WOODLAND CONNECTIVITY ANALYSIS REPORT FOR THE YEALM CATCHMENT

Document Information

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Commissioned by: Yealm Estuary to Moor (YEM)
Date: January 2026
Version: Final report

Contents

1 Report Overview

This report has been prepared for the Yealm Estuary to Moor (YEM), a community-led initiative that includes in its aims the delivery of environmental actions that strengthen habitats and improve species resilience across the Yealm Operational Catchment.

In line with the YEM strategy, this report was commissioned to identify and prioritise locations where targeted habitat creation or enhancement can deliver the greatest ecological benefit by improving *structural woodland connectivity*. By highlighting key linkage opportunities, this report provides YEM, local stakeholders, and potential delivery partners with a clear evidence base to guide land management discussions and practical restoration planning.

Improving woodland connectivity is an important part of landscape-scale conservation in this catchment. It enables species movement, supports natural regeneration, and builds ecological resilience in the face of pressures such as climate change, habitat fragmentation, and land-use intensification. This report therefore contributes to YEM's wider objectives of restoring nature networks and supporting the long-term health of the Yealm catchment's ecosystems.

Any technical terminology shown in *italics* throughout this report refers to the Glossary of Terms provided in the appendix.

1.1 Rationale for the connectivity analysis

The Yealm catchment contains a mosaic of woodland habitats ranging from upland Dartmoor woodlands to lowland valley and riparian woods. Although many areas remain relatively well connected, gaps can be identified between woodland clusters. These gaps, often located in agricultural lands, limits the movement of woodland-dependent species and the dispersal of tree and shrub seeds.

To address this, a connectivity analysis was undertaken to provide a robust, spatially explicit basis for identifying priority intervention zones. The analysis aims to answer three key questions:

1. Which existing woodland patches contribute most strongly to the overall ecological connectivity of the catchment?
2. Where do the most significant connectivity gaps occur?
3. Where would habitat creation or enhancement yield the greatest improvement in *landscape permeability*?

This information allows YEM and its potential partners to focus engagement and delivery efforts where they will be most effective, ensuring that resources are directed towards actions with measurable ecological impact. It aligns with local and national strategies promoting Nature Recovery Networks, Local Nature Recovery Strategies (LNRS), and catchment-scale habitat restoration.

The outcomes aim to inform landowner discussions, support funding applications, and guide practical design of woodland and hedgerow enhancement projects.

2 Methodology and connectivity analysis

2.1 Connectivity analysis

To find the best places to improve woodland connections in the Yealm catchment, a detailed mapping and connectivity study was conducted. The goal was to see how each woodland patch contributes to the overall connectedness of the landscape, which helps wildlife move between habitats and allows trees and plants to spread naturally.

The Integral Index of Connectivity (IIC) metric was used to do this. This metric gives us a score for each patch of woodland which tells us how important a woodland patch is for the whole network in terms of its *structural connectivity*. Higher scoring patches mean the patch plays a bigger role in linking habitats together.

Connections at three different *dispersal distances* were investigated (100 m, 200 m, and 500 m) to reflect how far small mammals, birds, insects, and tree seeds are likely to move. This helped in identifying areas were creating new woodland patches, planting trees, or improving hedgerows would have the greatest benefit.

The analysis was carried out using QGIS (for mapping) and Conefor 2.6 software (to calculate connectivity scores). The maps and results show which woodlands are most important and where gaps exist, providing a clear guide for where interventions could strengthen the network.

2.2 Spatial scales and buffer analysis

Connectivity was assessed at two *spatial thresholds*: 200 m and 100 m, representing movement ranges of small woodland species (e.g., mammals, invertebrates, amphibians) and tree seed dispersal.

- **200 m threshold:** Captures species with moderate dispersal abilities
- **100 m threshold:** Represents species with more limited dispersal

For each threshold, buffer zones of the corresponding distance (200 m and 100 m) were generated around every woodland patch. This means that an area extending outward from the edge of each woodland patch was mapped to represent the range within which species are likely to move or disperse.

Overlapping buffers indicate areas where dispersal pathways are functionally intact, while isolated patches or gaps between buffers identify where connectivity is weakest.

These outputs were visually mapped and analysed to highlight:

- High-IIC woodland patches acting as existing network *habitat cores or hubs*.
- Woodland functioning as *stepping stones* that maintain linkages between larger woodlands.
- Priority gaps where new woodland planting, natural regeneration, or hedgerow enhancement would most effectively strengthen the network.

2.3 Selection of target areas

Potential intervention areas were identified based on three key criteria:

1. **Linkage potential:** Areas lying between high-IIC woodland patches where improving connectivity would link otherwise separated habitats
2. **Network significance:** Locations that would help unify multiple woodland clusters, improving catchment-scale landscape cohesion
3. **Feasibility:** Consideration of current land use, accessibility, and potential barriers such as roads, rivers, or settlements to ensure realistic opportunities for implementation.

