

# DEVELOPING ECOSYSTEM ACCOUNTS FOR PROTECTED AREAS IN ENGLAND AND SCOTLAND: DORSET AONB SUMMARY REPORT



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# INTRODUCTION

Dorset AONB is made up of a mosaic of interconnected ecosystems including farmland, grassland, and coastal margins. These **ecosystem assets** provide a range of important services to people living within and visiting the area, including the provision of food and water; the regulation of air quality, water quality, and flood risk; and cultural services such as aesthetic value, a sense of heritage, and opportunities for recreation.

The value of these services is significant and the capacity of the environment to continue to provide such services has a direct impact on Dorset's prosperity and well-being. However, the monetary value of these **ecosystem services** is not always fully accounted for in the management of land and other natural assets.

**Ecosystem accounts** provide a framework for measuring the extent and condition of these assets, and monitoring changes in the provision of services over time. This provides a way to communicate the contribution the environment plays in supporting economic vitality and social wellbeing, and can also be used to evaluate trade-offs as to how investment can support or risk the capacity of ecosystems to function and provide services.

## Developing an ecosystem account for Dorset AONB

In 2014, Defra and the Scottish Government funded a project to scope the potential for developing ecosystem accounts for protected and other land areas in the UK. The project builds on work by Defra and the Office for National Statistics and draws on the UN System of Environmental Economic Accounting guidance.

The aim of the accounts is to quantify the extent and condition of ecosystem assets within six pilot areas, as well as to quantify and value the flow of ecosystem services from these assets. In addition to testing the principles of ecosystem accounting methodologies, a key aim of the project is to help inform resource management decisions within the pilot areas.

As part of this project, Dorset AONB was selected as one of the pilot areas. This report sets out some of the key findings for Dorset AONB from the development of the ecosystem accounts. The report is divided into six sections:

- **Asset account** – provides an overview of the quantity and quality of ecosystems in Dorset AONB to monitor changes in the extent and condition of the stock of ecosystem assets.
- **Physical flows** – provides an overview of the physical quantity of services provided within Dorset AONB in 2013.
- **Monetary flows** – provides an overview of the monetary value of the services provided in Dorset AONB in 2013.
- **Appendix A** – provides full details of the asset account tables for Dorset AONB.
- **Appendix B** – provides a series of maps highlighting the physical flows of ecosystem services at a 1 km<sup>2</sup> level.
- **Appendix C** – provides an overview of the methodology used to estimate the physical and monetary flows.

Further details on the methods used and the results can be found in the **Main Report** and the **Technical Appendix**.

## Experimental nature of the ecosystem account

It is important to note that the Dorset AONB ecosystem account has been developed as part of a wider effort to demonstrate the concept of ecosystem accounts in practice. As such, the findings outlined in this report should be read with an appreciation of the experimental nature of this exercise.

The number of ecosystem services covered by the account and the accuracy of its findings could be increased through methodological advances and the availability of improved data. This could include steps to further refine the Dorset AONB ecosystem accounts for local use, with a greater emphasis on local circumstances and the use of local data sources.

## Accompanying reports

There are two separate reports which accompany the Dorset AONB summary report. One report is the **Technical Appendix**, which describes in detail:

- The indicators considered for measuring the ecosystem services.
- The methodology and limitations of the different approaches.
- The reasons why certain ecosystem services are difficult to measure in quantitative and monetary terms.

The other report is the **Main Report** which discusses:

- The approach to the project.

- The findings from across the six pilot areas.
- Recommendations and conclusions including an overview of the key lessons learned, potential uses and benefits of the accounts, challenges of developing the accounts, and recommendations for developing the accounts further.

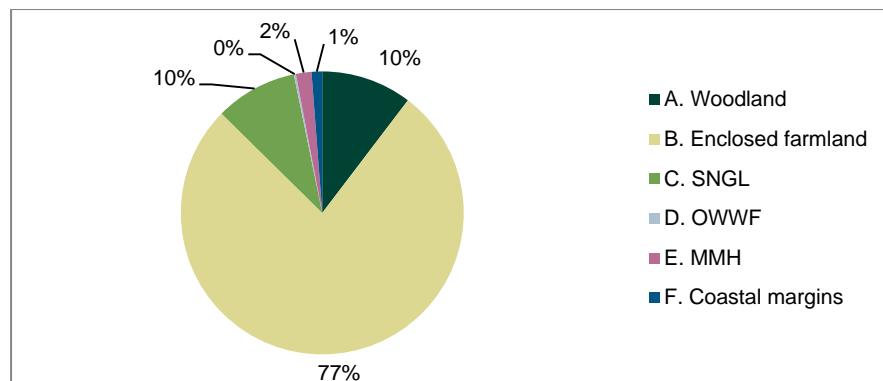
# ASSET ACCOUNT

The asset account was developed for six broad ecosystem types:

- A. Woodland
- B. Enclosed farmland
- C. Semi-natural grassland (SNGL)
- D. Open waters, wetlands, and floodplains (OWWF)
- E. Mountains, moorlands, and heaths (MMH)
- F. Coastal margins

Of these six broad ecosystem types, the centre of Dorset AONB is dominated by enclosed farmland interspersed with SNGL and woodland ecosystems. There is also a significant length of coast along the southern boundary of the AONB, with small but important areas of coastal margin ecosystems. An overview of ecosystem coverage is set out in Figure 1 and a map is provided in Figure 3 overleaf.

**Figure 1. Ecosystem types in Dorset AONB**

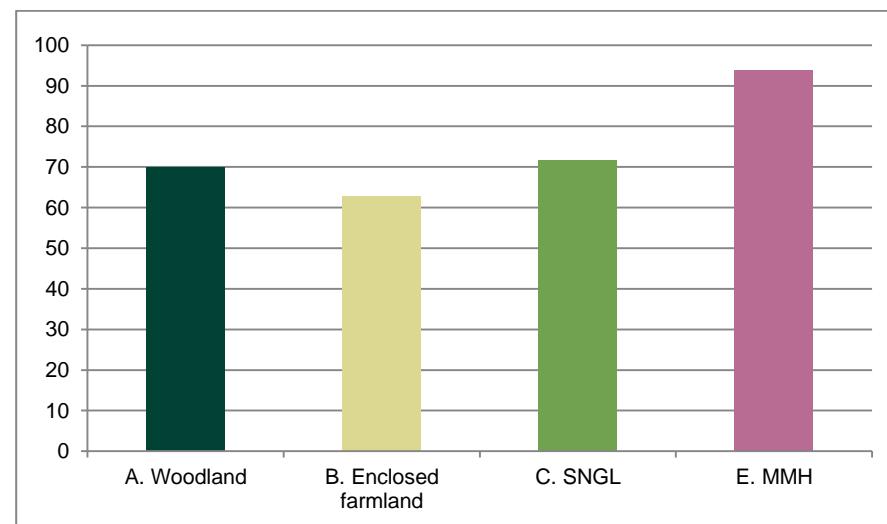


A set of indicators was developed to quantify the extent and condition of each of the six ecosystem types. The indicators are grouped into five categories and can be used to track changes in each ecosystem's capacity to provide services over time. This section provides an example of some of the indicators used to monitor ecosystem condition across the five categories.

