

Biodiversity & Climate Change INTHENATIONAL PARK

NATIONAL 4/5 & HIGHER ENVIRONMENTAL SCIENCE

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Cover Photo - Peatland Restoration Project © Wild Tracks Ecology

1. Introduction

This resource 'Biodiversity & Climate Change in Loch Lomond & The Trossachs National Park' has been developed to support the Environmental Science curriculum:

National 4/5 and Higher: Living Environment, Earths resources and Sustainability

It contains background information on Loch Lomond & The Trossachs National Park, its special qualities, the main land uses, and provides examples of habitats and biodiversity, highlighting the role of the National Park Authority in mitigating the impacts of climate change.

Through using this resource students will learn about the effects of climate change on a National Park and the important habitats and biodiversity these special places provide. Each case study provides additional references and web links to encourage further reading and research, and makes suggestions for field visits to the National Park.

The final section highlights other resources available to support learning and visits to Loch Lomond & The Trossachs National Park.



The resource can be used by both educators and by students.

This resource has been developed by Loch Lomond & The Trossachs National Park Authority



Looking south west towards Callander, from Easter Bracklin Farm © Gill Corden

2. Curriculum Links

SQA Outcomes and Assessment Standards for Environmental Sciences

NATIONAL 5:

LIVING ENVIRONMENT

- Investigating ecosystems and biodiversity
 (b) Biodiversity in the context (one terrestrial ecosystem).
- 2. Interdependence (g) Carbon cycle
- 3. Human influences on biodiversity
 - (b) Human activities which have a positive and/or negative effect on ecosystems, with a focus on species reduction or increase, extinction and loss of biodiversity.
 - (c) The role of a named indicator species in environmental monitoring.
 - (d) The impact of a named INNS on ecosystems.
 - (e) Conflicts between land and/or water-based activities. At least two stakeholders using a single resource, with potential solution/compromise for shared use.
 - (f) Relevant current national organisations (National Parks)

EARTH'S RESOURCES:

- 3. Hydrosphere
- (b) Water cycle: run-off, groundwater flow, storage.
 - (c) Main stores of water: freshwater (rivers, streams, springs), groundwater (soil moisture, rock pores and crevices)
 - (e) Issues arising from availability of water resources in Scotland and the rest of the British Isles: drought and flooding.
- 4. Biosphere
 - (d) Energy from biological resources: biomass (peat).
 Process of fermentation in formation of biofuels: conditions required for formation of peat (acidic and anaerobic), and methane as the primary biogas.

SUSTAINABILITY:

- 4. Energy
 - (f) Impacts (social, economic and environmental) of climate change: habitat loss, reduction in biodiversity, changes in species distribution, rising sea levels leading to flooding, loss of agricultural land, and loss of business.

HIGHER:

LIVING ENVIRONMENT:

- 1. Investigating ecosystems and biodiversity
- (b) Biodiversity in the context (one terrestrial ecosystem)
- 3. Human influences on biodiversity
 - (a) Human activities, in Scotland, through the Holocene period, which have affected ecosystems, from a positive and negative view-point. To include habitat destruction, species reduction and increase, changes in biodiversity and extinction (through afforestation and grazing)
 - (b) Development of intensive agriculture (drainage of wetland ecosystems) and its impact on biodiversity.
 - (h) The impact of climate change on biodiversity and species distribution.
 - (i) The impacts of non-native species and methods to minimise these impacts. Impacts to include loss of native species through competition. Examples to include grey squirrel, and Rhododendron ponticum
 - (j) Reintroduction to Scotland of nationally extinct species (beaver)
 - (k) The need for legislation and policies, to include current conservation and land/marine management policies. Key role of SSSIs. Role of statutory agencies (National Parks)

SUSTAINABILITY

- 3. Energy
 - (c) Environmental, social and economic impacts of climate change, including changing weather patterns.

3. Background

National Parks in Scotland

In Scotland, National Parks are extensive areas of the very highest value to the nation for their scenery, wildlife and cultural heritage.

They provide an integrated approach to management and sustainable development to safeguard the special qualities of these areas for the long term.

They also provide opportunities for the public to enjoy the special natural and cultural heritage.

There are two National Parks in Scotland: Loch Lomond & The Trossachs and Cairngorms. For more information visit the official National Park websites:

≽ www.lochlomond-trossachs.org

📐 www.cairngorms.co.uk



Looking north from Ben Venue over Loch Katrine and The Great Trossachs Forest © Ewen Kinninment

Loch Lomond & The Trossachs National Park

The Loch Lomond & The Trossachs National Park became fully operational on 19 July 2002 and was officially opened by Princess Anne on 24 July 2002 and encompasses around 720 sq miles (1,865 sq km) of some of the finest scenery in Scotland.

It is a place of contrasts from rolling lowland landscapes in the south to high mountains in the north, and has many lochs and rivers, forests and woodlands. It is also a living, working landscape which has been influenced by people for generations and is visited and enjoyed by many for its recreational value. The National Park includes Loch Lomond, the largest freshwater loch in Scotland, as well as nearly 40 miles of coastline around three sea lochs – Loch Long, Loch Goil and the Holy Loch.

It also contains The Great Trossachs Forest, which is the largest National Nature Reserve (NNR) in Scotland and will be the largest area of native broadleaved woodland in the UK.

The National Park is home to a rich variety of important wildlife including red squirrels, black grouse, otters, deer, eagles and powan – a rare freshwater fish native to only Loch Lomond and Loch Eck.



Loch Lomond & The Trossachs National Park Fact File

- The Park is 1,865 sq km (720 sq miles) and has a boundary length of 350km (220miles).
- 50% of Scotland's population lives within an hour's drive of the National Park.
- There are 21 Munros (mountains above 3,000ft) in the Park and the highest is Ben More at 1,174m.
- There are 19 Corbetts (mountains between 2,500ft and 3,000ft).
- There are 22 larger lochs, with numerous smaller lochs and lochans.
- About 50 rivers and large burns.
- 15,168 people live in the National Park (2011 census).
- There are two Forest Parks Queen Elizabeth in the Trossachs and Argyll in Cowal.
- is crossed by long distance routes including West Highland Way and John Muir Way
- contains 73 designated special nature conservation sites and 60 Sites of Special Scientific Interest (SSSI)



History of Scottish National Parks - Timeline

Some of the key dates for designation of National Parks in the UK and Scotland:



Aims of Scottish National Parks

As set out in the National Parks (Scotland) Act 2000:

- To conserve and enhance the natural and cultural heritage of the Park
- To promote sustainable use of the natural resources of the area
- To promote enjoyment and understanding of the special qualities of the Park, including enjoyment in the form of recreation
- **I** To promote sustainable economic and social development of the Park's communities

BIODIVERSITY & CLIMATE CHANGE IN THE NATIONAL PARK

4. National Park Partnership Plan – A Strategy for the Park

The Park Plan is the strategic guiding document for all public bodies operating in the Park and provides guidance and focus for our partners. It outlines the significant outcomes which can be achieved for the National Park area through the collaboration of the public, private and voluntary sectors as well as Park communities and local businesses.

View our National Park Partnership Plan here

The challenge in managing a successful National Park is that of delivering all four aims together. The National Park combines an internationally important environment with a fragile rural economy and a renowned visitor destination. This brings inevitable challenges.

All of the above can result in problems and conflicts within the Park area. Loch Lomond & The Trossachs National Park Authority has a role to play in minimising this conflict and providing a resolution through bringing key partners together; increasing dialogue between them and developing policy to guide the future management of the Park.

Where there appears to be a conflict between the aims of the Park e.g. conservation versus economic development, the National Parks (Scotland) Act 2000 will give greater weight to conserving and enhancing the natural and cultural heritage. This is called the Sandford Principle.



