



# Assessing the Natural Capital of Three Hagges Wood-Meadow

For Hagge Woods Trust

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## LIST OF ABBREVIATIONS

EWGS	English Woodland Grant Scheme
FWPS	Farm Woodland Premium Scheme
HWT	Hagge Woods Trust
ROM	Rough Order of Magnitude
THWM	Three Hagges Wood-Meadow

## EXECUTIVE SUMMARY

The aim of this study was to illustrate how natural capital concepts and tools can measure and communicate the benefits of the new wood-meadow created at Three Hagges Wood-Meadow (THWM) in Yorkshire. Furthermore, the approach has been intentionally light on data, to illustrate the extent to which meaningful conclusions can be drawn from information compiled in a relatively short space of time and with modest resources.

Given the limitation on time and resources, there has been an emphasis on a small number of significant benefits and the use of simple methodologies and assumptions to generate Rough Order of Magnitude (ROM) values for the economic benefits. The results, approximate as they are, have given a good view of the state of natural capital for the site, and a sense of the scale and value of the benefits it delivers.

In economic terms, the most significant benefits that can readily be expressed in monetary terms are recreation and education. Combined, these benefits are in the region of £350k-850k in present value terms, and easily justify the investment and level of grant funding committed to the project so far. Furthermore, these benefits have scope for further enhancement, both in terms of quantity (the number of beneficiaries) and quality of experience.

The primary benefit of the wood-meadow, namely the provision of biodiversity, was assessed but difficult to evaluate adequately in monetary terms. The reasons for this included: the difficulty in predicting future biodiversity improvements, especially given the early stage of development; the double counting of some wildlife benefits within the recreational and educational benefits evaluated above, and a lack of data to support an adequate economic valuation.

Other benefits considered include the provisioning benefits of timber and hay (both low in value) and the carbon sequestration of the woodland (in the range £51k - £181k). The simple model used to value the carbon sequestered illustrates that its value may be significant and suggests that there may be worthwhile opportunities for funding from voluntary carbon markets.

A simple assessment of the ongoing maintenance costs of the wood-meadow revealed that the present value of these tasks was around £86k or £3k per annum. The relatively low cost of maintaining (and improving) the natural capital of THWM is viewed by the Trust as a major advantage of the project and this helps to contribute to an improved net natural capital value.

A simple natural capital balance sheet was produced for THWM to illustrate the value of its natural capital assets and liabilities, both to the Trust itself and to external beneficiaries. This demonstrated substantial value to external beneficiaries and highlights the importance of external stakeholders to the assessment of the value of the site.

It is hoped that the valuations and outputs presented in this report can assist Hagge Woods Trust in their strategic and operational decision making as well as making a case for investment, encouraging others to initiate similar projects and attracting others to support the Trust.

## 1 BACKGROUND

This report describes the application of a natural capital valuation framework to understand and promote the value of new habitat creation at Three Hagges Wood-Meadow (THWM), Escrick, Yorkshire. The approach has been intentionally light on data, to illustrate the extent to which meaningful conclusions can be drawn from information compiled in a relatively short space of time and with modest resources.

Initiated in 2012 to celebrate the Queen's Diamond Jubilee, the recently planted 10 ha wood-meadow at THWM is designed to maximise biodiversity. Although it is still in the early stages of growth, the benefits case for investing in such a project needs to be established in order to encourage further schemes. Consequently, the aim of the analysis reported here was to illustrate how natural capital concepts and tools can measure and communicate the benefits of new habitat creation at THWM.

The remainder of this report is structured as follows:

- Section 2 defines the underlying concepts and methodology used in this study;
- Section 3 presents the initial outputs of the analysis; and
- Section 4 provides some initial conclusions.

## 2 APPROACH AND METHOD

Natural capital has been defined by the Natural Capital Committee as:

“The elements of nature that directly and indirectly produce value or benefits to people, including ecosystems, species, freshwater, land, minerals, the air and oceans, as well as natural processes and functions” (NCC, 2014).