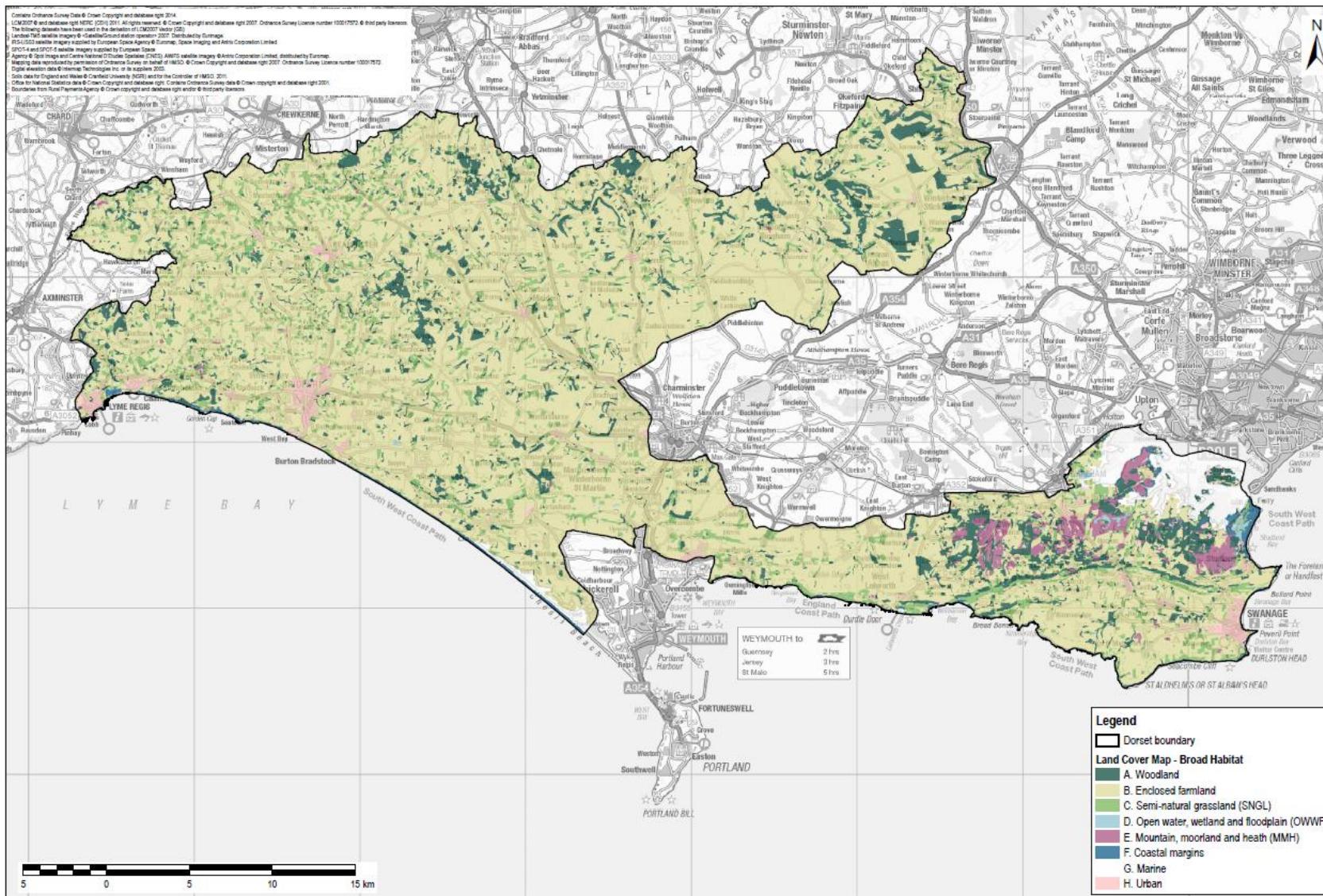
## 1) Biomass/carbon

Good data was available from the Countryside Survey on the concentration of carbon in the topsoil layer for four of the six ecosystem types. The results indicate that MMH ecosystems in Dorset have significantly higher topsoil carbon concentrations than other ecosystems, suggesting that they are able to provide significant carbon stores, see Figure 2 below.

**Figure 2. Topsoil carbon concentration (tonnes per ha)**



**Figure 3. Map of broad ecosystem types in Dorset AONB. Source: Land Cover Map 2007**

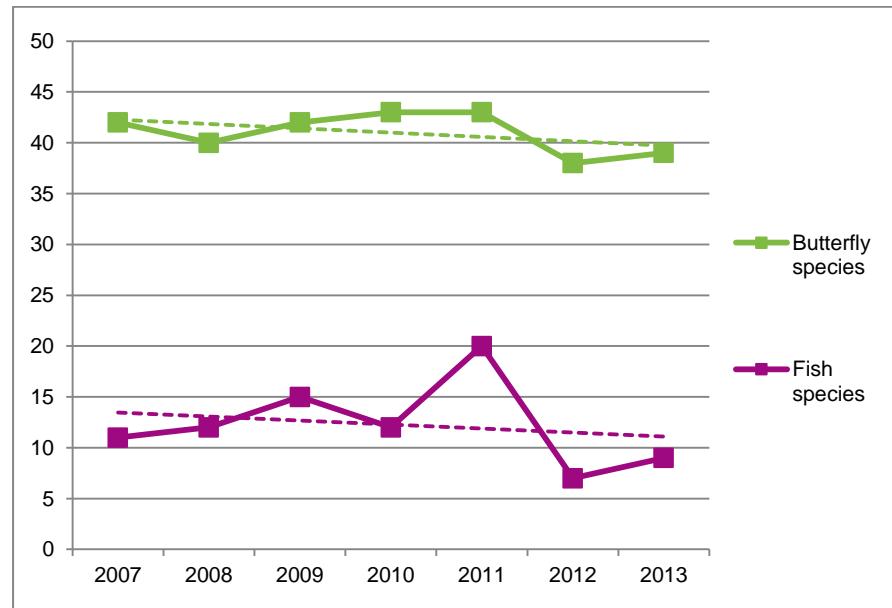


## 2) Biodiversity

Time series data on the trends in abundance and diversity of butterfly species was available from the Butterfly Conservation Monitoring Scheme. Butterfly data was chosen as an indicator of the condition of SNGL ecosystems although it should be noted that other factors such as climate can also affect butterfly populations.

