

REPORT OF THE INVASIVE NON-NATIVE SPECIES PROJECT COORDINATOR

SUBJECT: PWYTH MEWN PRYD – STITCH IN TIME PROJECT UPDATE

Purpose of Report

1. To accompany a presentation by the Project Coordinator on the *Pwyth mewn Pryd - Stitch in Time* project.

Background

2. The Authority's *Pwyth mewn Pryd – Stitch in Time* project, initially supported by the Sustainable Development Fund (SDF), is seeking to undertake control on a whole-catchment basis of three priority invasive non-native species (Japanese knotweed, Himalayan balsam and *Rhododendron ponticum*). The project is focussed on the Gwaun Valley.
3. This report accompanies a presentation on progress since the SDF phase of the project was completed in 2016. The Authority funded a 15 month project extension to maintain project continuity while external funding bids were prepared.
4. As part of the project extension, a desktop ecosystems services assessment of the SDF phase of the project was undertaken. A copy is attached to this report (Appendix 1).
5. In April 2017 the project received a further £100,000 from Welsh Government.

Financial, Risk & Compliance Considerations

6. The NPA has statutory responsibilities with regard to invasive non-native species on land it owns or leases and duties under the Environment (Wales) Act 2016 (biodiversity and resilience of ecosystems duty) and under the Well-being of Future Generations (Wales) Act 2015 (a resilient Wales).

Human Rights/Equality Issues

7. No issues have been identified.

Biodiversity Implications/Sustainability Appraisal

8. The Pembrokeshire Nature Partnership (formerly the Pembrokeshire Biodiversity Partnership) published an invasive non-native species Action Plan in 2014. The Plan prioritises species for action according to the threat they pose. *Rhododendron* species, Himalayan balsam and Japanese knotweed are included as priority species for control. Accordingly, this project is helping to implement the Biodiversity Action Plan for Pembrokeshire. The project benefited from input from the Partnership's Biodiversity Implementation Officer at an early stage.

Welsh Language Statement

9. No issues have been identified.

Recommendation

That Members note the report and presentation.

Background documents to this report

- Operational Review Committee report 06/16, 28th June, 2016
- *A Stitch in Time - Pwyth mewn Pryd. An ecosystem services assessment of a conservation project, June 2017* (attached)

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A Stitch in Time Pwyth mewn Pryd

An ecosystem services
assessment of a
conservation project

June 2017



Pembrokeshire Coast National Park Authority



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Summary

- (i) Ecosystem services are the benefits provided by plant and animal communities that contribute to making life possible and worth living. Such benefits include food production, regulation of the climate, clean water and recreation opportunities.
- (ii) Invasive Non-Native Species are species which are not native to those plant and animal communities and whose spread causes harm - to native wildlife, the economy and food production, for example.
- (iii) Pembrokeshire Coast National Park Authority's *Stitch in Time - Pwyth mewn Pryd* project, supported in its initial phase by the Sustainable Development Fund, is seeking to control three priority invasive plants - Japanese knotweed, Himalayan balsam and *Rhododendron ponticum* – in the Gwaun Valley, Pembrokeshire.
- (iv) The first phase of the project was assessed to determine the impacts of the project on ecosystem services. In summary, benefits of the project are likely to include:
 - Protection of land for agricultural or conservation use
 - A reduction in the threat to buildings (from Japanese knotweed)
 - Stabilisation of stream sides and river banks
 - Restoration of native species diversity
 - Improved soil health
 - Restoration of aspects of the natural landscape important to residents and visitors
- (v) Volunteers were essential to delivery of the project, with just over 140 volunteer days contributed. Many community groups were involved, with some individuals benefiting from training.
- (vi) It is concluded that taking action through projects such as *Stitch in Time – Pwyth mewn Pryd* to identify, prevent, control and eradicate non-native species within catchments will help to promote native vegetation cover, increase habitat area and restore/maintain native wildlife. This will contribute to better management of water and soils, reduce the cost of control of non-native plants to future generations, and protect assets and incomes.

1 Introduction

- 1.1 The Environment (Wales) Act 2016 requires public authorities to “seek to maintain and enhance biodiversity in the exercise of functions in relation to Wales, and in so doing promote the resilience of ecosystems, so far as consistent with the proper exercise of those functions.” (Section 6)
- 1.2 The Convention on Biological Diversity defines an ecosystem as “a dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.”
- 1.3 Ecosystems are usually described in terms of their dominant vegetation or environmental features. This allows the environment to be scaled to size depending on the question being asked or the decision being made (National Assembly for Wales, 2012)¹.
- 1.4 The UK National Ecosystem Assessment describes ecosystem services as “the benefits provided by ecosystems that contribute to making life both possible and worth living”. It classifies services along functional lines into the following categories.



Provisioning services:
The products obtained from ecosystems.

For example,

- food
- fibre
- fresh water
- genetic resources



Regulating services:
The benefits obtained from the regulation of ecosystem processes.

For example,

- climate regulation
- hazard regulation
- noise regulation
- pollination
- disease and pest regulation
- regulation of water, air and soil quality



Supporting services:
Ecosystem services that are necessary for the production of all other ecosystem services.

For example,

- soil formation
- nutrient cycling
- water cycling
- primary production



Cultural services: The non-material benefits people obtain from ecosystems.

For example, through

- spiritual or religious enrichment
- cultural heritage
- recreation and tourism
- aesthetic experience

Ecosystem services

(table from <http://uknea.unep-wcmc.org/EcosystemAssessmentConcepts/EcosystemServices/tabid/103/Default.aspx>)

¹<http://www.assembly.wales/Research%20Documents/Ecosystems%20and%20the%20Ecosystem%20Approach%20-%20Quick%20guide-08032012-231338/gg12-0006-English.pdf>

- 1.5 The aim of an ecosystem services assessment is to understand the services that a defined ecosystem provides and the impact that a policy or project has on the services.
- 1.6 This report describes an ecosystem services assessment of a catchment scale project. The project is *A Stitch in Time - Pwyth mewn Pryd*, which is aimed at controlling three invasive non-native plant species in the Gwaun Valley in Pembrokeshire Coast National Park².

