OxCam LNCP Natural Capital Baseline Assessment:

Lessons Learnt Report

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1.   Introduction

The first and most fundamental step in creating a local natural capital plan is to understand the natural capital assets of an area. Information is required on the type, extent, location and condition of natural capital assets, and mapping of habitats is the key step in this process. This is an important output in its own right but is also a necessary prerequisite to assessing the benefits that arise from natural capital, their value, and opportunities to enhance natural capital assets and place them at the heart of decision making.

To that end, the Oxford-Cambridge Arc Local Natural Capital Plan team commissioned Natural Capital Solutions to create a habitat basemap for the whole OxCam Arc, building on maps already created in several of the counties, and to carry out an assessment of the basemapping process and its consistency compared to other independently produced habitat basemaps. The project had the following five aims:

1. To create a detailed habitat basemap based on the best available existing data for Bedfordshire and (separately) for Oxfordshire.
2. To merge these maps with already existing habitat basemaps for Northamptonshire, Cambridgeshire and Buckinghamshire to produce a map for the whole OxCam Arc.
3. To produce a lower resolution raster (gridded) version of the habitat basemap for pubic release, along with a series of raster maps showing the location of key individual habitat types.
4. To carry out a detailed assessment to compare the basemap for Oxfordshire with other basemaps produced using a similar but entirely independent approach and with different data inputs.
5. To write reports on the processes involved in producing the basemap and raster maps (a data report), the basemap comparison, and to compile a report on the lessons learnt.

This report is the last of the reports: the *Lessons Learnt Report*. Please refer to the other two reports for full details of the basemapping process and the Oxfordshire comparison, although key points are provided in this report. The key lessons learnt have been divided into a number of categories and are presented in the following sections. Section 2 considers issues around input data and licensing, while Section 3 discusses the approach to basemapping and ways to improve consistency. Section 4 then briefly considers the outputs of the basemapping process, and Section 5 finishes by presenting future options and conclusions.

2.   Data and licensing

By far the biggest obstacle to producing high quality, sharable basemaps is the issue of access to data and licensing restrictions. Key points are as follows:

*   *OS Mastermap Topography Layer* is by far the best source of vector mapping data upon which a habitat basemap can be built, but does currently come at high cost and with license restrictions. This means that it is not currently possible to share vector basemaps with organisations that do not already hold a MasterMap licence. OS are to make the Toids (topographic identifiers) of MasterMap freely available from summer 2020[1], and full attribute data will be available in some circumstances and to smaller users. Unfortunately, however, this open data does not appear to extend to the underlying polygons (except for very small data requests), meaning that it is unlikely to be of use in creating basemaps. Enabling free use of the underlying MasterMap polygons, or at least allowing the sharing of outputs,

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[1] https://www.ordnancesurvey.co.uk/business-government/tools-support/open-mastermap-programme

would be a game-changer, enabling the creation and sharing of high quality basemaps for much lower cost. This should be explored with Ordnance Survey.

- *Locally derived habitat data* has the potential to significantly increase the quality of the final basemaps (as shown for Oxfordshire). However, the quality of the data, the cost and the license restrictions vary greatly from county to county. In Northamptonshire and Cambridgeshire data was supplied for free, whereas in Oxfordshire and Bedfordshire there was a significant cost attached. On the other hand, the data from Oxfordshire was very high quality with excellent coverage and was up-to-date, whereas the data from some of the other counties was sparse or very old. All of the Records Centre's placed restrictions on the use of their data so that the resulting basemaps cannot be used as a detailed vector output unless the recipients have also bought the source data. This is an area that needs to be looked at urgently, as it will seriously hinder the take-up of natural capital approaches. The best outcome probably depends on the quality of the local data available. If the local data is limited it would be best not to use it (if there is a charge), to avoid restrictions on the use of the outputs. If the local data is of high quality (e.g. Oxfordshire) then a possible way around this would be to engage the Records Centres as custodians of the resulting outputs in the way that they manage biodiversity data already. This is discussed in more detail in Section 5.