In other words, natural capital includes ecosystems, biodiversity and all sub-soil, abiotic resources like fuels and minerals. This definition represents the natural environment as a capital asset, i.e. something that has the productive capacity to generate value, in terms of benefits that we derive from them.

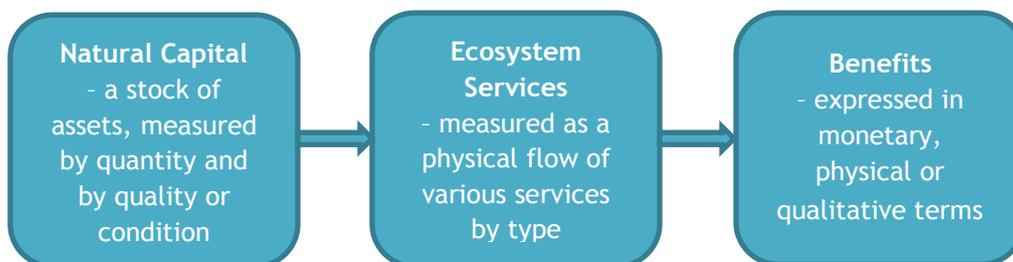
Some benefits accrue to the organisation / individuals who own (or manage) the natural capital. These are called private (or internal) benefits. They tend to be traded in markets and accounted for in financial accounts. An example is the value of timber from a forest.

Other benefits accrue to those who do not own (or manage) the natural capital. These are called social (or external) benefits. They tend not to be traded in markets (also known as non-market benefits) and hence are not accounted for in financial accounts. Examples include informal recreational opportunities, amenity benefits, and flood prevention functions of a woodland.

A common approach to understanding the provision of such benefits is the ecosystem services approach. This approach recognises four primary categories: provisioning services; regulating

services; cultural services; and supporting services (e.g. MEA, 2005; UKNEA, 2011). For each category of ecosystem service provision, various specific flows of benefit may be present for a particular site, dependent on land and other environmental management actions (either active or passive). As a result, it may be possible to evaluate these benefits to varying degrees, whether in monetary terms or only in qualitative terms. This chain is illustrated further in Figure 2.1.

**Figure 2.1: Benefits from Natural Capital.**



In order to analyse this chain, we need to:

- **Understand** which natural capital assets we own / manage / are asked to analyse; what benefits they produce and for whom;
- **Measure** these benefits as well as costs of maintaining the quality and quantity of these assets to ensure their sustainable use over time;
- **Account for** the costs and benefits to see how they change over time and whether our uses of the assets are indeed sustainable.

This project illustrates all three steps and produces:

1. A summary table of the main ecosystem services provided by THWM. This would highlight the main ecosystem services that would be the subject of further analysis. See Section 3.1.
2. A table of the (external) benefits derived by the main ecosystem services evaluated. This would detail the outputs in either quantitative or qualitative terms, and where possible provide an indication of monetary value. See Section 3.2.
3. A simple balance sheet for the site. This would follow the format of the natural capital accounts, as set out in the Corporate Natural Capital Accounting framework (eftec et al., 2015). See Section 3.4.

These outputs were produced over a two week period and demonstrate how quickly an outline natural capital picture can be generated for a single site. We hope the information can assist Hagge Woods Trust in their strategic and operational decision making as well as making a case for investment in similar projects and attracting others to support the Trust.

### 3 RESULTS

The three main outputs are described in turn below.

#### 3.1 Ecosystem Services

Based on discussions with Hagge Woods Trust (HWT), it was decided that for the purposes of the ecosystem service assessment, the site should be treated as a single unit. This is because the transitional zones that are created by the mosaic pattern of wood and meadow are key to the biodiversity and major benefits of the site.