2 A Stitch in Time – Pwyth mewn Pryd

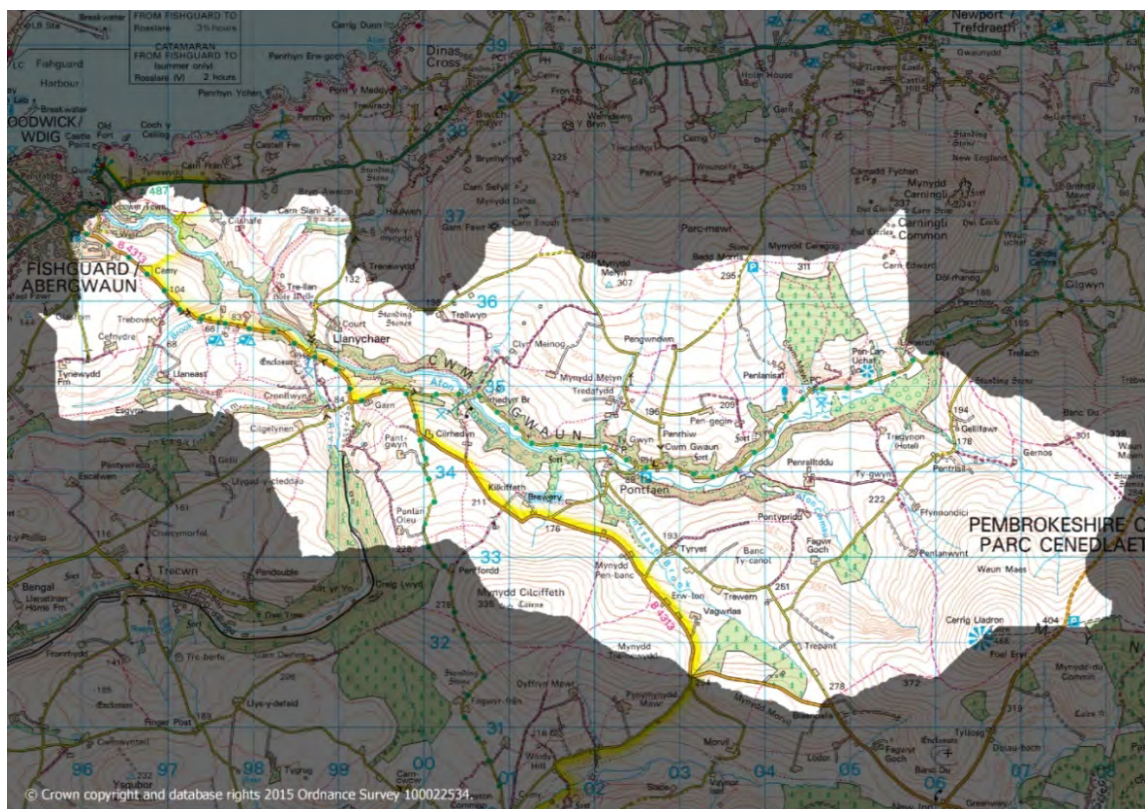
- 2.1 Invasive Non-Native Species (INNS) are species which are not native to an ecosystem and whose spread within it is believed to cause harm to native biodiversity, the economy, food production etc. INNS are often spread by human agency, whether deliberately (e.g. the introduction of ornamental species) or inadvertently.
- 2.2 Plant INNS can alter nutrient cycling, hydrology, and energy budgets in a native ecosystem and can greatly diminish the abundance or survival of native species. INNS are second only to habitat loss in terms of causing global biodiversity decline and the degradation of ecosystem function and productivity.
- 2.3 INNS have been identified as one of the major drivers of ecosystem degradation in Wales (UK National Ecosystems Assessment, 2011) and the Pembrokeshire Nature Partnership places Himalayan balsam, Japanese knotweed and *Rhododendron ponticum* amongst the priorities for control in the county.
- 2.4 The cost of removing INNS from agricultural, amenity or built land in the UK is estimated at £1.7 billion annually, with an annual cost to Wales of £125 million (Williams *et al.* 2010).
- 2.5 A number of organisations and individuals are involved with INNS control in Pembrokeshire and the Pembrokeshire Coast National Park, but the approach is often piecemeal. For example, due to land ownerships, treatment may not eradicate the target species at a particular site, only control it up to a certain boundary. Such containment efforts imply indefinite treatment costs and, by leaving a source of infection, do not necessarily prevent species spread to new areas. Systematic eradication (or near-eradication) from a defensible area is the most cost-effective solution in the long term, as management is reduced to preventing or treating any low level re-infestation.
- 2.6 Pembrokeshire Coast National Park Authority's (PCNPA) *Stitch in Time - Pwyth mewn Pryd* project, supported initially by the Sustainable Development Fund (SDF), is seeking to undertake control on a whole catchment basis of three priority INNS (Japanese knotweed, Himalayan balsam and *Rhododendron ponticum*)

² A report of the project can be found at:

<http://www.pembrokeshirecoast.org.uk/Files/files/Stitch%20in%20Time%20project/SiTEoP.pdf>

focussed on the Gwaun Valley, Pembrokeshire. The objectives of the SDF project were to:

- Develop a locally-adapted, catchment-based, invasive species control model, applicable in the National Park and wider Pembrokeshire, in even the most environmentally-sensitive areas.
- Map and reduce the extent of invasive species in the Gwaun valley catchment.
- Increase agency and individual/community awareness of and capacity to manage key invasive plant species.
- Document the project online as a reference resource, to include approaches to engagement with communities and partner organisations, invasive species survey, mapping, identification of transmission routes, treatment and lessons learned.



