EcoCo LIFE+

Assessment of opportunities for ecological restoration in the CSGN

Alistair Whyte
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The EcoCo LIFE+ project carried out a GIS-based opportunity assessment of potential ecological restoration options within the CSGN, and identified 82,170 ha of land (c. 8% of the CSGN area) within habitat networks which may have potential for habitat restoration or creation.

This report summarises and assesses the highest-scoring of these opportunities. It aims to maximise the benefits of the outputs of the project, inform the ‘AfterLIFE’ plan, and ensure longevity and sustainability. There is potential for many of these opportunities to be taken forward as new projects, to inform the targeting of agri-environment schemes, or to be subject to further analysis.

All maps in this report have been produced using SNH’s GeoView mapping system, where the EcoCo outputs are permanently stored, and are replicable and editable within this system.

1. Introduction

Opportunity mapping for a range of conservation actions was carried out for the whole of the CSGN using a GIS method based on a modified version of EcoServ_GIS and integrated habitat network modelling.

EcoCo LIFE+ has used this to inform the selection of new sites for the project. However, due to constraints within the project (funding, timescales etc.), the highest scoring sites for each conservation action were not necessarily taken forward.

This report summarises all the highest scoring (mapped as green) sites for each conservation action, and assesses whether further development may be feasible to take these sites forward outwith EcoCo LIFE+. AECS options are recommended where appropriate, as examples of possible mechanisms for implementing further work, along with other possible mechanisms for delivering improvements.

The GIS rules which created these results are also summarised in the report.

The table below summarises the total area of land identified as being an opportunity for conservation or restoration actions, and also the number of individual patches which make up this total area.

Table 1. CSGN opportunities summary

<table>
<thead>
<tr>
<th>Habitat/conservation action</th>
<th>Total opportunity identified (km²) (within habitat networks)</th>
<th>Number of individual patches</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lowland wetland creation</td>
<td>316</td>
<td>22,789</td>
</tr>
<tr>
<td>Mires (peat) conservation</td>
<td>460</td>
<td>1131</td>
</tr>
<tr>
<td>Floodplain wetland creation</td>
<td>10</td>
<td>825</td>
</tr>
<tr>
<td>Tree removal on peat</td>
<td>15</td>
<td>1319</td>
</tr>
<tr>
<td>Ditch blocking on peat</td>
<td>0.7</td>
<td>23</td>
</tr>
<tr>
<td>River restoration adjacent land</td>
<td>20</td>
<td>4059</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>821.7</strong></td>
<td><strong>30,146</strong></td>
</tr>
</tbody>
</table>
2. Lowland Wetland Creation

Total CSGN lowland wetland creation opportunity (within networks): 316km²

Number of patches: 22,789

Of these opportunities, five landscape areas scored within the highest EcoCo classification. These are illustrated and assessed below.

RULES

Abstract: Areas were mapped where opportunities exist for lowland wetland creation in order to support and enhance the existing lowland wetland habitat network.

Lineage: Locations were mapped where land was lower than 300 m elevation, within 2,000 m of the nearest waterbody, where current land use was not close to urban or infrastructure areas (> 20 m) and where there were no steep slopes (< 10 degrees). Field boundaries from EUNIS habitat map were used to identify land management units and all areas > 10,000 m² were selected.

Sites were then scored against the ecological coherence protocol. Variables included within the scoring were: patch area, nearest-neighbour connectivity (to the nearest 5 lowland wetland sites) (max search distance = 4 km), functional connectivity (to the lowland wetland network).

Limitations: The mapped sites do not included detailed information on hydrology or soil types that may influence site suitability for wetland creation. The score selection gives a higher weighting to connectivity, by including two connectivity variables. Ecosystem Services were not included in this landscape. It was not possible to fully run the EcoServ-GIS toolkit at this landscape scale.
b) Pathhead

Description

This site is located within south-east Scotland, and is predominantly on flat, agricultural land. Much of the northern part of the site is classified as prime agricultural land, and it is all currently under arable cropping. It scored highly principally due to its low gradient, the size of its units and its proximity to mapped wetland networks.

