB populations in Newtonmore, Insh Marshes, and Aviemore (NBN Atlas, 2025). This means that

the HWP population could serve as a bridging population, helping to maintain genetic diversity and dispersal potential across the Strathspey area.

The strong association between SSMB and devil's-bit scabious (DBS) (*Succisa pratensis*) gives this bee its name. The flight period of adult bees, from mid-July to mid-September, coincides with DBS' main flowering season (Buglife, 2019). The SSMB is a specialist pollinator; in Scotland, females collect pollen from DBS to create pollen balls, which are placed alongside their eggs. Once the larvae hatch, they feed entirely on the stored pollen until they develop into adult bees (Larsson, 2005).

Similar to other mining bee species, the SSMB constructs underground nests by digging burrows in exposed soil or sparse vegetation. Each burrow typically contains multiple larval chambers, where pollen and eggs are deposited (Stenmark, 2013). Females are approximately 1 cm long, with an abdomen colour ranging from black to orange and hairy back legs, which allow them to carry large amounts of pollen efficiently. Males are smaller, around 0.7cm in length, and have a black or dark brown body with a distinctive white marking on the centre of their face (Shaw, 2006).



Figure 14: Small scabious mining bee (*Andrena marginata*) at HWP.

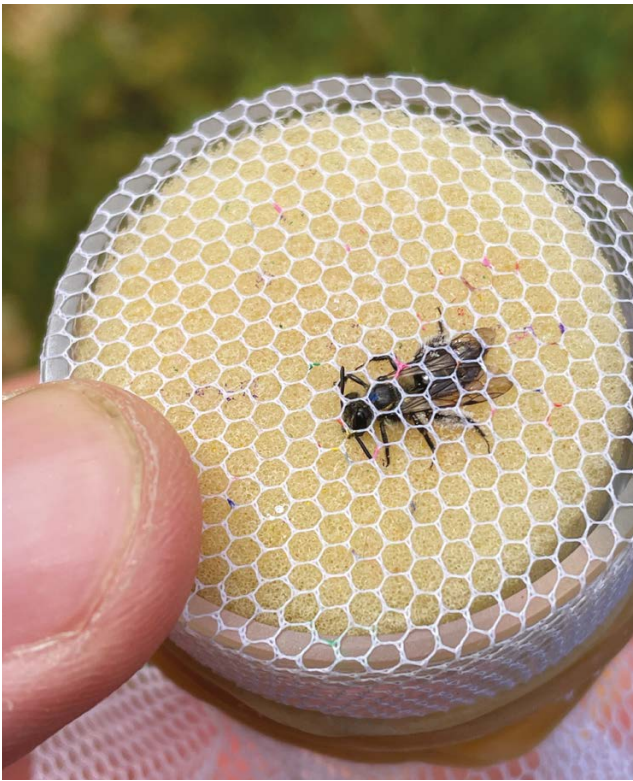


Figure 15: Marking of small scabious mining bee (*Andrena marginata*) for mark-recapture surveys.

OBJECTIVES

- Conduct annual population surveys from Q3 2022 to Q3 2024.
- Produce annual population and monitoring reports from Q4 2022 to Q4 2024.
- Implement habitat improvements by removing bracken and increasing devil's-bit scabious throughout HWP with annual planting

RATING

Green 

Monitoring and conservation efforts for the SSMB at HWP have steadily expanded since 2022, with surveys becoming increasingly detailed and structured each year. By 2024, surveys were conducted for four hours a day, six days a week, covering the entire flight season from mid-July to mid-September.

Through these surveys, both the start (mid-July) and end (mid-September) of the flight season have been documented, providing valuable data on the species' activity period.

Each year, a population estimate has been produced via mark-recapture survey methods (Figure 15), allowing for a better understanding of population trends. The 2024 survey produced the highest estimated population size of ~405 individuals since starting the surveys in 2022.

Habitat improvements have also been a focus, ensuring suitable conditions for the species within its known range at HWP. Bracken (*Pteridium aquilinum*), which was shading devil's-bit scabious, has been removed, while devil's-bit scabious plugs have been planted, and devil's-bit scabious seeds collected from other areas of HWP have been sown (Figure 16). These measures help increase the availability of the SSMB's key forage plant, supporting both the current population and potential future expansion.

Annual reports on SSMB monitoring and habitat work were shared with the CNPA to inform



Figure 16: Small scabious minging bee (*Andrena marginata*) habitat before (top) and after (bottom) bracken removal.

wider conservation efforts for the species across the region. This collaboration helps strengthen landscape-scale conservation planning, ensuring that SSMB populations across Scotland benefit from the findings at HWP.