5. Climate Change Action Plan

Scottish Government's Climate Change (Scotland) Act 2009 set world-leading greenhouse gas emissions reduction targets, including a target to reduce emissions by 80 % by 2050 from emission levels in 1990/95.



In early 2017 the Government proposed a new Climate Change Bill with even more ambitious emissions reduction target of up to 90 % by 2050. The documents contain the key commitments for the Scottish Government and places Scotland at the forefront of global efforts to tackle climate change, to create a growing, sustainable and inclusive economy. (Scottish Government climate change timeline)

Within the 2018-2023 National Park Partnership Plan, it is clearly identified that the National Park can offer many benefits to Scotland's environment. In our role as the National Park Authority, we have both the desire and an obligation to protect and enhance the Loch Lomond & The Trossachs National Park. We recognise that climate change will have far reaching effects on Scotland's economy, its people and its environment and we are determined to play our part in rising to this challenge. We will promote sustainable land use and management practices that better capture carbon and help mitigate against climate change. By taking an integrated approach to land use planning, we can also help deliver significant adaptation to and resilience against climate change for our communities.

As seasonal temperatures and rainfall patterns continue to rapidly change we will see some of our species put under the dual pressures of adapting to a warmer, wetter climate and the emergence of new plant diseases.

The impacts of climate change present very real challenges to National Park, such as:

- the increasing frequency of flood events across the area of the Park
- risk of major landslide event due to oversaturation resulting in significant disruption to strategic transport routes
- loss of biodiversity.

These threats require us to work to create more dynamic and resilient natural ecosystems where habitats are allowed to adapt to a changing world. As an organisation, we will work towards minimising our carbon emissions, working together with partner organisations to deliver much more comprehensive action plans, climate resilient services, processes and projects and raise awareness of the negative effects of climate change on the Park-wide scale.

Climate Change Action Plan

6. Habitats and species

The National Park is home for a huge variety of biodiversity, including a number of rare species and habitats which are conservation priorities at a UK and Scottish level.

The National Park straddles the Highland Boundary Fault so the area contains both lowland and highland habitats. This variety of habitats means that the National Park supports a wide range of species. Across the Park, 67 sites are designated for their special nature conservation value and the Park holds strategically important populations of species, such Atlantic salmon, golden eagle and native oak woods amongst others.



Woodland

A significant proportion of the National Park is covered in woodland and forest. Woodlands within the Park really are some of our most valuable habitats. Some are recognised as Sites of Special Scientific Interest and Special Areas of Conservation. That means our woodlands and the species they support are so valuable they have international significance. Trees store carbon and so by maintaining our woodlands and forest cover in a sustainable way we are also helping to combat climate change.



Water

The freshwater lochs in the National Park are some of the best-loved landscape features within the area. Along with Loch Lomond, there are 21 other large lochs and numerous smaller lochs and lochans. There are also approximately 50 rivers and larger burns. The National Park also includes 39 miles of coastline around three sea lochs.

The National Park is also a source of two major river systems. One of the impacts of climate change is an increase in the number of heavy rainfall events which results in localised flooding when the rivers are in spate. We need to help our habitats adapt to increased flooding and also look at 'soft engineering' solutions which lowers the flood risk to land and houses.

All this water is also a renewable resource and can be harnessed to generate hydroelectric power as a way to mitigate against climate change. Further information on this is available from our website: Geography Case Study on Hydro Electric Power.

Mountain Bogs & Peatland

Our wet, wild mountains are the perfect place to form a unique habitat – our mountain bogs. As the rain falls, a special kind of moss called sphagnum grows – it grows in deep layers. The layers gradually smooth out the features of the land like a blanket on a bed – we call it a blanket bog.

Deep peat is particularly important in locking up carbon. Collectively Scottish peat bogs hold ten times the carbon of the UK forests. Conserving our deep peat areas in the National Park is one way that we can help combat climate change and maintain our carbon stores.



7. Land Use in the National Park

These landscapes have been created and shaped by both natural and human forces over millennia, and are continuously evolving as climate and the use of the land changes. In recent history significant land use changes have included the spread of commercial forestry, the abandonment of grazing land for livestock in some areas and the growth of renewable energy production such as run of river hydro schemes in parts of the Park and wind farm developments just outside the Park boundary.

Most land within the Park is owned and managed by private individuals or businesses. The management of the land shapes the landscapes, the habitats and species and special qualities, as well as being an integral part of the economy and employment in the Park.

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Land Use

- 65% Agriculture mainly extensive livestock farming (hill sheep and beef cattle), not much arable farming
- 27% Woodland cover swathes of commercial forestry plantations, but also ancient broadleaves, wood pasture, farmland and policy trees
- 7% Water lochs and rivers



Land Ownership/Management

- 56% private farms and estates
- 38% Public mainly Forestry Commission Scotland
- 5% Charities and Non Governmental Organisations – includes RSPB (Nature Reserves), The Woodland Trust, the National Trust for Scotland

The National Park has a range of species that are under pressure from land-use changes, climate change, recreational impacts and other issues. Focusing on having habitats and ecosystems in good health will benefit the largest number of species that are reliant on those habitats. There are however a few species in particular for conservation management action include wading birds, Greenland white-fronted geese, black grouse, red squirrel, powan, salmon and water vole.

Managing and protecting the Park's natural heritage, cultural heritage, land and water resources in a sustainable way is central to being a National Park.

Summary

In conserving our biodiversity we need to understand the impacts that climate change will have on our habitats and species. Research that helps to inform us of predicted impacts will enable us to respond and adapt our land management to minimise the impact of climate change. In particular, ensuring that habitat networks are in good health and habitats are not fragmented will help some species to move through the landscape to locations with more favourable conditions.

8. Other resources to support field visits to the National Park

Resource packs

A teachers guide for visiting Inchcailloch is available for Loch Lomond National Nature Reserve (NNR). It provides guidance for schools and groups to help organise a visit to the island. Download the guide here.

'Getting into National Parks and National Nature Reserves' contains advice and guidance for teachers and group leaders on planning a visit to National Parks and NNRs. Townload the pack here.

Education Scotland

Education Scotland's on-line resource provides a wealth of information, guidance, advice and resources for taking learning outdoors.

www.educationscotland.gov.uk/learningteachingandassessment/approaches/outdoorlearning/index.asp

Outdoor Learning Directory

Scotland's Outdoor Learning Directory aims to provide a portal to services supporting outdoor learning which are provided by a collaboration between Cairngorms National Park, Loch Lomond and the Trossachs National Park, Forestry Commission Scotland, Royal Botanic Gardens Edinburgh, Scottish Environmental Protection Agency and Scottish Natural Heritage: www.outdoorlearningdirectory.com

National Park Ranger Service

Make use of the National Park Ranger service to enrich your learning experience. To book visit 👇 www.lochlomond-trossachs.org or e-mail: 🔀 education@lochlomond-trossachs.org

National Nature Reserves

There are two NNRs in the Park, Inchcailloch and The Great Trossachs Forest which protect an amazing range of wildlife and landscapes, where you can base your visit and learning experience. Find these NNRs at www.nnr-scotland.org.uk

The Great Trossachs Forest

The Great Trossachs Forest is a superb place for getting children of varying ages out into the countryside. Specifically designed for Secondary School pupils, the education pack covers a range of elements within the Curriculum for Excellence including art & design, geography and biology. This pre-prepared resource is a good source of inspiration for environmental, literacy, numeracy and cooperative learning themes and can be taught in the classroom or to facilitate outdoor learning.

thegreattrossachsforest.co.uk

Forests and woodlands

Discover the sights, sounds and experiences of the forest at Forestry Commission Scotland sites in the Park, including Queen Elizabeth Forest Park in Aberfoyle and Argyll Forest Park in Glenbranter, Argyll.