Assessment

Due to the high economic value of the land and its current use, this site is unlikely to be suitable for lowland wetland creation. However, any proposals within this area to create or enhance water features would have a significant positive impact on lowland wetland connectivity, and therefore should be prioritised or at least looked on favourably. For example, the AECS option *Water margins in arable fields* may be appropriate on this site.
d) Carnwath uplands

Description

This site is unimproved heath at the southern end of the Pentland Hills. Its large size and proximity to wetland networks were the main reasons it scored highly. It is partly on mapped peat soils.

Assessment

Lowland wetland creation, restoration or management may be possible on at least part of this site. It may be possible to improve the site for breeding waders, through sward management and targeted grazing. AECS options Wader grazed grassland, Wetland management and Grazing management may be available and suitable here.

With its peat soils and proximity to a new EcoCo peat restoration area being taken forward (see A1952652), this site may also be at least partially suitable for peat restoration work.
e) Muirkirk

Description

Five areas on the edge of the Muirkirk uplands were identified as having high potential for lowland wetland creation. The sites are all on rough grassland or peatland, and are within or close to lowland wetland networks.

Assessment

The two most westerly sites are mapped as rough grassland. There may be some opportunity here for enhancing lowland wetland connectivity through, for example, improvement of swards for waders. AECS options Wetland management, Wader grazed grassland and Grazing management may be available and suitable here.

The linear southerly site consists mainly of the same habitats, but also includes opencast workings. Restoration options of these which include the creation of lowland wetland features would strongly improve the connectivity of this habitat.

The most northerly site around Lesmahagow is predominantly made up of rough grassland. Wader grazed grassland, Grazing management and Water margins in grassland fields AECS options may be available and suitable here to strengthen the lowland wetland network.

The rough grassland within the most easterly site at Crawfordjohn may also be eligible for these options.
f) Kilpatricks

**Description**

This site consists of heathland in the Kilpatrick Hills above Dumbarton.

**Assessment**

Lying between two large areas within functioning wetland networks, this site could significantly improve connectivity in this area. AECS options *Wetland management*, *Wader grazed grassland* and *Grazing management* may be available and suitable here.
g) Dalmellington

Description

This site near Dalmellington is mapped predominantly as grassland.

Assessment

*Wader grazed grassland, Grazing management and Water margins in grassland fields* AECS options may be available and suitable here to strengthen the lowland wetland network.
3. Mires (peat) conservation

Total CSGN mires (peat) conservation opportunity (within networks): 460 km²

Number of patches: 1131

Of these opportunities, two landscape areas scored within the highest EcoCo classification. These are illustrated and assessed below.

RULES

Abstract: Known mires sites were mapped from the EUNIS habitat map. Sites were then scored against the ecological coherence protocol.

Lineage: Sites were mapped where EUNIS_desc = 'Blanket bog complexes’ OR EUNIS_desc = 'Raised and blanket bogs' OR EUNIS_desc = 'Wet heaths'). Small sites were removed (Default > 5,000 m²). Sites were scored against the ecological coherence protocol. Variables included within the scoring were: nearest-neighbour connectivity (to the 5 nearest mires source sites, max search distance = 4 km), functional connectivity (to the mires network).

Limitations: The scoring does not include species presence within sites. Ecosystem Services were not included in this landscape. It was not possible to fully run the EcoServ-GIS toolkit at this landscape scale.
b) Muirkirk Uplands

Description

This peatland site north of Muirkirk is partly within the Muirkirk Uplands SSSI.

Assessment

As one of two high priority peat sites within the CSGN, this part of the Muirkirk Uplands should clearly be a focus for peat restoration. The site may be suitable for AECS Moorland management and associated capital options.
d) Clyde Muirshiel Regional Park

Description

This extensive area of peatland is situated in the Clyde Muirshiel Regional Park. Much of the area is designated SSSI and SPA for breeding hen harrier, although this feature is currently unfavourable declining.