Table 3.1 illustrates the most significant ecosystem services delivered at THWM (indicated by a black dot). The table does not include all ecosystem services provided by the wood-meadow, but covers those services considered to some degree in discussions with HWT. Management judgement was used to prioritise the most significant services, which suggests that if a more comprehensive analysis of services were carried out, some other services may emerge as potentially material (such as pollination services). In the interests of time, this matrix was used to focus subsequent analysis on the six most significant benefits (highlighted in green) below.

**Table 3.1: Assessment of the Key Ecosystem Services at THWM**

	Ecosystem Service												
	Provisioning services				Regulating services					Cultural services			
	Water	Hay	Timber	Biodiversity	Climate regulation	Water quality regulation	Soil quality regulation	Pest regulation	Pollination	Carbon sequestration	Recreational	Educational	Aesthetics
Wood-meadow mosaic, comprising of:													
• Woodland	-	•	•	•	-	-	○	-	○	•	•	•	○
• Meadow													
• Shrub layer													
• Pond													

**Key: Most significant ecosystem services analysed**

- Significant ecosystem service flow
- Potentially significant/moderate ecosystem service flow
- Negligible ecosystem service flow

#### 3.2 Natural Capital Benefits

The six most significant ecosystem service benefits from THWM are described in Table 3.2 below. Most of the benefits have been expressed as a range of likely values, giving a lower, upper and sometimes central estimate based on the best available information and assumptions. A Graphical presentation of the range of benefits (and the costs of maintenance) is given at Annex 1.

Table 3.2: Summary Evaluation of the Significant Benefits at THWM

Benefit (type of benefit valued)	Physical Output	Present Value <sup>1</sup> (£k)	Assumptions and Sources
Timber (private benefit)	9 tonnes p.a. at steady state	£2k	Out of the 6ha of woodland, timber is provided by about 3-4ha of coppiced wood area. The coppiced wood will be harvested in about 10 years. We assume that the annual flow of timber provision is constant at 9t p.a. at an estimated value of timber of £10.38/t (Nix Farm Management Handbook, 2013)
Hay (external benefit)	16 tonnes p.a.	(low £12k, High £33k)	Out of the 4ha of meadow, c2.5ha will be harvested for hay. Low value assumes the value of hay equals the cost of making it (currently about £400 p.a.). High value assumes a price of £70 per tonne <sup>2</sup> .
Carbon <sup>3</sup> sequestration (external benefit)	Up to 28 tCO <sub>2</sub> e p.a. through major growth phase.	(low £51k, central £116k, High £181k)	Tree species at HWT are mainly broadleaved, with oak, lime, hazel, elm and birch constituting the main trees. Following eftc (2014) a simple model assumes sequestration of 2.2 tCO <sub>2</sub> /ha/year for the first 10 years, then 4.7 tCO <sub>2</sub> /ha/year, until 2114 (100 years). Central, lower and higher values are calculated using non-traded price of carbon profile to 2100 and held constant thereafter to 2114 (DECC, 2014).
Recreation (external benefit)	Currently c3,600 visitors p.a. but expected to increase	(low £183k, central £365k, High £548k)	The level of daily visitors is not measured, but has been estimated at around 10 per day (low 5 and high 15 per day to give a representative range). There is an expectation that this will grow as the wood becomes more established, but for the purposes of valuation the level of visitors has been assumed at current levels over the analysis period, and evaluated at an average value of £3.47 per visitor (Sen et al., 2012)
Biodiversity provision (Wildlife and Flora) (external benefit)	Diversity of species is expected to grow - simple composite/indicator measures still TBD	Not Quantified	There are many measures that can capture the level of diversity within the site. There are several periodic surveys either conducted or planned which will provide valuable information on both the state and trend of biodiversity. As the emphasis has been on building diversity "from the bottom" the expected outcome is for a steady improvement in wildlife as the wood-meadow matures. However, precise forecasts in improvements over time are impossible to predict. Consequently, providing a simple financial value for this benefit is problematic.
Education (external benefit)	Currently 150 students per year but planned to increase significantly	(Low £158k to High £303k)	According to Mourato et al. (2011), the value of two different nature sites is between £19-30 per child. Present value range is calculated on both values less assumed costs of £7 per student for time and materials. Assume 20% increase in visits per year, until maximum 500 students per year (in 2022). Benefit assumed constant thereafter into perpetuity.
<b>Total</b>		<b>Range: £405k to £1,065k</b>	

Notes: <sup>1</sup> Discount rate is 3.5%. Benefits assessed for the first 30 years. Then using a terminal value calculation to estimate value in perpetuity.