The 100 m IIC analysis was prioritised when developing the final recommendations, as it enhances connectivity for a greater range of species. Even species with larger dispersal ranges benefit, as improved fine-scale linkages strengthen overall movement and gene flow across the landscape. For example, a study found that population increases across bird species were greater when woodland creation plots were clustered together rather than randomly sited, highlighting the importance of strategic placement for effective connectivity.

2.4 Forms of recommended intervention

Three broad forms of habitat enhancement were identified as the most effective and feasible interventions within the Yealm catchment:

1. **Small copse creation:** Establishing new, small-scale woodland patches between existing woodlands to act as ecological *stepping stones*
2. **Hedgerow enhancement and creation:** Widening, gapping-up, or planting new hedgerows to form linear corridors linking woodland patches. These features support the movement of a wide range of woodland-edge fauna and act as dispersal pathways for shrub and tree species
3. **Scattered tree planting:** Planting individual or small groups of trees within open farmland to create long-term structural connectivity and seed sources, gradually improving *landscape permeability*

3 Map interpretation and use

The maps included throughout this report are designed to visually represent the results of the woodland connectivity analysis and to guide the prioritisation of future habitat interventions across the Yealm Operational Catchment.

Each map displays woodland patches, their connectivity importance, and their *buffer zones*, derived from the Integral Index of Connectivity (dIIC) analyses.

3.1 Understanding the colour gradient

Woodland patches are shaded according to their dIIC score, which represents the relative importance of each patch to the overall connectivity of the landscape.

- **Darker colours** indicate woodland patches with higher dIIC values, meaning they play a more critical role in maintaining network connectivity
- **Lighter colours** represent patches with lower dIIC values, which contribute less individually but may still provide valuable local habitat

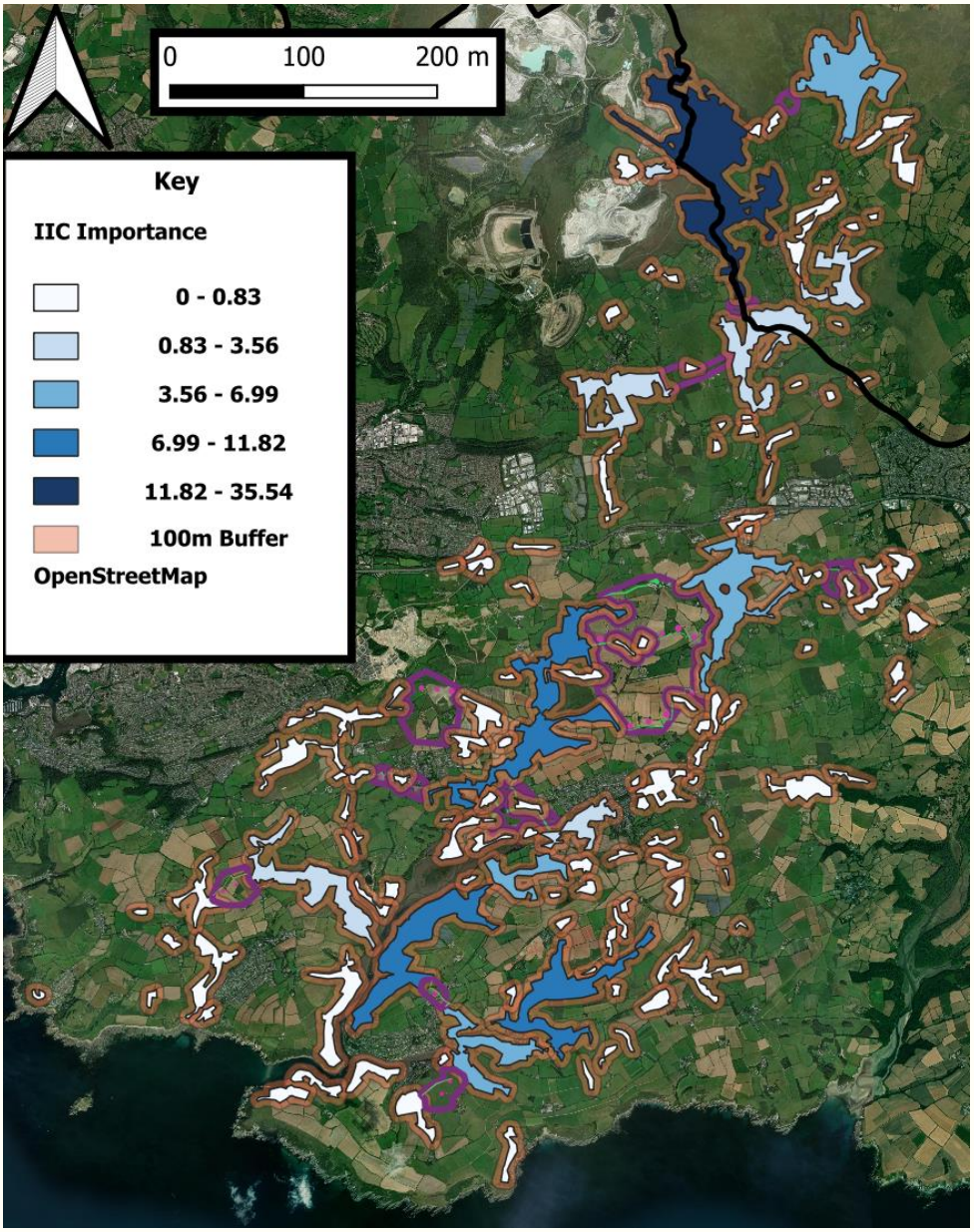
This gradient provides a quick visual cue to identify the most influential woodland patches within the network.