John Muir Award

Your visit to the Park may well fit in with gaining a John Muir Award, an environmental award scheme that focuses on wild places such as the National Park. Find out more here.

National Park Travel Grant

A travel grant scheme is available to support schools and groups to make educational visits to the Park, offering up to £200 or 75% of transport costs. Download the application form and guidance here.

Published by:

Loch Lomond & The Trossachs National Park Authority Carrochan 20 Carrochan Road Balloch G83 8EG

tel: 01389 722600 email: info@lochlomond-trossachs.org

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Peatland restoration

INTRODUCTION

Our mountain bogs are areas of peatland. Simply put, peatlands are areas where peat is found. Peat is the accumulation of undecomposed plant material that has built up over years and centuries.

Peat is formed on land that remains almost permanently wet from the remains of dead plants that are unable to decompose due to a lack of oxygen. Over time layers of this plant material build up with deeper layers being older than those above. As the layers of peat develop they compact the layers below preventing any further decomposition and so the peat keeps growing. On average peat grows about 1mm every year, and in Scotland we have peatlands that are over 10 metres deep.

The main builders of peat in Scotland are a group of mosses called Sphagnum which thrive in wet conditions and can hold over 10 times their weight in water.

The wet, wild mountains of the Loch Lomond and The Trossachs National Park are therefore the perfect place for this important habitat to form. One type of peatland that grows on many of our mountains has formed a layer so thick it smooths out the features of the land like a blanket on a bed this is called a blanket bog. In healthy peatlands, the living vegetation that is currently visible on the surface will form future layers of peat. Plants absorb carbon from the air to grow, and because this carbon is not released as the plants die (as they do not decay), growing peat actually removes carbon from the atmosphere and locks it up. Because of this the peatlands of the National Park store more than 20 million tonnes of carbon. They are the best carbon store we have, so it's vitally important we work with land managers to help protect and restore them.

Sphagnum moss growing in wetland





Wild Park

Wild Park is concentrating on the following four threats:



POOR QUALITY OF SOME LOCHS & RIVERS

Negative impacts on freshwater and marine water bodies from problems such as pollution from surrounding land uses.



INVASIVE, NON-NATIVE Species

The spread of invasive non-native species, which displace our rich native wildlife.



UNSUSTAINABLE LEVELS OF GRAZING Unsustainable levels of wild and domesticated grazing and browsing animals in some upland and woodland areas, leading to reduced tree cover and the erosion of soils, which are important carbon stores.

Historically, our mountains have been managed in a way that has caused damage to the blanket bogs. As a result the condition of these peatlands has deteriorated and is a poor habitat for wildlife. The peatlands have been drained in an attempt to make the land better for planting trees, or to allow animals to graze (including sheep and cattle). The drying of the peatlands combined with overgrazing, inappropriate burning, or erosion through recreational use has caused the widespread degradation of the habitat.

Damaged peatlands not only stop absorbing carbon but also start to emit carbon in the form of Greenhouse Gases into the atmosphere as the peat decomposes. These gases contribute towards climate change. The peatlands also release organic matter including carbon into water, which turns it brown.

These particles can silt up fish spawning beds and reservoirs and reduce oxygen in the water, affecting the invertebrates and fish that live in the burns, rivers and lochs. Drier peatlands are more susceptible to wildfires.

However, getting the right grazing levels suitable for these areas and undertaking sensitive restoration, such as grip (drain) blocking, the condition of the peatlands can be improved and these impacts eventually reversed. By working together across large areas of the National Park management of our peatlands can be integrated with other land management activities to ensure the whole landscape is used in a sustainable way. This will involve working with private landowners to draw up and implement deer (and other grazing animals) management plans, forest plans, and peat conservation projects.



CLIMATE CHANGE PRESSURES

The impacts of climate change leading to warmer, wetter weather patterns and a subsequent increase in flood events, major landslides and rapid shifts in natural ecosystems.



Objectives for 2023

Peatland restoration:

Reduce carbon and water flows through restoration of peat bogs and raise awareness of the value of peatlands in the climate emergency.

Increase the public's understanding and appreciation of the value of peatland habitats by working in partnership to host public events and talks, visitor centre displays and increasing volunteering opportunities to get involved in improving peatland habitats e.g. constructing peat dams, removal of INNS, surveys and the Mountains and the People project.

Resilience:

Pilot the use and management of trees, woodlands, peatlands and waterways upstream to reduce the risk of downstream flooding.

Promote the management of designated sites which move these protected areas towards favourable condition.



Peatland Restoration

The Loch Lomond & The Trossachs National Park Authority is working towards reducing the impacts of climate change. One of our key initiatives to do this is through our Peatland Restoration programme. By working with landowners and managers we hope to put on the path to recovery the areas of degraded peat that occur throughout the park.

LUSS CASE STUDY

In Sept 2017 work was completed on the second phase of a major project to restore peat bogs on Luss Estates within the National Park.

The joint project between the National Park Authority and Luss Estates saw work on 80 hectares on Beinn Dubh and Mid Hill, above Glen Luss (see map below).



The £65,800 project, funded by NatureScot's Peatland ACTION fund, involved reprofiling peat hags, and also blocking gullies, building peat dams and establishing vegetation over areas of bare peat in order to prevent peat from drying out and releasing carbon into the atmosphere.



Hag reprofiling

The project included an innovative trial of Sphagnum plug planting on two areas of bare peat. This is a new method for getting Sphagnum moss to recolonise areas of bare peat by taking clumps of the moss from healthy areas and planting it at a rate of around four clumps per square metre in hollows stamped into the bare peat. The bare peat needs to have a high water table and this has been restored by putting in dams to hold back water on the site.

Luss Estates and the National Park Authority successfully collaborated on the first phase of work in 2015. In places it is hard now to see where the bare peat previously existed as these areas have successfully grown over; a healthy revegetated blanket now covers the hillside in these restored areas.

Mitigating against Climate Change

Alongside the long-term climate change and biodiversity benefits, there are indirect economic benefits to conserving our peatlands. Healthy peat bogs provide a vital function within the hydrological cycle, helping to store and release water slowly which reduces the impacts of both floods and droughts. Peat bogs in poor condition on the other hand can erode during flood events, leading to a loss of water quality, and they do not have the same ability to slow the passage of water downstream. Conserving our mountain bogs helps to mitigate the impacts of flood events downstream and also help to maintain our water quality during these extreme weather events, which are becoming more common due to climate change.

As well as mitigating against climate change, restoring peatlands will also help reduce two of the other key threats highlighted in Wild Park.

Poor quality of some lochs & rivers

Negative impacts on freshwater and marine water bodies from problems such as pollution from surrounding land uses.

By covering degraded peat and putting peatlands back on the road to recovery prevents particulate matter entering our waterways helping keep the waters clear and unchoked.

Invasive, Non-Native Species The spread of invasive non-native species, which displace our rich native wildlife.

Putting the peatlands back on to the road to recovery produces a habitat that is hostile to some of the invasive species that could dominate on degraded peatlands (e.g. Rhododendron).



Future projects

So far the National Park Authority has worked on eight peatland projects restoring over 400 hectares of mountain bog across the National Park. Three further projects are in development for 2020, covering a further 200 hectares. It is hoped that with the availability of grant funding this work can continue to stop further degradation of our peatlands; and restart the growth of these important habitats.



Questions and pupil enquiry

- What past land use practices have contributed to the decline of healthy peatlands?
- Explain how peat can both store and release carbon.
- List the number of ways to improve the health of peatland.
- What are the economic benefits of a restored peatland?
- What are the biodiversity benefits of restoring a mountain bog?
- Why does there need to be a high water table for sphagnum moss re-colonisation to be effective?
- How old are the oldest Scottish peatlands? - Why are there none any older?