Assessment

There is significant opportunity to carry out restoration work here. Much of the peat is degraded and techniques developed elsewhere could be used to great effect. Parts of the site may be suitable for AECS Moorland management and associated capital options. The RSPB is developing a vision for this area, and should be strongly supported in implementing habitat improvements on this important site.
4. Floodplain Wetland Creation

Total CSGN floodplain wetland creation opportunity (within networks): 10 km²

Number of patches: 825

Of these opportunities, twelve landscape areas scored within the highest EcoCo classification. These are illustrated and assessed below.

RULES

Abstract: Areas were mapped where opportunities exist for floodplain wetland creation in order to support and enhance existing lowland wetland habitats. This is a modification of the main lowland wetland creation analysis to focus on areas within a defined floodplain.

Lineage: Locations were mapped where land was within the floodplain (or potential tidal influence) of the river (elevation < 5 m) and where current land use was not close to urban or infrastructure areas (> 20 m) and where there were no steep slopes (< 10 degrees). Field boundaries from OS EUNIS habitat map were used to identify land management units and only units above 10,000 m² were selected. Sites were then scored against the ecological coherence protocol. Variables included within the scoring were: patch area, nearest-neighbour connectivity (to 5 nearest lowland wetlands, max search distance = 4 km), functional connectivity (to lowland wetland network).

Limitations: The mapped sites do not included detailed information on hydrology or soil types that may influence sites suitability for wetland creation. The score selection gives a higher weighting to connectivity, by including two connectivity variables. Recent feedback suggests that analysis omitting the functional network connectivity score may be more appropriate in this study landscape. Analysis could therefore be re-run with just the structural isolation setting. Ecosystem Services were not included in this landscape. It was not possible to fully run the EcoServ-GIS toolkit at this landscape scale.
a) Barns Ness coastline

Description
An area to the south-east of a current EcoCo site (Whitesands Quarry) has been identified. Whitesands is currently being restored by Tarmac in partnership with RSPB to create much-needed wetland habitat adjacent to Barns Ness SSSI and the Firth of Forth SPA. The area identified in green here is currently either a working quarry or is planned to be quarried in the near future.

Assessment
Although current and planned quarrying operations rule out immediate work here, this assessment demonstrates that it is important to begin to influence the restoration plans for the area to maximise ecological benefits. This site should be restored using similar techniques to those employed at Whitesands. This would enhance connectivity with the wider wetland network, and would provide much-needed habitat on this stretch of coastline, which is highly developed and also suffers from high recreational pressure. Early engagement is recommended to build habitat restoration plans into the design of the quarry workings, to remove the need for major earthworks after quarrying has finished.
b) John Muir Country Park sites

Description

Both these sites consist of agricultural land, with the southern patch being bounded to the sea by an embankment. Both are adjacent to the John Muir Country Park, and to the Firth of Forth SSSI and SPA. The John Muir Way runs through the southern patch.

Assessment

The southern site in particular could benefit from coastal floodplain improvement works. Breaching the embankment to create additional habitat adjacent to the SSSI would have a significant effect on the connectivity and condition of the wider SSSI and SPA, providing valuable high tide roosting areas and feeding grounds. The AECS option Coastal Embankment Breaching, Lowering or Removal could be applied here.
c) Aberlady Bay sites

**Description**

The northern patch here is currently a golf course. The other patches are areas of mixed woodland around Gosford House.

**Assessment**

The large opportunity area on Gullane Links golf course would, if restored, provide valuable adjacent habitat to the Firth of Forth SSSI and SPA. Its use currently precludes this, but small scale improvements here, working to create or improve areas of wetland on the site, could aid wider connectivity along this part of the coastline.

The other patches of mixed woodland are probably not appropriate for restoration or habitat creation work.
d) Blackness and Bo'Ness

Description
Both these opportunity areas are on the south side of the Firth of Forth, directly adjacent to the Firth of Forth SSSI and SPA.