<sup>2</sup> July 2015 meadow hay price per tonne, Source: British Hay & Straw Merchants' Association/Defra, Available at: <http://dairy.ahdb.org.uk/resources-library/market-information/farm-expenses/hay-straw-prices/#.Vfqmvv-FPIU>

<sup>3</sup> Carbon sequestration benefits over 100 year period (to 2114) and then assumed to be zero thereafter.

A fuller discussion of the benefits follows<sup>1</sup>:

- **Timber:** The future use of coppiced timber is not yet known; hence the valuation is only indicative. Coppiced wood could be used for: craftwork in the bodger's den, coppice products, thatching spars, fencing materials, basketry, and possibly firewood or charcoal. The final use will depend upon future opportunities and the state of various markets at the time. Whatever the use, even a high premium specialist use of coppice wood is unlikely to yield values as high as the recreational and wildlife value of the site.
- **Hay:** Under the terms of the woodland grant, the trust is not permitted to sell the hay harvested from the meadow. However, this commercial constraint does not negate the economic value of the hay produced. Hay can be provided to beneficiaries, perhaps in exchange for some benefits in kind. The value of hay is subject to wide variation. Over the last four years the meadow hay price has fluctuated between the current value of £70/t and a high of £119/t, (source; note 2 to Table 3.2). Furthermore the quality of the THWM meadow hay is unlike typical commercial hay (i.e. due to the high flower/diversity content) so use of typical market prices may be misleading. For example there may be a premium for non-chemical or certified organic hay. In order to establish a reasonable range of possible values, the meadow price of hay has been used as an upper value (which currently represents a 50% premium on the standard big bale hay price), and a lower value that assumes the hay is equal to the cost of cutting/making it. Currently the trust pay about £400 for the hay to be cut and this cost is covered under the natural capital maintenance costs in the corporate natural capital account (Section 3.3).
- **Carbon Sequestration:** This benefit was evaluated for the 6 ha of woodland only. There is likely to be improved sequestration of carbon in the meadow/soil, but due to limited time and data this was not quantified but considered an additional benefit above and beyond woodland sequestration (see discussion at the end of this paragraph). For the woodland, given the complexities of modelling a diverse range of tree species (28) and the varying rates at which they sequester carbon, a very simple model was used to provide a rough order of magnitude (ROM) valuation of this benefit. Following the simple model for broadleaf woodland outlined in (eftec<sup>2</sup>, 2015), the first ten years the sequestration rate was assumed to be 2.2 tCO<sub>2</sub>/ha/year and 4.7 tCO<sub>2</sub>/ha/year for years 11-100. The longer term sequestration rates depend upon the management of the wood and the final use of any products. A conservative approach has been adopted here and it is assumed the wood is carbon neutral after 100 years (0 tCO<sub>2</sub>/ha/year for years 100+); even though some species (such as oak) will sequester carbon for up to 200 years or more, but at a lower rate. Therefore, this estimate is likely to understate the benefit, unless the coppiced wood is used for fuel. There is likely to be an additional carbon benefit arising from the creation of permanent grassland in the meadow, (mainly through avoiding both ploughing and the use

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<sup>1</sup> Benefits are calculated by forecasting future benefit flows for 30 years (except carbon sequestration, see note<sup>2</sup> to Table 3.2) and then using a terminal value calculation to estimate value in perpetuity. In perpetuity unit values have been assumed constant (other than carbon sequestration benefits that have been modelled as zero from after 99 years). This simple approach differs from Treasury guidelines which advise the gradual reduction of discount rates over the full term (starting from 3.5%). For ease of computation and considering the approximate nature of the estimates, it has been judged that the simpler approach to discounting will not materially influence the results. In any case, these perpetuity values are conservative as values are likely to increase in the future.