FURTHER READING



- More than just a Bog Education resource for Geography and Biology subjects
- UK National Parks Moorlands as Indicators of Climate Change Initiative (MICCI)
- Peatland Action: Future proofing Scotland's Peat bogs (NatureScot Publication)
- Peatland Action project resources
- Peatland Carbon fact and figures (NatureScot Publication)
- Peatland Learning Module (SRUC)



Blanket Bog in a bottle experiment

😓 Site visits

- Balmaha on east Loch Lomond is a great location to base a field visit, with the National Park Visitor Centre and Outdoor Classroom available for school groups. Conic Hill is a short hill climb accessible through the rear of the car park at Balmaha.
- Other sites suitable for field visits include the hills around Luss, west Loch Lomond.

Red Squirrel Conservation

INTRODUCTION

The red squirrel *Sciurus vulgaris* is one of our most popular and well-loved mammals but they are in danger of becoming extinct in Scotland.

There are less than 120,000 red squirrels remaining in Scotland which is about 75% of all of the red squirrels in the UK. Compare this to 2.5 million grey squirrels in the UK!

Historically large areas of native woodland across the country have been lost due to de-forestation and changes to land management Øfactices, and red squirrels are also threatened by the introduced North American grey squirrel, *Sciurus carolinensis*.



Loss of habitat

Tree cover in Scotland used to be so extensive that a red squirrel could have travelled from one side of the country to the other without touching the ground.

Following a long history of land use change, the small, isolated fragments left over from Scotland's once huge native woodland could not support our red squirrels. Modern-day woodland planting is helping to turn this around. With help from Scottish Forestry we're making sure large areas aren't felled all at once but in stages so red squirrels always have access to a suitable habitat.



The spread of American grey squirrels and squirrelpox



The non-native grey squirrel was introduced in Britain by the Victorians. This American cousins of our native red squirrels have spread out in our woodlands and ended up as neighbours to our red squirrels.

Grey squirrels are twice as big as red squirrels and can digest food such as acorns easier and get more nutrients from them. This means that grey squirrels need more food than reds and can utilise acorns better. They have also been found to steal food that red squirrels have saved up for overwinter leaving the reds hungry. They also carry a virus called squirrelpox which can be fatal to our native reds. Grey squirrels are carriers of the disease but they are resistant to it themselves.

Wild Park and key threats

Wild Park

Wild Park is the Biodiversity Action Plan for Loch Lomond and The Trossachs National Park. It details what projects and actions we would like to deliver to benefit nature in the National Park and where we would like to deliver them.

As well as highlighting objectives between 2018-23 the programme also details threats to the environment of the National Park.



Wild Park is concentrating on the following four environmantal threats:



POOR CONDITION OF LOCHS & RIVERS

Negative impacts on freshwater and marine water bodies from problems such as pollution from surrounding land uses.



UNSUSTAINABLE LEVELS OF GRAZING

Unsustainable levels of wild and domesticated grazing and browsing animals in some upland and woodland areas, leading to reduced tree cover and the erosion of soils, which are important carbon stores.



INVASIVE, NON-NATIVE SPECIES

The spread of invasive non-native species, which displace our rich native wildlife.



CLIMATE CHANGE PRESSURES

The impacts of climate change leading to warmer, wetter weather patterns and a subsequent increase in flood events, major landslides and rapid shifts in natural ecosystems.

Objectives for mammalian INNS by 2023 are:

- Reduce the population and re-colonisation of grey squirrel in the National Park through a network of community-led groups and land managers continuing responsible trapping efforts in vulnerable areas.
- Retain effective grey squirrel control in areas where populations have declined to ensure densities do not regain.
- Involve land managers and local communities in the reporting of INNS species.
- Continue to promote recording of squirrel sightings through SWT
- Improve habitats from native species, such as better connected native woodlands and more naturalised water courses.
- Increase volunteer involvement in surveys.

- Provide information on responsible land management to encourage land managers to have good forest and riparian management that benefits native species, such as creating water bodies, reducing bank side poaching, planting the correct tree species etc.
- Collaborate with partners to deliver native mammal conservation education throughout the National Park through public events, interpretation, social media etc.
- Continue and increase collaboration with land managers to reduce the presence of mammalian INNS but also to improve habitats to favour native species.
- Increase numbers of active volunteers (monitoring and control).



Work concentrating on one of the mammalian Invasive Nonnative species threats in the National Park is being done by the Saving Scotland's Red Squirrels partnership project, led by the Scottish Wildlife Trust. It is a national initiative which aims to reverse the current decline in the distribution and numbers of red squirrels in Scotland. The long-term vision is to secure red squirrel populations in all the areas they currently occupy, together with expansion into some of their former range. The most serious threat to red squirrel populations is the ever expanding population of invasive non-native grey squirrels with the attendant risk of squirrel pox.

Within the Loch Lomond & The Trossachs National Park the project seeks to protect identified red squirrel populations and other existing grey-free areas by undertaking grey squirrel control to reduce the risk posed to the major greyfree populations of red squirrels.

Since 2009 Saving Scotland's Red Squirrels have worked alongside, the National Park Authority, land managers, private estates, volunteers and Forestry and Land Scotland staff to establish long term surveying and monitoring of both red and grey squirrel populations and a strategy for targeted grey squirrel control. This had already seen large improvements and an increase in range of the red squirrel with the Loch Lomond and The Trossachs National Park now almost a greyfree area.

For more information about the project and its activities and to report squirrel sightings please see **scottishsquirrels.org.uk**





Survey methodology

FEEDER BOX SURVEYS

These surveys monitor the progression of populations over time and determine what is present in a specific area. The resulting data provides the most suitable locations to focus trapping or other conservation efforts.

In March and April hundreds of volunteers across Scotland visit sets of feeder boxes (usually 4 in a set area), filling them up with peanuts and placing a sticky tab on the lid. This is done every 2 weeks and the peanuts and sticky tab replaced each time the boxes are refilled. The sticky tab collects hairs from squirrels that visit the box allowing the presence or absence of reds and greys in that area to be determined.

Colour alone cannot be used to separate red and grey squirrel hairs. It is necessary to view the samples under a microscope to observe the cross-section of the hair which are different for red and grey squirrels.

CITIZEN SCIENCE

Public squirrel sightings are essential to the success of the project. This wide scale data recording helps to focus the control of greys but also helps ensure woodland is managed for red squirrel populations. Public participation raises awareness of the project and the plight of the red squirrels in Scotland.







TRAPPING

Trapping is a targeted approach to controlling grey squirrel populations in a specific area. It is illegal to release grey squirrels once they have been caught as they are a non-native species so they are humanely despatched. The captured grey squirrels are tested to investigate the presence of the Squirrelpox virus, allowing the project to gather important evidence of the health of populations and ensure that the disease is kept as far from red squirrels as possible.

Mitigating against Climate Change

There are various implications of climate change for red squirrels in Scotland which include changes in rainfall patterns, increased risk of storm damage which may reduce the number of seed-bearing trees and the amount of red squirrel habitat, and possible greater prevalence of new tree diseases which could have an impact on food sources. To allow populations to respond to these potential impacts, it will be necessary to continue to plan woodland management on a landscape scale, ensuring a sustainable food supply and habitat connectivity for red squirrels to successfully adapt and thrive.

The future for the project

Results from Saving Scotland's Red Squirrels spring survey in 2019 show that red squirrel populations have remained stable in the past few years, a sign that with continued effort from conservationists and volunteers, their decline can be halted. Our commitment is to work in partnership to continue with this flagship project so that the woodlands and forests can support healthy stable populations of our native red squirrels and further reduce the threat posed by the grey squirrel populations. Our ambition is to push back the grey squirrel population to the south and eastern boundaries of the National Park and to promote it as a place where visitors can experience and enjoy our much-loved red squirrels.