For OWWF ecosystems, data was available on the number of fish species based on surveys by the Environment Agency. As set out in Figure 4 below, the diversity of butterfly and fish species appears to be in slight decline.

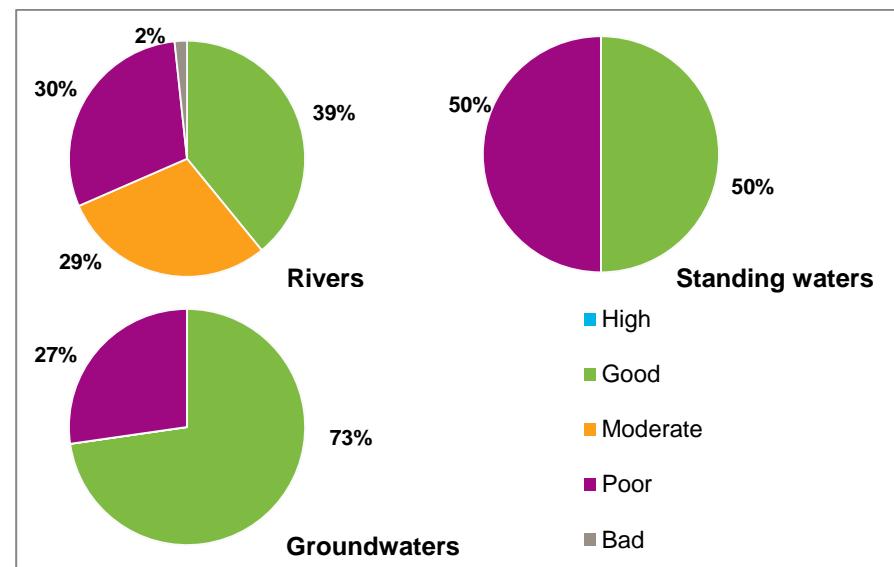
**Figure 4. Number of butterfly and fish species recorded in Dorset AONB (2007 to 2013)**



## 3) Soil/water quality

As an indicator of the condition of OWWF ecosystems, data was available on the Water Framework Directive ecological classification for rivers, standing waters, and groundwater. As set out in Figure 5, 39% of rivers in Dorset AONB were in 'High' or 'Good' status in 2013, 50% of standing waters, and 73% of groundwaters.

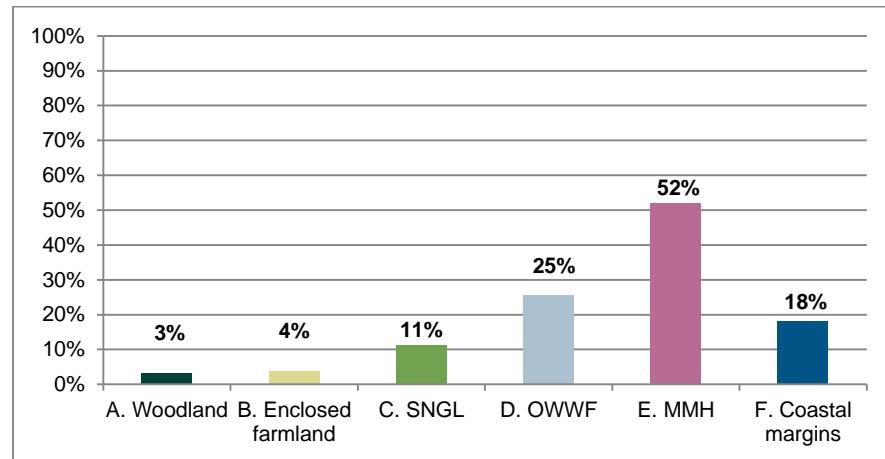
**Figure 5. Ecological classification in Dorset AONB 2013**



## 4) Accessibility

The proportion of land within each ecosystem that is publically accessible in terms of Countryside Right of Way (CRoW) designations was assessed using data held by Natural England. As set out in Figure 6, accessibility is highest for MMH followed by OWWF and is low for woodland and enclosed farmland.

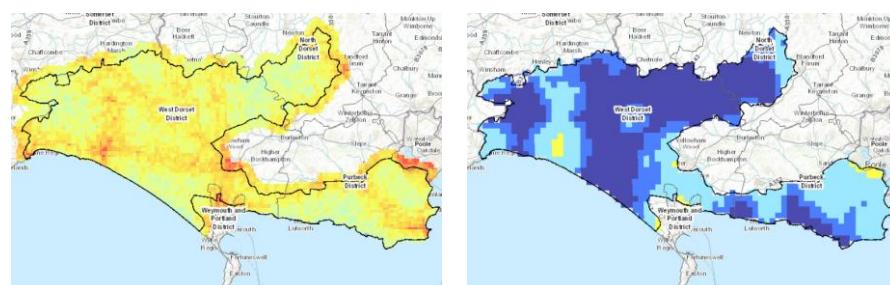
**Figure 6. Area of ecosystem accessible via CRoW (%)**



While not strictly a measure of accessibility, the level of tranquility and the extent of dark skies provides an indication of the access to 'wilder' ecosystems in the AONB. Good data on tranquility and dark skies in Dorset was available from a CPRE study undertaken in 2000. The data suggests coastal margins are most tranquil and woodlands have the darkest skies.