<sup>2</sup> These rates were a simplification of the annual rates provided in the Woodland Carbon Code Carbon Lookup Tables v1.5 2013.

of fertilisers associated with the previous arable use). Quantifying this benefit requires some data on previous soil carbon content and some evidence that new management practices are effective in raising soil carbon content. Soil samples have been taken from THWM with the aim of comparing soil quality with representative samples from arable fields in the area<sup>3</sup>. However indications from the Conservation Reserve Program (CRP) in the United States and in other temperate grasslands suggest that sequestration rates of 0.70 to 1.05 tC/ha/yr are possible<sup>4</sup> (or 2.6 to 3.9 tCO<sub>2</sub>e/ha/yr) for a period of up to 50 years. Assuming a non-traded carbon price of around £62/tCO<sub>2</sub> this would give a value in the range of £637 to £955 per annum for the meadow.

- **Recreation:** This is one of the most significant of the benefits that can be expressed in monetary terms. Uncertainties around the current level of visitors (the estimate used is a judgement of daily visitors from Rosalind Forbes Adam) mean that the value calculated is expressed as a wide range of possible outcomes. Consequently, it would be important to obtain a better view of current visitor levels (e.g. by surveys or visitor logs) and to develop some assessment of the scale of the opportunity to increase visitor numbers. It may also be useful to develop a qualitative understanding of the type of use visitors make of the wood, (e.g. nature watching, walking, health, well-being, peace, etc.) as this may influence the value attached to each visit.
- **Biodiversity Provision:** This is the main benefit of the site, but it is difficult and complex to articulate in monetary terms. Firstly, biodiversity as a supporting service should not be conflated with the provision of wildlife and flora for its own sake. For example the trees and shrubs of the woodland (the flora) are instrumental and essential to the sequestration of carbon and in this respect biodiversity is an important supporting service to enable the carbon sequestration benefit to be delivered. However, biodiversity provision for its own sake reflects the value that society places on the existence of diverse wildlife and flora. In the case of THWM, the prime motive of the project is to maximise the growth in diversity of all natural life. Not only is the future growth in diversity difficult to predict, but assigning values to either specific species or groups of species may not sit comfortably with the main supporters of the trust. A further consideration is that some of the biodiversity benefit will be accounted for in the recreational value, and in the educational value. However by way of indicating some level of monetary benefit, various grant payment schemes can be considered. Current HLS payments provide indications of habitat value, for example the option for the maintenance of species rich grassland pays at £200 per ha per annum, or about £800 p.a. for THWM. The option for maintenance of hedgerows of very high environmental value (one side) is £27 per 100m, or about £1,000 p.a. for the layout of THWM. A key aim of the trust is to enhance wildlife beyond the norms delivered by the HLS scheme (private communication), so these values would be an indication of the minimum value that could be ascribed to the creation of new habitat for wildlife. The high diversity of tree and wildflower species at THWM is a key factor in enabling the high diversity in wildlife. For example the range of wildflower species provides a rich habitat for pollinator species which in turn supports diverse bird species and other wildlife. It is also hoped (private communication) that a healthy population of small mammals is likely to support rare predators such as the Barn Owl (a Biodiversity Action Plan target species). Wildlife diversity data is being collected and in time it may be possible to assess this benefit more

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<sup>3</sup> Samples are currently being analysed by the University of York and results are expected at the end of the current year (2015). At this point it will be possible to make a reasonable estimate of the soil carbon sequestration benefits of the meadow.