- *CEH Landcover Map 2015* was also used during the basemapping process and suffers from similar licence restrictions to the Local Records Centre data, meaning that we are not able to share our outputs with any organisations that have not bought the data and hold a licence themselves. LCM 2015 data was of limited use in the basemapping process as more detailed information was used to map semi-natural habitats and the data was primarily used to distinguish arable from improved grassland. There are other sources of information that can provide this that are freely available, namely the CORINE Land Cover vector dataset and the Crop Map of England (CROME) produced by RPA. Given the license restrictions imposed by CEH, the costs, and the availability of alternatives, we would recommend that LCM 2015 is not used in future basemapping projects, even when limited local data is available. There are currently plans to produce new versions of the Landcover Map annually, which will be freely available to some users, but this will be limited to the raster versions of these maps and to non-commercial uses, and are likely to come with the same restrictions for sharing outputs.

- *Natural England's Priority Habitats Inventory (PHI)* attempts to map all habitats of principal importance (previously known as UK BAP habitats) across England and is a useful dataset, but has limitations. There seems to be inconsistencies in how accurately different habitats are mapped depending on both the habitat type and the area they occur in. Woodlands, in particular, are not considered to be reliable (many woodland patches that are not high quality are included), but other good sources of data on woodlands are available. If this data set was refined and updated further by Natural England it would really help with producing accurate habitat basemaps at lower cost.

- *Greenspace (GI) maps* have become more readily available and standardised in the last few years, thanks to the release of data by the OS. There are currently two versions available, the OS Open Greenspace layer, which is freely available, and the OS MasterMap Greenspace layer, which requires a Public Sector Mapping Agreement (PSMA) licence. Both layers should be used for basemapping if available, as the OS MasterMap Greenspace layer is much more detailed, but coverage is not complete, and the Open Greenspace data can fill in some of those gaps. These are very useful sources of information although both are currently required, and they do not entirely match. It would be helpful if the MasterMap Greenspace layer was extended into the smaller towns and villages that are currently excluded, to enable complete coverage and ideally made freely available.

- *Data checking* - One of the more significant issues faced by this project, which caused delays and a lot of extra work, was the discovery after we had completed the first version of the basemap that there were a large number of small gaps in the OS MasterMap data supplied by Defra for Oxfordshire. This was not simple to fix as data had to be obtained from a completely different source, and Toids (Topographic Identifiers, which are used to identify each polygon in MasterMap) could not be used to identify gaps, so a partly manual process had to be used. The new polygons then had to be run through the whole basemapping process and joined to the original version. This is not an error that we had seen before, but it is recommended that OS MasterMap data is thoroughly checked for gaps at the start of the project as well as for duplicates. All data sets should be checked for errors, duplicates and incorrect geometry before starting.

- *Licensing issues* have been a constant background issue during this project, with discussions required before we could start and then throughout the project, with a lack of clarity at the start over the outputs that were allowed and the resolution that would be acceptable. We would therefore advise that licence restrictions and outputs are fully discussed and understood at the start of any future projects. Furthermore, it is important that the end users of basemaps are identified early on, as this will shape discussions over licencing and may need to be included in any licence agreements.

- *Allow sufficient time* – following on from the above, there is a need to allow a significant amount of time at the start of any project to sort out licenses and obtain data. It delayed the start of this project by several months and in all projects that we have worked on it remains a significant factor. Allow for many weeks (months) to get everything in place. There also needs to be time allowed for basemap checking and to correct any problems that arise. Ideally the basemap should also be checked externally by local experts in each area.