Assessment
The area at Blackness Castle may be suitable for some small-scale habitat improvement works which would enhance its value as an area of complementary habitat to the SSSI/SPA. The smaller area near Bo'Ness is probably not suitable for floodplain wetland creation.
e) Black Devon

Description

This is an area of community woodland adjacent to the RSPB’s new reserve at Black Devon.

Assessment

As an area of mixed woodland, it is unlikely to be suitable for floodplain wetland creation. Enhancements to wetland features within the woodland would improve wider connectivity and should be encouraged. A more natural ecotone between the wet grassland of the RSPB reserve and the mature woodland (e.g. an area of willow scrub) would improve both parts of the site.
f) Carse of Stirling

Description
An area of flat, highly productive arable farmland lying in the Carse of Stirling adjacent to the River Forth.

Assessment
SNH has been working in this area as part of the Carse of Stirling project. The identification of opportunities would be best continued through this established project, but the EcoCo assessment supports the case for targeted ecological restoration of the floodplain to enhance coherence and connectivity.
Description

This is a small area of woodland and housing adjacent to the M8 near Glasgow airport.

Assessment

It does not appear that this is a likely candidate for floodplain wetland creation.
**h) Southannan Sands**

**Description**

This is an area of intertidal sandflats. The identified area is wholly within the Southannan Sands SSSI, designated for its sandflats feature. The area has been subject to historical land reclamation.

**Assessment**

Although intertidal and therefore with no possibility of creating new floodplain wetlands, the site forms an important part of the wider coastal network. Any further reclamation work would have significant negative impacts.
5. Tree Removal on Peat

Total CSGN tree removal on peat opportunity (within networks): 15 km²

Number of patches: 1319

Of these opportunities, six landscape areas scored within the highest EcoCo classification. These are illustrated below.

RULES

Abstract: Areas were mapped where there may be opportunities for peatland and mire restoration by removal of tree cover.

Lineage: Sites were mapped by selecting all areas of Woodland or Scrub from the EcoServ-GIS BaseMap that occur on areas of peatland soils (carbon class = 5 or 6). Areas of native semi-natural woodland were then buffered by 20 m and these areas removed, as were all areas of steep slopes (Default > 11 degrees). All areas greater than 5,000 m² were retained and these polygons were used to clip out areas from the OS MasterMap data. The polygons therefore frequently relate to land management units, such as fields, woods or forestry compartments. Again all areas less than 5,000 m² were removed.

Sites were then scored against the ecological coherence protocol. Variables included within the scoring were: patch area, nearest-neighbour connectivity (to the 5 nearest mire sites, max search distance = 4 km), functional connectivity (to mire networks).

Ecosystem Services were not included in this landscape. It was not possible to fully run the EcoServ-GIS toolkit at this landscape scale.

Limitations: The peatland soils mapping is not fully accurate. The use of OS MasterMap polygons to represent land management units is not fully accurate as these will not always match forestry compartment boundaries. In reality the distance to the nearest functioning mire network site may not represent connectivity for peatland species. Frequently small areas of mire vegetation and characteristic species remain within plantation sites on peat, such as around rides, ponds or extraction tracks. This however will depend on the stand age, tree planting density and success of establishment. This method will not locate some areas of birch tree cover or scrub where management may consider tree removal beneficial, it focuses on plantation or non-native tree cover. Separate analysis would be required to map such areas.