The Gwaun catchment in North Pembrokeshire

- 2.7 The project received approval for £25,318.25 of SDF funding in 2014 and ran from January 2015 to August 2016. PCNPA provided match funding of £6,000. Natural Resources Wales contributed £5,000 during the project. The actual drawdown of SDF was £24,140.45.
- 2.8 A post of Invasive Non-Native Species Project Coordinator (2 days per week) was created within PCNPA to deliver the project. Volunteer time was an essential element of the project, with almost 141 person days contributed, plus almost 52 days of officer time, which together totalled £16,615.53 of in-kind contributions at the approved rates. The Project Coordinator accumulated more than 100 unpaid hours, 89 of which were subsequently included as an in-kind contribution.

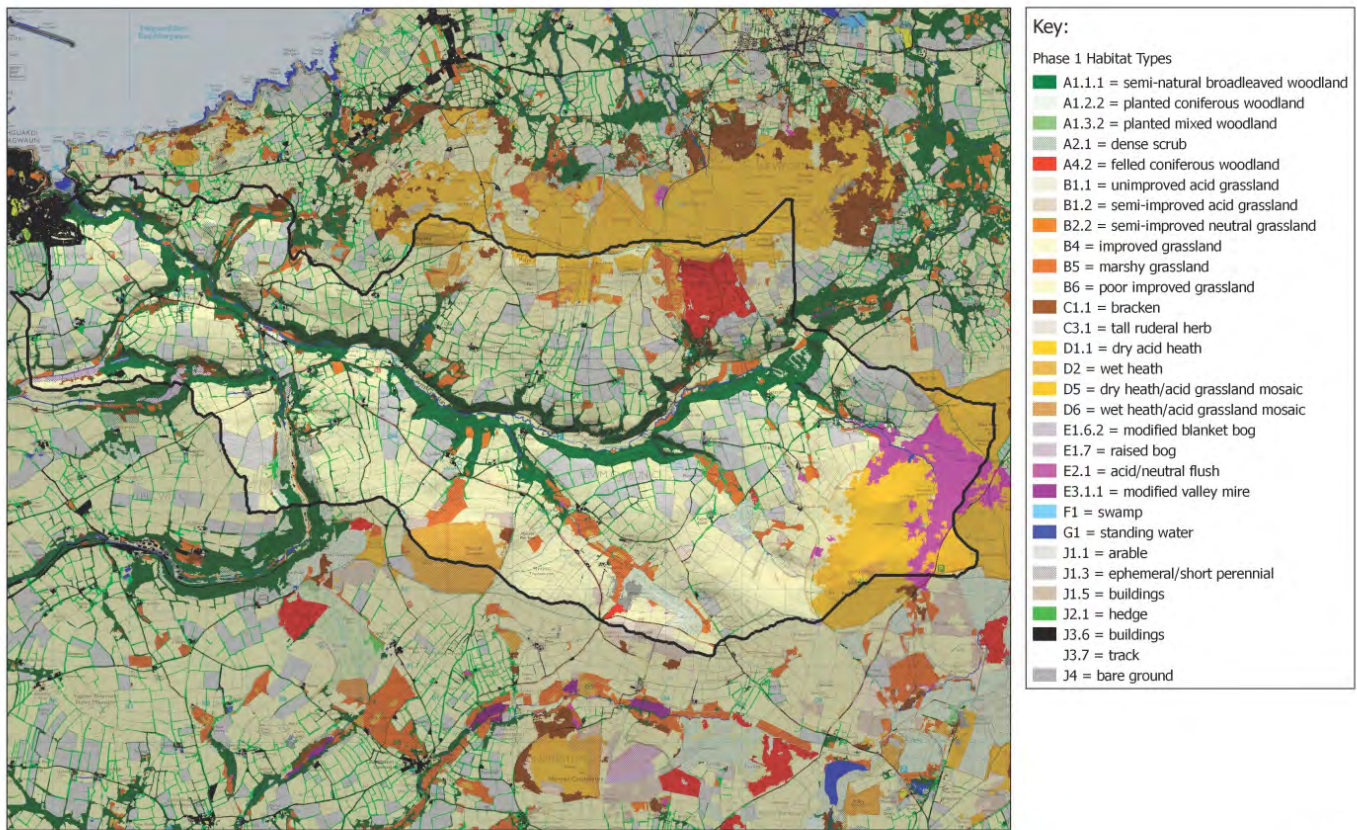
- 2.9 The project has mapped and achieved a reduction in the extent of the three target species. Control of the three target species (and, where required, general vegetation clearance for access) was undertaken by volunteers, landowners, PCNPA staff and other partner organisations. Contractors were involved in Japanese knotweed and *Rhododendron* control. The project established survey and treatment methods although it was recognised that eradication would require a longer term investment of resources and time.
- 2.10 PCNPA funded a 15 month project extension to maintain project continuity while external funding bids were being prepared. In April 2017 the project received a further £100,000 from Welsh Government.

3 A profile of the Gwaun catchment

- 3.1 The SDF-funded project phase focussed on the Gwaun Valley catchment, covering 4,546 hectares. Direct ecosystem service beneficiaries include the Cwm Gwaun community (approximately 250 people), many of whom rely on the integrity of the land and appearance of the landscape for income from agriculture and the visitor economy. Much of the catchment is privately owned.
- 3.2 PCNPA owns or leases a number of sites (predominantly woodland and heathland) for conservation and recreation and manages rights of way within the National Park area. Natural Resources Wales has management influence over designated sites. Pembrokeshire County Council has responsibility for some sites, transport routes maintenance and Council-managed access. There is a disused Dŵr Cymru Welsh Water treatment works in the catchment.
- 3.2 The catchment also includes the River Aer headwater within Trecwn Valley, under the management of Renewable Development Wales. This area has additional strategic importance for INNS (which are present at Trecwn) as it includes headwaters of the Eastern Cleddau.
- 3.3 The Phase 1 Habitat Classification is a standardised system to record semi-natural vegetation and other wildlife habitats. The Gwaun catchment has the following Phase 1 profile³:
- 61% improved grassland
 - 12% semi-natural broadleaf woodland
 - 8% dry acid heath
 - 4% hedges
 - 3% marshy grassland
 - 2% wet heath
 - 2% planted coniferous woodland
 - 2% acid neutral flush
 - 1% bracken
 - 1% dry acid heath
 - 1% semi-improved neutral grassland
 - 1% semi-improved acid grassland

³ excludes 171ha of felled woodland, tracks, buildings and unresolved data.