FUTURE

The next steps for the conservation of the SSMB at HWP will focus on continuing the summer survey to monitor and evaluate the population. The survey effort will alternate biannually between an in-depth survey, similar to the 2024 methodology, and a less intensive monitoring approach, ensuring that population trends can be tracked effectively over time.

To support the expansion of the SSMB's range within HWP, additional devil's-bit scabious

plugs will be planted in suitable areas, ensuring a greater availability of forage plants. At the same time, bracken removal will continue in key nesting areas.

A more focused survey effort will be undertaken to identify potential nesting locations outside of the main known area at HWP. This will provide a clearer understanding of the bees' habitat preferences and inform further conservation work within HWP.

Findings from the ongoing surveys will continue to be shared with the CNPA to support wider conservation efforts. By contributing to the CNPA's work on expanding the SSMB's range and connecting currently isolated populations, RZSS will play a key role in the long-term protection and recovery of this species across the Cairngorms National Park.

WADING AND GROUND NESTING BIRDS



DESCRIPTION

The main reserve at HWP is a key habitat for five wading birds, including common redshank (*Tringa totanus*), Northern lapwing (*Vanellus vanellus*), Eurasian oystercatcher (*Haematopus ostralegus*), common snipe (*Gallinago gallinago*), and Eurasian curlew (*Numenius arquata*). In the UK, between 1994 and 2023, breeding populations decreased by 21% for Eurasian oystercatcher, 51% for Northern lapwings, 50% for Eurasian curlews, and 49% for common redshanks (BTO, 2024). Factors contributing to these changes in breeding areas include agricultural intensification, alterations in cropping or grazing management, drainage, predation, and disturbance (Galbraith, 1988; Ottvall, 2005; Smart *et al.*, 2006; Eglington *et al.*, 2010; Showler *et al.*, 2010; Fletcher *et al.*, 2010; Van Dijk *et al.*, 2015). In more recent years, Highly Pathogenic Avian Influenza (HPAI), commonly known as bird flu, has heavily influenced some wading bird populations. The H5N1 strain has caused significant mortality in wild birds, including waders and seabirds, with outbreaks in 2021 and 2022 resulting in mass die-offs in the UK (RSPB, 2024).

Positioned within the Cairngorms National Park, opposite the Royal Society for the Protection of Birds (RSPB) Insh Marshes, the main reserve structure at HWP, which houses large herbivores, ensures that wading birds remain undisturbed by visitors, as public access on foot is prohibited. However, members of the public can still view the wading birds in these area from their vehicles.

The presence of megafauna can support both the creation and maintenance of habitat for ground-nesting birds (Pereira, 2015). The main reserve at HWP is home to *ex-situ* large ungulates including deer, bison and horses (Figure 2 and Figure 17). Their presence may contribute to a diverse habitat well-suited for waders included a mosaic of sward heights providing varied nesting and foraging opportunities for the five different species. This can be further improved through management including rush cutting which is also beneficial for breeding waders (DEFRA, 2025). Additionally, the main reserve contains several water channels, which could help to reduce the risk of nest flooding and increasing the chances of nest success.