Assessment

The following sites have all been identified as potential candidates for (non-native, plantation) tree removal to restore peatlands. There has been success in the EcoCo project where this action has been proposed on Forestry Commission-owned land. Where the high-scoring sites are owned by FC, this is therefore highlighted.
a) Kype Muir

Tree removal on peat opportunity assessment: 1

b) Carsphairn Forest: Forestry Commission land

Tree removal on peat opportunity assessment: 2
c) Balloch Plantation: Forestry Commission land

Tree removal on peat opportunity assessment: 3

![Balloch Plantation Map](image)

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d) Loch Macaterick: Forestry Commission land

Tree removal on peat opportunity assessment: 4

![Loch Macaterick Map](image)
e) Barhill North: partially on Forestry Commission land

Tree removal on peat opportunity assessment: 5

f) Barhill South: partially on Forestry Commission land

Tree removal on peat opportunity assessment: 6
6. Ditch Blocking on Peat

Total CSGN ditch blocking on peat opportunity (within networks): 0.7 km$^2$

Number of patches: 23

Of these opportunities, three landscape areas scored within the highest EcoCo classification. These are illustrated and assessed below.

**RULES**

**Abstract:** Areas were mapped where there may be opportunities for restoring or enhancing peatland and mires sites by blocking ditches, grips or streams to raise or restore site hydrology.

**Lineage:** All sites on, or close to (Default <= 50 m), known peatlands were selected from the EcoServ-GIS BaseMap (HabBroad = “Mire”). These areas were combined with all mapped peatland soils (carbon class 5 or 6). Only low slope areas (Default < 5 degrees) were selected. OS MasterMap line features representing streams, ditches etc were clipped to these mapped peatland areas. The line data was split at vertices, and lines longer than 75 m were selected as being most likely to be artificial, straight ditches or channels. Line density calculation (search distance 500 m) measured the density of these line features. The density data was split into three equal interval classes and the top 2 tertiles were selected, converted to polygon features. All sites above a threshold (Default >= 2,500 m$^2$) were mapped for subsequent scoring.

Sites were then scored against the ecological coherence protocol. Variables included within the scoring were: patch area, nearest-neighbour connectivity (to the 5 nearest mires sites, max search distance = 4 km), functional connectivity (to mires network).

Ecosystem Services were not included in this landscape. It was not possible to fully run the EcoServ-GIS toolkit at this landscape scale.

**Limitations:** The main limitation is that the OS MasterMap line data used to calculate ditch density may not be ditches, but may show natural stream features. In some cases ponds, streams and other natural features will be inaccurately identified. These could be removed at the stage of site mapping, before sites were scored, by visually assessing the areas. Alternatively natural areas should be discounted when examining the site scores, using local knowledge. The peatland mapping is not fully accurate, some of the mapped areas may not hold peatland soils, other areas will have been missed.

The settings for 75 m line length to represent artificial watercourses, 500 m to apply the line density search, and the use of the top two density tertiles to represent the areas with highest ditch density are all informed by a visual assessment of the landscapes examined during this study and iterative testing of different settings. However these are essentially arbitrary and would benefit from further formalised testing to examine the effects of different distances on the location of mapped areas.
a) Gardrum Moss

Description

This is an area of degraded and worked-over peat near the Slammanan plateau. It recently came onto the market, but despite initial investigations, a purchase by conservation bodies was not possible, and the site was subsequently sold.

Assessment

This peat site displays high potential to be a crucial part of the wider peatland network in this area. Its restoration should be a priority. Ditch blocking, removal of conifers and other peatland restoration techniques should be used, and early engagement with the new owners of the site, possibly through an EcoCo partner, would be advantageous. Given its location within the network, further peat extraction or any work which would result in further degradation of the peat would be extremely damaging not only to the site itself but to the ecological coherence of the wider network.
b) Coalburn Moss

Description

This raised bog is a designated SSSI and SAC for its active raised bog feature. Its condition has been assessed by SNH (2008) as "in an unfavourable and declining condition as a result of the network of erosion channels with flowing water and exposed peat, the physical impacts of livestock on the mire surface and the presence of scrub and mature conifer plantations on the mire surface." This assessment may not reflect more recent restoration work, but it has still been identified by the EcoCo system as being in need of ditch blocking. The site is owned by the Forestry Commission.