3.   Approach to basemapping

A key part of this project has been to review and describe the methods used in producing the basemaps, to compare them to an independently produced habitat basemap for Oxfordshire, and hence to produce recommendations on how habitat basemaps can be produced elsewhere in the country. Methodological details are provided in the *Data Report* and a detailed assessment is provided in the *Oxfordshire Comparison Report*, but key points and recommendations are as follows:

- *Overall approach* – the approach to basemapping that was adopted for this project uses the OS MasterMap Topography Layer as the underlying mapping unit and then uses a series of rules to classify each polygon to the most appropriate habitat, based on a series of additional data layers (which can vary from place to place or depending on license restrictions). We consider this general approach to be much the best way of creating natural capital (habitat) basemaps, and would recommend that this should be the approach used elsewhere. It has already been used in many parts of GB by a number of different people and a very similar approach was developed independently by Alison Smith (University of Oxford). The approach is highly flexible as it can use any combination of data available and can incorporate new data sources as they become available (e.g. Sentinel derived maps). Overlaying data onto an OS MasterMap base layer remains better than using maps without the underlying polygons. OS MasterMap remains a rich source of mapping information, capturing details that would not be captured by satellite data alone, and relating it to on-the-ground reality. Finally, creating one seamless habitat basemap is considered better than the traditional approach to habitat mapping often employed by Natural England (and others) whereby a whole series of different habitat layers are created for each

habitat in turn, focusing mostly on semi-natural habitats. Individual habitat layers can still be extracted from a comprehensive basemap such as ours, if desired, but it also has the advantage that it considers the whole landscape and interactions with the built environment and is far more useable in terms of modelling the supply of and demand for ecosystem services.

- *Habitat classifications* – the largest disparity between the independently created habitat basemaps for the same area (assessed in the *Oxfordshire Comparison Report*) was due to differences in the habitat classifications used. There is a need to align the habitat classification schemes used in basemapping so that natural capital basemaps can be compared more easily. The Phase 1 classification scheme has been the default until recently but is now being superseded by the UK Habitat Classification Scheme. This has the major advantage over Phase 1 that secondary habitats, such as trees and scrub, can be added easily as a secondary code and functional characteristics such as a playing field can also be added. This would really help to address the issue of how to classify mixed habitats, which was highlighted as one of the major causes of discrepancies between the maps. It is recommended, therefore, that classifications move towards using UK Hab.

- *Mapping land-use function (green infrastructure)* – information on the functional use of land, particularly green infrastructure functions (e.g. presence of golf courses, public parks, playing fields etc.) is a useful attribute, especially when moving towards mapping ecosystem service provision. It can also give a good indication of habitat type when creating a basemap. However, function should not be conflated with form (habitats), so the final habitat type presented should be true habitats only. However, it is recommended that GI functions are recorded on basemaps, but as an additional attribute in a different column. Using the UK Habitat Classification Scheme in future basemaps may make this easier and data to identify GI is becoming increasingly available (see Greenspace maps in Section 2). It can also be useful to record public access as part of this process, which can be largely determined from GI function. This has little to do with habitat, but does provide additional information on natural capital assets and is crucial when mapping recreation, access to natural greenspace and other cultural ecosystem services. Note that GI function and public access have been recorded in the OxCam basemaps, although is not currently part of the output.

- *Designated land* – as well as information on GI function and public access, information on statutory and non-statutory designations can also be captured in the basemap. These are not directly related to habitat and could be captured separately, but are an important part of building up a natural capital baseline and asset register. It would be possible to overlay the boundaries of designations onto the habitat basemap as a series of additional attributes so that all this information was available in one place and could be interrogated further. This could include statutory designations such as SAC, SPA, SSSI, Ramsar sites, NNR and LNR, but also local designations such as county wildlife sites and equivalent, as well as boundaries such as national parks and AONBs. Many of these designations overlap, but this can be captured easily by assigning multiple designations to polygons of land.

- *Standardised approach* – as natural capital approaches become more widely used there is a need to move towards a standardised approach for basemapping and this is discussed further in Section 5 (below). This will lead to greater consistency from place to place both in terms of the basemap, but also in terms of measuring the benefits that are derived from natural capital. This could be taken forward as part of the roll out of Local Natural Capital Plans and promoted by Defra, or by organisations such as the Natural Capital Committee or the Natural Capital Coalition.

