Whole feature assessment pilot evaluation report

SSSI Monitoring and Evaluation – 2021 Pilots

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Project details

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Executive Summary

In 2018, following several years of review Natural England (NE) decided to change the way SSSI condition is monitored and reported. It was decided that a move to whole feature assessment (WFA) would support the need to reinvigorate the monitoring programme, enable the use of new technologies, increase the sources of information utilised and provide understanding of SSSI condition in the wider landscape. WFA would also align with the methods of monitoring and reporting used in NE marine protected areas and by the other UK Country Nature Conservation Bodies (CNCBs). This report summarises the findings of the 2021 WFA pilot studies and evaluates the risks identified in moving to WFA.

The pilot sites were chosen as complex and large sites, so to address key concerns raised by both internal and external stakeholders in moving to WFA. The pilots successfully produced condition assessments via WFA for West Nidderdale Barden and Blubberhouses Moors SSSI (large upland habitats) and Duddon Estuary SSSI (complex coastal habitats). The methodology used, mirrors that of NatureScot and is based on uplands Common Standards Monitoring (CSM), where 28 randomly selected stops are visited per feature. Further data to support the condition assessment came from Earth Observations (EO), agreements with third-party organisations such as Royal Society for the Protection of Birds (RSPB) and via external specialist contracts.

The pilots successfully determined condition for all monitored features (except one due to seasonality constraints) and addressed all associated CSM attributes. It is expected that WFA will be successful for comparative SSSIs. However, the pilots identified issues with assigning unfavourable condition trend qualifiers (sub-categories) at the feature scale and highlights the requirement for further consideration. In addition, it was found that many attributes and targets in Monitoring Specifications (MS) are tailored for unit-based monitoring and adjustments for WFA will be required. The pilots found that WFA requires flexibility in methodology to accommodate attributes for which stop data is not applicable or sufficient, and that WFA requires a greater focus on collecting data between stops, from all SSSI units.

A key aspect of condition monitoring is the identification and tracking of Threats, Adverse Condition Reasons (ACRs) and ongoing Remedies and Actions (currently being reformed into Pressures and Actions). The pilot results suggest that WFA can identify pressures and can assign them to both units and features, however limitations in the pilot methodology mean unresolved risk remains. To adequately ensure WFA can identify pressures and actions spatially, an adjusted methodology is required, in which surveyors will visit all units and have an increased focus on pressure data collection. The adjustment will be trialled in the 2022 pilots.

The pilot condition results cannot be accurately compared to historic unit-based monitoring, due to multiple factors. The 2022 pilots will address this in more detail. The results of the pilots have not yet been discussed with landowners or Area Teams (ATs) to compare if the findings align or differ from their views. NE is an evidence-led organisation and condition assessments should ideally have statistical rigour. This is achievable for some habitats, but others are limited due to their CSM guidance; an issue for both WFA and unit-based monitoring. The 2022 pilots will commission time from Data Science Services (DSS) to help develop the role of statistical confidence in condition assessment results.

A significant concern in moving to WFA is whether enough data is gathered to inform localised management decisions. The pilot methodology has not gathered sufficient information to

adequately inform management across the SSSI series, however, with an adjustment in methodology, WFA is thought capable of sufficiently informing management at an appropriate scale. This methodological change is expected to add nominal resource to the overall condition assessment process. The key difference will be the production of unit-specific feature conditions, alongside the reported overall feature condition. Unit-specific conditions may differ from the overall feature condition and will provide indication and reporting of localised management issues. Central to this method will be an increase in recording pressures and localised condition issues. Even with the new proposed methodology, extra survey visits will be required for complex management decisions as condition assessments are not intended to provide information for all decisions, but rather to provide the background and context upon which detailed issues can be addressed.

The pilots used new technologies to inform the condition assessments, trialling satellites imagery, drones and LiDAR (Light Detection and Ranging). The pilots found that new technologies must be used in conjunction with traditional methods, as they can answer specific attributes questions but not everything for a condition assessment. The applicability of EO varies between monitored features. EO can provide data for attributes that have been insufficiently addressed historically, such as coastal geomorphology elevation change. EO can provide more accurate and reliable data for frequently assessed attributes, such as extent, bare ground or cover of scrub. New technologies are found to provide superior data for many aspects of condition assessment and increase confidence in results. Preliminary findings suggest there are no time or cost savings with EO, due to the requirement of specialist and on occasion the cost of raw data. The costs can be expected to reduce with NE investing in specialist staff and gradual NE familiarity. The pilots have highlighted the need to integrate new technology data into NE's existing systems, especially to allow data accessibility for other work areas. Other new technologies will be trialled, and further evidence gathered in the 2022 pilots.

The pilot evaluation analysed the time and costs of WFA compared to unit-based monitoring. Reliable comparison for time and costs are not possible due to lack of comparable baseline data and the anomaly of the pilot data. However, preliminary results indicate there are both time and cost savings for area monitored.

NE require internal systems capable of recording data from WFA. The pilots found that the Natural England Site Survey (NESS) app is capable of accommodating information for WFA but requires development to improve functionality and usability. Procurement for development has commenced. CMSi is the system which holds protected site condition and monitoring information. It currently is not compatible with WFA, but development has begun, with confidence in the outcome. Other applications used in the pilots provide benefits in collecting and analysing WFA survey data, such as ArcGIS Online. The pilots identified potential issues in NEs existing databases, that reduce WFA efficiency and are potential barriers to its success. These include incomplete or inaccurate habitat maps, monitoring specifications and citation interpretations. It is worth noting these are barriers to all monitoring and not just WFA. Projects to address these issues have begun but are unlikely to be completed before the shift to WFA in 2023.

The use of third-party data and external contracts are already commonplace providing data impractical for NE to gather itself. The pilots used both, and it is expected they will be extensively used in the shift to WFA. The success of the contracted surveys was found to be determined by the quality of the specifications commissioned. Moving to WFA will require large increases in specialist resource, to create guidance's and assist ATs in specification creation and result interpretation. This shift in some aspects of monitoring away from ATs to national specialist teams,

will require appropriate uplift in specialist resource. Memorandum of agreements (MoAs) will further contribute to WFA and increase overall efficiency.

The pilot studies have demonstrated that some risks identified by stakeholders are not valid and has identified where risks remain requiring further evaluation. The pilots have also identified issues in need of further work and mitigation. The 2022 pilots aim to address the remaining risks and issues, test the proposed new methodologies and evaluate WFA in other complex habitats.

1. Introduction

SSSI monitoring is integral to many aspects of NE's statutory functions. SSSI monitoring is the tool NE uses to understand the impact of management interventions on SSSIs. Knowing the condition of SSSIs and their features, enables NE to provide advice on the potential impacts of development, land management, pollution and other factors which require permissions to proceed.

NE also report the condition of the SSSIs (currently by area) as an official statistic which is used by many organisations for a wide variety of purposes. SSSI owners need to understand the condition of the land they own to track progress of the management interventions and potentially secure funding, e.g. The Water Services Regulation Authority (or Ofwat) funding for water companies.

In 2018 NE decided to review the way that SSSI condition is monitored and reported. It was decided that a move to whole feature assessment (WFA) would support the need to reinvigorate the monitoring programme, enable new technologies to be identified and allow wider sources of information to be used. This shift to WFA will allow the understanding of a SSSIs features within the wider landscape. This will support the shift to landscape scale conservation and links directly into the Nature Recovery Network.

The WFA approach will also mean that NE aligns with the other UK Country Nature Conservation Bodies (CNCBs) for monitoring at feature level, and with the approach taken to monitor used in the marine environment within NE. This will make it simpler to review condition of cross border sites, intertidal sites and provide an assessment of the state of the protected sites across the whole country.

It is important to understand the implications of this shift to WFA and make sure that the new approach can be implemented across all the features monitored within SSSIs.

This report evaluates the 2021 pilots, that were established to review the impact of WFA on data collection, condition assessments and reporting. A further document will review the impacts on the wider NE business.

2. Project aim

The overarching aim of the pilots was to establish if it is possible to collect sufficient data for all the notified features in large and complex sites, and therefore make a condition assessment for each feature. It was important to also assess whether sufficient information was collected to be able to support management decisions.

In achieving this, NE can provide information for land managers, other duties and activities (including Nature Recovery Networks, Local Nature Partnerships etc), government targets and international targets.

The pilots aimed to address those risks involved in moving to WFA. Risks that are unresolved, or subsequently identified will be addressed in the 2022 pilot studies. The 2022 pilots will further add to our understanding of WFA on complex sites, as they will address rivers and lowland mosaic habitats.

3. Risks identified in moving to whole feature assessment

Moving to WFA comes with risks, especially when looking at complex sites. To implement this shift, an evaluation is required to ensure the future approach taken by NE in monitoring and reporting is appropriate. At the start of the SSSI reform programme, the risks of moving to WFA were identified through discussion with the Investment Committee, ATs, landowners and through a formal public consultation including Major Landowners Group (MLG) representation during December 2020 and January 2021. Further details are provided in

Annex 1.

The risks identified are grouped and presented as evaluation questions, providing the structure of this report. The project aimed to evaluate each question and by doing so, recategorize the associated risks into:

- Resolved Risk (The pilot has demonstrated that this risk is not valid),
- Remaining Risk (our work has identified the risk to still be a potential issue, with need of further work and evaluation), or
- Identified Issue (our work has highlighted this is a confirmed issue, with work needed to identify the potential for mitigation).

Table 1 below summarises the risks identified and presents them as evaluation questions. Some of the questions raised during the consultation were out of scope of this report and therefore not included but will be addressed subsequently. Section 5 of this report outlines how the project has answered the evaluation questions and therefore substantiate and categorise the associated risks.

Table 1: Evaluation objectives and questions to be addressed by the pilot

Evaluation Objectives	Evaluation Questions
Production of a reliable condition assessment for large complex sites.	• Does WFA provide the level of detail required for the condition assessment of complex SSSI sites? • Can WFA provide sufficient data to answer all CSM attributes using NE's available resources? • Does WFA sufficiently identify Threats, Adverse Condition Reasons (ACRs) and ongoing Remedies and Actions?

	• How do the conditions assigned via WFA, compare to the conditions assigned via the unit-based approach? • Does the information gathered fit with what landowners/Area Teams know of the sites? Do they support it? • What statistical confidence can be reported using the WFA approach?
To understand how WFA data can influence management interventions.	• Does the spatial resolution of WFA data enable decisions about management to be made? • Will separate visits be required for complex management decisions?
To use new technologies to support condition assessment.	• Does using new technology such as DNA, earth observations and drones alongside traditional methods, reduce costs and maximise efficiency? • Can new technologies be used as a tool to directly answer questions relating to CSM guidance i.e., feature extent, scrub mapping using LiDAR data? • What are the limitations of these new technologies and how do they need to work alongside gathering field data?
To assess whether WFA is time and cost efficient compared to current approach.	• How does WFA compare to unit-based monitoring for time and cost?
To assess whether NE's current IT systems for SSSI data collection, analysis and database are suitable to support the move to WFA.	• Is NESS capable of gathering data for WFA and is it fit for purpose? • Is CMSi capable of gathering data for WFA and the associated data analysis and storage?
To evaluate whether NE's baseline data is up to date and suitable to support the move to WFA.	• Do Natural England's existing databases have capacity to adopt WFA? • What improvements to NE datasets are suggested to assist in WFA national roll out?
To use contractors for species data gathering, data from third parties and citizen science to support condition assessment.	• Does third-party data provide the right information for a WFA condition assessment and are contracts cost effective?

The risks with outstanding or unresolved elements after the 2021 pilots, will be addressed in the 2022 pilots.

4. SSSI pilot details

4.1. SSSI choice rationale

The move to WFA is expected to be relatively simple on small sites, being used successfully in 2020 and 2021 by several Area Teams, particularly when combined with the option to undertake Rapid Assessments. The move to WFA in large and complex site such as uplands, coastal, rivers

and large lowland complexes is likely to be more difficult and potentially require a different approach.

To assess the potential implementation mechanisms the programme decided to undertake several pilots and asked Area Teams to submit potential sites to be part of the process. It was important to choose sites where mapping of the features was at least partially available and where there was landownership by some MLG members, in order to keep their involvement and engagement during the shift to WFA. It was also important to be able to use EO and other new technologies and gain access to third-party party data.

Two sites were chosen for the 2021 pilots:

- the Duddon Estuary SSSI in Cumbria and,
- West Nidderdale, Barden and Blubberhouses Moors SSSI in Yorkshire.

The Duddon Estuary SSSI is within the Cumbria Area Team and has ownership by RSPB, National Trust, Crown Estate and is adjacent to a prison managed by the Ministry of Justice (MoJ). The monitoring specification is in consultation draft and there was partial coverage of feature mapping by the Environment Agency. This coastal site has a wide variety of features allowing the evaluation of WFA in many diffing scenarios.

Contracts were let for breeding birds, invertebrates, and vascular plants. Third-party data was gained from the Amphibian and Reptile Conservation Trust (ARC) to inform natterjack condition, the British Trust of Ornithologist (BTO) to support the overwintering birds' assessment and RSPB for breeding bird data.

West Nidderdale Barden and Blubberhouses Moors SSSI (referred to as 'Nidderdale SSSI' in this report) sits within the Yorkshire and North Lincolnshire Area Team. MLG ownership includes Yorkshire Water. The site includes multiple upland habitats including upland blanket bog, wet and dry heath, short sedge acidic fen and woodland. Another key feature is the breeding bird assemblage, and this data was gathered via contract.

These sites fit the requirements for the pilots and had the support of the local teams.

4.2. Methodology

The WFA monitoring approach is based on the assessment of the condition of each notified feature at the scale of the SSSI, rather than its condition at a site unit level. Since the Common Standards Monitoring (CSM) approach was agreed in 2005, all other UK CNCBs have monitored by ecological interest feature, assigning a condition status to each feature. Natural England is alone in breaking SSSIs down into units and applying a condition to each unit.

The CSM Guidance for uplands outlines different approaches to data gathering for a condition assessment, although it recommends that monitoring is based on a *'series of relocatable sample points in each feature, which should be selected prior to the field work to avoid bias'*. Natural England have not taken this approach in the past, relying on a structured walk within individual units to inform condition assessments. Pre-selected random points have been used before, especially in formal agri-environment scheme and overgrazing monitoring.

A field method was developed by A. MacDonald (MacDonald, 2004) following the production of the CSM guidance which was adopted by NatureScot (and a similar version by DAERA in Northern Ireland) to form the basis of their Site Condition Monitoring (SCM). NatureScot have monitored at feature level for several years and are confident of its reliability. Their survey at Coille Dalavil (Dayton, 2018) is an example of a complex upland site.

With the support of NE statisticians, the pilots used this field method as the basis for monitoring the habitats. The random sample approach was used for both pilot sites as it was expected to gather sufficient information to make statistically robust conclusions on condition, as well as remove bias and save survey time due to the predefined locations. This random sample approach is not suitable for all features so more appropriate methods were used and are outlined in Table 2 for Duddon Estuary SSSI and Table 7 for Nidderdale SSSI.

Summary of method: For both sites, 37 sample locations were randomly selected for each habitat feature, using GIS. At each of these locations, data was gathered for all the attributes identified in the monitoring specification and/or the CSM guidance. The NESS app was used to collect data on iPads, with the data being uploaded at the earliest opportunity.

A maximum of 37 samples per notified feature were chosen on the probability that this would ensure 28 assessed samples would be located within the correct feature and allow data gathering. This was to account for the lack of baseline data and correct habitat maps. If more than 28 sample points were in the target feature and assessed, these were further randomised after the survey to provide 28 fixed survey points for future CSM assessments. Statistically 28 is the minimum samples required to provide sufficient data to conclude if the feature is favourable over 90% of its extent, with a 95% confidence level (MacDonald, 2004). This approach reduced resource requirements while still providing an acceptable level of confidence in the result. Having 28 stops provides a baseline statistical confidence for the condition assessment results. The number of stops used during condition assessments should not be seen to be fixed to the 28 randomly assigned, but rather a guide, as it provides a baseline statistical confidence. Extra stops can be incorporated into condition assessments, for example in areas of a site with reason for local concern, or less stops for features with limited extent.

CSM guidance differs between the two pilot sites in how condition is determined. Upland CSM guidance recommends that "*when a feature is reported as favourable, it should be possible to state with a high degree of confidence that each target is met over at least 90% of the feature*" (JNCC, 2009). This requires 28 stops to pass, for the feature to be favourable. The coastal CSM guidance, however, recommends that each attribute must pass its target from a site wide point of view, for the feature to be favourable (JNCC, 2004).

The effectiveness of the random sampling procedure was influenced by the accuracy of the mapping held and the reliability of the monitoring specification. The quality of feature mapping and monitoring specifications will vary considerably across England's SSSI series. Where mapping was deemed inadequate for the purposes of WFA, efforts were made to improve and update them, through earth observation interpretation or other EO techniques. Mapping was careful not to reclassify areas where the underlying feature is or should be present but appears not from EO, due to a lack of management.

Where there was very low confidence in the mapped habitat, the area was not included for selection of random samples but highlighted as areas to 'check' during the survey. This would allow the development of improved habitat maps and reduce time from incorrect habitats at

samples. Features which were small in extent were assessed using a CSM-compliant rapid assessment.

Figure 1 shows a subsection of the final map produced for the Duddon Estuary SSSI after the random allocation of sampling points. Figure 2 shows a subsect of the final Nidderdale SSSI map with sampling points. Due to the size of this SSSI, its difficult terrain and remoteness, routes were created each day to help surveyors navigate the site and ensure surveyors visit specific areas of interest or concern. The blue polygons outlined the areas to check the habitats present. Threats, ACRs and ongoing remedies were noted throughout and will be recorded on CMSi.

Figure 1: Duddon Estuary SSSI sampling point locations (Haverigg & Hodbarrow example)

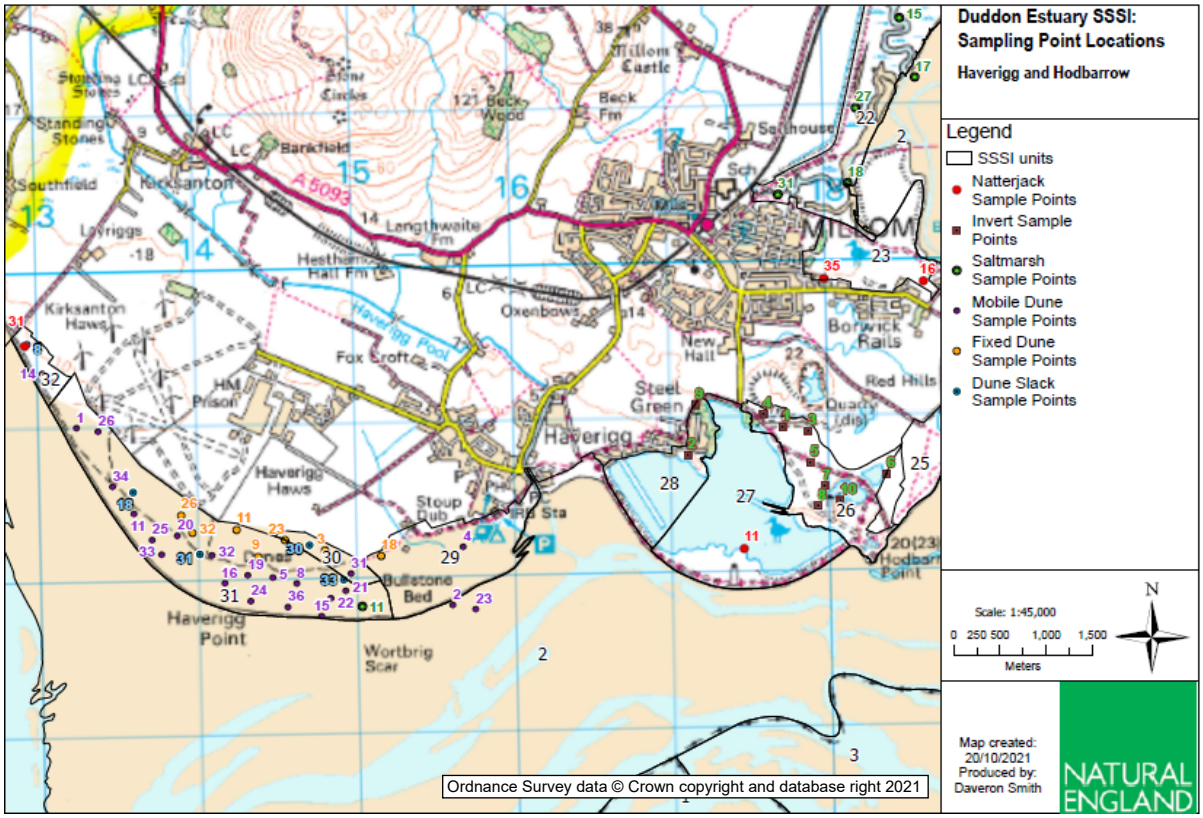
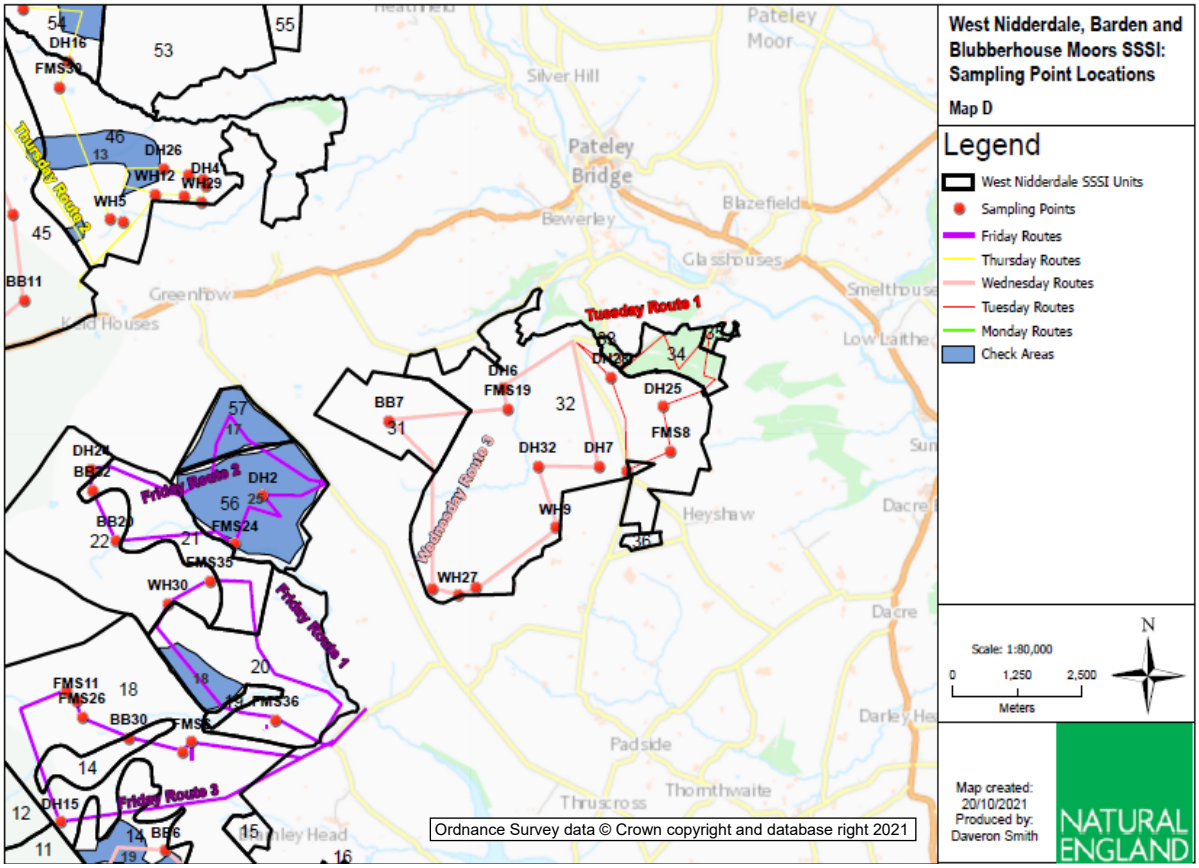


Figure 2: Nidderdale SSSI sampling point locations (Map D, Central)



Data gathered was quality assured by members of the Natural England Field Unit (NEFU) who were also present during the pilots. The data was then used alongside the recorded management issues and pressures, and each feature was allocated a condition of either favourable or unfavourable. Area Teams provided information on where management is in place and whether it is working, so as to inform the unfavourable condition trend qualifiers. The final decision on feature condition and the supportive data will be made public through DSViews. Annex 3 provides the full methodology used at each site and the complete series of maps produced for each site.