3.2 Buffer zones and dispersal distances

Around each woodland patch, connectivity buffer zones have been generated to illustrate potential dispersal ranges.

- On the maps in this report, the 100 m buffer is shown in light orange, representing the threshold within which species with limited mobility (e.g. small mammals, tree seeds, invertebrates) can realistically disperse between habitats.

Overlapping 100 m buffers indicate areas where woodland connectivity is likely functionally intact. Conversely, visible gaps between buffers highlight priority zones for intervention, where hedgerow enhancement, copse planting, or natural regeneration could close connectivity breaks.



3.3 Application in planning and engagement

When viewed together, the dIIC values and buffer zones help identify:

- ***Core woodland hubs***: dark-shaded patches critical to network function
- ***Stepping-stone patches***: smaller woods that bridge key gaps between larger hubs
- ***Connectivity gaps***: open or semi-improved land where targeted interventions would most effectively improve ecological linkages

These maps should therefore be used as decision-support tools for the Yealm Estuary to Moor (YEM) project and partner organisations to focus engagement with landowners and stakeholders in the most strategically valuable locations for woodland connectivity enhancement.

4 Landowner engagement context

This Woodland Connectivity Report has been developed specifically to provide YEM and its potential partners with a spatial and ecological framework for prioritising engagement and action. By identifying where interventions will most effectively improve woodland connectivity, the report aims to support evidence-based dialogue with landowners and helps guide the design of habitat enhancement projects that deliver tangible biodiversity benefits.

4.1 Role of landowners in delivering connectivity

Achieving meaningful improvements in habitat connectivity depends fundamentally on the collaboration and willingness of local landowners. Much of the Yealm catchment comprises privately managed farmland, where hedgerows, field margins, and small woodlands offer some of the most effective opportunities for ecological linkage.

Engaging these landowners is therefore critical to:

- Identify feasible and locally appropriate interventions, such as hedgerow restoration, tree planting, or natural regeneration
- Ensure interventions are compatible with existing land management practices and farm business objectives
- Promote long-term stewardship, ensuring that new or enhanced habitats are maintained beyond initial project delivery

4.2 Using the connectivity analysis in engagement

The connectivity analysis and accompanying maps serve as decision-support and communication tools. They can be used to:

- Demonstrate the scientific rationale for focusing on particular areas or parcels of land
- Show landowners how their participation contributes to a wider landscape network, reinforcing a sense of collective purpose
- Identify potential funding and support mechanisms, such as Countryside Stewardship Schemes, Local Nature Recovery Strategies (LNRS), or private nature-based investment opportunities

4.3 Principles for landowner engagement

Engagement should be collaborative, adaptive, and locally grounded. The following principles are recommended as appropriate to the situation on the ground:

- Transparency and inclusion: share mapping outputs and analysis with landowners early in the process to encourage understanding and co-design
- Flexibility: tailor interventions to individual landholding contexts, recognising variation in soil type, land use, and management priorities
- Incentive alignment: link ecological goals with financial or practical support wherever possible, using existing agri-environment schemes or bespoke local initiatives
- Partnership delivery: it is essential to work in the partnership with locally recognised conservation organisations, such as with Dartmoor National Park Autority and South Devon National Landscapes plus other expert conservation and farming organisations. Parish-level networks and knowledge will also be essential to facilitate delivery at this level.

By situating connectivity priorities within this landowner engagement framework, YEM can move from spatial evidence to on-the-ground assessment and delivery, ensuring that improvements in woodland connectivity are both ecologically effective and socially supported.

5. Recommendations for the northern catchment

Overview

For the purposes of this report, the northern catchment is defined as the area lying north of the A38 (Devon Expressway), extending into the upland fringe of Dartmoor National Park. This part of the Yealm Operational Catchment is characterised by a mixed landscape of improved pasture, moorland edge, and farmland, interspersed with predominantly small to medium-sized broadleaved woodlands, alongside one particularly large woodland block. This large patch represents the highest-scoring site for connectivity within the entire catchment, forming a crucial ecological core that underpins woodland network integrity across the wider landscape.