4.   Mapping outputs

The main mapping outputs of the project are a detailed vector basemap showing the habitat of every parcel of land across the OxCam Arc, which will be available to project partners who hold all of the relevant source data licences only, and lower resolution raster maps showing broad habitats and certain specific habitats of biodiversity conservation interest, for free public access via an online mapping platform. Further details and key points are as follows:

- *Creating a natural capital (habitat) basemap is an essential output*. It is an important output in its own right, enabling a greater understanding of the type, extent and location of natural capital assets. It is also a key input into steps required to map the supply of and demand for ecosystem services, values and opportunities. These are the foundations for the production of a Local Natural Capital Plan.

- *Vector basemap* – this was the primary output of this project, providing detailed habitat information for each individual land parcel across the OxCam Arc. The combined basemap contained 6.81M polygons classified into 99 different detailed habitat types or 18 broader habitat groupings (known as HabType2) and covered an area of 1,148,900 ha or 11,479 km^2. The vector output is the version that should be used going forward to map ecosystem services and opportunities and should be shared as widely as license restrictions will allow.

- *Raster basemaps* – these provide a lower resolution output, replacing the underlying polygons with simple grids to enable full sharing. These will be publicly available. An overall habitat raster shows the dominant habitat type for each grid square based on the 18 habitat groups described above, and 9 additional rasters map individual habitats for some of the rarer habitats of importance for biodiversity.

- *Raster resolution* – the resolution of the rasters was dictated to us by the data providers, who do not want free maps available that will undermine the need to purchase their products. Unfortunately, this means that the publicly available maps will be at a low resolution, which means that they will have limited use, although it is recognised that these map will still be useful in promoting the work of the LNCP and the detailed data that they are derived from. They will be useful as a way of highlighting broad patterns of habitats and land-use at a landscape scale, and key areas of semi-natural habitats, but will not be particularly useful at a local scale. It is hoped that license restrictions can be eased in the future so that rasters could be created at a higher resolution, which would subsequently provide more freely accessible detail.

5.   Looking forward

The natural capital basemaps produced during this project are a key part of the natural capital baseline assessment for the OxCam Arc. They also enable a number of follow-on steps to be taken, towards the ultimate goal of producing a local natural capital plan for the area. **Next steps for the OxCam Arc LNCP**, which can build on the basemap are shown below:

- *Mapping habitat quality and ecosystem condition* – the habitat basemap provides information on the type, extent and location of natural capital assets across the OxCam Arc, but it does not provide information on quality. This is a key missing component, but one that is being investigated in a parallel project. Once recommendations have been agreed with stakeholders, the approach could be rolled out across the rest of the OxCam Arc. A complete natural capital baseline assessment should contain the habitat basemap (including information on GI function), an assessment of quality, and a risk register (also being developed by the LNCP team).

- *Mapping ecosystem services* – the basemaps and data can now be used to assess ecosystem service provision (and value) across the area and is in a form that is appropriate for both a metric approach (e.g. applying the EcoMetric scores at a landscape scale) or a more detailed modelling and mapping approach. The former has the advantage that it is quick. The latter has the advantages that it takes into account spatial location and attributes of the habitats, is more accurate and nuanced, and importantly can also map demand for services. This means that areas that are currently providing high capacity and with high demand can be protected, whereas areas with low capacity and high demand can be targeted for habitat creation or enhanced access. It would also be possible to map the monetary value of a number of ecosystem services.

- *Habitat opportunity mapping* – another advantage of mapping ecosystem services using a more detailed approach is that habitat opportunity mapping (HOM) can then be undertaken based on these maps. HOM is a GIS based approach that is used to identify potential areas for the provision of key ecosystem services through the expansion of relevant habitats. This is done by identifying possible locations where new suitable habitats can be constructed whilst at the same time taking certain constraints into account (such as current land use or proximity to gas lines or Scheduled Monuments). Individual maps show the best areas to create new habitats, focused on each particular benefit, and can also be overlain to show areas where new habitats could deliver multiple benefits. Opportunities can be mapped to enhance biodiversity and for a number of ecosystem services such as reduced surface water runoff, reduced soil erosion, enhanced air quality, increased carbon sequestration, and increased access to natural greenspace.