4.3. Results

4.3.1. Duddon Estuary SSSI

Background: Duddon Estuary SSSI has 57 “NVC, GCR, species and other features” identified on Designated Sites Views. After being reviewed by specialists, three of these features were reclassified due to updated understanding of NVC communities since designation, and one features was identified as supporting habitat rather than being designated in its own right. The 53 remaining notified features correspond to 25 monitored features shown in Table 2 below.

Table 2 also outlines how the condition data was gathered, with some monitored features having multiple sources. An illustrative example is the invertebrate assemblage for which a contract was commissioned providing the specialist invertebrate surveys data and fieldwork by NE staff provided the remaining habitat indicator information. The decision was made to postpose monitoring littoral

sediment until April 2022 following specialist advice, due to the restrictive suitable monitoring times and the need for biotopes to be present.

Table 2: Duddon Estuary SSSI - Monitored Features and Data Gathering Sources

Monitored Feature	Assessment Type	Data Gathering Source
>20,000 Non-breeding waterbirds	CSM Compliant	Desk based - WeBS
Aggregations of breeding birds - Sandwich tern, *Sterna sandvicensis*	CSM Compliant	Desk based - RSPB data
Aggregations of non-breeding birds - Curlew, *Numenius arquata*	CSM Compliant	Desk based - WeBS
Aggregations of non-breeding birds - Dunlin, *Calidris alpina alpine*	CSM Compliant	Desk based - WeBS
Aggregations of non-breeding birds - Knot, *Calidris canutus*	CSM Compliant	Desk based - WeBS
Aggregations of non-breeding birds - Oystercatcher, *Haematopus ostralegus*	CSM Compliant	Desk based - WeBS
Aggregations of non-breeding birds - Pintail, *Anas acuta*	CSM Compliant	Desk based - WeBS
Aggregations of non-breeding birds - Red-breasted merganser, *Mergus serrator*	CSM Compliant	Desk based - WeBS
Aggregations of non-breeding birds - Redshank, *Tringa tetanus*	CSM Compliant	Desk based - WeBS
Aggregations of non-breeding birds - Ringed plover, *Charadrius hiaticula*	CSM Compliant	Desk based - WeBS
Aggregations of non-breeding birds - Sanderling, *Calidris alba*	CSM Compliant	Desk based - WeBS
Aggregations of non-breeding birds - Shelduck, *Tadorna tadorna*	CSM Compliant	Desk based - WeBS
Assemblages of breeding birds - Sand-dunes and saltmarshes	CSM Compliant	Contract and RSPB
Coastal vegetated shingle (SD1-3)	CSM compliant (Rapid Assessment)	NE Survey and Desk Analysis
Dune Heath	CSM compliant (Rapid Assessment)	NE Survey and Desk Analysis
Fixed dune grassland	CSM Compliant	NE Survey and Desk Analysis
Humid Dune Slacks	CSM Compliant	NE Survey and Desk Analysis
IA - Coastal Geomorphology	CSM Compliant	Contract

Invertebrate assemblage (F111 & F112)	CSM Compliant	NE Fieldwork and Contract
Littoral sediment	N/A (Next year)	Contract
Natterjack toad, *Bufo calamita*	CSM Compliant	NE Fieldwork and MOA
Sand dune; strandline, embryo and mobile dunes (SD1-6)	CSM Compliant	NE Survey and Desk Analysis
SM4-28 - Saltmarsh	CSM Compliant	NE Survey and Desk Analysis
Vascular plant assemblage	CSM Compliant	Contract

Condition results: The resultant condition of each feature is shown below in Table 3. Of the 23 monitored features completed, 18 have been found to be in favourable condition and five features unfavourable.

Table 3: Duddon Estuary SSSI - Condition of Monitored Features

Monitored Feature	Condition
>20,000 Non-breeding waterbirds	Favourable
Assemblages of Breeding birds - Sand-dunes and saltmarshes	Favourable
Assemblages of Non-breeding birds – Curlew	Favourable
Assemblages of Non-breeding birds - Dunlin	Favourable
Assemblages of Non-breeding birds – Knot	Favourable
Assemblages of Non-breeding birds - Oystercatcher	Favourable
Assemblages of Non-breeding birds - Pintail	Unfavourable
Assemblages of Non-breeding birds - Red-breasted Merganser	Favourable
Assemblages of Non-breeding birds - Redshank	Favourable
Assemblages of Non-breeding birds - Ringed Plover	Favourable
Assemblages of Non-breeding birds - Sanderling	Favourable
Assemblages of Non-breeding birds - Shelduck	Favourable
Breeding birds - Sandwich Tern	Favourable
Coastal vegetated shingle (SD1-3)	Favourable
IA - Coastal Geomorphology	Favourable
Dune Heath	Favourable
Fixed dune grassland	Favourable
Humid Dune Slacks	Unfavourable
Invertebrate assemblage (F111 & F112)	Favourable
Natterjack toad	Unfavourable
Sand dune; strandline, embryo and mobile dunes (SD1-6)	Unfavourable
SM4-28 - Saltmarsh	Favourable
Vascular plant assemblage	Unfavourable

Unfavourable trend qualifiers: Following NE current guidance, features identified as unfavourable, require sub-categorisation into the trend qualifiers of declining, no-change or recovering. The NE guidance is designed to be used at the unit scale, and we need to be confident that this approach is still relevant when thinking about management at the whole feature scale. As such, assigning trend qualifiers to features requires further work and is discussed later in the report in Section 5.2.1.

Identification of Pressures: A key part of condition assessments is the identification of causes, or potential causes likely to result in a change of favourable status. NE record these as ACRs and Threats. This system is currently under review, and a new system is expected to be rolled out across NE alongside whole feature monitoring. This work is being done in Strategy and Government Advice as part of Resilient Landscapes and Seas (RLS) programme.

This new system will simplify the current process and will unify ACRs and Threats into “Pressures” and Remedies and Threat Actions into associated “Actions”. These pressures and actions will have the option of being assigned to features and/or units, unlike the current system which is only units. By linking pressures to features as well as the appropriate spatial location, NE will have more useful information to inform management and understand progress towards favourable status. It will also allow more clarity about areas of land in favourable condition to inform area-based targets such as the 25 Year Environment Plan (25YEP) and 30x30 (UK Government’s commitment to protect 30% of land by 2030).

At the time of pilot planning, there was no understanding of what the new system of recording ACRs and Threats would be, and as such all the appropriate data was not collected. Some data was collected, and examples are provided below to illustrate that the required detail can be obtained during WFA. Table 4 shows pressures linked to features irrespective of units, and Table 5 examples of pressures identified at the scale of units. These tables are intended to illustrate how data to identify and record pressures and actions are possible using WFA and can then be used to inform management. A formal system to record these pressures and actions is under development for the 2022 pilots.

Table 4: Duddon Estuary SSSI - Example Feature Level Pressures.

Monitored Feature	Pressure (Threat and ACR)	Pressure details
Sand Dunes	Dune stabilisation	Coastal squeeze and the inability for coastal systems to 'roll back' has arrested dunes in a fixed state, resulting in an over-stabilised dune grassland habitat across most sites. The reduction in grazing and rabbit populations has exacerbated this issue.
Sand dunes	Nutrient enrichment	Even in the absence of sea defences, there is an increase in vegetation establishment including scrub (mainly European gorse), there is evidence to suggest the dunes in the NW are suffering excessive nitrogen deposition.
Saltmarsh	Drainage	Historic and current drainage practices have gradually altered saltmarsh structures, these occur very subtly over time and are often unnoticed from the surface. The main consequence is the loss of surface water 'flashes' used by other species: invertebrates, natterjack toad and breeding birds. But changes

		in saltmarsh structure can also occur leading to changes in sediment distribution and natural creek alignment and function.
Mudflats and sandflats	Sediment deficit	Changes in sediment supply and distribution within the estuaries, particularly inner estuaries bounded by structures such as viaducts, has resulted in sediment trapping and increase in extent of vegetated saltmarsh. This consequently reduces the area of mud and sand habitats necessary for invertebrates and feeding wetland birds.
Breeding bird assemblage	Disturbance/ unsuitable habitat	Evidence shows that SSSI (Saltmarsh & sand dune) assemblage bird species are not breeding outside the 2 reserves of N Walney and Sandscale Haws, suggesting that there are issues across all other suitable habitats making these unfavourable for nesting. Historic drainage practices on saltmarshes have resulted in the change of surface structure, and availability of wetland features used by birds. Disturbance from off road vehicles is widespread, in addition to dogs off lead and water sports.
Natterjack	Management	Change in grazing due to changing farm practices, stock availability and practicality of grazing difficult sites has resulted in many natterjack toad breeding sites becoming rank and unsuitable. Suitable pond management is also lacking.
Coastal vegetated shingle (SD1-3)	Erosion (recreational)	Across the entire SSSI there is a consistent pressure from erosion via recreation. This includes walking and vehicle use. There are areas that are particularly bad, but the feature as a whole is under threat due to recreation.
Humid Dune Slacks	Lack of management	There is a lack of management in keeping appropriate zonation. With too higher percentage of dune slacks becoming dominated by scrub and tree growth.

Table 5: Duddon Estuary SSSI - Example Pressures Identified for Units.

Unit	Pressure	Pressure Details	Feature(s) being Affected
5	Recreation (Damage and disturbance)	Vehicles regularly driving along foreshore and entering dunes at northern end.	Breeding birds, Sand dune
6	Grazing management	Trespassing sheep. This is an un-grazed saltmarsh, but sheep regularly get onto the marshes preferring the salt washed turf to the coarser dune grasses, causing change on vegetation structure and community.	Saltmarsh
	Recreation (disturbance/dogs)	Walkers deviating from Public Rights of Way (PRoW), dogs off lead, disturbing (feeding/roosting) birds.	Breeding birds

8	Change in management	Removal of full-time reserve manager/warden. Access no longer managed throughout reserve, lack of wardening (dog etc) during breeding bird season, unauthorised vehicular access. Withdrawal of resource for habitat management and volunteer coordination. Reduced site monitoring, record keeping	Sand dune, Dune grassland, Breeding birds, Vascular plants, Natterjack toad,
10	Encroachment by development	Properties bordering the SSSI appear to have extended into the SSSI for development or storage, pollution incidents have occurred in the past.	Sand Dune, Dune grassland
	Non-native invasive species	Rosa rugosa locally abundant.	Sand dune
11	Lack of appropriate management, undergrazing	Removal of grazing to benefit golf course has resulted in the development of very rank grassland unsuitable for natterjack toad. Dune grassland and saltmarsh is similarly becoming rank with lack of grazing. Discussions in progress for new agri-environment scheme.	Saltmarsh, Sand dune, Dune grassland, Natterjack toad
19	Inappropriate grazing, habitat management	Overgrazed by sheep, modified surface drainage to remove surface water. Natterjack breeding ponds unmanaged/choked with tall vegetation.	Saltmarsh, Natterjack toad, Breeding birds
26	Fly-tipping	Excessive fly-tipping into the lake at (317979, 478572)	Site mosaic habitat
	Recreation, vehicles, dogs	off road vehicles deviating from route of B.O.A.T. onto adjacent habitats, dogs off leads during breeding bird season.	Dune heath, Sand dune, Dune grassland, Natterjack toad, Vascular plants
27, 28	Recreation/water sports	Watercraft during breeding bird season.	Breeding birds
29	Recreation (off road vehicles),	Access from Haverigg beach carpark enables vehicles to easily access the dunes and intertidal zone.	Sand dunes, shingle, B and NB birds, Saltmarsh, Natterjack toad,
30, 31, 32	Undergrazing	Grazing enclosures to contain stock away from public/dogs has resulted in lack of management across dune system and undergrazed areas of dune/dune slack habitats.	Saltmarsh, Sand dune, Dune grassland, Dune slack, Natterjack toad, Breeding birds
	Recreation (off road vehicles),	Access from Haverigg beach carpark enables vehicles to easily access the dunes and intertidal zone.	Sand dunes, shingle, Breeding birds, Saltmarsh, Natterjack toad, Wintering waders
38	Non-native invasive species	Rosa rugosa locally abundant.	Sand dune

	Recreation (off road vehicles),	Historic use of the post-industrial habitats adjacent to the SSSI and the SSSI areas by off road vehicles.	Natterjack toad

Statistical confidence: Features that were assigned condition predominantly via stop data have statistical confidence reported below.

Table 6: Duddon Estuary SSSI - Condition Statistical Confidence

Feature	Condition	Stops	Confidence level *
Fixed Dune Grassland	Favourable	26	>95% confidence that 89% feature passes favourability
Saltmarsh	Favourable	30	>95% confidence that 90% feature passes favourability
Dune Slacks	Unfavourable	38	<5% chance that the feature passes favourability
Sand dunes	Favourable	30	>95% confidence that 90% feature passes favourability

*The confidence levels reported, have been calculated by following the statistical reasoning laid out in the uplands CSM. The reliability of these statistics is weakened, when applied to the methodology outlined in the coastal CSM and used for the Duddon Estuary SSSI condition assessment. This is discussed further in Section 5.1.

4.3.2. West Nidderdale Barden and Blubberhouses Moors SSSI

Background: Nidderdale SSSI has 23 “NVC, GCR, species and other features” identified on Designated Sites Views. After being reviewed by specialists, local staff and NE’s designation team, five of these features were excluded as they were not deemed to be notified, rather recorded as descriptive supporting information. The remaining 18 features correspond to the seven monitored features shown in below in Table 7, alongside how the data was gathered for the assessment.

Table 7: Nidderdale SSSI - monitored features and data gathering approach

Monitored Feature	Type of Assessment	Data Gathering Approach
Breeding birds – Merlin *Falco columbarius*	CSM Compliant	SPA review data
Assemblages of breeding birds - Upland moorland and grassland without water bodies	CSM Compliant	Contract
Subalpine dwarf-shrub heath (Dry Heath)	CSM Compliant	NE Survey and Desk Analysis
Short sedge acidic fen (upland)	CSM Compliant	NE Survey and Desk Analysis
Blanket bog and valley bog (upland)	CSM Compliant	NE Survey and Desk Analysis
Wet heath (upland)	CSM Compliant	NE Survey and Desk Analysis
Upland oakwood	CSM compliant (Rapid Assessment)	NE Survey and Desk Analysis

Condition results: The condition for each monitored feature is shown below in Table 8. Of the seven monitored features only two are favourable and five features unfavourable.

Table 8: Nidderdale SSSI - condition of monitored features

Monitored Feature	Condition
Breeding birds - Merlin, *Falco columbarius*	Unfavourable
Assemblages of breeding birds - Upland moorland and grassland without water bodies	Favourable
Subalpine dwarf-shrub heath (Dry Heath)	Unfavourable
Short sedge acidic fen (upland)	Unfavourable
Blanket bog and valley bog (upland)	Unfavourable
Wet heath (upland)	Unfavourable
Upland oakwood	Favourable

Unfavourable trend qualifiers: Those features that monitoring has identified as unfavourable, require sub-categorisation into the unfavourable trend qualifiers; declining, no-change or recovering. As mentioned, assignment of trend qualifiers to features requires further work and is discussed later in the report in Section 5.2.1.

Identification of Pressures: As explained above Threats, Remedies and ACRs are undergoing a reform, being unified into a system using pressures and actions. This new system will allow the assigning of threats to both features and the units they are present. In Table 9, provides examples of feature wide pressures and Table 10, examples of pressures at the unit level.

Table 9: Nidderdale SSSI - example pressures identified for features

Monitored Feature	Pressures	Pressure details
Blanket bog and valley bog	Erosion	A third of stops failed due to erosion.
	Burning	Burning of blanket bog, is reducing coverage and causing loss in blanket bog extent and burning of peat.
	Drainage	There is evidence of widespread drainage, reducing the water table and causing blanket bog to dry out.
Subalpine dwarf-shrub heath	Burning	Burning of dry heath, is reducing coverage and causing loss in blanket bog extent, and reduction in species diversity.
Short sedge acidic fen	Drainage	There is evidence of widespread drainage, reducing the water table and causing the habitat to dry out.
Wet heath (upland)	Burning	Burning of wet heath, is reducing coverage and causing loss in extent, as habitats become drier and less biodiverse.
	Drainage	There is evidence of widespread drainage, reducing the water table and causing dry heath to dry out.

Table 10: Nidderdale SSSI - example pressures identified for units.

Unit	Pressure	Pressure details	Feature Associated
29	Burning	There is widespread burning, that has led to burning of the peat. This has resulted in clear erosion, and in areas negligible regeneration.	Wet Heath, Dry Heath
	Cutting	Intensive cutting of heath is reducing species diversity.	Wet Heath, Dry Heath

24	Game Management, Rotational Burning	Calluna dominant with absence of full range of indicator species, due to rotational burning.	Blanket Bog
	Drainage	Absence of range of indicator species. Drainage features and clear erosion through area.	Blanket Bog
	Bracken Encroachment	Bracken encroachment on slopes, on habitat that is wet heath based on peat depth.	Wet Heath

Statistics: 28 stops are the optimal number of samples required to report that favourability covers at least 90% of a feature's extent, with a 95% confidence level. This is the best choice in terms of minimising the number of samples required while still providing an acceptable level of confidence in the result. CSM guidance for the assessment of upland features recommends that "*when a feature is reported as favourable, it should be possible to state with a high degree of confidence that each target is met over at least 90% of the feature*". The condition for the four habitat features from Nidderdale SSSI are presented below in Table 11 with their respective statistical confidence.

Table 11: Nidderdale SSSI - condition statistical confidence

Feature	Condition	Stops	Confidence level
Blanket Bog	Unfavourable	33	<5% chance that the feature passes favourability
Short Sedge Acidic Fen	Unfavourable	24	<5% chance that the feature passes favourability
Wet Heath	Unfavourable	28	<5% chance that the feature passes favourability
Dry Heath	Unfavourable	36	<5% chance that the feature passes favourability

5. Evaluation objectives and questions

As a result of the consultation that explored the potential risks associated with moving to WFA, evaluation questions were developed. Table 1 summaries these questions, and below we address each evaluation objective in more detail.

5.1. Production of a reliable condition assessment for large complex sites

Risk: WFA does not provide enough detail to produce a condition assessment for complex sites.

Outcome: The pilot studies have shown that WFA can produce condition assessments for large, complex upland and coastal sites. It can determine favourability/unfavorability for all features trialled and their associated CSM attributes. With a slight change in methodology, WFA is expected to be capable of identifying threats, remedies and ACRs. Outstanding risks include the ability to assign trend qualifiers (unfavourable sub-categories) to feature conditions.

This evaluation category has been broken down into further specific evaluation questions, to provide detail.

5.1.1. Does WFA provide the level of detail required for the condition assessment of complex SSSI sites?

Risk: WFA cannot produce reliable condition assessments.

Outcome: The pilots successfully produced condition assessment for the upland and coastal sites and is expected to be capable of producing condition assessment for comparative sites.

A fundamental aim of the pilots was to provide evidence that it is possible to produce a reliable condition assessment on large complex sites. As the pilot results show (Section 4.3), favourability or unfavorability has been determined for all monitored features undertaken across the two SSSIs.

The condition assessments were produced using field surveys, new technologies and third-party data (both contracts and open-source information). The steps taken to produce the condition assessments are believed to be applicable to all comparative SSSIs. Meaning it is expected that WFA is applicable to all upland and coastal SSSIs, with the understanding that we have not evidenced this for all designated features, and that site-specific factors may cause currently unforeseen difficulties.

The features successfully monitored are both habitats and species. The habitats include successional and dynamic habitats such as saltmarsh and sand dunes systems, as well as less dynamic systems such as blanket bog and woodlands. The pilots also monitored dispersed features such as dune slacks across the dune system and natterjack toad ponds. Features requiring specialist monitoring were also included, such as geomorphology, invertebrate assemblages and Annex 1 bird species. The condition assessments have been quality assured by relevant habitat and species specialists and/or responsible officers.

An outstanding risk requiring further evaluation, is the application of trend qualifiers (sub-categories of favourable or unfavourable) to feature conditions. Unfavourable qualifiers are currently determined on management activities and are assigned to units where it is practical to gather all ongoing management information. This is seen as applicable to features on small sites, however, not for large complex sites. How condition trend qualifiers are to be integrated in WFA system remains unresolved and is discussed further in Section 5.2.1.

5.1.2. Can WFA provide sufficient data to answer all CSM attributes using NE’s available resources?

Risk: Monitoring at the whole feature scale might not provide enough data for all CSM attributes, using the resources available for NE.

Outcome: CSM guidance was designed with WFA in mind. As a result, WFA produces CSM-compliant monitoring. The pilots successfully gathering data for all CSM attributes monitored. The data gathered at the randomly selected stops, provides information for most attributes, however not all. WFA is not tied to only the random stop data, and with careful planning and other gathering techniques, WFA scale data can inform all attributes sufficiently with NE’s available resource. The pilots have fond that monitoring specification are tailored towards unit-based monitoring and some

attributes should be adjusted for a WFA approach. Finally, CSM was not designed for new technologies, and may need updating, as new technology can provide better condition insights than the current CSM recommendations.

In the uplands, NE have not historically used the approach outlined in the CSM guidance, rather opting to undertaking condition assessments on a much smaller scale (units) giving a more detailed picture of a particular location but masking the wider ecosystem scale impacts.