Questions and pupil enquiry

- What are the main causes of red squirrel population decline in Scotland?
- List the ways grey squirrels eventually replace red squirrels in locations they spread to.
- Explain the variety of ways conservation management can support the increase of red squirrel populations
- How will climate change impact red squirrel populations?

FURTHER READING

Online

- https://scottishsquirrels.org.uk/publications/
- https://www.nature.scot/plants-animalsand-fungi/mammals/land-mammals/ red-squirrel
- https://forestry.gov.scot/forestsenvironment/biodiversity/conservingscotlands-red-squirrels

😓 Site visits

- Balmaha on east Loch Lomond is a great location to base a field visit, with the National Park Visitor Centre and Outdoor Classroom available for school groups.
 Follow the red squirrel trail through woodland walk behind the visitor centre to learn more about them and hopefully spot a squirrel too.
- Other suitable sites for field visits include at the The Lodge, Aberfoyle owned by Forestry and Land Scotland which has a viewing hide where they regularly feed the squirrels.

Invasive Non Native Species (INNS)

INTRODUCTION

Invasive non-native plants literally invade, spread and settle resulting in a significant loss of native plant and invertebrate biodiversity.

The native plants in these habitats are used to co-existing with each other, evolving over a significant period of time together. When a non-native species is introduced to this established habitat, the native species are outcompeted.

IN THE NATIONAL PARK OUR FOCUS IS ON THE FOLLOWING 5 INVASIVE NON-NATIVE SPECIES

1. RHODODENDRON PONTICUM

Rhododendron ponticum escaped from beautiful, managed rhododendron gardens taking over whole sections of our native woodlands and forests. It blocks out light to the forest floor so no other plants are able to survive.



2. JAPANESE KNOTWEED

Japanese Knotweed as the name suggests is originally from Japan, where it is in fact a rare plant. It was first recorded in the wild in the UK in South Wales, in 1886. It was introduced to large gardens as an ornamental plant. All plants in the UK are a male-sterile clone, so luckily no seeds are produced, however, the plant can spread easily from small fragments of the roots, stems or leaves. Large stands of knotweed often become established in the wild, particularly along waterways where fragments of the plant or soil containing its roots are washed downstream during floods. The small fragments of the plant become established on the banks of rivers and lochs growing into dense stands over time.





These dense stands rapidly expand and take over, replacing the nativeplants which once grew there, often resulting in an ever increasing lifeless monoculture of knotweed. As well as having a negative impact on biodiversity, large patches of the plant can prevent access to riverbanks and lochsides, and can also cause structural damage to property.

The best method of controlling it is by using chemicals. This is usually done by spraying the leaves directly but can also be done by injecting the chemical directly into the hollow stems of the plants. This is a time consuming process and it can take several years before the plants are showing no signs of regrowth.

BIODIVERSITY & CLIMATE CHANGE IN THE NATIONAL PARK

CASE STUDY 3

3. HIMALAYAN BALSAM

These attractive plants with purple flowers are native to the western and central Himalaya. They were introduced to Kew Gardens in London in 1839. Unfortunately it is now a major weed problem throughout the UK, especially on riverbanks, wet woodlands and waste land.



Himalayan Balsam only spreads by seeds, not from fragments of roots or leaves. The plants flower from July to October, setting seed from mid-July onwards. Each plant can easily produce as many as 800 seeds, scattered widely from explosive pods. The seeds float and can travel long distances before becoming lodged and germinating in soft muddy areas such as riverbanks.

Where plants have become dominant they quickly shade out native species resulting in the loss of native biodiversity.

There are a few ways to control Himalayan Balsam. If the plant has formed very dense stands then spraying with chemical is an option, however, the most common way to control it is by pulling them up by hand before they have a chance to set seed. The plants are very shallow rooted and are easy to pull up. This is usually done in early July as the plants come into flower. The uprooted plants can simply be left to rot down in a pile.

4. AMERICAN SKUNK-CABBAGE

Native of western North America, its normal habitat is wet woodland, where it grows in nutrient-rich mud. It produces large yellow flowers in spring which emit a strong odour like that of a skunk.

The plant has large leathery leaves which can grow up to about 1 m in length. In the UK it has been widely planted beside ponds and bog gardens and is still widely available from garden centres and plant catalogues.



Unfortunately, under the right conditions, it is very invasive, especially in muddy ditches and wet woodlands . The plant produces green berries which ripen in July.

The berries can be transported downstream where they become lodged on muddy loch-shores and riverbanks. New colonies of the plant establish and replace native plants by competing with them for light, nutrients and water.

These plants can be dug up but this is very muddy hard work and not always successful. A more practical solution is to treat them with chemical. Removing the flowers can also help prevent the plants from setting seed.



5. GIANT HOGWEED

Aptly named 'giant', this plant has flowering stems typically 2-3 m high bearing large white flowers which can grow to be over 1 m in diameter with leaves often 1 m or more in size. It is especially abundant by streams and rivers, but also occurs widely on waste ground. Originally from southwest Asia it was planted as an ornamental in gardens beside streams and ponds.

It spreads entirely by seeds which are dispersed by wind, water and in contaminated soils. A single plant can easily produce over 20,000 seeds each year.

The mature plants form dense impenetrable stands, preventing access to riverbanks, reducing species diversity, and posing a serious health risk. The plant produces phytotoxic sap which in contact with human skin and combined with sunlight causes severe burns and blisters.

Chemical treatment is an effective method of control and is best carried out during late spring or early summer when the plants are still small and pose less of a risk.

Wild Park and key threats

Wild Park

Wild Park is the Biodiversity Action Plan for Loch Lomond and The Trossachs National Park. It details what projects and actions we would like to deliver to benefit nature in the National Park and where we would like to deliver them.

As well as highlighting objectives between 2018-23 the programme also details threats to the environment of the National Park.

Wild Park is concentrating on the following four environmental threats:



POOR CONDITION OF LOCHS & RIVERS

Negative impacts on freshwater and marine water bodies from problems such as pollution from surrounding land uses.



UNSUSTAINABLE LEVELS OF GRAZING

Unsustainable levels of wild and domesticated grazing and browsing animals in some upland and woodland areas, leading to reduced tree cover and the erosion of soils, which are important carbon stores.



INVASIVE, NON-NATIVE SPECIES [INNS]

The spread of invasive non-native species, which displace our rich native wildlife.



CLIMATE CHANGE PRESSURES

The impacts of climate change leading to warmer, wetter weather patterns and a subsequent increase in flood events, major landslides and rapid shifts in natural ecosystems.



We're working in partnership with landowners, fishery trusts, government agencies and volunteers to reduce the extent and damaging impact of these species. Wherever possible, we are seeking to remove invasive non-native plants completely.

These species can take over and out compete natural vegetation like wildflowers, shrubs and trees. When these invasive plants are removed the native plants begin to return.

Rhododendron

In 2014 the National Park was recorded to have 5,787 ha of native woodland, with an estimated 7% (396 ha) being adversely affected by the presence of rhododendron. This may seem a small percentage, however, the task is a large and difficult one and key to controlling rhododendron is colony scale control which is co-ordinated, if required, over multiple land holdings.

OBJECTIVES BY 2023

- Active management of Rhododendron in all ten designated sites by 2023.
- Expand control of rhododendron to create a buffer zone to protect all areas under current active management, such as designated sites.
- All sites within the National Forest Estate will remain in active management.
- The National Park Authority and partners will identify priorities and opportunities for control programmes on a landscape scale, through both grant funding and officer time.
- Work with partners, such as Plantlife, to monitor control sites that will produce data on clearance and habitat restoration that can be used by land managers to inform future management.
- Ensure all long-term forest plans detail management of invasive rhododendron in line with the Forestry and Land Scotland publication.