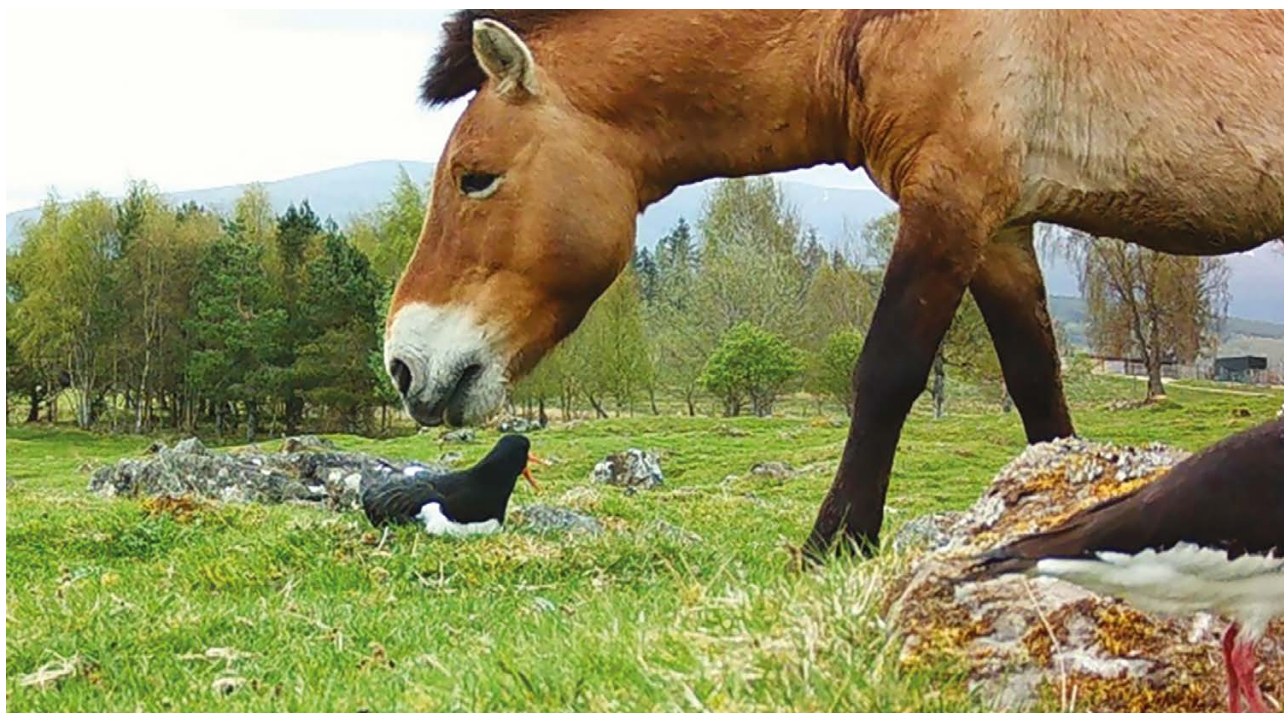


Figure 17: Przewalski's horse (*Equus przewalskii*) in close proximity to nesting oystercatcher (*Haematopus ostralegus*) at HWP.

OBJECTIVES

- Continue to maintain grasslands across the park, taking advantage of herbivores that browse more than graze which provides a taller sward for birds to nest in.
- Continue annual wading bird survey
- Review the impact of mesopredators (foxes, gulls, corvids) on nesting and recruitment of ground nesting birds and investigate measures to control them.

RATING

Green 

Wading bird surveys at HWP have been conducted by the Living Collections team from 2000 to 2015 every five years, and annually from 2016 to 2024, with all survey data reported to the RSPB. These surveys are part of the wide

Strathspey Wader Bird Initiative which carries out monitoring elsewhere in the Strathspey area every five year. The results indicated a significant decline in wading bird species since 2015 onward, with the RSPB suggesting that this may be due to low productivity among wading pairs nesting at HWP (see RSPB Highland Wildlife Park Wader Survey Results 2023).

Therefore, nest monitoring and productivity surveys of oystercatcher and lapwing nests (Figure 18) were carried out in 2024 to determine the reasons for low productivity. See RZSS Highland Wildlife Park wading bird monitoring report 2024 for more details regarding breeding success, productivity, disturbance and nest failure events. The results were mixed, as hoof-stock consistently tampered with mounted cameras, but findings showed predation by red foxes and jackdaws and trampling by hoof stock to be key nest failure events (Figure 19).

In partnership with the RSPB, eight 30x30cm oystercatcher platforms were mounted on



Figure 18: Oystercatcher (*Haematopus ostralegus*) nest (left) and lapwing (*Vanellus vanellus*) nest (right) with newly hatched chicks at HWP.

fence post around HWP as a trial to try to encourage oystercatcher to nest on them in 2024. These platforms aimed to protect nest from ground predators such as foxes. However, no oystercatchers used the platforms during the breeding season.

HWP is also home to a healthy population of breeding barnacle geese (*Branta leucopsis*). Typically, this species migrates to the UK in the winter; however, small numbers also nest in the UK during summer (BTO, 2025), with HWP serving as a nesting site. In years when barnacle geese produced goslings, ringing of adults and goslings has been carried out (Figure 20). However, in 2022, ringing of barnacle geese could not take place due to bird flu, and in 2024,

no goslings were present at HWP, so no ringing took place.

FUTURE

Wading bird conservation plans at HWP include continuing surveys to monitor populations, breeding success and productivity but with wider monitoring of habitat types introduced to the survey method. Rush management will also continue, and lessons learned from wading bird nest cameras will be used to improve monitoring and protection efforts. Predator monitoring may also be introduced to determine how predators use the reserve to further evaluate potential threats to nesting success.

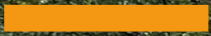


Figure 19: Predation of wader nest by fox (*Vulpes vulpes*) at HWP.



Figure 20: Barnacle geese (*Branta leucopsis*) catch up and ringing at HWP.