The methodology used in the pilots, follows uplands CSM. It also gathers sufficient data to be compliant with the coastal CSM specifications. The difference in data gathered between WFA and the traditional unit-based approach, is minor as the same questions are asked at each stop. The key difference is that stops are less frequent per area covered. This decrease in stop frequency inevitably reduces the data gathered and as a result, reduces our understanding for some attributes. However, sufficient data is gathered for robust condition conclusions. It also is a trade-off for efficiency, and therefore will allow more monitoring.

The main attribute that cannot be answered with WFA stop data is feature extent. This attribute has arguably never been satisfactorily addressed when using stop data even when monitoring at the unit scale. The use of EO allows extent of many features to be mapped and provides better quality data. For features that EO may not be applicable, such as distinguishing between calcareous grassland types, other approaches may be required.

Two other types of attributes have been noted as not confidently answered with stop data only. Firstly, the ‘process’ attributes where natural processes such as succession and movement of features are monitored. The methodology of returning to the same sample stops each survey event, means that early succession cannot be readily picked up. Secondly, where the attribute relates to specific sub-areas of a habitat. If samples are selected at random across a feature, surveyors may not have enough data from the sub-section of a feature in question. It is worth mentioning that these attributes are difficult and require tailoring of methodology, even when monitoring at the unit scale. For both situations where attributes could not be immediately answered by stop data, we found alternative data collection methods. In many cases this provided data with a higher degree of certainty and confidence. These difficult attributes are not barriers to WFA, as careful planning of routes taken when surveying, and the use of new technologies are able to collect satisfactory data.

Illustrative examples of these are:

Feature: Saltmarsh

Attribute: Vegetation Structure: zonation of vegetation

Target: Maintain the range of variation of zonation’s typical of the site.

This target requires data that can be easily missed when visiting relatively few randomly sampled stops. The relative infrequency of stops, and the mobile nature of saltmarsh pioneer zone, reduces the confidence in having sufficient data.

Pilot Solution: The data to inform this attribute can be gathered sufficiently from survey data if the methodology is slightly adapted. This would involve gathering data between stops and having routes that act as transects across zonation. Careful preparation of attributes can ensure routes collect sufficient data. The pilots took an alternative approach, using EO. Drones were used to fly

transects spanning from saltmarsh pioneer zones to the mid and upper marsh, producing ortho mosaic images. The image transects made it possible to identify the range of zones present in the saltmarsh, providing a much higher resolution than earth imagery, also allowing accurate remapping of the saltmarsh and its extent. Oblique imagery taken at 3-meter height was used to identify key indicator species in the pioneer zones; *Anglica spartina*, *Puccinellia maritima* and *Salicornia europaea* (Figure 8). This data used in conjunction with WebMap2 earth imagery made it possible to accurately map the zonation of the Duddon Estuary SSSI saltmarsh as well as increasing surveyor safety.

Feature: Humid Dune Slacks

Attribute: Vegetation structure: range of zones

Target: All humid dune slack communities should be present – from embryonic dune slacks with a high percentage of bare ground to those with more closed vegetation and up to 33% cover of creeping willow *Salix repens*. Early dune slack successional stages at least occasional.

This target is recommended to be gathered by a visual assessment during a structured walk. The nature of infrequent random samples means that observations of all dune slack stages can be missed. Alongside this, if the methodology of returning to the same stops each survey session is adopted, the stops will be skewed to more mature slacks than embryonic overtime.

Pilot Solution: There are multiple approaches to gather the data for this attribute. The first and most simple is planning the walks between stops to cover the habitats that dune slacks are present. The second approach adopted in the pilot was the use of EO, using CASI and LiDAR habitat maps that mapped creeping willow and bare ground. These maps made it possible to identify mature slack and highlight the absence of immature dune slacks.

It is believed that all attributes can be addressed sufficiently, with careful planning and identification of the more difficult attributes. It is also concluded that new technologies can often be used to confidently answer many ‘difficult’ attributes.

Alongside the specific examples shown above, the pilots have highlighted the need to assess and evaluate monitoring specifications. The current suite of monitoring specifications are in varying degrees of completion and they are tailored to unit assessments rather than a whole feature assessment. The changes are often subtle but can improve the data gathered and increase the applicability of data for WFA. A simple example could be changing methodology so that data is gathered at the 30m scale opposed to a $2m^2$ quadrat.

A final note on attributes is that CSM guidance was not designed for the use of new technologies, and as such many of the attributes/ecological parameters could be answered quicker and more informatively by adopting new technology. This is discussed further in Section 5.3.

5.1.3. Does WFA sufficiently identify Threats, Adverse Condition Reasons (ACRs) and ongoing Remedies and Actions?

Risk: Moving to WFA will reduce the ability to accurately identify ongoing Threats, Remedies and ACRs.

Outcome: The 2021 pilots suggest identifying Threats, Remedies and ACRs is possible in WFA. A change in methodology to make this data collection more focused will be trialled in the 2022 pilots.

A key part of condition assessments is the identification and tracking of Threats, ACRS and ongoing Remedies and Actions. The inability to do so in moving to WFA was identified as a potential risk. The results of the pilots suggest confidence that WFA can successfully identify ongoing issues. In Section 4.3, within Table 4, 5, 9 and 10 are examples of recorded pressures for both specific features and specific units, gathered as part of the pilot. It is expected that with a slight adaptation to the methodology, the 2022 pilots will reliably collect this information across the entire SSSI, for all units.

It is proposed that the survey methodology will be adapted to ensure surveyors visit every unit in the SSSI. This 'unit visit', can be seen as a management focussed site check/rapid assessment, where the surveyor isn't specifically collecting data to inform the feature condition, as this is provided from stop data, but rather to collect data to inform management and identify pressures and ongoing actions. Pre-survey, surveyors will have a list of identified Threats, ACRs and Remedies for each unit they visit, acquired through exporting CMSi data. This proposed change to the pilot methodology will be tested for its practicality and success in the 2022 pilots.

5.1.4. How do the conditions assigned via WFA, compare to the conditions assigned via the unit-based approach?

Risk: The data collected from WFA, might provide drastically different results to condition outcomes gained from unit-based monitoring, potentially being an indicator of inaccuracy.

Outcome: Reliable comparison between historic unit conditions and feature conditions gained via WFA were not possible, due to lack of reliable historical data and as the methodology used in the pilots did not assign unit-specific feature conditions. Changes to methodology for the 2022 pilots will hopefully allow comparison. Comparison between the least favourable business rule (LFBR) determined feature condition, and those acquired via WFA do not indicate worrying differences and the differences that are present are most likely due to limitations in the LFBR.

A comparative exercise between the data gathered via WFA and unit-based approach would be beneficial to ensure the WFA results are not significantly different to unit-based results, without clear justification. The ability to undertake this exercise is however limited due to old and varied unit-based information, and that in these pilots WFA did not produce unit conditions.

Comparison can be done however, between the feature condition gained during the pilots, and the calculated feature condition baselines, that have been produced via the LFBR; as per consultation with MLG in 2021. The least favourable business rule, is the agreed methodology in which NE will assign baseline feature conditions using existing unit condition data. A feature will be assigned the same condition as the least favourable unit in which the feature is present on a SSSI. Below shows the feature conditions calculated via LFBR and the condition calculated during the WFA pilots. Light red highlights the features that have differing conditions, light grey is where comparison is not possible.

The differences between the LFBR and the pilot feature conditions can be due to multiple different reasons including but not limited to; the age and gaps in LFBR data, survey types used, and the tendance for LFBR to be unfairly weighted towards small, local condition issues. Due to these limitations this comparison provides only limited useful information.

Only three features have different condition (excluding trend qualifiers), and all three found the feature to be favourable when before unfavourable. This is expected, as the LFBR tends to bias condition towards a lower favourability condition, due to the weighting that single unfavourable unit can have on the overall condition.

A more in-depth comparative exercise will be done in the 2022 pilots, as these pilots will involve assigning unit-specific conditions, as well as feature conditions. The unit-specific conditions arising from WFA can then be compared to the existing data sets. This approach is outlined in Section 5.2.

An ideal comparative exercise, would have been monitoring the SSSIs at the same time, using unit-based approach and feature based approach. This however was deemed too resource intensive and expensive.

Table 12: Condition comparison between example LFBR and pilot feature condition.

Monitored feature	Least Favourable Business Rule Feature Condition	Pilot Feature Condition
Duddon Estuary SSSI		
Coastal Geomorphology	Favourable	Favourable
Dune Slacks	Unfavourable no change	Favourable
Fixed Dune Grassland	Unfavourable no change	Unfavourable
Natterjack Toad	Unfavourable declining	Unfavourable
Saltmarsh	Unfavourable declining	Favourable
Sand Dunes	Unfavourable no change	Unfavourable
Vegetated Shingle	No condition	Favourable
Dune/Dry Heath	No condition	Favourable
Nidderdale SSSI		
Aggregations of breeding birds - Merlin, Falco columbarius	Unfavourable - Recovering	Unfavourable
Assemblages of breeding birds - Upland moorland and grassland without water bodies	Unfavourable - No Change	Unfavourable
Blanket bog and valley bog (upland)	Unfavourable - Recovering	Unfavourable
Subalpine dwarf-shrub heath	Unfavourable - Declining	Unfavourable
Upland oakwood	Unfavourable - Recovering	Favourable
Wet heath (upland)	Unfavourable - No Change	Unfavourable
Short sedge acidic fen (upland)	N/A	Unfavourable

5.1.5. Does the information gathered fit with what landowners/Area Teams know of the sites? Do they support it?

At the time of this report being written, the results discussion with landowners and areas teams has not occurred. This is principally due to the delays in contracts, with the condition assessments only being finalised recently. ATs and landowners will be provided with the results, and their feedback will be used to identify if the pilot's findings align or differ. If the results differ, the next step will be identifying why, with a focus on changes that can be adopted for the 2022 pilots.

5.1.6. What statistical confidence can be reported using the WFA approach?

The approach required when reporting on the statistical confidence of condition, depends upon the type of data used to make the decision. The condition assessment made for Nidderdale SSSI, followed the upland CSM guidance, where condition is determined in a stop-by-stop approach. In brief, each sample stop is assigned a pass (if all attributes pass) or fail. To say a feature is over 90% favourable by area, 28 randomly selected stops must all pass. This would have an associated 95% confidence.

However, reporting statistical confidence for the condition of Duddon Estuary SSSI, isn't so simple. This is because condition is determined in an attribute-by-attribute approach, as described in the coastal CSM (Saltmarsh and Sand dune). In brief, data is collected for each attribute at each stop. A mean for each attribute is then produced (when applicable), which is assessed against the target and provides data to decide if the attribute passes or fails. To say a feature is favourable, all attributes must pass. This approach, using means to ascertain favourability, cannot have the same statistical approach applied as used in the uplands.

Statistical confidence can be produced for this data but would require a different approach. This would likely require not only the number of sample points, but also the range and distribution of data involved to be considered. If a novel approach cannot be found this would be considered outside the requirement for condition assessments and NE, partially as it would be extremely time consuming and require specialist help for advisors. The Duddon Estuary SSSI pilot would have over 55 individual datasets for only four features, each requiring analysis. This is further made difficult, as not all attributes produce quantitative data and cannot have means calculated, resulting in a variety of statistical approaches being required, each attribute requiring tailoring.

Perhaps for these reasons, the Coastal CSM is not designed for statistical rigour stating,

> *"*The recommended method of selecting the number and location of stops is not intended to have statistical value, and the final condition of the interest feature is not simply the average of the condition of each stop. On the contrary, each stop should contribute to improve the assessor's overview of the state of the site."

Natural England is an evidence-led organisation, part of which is making decisions backed up by best available evidence. When assessing condition in line with CSM guidance, statistical rigour in combination with key insight provided by assessors, may offer the best available evidence as statistical methods alone may prove infeasible.

Within these constraints however, further work is needed to ensure statistical power is maximised across CSM assessment methodologies. This will involve evaluating options for data gathering and presentation to ensure NE is reporting confidence in our findings. The 2022 pilots will commission time from Data Science Services to help develop this.

5.2. Ability to inform management from the data collected in WFA

5.2.1. Does the spatial resolution of WFA data enable decisions about management to be made?

Risk: WFA does not produce enough information at the appropriate scale, to reliably allow NE to inform management. By producing a feature condition, we will not be able to identify where within a SSSI the issues are occurring, and therefore cannot inform management to bring about positive change.

Outcome: The 2021 pilots have not gathered enough information from all locations to reliably inform management across the entire SSSI. However, the pilots have resulted in a proposed change to the methodology, which will allow the gathering of data at an appropriate scale inform management. The most appropriate scale available, taking NE's system constraints into account is the unit. The key change will be the production of unit-specific feature conditions, alongside a reported whole site feature condition. Unit-specific conditions may differ from the overall feature condition and will provide indication and reporting of localised management issues, through the identification of pressures and localised condition variation. The result will be reporting of condition at two scales; the whole site feature condition and the feature condition at the scale of the unit.

Central to the aims of the pilot is to assess whether sufficient information can be gathered to support management decisions. This is key to condition monitoring and predominantly takes the form of identifying ongoing Threats, Remedies and ACRs. The ability to gather this information is discussed above in Section 5.1.3.

Informing management and providing feedback to landowners of the condition of their land, goes further than just identification of Threats, Remedies and ACRs. Key to this management feedback, is the assigning of unit-specific conditions, to which stakeholders are practised. It is proposed that WFA should continue to assign unit-specific conditions alongside feature condition, and it is expected that the mechanism to do so, does not significantly increase the cost and time spent surveying. The benefits will include those gained from WFA and the associated landscape scale understanding for feature condition, as well as management level understanding and reporting at a unit level. The unit-specific conditions will be greatly influenced by ongoing pressures and management.

Natural England is already committed to producing unit conditions for the MLG until 2025, concurrent to feature based assessing. Longer term there is a requirement to be able to report on area for the 25YEP and the 30 x 30 targets.

A unit-specific condition cannot be recalculated from the raw data collected in WFA, as to be statistically robust, it would require 29 stops per unit and therefore lose all benefits of time and cost saving in the shift to WFA.

The mechanism proposed is that by default all units receive the feature condition that has been calculated from the WFA. There is then the opportunity to assign a unit-specific feature condition, that can vary from the whole site feature condition. The unit-specific feature condition may remain the same as the overall feature condition or may differ to reflect localised condition issues (issues that may have been diluted through the whole feature assessment approach), observations and

unit-specific pressures (recorded as part of the survey) or understanding of long-term management. It also allows the application of professional judgement in condition assessment decision making. This proposal does not require extra data gathering but does require changes to the methodology used in the 2021 pilots.

As explained in Section 4.3, the system for recording Threats, Remedies and ACRs is being revised. The new format of pressures and actions will be compatible with the above proposed methodology and expected to be a better fit.

Once the data has been gathered with pressures and actions recorded and feature conditions assigned, the surveyors will have all the information with which to assign unit-specific feature conditions. It is expected that this task would be relatively straightforward, as a surveyor will have the raw data from stops in the unit (if applicable), the overall feature conditions, a list of all pressures and actions on going in the unit and notes made by the relevant surveyor. Currently, the unit is assigned an overall condition taking into account the condition of its constituent features following the least favourable business rule. Whether this is continued, in WFA monitoring, is under further discussion both internally in NE and with external stakeholders.

As identified in the results in Section 4.3, the ability to assign condition trend qualifiers (sub-categories of conditions) to features remains unresolved. Current NE guidance requires that unfavourable features are assigned either unfavourable declining, no-change or recovering qualifiers. For the recovering trend qualifier to be assigned, the current unit-based NE guidance is that

> "based on the surveyor's judgement and the best available evidence, **all** the necessary management mechanisms are in place to achieve favourable condition".

This guidance is designed to be used at the unit scale, and NE need to be confident that this approach is still relevant when thinking about management at the whole feature scale. The pilots have found that this guidance is not compatible with WFA when analysing large and complex sites, as having knowledge that *all* management is in place for a widespread feature, with many landowners is unlikely. It is not seen as an issue for small sites, where all management information can be gathered. In the new methodology proposed, the unit-specific feature conditions can be assigned unfavourable qualifiers, as per the existing methodology and rationale, but the whole site feature condition will only have the ability to be assigned favourable or unfavourable, without qualifiers. Condition of simply 'favourable' or 'unfavourable' for features are in line with the Statement on CSM 2019. The methodology to assign unit-specific feature condition categories will be trialled in full in the 2022 pilots.

Preliminary exploration of this methodology indicates that the data gathered from WFA is sufficient to produce unit-specific feature conditions. In the 2021 pilots, surveyors did not visit all units, however, below are examples of units which were, and in which pressures were identified (recorded in detail in Table 5 and Table 10).

Table 13 and 14 below are examples of how assigning unit-specific condition could work, by taking the feature condition, and using recorded pressures and local issues to assign unit-specific condition.

Table 13: Duddon Estuary SSSI - unit-specific feature condition examples

Unit	Features present	Feature condition	Pressures and local issues	Unit-specific feature condition
10	Sand dunes	Unfavourable	- Non-native invasive species (*Rosa rugosa*) - Encroachment by development	Unfavourable - No change
	Dune grassland	Favourable	- Encroachment by development	Unfavourable - No change
	Saltmarsh	Favourable	- Recreational damage and erosion	Unfavourable - Declining
			Unit-specific condition:	**Unfavourable - Declining**
8	Sand dunes	Unfavourable	- Loss of nature reserve staff	Favourable
	Saltmarsh	Favourable		Favourable
	Dune Slacks	Unfavourable		Unfavourable Recovering
	Dune grassland	Favourable		Favourable
			Unit-specific condition:	**Unfavourable Recovering**
28	Sandwich Tern	Favourable	- Recreation/water sports - Fly tipping	Unfavourable – No change
	Assemblages of breeding birds	Favourable	- Recreation/water sports - Fly tipping	Unfavourable – Declining
			Unit-specific condition:	**Unfavourable – Declining**

Table 14: Nidderdale SSSI - unit-specific feature condition examples

Unit	Features present	Feature condition	Pressures and local issues	Unit-specific feature condition
24	Blanket Bog	Unfavourable	- Game Management and Burning - Drainage	Unfavourable - No change
	Wet Heath	Unfavourable	- Lack of management (bracken encroachment)	Unfavourable - No change
			Unit-specific condition:	**Unfavourable - No change**
40	Blanket Bog	Unfavourable	- None recorded	Unfavourable Recovering
	Dry Heath	Unfavourable	- None recorded	Unfavourable Recovering
			Unit-specific condition:	**Unfavourable Recovering**
29	Blanket Bog	Unfavourable	- Game Management (Burning and cutting)	Unfavourable – No change
	Dry Heath	Unfavourable	- Game Management (Burning and cutting)	Unfavourable – No change
			Unit-specific condition:	**Unfavourable – No change**
45	Blanket Bog	Unfavourable	- None recorded	Unfavourable Recovering
	Dry Heath	Unfavourable	- None recorded	Unfavourable Recovering
			Unit-specific condition:	**Unfavourable Recovering**

5.2.2. Will separate visits be required for complex management decisions?

Risk: WFA may results in extra survey visits being required for complex management decisions.

Outcome: Extra survey visits will be required for complex management decisions. Condition Assessments are not intended to provide information for all decisions, but rather to provide the background and context upon which detailed decisions can be addressed including further visits.

SSSI condition assessments are not designed to provide all information to inform complex management decisions, nor are they expected to provide information to inform agri-environment schemes. Shifting to WFA does not change this and cannot provide the required data to inform complex issues on the many wide ranging and unique protected sites across England. Condition assessments and WFA provide the background understanding and data, from which NE can then

address specific issues with an understanding of the context of the wider feature conditions. It will also identify and flag specific issues, which will help target additional visits to gather specific data or understanding. By doing so, it will also make these follow-up visits less onerous, as the specific on-site issues and locations may already be known. The ability to narrow down the survey area is particularly beneficial in the uplands where units extend over very large areas.

It is also important to clarify that WFA does not need to be completed in a short period of time. The pilots were completed in an intense week of monitoring, but this is not a requirement. Collecting data for WFA can be spread out, so to accommodate NE staff other work commitments. Data does not need to be gathered in one season, even for the same feature, but when a feature condition is assigned this must take into account all the data collected. The 2022 pilot at Salisbury Plain SSSI is anticipated to be spread out over several weeks. The frequency that separate condition assessments will be undertaken (e.g. the return period) will be detailed in the long-term monitoring plan will be determined via a risk-based approach, considering habitat types and localised risk issues. The long-term monitoring plan will also be designed to consider the frequency/availability of external data sources that are used in condition assessments. For example, coordinating NE saltmarsh condition assessments, with the EA's production of new saltmarsh EO mapping.

5.3. Use of new technologies to support condition assessment

Risk: Natural England cannot use new technologies to provide the correct type of data at the resolution required to support SSSI condition assessments.

Outcome: It was possible to trial the use of new monitoring technology in support of a condition assessment. Technology provided the primary source of data for some features, such as coastal geomorphology and provided supporting data for multiple others. It has been found that new technologies are unlikely to reduce time monitoring but can provide better quality data. Due to the SSSIs chosen for the pilots, technologies such as DNA and acoustic monitoring were not applicable. To adopt new technologies into NE common practise, an increase in new technology specialists will be required, such as GIS specialists. The pilots have also highlighted the need for GIS competency in ATs, to take advantage of new technology advantages.

The various roles and implications of new technologies in producing condition assessments have been provided below in more detail.

5.3.1. Does using new technology alongside traditional methods, reduce costs and maximise efficiency?

For some designated features, Earth Observation (EO) can gather data required for attributes where ground surveying cannot. However, for most features EO provides supportive data towards condition assessments, and therefore must be used alongside traditional methods.

Because of that reason and because often EO approaches necessitate ground truthing, surveyors will still be required to visit a site to complete an assessment. When this occurs, surveyors will have the opportunity to gather the attribute information in the traditional approach, and so analysis is needed to identify the gains in data quality and weigh them against any potential additional costs of EO.

Due to the required field work, it is unlikely that EO methods will reduce the amount of time taken to assess a site. For example, scrub analysis using LIDAR for Nidderdale SSSI took Natural England Evidence Earth Observation Service (NEEEOS) 7 days to complete, whereas collecting this data at each stop would take the surveyor roughly an extra 15 seconds per survey point. Much of the work undertaken by the NEEEOS included first-time development, accounting for a large proportion of the time taken. Now the process is developed and written up, running the same project will be much quicker to complete. Looking forward, having a dedicated national resource that are specialised in EO will further increase the efficiency, and reduce resource requirements.

Time efficiency aside, the key benefit to EO is the potential to provide greater quality of data and understanding of assessed attributes across an entire feature, opposed to having a representative sample as is done with stop data. An illustrative example is the “percentage scrub” attribute, where LiDAR (or aerial photography) can be used to produce a percentage cover within set metrics and boundaries. This further reduces bias and increases replicability across sites and over time. The results are more accurate and produce more reliable condition assessments. Figure 3 shows a map of Sandscale Haws in the Duddon Estuary, using LIDAR data from the 2019 coastal habitat mapping work produced in collaboration with the Environment Agency.