Riparian INNS

The removal of INNS from beside rivers and lochs will allow native plants to recolonise resulting in an increase in Biodiversity.

OBJECTIVES BY 2023

- Reduce riparian INNS that negatively affect habitats in the National Park along with active control of any spread, prioritising designated sites.
- Develop control programmes at a catchment level to remove known riparian INNS from the Upper Tay, Upper Forth, Teith, Loch Lomond, Endrick, Loch Eck and Loch Goil catchments, and ensure management of contamination downstream.
- Continue to use agreed monitoring and recording process which will also report on indicators of success.
- Work with land managers, fishery trusts, government agencies, communities and volunteers to reduce the extent and damaging impact of these species and, wherever possible, remove them completely.
- Develop rapid response measures for removal and control to any new outbreaks of riparian INNS.
- Train volunteers and land managers involved in projects to control riparian INNS.
- Raise awareness of how to avoid spreading riparian INNS through both formal and informal education.
- Work with partners to keep up-to-date records of known INNS locations.
- Map the locations of INNS and use treatment and survey data.
- Devise an overarching Riparian INNS strategy with agreed criteria for prioritising treatment of non-native riparian INNS plants within the NP, both the geographic areas to be prioritised first and the species to be prioritised within each catchment or sub catchment.

Removal of Rhododendron and INNS will help with a number of key threats to wildlife

- Natural riverside habitats will be restored and better connected providing corridors for wildlife.
- Bank erosion will be reduced as the root systems of native trees and shrubs become established.
- The amount of sediment and diffuse pollution entering rivers will be reduced as natural vegetation provides a natural buffer.
- Restored habitats will reduce the impacts of climate change such as storm events and flooding.

- Increased dappled shade, leaf litter and woody debris will improve freshwater habitats for invertebrates and fish.
- Removal of rhododendron will improve the health of woodlands and allow native trees to grow increasing their ability to store carbon.
- Soil health will improve increasing the ability of the soils to store carbon.



Upper Tay Invasive Non-Native Species Project

The Upper Tay Invasive Non Native Species Project (UTINNS) was established in 2012. The project is a key part of the Riparian INNS Wild Challenge set out in National Parks Biodiversity Action Plan, Wild Park.

The aim of the project is to improve the quality of habitats by controlling the spread of invasive Knotweed, American Skunkcabbage, Himalayan Balsam and Giant Hogweed, within the upper catchment of the River Tay within the National Park. Control of these non-native invasive plants will result in the restoration and enhancement of degraded riverside and lochside habitats including woodlands and wetlands.







The project is working in partnership with land managers, local communities and volunteers and has assisted 29 landowners within the project area including several large Estates, local businesses, community groups and private households. The co-ordinated, innovative approach to the project has allowed for flexible, proactive treatment of INNS providing multiple benefits including habitat enhancement, improved access and improved water quality.

UTINNS Project Outputs & Outcomes

PROJECT OUTPUTS 2012 - 2019

- 12 volunteers trained in PA1 and PA6Aw safe use of pesticides
- 210 hours of volunteer time spent spraying invasive Knotweed
- 74 hours of volunteer time spent hand pulling Himalayan Balsam
- 3 locations of Giant Hogweed eradicated

PROJECT OUTCOMES 2019

- 10 locations of Himalayan Balsam hand pulled
- 102 locations of Japanese Knotweed chemically treated
- 11 locations of American Skunk-cabbage chemically treated
- In 2019 Giant Hogweed remains absent from the entire project area.
- In 2019 the number of locations where no regrowth of Japanese knotweed and American Skunk-cabbage has risen from 33 sites to 47 sites.
- In 2019 69 INNS locations have shown a large decrease in size and density.
- Himalayan Balsam has been significantly reduced from all lochside and woodland locations within St Fillans, improving habitat connectivity, reducing bankside erosion and improving water quality. Five sites in St Fillans are now known to be clear of Himalayan Balsam.
- Improved partnership working with landowners, community groups and local businesses, achieving multiple public benefits.
- Providing opportunities for volunteers to become actively involved in a landscape scale conservation project within the National Park.

Why do we control invasive non-native plants?

These species can take over and out compete natural vegetation like wildflowers, shrubs and trees. When these invasive plants are removed the native plants begin to return.

How does this improve water quality and reduce the pressures of climate change?

- Natural riverside habitats will be restored and better connected providing corridors for wildlife.
- Bank erosion will be reduced as the root systems of native trees and shrubs become established.
- The amount of sediment and diffuse pollution entering rivers will be reduced as natural vegetation provides a natural buffer.
- Increased dappled shade, leaf litter and woody debris will improve freshwater habitats for invertebrates and fish.
- Restored habitats will reduce the impacts of climate change such as storm events and flooding.



Questions and pupil enquiry

- What are the main causes of the spread of invasive non-native species?
- Explain how invasive non-native species out compete native wildlife.
- List the number of ways to remove invasive non-native species.
- What are the benefits of a removing invasive non-native species?

FURTHER READING



- Learn more about Wild Park our Biodiversity Action Plan
- Learn more about our Key Environmental Threats to Nature and Invasive Non-Native Species



Wild Challenge 2 - Invasive Non-Natives

Site visits

- Balmaha on east Loch Lomond is a great location to base a field visit, with the National Park Visitor Centre and Outdoor Classroom available for school groups. If you follow the Millennium path look out for rhododendron ponticum where the path goes through woodland alongside the visitor centre car park. You will also see Himalayan Balsam growing along the foreshore.
- Other sites suitable for field visits include the hills around Luss, west Loch Lomond.

Species reintroductions

Our environment is changing all the time and species will naturally die out and become extinct. Human activity such as pollution, land use and climate change can increase the numbers of species becoming extinct beyond the rate which would naturally occur.

When a species becomes extinct this can have an effect on the whole ecosystem and the animals, plants, insects and birds which depend on that system. If a species has only become extinct from part of its range, reintroducing the species to these areas can help restore this balance.

All proposals for reintroducing species must be assessed against the International Union for the Conservation of Nature's (IUCN) Guidelines for Reintroductions and Conservation Translocations, as well as the Scottish Code for Conservation Translocations. Conservation translocations involve the movement of plants or animals from one area to another for the purpose of conservation and are usually considered as a last resort.

The necessary permissions must then be secured from the landowners and statutory licensing authority.

Here we look at two species reintroductions. The first is **water voles** which were thought to have disappeared from Loch Lomond and The Trossachs National Park.

The second is the **Eurasian beaver** which had been extinct across the UK since the 16th century.





Reintroduction of water voles in the Trossachs

Introduction

The water vole (*Arvicola amphibious*), or 'water rat' as it is often mistakenly known, was once one of our most familiar and abundant riverside mammals. It is a semiaquatic member of the rodent family spending time in water and on land. It is very similar to the brown rat in appearance, but has a blunt nose, small ears and a hairy tail. It is the largest of the British voles and has seen a dramatic decline particularly in the latter part of the twentieth century. Most Scottish populations are now to be found in the uplands.



Water vole distribution and ecology



Water voles usually live beside bodies of water, where they feed on grasses and other vegetation such as sedges and herbs. They prefer slow moving water in burns, ditches, overgrown field drains and canals. They dig their burrows in the banks and prefer steep sided muddy banks where they can create nests above the water table. They are a prey species for a number of mammals and birds, so prefer continuous long vegetation in which they can hide!