- *Scenario modelling* – habitat opportunity mapping combined with an assessment of existing habitat quality can give a really good indication of the best locations to enhance existing habitats or create new habitats to enhance biodiversity and ecosystem services under the current situation. But the OxCam Arc is undergoing rapid development and change. The detailed basemap created for this project can be altered to show the new developments and different scenarios can be created to illustrate alternative alignments of road and rail or different locations of major developments. It is then possible to run the ecosystem service models to show the impact under the different scenarios or to create scenarios that minimize negative impact sand maximize positive impacts.

In addition to future projects for the OxCam LNCP project, there are important **next steps for the basemapping process** and regarding **data access, licensing and funding**. Key points are outlined below:

- *Standardised approach* – as described above, producing basemaps by overlaying a number of data layers onto OS MasterMap is considered to be the best way of producing accurate basemaps. However, where this approach is applied using different tools, there will remain differences in the rules applied and therefore in the way that habitats are assigned. It would be highly beneficial, therefore, if a standardised approach was developed and used throughout the country. To that end the project team (Natural Capital Solution and the University of Oxford) are currently working with Forest Research and the University of Liverpool to produce an updated basemapping approach that builds on both of the methods described in the *Oxfordshire Comparison Report* and takes on board the issues raised in Section 3 (above). The approach will be updated with new data sources and standardised classifications, and will have the ability to incorporate additional data sources as and when they become available (e.g. Sentinel based maps). This will be automated so that maps can be produced much more quickly in the future and will be free to use to encourage uptake and standardisation. It is hoped that this will become the default way to produce baseline natural capital (habitat) maps. That

would ensure consistency of approach and outcomes, and enable maps to be compared directly from different areas.

- *Data access, licensing and funding models.* This remains one of the biggest headaches for basemapping projects. It is therefore recommended that basemapping should either move towards using exclusively free data if possible, so outputs are freely available without restriction OR involve Local Records Centres (LCRs) as the data holder and custodian. The latter would enable the use of the best available data and alternative funding models are suggested:

In the <u>free model</u>, OS MasterMap will become free to use (there is still some uncertainty about exactly how this will work so the situation will need to be monitored), CEH data can be replaced by CORINE or CROME data and LRC data is either not very good or can be replaced by (enhanced) PHI data or other emerging data sources. The outputs would then have no license restrictions and could be made publicly available. The key advantage of this model would be that it would encourage the widespread use of the basemap, and by extension the natural capital approach, across sectors. An important disadvantage of this approach is that the basemap may not be based on the best available data, which may lead to some inaccuracies on the resulting basemap. A further disadvantage is that there would be no income stream to pay for habitat surveys or for the creation and updates to the basemap, so funding would have to be secured separately. This could come from either a central organization (government funded) or alternatively could be paid for through receipts from the forthcoming biodiversity net gain (offsetting) requirements. This legislation is likely to see developers paying money into a pot to meet net gain requirements where it cannot be met on site. A small part of this money could be put aside to develop and update the evidence base, so that habitat baselines were accurate and the best opportunities for offsetting were identified.

In the <u>Local Records Centre model,</u> the LCRs collect detailed Phase 1 (or equivalent) habitat data and update this on a rolling basis. This is a key input into the basemap and would ensure that the best available data was used in the maps, hence producing the most accurate basemaps possible. The LRCs would then hold the license for the basemap and other outputs produced. A process can then be set up mirroring that for biodiversity data, whereby developers and other interested parties put in a request for information about a site, the LRC would clip the habitat map and other ecosystem services and opportunity maps with a buffer around the site and send them a report showing the baseline position and opportunities. This can be automated so that it is not too difficult to administer. The income from this process would then pay for a rolling update of the habitat surveys that underpin the basemap and for periodic update of the basemap itself. This model can be further encouraged by writing local planning policy and Supplementary Planning Documents that require developers to report the impact of proposals on natural capital and achieve natural capital net gain (which is the direction of policy travel as stated in the 25 Year Environment Plan). A variation on the Local Records Centre model would be a <u>centrally funded LRC model</u>, which would ensure that the best available data was included in basemaps, but because the record centres do not need to fund themselves the data would be freely available.