**Figure 7. Tranquility and dark skies within Dorset AONB**

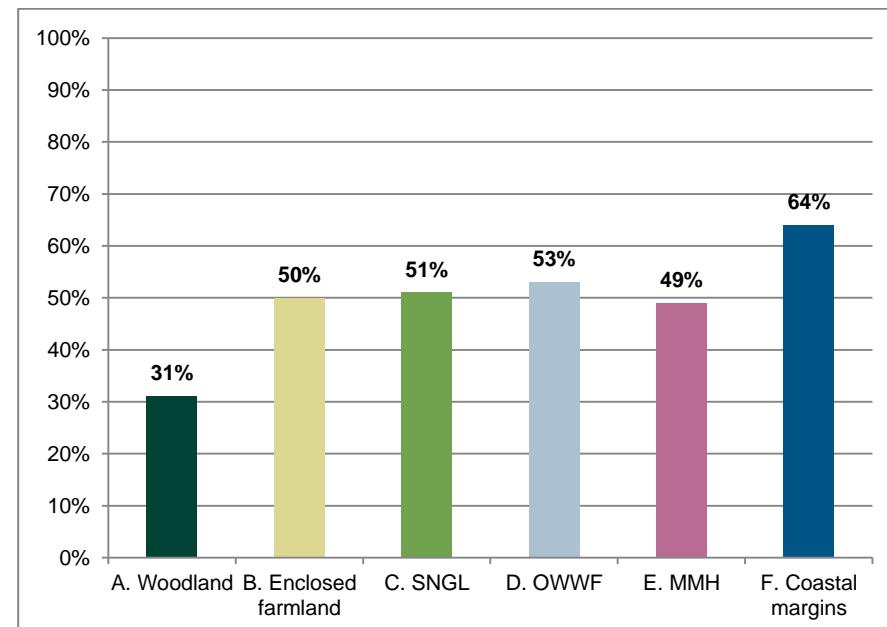
Tranquility (blue high, red low)    Dark skies (blue high, red low)



## 5) Conservation status

Information on the area and condition of SSSIs within the AONB was available through Natural England GIS datasets and the FMEOPL monitoring framework. Of the six ecosystem types, coverage was highest for MMH (83%) and lowest for enclosed farmland (3%). The area of designated SSSIs in favourable condition was highest in coastal margin ecosystems, and lowest in woodlands. See Figure 8.

**Figure 8. Area of SSSIs in favourable condition (%)**



The full set of asset account tables developed for each of the six broad ecosystem types in Dorset AONB is available in Appendix A of this report.

# PHYSICAL FLOWS

Ecosystems in Dorset AONB provide a range of important services including crops and livestock, wild foods, drinking and other water uses, recreation, and aesthetic values. Flood protection, education, and cultural heritage are also important, although it was not possible to quantify the physical flows of these services.

With regards to particular ecosystems:

- **Woodlands** are important for provision of timber, woodfuel, and venison, and regulation of air quality and climate.
- **Enclosed farmlands** are important for provision of crops, livestock fodder, and wild foods, as well as their aesthetic and recreation value.
- **SNLGs** are important for livestock grazing, recreation opportunities, and aesthetic value.
- **OWWFs** are important for the provision of wild foods, as well as water for drinking and other uses.
- **MMHs** are important for climate regulation.
- **Coastal margins** are important for recreation opportunities and their aesthetic values.

A summary is provided in Table 1 opposite and the full account is set out in Table 2 overleaf.

**Table 1. Physical flows of ecosystem services in 2013**

Ecosystem service	Measurement unit	Physical flows
Crops	tonnes crops harvested	339,473
Livestock	livestock units on land	72,998
Wild foods	kg meat harvested	22,545
Drinking water	m <sup>3</sup> water abstracted	15,831,888
Timber	tonnes timber harvested	14,912
Other water uses	m <sup>3</sup> water abstracted	26,438,933
Energy	tonnes woodfuel harvested	4,240
Air quality	tonnes PM <sub>10</sub> absorbed	1,878
Flood protection	-	-
Climate regulation	tonnes carbon absorbed	25,082
Recreation	no. visitors to ecosystems	6,100,300
Education	-	-
Heritage	-	-
Aesthetic	no. photos of landscapes	698
Existence	-	-

**Table 2. Physical flows account for Dorset AONB in 2013**

Ecosystem service	Measurement unit	Woodland	Enclosed farmland	SNGL	OWWF	MMH	Coastal margins	Total
<b>Crops</b>	tonnes crops	-	339,473	-	-	-	-	<b>339,473</b>
<b>Livestock</b>	livestock units	-	70,678	2,027	4	169	120	<b>72,998</b>
<b>Wild foods (game birds)</b>	kg meat	-	13,126	-	-	-	-	<b>13,126</b>
<b>Wild foods (venison)</b>	kg meat	8,652	-	-	-	-	-	<b>8,652</b>
<b>Wild foods (fish)</b>	kg meat	-	-	-	767	-	-	<b>767</b>
<b>Drinking water</b>	m <sup>3</sup> water	-	-	-	15,831,888	-	-	<b>15,831,888</b>
<b>Timber</b>	tonnes timber	14,912	-	-	-	-	-	<b>14,912</b>
<b>Other water uses</b>	m <sup>3</sup> water	-	-	-	26,438,933	-	-	<b>26,438,933</b>
<b>Energy</b>	tonnes woodfuel	4,240	-	-	-	-	-	<b>4,240</b>
<b>Air quality</b>	tonnes PM <sub>10</sub>	1,213	578	69	-	13	5	<b>1,878</b>
<b>Flood protection</b>	-	-	-	-	-	-	-	-
<b>Climate regulation</b>	tonnes carbon	20,126	2,426	1,098	7	323	1,102	<b>25,082</b>
<b>Recreation</b>	no. visitors	480,339	912,643	720,508	288,203	312,220	3,386,387	<b>6,100,300</b>
<b>Education</b>	-	-	-	-	-	-	-	-
<b>Heritage</b>	-	-	-	-	-	-	-	-
<b>Aesthetic</b>	no. photos	54	325	158	12	12	137	<b>698</b>
<b>Existence</b>	-	-	-	-	-	-	-	-

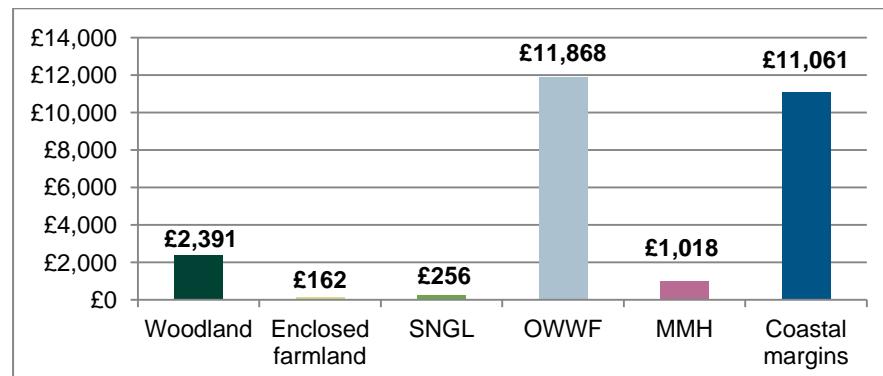
## MONETARY FLOWS

The total value of the nine services which could be quantified in Dorset AONB was estimated to be around £62 million in 2013. This is predominantly made up from air quality and recreation although climate regulation and drinking water were also significant.