- 1% standing water



Sitch in Time/Pwyth mewn Pryd:

Phase 1 Habitat Types Present in the Gwaun Catchment

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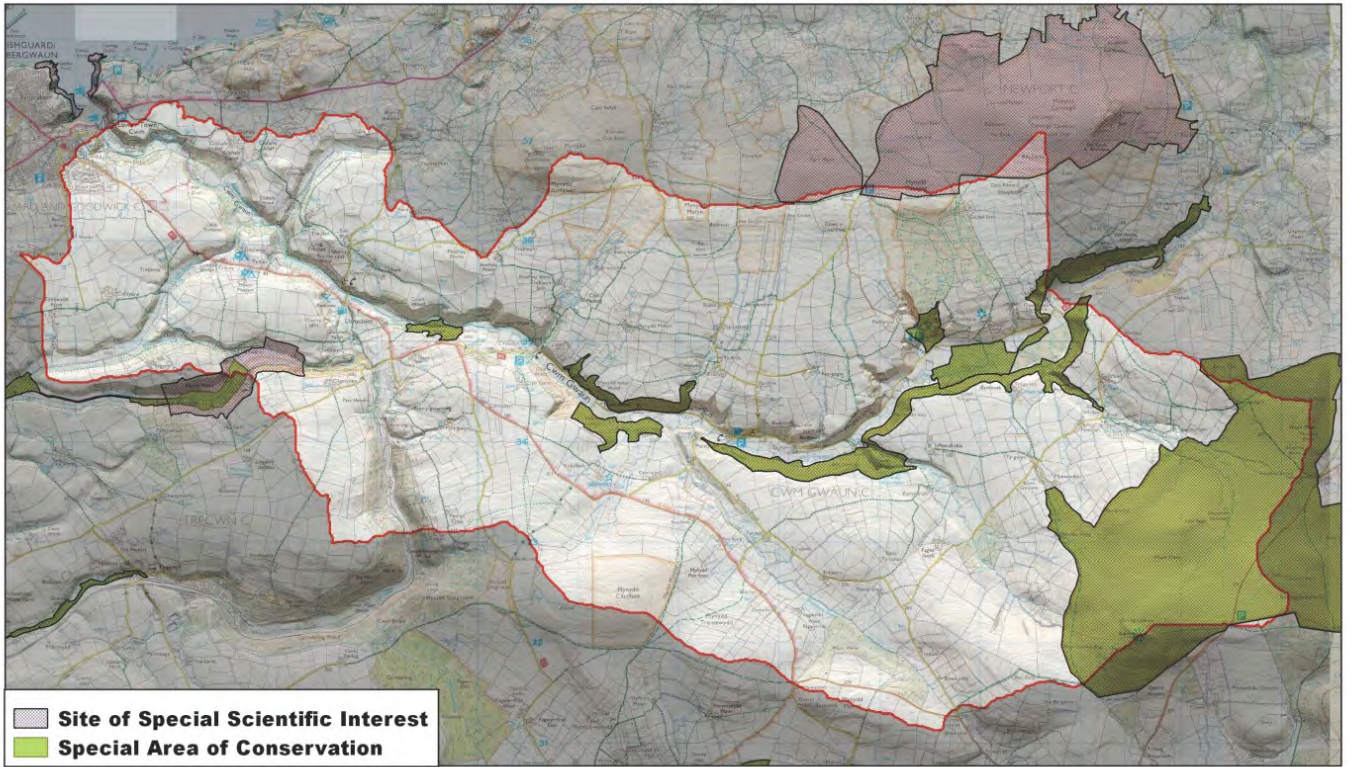


Phase 1 Habitat types present in the Gwaun catchment

- 3.4 The catchment includes the following woodlands (136ha):
- Allt Garn Site of Special Scientific Interest, Ancient Semi-Natural Woodland *
 - Coed Kilkiffeth and Allt Clyn Sites of Special Scientific Interest, Ancient Semi-Natural Woodland *
 - Allt Pontfaen Site of Special Scientific Interest, Ancient Semi-Natural Woodland *
 - Allt Pengegin Ancient Woodland Site (ancient woodland is land that has been continuously wooded since at least 1600)
 - Sychpant Site of Special Scientific Interest, Ancient Semi-Natural Woodland*
 - Coed Pentre Ifan, restored Planted Ancient Woodland Site, adjacent to Tycanol National Nature Reserve*