Because of the losses of water voles in the lowlands, they are mainly restricted to smaller tributaries and headwaters of our upland rivers. Here, they are found in narrow burns and ditches and prefer gently sloping sites with a thick layer of peat. Water voles will avoid areas which are densely shaded by trees and shrubs. Water voles live in colonies and are very territorial. Females defend a linear territory of 30–50 m, while males occupy home ranges of 60–300 m, often overlapping the territories of several females. . During the breeding season (April to September) they will mark their territories with piles of droppings called latrines which have a distinct smell to keep other water voles away! Water voles have between 2-5 young per litter and can breed up to 8 times a year!

More recently water voles have been discovered in Glasgow living away from water. Large populations have been recorded in the east end of the city living in long grassland in parks, road verges, gardens and derelict land. These terrestrial water voles are termed fossorial which means adapted for digging and they spend more time underground like a mole. This adaptation to living in grasslands in such high densities in an urban environment is unique in the UK.



Threats to water voles

The total UK population of water voles was reduced by approximately 90% between 1989 and 1996. Reasons for this decline are thought to be due to two main factors:

1. Habitat that the water voles favour has either been lost or broken up into fragments. This has reduced suitable areas where the voles can live and breed. Examples of this are draining of wetlands and the introduction of hard engineering to rivers (e.g. concrete embankments and other man-made structures). Riparian vegetation (vegetation growing at the edges of water) can change due to over grazing by wild herbivores such as deer and also domestic livestock. This reduces the abundance of vegetation for the voles to eat and enables predators to see them more easily. However, not enough grazing is equally as damaging, allowing shrubs and trees to take hold along water courses.

2. Predation by the non-native American mink.

Water voles have many native predators but none seem to threaten the survival of the species. Because they have evolved alongside these predators, they have well-balanced predator-prey relationships and effective defence systems. Water voles have developed evasive behaviours to minimise their chances of being caught. They



maintain runway systems on the banks so they can move through the vegetation remaining relatively unseen and when threatened they will jump into the water creating a distinctive 'plop'! and seek out their burrows to hide. However, when the non-native American Mink was introduced to the UK, they were able to exploit the gaps in our natural food webs and became a very problematic predator. American mink are very clever and opportunistic predators, they are aggressive, good swimmers and cache kill, meaning they kill more prey than they need to store for later. Most importantly, female mink can fit into water vole burrows where they can easily catch defenceless voles that are unable to escape.

Protection of water voles

The water vole receives partial protection under <u>Schedule 5 of the Wildlife and Countryside Act 1981 (as amended)</u>.

In Scotland, this legal protection is currently restricted to the water vole's places of shelter or protection and doesn't include the animal itself. Full protection, to also cover the animal, is proposed. Currently it is an offence to intentionally or recklessly:

- damage, destroy or obstruct access to any structure or place that water voles use for shelter or protection.
- disturb a water vole while it is using any such place of shelter or protection.

The Trossachs Water Vole Reintroduction Project

The Trossachs Water Vole Reintroduction Project began in 2008 and has been an amazing success story with signs of water voles spreading fast. Surveys across Loch Lomond and The Trossachs National Park prior to this showed that water voles had been lost from most of the National Park. Forest Enterprise Scotland (Now Forestry and Land Scotland) with help from partners had carried out a lot of work to restore wetlands and created habitats which were suitable for water voles in the Trossachs area of the National Park.

This work was part of a project to improve the habitat for wildlife in the Loch Ard Forest. Ponds were dug, tree-free buffer zones were created on river edges and riparian vegetation allowed to grow, and dams were built in ditches, all of which created good habitat for the water voles and other wildlife. Mink control was also undertaken to ensure the areas were as far as possible free from this invasive species.

The nearest known surviving water vole colonies in the National Park were in isolated upland sites too far away to re-colonise this area. Meanwhile a small population of water voles needed to be relocated from a large development site in North Lanarkshire. The displaced voles were bred in captivity to increase their numbers and, between 2008 and 2011 almost a thousand were released into fifteen small areas of good quality habitat in the Loch Ard Forest. Since the releases, mink control has continued and a buffer zone of mink monitoring activity was created, and continually expanded to allow the water vole population to naturally expand.

The water vole population has been monitored every year by surveys carried out by a dedicated group of volunteers coordinated and led by a Project Officer and other staff from the project partners including Loch Lomond and The Trossachs National Park Authority.



The annual surveys (see maps on next page) have shown that the water vole population now occupies over 100km squares and they have travelled as far as 12 km from the original release sites. Around 120 volunteers have taken part in surveys covering more than 200km of waterway. In 2019, 11 volunteers surveyed for a total of 231 hours. In total, more than 25 land managers are now involved in the project.

This was originally a partnership project led by Forest Enterprise Scotland with the Forth Rivers Trust, Loch Lomond & The Trossachs National Park Authority, the Royal Zoological Society of Scotland, Scottish Natural Heritage and the Derek Gow Consultancy. Since 2019 the steering group has been made up of representatives from Forestry and Land Scotland, The Forth Rivers Trust, Loch Lomond and The Trossachs National Park and Scottish Natural Heritage.

BIODIVERSITY & CLIMATE CHANGE IN THE NATIONAL PARK

CASE STUDY 4

Water Vole survey results



Reintroduction of the **Eurasian Beaver**

Introduction



Beavers in Scotland are protected by law as a European Protected Species. This protection came into force on 1st May 2019 which will allow the current beaver population to spread naturally. This was a huge decision that will change wildlife and habitats in Scotland. The Eurasian beaver (*Castor fiber*) is known as a 'Keystone' species. This means that its presence has a positive effect on the environment around where it lives.

The beaver is a large semi-aquatic rodent, so is related to rats and squirrels! It is the second largest rodent after the South American Capybara. It lives in woodland or scrub on the edges of standing or slow moving freshwater. It is a herbivore and eats the leaves, buds, roots and inner bark of broadleaved trees. It often fells the trees so it can reach the leaves and bark by gnawing through the tree with its incredibly powerful teeth. Beavers also eat grasses, water plants and other herb species. Beavers live in family groups and will burrow into banks in order to create chambers. Where this is not possible, the beaver will build 'lodges' out of piles of wood.

Beavers are well known for their amazing engineering skills! The beaver will sometimes build dams in streams to keep water levels high. It will also sometimes build canals as a way of making it easier to travel to and from feeding areas. This engineering can have benefits to a large number of species including amphibians, dragonflies and fish and impact in a positive way on the entire freshwater ecosystem. Beavers can also help reduce flooding downstream and attract tourists to areas where they are present which boosts local economies.



History of the reintroduction of beavers



The Eurasian beaver was present in Scotland and the UK for thousands of years, but died out around the 16th Century. It was hunted to extinction for its meat, scent glands and fur. Its fur was very prized as it is so soft and the scent glands produce a secretion which was used in perfumes and medicines.

In May 2009, the Scottish Wildlife Trust, in partnership with the Royal Zoological Society of Scotland and Forestry and Land Scotland, released the first wild beavers in Scotland in over 400 years. This took place on the west coast of Scotland in Knapdale, Argyll. It was called the Scottish Beaver Trial and the aim was to help the Scottish Government decide on the future of beavers in Scotland. In November 2016, the Scottish Government ruled that the trial had been a success and that the beavers could stay in Knapdale for good. More beavers were subsequently released, and the population will now be allowed to expand naturally. More information about the Scottish Beaver Trial can be found on the <u>website</u>.

The first confirmed records of beavers in the Tay Catchment in Scotland were in 2006. It is not known how they got there but it is thought that they were either accidently or deliberately released as no licence was issued for their release in this area. The upper Tay catchment includes the Rivers Dochart and Fillan both within Loch Lomond and The Trossachs National Park. Surveys in the Tay catchment have since confirmed that there has been an increase in the number of family groups and that the beavers have spread in range, with animals now being recorded outside of the catchment. The Tayside Beaver Study Group was involved in monitoring the beavers. Beavers have been seen in the National Park and signs of beavers here are spreading.