However, it is important to note that due to the challenges of monetising the services provided by ecosystem assets, it was not possible to quantify the monetary flows for all of the services included in the accounting framework. As such, these estimates do not capture all of the value of Dorset AONB.

With regards to specific ecosystems, woodland was found to have the highest total value (£27 million). In terms of average value per ha, OWWF was found to be the most valuable due to the relatively small extent of this ecosystem and the important services it provides such as drinking water (see Figure 9). Coastal margins were also found to have high average values due to their small area and importance as a recreation destination.

**Figure 10. Value of service flows per ecosystem in 2013 (£/ha)**



**Table 3. Monetary flows of ecosystem services in 2013**

Ecosystem service	Valuation basis	Monetary flows
Crops	Resource rent from crops	£444,960
Livestock	Resource rent from livestock	£1,305,683
Wild foods	Market value of meat	£20,551
Drinking water	Resource rent from water	£2,417,582
Timber	Stumpage price of timber	£184,777
Other water uses	-	-
Energy	Resource rent from woodfuel	£28,275
Air quality	Avoided damage costs	£31,648,651
Flood protection	-	-
Climate regulation	Avoided abatement costs	£5,409,809
Recreation	Willingness-to-pay	£20,763,573
Education	-	-
Heritage	-	-
Aesthetic	-	-
Existence	-	-
<b>Total</b>		<b>£62,223,861</b>

**Table 4. Monetary flows account for Dorset AONB in 2013 (all figures are presented in 2013 prices)**

Ecosystem service	Woodland	Enclosed farmland	SNGL	OWWF	MMH	Coastal margins	Total
Crops	-	£444,960	-	-	-	-	£444,960
Livestock	-	£1,282,208	£20,514	£40	£1,710	£1,212	£1,305,683
Wild foods (game birds)	-	£6,713	-	-	-	-	£6,713
Wild foods (venison)	£12,835	-	-	-	-	-	£12,835
Wild foods (fish)	-	-	-	£1,003	-	-	£1,003
Drinking water	-	-	-	£2,417,582	-	-	£2,417,582
Timber	£184,777	-	-	-	-	-	£184,777
Other water uses	-	-	-	-	-	-	-
Energy	£28,275	-	-	-	-	-	£28,275
Air quality	£20,444,118	£9,738,676	£1,162,576	-	£219,036	£84,245	£31,648,651
Flood protection	-	-	-	-	-	-	-
Climate regulation	£4,340,942	£523,279	£236,731	£1,477	£69,639	£237,741	£5,409,809
Recreation	£1,695,704	£1,485,573	£1,172,821	£554,158	£1,661,252	£14,194,065	£20,763,573
Education	-	-	-	-	-	-	-
Heritage	-	-	-	-	-	-	-
Aesthetic	-	-	-	-	-	-	-
Existence	-	-	-	-	-	-	-
<b>Total value</b>	<b>£26,706,650</b>	<b>£13,481,409</b>	<b>£2,592,641</b>	<b>£2,974,261</b>	<b>£1,951,637</b>	<b>£14,517,263</b>	<b>£62,223,861</b>
<b>Total area (ha)</b>	<b>11,171</b>	<b>83,138</b>	<b>10,137</b>	<b>251</b>	<b>1,917</b>	<b>1,312</b>	<b>107,926</b>
<b>Value per ha</b>	<b>£2,391</b>	<b>£162</b>	<b>£256</b>	<b>£11,868</b>	<b>£1,018</b>	<b>£11,061</b>	<b>£577</b>

## APPENDIX A. ASSET ACCOUNT TABLES

For each of the six broad ecosystem types within Dorset AONB an asset account was populated using the methodology described in the **Main Report** and accompanying **Technical Appendix**. Complete versions of the populated asset account tables are provided in the following section.

**Table 5. Woodland asset account results for Dorset AONB in 2013**

Ecosystem extent													
Total area													
Woodland		Broadleaved woodland			Coniferous woodland			Ancient woodland		Managed woodland			
(ha) <sup>1</sup>		(ha) <sup>1</sup>			(ha) <sup>1</sup>			(ha) <sup>2</sup>		(ha) <sup>2</sup>			
11,171		8,794			2,377			3,277		6,082			
Ecosystem condition													
Biomass/carbon				Biodiversity	Soil/water quality	Accessibility				Conservation status			
Standing timber volume	Mean annual increment	Topsoil carbon stock	Vegetation carbon stock	Woodland bird index	-	Length national trails	Accessible ecosystem	Light pollution	Tranquillity	SSSI cover	SSSI favourable		
(m <sup>3</sup> ) <sup>4,5</sup>	(m <sup>3</sup> ) <sup>6,7</sup>	(tonnes carbon in 15 cm) <sup>8</sup>	(tonnes carbon) <sup>9</sup>	- <sup>10</sup>	-	(km) <sup>2</sup>	(%) <sup>2</sup>	(0 to 255) <sup>11</sup>	(-141 to 149) <sup>12</sup>	(%) <sup>2</sup>	(%) <sup>2</sup>		
2,794,698	63,332	312,687	781,970	-	-	8.2	3%	29	13	20%	31%		

<sup>1</sup> CEH (2007) Land Cover Map

<sup>2</sup> Natural England (2015) GIS digital boundary datasets

<sup>3</sup> Natural England (2013) FMEOPL

<sup>4</sup> Forestry Commission (2011) Standing timber volume for coniferous trees in Britain

<sup>5</sup> Forestry Commission (2013) NFI preliminary estimates of quantities of broadleaved species in British woodlands, with special focus on ash

<sup>6</sup> Forestry Commission (2012) GB 25-year forecast of standing coniferous volume and increment

<sup>7</sup> Forestry Commission (2014) 50-year forecast of hardwood timber availability

<sup>8</sup> CEH (2007) Countryside Survey 2007: Model estimates of topsoil carbon

<sup>9</sup> Natural England (2012) Carbon storage by habitat: Review of the evidence of the impacts of management decisions and condition of carbon stores and sources

<sup>10</sup> Data is available from the BTO on bird populations associated with different ecosystems over time although the actual estimates were not available for this project.