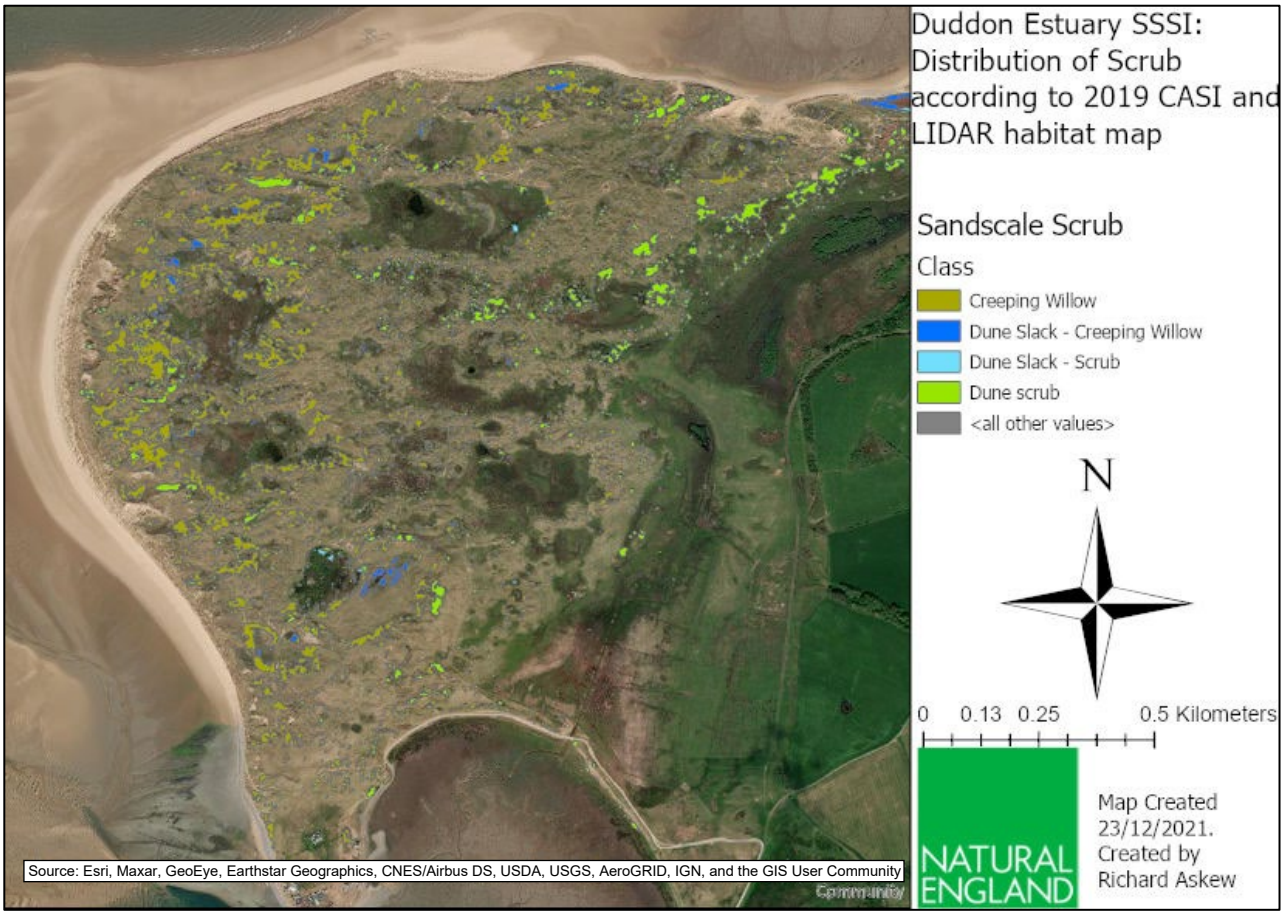


Figure 3: Scrub and bare sand distribution across Sandscale Haws at Duddon Estuary SSSI.

The greater spatial coverage of EO data opposed to field methods, also provides more information on where pressures are located, therefore producing more accurate and complete identification of pressures. This data will be valuable for ATs and NE by providing a better understanding of the

site and its management needs. In this instance, using technology does increase efficiency as to gain a similar understanding or quality of data from ground survey, would take longer.

When used in a full condition assessment, new technology such as EO can be reliably used to replace monitoring of some attributes, and in many cases provide a higher resolution of data. It can also provide valuable data on the spatial distribution of features. EO data makes it possible to better target future survey efforts by verifying and updating feature mapping. A further key benefit of EO data, is to allow the targeting of site visit, highlighting areas for extra attention or for specific data collection. A key point to note, is that most often EO must be used in collaboration with site visits, as each approach have different merits and strengths.

All EO work was conducted within NE, using datasets already available, incurring no additional contract costs. For certain attributes (e.g. extent, zonation and scrub) using EO can be more cost effective as the work can be conducted from a desk rather than in the field saving staff resource. This does depend however on the availability of free and appropriately licenced third-party data, commissioning surveys and paying for high resolution satellite images which can add significant costs.

The pilots did not trial the use of eDNA, but it is a good example of where the technology has the potential to provide a cost-effective method compared to traditional results. Fruiting fungal body surveys can cost up to £2000 for a 15 ha site, whereas an eDNA soil survey for site that size would cost approximately £840. It is still difficult to compare between the methods as they are likely to produce different species lists and until eDNA methods are fine-tuned, meaningful comparisons are not possible. DNA analysis at present can only provide presence/absence data and therefore cannot always be used on its own to substitute traditional methods for a condition assessment. However, presence/absence can suggest whether a species has completely disappeared or whether further in field surveys are needed, potentially saving resource.

As well as detailed CSM-compliant surveying, new technologies are applicable to, and will improve the quality of other monitoring methods such as rapid assessment. In such surveys EO can be used to assess some attributes rapidly and reliably such as extent, as well as highlight specific areas of concern, that potentially will require extra attention during the site visit.

5.3.2. Can new technologies be used as a tool to directly answer questions relating to CSM guidance? E.G. Feature extent and scrub mapping using LiDAR data?

Not all the data produced by new technology during the pilots are available for this report. However, it is still possible to discuss the potential data outputs and their use in SSSI feature assessments. The pilots have shown the potential to use EO for answering specific CSM monitoring attributes, and there are certain features where EO techniques provide more accurate and informative data that ground survey work.

One example from the pilots, is the used of EO to undertake change analysis for the coastal geomorphology feature. Figure 4 shows the information gained from EO, which are unattainable using surveyors on the ground. More commonly however, is when surveyors on the ground can produce the data for a condition assessment, but EO can provide greater spatial coverage and assess condition across a whole feature, therefore producing better quality data. Using the CSM

monitoring approach as a guide, the pilots were successful in using EO data to assess the following attributes:

- Natural evolution of feature for Coastal Geomorphology (Figure 4)
- Saltwater Inundation of Ponds for Natterjack Toads (Figure 5)
- Extent for all features (Figure 6)
- Occurrence of Burning for blanket bog, wet heath and dry heath (Figure 7)
- Indicator Species for the saltmarsh pioneer zone (Figure 8)
- Percentage Scrub Cover and Percentage Bare Ground/Sand for features where LIDAR coverage (scrub) and CASI (bare ground) data is available (Figure 9)

As mentioned, some of the above features can be monitored using traditional stop data, but the pilots have found that EO provides more informative and reliable data, by taking into account larger areas when making the assessments and are also less subjective to surveyor bias or error. Other features such as natural evolution of feature for Coastal Geomorphology, cannot be monitored accurately using traditional approaches, and so EO must be used to be confident in our reporting.

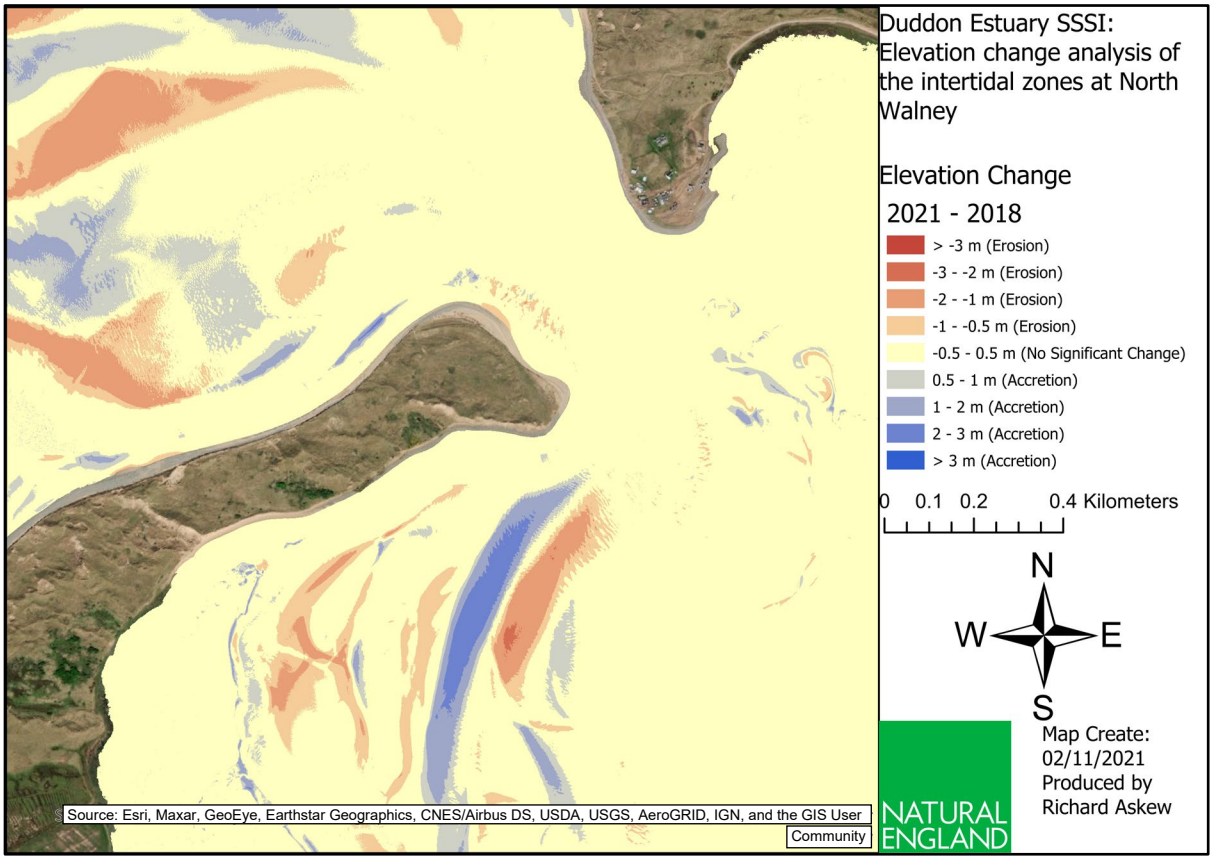


Figure 4: Map showing intertidal elevation change used in coastal geomorphology

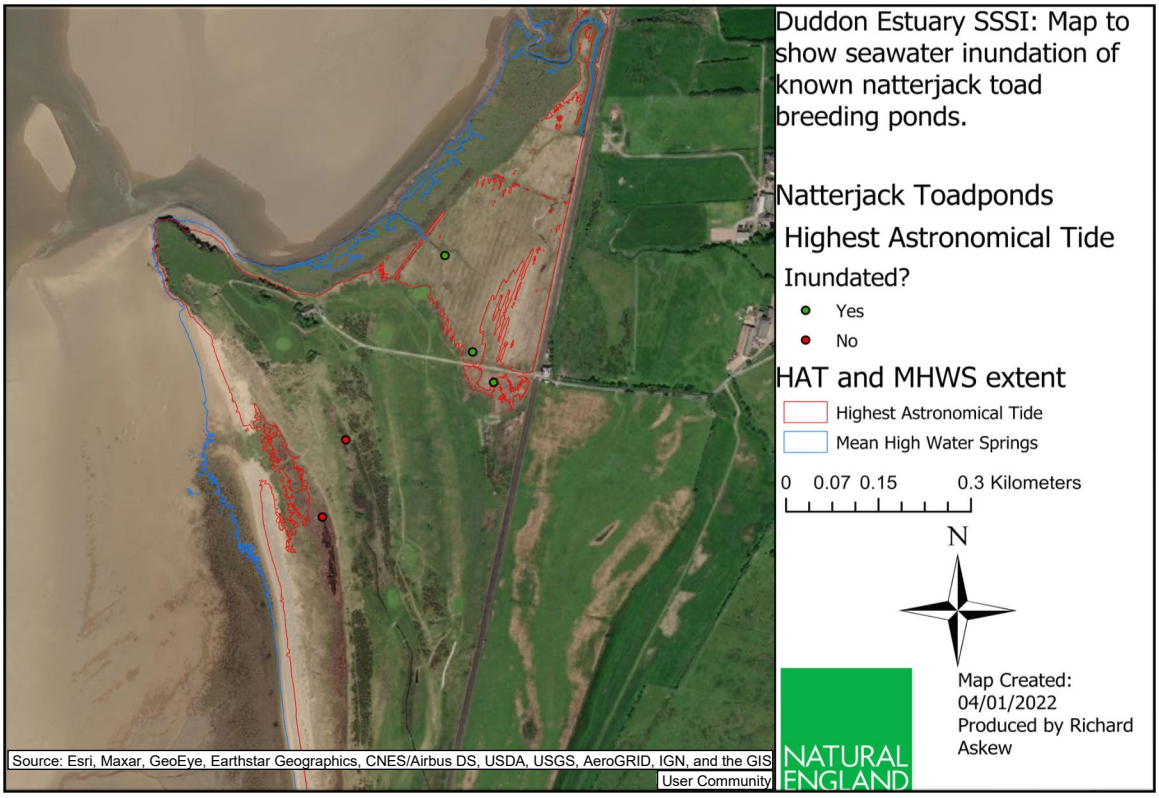


Figure 5: Natterjack toad ponds experience seawater inundation

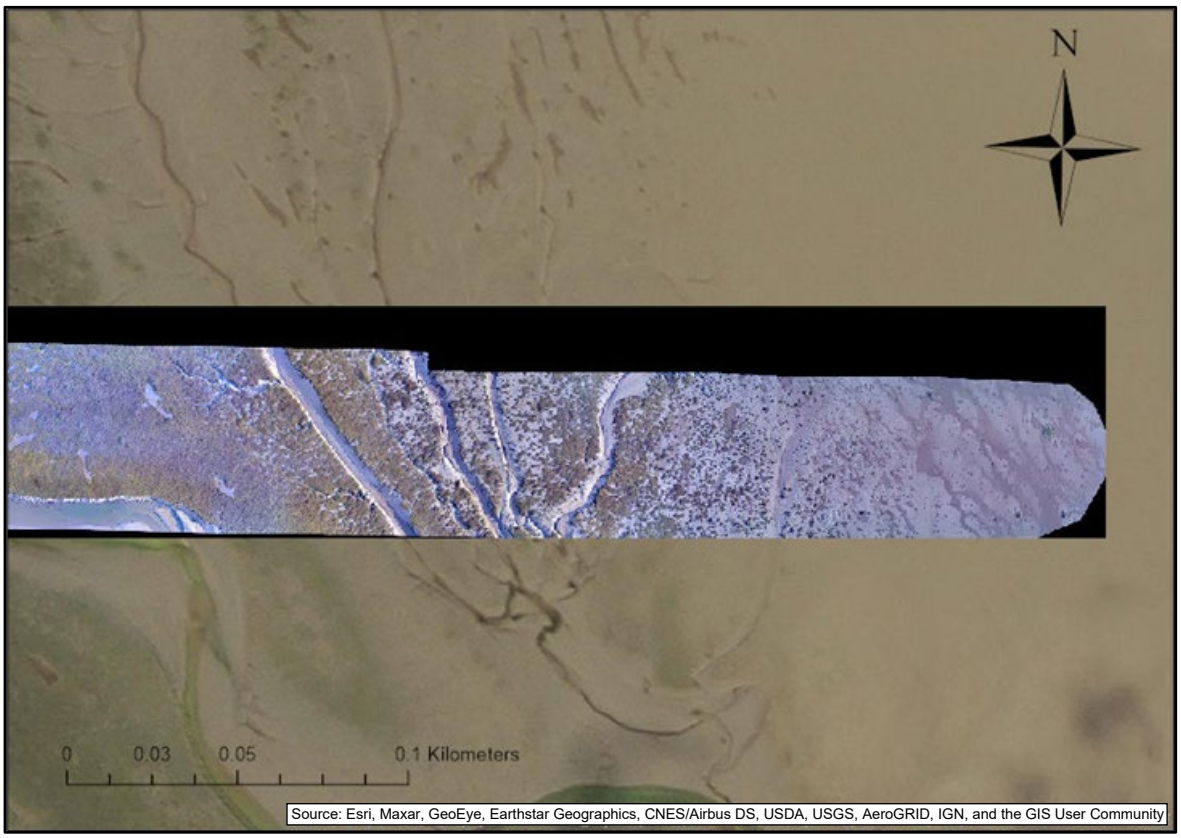
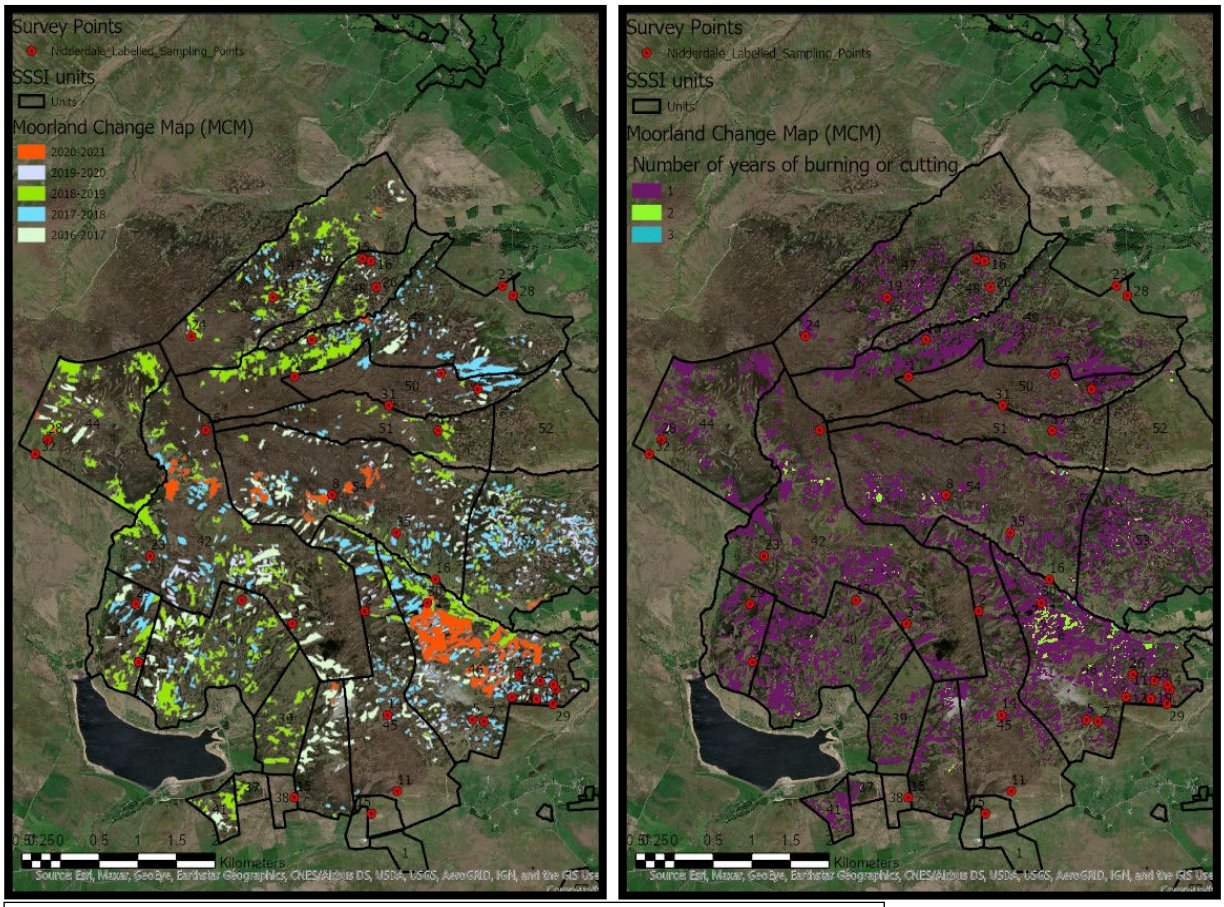


Figure 6: Drone derived ortho-mosaic transect, overlaying satellite imagery informing saltmarsh extent



Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 7: Distribution of change across a section of Nidderdale SSSI, including multi-year burning analysis.

Figure 8: Drone images; left *Salicornia* and *Puccinellia*, right *Spartina anglica*

Drones can be considered a subsect of EO and they were used to provide data from inaccessible places. Of most notes, was the saltmarsh on the Duddon Estuary, where images produced were used to help remap the extent of saltmarsh and to identify indicator species in the pioneer zone.