*part of the North Pembrokeshire Woodlands Special Area of Conservation

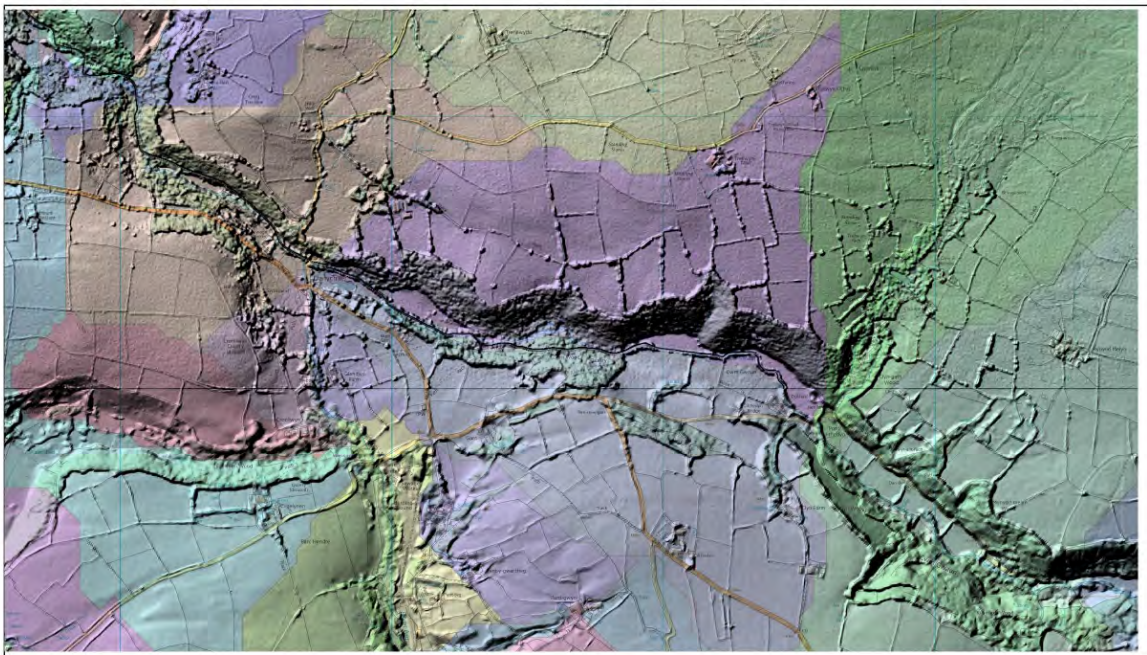
- 3.5 The catchment includes parts of the Preseli Special Area of Conservation, Mynydd Preseli Site of Special Scientific Interest and Carn Ingli Site of Special Scientific Interest. Local Biodiversity Action Plan species include lichens, dormouse, bats, marsh fritillary and damselfly species.



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Special Areas of Conservation and Sites of Special Scientific Interest in the project area



Half-drainage basins in a section of the Gwaun Valley

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Half-drainage basins in a section of the Gwaun Valley

- 3.6 Watercourses are a major dispersal pathway for INNS. Catchments, and sections of catchments, are therefore an appropriate scale at which to work. A Geographic Information System (GIS) enabled the project to take a tactical approach within the catchment, based on stream order and drainage basins. Essentially, this means working from the top of a drainage unit down and from the outside in as the most cost-effective way to protect the largest area and the most ecologically-sensitive parts of the catchment, while minimising reinfection risk along watercourses.

4 Ecosystem services deriving from the principal habitats

Provisioning services

- 4.1 Rivers, streams, lakes and wetlands support a diverse range of species essential for maintaining ecosystem health, provide drinking water and contribute to human enjoyment through leisure and amenity. Watercourses and wetlands are important for the sustenance of other ecosystems. The Afon Gwaun has no commercial fishing and little recreational fishing although trout are present and sea trout may have used the river in the past.
- 4.2 Semi-natural grasslands in the catchment mostly lie within farming systems (dairy/beef/sheep) but are distinguished from improved grasslands by lack of recent cultivation, re-sowing or heavy fertilisation, and lower-intensity management. They are species-rich and support a range of pollinators.

Regulating services

- 4.3 Freshwater systems help to control runoff from the land to rivers, floodplain inundation, groundwater recharge and water quality. These processes are vital for the regulation and supply of water, nutrients, energy flows, sediments and migratory organisms. Freshwater systems remove and dilute pollutants and capture carbon. They are therefore critically important in supporting the functioning of social and economic systems and the ability of humans and other species to adapt to climate change.
- 4.4 Grasslands provide climate regulation through sequestration and storage of carbon and other greenhouse gases. They help the purification of pollutants and storage of water. Grasslands can closely interact with wetland systems (in particular, water meadows which were traditionally managed so that they stored seasonal floodwaters). The positive management of enclosed farmland is important to help safeguard against soil loss, to reduce impacts on water quality from pollution and siltation and to address localised flooding.
- 4.5 Woodlands provide timber, are a valued recreational resource, help to regulate climate stress at a local level, provide carbon sequestration, regulate water flow, safeguard soils and improve air quality.

- 4.6 Upland habitats play important roles in water regulation and purification (e.g. storing water reducing flooding downstream and maintaining river base flows during periods of drought), and in carbon storage and carbon sequestration. Upland habitats are amongst the most species-rich habitats in the UK.

Supporting services

- 4.7 Woodlands play a major role in pollination, soil formation and stability, nutrient cycling, water regulation and cycling and oxygen production, all of which are crucial in supporting our health and well-being. Woodlands and scrub play key connectivity roles; oak woods are the most species-rich habitat in the UK, home to UK and European protected species and a range of pollinators for example.
- 4.8 Semi-natural enclosed farmland is a distinctive landscape in which plants, animals and other organisms live and through which they travel. Hedges provide physical landscape connectivity; those with a diversity of native woody species e.g. ash, hazel, holly are generally more species-rich.

Cultural services

- 4.9 The Gwaun Valley community has a unique culture and the majority are first language Welsh speakers.
- 4.10 Rivers and streams provide a sense of place, defining specific landscapes, and support charismatic protected species such as otter.
- 4.11 Enclosed farmland supports functioning of social and economic systems in a number of ways, being a focal point for relationships within and between rural communities.
- 4.12 Uplands are archaeologically and historically rich, inspirational, and contribute to Wales' distinctive landscapes and national identity. People are more likely to identify mountains and moors as the places they would like to visit more often for recreation. There is extensive access to the coast and to land of high nature conservation value and high scenic value. There are three Landscape Character Areas of relevance to the project boundary (Annex 2).