Findings

The connectivity analysis identified a number of woodland patches within and adjacent to Dartmoor that exhibit high Integral Index of Connectivity (IIC) scores, demonstrating their strong contribution to the resilience and connectivity of the wider woodland network.

While many of the larger patches are already relatively well connected, several gaps were identified. These locations present priority opportunities for targeted intervention, where modest habitat creation or enhancement could deliver substantial ecological benefits by improving woodland linkages and facilitating species movement between core areas.

A small number of completely isolated or “island” patches were also identified; however, due to their isolation from the main woodland clusters, these are not considered immediate priorities for connectivity interventions.

To enhance overall landscape cohesion, ecological resilience, and species movement across the northern catchment, three priority areas have been identified for potential action.

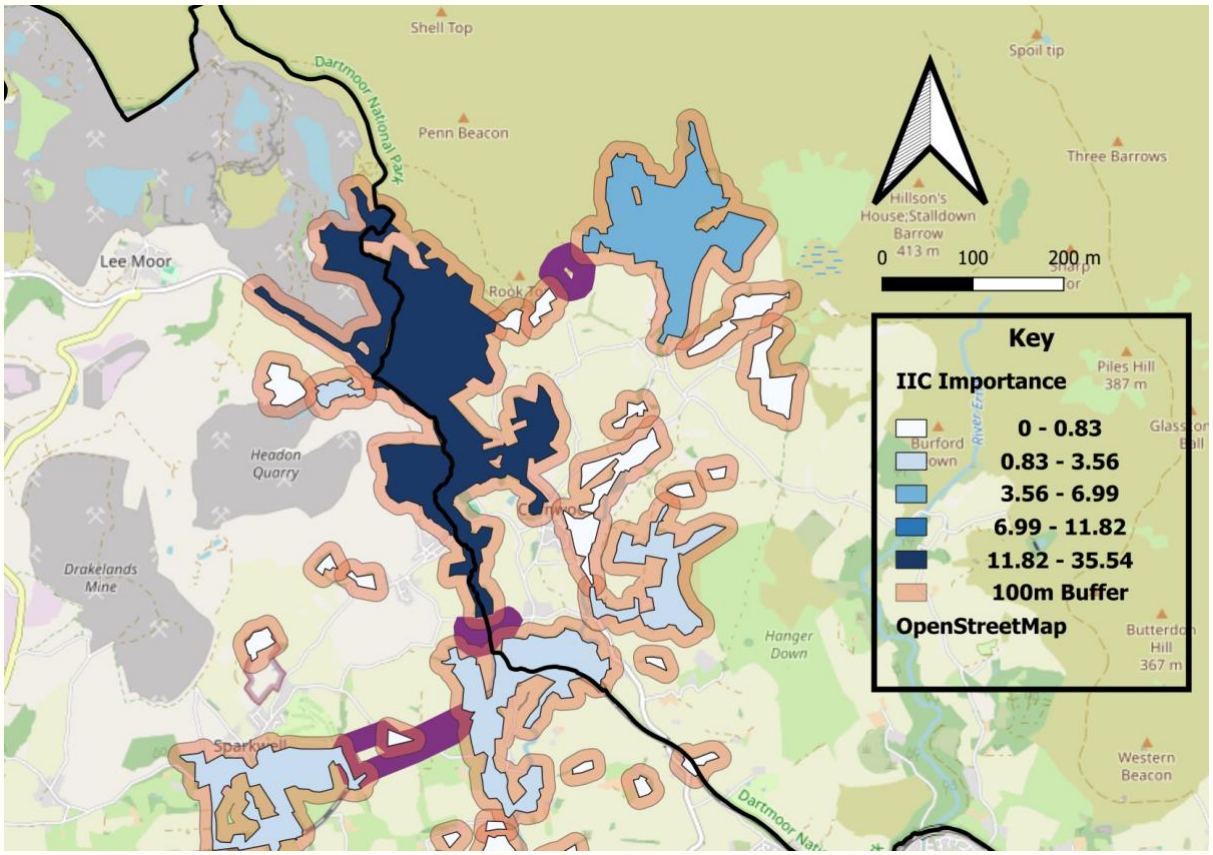
Summary of recommended interventions

Three priority intervention areas have been identified within the northern catchment, labelled Sites N1–N3. Collectively, these sites aim to:

- Strengthen connectivity between high-IIC woodland patches within and adjacent to Dartmoor National Park
- Improve and widen existing hedgerow networks to enhance their role as ecological corridors
- Establish or expand small copses to act as stepping stones between isolated woodland blocks

The detailed site descriptions, including specific recommendations and next steps, are provided in the accompanying Infosheets for Recommended Interventions document (Sites N1–N3) and illustrated on the Northern Catchment Map (see below).