The work of the Scottish Beaver Trial, The Tayside Beaver Study Group and a number of other organisations all contributed to the Scottish Government making the decision in 2019 to allow beavers to stay in Scotland and give them the protection they needed.

Potential issues and conflicts

Although beavers provide benefits in terms of wildlife and tourism, conflicts with other interests may arise. In some places beavers may flood farmland, gardens or roads. Although they may have potential benefits for migratory fish, there might also be localised negative effects. Sometimes this can be easily managed to prevent damage such as by fencing vulnerable areas or protecting individual trees, and in others there is the potential for more novel techniques.

Scottish Natural Heritage provide advice to help people experiencing problems and where possible will help through the beaver mitigation scheme. Information can be found on the NatureScot website.



Wild Park and key threats

Wild Park

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As well as highlighting objectives between 2018-23 the programme also details threats to the environment of the National Park.



Wild Park is concentrating on the following four environmental threats:



POOR CONDITION OF LOCHS & RIVERS

Negative impacts on freshwater and marine water bodies from problems such as pollution from surrounding land uses.



UNSUSTAINABLE LEVELS OF GRAZING

Unsustainable levels of wild and domesticated grazing and browsing animals in some upland and woodland areas, leading to reduced tree cover and the erosion of soils, which are important carbon stores.



INVASIVE, NON-NATIVE SPECIES

The spread of invasive non-native species, which displace our rich native wildlife.



CLIMATE CHANGE PRESSURES

The impacts of climate change leading to warmer, wetter weather patterns and a subsequent increase in flood events, major landslides and rapid shifts in natural ecosystems.

Water voles are a vital part of our freshwater ecosystem, providing a prey source for many animals and birds and creating conditions in our waterways which benefit a wide range of species.

As beavers spread in range and increase in numbers across Scotland and through the National Park, they will also become very important in the freshwater ecosystems of the National Park.

All four of these threats will impact the success of the continued spread of both the water vole and beaver populations. Conversely, the spread of beavers may have a positive impact on these threats as they are thought to be 'keystone' species.



Poor quality of lochs and rivers

Pollution from land uses including agriculture and forestry operations will affect the water habitat which will in turn impact on the plant species which can grow in areas of wetland. The condition of the water voles' and beavers' habitat including trees, plants, and banks of burns or ditches will also have an impact on numbers. Beavers can also have a positive effect on water quality and improve entire ecosystems. Many actions in Wild Park to increase water quality by 2023 will benefit water voles and beavers.



Unsustainable grazing impacts

Water voles eat a very wide variety of plant species and also require plants to hide in. Too much or too little grazing around sites occupied by water voles will have an impact on the quality of vegetation available to eat and the height of vegetation in which to take cover. Broadleaved trees and other herbaceous plants are important food sources for beavers and also for their engineering works to improve freshwater habitats. Sustainable grazing will improve habitats for both these species.

Invasive non-native species

American mink which is a non-native species continues to be controlled across the Trossachs Water Vole Project area and areas in which it has spread. It is important this continues and more land owners, managers and volunteers become involved in monitoring mink populations to protect the water voles. Non-native invasive plants such as Himalayan balsam and Japanese knotweed will out-compete native plants which the water voles and beavers feed on. Projects in Wild Park which prevent the spread of these plants will be important in sustaining the water vole populations and allowing beaver populations to grow. (See Case study 3 – Invasive non-native species).



Climate change pressures

Climate change will have an impact on the wildlife and ecosystems in the National Park including water voles and beavers. It is the single greatest threat to Scotland's habitats, some habitats will be directly affected but more often, climate change will alter the ecological balances that let plants and animals grow and thrive such as the wetland habitats where our water voles and beavers live. Beavers may help to mitigate some of the effects of climate change by reducing downstream flooding.

Objectives for mammalian INNS by 2023 are:

- Reduce the population and re-colonisation of grey squirrel in the National Park through a network of community-led groups and land managers continuing responsible trapping efforts in vulnerable areas.
- Retain effective grey squirrel control in areas where populations have declined to ensure densities do not regain.
- Involve land managers and local communities in the reporting of INNS species.
- Continue to promote recording of squirrel sightings through SWT
- Improve habitats from native species, such as better connected native woodlands and more naturalised water courses.
- Increase volunteer involvement in surveys.

- Provide information on responsible land management to encourage land managers to have good forest and riparian management that benefits native species, such as creating water bodies, reducing bank side poaching, planting the correct tree species etc.
- Collaborate with partners to deliver native mammal conservation education throughout the National Park through public events, interpretation, social media etc.
- Continue and increase collaboration with land managers to reduce the presence of mammalian INNS but also to improve habitats to favour native species.
- Increase numbers of active volunteers (monitoring and control).

For more information on freshwater ecosystems and objectives by 2023 to increase water quality of lochs and rivers see: Case study 5 - Waterbodies in the National Park.

Mitigating against climate change

It is predicted that in the future typically the summers will be hotter and drier and the winters and autumns will be milder and wetter. The hotter weather in the summer will mean water levels may fall, banks may dry out affecting burrows and vegetation growth will also be affected. In the autumn and winter, water levels may rise with flooding occurring more frequently. All these changes in the climate will affect the habitat and the ecosystem where water voles, beavers and other species have adapted to survive.

We need to ensure that ecosystems in the National Park can withstand the effects that climate change is bringing to our native biodiversity and wider environment. These ecosystems can also help mitigate climate change by maintaining carbon stores, storing carbon and surface water. The National Park's peatlands hold an estimated 20 million tonnes of carbon and our forests hold another 2.5 million tonnes.

Restoring peatlands by blocking drainage ditches and covering bare peat will not only store carbon, but will also hold onto water for longer, preventing flooding downstream in areas where there may be water voles. Planting trees upstream in our upland areas can also help reduce flooding, although we need to make sure woodlands are designed not to have a negative effect on water vole habitats. Many of the actions in Wild Park will help reduce climate change which will in turn help water voles and beavers.

Future projects

The Trossachs Water Vole Project turns 12 in 2020 and we are as committed as ever to the protection of our water vole population and their habitats. However, in the coming years the project also hopes to build on our successes and expand the breadth of our work, helping to bring about positive changes to the health of wetland and riparian habitats throughout the wider Forth catchment.

BIODIVERSITY & CLIMATE CHANGE IN THE NATIONAL PARK

CASE STUDY 4



Questions and pupil enquiry

- What may cause species to become locally and nationally extinct?
- What is a keystone species?
- List two reasons for the decline of water voles across the UK
- Where did the captive water vole population come from which were reintroduced into the Trossachs?
- When did beavers in the UK become protected by law and under what law are they protected?
- How may climate change affect water voles and beavers in Loch Lomond & The **Trossachs National Park?**

FURTHER READING



Online

- Read more about Wild Park and the 4 key threats to wildlife.
- NatureScot information about beavers and their protected status
- NatureScot information about a shared approach to wildlife management
- Read more about the Scottish Beaver Trial and Scottish Beaver Reinforcement Project
- Read about species management in Scotland in the Species Action Framework Handbook
- Read more about the Reintroduction of water voles in the Trossachs
- Read more about the protected status of water voles and beavers



Video clips

Video clip of water voles on mink raft

Video clip of beavers



- Water voles are very difficult to see. Loch Ard Forest in Aberfoyle has populations of water voles. For more information contact the Trossachs Water Vole Project Project Officer Emily Marshall emily.marshall@forestryandland.gov.scot
- Beavers are nocturnal, so you very unlikely to see them. They are beginning to move into Loch Lomond & The Trossachs National Park so keep your eyes open for signs that beavers are present such as gnawed wood and felled trees.