<sup>4</sup> Information from Kelly Redeker (University of York), and source IPCC at: [http://www.ipcc.ch/ipccreports/sres/land\\_use/index.php?idp=230](http://www.ipcc.ch/ipccreports/sres/land_use/index.php?idp=230)

fully. Finally, there may be connectivity benefits for wildlife provided by the habitat but this was not considered in this analysis. Given these complexities no definitive value has been quantified in Table 3.2.

- **Education:** This valuation has only considered the benefit to school children from learning outdoors using the range of £19-30 per student (Mourato et al., 2011). The Mourato study may not be entirely suitable for transfer to this site as it was based on two reservoirs (Hanningfield Reservoir/London Wetland Centre, i.e. not woods) close to London (not in a rural setting as for THWM). However it is the only study that could be found which specifically addressed the value of school visits. Given the high level of effort that HWT is putting into educational visits, it is reasonable to assume that a valuation towards the upper range of estimates is appropriate. The costs of delivering an educational visit must be deducted from these benefits to give a net benefit value. A typical visit should allow for the costs of travel, materials and labour. Assuming £200 in total for a visit of 30 students, and rounding to the nearest pound yields an average cost of £7 costs per child. Consequently the range of net benefits has been calculated on the basis of £12 to £23 per student. The range of education benefits could be extended to include adults via guided walks. There is also value in the research opportunity that the creation of THWM presents, which may be developed in the future alongside the universities that are involved in learning from the wood-meadow. The trust has an aim to nurture citizen scientists as mentioned in the recent annual report (Hagge Woods Trust, 2015). These aspects have not been possible to value in this analysis.

Overall, the valuation has been conservative and illustrates that, even without any figures for the primary benefit of wildlife provision, the wood-meadow could be generating an expected value in the region of £0.4m to £1m or in the range of £15-20k per year. This provides a considerable return on the combined grant investment<sup>5</sup> from the English Woodland Grant Scheme (EWGS) and the Farm Woodland Premium Scheme (FWPS).

In addition there may be other benefits that warrant further investigation, such as pollination, and improvements to soil quality. See section 4 for a discussion on possible next steps for further evaluation.

### 3.3 Natural Capital Maintenance Costs

The annual costs of maintaining the wood-meadow have been estimated at around £3k per annum<sup>6</sup>. This includes £1.2k for weeding/spot spraying, £1.4k for brush cutting/strimming and £0.4k to pay for mowing the meadow and the removal of hay. These are largely labour costs and are assumed to not include any element of voluntary labour - (all voluntary labour is assumed to be spent on non-core maintenance tasks). Over time the activities will change as the wood matures (e.g. there will be more pruning and coppicing but less weeding), but the current management view is that the overall costs of maintenance will be roughly the same. Consequently the natural capital maintenance liability has been calculated on the basis of £3k in perpetuity, (i.e. £86k present value).

The trust incurs other costs for educational visits/development (costs of delivering visits have been included in the net educational benefit calculation, see section 3.2), specific events, promotion and management costs (currently assessed at around £13k p.a.). These are to some degree

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<sup>5</sup> According to HWT the eWGS grant was £45,888 and the FWPS is currently £2,868 p.a.

<sup>6</sup> Spreadsheet from Tango Fawcett of HWT.

discretionary and are not directly related to the maintenance of the wood-meadow, so have not been included in the natural capital maintenance account.

The level of volunteer effort at the site is considerable. However, it has not been possible to assess its scale and value in this study. Some of the maintenance activity could be done by volunteers (although in the maintenance account none is assumed). This would have the effect of reducing the private maintenance liability, but should be offset by an equal increase in external liability.

### 3.4 Natural Capital Account

Organisations assess the value of their assets through conventional financial accounting processes. This includes balance sheets that summarise the assets and liabilities that the company holds, and profit and loss accounts that record flows of values in an accounting period. This basic information underpins multiple decisions in an organisation, such as knowing when funds will be required for maintenance and improvement, and how to capitalise on increasing the value of their assets.