The map below illustrates the Integral Index of Connectivity (IIC) scores for each woodland patch, with 100 m buffer zones shown in orange and the proposed intervention zones highlighted in purple. The Dartmoor boundary is also visible as a black line for reference.



The map below shows only the recommended intervention areas (N1-N3) on satellite imagery to better conceptualise their locations:

Table giving the coordinates for the central point locations of each of the intervention sites (Long/Lat DD):

	Central point coordinates
N1	50.438212549276706, -3.9628541933653225
N2	50.41155510243601, -3.9712227055654816
N3	50.40285816728773, -3.980722097983787

6 Recommendations for the central catchment

Overview

For the purposes of this report, the central catchment is defined as the area lying south of the A38 (Devon Expressway), and north of the Yealm estuary. This part of the Yealm Operational Catchment is characterised by a mix of agricultural land, pasture, and clusters of broadleaved woodland. Two large woodland patches dominate the landscape, alongside several smaller, moderately connected patches. Some clusters remain isolated at the 100 m buffer scale, and a small number of "island" patches are completely disconnected from the main network.

Findings

The connectivity analysis identified the two largest woodland patches for maintaining landscape-level connectivity, contributing the highest IIC scores within the central catchment. While the overall network shows moderate connectivity, gaps between these key patches and smaller woodland clusters represent priority areas for intervention. Linking the two main patches, which are the highest-scoring centrally, is a key objective. Targeted habitat creation or enhancement in these zones could significantly improve woodland linkage and support species movement. Another priority is to integrate semi-isolated clusters of patches into the broader ecological network.

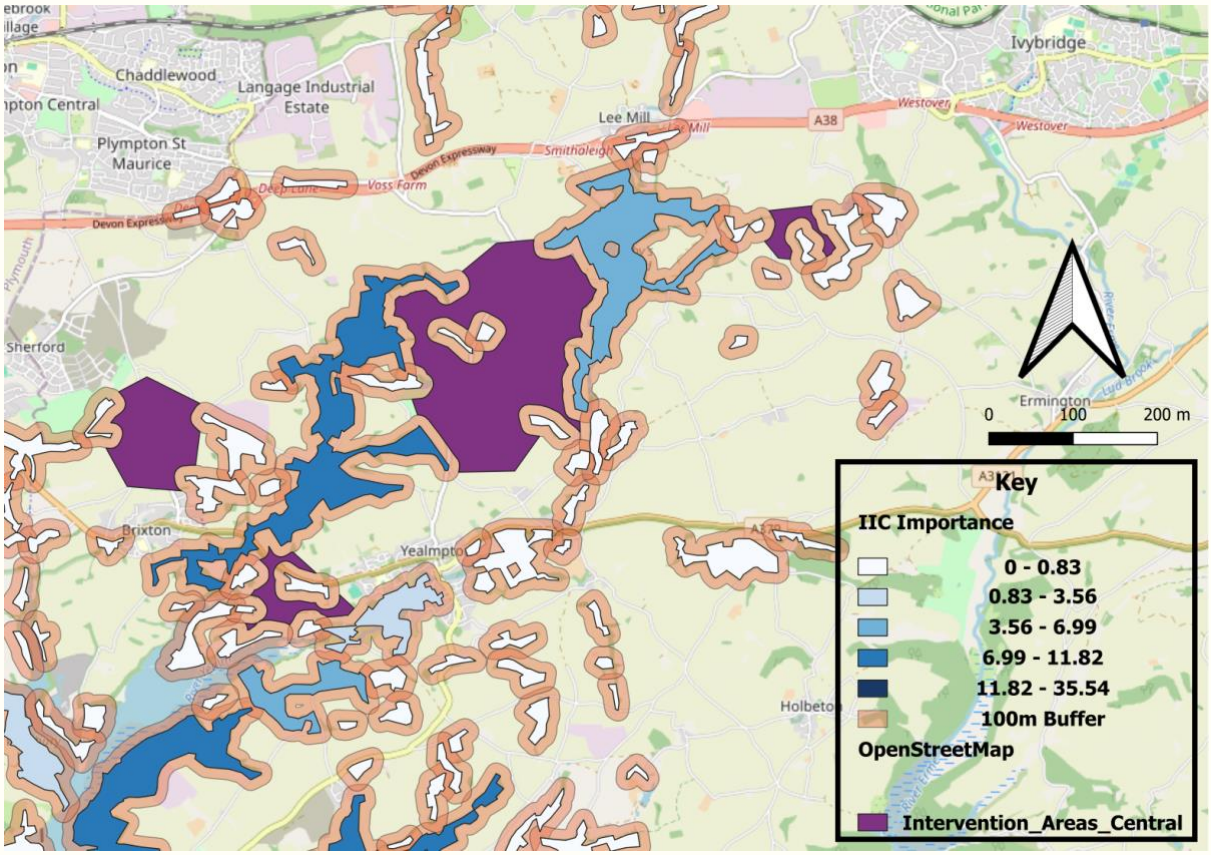
Summary of recommended interventions

Four priority intervention areas have been identified within the central catchment, labelled Sites C1–C4. Collectively, they aim to:

- Connect the two largest and most important woodland patches for overall connectivity
- Link smaller clusters of woodland patches to the two largest woodland patches
- Enhance existing hedgerows and field boundaries to improve their function as ecological corridors

The locations and details of each recommended intervention are described in the accompanying Infosheets for Recommended Interventions document (C1–C4) and illustrated blow on the central catchment map.