5 Impacts of the target species on ecosystem services

- 5.1 Each of the target invasive species outcompete native species, degrade commercial land potential and compete for pollinators from native species. Untreated, the cost of control for each becomes cumulative (NRW, 2016). The target species also have plant-specific impacts, listed below.
- 5.2 Letters in brackets indicate where the impact affects provisioning (P), regulating (R), supporting (S) or cultural (C) services (see para 1.3).
- 5.3 Plant-specific impacts of Himalayan balsam:

- Promotes soil erosion along riparian zone, increasing nutrient rich sediment entering aquatic environment which could impact catchment water quality; impacts on spawning fish. (P)
- Reduces diversity of primary production species (photosynthesis) due to monoculture; habitat loss/ fragmentation impacts genetic diversity reducing overall site, landscape/catchment resilience. (The Poppit Himalayan balsam eradication project noted over 90 species recolonising what had been a dense balsam stand covering 30 acres.) (S)
- Modifies nutrient regimes. Below and above ground disruption of soil formation, communities and composition. (S)
- Restricts access to forage sites - berries, timber, freshwater fish food sources. (C)
- Decreases aesthetic value of landscape. (C)
- Impacts on cultural heritage e.g. condition of monuments, ancient woodland. (C)
- Prevents access for recreation activities (fishing, walking) which could impact tourism. (C)
- May lead to disputes between neighbours/within communities. (C)

5.4 Plant-specific impacts of Japanese knotweed:

- Reduces carbon sequestration potential of other species. (R)
- Alters habitat due to reduced, increasing erosion, increased sedimentation in water environment (Kurose et al 2006). (R)
- Reduces diversity of primary production species (photosynthesis) due to monoculture; habitat loss/ fragmentation impacts genetic diversity, localised extinction reducing overall site, landscape/catchment resilience. (S)
- Modifies nutrient regime, homogenisation of soil conditions. (S)
- Below and above ground disruption of soil formation, communities and composition. (S)
- Restricts access to/existence of forage sites - berries, timber.
- Increases sedimentation, impacting freshwater fish spawning. (C)
- Decreases aesthetic value of landscape. (C)
- Impacts on cultural heritage e.g. condition of monuments, ancient woodland. (C)
- Prevents access for recreation which could impact tourism. (C)
- May compromise social relations and community cohesion due to impacted livelihoods, costs of control and difficulty of achieving integrated control. (C)
- Degrades of built structures. (C)
- Devalues property, cause for mortgage refusal. (C)

5.5 Plant-specific impacts of *Rhododendron*:

- Livestock death by ingestion. (R)
- Hosts diseases and pathogens such as *Phytophthora*. (R)
- Invaded sites may have lower carbon sequestration potential. (R)
- Leads to erosion, sedimentation and increased run off. (R)
- Modifies nutrient regime impacting soil formation and soil health increasing acidity and reduction in soil communities such as earthworms. (S)
- Inhibits woodland regeneration (S).

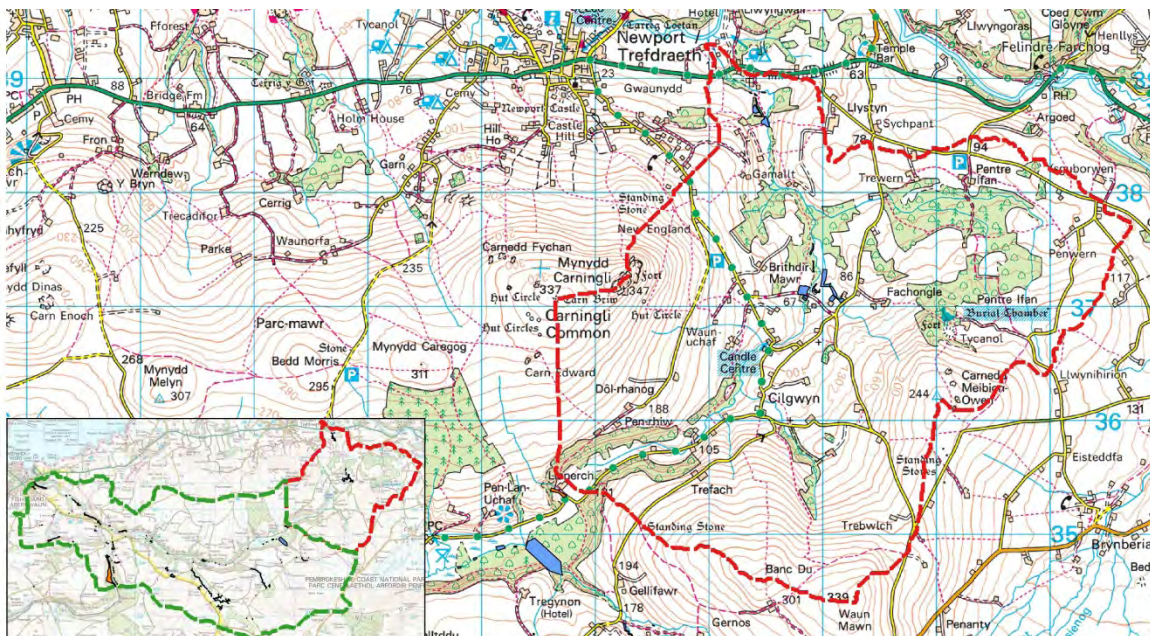
- Changes lowland heath soils significantly (Manchester and Bullock, 2000). (S)
- Impacts on cultural heritage e.g. condition of monuments, ancient woodland. (C)
- Prevents access for recreational activities which could impact tourism. (C)