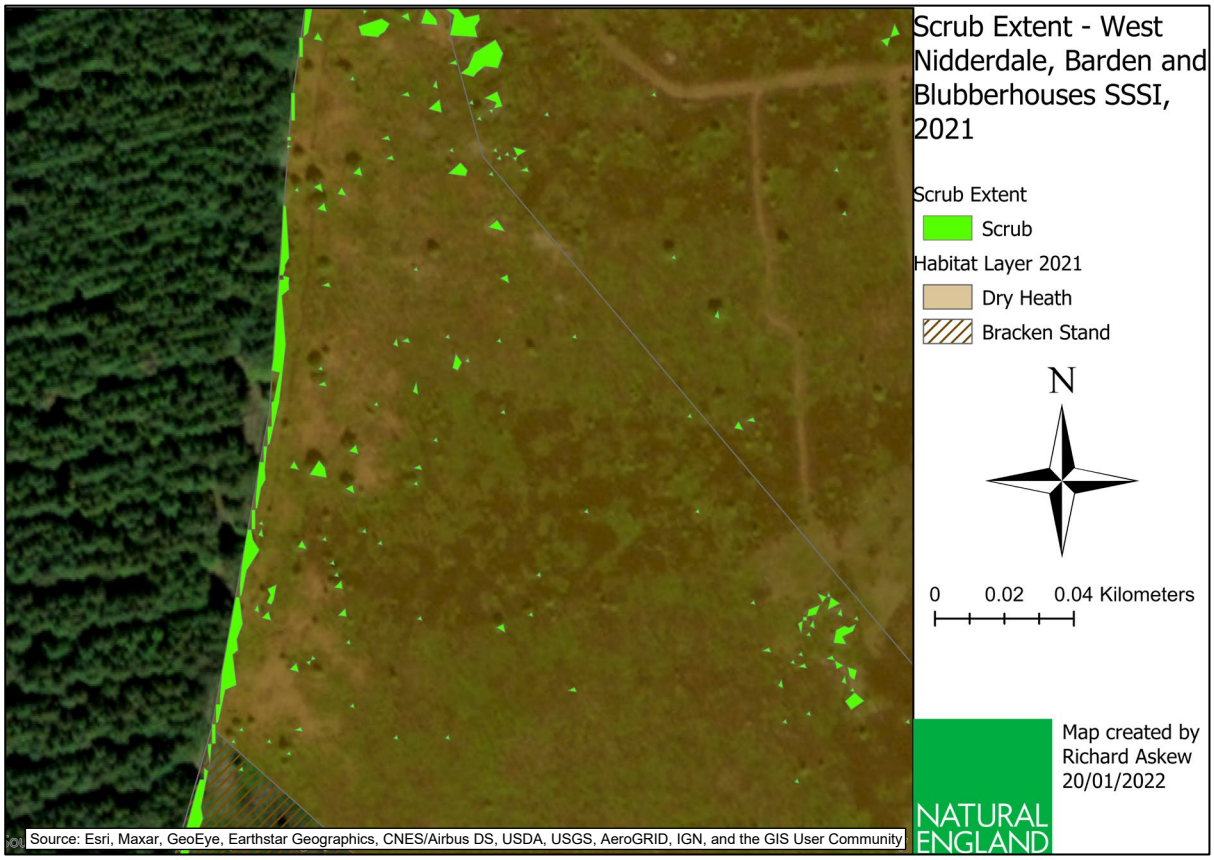


Figure 9: Scrub extent using LIDAR showing scrub encroachment onto dry heath from a neighbouring coniferous plantation

EO provides many benefits because of the data used is gathered across an entire feature, opposed to data coming from a reduced subsect via random sample stops. Once the initial mapping of a feature has occurred and analysis has done, the understanding of attributes such as scrub extent can be used in subsequent monitoring surveys. These will be detailed baselines and improve the quality of condition assessments going forward. EO improves understanding of spatial and temporal changes across a site. This whole feature analysis will also provide NE advisors with direction towards specific regions of a SSSI that need extra focus due to potential condition issues or management.

There are clear and substantial benefits in using new technology to assist in condition assessments. However, consideration is needed on how best to quantify and integrate the data gained, into a formal condition assessment. This will include the incorporation of new technology outputs into CMSi and NE's other IT systems to ensure the data is available for other purposes across the organisation. Development of NESS is underway to add the functionality of taking phones in surveys and uploading these to CMSi. This is the first step of new technology integration. Further details of system improvements are outlined in Section 5.5.

5.3.3. What are the limitations of these new technologies and how do they need to work alongside gathering field data?

It was only possible to trial the use of EO during the pilot studies. Given more opportunities, testing other technology such as DNA methods or acoustics will be a priority. The trials did present the

opportunity to test EO methods in the traditional sense (feature extent) and to test new approaches to SSSI feature assessment (elevation change mapping for coastal geomorphology).

The ability to use EO, and the confidence in its outputs vary between habitats and between sites. For example, when assessing extent, some habitats such as saltmarsh or woodland are relatively easy to distinguish due to their composition and distinctive structure, whereas other features such as wet and dry heath in upland sites, where each habitat is determined primarily by peat depth, and therefore not observable from EO, are harder or impossible to map. This difficulty is exaggerated when factoring in degraded wet heath having the vegetation appearance of dry heath. Habitats will vary in their applicability for mapping via EO, and those habitats that are compliant with EO analysis will be found with time.

EO can be further limited due to poor baseline datasets. For example, to produce '% cover' of an attribute within a feature via LiDAR, the boundaries of that feature need to be known. This is not always possible if the site has not been surveyed for several years, or the habitat maps are outdated. The difficulties caused by lack of baseline data should not be considered a limitation of EO itself, but rather a requirement for their use by NE.

Reliance on third-party data, is another limiting factor in the use of EO. Natural England rely on LiDAR data collected by the Environment Agency geomatics team and if a SSSI is not within their flight plans, it might not be possible to request a flight in that area. Mapping of extent often relies on satellite imagery that varies in age and quality, which in turn influences the confidence of results. As previously mentioned, many aspects of EO require ground truthing which in some scenarios prevent EO monitoring from being a purely desk-based process. There are options for countering these limitations, and it will be important to use field data, new technologies and third-party data in conjunction, to reduce the individual limitations of each approach.

To make the most of third-party data it will be important to map out which features, and sites will be monitored as part of NE's national monitoring programme over the next 5-10 years. This would allow discussion with the third-party organisations and the potential for agreements in data sharing or MoAs.

EO data should be collected before a site visit is conducted, as this allows habitat maps to be updated and the analysis of attributes may highlight areas where the ground survey efforts should be focused. All the EO work during the pilots was conducted through the Natural England Evidence Earth Observation Service (NEEEOS). This presents its own limitation, that using earth observation techniques has a reliance on specialists. Natural England may not have the specialist capacity to carry out frequent EO analysis if demands increase through national EO adoption. This limitation can be mitigated through expansion of the NEEEOS, increase use of contractors, NE specialists or an increase in Area Team training.

The pilots have identified limitations in EO, but also have identified recommendations and requirements. Firstly, its recommended that EO data is digitised on a GIS maps, alongside habitat maps, providing an interactive tool that can be used to better understand feature conditions across a SSSI and be used to locate where attributes are failing. Third-party, contractor and field data can be amalgamated into the same map, to further our understanding of whole feature condition. As well as looking at ways to integrate monitoring technology data into CMSi and NE data storage, there should be considerations around how this data can be presented in the best way.

The next opportunity to trial technology in WFA should focus on using a wider variety of data outside of EO, such as acoustics and DNA. There needs to be a focus on gathering the data before a ground survey takes place, so to fully gain the benefits. Other forms of new technology are expected to be trialled in the 2022 pilots. It will be necessary to produce a set of standards and guidance for using new technology derived data in assessing feature attributes. The benefits provided by EO are clear, but work must be done to integrate it into our current systems. A further future aim will be to work with other CNCBs to review CSM attributes to accommodate the use of new technology as common practice.

5.4. Assessing time and cost expenditure of WFA compared to unit-based assessments.

Risk: Shifting to WFA could result in more time and/or costs for NE's monitoring programme.

Outcome: Comparison for time and costs saving is hard to undertake, due to the lack of conclusive baseline data for historic monitoring and inaccuracies in recording time spent on the pilots. To improve this data the 2022 pilots will ensure more accurately time and cost keeping.

Natural England's current approach to monitoring protected sites has weaknesses and is proving unsustainable to resource. The high resource requirement can, at least in part, explain the small number of units monitored over the last years. The percentage of units being assessed has fallen year on year since 2012, with less than 3% of units being monitored in 2016.

5.4.1. Timings

One of the drivers for the move to WFA is to increase the efficiency of condition assessments and ensure all features are assessed within acceptable timeframes. This will ensure that NE have all the information needed to be an evidence led organisation. For sites not deemed complex, the use of NESS, third-party data, the introduction of new technologies (including online GIS tools and AO) and the use of the rapid assessment survey approach will bring both cost and time efficiencies to the process.

Preliminary work by NE in comparing WFA rapid assessments and unit-based rapid assessments, found that WFA can cover more ground per hour than unit-based. The results and details of this work can be found in Annex 2. For these non-complex sites, the shift to WFA will still enable staff or contractors to gather all the necessary data to support management interventions. The incorporation of rapid assessments is expected to save resources in the monitoring programme, particularly when all the technological advances can be implemented.

The randomised stop approach used in the pilots for the uplands and the coasts has the potential to reduce the granularity of the outcome and could potentially require additional targeted sites visits to gather additional information to answer specific management questions. This needs to be set in the context of the current situation where 9906 SSSI units (as of November 2021) have not been visited for more than a decade.

Analysis of ORION codes (NEs time recording system) for the financial years 2015/16 and 2016/17 shows that each condition assessment took 3.6 days on average. This information has come from the '*Reforming Protected Sites Monitoring Project Evaluation Report (2017)'*, and the years (2015-

17) used are the best available at the time of writing, mitigating for impacts by Covid-19. There will be a lot of variability between assessment types included in these statistics, but it shows that the current process is quite resource-intensive and there should be potential to improve efficiency. Shifting to WFA is expected to bring about resource savings, and result in more sites being monitored.

The pilots provide the first insight into the time and resource expenditure of undertaking WFA for large complex sites. Table 15 gives a breakdown of time resource spent surveying. It must be noted that these times do not include the writing or procurement of contracts, survey preparation or the condition assessment write up. Further to this, as this was a pilot, considerably more time was spent in designing the new approach and in training staff with unfamiliar techniques. These factors make direct comparison difficult, and so should only be taken as an early indicator.

Table 15: Time spent surveying during the pilots

	Nidderdale SSSI	Duddon Estuary SSSI	Mean
SSSI Units	57	34	45
SSSI Area (ha)	13421.85	6785.95	10103.90
Mean staff per day	12.20	9.80	11.00
Total Employee Weeks (@37h)	13.52	9.19	22.71
Total Employee Days (@7.4h)	67.60	45.93	113.53
Employee days per unit	1.19	1.35	1.25
Total hours surveying	500.25	339.90	840.15
Minutes per hectare	2.24	3.01	2.49
Hours per unit	8.78	10.00	9.23
Days per unit	**1.19**	**1.35**	**1.25**

The key figure worth noting is the number of days per unit. For the pilots it is **1.25 days**. The mean of the financial years 2015/16 - 16/17 is **3.6 days**.

It must be stressed that these figures cannot be a directly compared, as 1.25 days from the pilot is the active surveying time, whereas the 3.6 day statistic include survey set-up, write-up and feedback. The report acknowledges the fundamental flaw that this makes in any comparative exercise, and therefore should only be interpreted as a rough illustration. The 2022 pilots will have greater accuracy in time recording.

Although these figures are not directly comparable, they provide an insight into the time expected to take for WFA condition assessments. It is regarded as highly unlikely that the preparation and write up of the two pilots, in addition to the 1.25 days spent surveying, would amount to more than 3.6 days per unit.

Multiple factors reduce the confidence in this comparison. The 3.6 days is a mean of all SSSIs units monitored and not just sites that are large complex upland or coastal sites, unlike the pilot data. Further to this, the 3.6 days statistic considers monitoring that wasn't CSM-compliant and therefore quicker and not comparable.

In 2021, as part of the national monitoring programme, estimates for how long surveying would take per unit, was produced to help ATs forecast. These figures encompass all survey types and

include the expected time saved from rapid assessments, as well as survey preparation, field work, write up and feedback. After a survey season, these estimates are largely viewed as accurate. Again, these figures do not allow robust comparison, but can be used as a guidance.

- Complex Site (per unit) – 2.5 days
- Medium Site (per unit) – 1.5 days
- Simple Site (per unit) – 1 day

There is an expected lag time in which NE staff will become familiar with the WFA approach, before the resource saving will be seen. The 2022 pilots will have more accurate time recording, using unique ORION codes to provide better comparative data.

It is worth a final note, that although the surveying for the pilots were done in an intense week, this is not the expectation, nor requirement for WFA. The data used in WFA can be collected over large time scale and therefore monitoring will be more compatible with other NE staff commitments.

5.4.2. Costings

Part of the move to WFA, is a focus on increasing NE's use of contracts and third-party data. These shifts are expected to create time savings but thought to increase costs. Analysis of the financial years 2015/16 – 16/17 report a programme spend for SSSI monitoring to be £769,500 (GiA Programme Spend) and £66,250 (GiA Innovation) resulting in a total cost, not including staff salaries to be £835,750. An average of 474 units were monitored in this time, resulting in a cost of **£1765.05 per unit**. Table 16 summarises the costs involved in the pilot, not including the staff salaries to allow comparison.

Table 16: Costs involved in the pilots

Costs	Duddon	Nidderdale	Mean	Comment
Units	57	34	45.5	N/A
Travel & Subsistence Costs	£4857.10	£6566.61	£5711.86	Expected underestimation as not all surveying staff included, however potentially overestimation as non-Area Team staff undertook the pilots and stayed in hotels.
Contracts Costs	£27037.44	£30143.46	£28590.45	N/A
Total cost	£31894.54	£36710.07	£34302.31	N/A
Cost per unit	£559.55	£1079.71	**£753.90**	N/A

The key figure worth noting is the cost per unit. For the pilots it is **£753.90**. The mean of the financial years 2015/16 - 16/17 is **£1765.05**.

These figures cannot be directly compared due to multiple factors including the pilots' figure being potentially underestimations due to incomplete data from staff, but also overestimations due to the requirement of one-time purchases such as new survey equipment and the cost of staff staying in hotels. Further to this, the financial years 2015/16 - 16/17 figure includes all survey types and averages all SSSIs. The variation in unit sizes and features present on different units will influence the cost of per unit reported. The figures preliminarily suggest however that WFA is less expensive than the unit-based approach.

It is expected that once WFA is adopted by NE, the initial costs and time taken will be inflated due to the initial learning of new approaches and systems. The costs can be further expected to decrease though increases in specialist staff for new technologies, established MoAs, contract specification templates being produced and guidance documents. Similarly, because of the 2022 SSSI training, it is expected that costs and time will be reduced through staff confidence and familiarity.

The 2022 pilots will not be able to provide robust forecasts of costs and times for all WFA, as it will be focussed on only two sites and not include all survey approaches. However, they will provide more evidence and help to indicate expected cost and timings.

5.5. Natural England systems capacity to adopt WFA

Risk: NE need internal systems capable of recording, storing and reporting data in the new WFA format.

Outcome: This risk is believed to be reduced, yet still outstanding, as development of NE's systems to accommodate WFA is underway but not completed or tested.

The key two systems that need to be capable of WFA are Natural England Site Survey App (NESS), and NE's Protect Site Database and Reporting System (CMSi and DSViews). The function of each and the requirements needed in development to facilitate WFA, are addressed below.

5.5.1. Is NESS capable of gathering data for WFA and is it fit for purpose?

NESS is the application in which survey data can be collected in the field and uploaded directly into CMSi. NESS is designed for CSM and as a result does not require significant changes. The development needed however, is to improve its functionality and usability. These are required to ensure that NESS is efficient and easy to use for all NE, as NESS should be mandated to reduce the double handling of data and reduce human errors involved in condition assessments.

The ability to currently undertake WFA in NESS, is possible through the selection of the 'whole site unit' rather than a specific unit when creating a survey event. The Survey and Monitoring (SAM) module allows the tailoring of surveys in NESS, so to ensure the data collected is in accordance with the monitoring specifications.

The pilot highlighted difficulties in data collection using NESS, resulting in the procurement for further development (See details in Annex 1). This work is being done by Exegesis Spatial Data Management (ESDM) and specification for the work has been submitted and is under ESDM review.

The ability to use NESS relies on attribute lists for features being produced and digitised. Currently, NE does not have a complete digital attribute list for all monitored features. This need is being addressed by the SSSI M&E team in 2022.

5.5.2. Is CMSi capable of gathering data for WFA and the associated data analysis and storage?

CMSi is the system which holds protected site condition and monitoring information. The data we maintain through that system is shared with partners and the public through the Designated Sites Views (DSViews) system. CMSi Desktop and DSViews are tailored to record and report our information at the unit level, and development is required to record and report WFA

CMSi Desktop will no longer be available sometime in 2024/25 and will be replaced by a new version of CMSi, called CMSi Web. Consequently, development for WFA is being undertaken in CMSi Web. Further details on CMSi Web development are in Annex 1.

Natural England are planning on undertaking WFA in 2022. As such, WFA capability will required before CMSi Web development is complete. The current CMSi version has undergone development to allow this interim period of WFA, both in recording feature condition and reporting through DSViews.

5.5.3. Other useful systems identified.

Other systems are available to NE to assist in data collection and analysis. They are not replacements of NESS/CMSi, but can offer solutions to some existing issues, such as problems caused by using paper forms and maps.

One system used during the pilots was ArcGIS Online (AGOL) which is an ESRI data collection and spatial analysis platform. ESRI is already widely used at NE and business membership is paid, resulting in no additional costs. AGOL was used in the pilots as a user-friendly mapping tool, providing a SSSI map containing all the survey points. The maps were linked to one of AGOL's survey apps called Field Maps App. This app provided the following functionalities:

In field navigation tool.

Georeferenced photographs, labels and field notes linked to the AGOL as mapping layers.

Drawing shapefiles, linked to AGOL. Especially useful when habitat mapping.

These functionalities proved useful when checking areas of unknown habitats and note taking of notable information (management, threats, notable species etc.). This reduced time spent in the field and improved the data gathered. The use of AGOL/Field Maps App will continue in the 2022 pilots.

AGOL will be used to produce an interactive map by collating the field, third-party and EO data sets. This data summary map will provide an effective overview of where threats and pressures are affecting the SSSI, and highlight which units require management interventions. The map is also a user friendly and accessible way of presenting condition monitoring findings. It is being explored whether the AGOL data sets can be incorporated in CMSi Web, when developed.

5.6. Natural England's existing database capacity to adopt WFA at a national scale.

Risk: Natural England's database of information is currently not up-to-date or complete, potentially impeding WFA national roll out.

Outcome: The lack of complete and reliable data held by NE produced multiple difficulty in the pilots and WFA. These included incomplete or inaccurate habitat maps, monitoring specifications and designated feature clarity. Many of these are already identified as NE issues with associated projects to resolve them.

The section below reviews the main database related issues encountered during the pilots. The issues are expected to not prevent WFA, but rather hinder its efficiency and produce resistance to WFA adoption by staff. These issues have already been identified in NE's data validation project and have associated projects working to resolve them.

5.6.1. Baseline maps

Up to date SSSI habitat maps are required for WFA, to allow allocation of random samples within habitats known extent. During the pilots, historic SSSI maps were used, but were found to be out of date, unavailable or incorrect.

The statistical approach used in the pilots, requires 28 stops per feature. The quality of the maps available, dictate the number of stops needed to be visited, to ensure this. This is because the better the map quality then the more likely a stop is on the correct habitat, and the worse the map quality the more stops need to be visited, allowing for stops being found to be on incorrect habitat. The pilots decided that 37 stops would be sufficient to ensure 28 stops fell in the correct habitat. As a result, a considerable amount of additional time was spent in the field. Good habitat mapping is not just an issue for WFA, but for many aspects of NE's work.

Evidence services are testing the feasibility of contracting out the creation of habitat maps for SSSIs, for use in monitoring. This is primarily focussed on digitising the maps from, or as close as possible to, the time of designation. If no maps are available, then the possibility of having new habitat maps produced is being explored. This was intended to be actioned this financial year, but due to the costs and delays in DEFRA procurement, it has been delayed. A key objective for next year is to re-assess habitat mapping digitisation and creation feasibility. The creation of a nationally accessible database with all SSSI habitat maps in one place, digitised and with associated shapefiles is seen as a future requirement for NE.

5.6.2. Monitoring specifications

Monitoring specifications outline the attributes and targets for the feature(s) of interest on a SSSI. The attributes and targets are selected to be representative and site specific. The monitoring specifications are dynamic documents and should be updated and changed as required. Duddon Estuary SSSI's monitoring specification was comprehensive and relatively up to date apart from its habitat maps, however, the Nidderdale SSSI monitoring specification was poor and incomplete, in a draft stage.

The Nidderdale SSSI monitoring specification was an issue as it was not clear what the monitored features, their attributes or the appropriate targets and baselines were. As a result, when planning the survey and preparing NESS, a generic upland CSM survey had to be used without site specific targets, resulting in inappropriate attributes monitored. As monitoring specifications explain in detail what SSSIs were like at notification, the lack of a complete monitoring specification produced difficulty in commenting on management or changes that had occurred. This information and missing targets/baselines were found through alternative routes such as the SSSI citation, criteria sheet, ATs knowledge and other monitoring reports. Incomplete monitoring specifications are a significant barrier to condition assessments for both unit based and WFA approaches. This should not be seen as a WFA issue, but a wider protected site issue as monitoring specifications have a multitude of applications within NE.

An ongoing project within NE's Evidence Services, aims to bring every monitoring specifications into final version. The project provided recent statistics on the current state of monitoring specifications as follows: 405 in draft, 1694 in consultation draft and 2024 in final. The project also highlighted the variability in quality, with some of the draft monitoring specifications being more accurate and generally better than some of the consultation versions, and similarly between final and consultation versions.

5.6.3. Designated feature from citation

Citations are the main legal document of a SSSI designation. They detail the 'features of interest' for which a SSSI is considered special and has been legally notified. During planning the pilots, differences were apparent between the notified features in the citation and the monitored features reported in the SSSI. This highlights the issue of inaccurate interpretation of citations, leading to potential inaccuracies in monitoring specifications.

An example from the pilot is the 'Saline Lagoon' which is an artificial lagoon at Hodbarrow, in the Duddon Estuary. The lagoon is a very important site for breeding and wintering birds. The lagoon was recorded as a monitored feature on the monitoring specification and DSViews. However, upon advice of specialists and reviewing the citation, the lagoon is not an interest feature of the site in its own right, but rather a supporting habitat for other features.

The same project finalising monitoring specifications is looking to verify the features of interests on citations so to ensure NE are monitoring and reporting the correct features. The issues caused by incorrect citation interpretation are for all monitoring, not just WFA.

5.6.4. What improvements to NE datasets are suggested to assist in WFA national roll out?

The following list provides a summary of improvements and changes suggested to assist an effective national rollout of WFA. The need for these improvements were highlighted through the pilot studies.

1. Confirmation of citation interpretation.
2. Monitoring specifications need to be at least in consultation draft, for reliable monitoring.
3. SSSI habitat maps need to be completed and digitised into a nationally accessible database.

4. Feature attribute lists need updating, verifying and digitised for CMSi, so to allow the use of NESS.
5. Further development of NESS for user interaction.
6. Owner/Occupier data must be gathered and kept up to date. Incorrect owner occupier data, disproportionately effects WFA, as site wide access is required.
7. Increase in NE capacity for EO and new technologies analysts, specialists, GI analysts and statisticians for the expected increase in demand on these areas.
8. The creation of WFA guidance documents for ATs, including new systems.
9. ATs need to receive the relevant training for WFA. This is in development and will start in April 2022.
10. WFA training for stakeholders and MLGs.

Projects are underway to address the above issues, and the work will run in parallel with the 2022 pilots. It is not expected that these issues will be fully resolved by March 2023, but the negative impact they will produce, is expected to be diminished. The long-term monitoring plan for NE is taking these issues into account and working to minimise the disruption they cause.

5.7. Use of third-party organisations and data to contribute to WFA condition assessment

Risk: Third-party data (including citizen science) can be unreliable and not provide the correct data needed for condition assessments. Third-party organisations may also not wish to share their data and using contractors can be costly and contract management resource intensive.