The map below illustrates the IIC scores for each woodland patch, with 100 m buffer zones shown in orange and the proposed intervention zones highlighted in purple.



The map below shows only the recommended intervention areas (C1-C4) on satellite imagery to better conceptualise their locations:

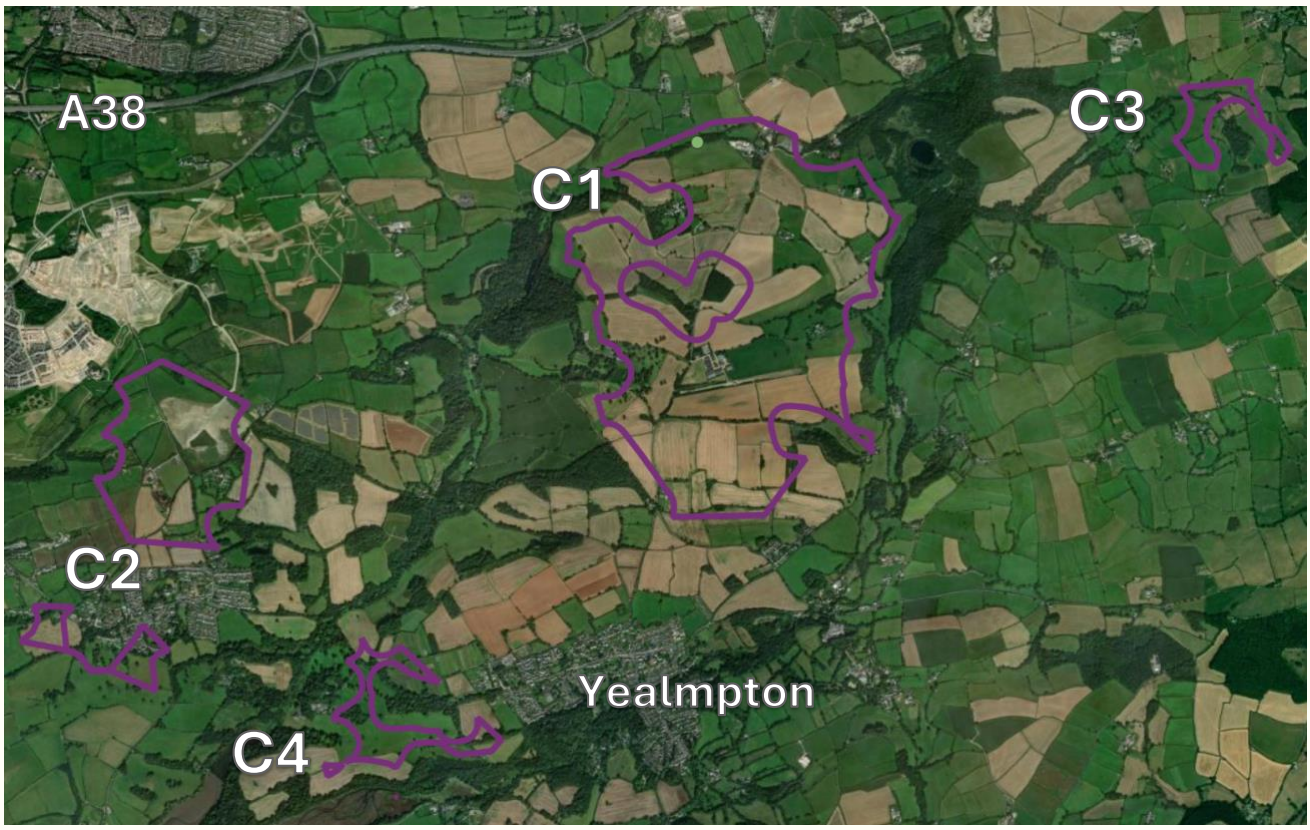


Table giving the coordinates for the central point locations of each of the intervention sites:

	Central point coordinates
C1	50.36737001443789, -3.9937552829984964
C2	50.35755039132169, -4.035809981637133 50.348577693691055, -4.039681140666049
C3	50.377506041176616, -3.9498544488330882
C4	50.34731734750173, -4.019930329128604

7 Recommendations for the southern catchment

Overview

For the purposes of this report, the southern catchment is defined as the area south of the A379. This part of the Yealm Operational Catchment comprises a mosaic of agricultural land, pasture, and scattered broadleaved woodland patches. Connectivity analysis indicates that, while most woodland patches in the southern catchment are moderately connected, gaps remain between some of the larger patches, and the estuary acts as a significant barrier to functional movement across the landscape. The woodland network consists of numerous clusters that are generally well connected at the 200 m buffer distance, but several clusters become disconnected at the 100 m threshold, revealing finer-scale connectivity gaps. The catchment contains some large, high-IIC patches alongside smaller, less connectivity-important clusters, providing clear opportunities for targeted habitat enhancement.