6 Infestation, treatment extent and effects

- 6.1 The total extent of Himalayan balsam, Japanese knotweed and *Rhododendron ponticum* recorded to date is 28 hectares. The coincidence of each of the target species with Phase 1 habitat types was determined using Quantum GIS.
- 6.2 The habitat types with the most instances of the three target species are (greatest first):
1. Semi-natural broadleaf woodland
 2. Improved grassland
 3. Watercourses and standing water
 4. Hedge
 5. Buildings
 6. Marshy grassland
 7. Poor improved grassland
 8. Dense scrub
 9. Semi-natural coniferous woodland
 10. Semi-improved neutral grassland
- 6.3 The ranking is not simply a function of habitat extent. For example there is five times more improved grassland than broadleaved woodland in the project area.
- 6.4 Approximately 55% of the INNS records identified during the project received treatment during 2015 and or 2016.
- Himalayan balsam***
- 6.5 The project recorded approximately 30 instances of Himalayan balsam within the catchment covering a total land area of approximately 4.5ha. Himalayan balsam was found to have formed monocultures in springs, ditches and tributary banks and has colonised farm land (some with conservation value) at tributary sites feeding the Afon Gwaun.
- 6.6 Liaising with existing projects and groups within Pembrokeshire was key to effective and efficient control. The project coordinator for separately SDF-funded Himalayan balsam control initiatives at Poppit and at Cemaes Head was instrumental to advising on best practice in terms of Himalayan balsam control.
- 6.7 Control took place on approximately 3.5ha of sites identified with source populations. The project has achieved a reduction from thousands of stems to hundreds at target sites, allowing for example the re-colonisation of native plant species such as the nettle family (an important invertebrate life cycle plant) and more generally increasing the local diversity and abundance of native flora. Himalayan balsam control helps prevent bank destabilisation and the

consequences of increased sedimentation. Local site balsam seed banks will have been reduced, further reducing the numbers of plants able to colonise a local habitat as well as removing wider catchment source populations.

- 6.8 Some strategic Himalayan balsam sites have been adopted by the Friends of the Pembrokeshire Coast National Park. Others have been included in PCNPA's forward work programmes and those of partner organisations and volunteer groups. Landowners have a better understanding of Himalayan balsam spread and control. Effective eradication in the catchment may be achievable by 2019.
- 6.9 The Project Coordinator worked with members of the Newport Paths Group to create a catchment strategy of volunteer and contractor control works on the headwater system of the Clydach valley (adjacent to headwaters of the target catchment and a risk to it), assisted by a financial contribution by Natural Resources Wales.



Himalayan balsam control in the Clydach catchment

Legend

- ▭ Clydach catchment
- ▭ Gwaun catchment
- INNS sites
- ▭ Treatment in progress
- ▭ Recorded



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*Main map: The Clydach catchment (red outline)
 Inset map: Clydach catchment (red) and Gwaun catchment (green)*

- 6.10 Pembrokeshire Rivers Trust, Cymthedias Llandudoch, Keep Wales Tidy, PCNPA and Natural Resources Wales all contributed to the creation of a practical advice leaflet for Himalayan balsam control strategies. The leaflet has been translated and published ready for the 2017 season.

Japanese knotweed

- 6.11 The project recorded approximately 75 instances of Japanese knotweed within the catchment, covering a total land area of approximately 9 ha. Japanese knotweed control has been focussed strategically on headwater tributaries, on sections of the main Afon Gwaun and in areas identified as an acute risk to catchment biosecurity (e.g. farmyards).
- 6.12 Stem injection in 2015 produced excellent results with knotweed vigour/extent reduced and/or rhizome dormancy evident in 2016. Pulling and drying was used on knotweed growing in river banks during 2016. No regrowth was observed when revisited 14 days later. Treatment at one site was compromised due to flooding in 2015 and a tree fall disturbing knotweed further in 2016.
- 6.13 The short term local site benefits from Stitch in Time treating Japanese knotweed has been positive in that Japanese knotweed vigour/extent has been reduced and/or entered rhizome dormancy. All Japanese knotweed treatment is a long term (3-6 years+) process of continual treatment and site monitoring. The benefit of targeting this species within the catchment is that the long term process has been initiated with some sites receiving at least two treatments during the SDF project phase. The ongoing focus of resources should be on high priority sites such as headwater tributaries, designated sites and their surroundings.

Rhododendron ponticum

- 6.14 The project recorded 36 instances of *Rhododendron* within the catchment covering a total land area of almost 14 ha.
- 6.15 Control work focussed on the River Aer tributary, which rises at the head of the Trecwn valley. Access was granted to a strategic section of Trecwn valley by kind permission of Valley Management Services Ltd, for Renewable Developments Wales Ltd (RDW), who also made an in-kind contribution to the project of 13 person days. Three hectares of *Rhododendron* was cut, treated and processed, at Trecwn and at an adjacent site. This part of the project also benefited from additional funding of £5,000 from Natural Resources Wales.
- 6.16 Coed Cymru and Tir Coed provided input and a remote sensing project (drone survey for INNS) was undertaken by a student of the University of Wales.
- 6.17 Activities within Trecwn Valley occupied the Project Coordinator in setting up the partnership by delivery of a management report, and contractor paperwork before and during operations. The Project Coordinator was present during all contractor and PCNPA woodland team *Rhododendron* operations.
- 6.18 *Rhododendron* is present to a lesser extent at other locations in the Gwaun. These instances are of limited size and it has been possible to include them in the PCNPA Woodland Team's 2016/17 work programme.
- 6.19 *Rhododendron* control sites will require post-project monitoring for regrowth and restoration.

7 Impacts of the project on ecosystem services

- 7.1 The impacts listed below are, where unquantified, based on published research and describe the most likely effects of such a project on ecosystem services. Tailored analysis shows positive impact for each of the ecosystems services when compared against the known impacts of each invasive plant set out above.