<sup>11</sup> CPRE (2000) Dark skies mapping

<sup>12</sup> CPRE (2000) Tranquillity mapping

**Table 6. Enclosed farmland asset account results for Dorset AONB in 2013**

Ecosystem extent					
Total area					
Enclosed farmland	Arable and horticulture		Improved grassland		Length hedgerows
(ha) <sup>1</sup>	(ha) <sup>1</sup>		(ha) <sup>1</sup>	(km) <sup>2</sup>	
83,138	40,015		43,123	3,793	
Ecosystem condition (part 1)					
Biomass/carbon		Biodiversity	Soil/water quality	Accessibility	
Topsoil carbon stock	Vegetation carbon stock	Farmland bird index	Grade 1 & 2 land	Length national trails	Accessible ecosystem
(tonnes carbon in 15 cm) <sup>3</sup>	(tonnes carbon) <sup>4</sup>	- <sup>5</sup>	(%) <sup>2</sup>	(km) <sup>2</sup>	(%) <sup>2</sup>
6,279,900	83,138	-	4%	75.4	4%
Ecosystem condition (part 2)					
Accessibility		Conservation status			
Light pollution	Tranquillity	SSSI cover	SSSI favourable	ELS agreements	HLS agreements
(0 to 255) <sup>6</sup>	(-141 to 149) <sup>7</sup>	(%) <sup>2</sup>	(%) <sup>2</sup>	(%) <sup>8</sup>	(%) <sup>8</sup>
40	8	3%	50%	58%	36%
OEELS agreements					
11%					

<sup>1</sup> CEH (2007) Land Cover Map

<sup>2</sup> Natural England (2015) GIS digital boundary datasets

<sup>3</sup> CEH (2007) Countryside Survey 2007: Model estimates of topsoil carbon

<sup>4</sup> Natural England (2012) Carbon storage by habitat: Review of the evidence of the impacts of management decisions and condition of carbon stores and sources

<sup>5</sup> Data is available from the BTO on bird populations associated with different ecosystems over time although the actual estimates were not available for this project.

<sup>6</sup> CPRE (2000) Dark skies mapping

<sup>7</sup> CPRE (2000) Tranquillity mapping

<sup>8</sup> Natural England (2013) FMEOPL

**Table 7. SNGL asset account results for Dorset AONB in 2013**

Ecosystem extent									
Total area									
SNGL	Rough grassland	Neutral grassland			Calcareous grassland		Acid grassland		
(ha) <sup>1</sup>	(ha) <sup>1</sup>	(ha) <sup>1</sup>			(ha) <sup>1</sup>		(ha) <sup>1</sup>		
10,137	8,090	1,272			647		128		
Ecosystem condition									
Biomass/carbon		Biodiversity		Soil/water quality	Accessibility				Conservation status
Topsoil carbon stock	Vegetation carbon stock	Butterfly abundance	Butterfly richness	-	Length national trails	Accessible ecosystem	Light pollution	Tranquillity	SSSI cover
(tonnes carbon in 15 cm) <sup>2</sup>	(tonnes carbon) <sup>3</sup>	(no. butterflies) <sup>4</sup>	(no. species) <sup>4</sup>	-	(km) <sup>5</sup>	(%) <sup>5</sup>	(0 to 255) <sup>6</sup>	(-141 to 149) <sup>7</sup>	(%) <sup>5</sup>
71,465	10,137	61,924	39	-	23.5	11%	43	9	15%
51%									

<sup>1</sup> CEH (2007) Land Cover Map

<sup>2</sup> CEH (2007) Countryside Survey 2007: Model estimates of topsoil carbon

<sup>3</sup> Natural England (2012) Carbon storage by habitat: Review of the evidence of the impacts of management decisions and condition of carbon stores and sources

<sup>4</sup> Butterfly Conservation (2013) UK butterfly monitoring scheme

<sup>5</sup> Natural England (2015) GIS digital boundary datasets

<sup>6</sup> CPRE (2000) Tranquillity mapping

<sup>7</sup> CPRE (2000) Dark skies mapping

**Table 8. OWWF asset account results for Dorset AONB in 2013**

Ecosystem extent								
Total area								
OWWF	Fen, marsh, and swamp	(Lowland) bog	Freshwater	Length rivers	Standing waterbodies	Groundwater bodies	Average precipitation	
(ha) <sup>1</sup>	(ha) <sup>1</sup>	(ha) <sup>1</sup>	(ha) <sup>1</sup>	(km) <sup>2</sup>	(no.) <sup>2</sup>	(no.) <sup>2</sup>	(mm/year/km <sup>2</sup> ) <sup>2</sup>	
251	53	0	197	359	2	11	940	
Ecosystem condition (part 1)								
Biomass/carbon		Biodiversity			Soil/water quality			
Topsoil carbon stock	Vegetation carbon stock	Fish abundance	Fish richness	Wetland bird index	Rivers in high / good status	Standing water in high / good status	Groundwater in high / good status	Lowland peatland favourable
(tonnes carbon in 15 cm) <sup>3</sup>	(tonnes carbon) <sup>4</sup>	(no. fish) <sup>5</sup>	(no. species) <sup>5</sup>	- <sup>6</sup>	(%) <sup>2</sup>	(%) <sup>2</sup>	(%) <sup>2</sup>	(%) <sup>7</sup>
0	106	1,782	9	-	39%	50%	73%	95%
Ecosystem condition (part 2)								
Accessibility				Conservation status				
Length national trails	Accessible ecosystem	Light pollution	Tranquillity	SSSI cover	SSSI favourable	Eutrophic NVZs	Groundwater NVZs	Surface water NVZs
(km) <sup>7</sup>	(%) <sup>7</sup>	(0 to 255) <sup>8</sup>	(-141 to 149) <sup>9</sup>	(%) <sup>7</sup>	(%) <sup>7</sup>	(ha) <sup>7</sup>	(ha) <sup>7</sup>	(ha) <sup>7</sup>
0.9	25%	43	10	60%	53%	50,695	46,650	9,867

<sup>1</sup> CEH (2007) Land Cover Map

<sup>2</sup> Natural England (2013) FMEOPL

<sup>3</sup> CEH (2007) Countryside Survey 2007: Model estimates of topsoil carbon

<sup>4</sup> Natural England (2012) Carbon storage by habitat: Review of the evidence of the impacts of management decisions and condition of carbon stores and sources

<sup>5</sup> Data requested from the Environment Agency.

<sup>6</sup> Data is available from the BTO on bird populations associated with different ecosystems over time although the actual estimates were not available for this project.