Outcome: The use of third-party data and contractors are commonplace in NE, providing data that NE cannot gather itself. The pilots used multiple sources of third-party data, which were validated by specialists and used in the WFA successfully. Conclusions about implications on costs are not possible, as the comparative costs for NE to do the same work are not known. The quality and success of contracts in condition assessments have been found to be heavily dependent upon the specifications commissioned. Moving to WFA will require the creation of new robust specifications and protocols, verified by NE specialists. WFA will result in an increase demand in specialist resource, especially initially during the creation of generic contract specifications, and is expected to shift some dependence away from AT to national teams.

5.7.1. Does third-party data provide the right information for a WFA condition assessment and are contracts cost effective?

Third-party data can provide valuable long-term data, such as wetland birds' populations (WeBSs), which would be impractical, if not impossible for NE to gather. As such, using third-party data is often a requirement for condition assessments, and have been used extensively by NE for unit-based condition monitoring. Using third-party data for WFA, presents no significant difference, and often means the data available is more applicable. For example the WeBS data recorded by BTO, is at the site level, opposed to unit.

The use of third-party data was a key component of the Duddon Estuary SSSI condition assessment. Data used to inform non-breeding birds condition assessments came from WeBS (through an existing agreement of data sharing), data for the breeding sandwich terns came from the RSPB, data for the vascular plant assemblage (VPA) and invertebrate assemblage were

gained through specialist external contracts. Bird surveys for both pilot sites were contracted, with NE specialists using the data received to produce condition assessments. Data to inform the natterjack toad condition was expected from Amphibian and Reptile Conservation Trust (ARC) through an existing MoA, however it did not provide enough data for condition assessments. This MoA is being reviewed to ensure it provides sufficient data for CSM compliance. The use of these third-party data sources allowed rapid, reliable condition assessments to be made by NE staff.

Specific contracts allow data to be gathered on behalf of NE, when it is unfeasible for NE to do it themselves. The data derived from contracts are determined by the requirements outlined in the contract specifications and agreements. As such, it is of great importance that specifications are written so to ensure all appropriate data is provided by the contractor to allow a condition assessment to be made by NE staff.

During the pilots, writing and procuring the contracts were found to be a time-consuming process, due to missing information in monitoring specifications, no robust templates and the requirement of specialist support that entailed time consuming budgeting for time. Going forward, NE will need a user protocol to clarify the steps needed in designing and procuring contracts. It is recommended that example and template specifications are made for specialist surveys, which can then be tailored by ATs. The shift to WFA and the uplift in monitoring funding, is expected to result increased contracting of survey work. This will result in more resource required for the NE specialists to support with specification writing, QA and analysis.

Similarly, MoAs must be agreed so that the data derived, are suitable to inform condition assessments. Data licensing agreement will also need to be negotiated, so to ensure that the data can be used for all NE requirements not just feature condition. The pilots have highlighted the need for MoA data to be QA'd by NE specialists or relevant AT staff, before being entered on CMSi or used in a condition assessment.

The pilots did not use information gained from citizen science directly, but rather used data provided by other respected organisations such as BTO that includes data produced by citizen science. By using citizen science data, after it has been verified by reliable organisations, NE has a reduced risk of inaccurate data that are frequent when working with citizen science datasets.

The pilots cannot provide cost comparison, to address the cost-effectiveness of contracts. However, the contract costs using in WFA are comparable to contract costs when monitoring at the unit-level. It is widely acknowledged that NE do not have the staff or resource to undertake all surveys and so, contracts are an effective approach to monitor sites.

6. Evaluation outcome summary

The evaluation questions presented in Table 1, have formed the structure of this report. Table 17 below, summaries the status of the risks that underpin the evaluation questions, and highlights any outstanding work required for a move to WFA.

Table 17: Status of the risks underpinning the evaluation questions

Evaluation Objectives	Evaluation Question	Status of risks underpinning question.	Summary
Production of a reliable condition assessment for large and/or complex sites.	Does WFA provide the level of detail required for a condition assessment of complex SSSI sites?	Remaining Risk	2021 pilots successfully produced condition assessments for coastal and upland sites. 2022 pilots will address other complex sites - rivers and lowland mosaic habitats.
	Can WFA provide sufficient data to answer all CSM attributes using NE's available resources?	Resolved Risk	2021 answered all required attributes, with the 2022 pilots addressing more/different attributes. Attribute details in monitoring specification, may require adjusting to WFA as they are currently tailored to unit-based assessing.
	Does WFA sufficiently identify Threats, ACRs and ongoing Remedies and Actions?	Remaining Risk	Results from the 2021 pilot suggest this is not an issue, but a slight change in methodology in the 2022 pilots is required to ensure the risk is adequately evaluated.
	How do the conditions assigned via WFA, compare to the conditions assigned via the unit-based approach?	Resolved Risk	Direct comparisons are not possible. However, indications suggest there is no substantial difference.
	Does the information gathered fit with what landowners/ATs know of the sites? Do they support it?	Remaining Risk	The details of the 2021 pilot condition assessments have not been shared with landowners or ATs due to time constraints but will be undertaken.
	What statistical confidence can be reported using the WFA approach?	Identified Issue	Statistical confidence can be applied to data used in upland CSM. However, there is currently no ability to assign statistical confidence to some CSM techniques.
To understand how WFA data can influence management interventions	Does the spatial resolution of WFA data enable decisions about management to be made?	Remaining Risk	Results from the 2021 pilot suggest this is not an issue and has helped in refining the proposed methodology. The new methodology will be tested in the 2022 and will involve assigning unit-specific conditions. Work is

			required to assess how condition trend qualifiers will be implemented in WFA.
	Will separate visits be required for complex management decisions?	Resolved Risk	Separate visits will be required. WFA provides the backdrop to help locate where additional visits may be required and will make future visits more targeted.
To use new technologies to support condition assessment	Does using new technology such as eDNA, earth observations and drones alongside traditional methods, reduce costs and maximise efficiency?	Remaining Risk	Preliminary finding for EO suggests there isn't time or cost saving, but the data produced is superior, safer and of more use. 2022 Pilots will investigate other new technologies and provide more evidence to support cost and efficiency conclusions.
	Can new technologies be used as a tool to directly answer questions relating to CSM guidance i.e., feature extent, scrub mapping using LiDAR data?	Resolved Risk	New technologies can directly answer attribute questions, but more often are used in conjunction with traditional field data. New technologies can improve the confidence of condition assessments. Further evidence and other technologies will be gathered and tested in 2022 pilots.
	What are the limitations of these new technologies and how do they need to work alongside gathering field data?	Remaining Risk	Limitations include the need for training and specialist time. EO should be used before field data is gathered and allows more precise and efficient survey work.
To assess whether WFA is more time and cost efficient compared to current approach.	How does WFA compare to unit-based monitoring for time?	Remaining Risk	Results from the 2021 pilot suggest WFA may save time, however more accurate analysis is required and will be achieved in the 2022 pilots.
	How does WFA compare to unit-based monitoring for costs?	Remaining Risk	Results from the 2021 pilot suggest WFA may save costs, however more accurate analysis is required and will be achieved in the 2022 pilots.
To assess whether NE's current IT systems for SSSI	Is NESS capable of gathering data for WFA and is it fit for purpose?	Resolved Risk	NESS is capable of WFA, and development is underway to improve its performance.

data collection, analysis and database are suitable to support the move to WFA.	Is CMSi capable of gathering data for WFA and the associated data analysis and storage?	Remaining Risk	CMSi is under development to allow WFA, with expected development to be trialled in the 2022 pilots.
To evaluate whether NE's baseline data is up to date and suitable to support the move to WFA	Do Natural England's existing databases have capacity to adopt WFA?	Remaining Risk	A condition assessment with WFA was completed and is possible with NE datasets. However there are datasets missing information, that make the process harder and time consuming.
	What improvements to NE datasets are suggested to assist in WFA national roll out?	Remaining Risk	Projects are already addressing the identified issues of monitoring specification, baseline maps and figures and citation clarification.
To use contractors for species data gathering, data from third parties and citizen science to support Condition Assessment	Does third-party data provide the right information for a WFA condition assessment and are contracts cost effective?	Resolved Risk	Third-party data and contracts provide data that NE cannot gain independently. It has been found that to gain data sufficient for condition assessments, is largely depend on the specifications written by NE. Contracts can be cost effective. Guidance for procurement and specifications are needed as well as more investment in specialist resources.

6.1. Risks outstanding to be addressed in 2022 pilots

The 2022 pilots aim to further address the above risks. The key aims are summarised in Table 18.

Table 18: Key aims for the 2022 pilots.

Outstanding Risk	Action
WFA cannot be applied to difficult habitats such as Rivers and Lowland Grassland Mosaics.	The 2022 pilots will be producing a condition assessment of the River Frome SSSI and Salisbury Plane SSSI. This will result in more attributes being tested for WFA compatibility.
The ability for WFA to identify all Threats, ACRs and ongoing, Remedies and Actions.	The 2022 pilots will have an updated methodology in which identifying pressures will have a key focus.
WFA cannot provide sufficient data to inform management advice	The 2022 pilots will have an updated methodology in which every unit will be visited and have a unit-

	specific condition assigned. Monitoring of management issues will be a key focus.
Some forms of new technology do not provide benefits to condition assessment, and do not increase efficiency.	The 2022 pilots will trial other new technologies and provide data to make judgements on their roles within condition assessment.
WFA may require more time and monetary resources than unit-based approach.	The 2022 pilots will gather more data on costs and times taken, to provide evidence to evaluate this risk.

6.2. Recommendations for further work outside of the scope of SSSI M&E 2022 pilots.

Further work is recommended in the following areas:

- Updating and improving of monitoring specifications. Including citation clarification, baselines and targets and habitats maps. Large benefits would be gained if monitoring specifications were also digitised.
- The digitisation of habitat maps, for use on ESRI products.
- The creation of attribute lists when missing and the verification/updating of others. This will allow reliable monitoring and allow the use of NESS.
- Work on how to use the WFA and condition assessment to answer area-based targets and satisfy the 25YEP and the 30x30 target.

7. Conclusion

The whole feature assessment pilots have enabled the trialling of new monitoring methodologies to gather information to produce condition assessments for large upland and coastal sites. The pilots have found that WFA can successfully produce reliable condition assessments and integrate data derived from new technologies and third-party sources. The pilots have indicated this approach can provide condition information at the right scale for use by both internal and external stakeholders, with the ability to inform management as well as provide context of a feature's condition at the landscape scale.

There will be changes needed to the methodology used in the pilots, which will be trialled in the 2022 pilots. The most notable change will be the assigning of unit-specific conditions as well as whole feature conditions with the incorporation of identifying ongoing pressures and actions into a more central role within the condition assessment framework.

It is not anticipated that any of the remaining risks and issues identified will be insurmountable. The 2022 pilots will address most and the necessary work on Threats, Remedies and ACRs, alongside the updating of monitoring specifications and citation clarification, are all underway. All three of these projects are required to monitor confidently at all scales not confined to WFA and are expected to assist the shift to WFA saving Area Team Advisors time in the future.

The increased reliance on contracts, use of third-party data and the ability to use new technologies are not predicated on the shift to WFA. However, the whole feature approach means the data derived from these sources are more applicable and useful. It is foreseen that using third-party and EO data will be the recommended first approach in monitoring, with the result indicating the level of assessment detail required to be undertaken by NE staff.

The pilot's findings and confidence in WFA, are being used to inform the creation of the Long-term Monitoring Plan. This long-term monitoring plan will also consider the issues highlighted, so that SSSI monitoring can be undertaken with minimal delays.

The shift to WFA will be beneficial for the organisation and external stakeholders. It will also assist the organisation in adapting to the challenges faced by protected sites due to climate change. Embedding this approach and the reform, will require time and resources including training, new guidance and extra support to help Area Teams and Specialists in making the shift.

8. List of tables

9. Table of figures

10. References

Dayton, N. 2018. Site Condition Monitoring survey of upland notified features on designated sites – Coille Dalavil. Scottish Natural Heritage Research Report No. 1028 [online]. [Accessed 27 October 2021].

Environment Agency. CASI and LIDAR Habitat Map. [online]. [Accessed 19 November 2019]

JNCC, 2004. Common Standards Monitoring Guidance for Coastal [online]. [Accessed 27 October 2021].

JNCC, 2009. Common Standards Monitoring Guidance for Upland habitats [online]. [Accessed 27 October 2021].

JNCC. 2019. A Statement on Common Standards for Monitoring Protected Sites 2019, JNCC, Peterborough, ISBN 978-1-86107-631-1.

Macdonald, A. 2004. Site Condition Monitoring of Upland Sites in Scotland: Method of Field Assessment (B151528). Scottish Natural Heritage.

Natural England Guidance (Laws., T.) 2013. Guidance on establishing an unfavourable condition category.

Natural England. Defining a new baseline and assessing the implications of change to SSSI reporting metric. 2020. [online] [Accessed 19 November 2021]

Natural England. Policy Paper Overview: Nature Recovery Network [online]. [Accessed 19 November 2021]

NatureScot. Site Condition Monitoring. [online]. [Accessed 19 November 2021]

UK Government. A Green Future: Our 25 Year Plan to Improve the Environment. [online]. [Accessed 19 November 2021]

UK Government. Press Release: PM commits to protect 30% of UK land in boost for biodiversity. [online]. [Accessed 19 November 2021]

11. List of abbreviations

Name	Abbreviations
25 Year Environment Plan	25YEP
Adverse Condition Reasons	ACRs
Amphibian and Reptile Conservation Trust	ARC
ArcGIS Online	AGOL
Area Teams	ATs
Botanical Society of Britain and Ireland	BSBI
British Trust for Ornithology	BTO
Common Standards Monitoring	CSM
Condition Assessment	condition assessment
Country Nature Conservation Bodies	CNCBs
Defra Digital Transformation Services	DDTS
Department of Agriculture, Environment and Rural Affairs	DAERA
Department of Environment, Food and Rural Affairs	DEFRA
Designated Sites Views	DSViews
Earth Observations	EO
Environmental DNA	eDNA
Environment Agency	EA
Environmental NGOs	eNGOs
Evidence Earth Observation Service	EEOS
Exegesis Spatial Data Management	ESDM
Financial Year	FY
Joint Nature Conservation Committee	JNCC
Major Land Group	MLG
Memorandum of Agreement	MoA
Ministry of Justice	MoJ
Monitoring Specification	MS
Natural England	NE
Natural England Field Unit	NEFU
Natural England Site Survey	NESS
Quality Assurance	QA
Royal Society for the Protection of Birds	RSPB
Site Condition Monitoring	SCM
Site of Special Scientific Interest	SSSI
SSSI Monitoring and Evaluation	SSSI M&E
Survey and Monitoring	SAM
The least favourable business rule	LFBR
UK Government's commitment to protect 30% of land by 2030	30x30
vascular plant assemblage	VPA
Wetland Bird Survey	WeBS
Whole Feature Assessment	WFA

Annex 1

NESS 3.0 Development

The development specified and under consideration by ESDM are:

- The ability to take photos within the app, which will be linked to the stop data.
    - This will provide photos for QA or for comparison in later surveys.
- A mapping function, showing the SSSI and units overlaid on aerial maps. This map will show user position in real time and is hoped to allow shapefiles to be imported.
    - This will mean surveyors will not be dependent upon other applications for maps.
- The addition of comment boxes per stop, to allow the recording of extra narrative information not picked up in the stop attribute data.
- Additional guidance and support in how to best gather survey data. This will be in the format of 'extra information', which will explain how to measure an attribute, and have examples of various conditions. This will help surveyor accuracy and reduce mistakes made in the field.

The next potential stage of development for NESS is the incorporation of pressures and actions into the app. This will allow simpler and more reliable recording, as well as help automate the process in assigning unit-specific condition.

CMSi Web Development

Development of CMSi Web to be compatible with WFA began in January 2021 and the first stage was completed in March 2021. A beta version of CMSi Web and DSViews, with WFA functionality is complete and under review with NE.

This development involved:

- The development of condition assessments to be completed at the feature and site level, and not unit level. That is: for the feature, what is its condition status? For the site and its associated features, what is the condition status of each feature? What proportion (%) of the features are in each condition status category?
- The development of feature scale reporting, with the SSSI statistic, "the proportion (%) of features in each condition category, at the site and national level".
- The development of recording and reporting of condition threats and adverse reasons, at the unit and feature level.

In order for WFA to be easily adopted by all NE staff, further development to the work outlined above will be required for CMSi Web. Currently, the monitoring tailoring module have not been developed in CMSi Web, which will be a necessity. Alongside this, the system has not yet been developed for the new format of pressures and actions. A review of the already completed development within CMSi Web is underway. It is forecast that the specification for the next round of development will be completed in March 2021.

There is currently another broader project underway to replace NEs protected sites database. The project is in the discovery stage funded by SR20 will be run by Evidence Services and DDTS in Q3/4 this FY, aimed to identify user requirements and business needs for a replacement system. An identified and key requirement is WFA. The project will be taken further under SR21 with the aim to deliver a replacement system in 2024/25.

Consultation details that resulted in Evaluation Questions

The risks were identified through a formal consultation on defining a new condition baseline and assessing the implications of change to SSSI reporting metric which was undertaken for a period of 6 weeks, between 7 December 2020 and 18 January 2021. NE contacted national and local stakeholders with an interest in the SSSI official statistics and the proposed change in metric. A total of 91 stakeholders including the MLG, water companies, Local Authorities, universities and national representative from the Wildlife Trusts, were contacted on the start date of the formal consultation. NE received 57 formal consultation responses which are summarised in a separate report. Later, a workshop was also organised with ATs to address their concerns as to how this would work in the upland environment.

Annex 2

A comparison of conducting feature-based assessments with unit-based assessments when doing Rapid Assessments.

Introduction

Part of Protected Sites Monitoring Reform is the proposal to assess SSSIs feature by feature instead of unit by unit. This means that, during assessments, the units are ignored, and the features are assessed across the whole site (feature-based method), instead of every feature within every unit requiring an assessment (unit-based method).

In the unit-based method we used to do 10 ‘stops’ and assess all attributes of each feature at each stop.

In the feature-based method we developed a method where stops were not compulsory and the assessor carried out a walk over, just stopping as and when it was felt necessary, assessing the attributes as he went.

In 2018 an assessment was conducted to compare these two methods and it found that the feature-based method was usually much quicker, especially in open areas.

Conducting SSSI assessment without a requirement to carry out a specific number of stops has now been adopted as a new, quicker methodology for conducting all routine SSSI assessments, termed Rapid Assessments. It was decided to conduct a comparison of the unit-based method and the feature-based method where Rapid Assessments are conducted i.e. where stops are not required in either method.

Two adjacent SSSIs in Dorset were chosen. Eggardon Hill SSSI is a very open site on chalk grassland and neutral grassland, much of the site is visible from certain points. Powerstock Common is a similar size to Eggardon but is wooded and so very little of the site is visible from any one point.

Methods

On each SSSI two teams were asked to conduct SSSI assessments, starting from the same point. Each team were given assessment forms for each of the habitat based Notified Features on the SSSI. Species features were not assessed, just habitat features. This is because most species features are already assessed at a whole site level and so there is likely to be no difference in the two methods.

One team conducted unit-based assessments. Within each unit, they assessed each of the habitat features. The other team conducted feature-based assessments. Each feature was assessed over the whole site as the team walked the site, ignoring unit boundaries. Each team recorded the

length of time it took them to do the assessments and the amount of ground covered, so that we could calculate and compare the area covered by each team.

It must be remembered that this exercise was carried out as a brief comparison of the two assessment methods. It was not intended to be rigorously scientific, but more of a rough and ready field-based exercise to give an idea of the likely difference in timings, resource and methodology.

Results of a comparison of feature-based assessments and unit-based assessments when doing Rapid Assessments

The table below shows the results that compare the feature-based assessments with the unit-based assessments when doing Rapid SSSI Assessments. Results for the unit-based assessments are shown in pale blue. Results for the feature-based assessments are shown in pale orange.

Site	Hectares covered	Time	Ha / hour
Eggardon (open habitat) – unit based	56.6	6 hours	9.4
Eggardon (open habitat) – feature based	74.1	6 hours	12.3
Powerstock (wooded habitat) – unit based	0.2	6 hours	1.3
Powerstock (wooded habitat) – feature based	68	6 hours	11.3

Table 19: Coverage of different SSSIs compared between feature method and unit method.

Overall the feature-based assessment can cover more ground per hour than the unit-based assessments, but not by a lot on open ground. In open habitats such as grasslands, the differences are slight with feature-based assessments covering a little more ground than the unit-based method.

In the woodland the difference was very marked. This is because the unit-based team carried out several stops and took detailed notes, a method more akin to the Full Assessment method. So, the difference in timing is not due to the difference in feature method versus unit method, but more in Rapid Assessment method versus Full Assessment method.

It was felt that this was because in open habitats much more ground could be viewed as you walk around and thus assessed without the need to do many stops. Also the habitat did not change a great deal and so very few stops were required. This means that the pace of walking was similar between the two methods.

Powerstock Common is a mosaic of habitats. The unit-based team carried out more stops and in a more detailed way than the feature-based team. Thus the unit-based team carried out more of a Full Assessment than a Rapid Assessment. Both teams came to the same conclusion on favourability of the area assessed.

I conclude that there is not a lot of difference in timing between unit based and feature based methods when conducting Rapid Assessments.

SSSI Unit and Notified Feature	Status under FEATURE method where the whole feature is assessed as one	Status under UNIT method	Latest condition recorded on CMSi
Eggardon Unit 1 – chalk grassland	Favourable	Favourable	Favourable
Eggardon Unit 2 – woodland	Unfavourable	Favourable	Unfavourable recovering
Eggardon Unit 3 – chalk grassland	Favourable	Favourable	Favourable
Eggardon Unit 4 – chalk grassland and neutral grassland	Favourable	Favourable	Favourable
Eggardon Unit 5 – chalk grassland	Favourable	Unfavourable	Unfavourable recovering
Eggardon Unit 6 – neutral grassland	Favourable	Unfavourable	Favourable
Eggardon Unit 7 – chalk grassland and neutral grassland	Favourable	Favourable	Favourable
Eggardon Unit 8 – neutral grassland and fen	Favourable	Not assessed	Favourable
Eggardon Unit 9 – neutral grassland and fen	Favourable	Favourable	Favourable
Eggardon Unit 10 – neutral grassland and fen	Favourable	Favourable	Favourable
Eggardon Unit 11 – woodland	Unfavourable	Not assessed	Unfavourable recovering
Powerstock Unit 4 – woodland and fen meadow / rush pasture and neutral	N/A	N/A	Unfavourable recovering

Table 20: A comparison of favourability determined via both methods.

The table shows what condition that area of land would be recorded as, via the different methods and compared with their present condition on CMSi. As can be seen, the conclusion as to favourability was more or less the same for each habitat in both assessment methods.