INVASIVE SPECIES AND BRACKEN CONTROL



DESCRIPTION

An invasive non-native species (INNS) is any species that has been introduced to Scotland outside its natural range through human activity, either deliberately or accidentally (DEFRA, 2018). If not actively managed, these species can negatively impact native biodiversity, economic interests, or human health. While some species are formally recognised under the Wildlife and Natural Environment (Scotland) Act 2011, a species does not need to be listed in legislation to be considered invasive if it poses a significant threat to the environment (Bennett, 2024).

At HWP, several invasive non-native plant species require management to prevent their spread and minimise ecological impacts. These include Japanese rose (*Rosa rugosa*) and rhododendron (*Rhododendron ponticum*), which are listed under the Wildlife and Countryside Act 1981, as amended by the Wildlife and Natural Environment (Scotland) Act 2011.

Other non-native species at HWP that, while not currently listed under legislation, still require control include Spanish bluebell (*Hyacinthoides hispanica*) and pirri-pirri bur (*Acaena novae-zelandiae*) (Figure 21), both of which can spread aggressively and displace native flora (EPPO Global Database, 2018; Ruhsam et al, 2020; Ruhsam et al, 2023).

Another non-native species managed at HWP is Sitka spruce (*Picea sitchensis*), which originates from previous plantation forestry surrounding HWP. Although widely planted in Scotland for commercial forestry, Sitka spruce readily self-seeds and can spread into sensitive habitats, altering ecosystem composition if not controlled.

While bracken is a native species, it can become problematic due to its ability to form dense colonies, outcompeting other vegetation and reducing plant biodiversity (Marrs, 2000). At HWP, bracken is controlled in specific areas to prevent its dominance and to maintain a more diverse habitat structure that supports a wider range of species.



Figure 21: Pirri-pirri bur (*Acaena novae-zelandiae*) at HWP.



OBJECTIVES

- Eradicate Japanese rose and rhododendron from HWP by 2023, preventing their impact on native biodiversity.
- Ensure zero planting of non-native species, maintaining a strict policy to support native habitat restoration by Q1 2022.
- Deliver staff training in the identification of notable invasive species, improving early detection and management efforts by Q4 2022.

RATING

Amber

Significant progress has been made in removing invasive non-native species and managing plants that impact biodiversity at HWP. Targeted control efforts have successfully eradicated some species, while ongoing management continues to reduce the presence of others.

Rhododendron and Spanish bluebell have been fully removed from HWP, ensuring that these species no longer compete with native flora. Japanese rose, while not yet completely eradicated, has been steadily reduced and weakened since 2022. Each autumn, volunteer working groups remove hardened stems and rhizomes, which gradually weakens the plant and allows native vegetation to recolonise the area. pirri-pirri bur remains prolific in certain areas of HWP, requiring ongoing control efforts to prevent its further spread.

Sitka spruce is continuously managed to prevent its spread, with self-seeded plants removed as soon as they are identified. However, due to the proximity of commercial Sitka plantations surrounding HWP, self-seeding will remain an ongoing issue requiring continuous monitoring and removal. The clearance of windblown Sitka plantations

(discussed in the woodland management section) has been approved by Scottish Forestry, with these areas now designated for replanting with a diverse mix of native tree species.

Bracken control has also been a priority in biodiversity-sensitive areas, particularly where it threatens key species such as the SSMB. While bracken is a native plant that provides habitat and food for some wildlife, unchecked growth can outcompete other vegetation and reduce overall biodiversity (Marrs et al, 2006). To manage this, external volunteer groups have been involved in removing bracken in targeted areas, while RZSS has initiated trials on non-chemical bracken control methods in 2024 (Figure 22). These trials aim to assess whether alternative approaches can be applied more widely within HWP and potentially further afield.

FUTURE

The management of invasive species at HWP will continue with proven control methods, ensuring that non-native and problematic species do not negatively impact biodiversity. Bracken removal will remain a priority in conservation-sensitive areas, where unchecked growth could threaten key species by outcompeting native vegetation. Similarly, Japanese rose will continue to be manually removed, with annual efforts to extract stems and rhizomes.

To prevent the introduction of new invasive species, all new plantings at HWP will be carefully inspected to minimise the risk of introducing disease or unintended invasive species. Additionally, no plants classified as invasive or non-native will be purchased or planted within HWP, ensuring that all landscaping and habitat restoration efforts support native biodiversity



Figure 22: Before (top) and after (bottom) bracken (*Pteridium aquilinum*) removal next to conservation hub at HWP.



ACKNOWLEDGEMENTS

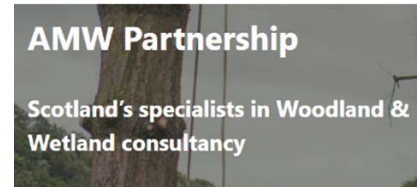
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