Most of the natural capital benefits do not appear in financial accounts. Shortcomings of financial accounting are demonstrated quite clearly in the way parks are treated in local authority accounts. The park is the physical asset. It gives rise to a liability via the cost of maintaining the park for public use year on year. This is shown in the financial accounts of the local authority as a cost. The park also generates recreational value, but this is not recorded financially, as entry to the park is free. Financial accounts therefore register nothing for this element of asset value of the park. The actual value to the users and wider society is of course much higher than this, but is not visible in the financial accounts and would be hard to articulate in decision-making.

Corporate Natural Capital Accounting (CNCA) is designed to address this missing information. CNCA is a framework that collates natural capital information in a similar way to other capital assets<sup>7</sup>. The simplest natural capital account that can be produced for THWM is the balance sheet at the current point in time, and this is shown in Table 3.3 below.

**Table 3.3: Natural Capital Balance Sheet for THWM, as at 31 July 2015**

<b>Balance Sheet at 31 July 2015</b>	<b>Private Value £k</b>	<b>External Value £k</b>	<b>Total £k</b>
NC Assets	82	323	405
Liabilities	(86)	-	(86)
<b>Net Natural Capital</b>	<b>(4)</b>	<b>323</b>	<b>319</b>

The figures are provisional and intended to indicate how a natural capital balance sheet would portray the natural capital of THWM. The account is partial and does not present a definitive value for the natural capital of THWM, only a minimum value. Values are computed as follows:

<sup>7</sup> Developed by a consortium of Economics for the Environment Consultancy (eftec), PwC and the Royal Society for the Protection of Birds (RSPB) for the Natural Capital Committee: full report eftec et al. (2015) 'Developing Corporate Natural Capital Accounts' are available at: <http://www.naturalcapitalcommittee.org/corporate-natural-capital-accounting.html>

- **Private Value of natural capital assets** is the sum of the present value of the grant income from FWPS (£80k assuming follow on grants of the same value or payable in perpetuity) and the value of timber shown in Table 3.2 (£2k). The total, £82k, represents the present value of all income streams that flow to the trust. [the EWGS grant has been (largely) paid already and offsets the costs of creation so far. We have neglected donations which cover promotional activity and management costs].
- **External Value of natural capital assets** is the sum of the present value of all benefits that flow to external beneficiaries and is calculated as the total benefits less the private benefits calculated above. This includes the following from Table 3.2: Hay £12k, Carbon sequestration £51k, recreation £183k, and education at £158k, less the £80k PV of grants which pay for some of these benefits. The total £323k does not include any specific valuation for wildlife benefits, although some of these will be realised in the recreational and educational benefits.
- **Liability** is the present value of the future costs of maintaining the wood-meadow in the intended condition. This has been based on estimated annual management costs of £3k p.a. in perpetuity (see section 3.3).

Overall, the account shows that the grant income is broadly in line with the costs of maintaining the wood and hence from a private income point of view the wood-meadow generates negligible net income. However, the benefits to external beneficiaries are several times the private asset value and illustrate the scale of the benefits delivered to wider society.

## 4 DISCUSSION/RECOMMENDATIONS

Hagge Woods Trust has a good understanding of what underpins the natural capital value and ecosystem services of Three Hagges Wood-Meadow: namely the diversity of the wood-meadow habitat that is being created there. The underlying health and condition of the wood-meadow is the primary concern of the trust and does not need to be elaborated here. What may be unfamiliar to the Trust is the relative economic value of the benefits delivered.

### Economic Valuation

In economic terms, the most significant benefits that can be expressed in monetary terms are recreation and education. There are plans to increase the scale of school visits and expectations that visitor numbers will increase as the site matures and its reputation grows. The estimates used here only allow for growth in educational visits, hence there is scope to increase the level of economic benefits beyond the range used in Table 3.2. It is important to appreciate that these benefit levels can be increased via better quality of experience (reflected in economic price) as well as by the sheer number of visitors or students. There was insufficient time in this study to explore the qualitative aspects of recreation and education, but this may be something that is worth exploring in the future.