Provisioning services

- 7.2 The impacts of the project on provisioning services (the products obtained from ecosystems) include:

- Recovered land safeguarded for food/fuel/fibre/conservation uses.
- Water can be accessed safely without INNS spread.
- Likely improvement in ecosystem function (provision of habitat) indirectly safeguarding supporting services.

Regulating services

- 7.3 The impacts of the project on regulating services (e.g. regulation of climate, hazards, pests and diseases, water, air and soil) include:

- Increased stability, reducing erosion potential and river sedimentation, reducing further INNS spread and increasing biosecurity.
- Restoring capacity of sites to support species richness, increasing and safeguarding greenhouse gas sequestering potential and resilience (species diversity and multi-functionality).
- Pollinators are free of invasive species dominance. Native plants are free of competition for light, space, nutrients and pollinators increasing pollination potential.
- Initiating disease regulation by reducing host tree (*Rhododendron*) disease (*Phytophthora* species).

Supporting services

- 7.4 The impacts of the project on supporting services (e.g. soil formation, nutrient and water cycles, nutrient production) include:

- Improved soil health and formation, reduced disruption of nutrient cycling (although there are concerns with the use of glyphosate on soil).
- Extinction or exclusion of native species mitigated as increased area for provision of habitat, increases biodiversity, increasing genetic diversity and ecosystem function and ecological process.

Cultural services

- 7.5 The impacts of the project on cultural services (e.g. recreation and tourism, aesthetic and spiritual experience) include:

- PCNPA footpath survey during 2015 in the Gwaun found that 90% of respondents were walking to 'enjoy the natural landscape, 55% to 'explore the area' and 44% to 'see wildlife'.
- Generally improved aesthetic value of landscape and important/well-accessed habitats. Woodland, stream and river footpaths are more biosecure. It is noted that there is also public appreciation of *Rhododendron* in bloom.

- Reduced risk to buildings from structural degradation by INNS.
- Reduced scope for boundary disputes and treatment costs.
- Over 140 volunteer days were contributed to the project.
- Three volunteers and one contractor received specialist training in safe use of and application of pesticides.
- Two community groups received equipment through the project to assist with control efforts within the project catchment and wider National Park.
- Members of the Newport Paths Group mapped, liaised with landowners, organised and led Himalayan balsam work parties in the Clydach Valley in 2016.
- Members of Cymdeithas Llandudoch and the Pembrokeshire Rivers Trust provided expertise throughout the whole project, including input to a Himalayan balsam leaflet.

8 Conclusion

- 8.1 It is concluded that taking action through projects such as *Stitch in Time – Pwyth mewn Pryd* to identify, prevent, control and eradicate non-native species within catchments will help to promote native vegetation cover, increase habitat area and restore/maintain native wildlife. This will contribute to better management of water and soils, reduce the cost of control of non-native plants to future generations, and protect assets and incomes.

Annex 1 - References

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Annex 2 – Landscape Character Areas of relevance to the project area

The tables describe the characteristics of Landscape Character Areas (LCAs) of relevance to the project area.

	Visual and Sensory Characteristics	Historic and Cultural Characteristics
LCA 22 Mynydd Carningli	The Mynydd Carningli is a relatively small yet distinctive area characterised by open moorland and heath, with rocky summits and scree slopes evident on the higher parts. As with the Preseli Hills, the extensive tracts of open moorland on Carningli give an exposed and mountainous feel to the landscape. Conifer plantations are also present, forming incongruous features and breaking the skyline in some places, with a notably discordant effect on the long curves of the summits punctuated by rocky outcrops. The upland area affords wide-ranging views across to the neighbouring Mynydd Preseli - with which there is a strong visual relationship - and along the coast.	There are Prehistoric standing stones, settlements and field systems, Medieval and post-Medieval structures and buildings of national significance. This archaeological wealth has led to the inclusion of part of the eastern section of this LCA - Carningli Common, Mynydd Carregog and the land sloping northwards down to Newport - within the Newport and Carningli Registered Landscape of Special Historic Interest in Wales. Extensive 19th and 20 th century rectilinear enclosure of common land is evident on the southern flank of the mountain block. The boundary between cultivated land and moorland on the northern fringe, however, appears to have changed little since the early 19th century.
LCA 26 Cwm Gwaun/Afon Nyfer	A series of narrow enclosed and sheltered wooded valleys, overlooked by the Preseli hills, which provide a strong sense of place and accentuate the incised nature of these valleys. They are densely wooded valleys with small agricultural fields, often bounded by overgrown hedges, and there is rough grazing land on the upper valley fringes. The woodland blocks are composed of deciduous and mixed deciduous/coniferous species.	This LCA includes a very small part of the Preseli Registered Landscape of Outstanding Historic Interest in Wales. In addition, a small part of the LCA lies within the Newport and Carningli Landscape of Special Historic Interest in Wales, notably for the presence of Neolithic tombs in the vicinity of Nevern. There are Iron Age forts, Medieval and post-Medieval buildings and structures of national significance. The valley supports a traditional Welsh speaking community, and there is a real sense of community amongst local families that have lived in the valley for many generations and have retained

		aspects of Welsh rural life which date back centuries.
LCA 28 Mynydd Preseli	The Mynydd Preseli is a distinctive upland area characterised by open moorland and heath with rocky summits and scree slopes evident on the higher parts. Conifer plantations are also present, particularly on the southern flanks. The upland area affords wide- ranging views across to the neighbouring Mynydd Carningli, and along the coast.	The unenclosed moorland contains nationally important features, including Iron Age Hill forts, Round Barrows and Deserted Settlements. This archaeological wealth has lead its designation as the Mynydd Preseli Registered Landscape of Outstanding Interest in Wales. Much of the hill area is common land - 19th & 20th century enclosure of common land is evident on the southern flank of the mountain block. The boundary between cultivated land and moorland on the northern fringe, however, appears to have changed little since the early 19th century. The rectilinear field shapes were formed following enclosure of common land.