Findings

Several large woodland patches contribute particularly high Integral Index of Connectivity (IIC) scores, underlining their importance to the regional network. Strengthening connections between these high-IIC patches, and linking the western cluster to the central and southern woodlands, presents a key opportunity to enhance landscape-scale connectivity, support species movement, and improve ecological resilience across the catchment.

Priority areas for intervention focus on locations disconnected at both 100 m and 200 m thresholds, where targeted actions could most effectively improve cohesion across the woodland network. The combination of large high-IIC patches and smaller clusters offers multiple opportunities for strategic habitat enhancement, including woodland creation, natural regeneration, and hedgerow strengthening.

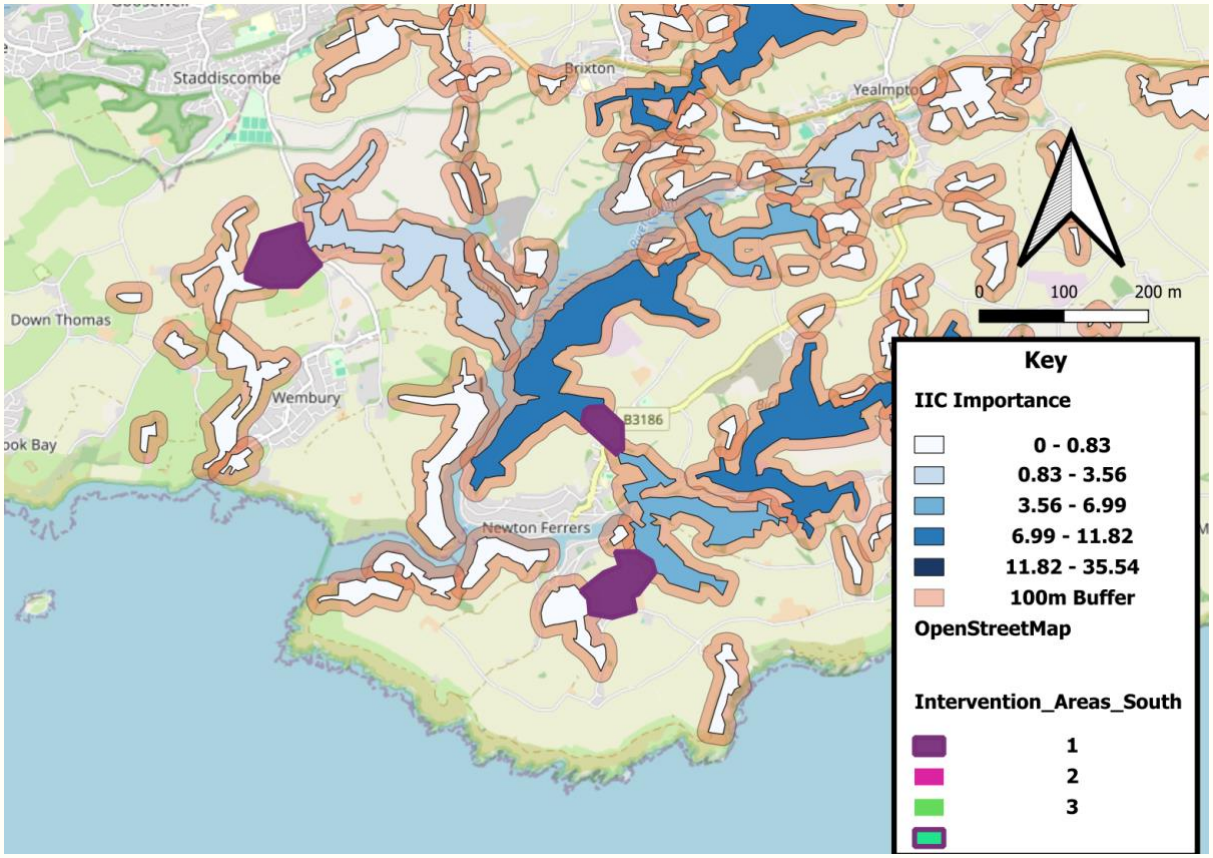
Summary of Recommended Interventions

Three priority intervention areas have been identified within the southern catchment, labelled Sites S1–S3. Collectively, they aim to:

- Strengthen connectivity between high-IIC woodland patches and smaller surrounding clusters
- Improve connections across the western cluster to integrate it with the central and wider southern woodland network.