The next significant benefit is carbon sequestration (£51k -£181k for the woodland alone). A more accurate value of carbon sequestration may be worth assessing for the particular coppice regime planned for THWM, as the figure could be considerably higher than the conservative figure assumed here. Also there may be merit in investigating sources of funding from the voluntary carbon market. Finally, a better view of the soil carbon in the meadow may lead to an increase in the overall carbon estimates.

Although the provisioning values (timber and hay) are much lower, these benefits can still do much to raise awareness amongst visitors about the multiple benefits of natural capital assets. Furthermore, there may be opportunities to exploit niche markets for some timber (e.g. craft products from the bodger's den).

While biodiversity provision is intended to be the key benefit of the site, this particular benefit has not been fully captured in this study. However it is important to appreciate that some of this value is likely accounted for in the recreational and educational values evaluated above. Although the full value may be difficult to express in monetary terms, it is still important to monitor and express this service in qualitative and quantitative terms, such as by trends in survey data, or by tracking important indicator species. This is particularly important for this project as one of its main aims is to maximise biodiversity through its innovative management approach (such as the maximisation of transition zones through the planting of multiple coppices in lazy S bend formation, and extending the flower season for pollinators by a late summer cut of the meadow). The effectiveness of these approaches can be tested if biodiversity is measured over time and compared to more traditional approaches to habitat creation.

Whilst this study has been limited to an assessment of the more significant and readily assessable benefits of the wood-meadow, it is important to realise that there are further benefits that may be worthy of further investigation. For example, more work may capture some of the regulating benefits of bio-diversity, such as pollination services. There have been several studies on the value of pollination services and applying these to the specific circumstances of THWM may generate further value.

Other aspects of the project can be captured in economic terms. For example, planting of trees in fine grass avoids the use of glyphosate weed killer which is conventional practice in creating new woodland. The benefits include reduced expenditure as well as avoiding pollution and reducing soil evaporation. The reduction in cost is reflected in the lower natural capital maintenance costs (see Section 3.3). A potentially important economic case may be developed that compares the overall natural capital costs of this project with the costs of more conventional habitat creation projects. This of course will require further study.

### **Natural Capital Accounting**

In terms of natural capital accounting, the balance sheet provides a snapshot which highlights the extent to which external beneficiaries derive considerable economic value from THWM. In the future it may be worth repeating this exercise at five-yearly intervals to test for any significant shifts in benefit levels or market conditions. However, the real benefit in accounting for natural capital will be to monitor the health and diversity of wildlife in the wood-meadow in physical terms and on a regular basis - i.e. in line with the annual surveys planned. This would also extend to monitoring visitor numbers and keeping records of educational activities.

### **Next Steps**

The next steps for HWT depend largely upon what the trust wants to achieve with the natural capital approach. For example, if the main aim is to promote the value of this kind of project to farmers and local communities to encourage the launch of similar schemes then the following may be appropriate next steps:

- Publish and promote the lessons from this study. Test the reception with feedback from a select audience, first. For example does this adequately make the case? Or more usefully to which type of audiences will this approach make an adequate case?
- Consider exploring the value of other benefits not covered in this study, (pollination, meadow soil carbon and quality, lower natural capital maintenance costs, etc.).
- Consider surveying visitors to gain a deeper understanding of the benefits they derive from visiting THWM - at least have a visitor count in place and learn the proportion of repeat visits.
- Capturing some of the educational benefits in terms of positive outcomes for students. This emphasises the quality of the learning experience at THWM.
- Develop the biodiversity value for money case for the project by comparing biodiversity outcomes and costs with other typical habitat creation projects.

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## ANNEX 1

Graphical Presentation of the Range of Cost/Benefit Values at THWM