<sup>7</sup> Natural England (2015) GIS digital boundary datasets

<sup>8</sup> CPRE (2000) Dark skies mapping

<sup>9</sup> CPRE (2000) Tranquillity mapping

**Table 9. MMH asset account results for Dorset AONB in 2013**

Ecosystem extent									
Total area									
MMH	Heather	Heather grassland	Montane habitats	Inland rock	(Upland) bog				
(ha) <sup>1</sup>	(ha) <sup>1</sup>	(ha) <sup>1</sup>	(ha) <sup>1</sup>	(ha) <sup>1</sup>	(ha) <sup>1</sup>				
1,917	648	1,042	0	227	-				
Ecosystem condition									
Biomass/carbon		Biodiversity	Soil/water quality	Accessibility				Conservation status	
Topsoil carbon stock	Vegetation carbon stock	Upland bird index	Upland peat favourable	Length national trails	Accessible ecosystem	Light pollution	Tranquillity	SSSI cover	SSSI favourable
(tonnes carbon in 15 cm) <sup>2</sup>	(tonnes carbon) <sup>3</sup>	- <sup>4</sup>	(%) <sup>5</sup>	(km) <sup>5</sup>	(%) <sup>5</sup>	(0 to 255) <sup>6</sup>	(-141 to 149) <sup>7</sup>	(%) <sup>5</sup>	(%) <sup>5</sup>
140,715	3,380	-	-	0.3	52%	43	13	83%	49%

<sup>1</sup> CEH (2007) Land Cover Map

<sup>2</sup> CEH (2007) Countryside Survey 2007: Model estimates of topsoil carbon

<sup>3</sup> Natural England (2012) Carbon storage by habitat: Review of the evidence of the impacts of management decisions and condition of carbon stores and sources

<sup>4</sup> Data is available from the BTO on bird populations associated with different ecosystems over time although the actual estimates were not available for this project.

<sup>5</sup> Natural England (2015) GIS digital boundary datasets

<sup>6</sup> CPRE (2000) Dark skies mapping

<sup>7</sup> CPRE (2000) Tranquillity mapping

**Table 10. Coastal margins asset account results for Dorset AONB in 2013**

Ecosystem extent						
Total area						
Coastal margins	Supra-littoral rock		Supra-littoral sediment		Saltmarsh	Coastal waterbodies
(ha) <sup>1</sup>	(ha) <sup>1</sup>		(ha) <sup>1</sup>		(ha) <sup>1</sup>	(no.) <sup>2</sup>
1,312	120		713		479	2
Ecosystem condition (part 1)						
Biomass/carbon		Biodiversity	Soil/water quality			
Topsoil carbon stock	Vegetation carbon stock	Seabird index	Bathing water compliance	Blue flag beaches	Coastal waterbodies in high/good status	Transitional waterbodies in high/good status
(tonnes carbon in 15 cm) <sup>3</sup>	(tonnes carbon) <sup>4</sup>	- <sup>5</sup>	(% beaches) <sup>6</sup>	(no.) <sup>7</sup>	(%) <sup>2</sup>	(%) <sup>2</sup>
0	479	-	100%	1	0%	0%
Ecosystem condition (part 2)						
Accessibility				Conservation status		
Length national trails	Accessible ecosystem	Light pollution	Tranquillity	SSSI cover	SSSI favourable	
(km) <sup>8</sup>	(%) <sup>8</sup>	(0 to 255) <sup>9</sup>	(-141 to 149) <sup>10</sup>	(%) <sup>8</sup>	(%) <sup>8</sup>	
12.8	18%	40	19	59%	64%	

<sup>1</sup> CEH (2007) Land Cover Map

<sup>2</sup> Natural England (2013) FMEOPL

<sup>3</sup> CEH (2007) Countryside Survey 2007: Model estimates of topsoil carbon

<sup>4</sup> Natural England (2012) Carbon storage by habitat: Review of the evidence of the impacts of management decisions and condition of carbon stores and sources

<sup>5</sup> Data is available from the BTO on bird populations associated with different ecosystems over time although the actual estimates were not available for this project.

<sup>6</sup> Environment Agency (2013) Bathing water quality

<sup>7</sup> Blue Flag Beaches (2015) Beaches and marinas with blue flags

<sup>8</sup> Natural England (2015) GIS digital boundary datasets

<sup>9</sup> CPRE (2000) Dark skies mapping

<sup>10</sup> CPRE (2000) Tranquillity mapping

## APPENDIX B. ECOSYSTEM SERVICE MAPS

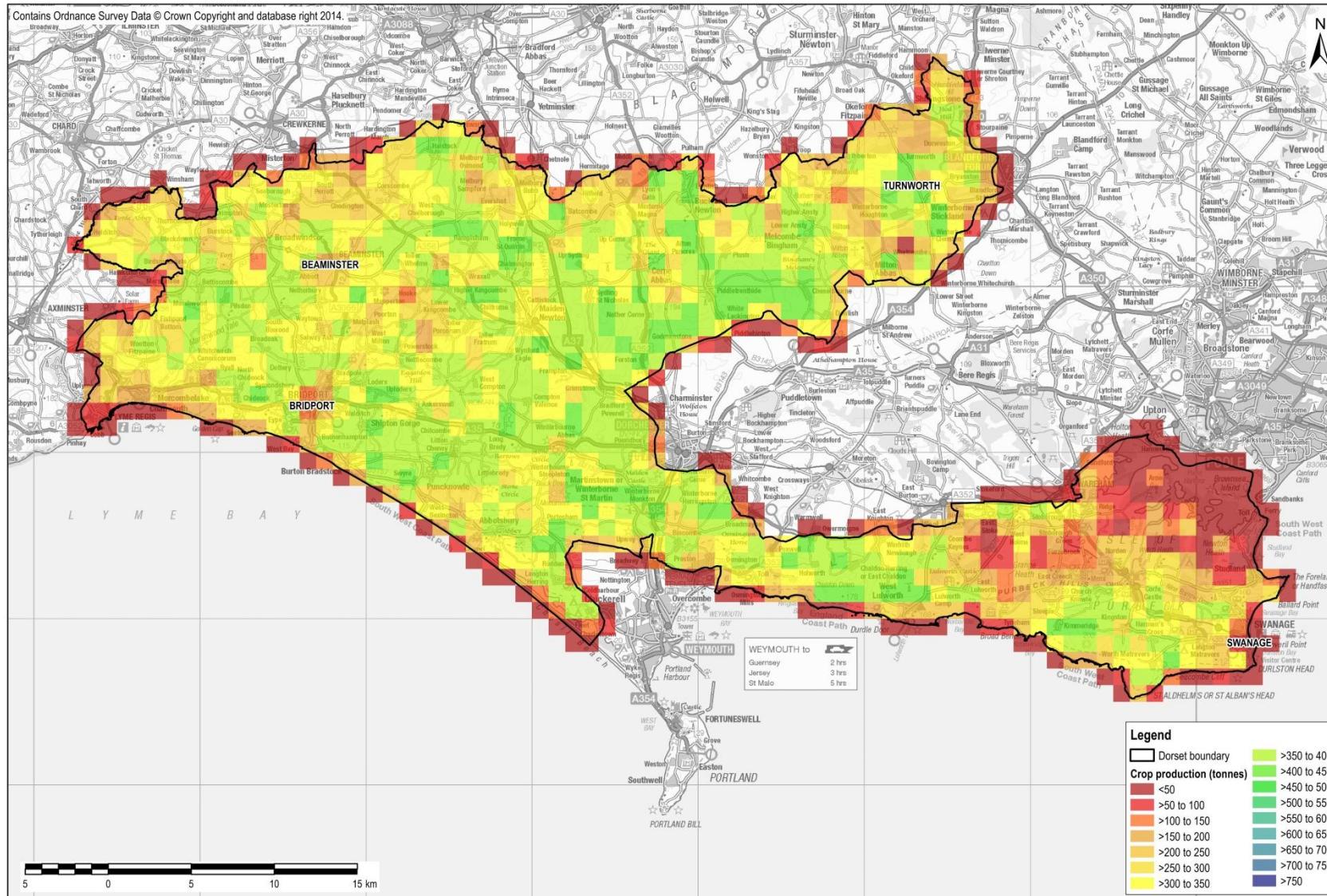
GIS maps were developed for each of the ecosystem services where data was available on physical flows. The quantities of each service are divided up spatially into 1 km<sup>2</sup> grid squares. All maps are based on data from 2013.