The locations and details of each recommended intervention are described in the corresponding Infosheets for Recommended Interventions document (S1–S3) and illustrated on the accompanying southern catchment map.

The map below illustrates the IIC scores for each woodland patch, with 100 m buffer zones shown in orange and the proposed intervention zones highlighted in purple.



The map below shows only the recommended intervention areas (C1-C4) on satellite imagery to better conceptualise their locations:

Table giving the coordinates for the central point locations of each of the intervention sites:

	Central point coordinates
S1	50.32215384015447, -4.03296586509993
S2	50.33536760385736, -4.076970673872866
S3	50.3097941333546, -4.033123871405888

8. Proposed next steps

To ensure that the recommended interventions are feasible and deliver maximum ecological benefit, a series of practical actions are proposed for all catchment areas. These actions should be developed in coordination with other land initiatives and adapted to specific land-use contexts.

8.1 Landowner identification and engagement

- Identify landowners of intervention areas using public records, local authority planning data, or land registry information
- Consider feasibility and best route to achieve engagement of landowners in the intervention area based on local knowledge and potential for funding/support. Also consider other activities likely to impact on the outcome, such as constraints or synergies due to other land-based obligations or improvement initiatives (e.g. Countryside Stewardship or Environmental Land Management Schemes)
- Engage landowners as appropriate through the best route for a discussion about the proposed interventions, outlining ecological benefits, practical requirements, and potential support through YEM, local stewardship schemes, or government-funded programmes
- Encourage collaboration across adjacent landholdings to maximise the connectivity benefits of hedgerow, copse, or scattered tree plantings

8.2 Ground-truthing of sites

- It is essential to verify the location, condition, and quality of woodland patches, hedgerows, and potential sites for new copses this can be done based on existing local knowledge or by conducting a field survey
- Assess structural attributes such as hedgerow width, species diversity, continuity, and evidence of management or grazing pressures
- Record soil conditions, topography, and existing land use to identify areas suitable for tree planting, scrub regeneration, or hedgerow enhancement
- Use ground-truthing findings to refine the size, alignment, and species composition of proposed interventions
- Document other land use features present on site, such as power lines, drainage infrastructure, or pipelines, which may affect intervention planning

8.3 Verification and refinement of intervention plans

- Review field survey and landowner feedback to verify the feasibility of each intervention site
- Adjust intervention designs as required, including exact placement of copses, hedgerow alignments, planting densities, and species mixes
- Ensure that interventions align with local management practices, landscape character, and broader connectivity objectives across the catchment

8.4 Implementation Planning

- Prepare site-specific management plans detailing planting, maintenance, and monitoring requirements
- Identify potential funding sources or community volunteer support to assist with planting, ongoing maintenance, and monitoring
- Establish a phased implementation schedule, prioritising interventions that offer the highest connectivity gains and are most feasible in terms of access, ownership, and land use

9 Glossery of key terms

Term	Definition
Structural woodland connectivity	How well woodland patches are linked across the landscape, allowing animals and plants to move, spread, and thrive
Ecological resilience	The ability of ecosystems to cope with changes like climate change or habitat loss without losing their function or species
Connectivity gaps	Places where there is a break in woodland cover or habitat, making it harder for species to move between woodlands
Stepping-stone patches	Small woodlands or tree groups that help wildlife move between larger woodlands.
Dispersal distances	How far animals, insects, or seeds can naturally move from one place to another
Dispersal range	The overall area or extent within which a species can move or spread; usually linked to its dispersal distance
Spatial thresholds	The distance limits used in analysis to represent how far different species are likely to move
Core woodland/ hubs	Large woodland areas that are critical for maintaining connectivity
Landscape permeability	How easy it is for wildlife to move across the landscape between habitats

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11 Disclaimer / legal disclosure

This report has been prepared by Ciera Lowe for the Yealm Estuary to Moor (YEM) Project for the purposes of providing guidance on woodland connectivity and priority intervention areas within the Yealm Operational Catchment. The analysis, recommendations, and maps presented herein are based on currently available data, spatial modelling, and professional judgement at the time of writing.

Important:

- This report is intended as guidance only and does not constitute legal, financial, or planning advice.
- Implementation of any recommendations should be subject to ground-truthing, site-specific assessment, and consultation with relevant landowners, authorities, and ecological professionals.
- The author and associated parties accept no responsibility or liability for any loss, damage, or disagreement arising from the use of this report, including any actions taken, not taken, or resulting outcomes on the ground.
- Users of this report are responsible for ensuring compliance with all relevant legislation, policies, and regulations in relation to land management, environmental protection, and habitat restoration.

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