The main difference is that because the feature method looks at the Notified Feature across the whole site, smaller units that are unfavourable (such as Unit 5 of Eggardon) do not reach the thresholds for the whole feature and so it is marked as favourable. i.e. Unit 5 is less than 5% of the chalk grassland thus less than 5% of that feature is unfavourable and so the whole feature is deemed to be favourable. Also using the feature method asks the assessor to use a wider scale approach. On this more holistic basis the grassland habitat at Powerstock was being maintained in good condition, despite some units, at a given time, containing excess scrub.

Conversely a feature might be unfavourable in one unit, but not another (such as woodland in units 2 and 11 of Eggardon). Unit 11 comprises about 40% of the woodland feature and its unfavourable condition then turns all the woodland (including Unit 2) unfavourable.

Overall conclusion

The previous study established that feature-based assessments were more rapidly conducted than unit-based assessments because the unit-based assessments required 10 stops per feature per unit and the feature-based assessments did not. This study concludes that when conducting rapid assessments (that do not require any particular number of stops) then the time difference between unit-based assessments and feature based assessments is only slight.

There is still a key and important difference in condition findings between the two methods. This is because the large scale of the feature-based reporting masks small scale differences at the unit level. To properly show the locations of those areas that differ in condition from the majority of a feature they should be mapped.

Annex 3

Duddon Estuary SSSI sampling point maps

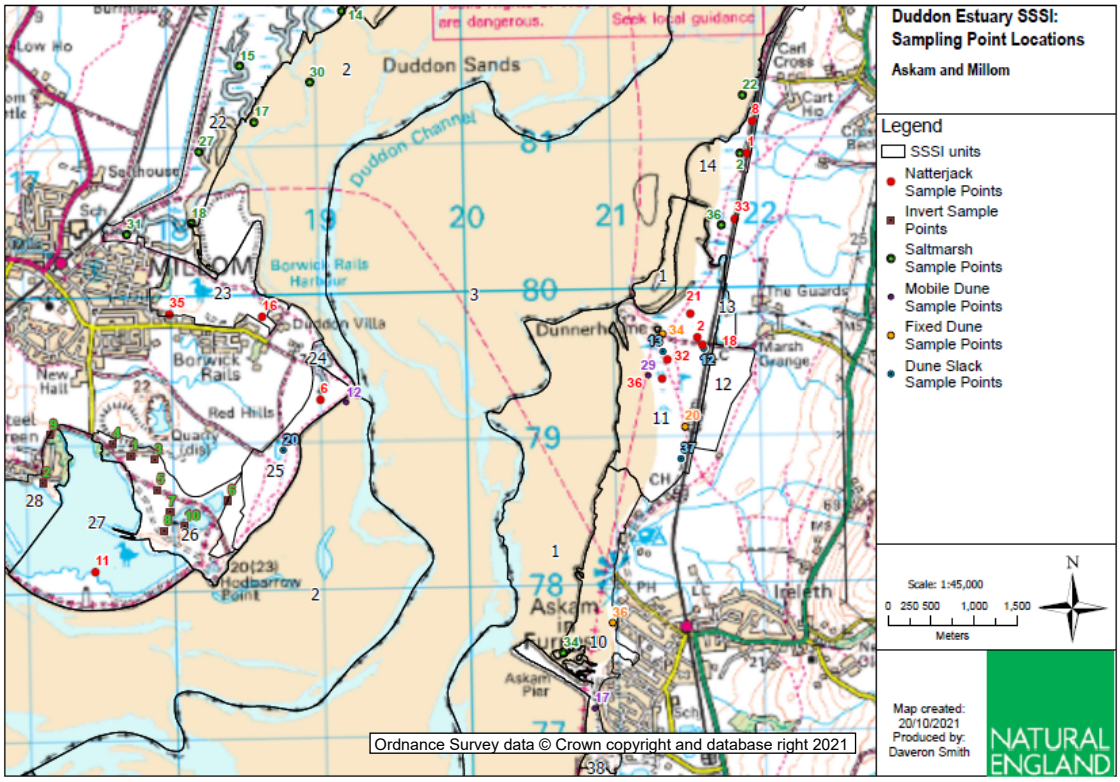


Figure 9: Duddon Estuary SSSI sampling point locations (Askam & Millom)

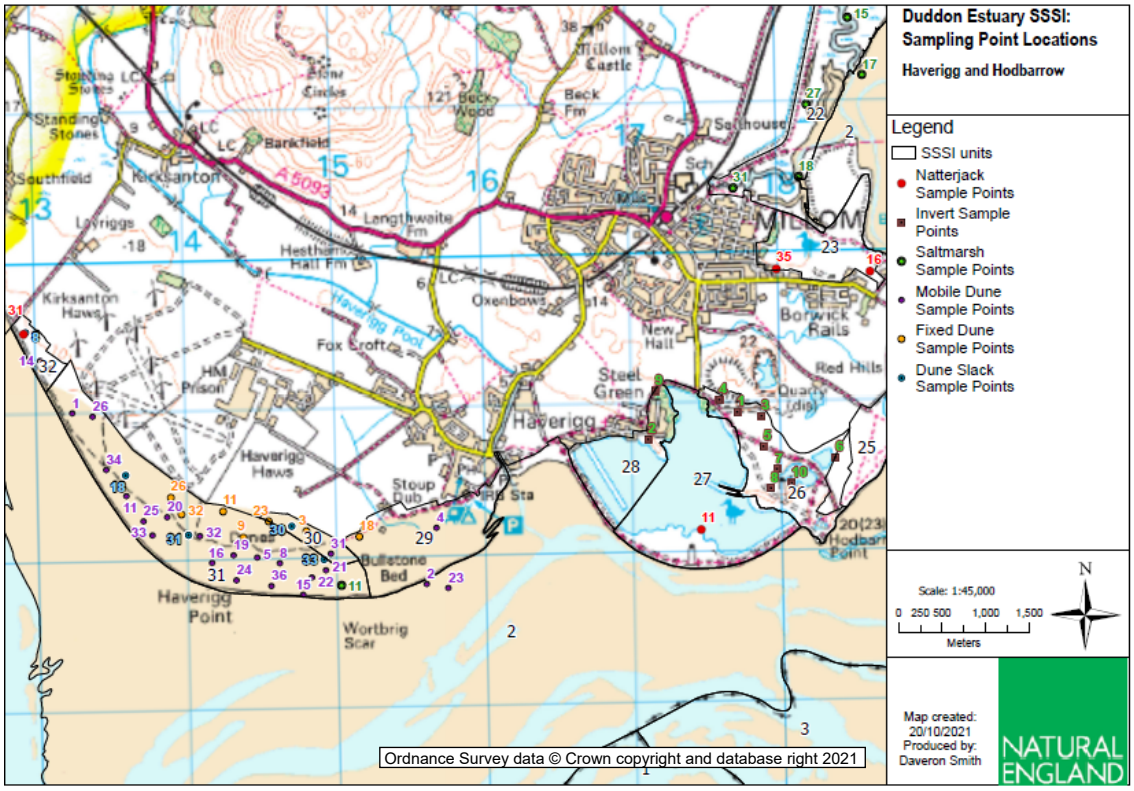


Figure 10: Duddon Estuary SSSI sampling point locations (Haverigg & Hodbarrow)

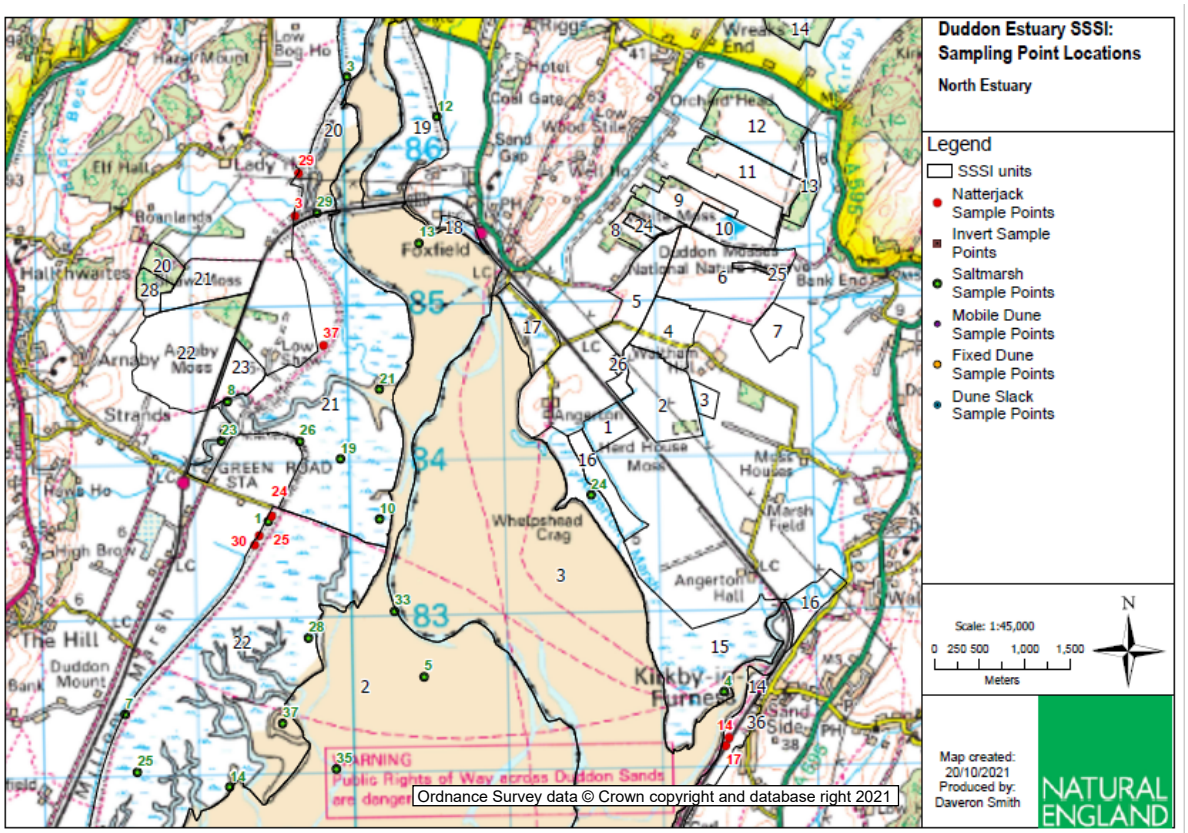


Figure 11: Duddon Estuary SSSI sampling point locations (North Estuary)

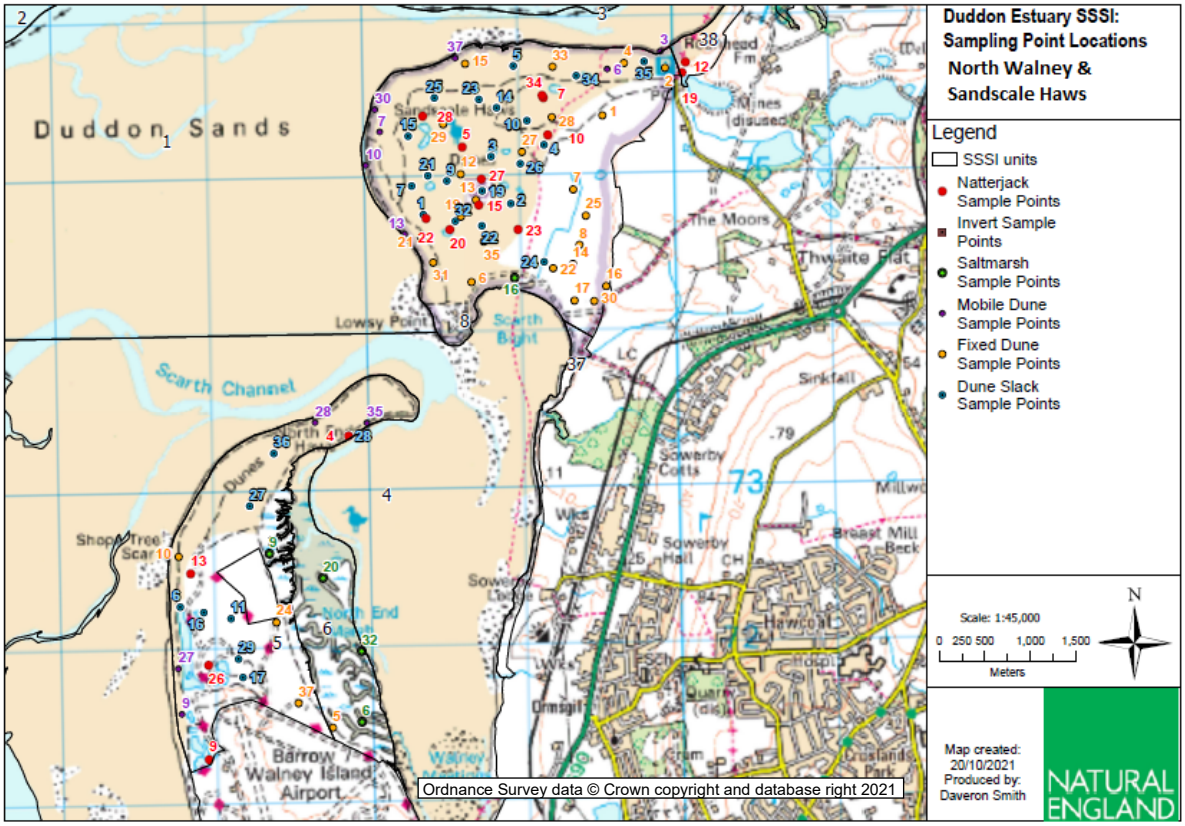


Figure 12: Duddon Estuary SSSI sampling point locations (North Walney & Sandscale Haws)

Duddon Estuary SSSI Full Methodology

The mapping available for the Duddon Estuary was produced by the Environment Agency in 2019 using Earth Observation and ground truthing. These maps only covered the three main sand dune sites, Sandscale Haws, North Walney and Haverrig Haws. Habitats at North Walney and Sandscale Haws appeared to be a reasonable match when compared to earth imagery. The remaining mapping was poor.

A comprehensive earth observation interpretation of the whole site was conducted to validate habitat features. However, it was accepted that some habitats could not be identified with certainty. For instance, it was difficult to differentiate between wetland, scrub and dune slacks. This was eventually confirmed in the field once the species composition was assessed.

Areas were assigned to one of the notified features (e.g. vegetated shingle; humid dune slacks; strandline embryo and mobile dune; dune heath or saltmarsh). Where no notified features were present, these areas were excluded from the map. Areas of negative indicators such as scrub were assigned to that underlying feature as these are likely to result from lack of management.

Other exclusions from the detailed sampling approach included areas where there was very low confidence in the mapped habitat. These were not included in the random point selection but were highlighted as areas to ‘Check’ during the survey. Features which were small in extent were assessed using a CSM compliant rapid assessment.

When considering supporting habitat for notified features such as the saline lagoon at Hodbarrow, which is supporting habitat for breeding birds, an assessment of the attributes required to support the notified features was made.

The “Random points inside polygons” function in QGIS version 3.16 was used to select the 37 random sample points within each feature polygon. To do this, it was necessary to define a buffer around each sample point to avoid clustering of sample sites, which could leave large areas unsampled. The size of the feature influenced the spread of points. Within the habitats covering < 50 ha each (fixed dune, embryonic dune and dune slack) a distance of 100m between points was specified to allow 37 points to be allocated. For the more extensive features (saltmarsh), with large contiguous areas of habitat, a minimum separation of 250m was used. This adjustment in minimum distance between points ensured a good spread of random points across the area of the feature.

Surveyors were drawn from a range of Natural England teams, some with CSM monitoring and significant fieldwork experience, some with good botanical skills and others with a greater degree of technical experience and knowledge of data entry on NESS. Surveyors worked in pairs or threes and individuals within those groups were selected so that their skills would complement each other.

A bespoke Ness survey was created on CMSI and under a single Lead Surveyor who then had the role of adding the other surveyors onto the Ness survey and upload the data on CMSI by simply pressing the upload button. Detailed Assessments were conducted using NESS with at least one member of each survey team in possession of an iPad.

Notes made about a sample point were labelled with the unique number of the sample point, added to the paper forms or spreadsheet on the iPad and given to the Lead Surveyor at the end of each survey day.

In view of the occasional technical issues experienced with NESS and the potential for possible surveyor error, it was agreed that the NESS data collection would be backed-up using forms/spreadsheets on the iPad or paper forms.

The locations of the 37 pre-determined sample points for each feature were uploaded onto ArcView online for location in the field via the Field Maps App. Surveyors were provided with maps of the random points and told which ones to focus on each day. In some cases, there were areas to 'check' on their route and surveyors were asked to loosely map those areas to feed into the mapping held by the Area Team. The areas defined as 'check' did not need to be formally sampled, rather assigned to a habitat or described if necessary. Where there were management issues these were noted.

Whenever the appropriate feature was found, a condition assessment was made. However, where the sample point fell on another target habitat, a condition assessment was carried out for that habitat and the location re-labelled accordingly.

The sample locations for all features were not visited in any order which provided flexibility to plan efficient travel routes over the sites. It was important for surveyors to note the unique sample number reference along with the NESS sample number so that it was clear which sample points were surveyed. Suggested routes were indicated on the survey maps which attempted to reduce walking time to a minimum and guide surveyor to useful tracks and footpaths.

The CSM attributes and targets table were worked through systematically at each sample location. All attributes should have been assessed.

On arrival at the sample point (taken to always be the lower left-hand corner of the quadrat), a 2 metre × 2 metre quadrat was set out using some form of marker. To avoid subjective bias when arranging the quadrat, the next corner was determined by pacing 2 metres in a northerly direction, with the remaining two corners placed two metres to the right, parallel of this line. Each sample point was assigned to a broad vegetation/habitat type in the field. Quadrats took an average of 20 minutes to complete.

Presence of the feature was taken to be the nearest occurrence of the appropriate feature type within a 20 m radius of the GPS location given. If the surveyor moved from the GPS location given to make the assessment the new GPS location was recorded for use on future monitoring visits.

A condition assessment was not undertaken at the sample point if it fell on features such as manmade structures. If a sample point landed outside of the target habitat on non-vegetated habitat, presence of the feature was taken to be the nearest occurrence of the appropriate feature type within a 20m radius of the GPS location. If within that 20m radius there was no sign of the feature, a note was made so that the maps could be altered. Again, a new GPS location was recorded.

If a random point fell where access was dangerous or impossible, the assessment was either made from a vantage point or using a telescope or binoculars, if it was possible to complete the assessment of all required attributes. If this was not possible a judgement was made into the field

about whether it was possible to move the point to a safer location along the same vertical or horizontal line. This point had to be of the same seral stage to the initial point. If this was not possible a note had to be made and the potential for assessing this point using a drone was assessed. The point at which the observer made the observations and assessment was fixed with a new GPS.

When using NESS at the sample point, data was not entered for the Extent, Natural function, or zonation attributes these were all completed remotely for the whole site.

Dune Heath: From the mapping exercise there seemed to be two units where dune heath was present (Unit 25 and 5), Millom and North Walney.

Where habitat features were discontinuous on sites - each block of each habitat feature should have been visited. If a block of a habitat type was very small, then a judgement was needed to consider the habitat type, significance, its importance within the wider site and landscape context, and the level of attention to give it.

On each block of habitat, an initial stop was undertaken soon after entering the feature.

Extent and position of features were mapped during the site visit. Including:

- Negative aspects or causes of negative condition
- Important species and habitats

At a stop, details of the feature condition were noted and recorded. These details were not restricted to any radius from the stop position but were a summary of the details that could be seen around, and from, the stop position.

Photographs were taken to supplement habitat details.

Details of the route taken and position of stops and photographs could be mapped whilst on the site visit.

Vegetated shingle: Was assessed in the three likely areas:

- West coast of N Walney. **Units 4/5**
- Scattered patches along the coast of Haverigg. **Units 31/32**
- The South Western shoreline of Sandscale Haws. **Unit 8**

The approach was not to access the shingle unless necessary due to the potential presence of ground nesting breeding birds.

Surveyors stopped on the dune face opposite the shingle and used binoculars to assess the presence of positive and negative indicators. This was a rapid assessment approach as above. An initial stop (using approximately a 30x30m field of view) was made looking at all the attributes in the list below, continuing along the dune front until the shingle had significantly altered.

The area of vegetated shingle was very small and, in some areas, did not cover the 30x30 initial stop.

1. Maintain frequency of characteristic species of the vegetated shingle zones: Annual vegetation of drift lines (strandline); Perennial vegetation of stony banks (SD1).
2. Negative indicator species no more than occasional. These are species which are indicative or changes in nutrient status or non-natives including:
   - *Lupinus arboreus*
   - *Centranthus ruber*
   - *Tamarix gallica*
   - *Senecio jacobaea*
   - *Pteridium aquilinum*
3. No loss of vegetated substrate within the habitat because of anthropogenic activities.
4. Maintain presence of sea kale and Ray's knotgrass.

Supporting habitat assessment

Natterjack toad: The natterjack supporting habitat was assessed through visiting the randomly assigned pools, here NESS was not used as there is no current mechanism in NESS to input the necessary attributes for the supporting habitat.

The attributes which were measured on site were:

- Water depth, specifying: dry, <5cm or >5cm at the centre of the pool
- Was the habitat in the immediate vicinity (5m buffer) of the pool, open with short vegetation and some bare sand. A yes or no answer with a photo was required.

When assessing the supporting habitat for breeding and wintering birds and invertebrates surrounding Hodbarrow lagoon, units 28,27 and 26, the assessment was based around identifying any 'reasons for adverse condition' or threats to the interest feature. EO was used to identify the habitat surrounding Hodbarrow as being a mosaic of woodland, short grass, scrub and bare sand/gravel. NESS was not used for this purpose and a form was used instead.

The data on reasons for adverse condition' or threats to the interest feature were collected doing a walk over when moving between the random sample stops and notes were taken on the spreadsheet. An experienced entomologist carried out most of the invertebrate assessment.

Data on supporting habitat was gathered as part of the CSM sand dune assessment, at each stop physical structure (bare sand), fruiting species, plant species composition and other attributes required by the above invertebrate assemblages were assessed. This data was recorded on NESS.

Data was collected using a Round-rat method. A spreadsheet was used for data capture. The aim was to assess structural diversity of vegetation within 6m of where we were stood, and to cover 10 points within the surrounding Hodbarrow Lagoon area.

Recording between sample points

As surveyors walked between sample points, additional data were collected in a structured way to support the assessment and to collect information about the management activities which could be influencing the condition of the feature. Surveyors were provided with an additional form with specified check boxes to record a maximum of three positive management activities they observed and a maximum of three negative activities. See below for the standardised list.