Assessment

Given the condition of the site, its importance, and its ownership, work should continue to restore it to favourable condition.
c) Bloak Moss

Description

This is an undesignated site near Kilwinning. Much of the site has been drained, and a considerable proportion appears to have become encroached with scrub.

Assessment

This is a high priority peat site, in what appears to be a poor condition. Further investigation and site visits would provide greater detail on condition and required restoration.
7. River Restoration (adjacent land)

Total CSGN river restoration (adjacent land) opportunity (within networks): 20 km²

Number of patches: 4059

This action produced a large number of highest priority (green) sites. It was not possible to assess them all. A representative sample of the largest sites, or those which appear to have the highest potential, are summarised below, but an analysis of the layers within GeoView will allow all the highest priority sites to be viewed.

RULES

Abstract: Areas were mapped where there may be opportunities for river restoration by reconnecting rivers to the floodplain, re-meandering, or creating areas of marginal wetlands, in order to support the wider network of freshwater habitats and natural processes. This action relates to land that is adjacent to watercourses.

Lineage: Sites were identified where rivers are currently in less than good ecological status and the morphology is modified. These rivers were then used to select all nearby areas of mapped OS Open Rivers (Default < 60 m). These areas were then buffered (Default 250 m). Areas of suitable land within these areas were then identified where land use change for river restoration might be possible (Default = not woodland, infrastructure or buildings). Areas of steeper slopes (Default > 10 degrees) and areas close to infrastructure or buildings (Default <= 10 m) were then removed from these mapped areas. Finally all areas above a size threshold (Default >= 10,000 m²) were selected.

Sites were then scored against the ecological coherence protocol. Variables included within the scoring were: patch area, nearest-neighbour connectivity (to the 5 nearest lowland wetland sites, max search distance = 4 km), functional connectivity (to lowland wetland network).

Ecosystem Services were not included in this landscape. It was not possible to fully run the EcoServ-GIS toolkit at this landscape scale.

This analysis can be conducted using the classification of whole stretches of mapped waterbody, or using mapped stretches where it is known that morphology has been altered. This version uses the SEPA morphology data that classifies individual areas or stretches of river. River stretches were selected when they were close to one of the following active morphology modifications: SEPA data: Repomaster_REPOMASTER_SV_MP: embankments, bank reinforcements, high impact realignment, low impact realignment, pipe box culverts, set back embankments.

Limitations: This analysis examines all opportunities along the length of a watercourse that have been identified as in poor condition and that have been modified. The restriction to lowland wetland networks limits the river restoration scores to selected areas. It will not always be the case that river restoration aims to benefit lowland wetland habitats, therefore this version of the mapping may not always be required.
a) Dour Burn

Description

This area is within the existing EcoCo partner body SWT’s Cullaloe wildlife reserve. It consists of wet willow scrub woodland, where some wetland creation work (pond creation) has been carried out in recent years.

Assessment

Due to the nature of the land tenure, location within networks and previous work, any work to improve the condition of the Dour Burn and its immediately adjacent areas should be prioritised, and should be relatively straightforward to carry out. Examples of possible work include coppicing the willow scrub, creating ponds, or re-meandering a section of the burn.
b) Peffer Burn

Description

This site lies within the highly productive farmland of East Lothian. It links closely with floodplain wetland opportunities identified previously.

Assessment

This may not be a straightforward project, but any work here would have significant positive effects on this highly modified and artificial landscape.
c) River Avon

Description

This is a large area along the north bank of the Upper River Avon. It is very close to the current EcoCo project site of Fannyside Muir on the Slammanan plateau and the RSPB reserve at Fannyside. It consists predominantly of rough grassland.

Assessment

This would be worthy of further investigation, both due to its current land use and its location within the network and proximity to other restoration works.
d) Goodie Water

Description

This stretch of water course, which appears to be heavily modified, is within Forestry Commission land (although this ownership may not be current – this should be checked).

Assessment

If ownership is established, there could be significant opportunity to carry out improvements here which would benefit both the modified watercourse and the wider wetland network.