1. Agricultural operations (specify)
2. Over-grazing
3. Deer browsing
4. Under-grazing
5. Water management (drainage, ditch-blocking, altering the water table)
6. Water quality (siltation, evidence of water pollution, nutrient enrichment)
7. Recreation (inappropriate off-road vehicle use, evidence of BBQ's and inappropriate wild camping)
8. Statutory works not requiring planning permission (e.g. military operations)
9. Lack of remedial management (e.g. scrub or bracken control, erecting deer fences).
10. Dumping / spreading / storage of materials.
11. Other (specify).

Photographs were taken at each sample point and in between points and were labelled as follows, Featuretype_stopnumber_date_surveyorname.

West Nidderdale Barden and Blubberhouses Moors SSSI sample point maps

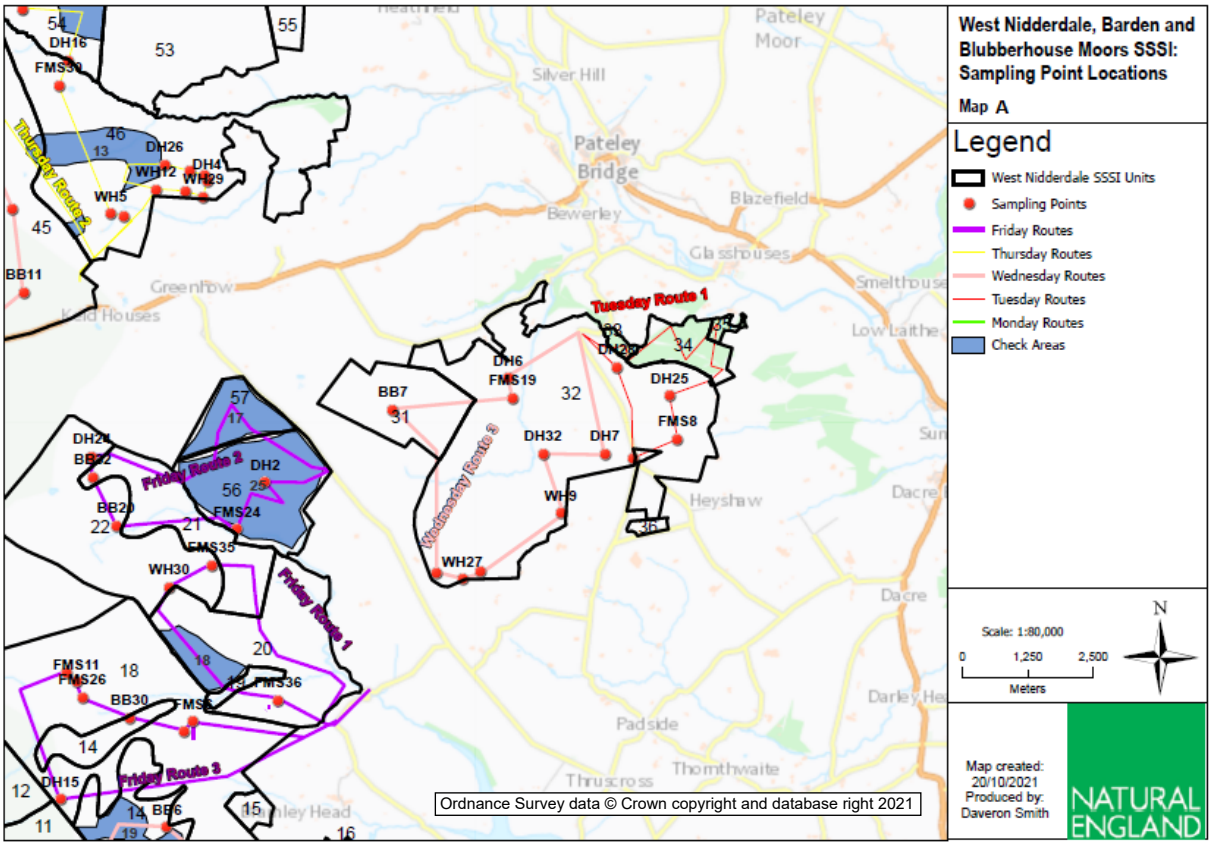


Figure 13: West Nidderdale Barden and Blubberhouses Moors SSSI sample point maps A (East)

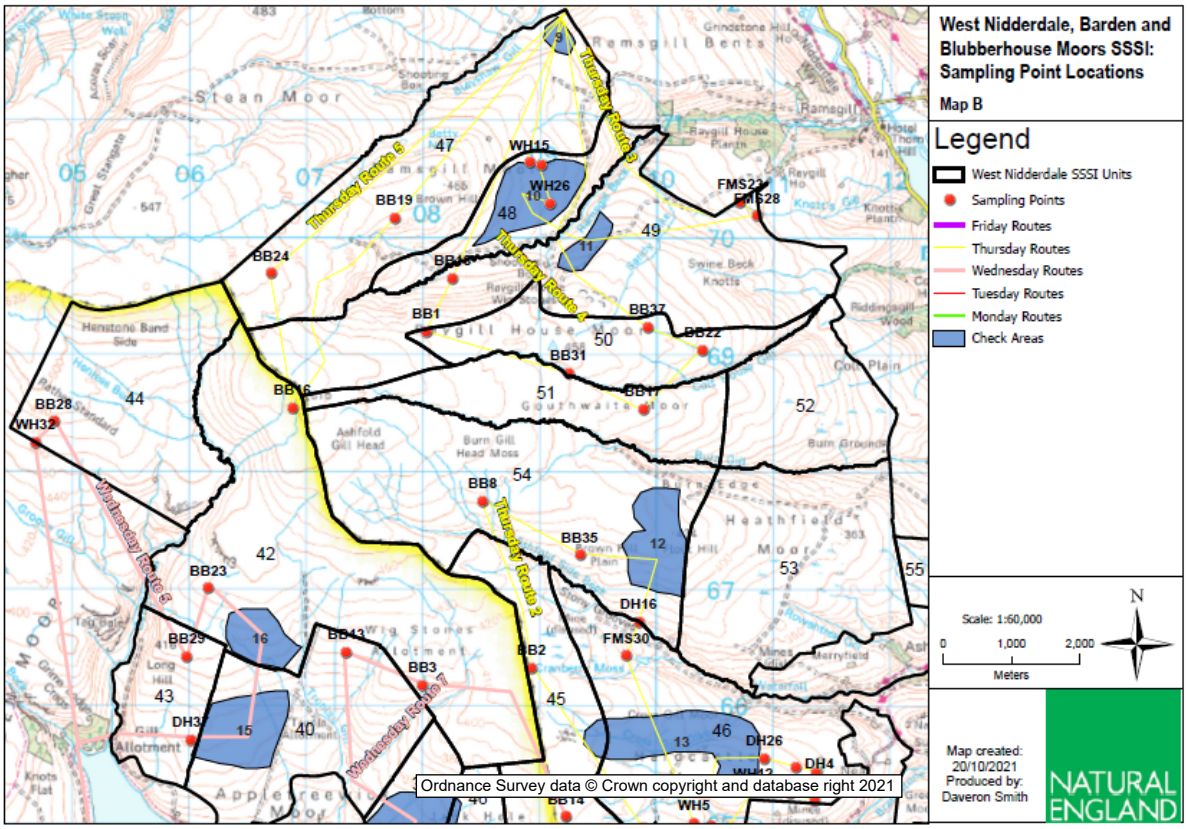


Figure 14: West Nidderdale Barden and Blubberhouses Moors SSSI sample point maps B (North)

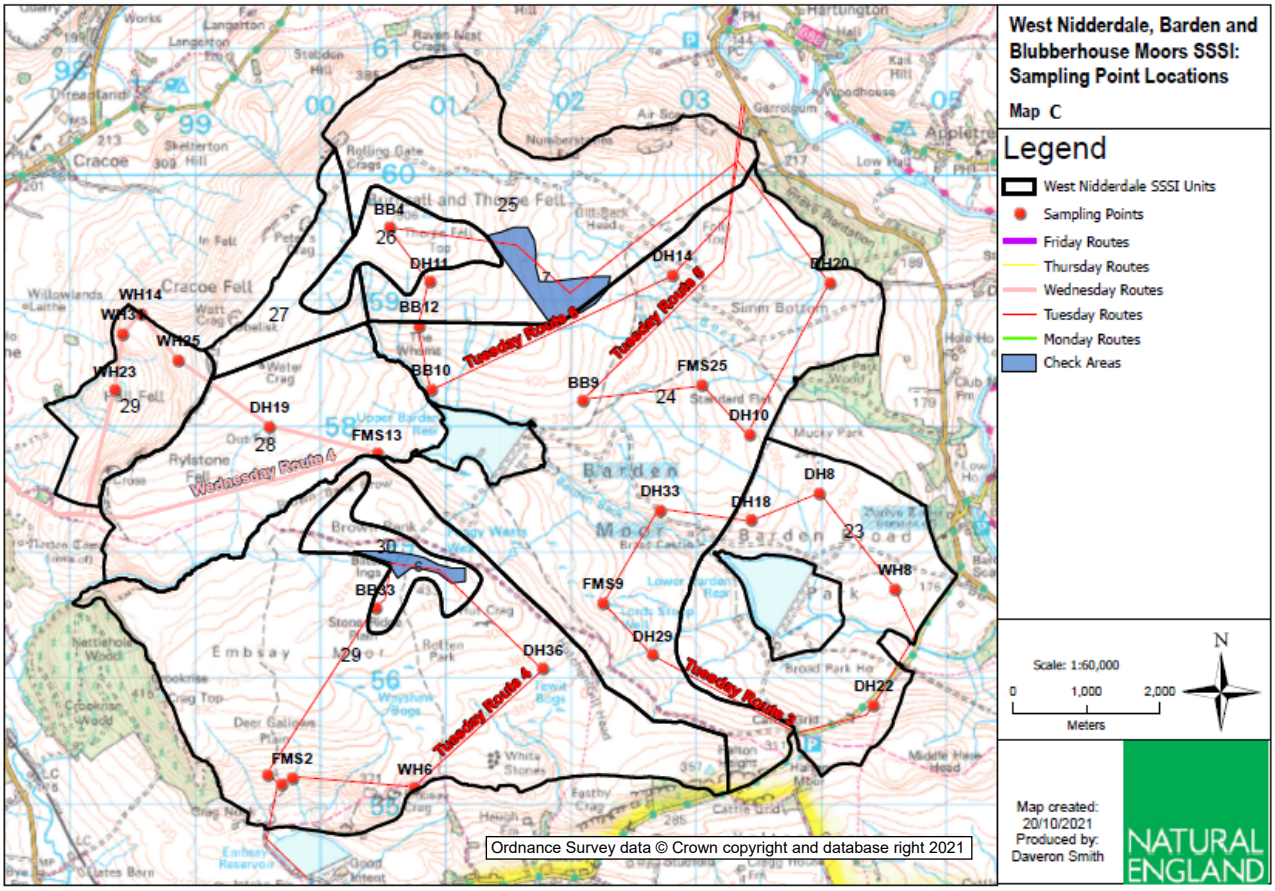


Figure 15: West Nidderdale Barden and Blubberhouses Moors SSSI sample point maps C (West)

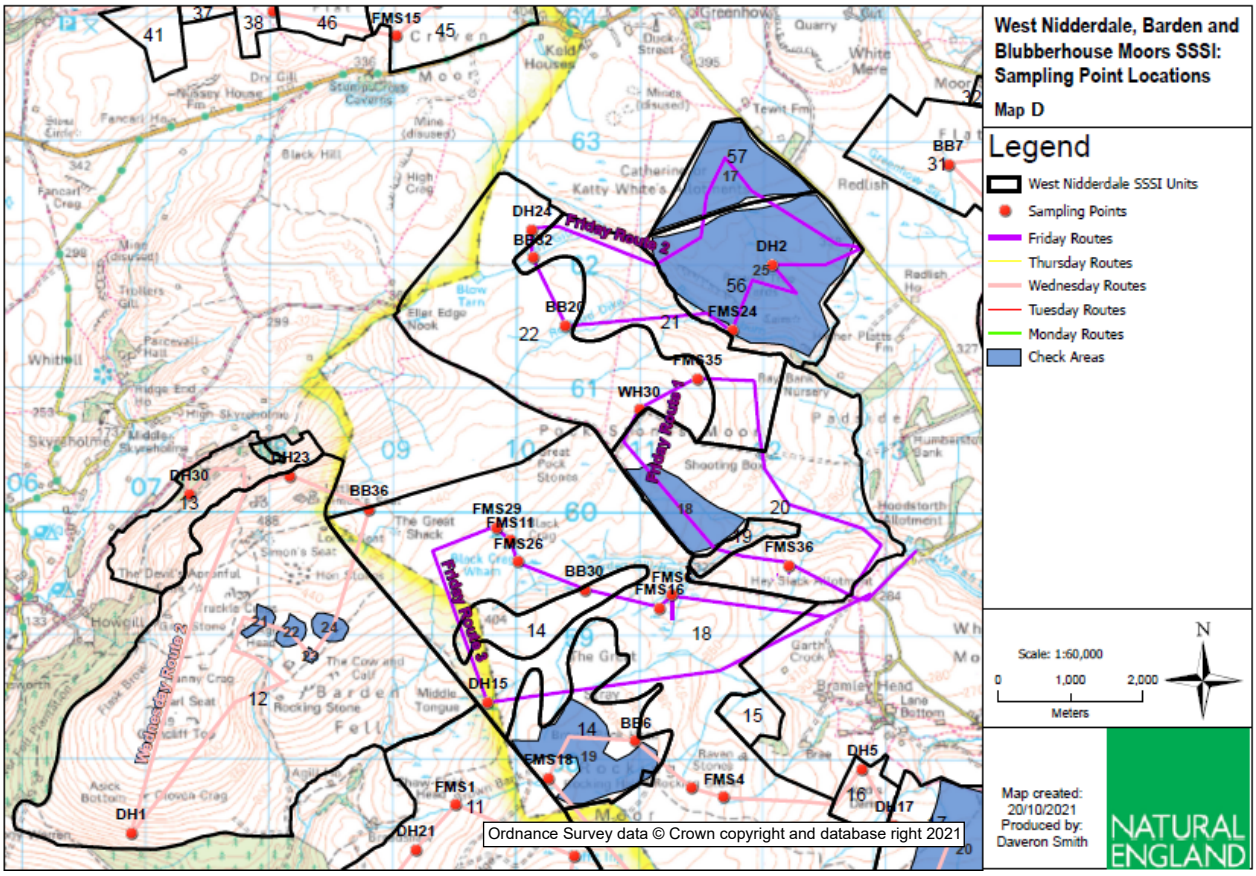


Figure 16: West Nidderdale Barden and Blubberhouses Moors SSSI sample point maps D (Central)

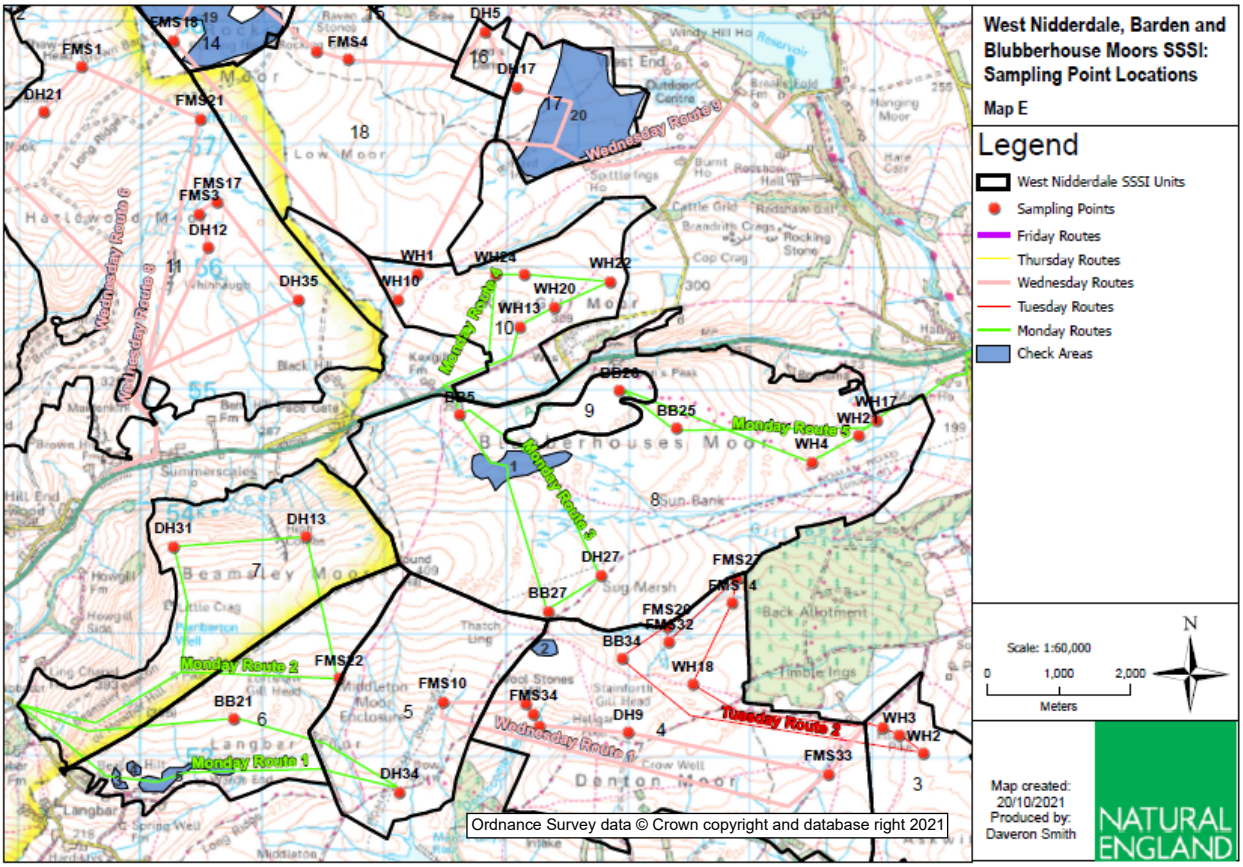


Figure 17: West Nidderdale Barden and Blubberhouses Moors SSSI sample point maps E (South)

West Nidderdale Barden and Blubberhouses Moors SSSI Full methodology

The methodology used for this upland site was very similar to the one used for the coastal SSSI. The survey aimed to obtain data from 28 sample points within each notified feature for CSM analysis. Statisticians determine 28 to be the optimal number, in terms of minimising the number of samples required while still providing an acceptable level of confidence in the result.

To achieve these 28 sample points, 37 sample locations were randomly selected for each feature using GIS, and a detailed field assessment conducted at each. The “Random points inside polygons” function in QGIS version 3.16 was used to select the 37 random sample points. Probability analysis indicates that to ensure location of 28 points within the target feature, over-sampling is initially required, as in some cases the target habitat will not be present at the sample location. Where more than 28 points per feature are surveyed, further randomisation can be undertaken after the survey. If fewer than 28 samples are achieved, the condition assessment outcome is less certain, but even 18 samples can provide an acceptable level of confidence of the condition of a large proportion of the feature.

Acknowledging that the effectiveness of the random sampling procedure would be influenced by the accuracy of the habitat-mapping held for the SSSI, effort was made to refine the mapping through earth interpretation prior to the survey. The broad term ‘Fen, Marsh, Swamp’ was adopted to cover all small wetland features, as it was not possible to determine the exact vegetation community from the existing mapping. Some areas of habitat were excluded from the detailed sampling approach where there was very low confidence in the mapping, but were highlighted as areas to ‘Check’, alongside locations where the earth photography indicated a potential management issue. With reference to the draft FCT, the Area Team and Specialists, it was agreed that only ‘Blanket bog’, ‘Dwarf shrub heath’, ‘Wet heath’ and ‘Fen, marsh, swamp’ would be assessed; ‘Acid grassland’ was not considered a notified feature and viewed as ‘site fabric’ and consequently not assessed. A Rapid Assessment was conducted of the Broadleaved, mixed and yew woodland within the SSSI with data recorded on an Excel spreadsheet form, supported by annotations made on the accompanying paper map.

To mitigate for technical problems with NESS, Excel spreadsheets based on the NESS format were designed for use on iPads. These also enabled the unique sample point identifier and peat depth to be recorded (not catered for in NESS). The Excel forms were also used to record data collected on the ‘Check’ sites and between samples. As surveyors walk between sample points there is the opportunity to collect additional data in a structured way to support the assessment. Surveyors were asked to record a maximum of four management activities they observed and to indicate whether these were having a positive or negative affect on habitat condition.

All notified features received a Detailed CSM assessment at WFA scale, conducted using NESS and utilising the Group Survey function. Surveyors uploaded their data on a daily basis to the ‘Survey Lead’. NESS is designed to allow surveyors to visit sample locations in any order, to switch between habitats, and does not limit the number of samples you can take. Suggested survey routes were indicated on survey maps in an attempt to reduce time spent walking and guide surveyors to tracks and footpaths. The locations of the 37 pre-determined sample points for each feature were uploaded onto the Field Map app for location in the field (with NESS able to geo-reference each survey location or hand-held GPS available to confirm the accuracy of the location). Presence of the feature was taken to be the nearest occurrence of the

appropriate feature within a 20 m radius of the sample point. Whenever the appropriate feature was found at each of the 37 sample locations, a condition assessment was made, using a set protocol for laying-out the plot and working through the attributes and targets table systematically. Where the sample point fell on another target habitat, the condition assessment was carried out for the new habitat and the location re-labelled accordingly. Where small or fragmented habitats were the target (e.g., sedge-fen), greater leeway was available, with sample locations allowed within a 50 m radius of the given point. Condition assessments were not undertaken where sample points fell on non-vegetated features but were re-located to the nearest occurrence of the appropriate feature type within a 40m radius of the given GPS location.

A major land management practice on West Nidderdale is burning (for grouse and to re-generate dwarf shrub heath habitat). Where random samples occurred within a recent burn a 'trimmed-down' set of attributes was recorded in recognition that at an early stage of recovery after a burn, many attributes cannot be realistically measured. The attributes recorded were selected to indicate whether negative management had occurred and whether there were signs of positive regeneration. During future monitoring visits it will be possible to assess the recovery of burn areas towards favourable status.

Photographs were labelled as per the Duddon Pilot ones and taken for all sample points to illustrate favourable habitat and issues of concern and key aspects of management across the whole site.

Guidance was provided to help differentiate between dwarf shrub, blanket bog and wet heath habitat in the field, with peat depth were measured to the nearest 5 cm up to 50 cm depth. The general rule adopted was that blanket bog lies on peat ≥40 cm in depth, wet heath on <40 cm to a minimum of ≥10 cm and dry heath on <10 cm depth. Surveyors were also provided with guidance on behaviours to mitigate against disturbance to breeding birds; a notified feature of the SSSI.

The overall condition of each feature was not determined in the field as this is not possible when using the Group Survey function in NESS. Also, some attributes required alternative methods of assessment (e.g. the assessment of habitat 'Extent' is better determined via EO techniques). The final assessment of each feature was conducted after the survey data had been uploaded to CSMi and combined with other supporting evidence.

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