Colour bars were developed to highlight hotspots of ecosystem service provision. In each of the maps, red indicates low or absence of provision while blue indicates significant provision. For each of the services (except for water values), the same scale is used across the four English pilot areas in order to allow comparison of the provision of services in different areas.

The maps have been developed based on estimates of the services provided by ecosystems within Dorset AONB boundaries. As such, squares which overlap the boundaries only represent the value of ecosystem services provided within the boundaries, not the whole value of the 1 km square.

Due to the data limitations, it was not possible to develop maps for the following services: flood protection, education, heritage, and existence values.

**Figure 11. Crop production in Dorset AONB (tonnes of crops in 2013)**



## Figure 12. Livestock density in Dorset AONB (Livestock Units in 2013)

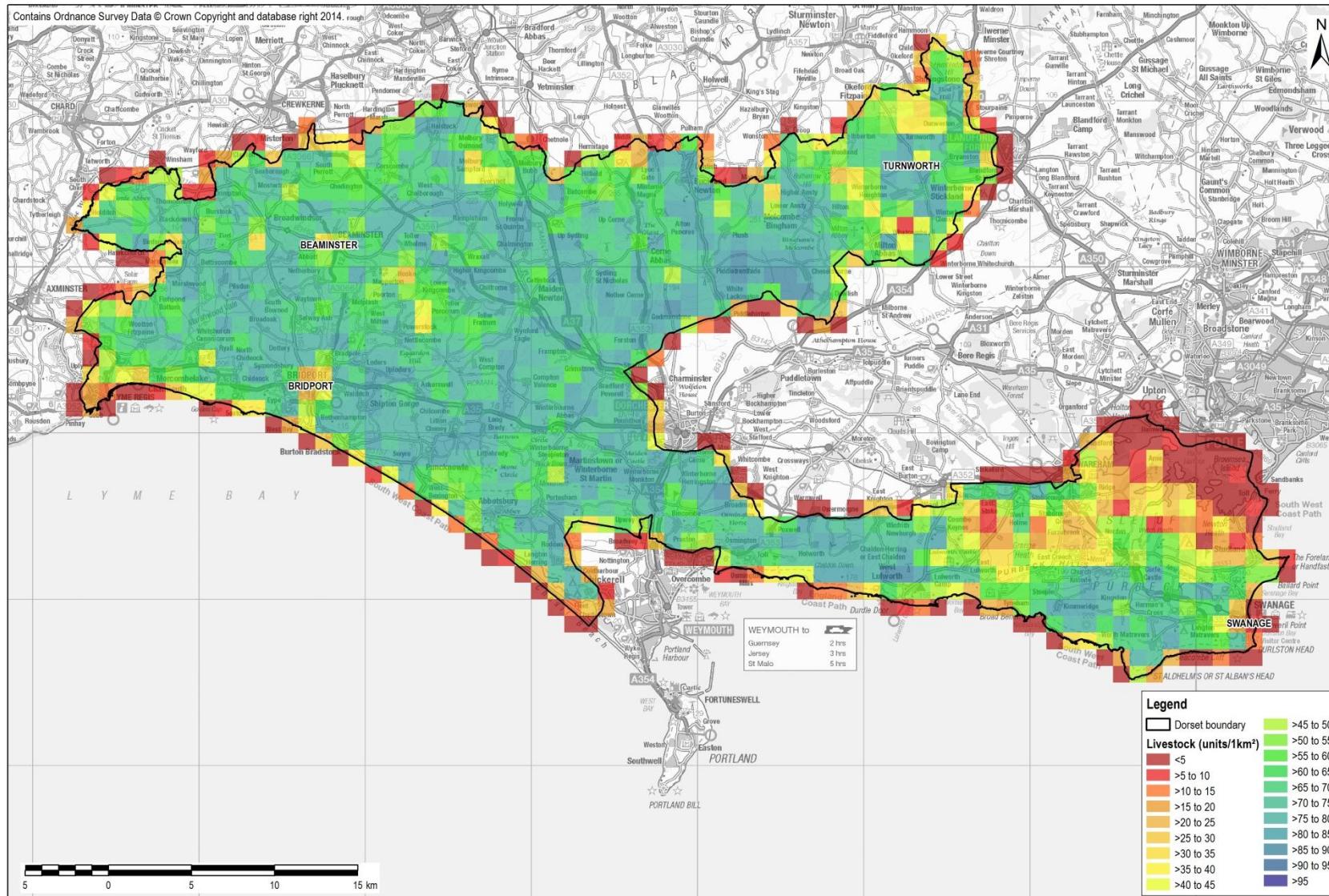
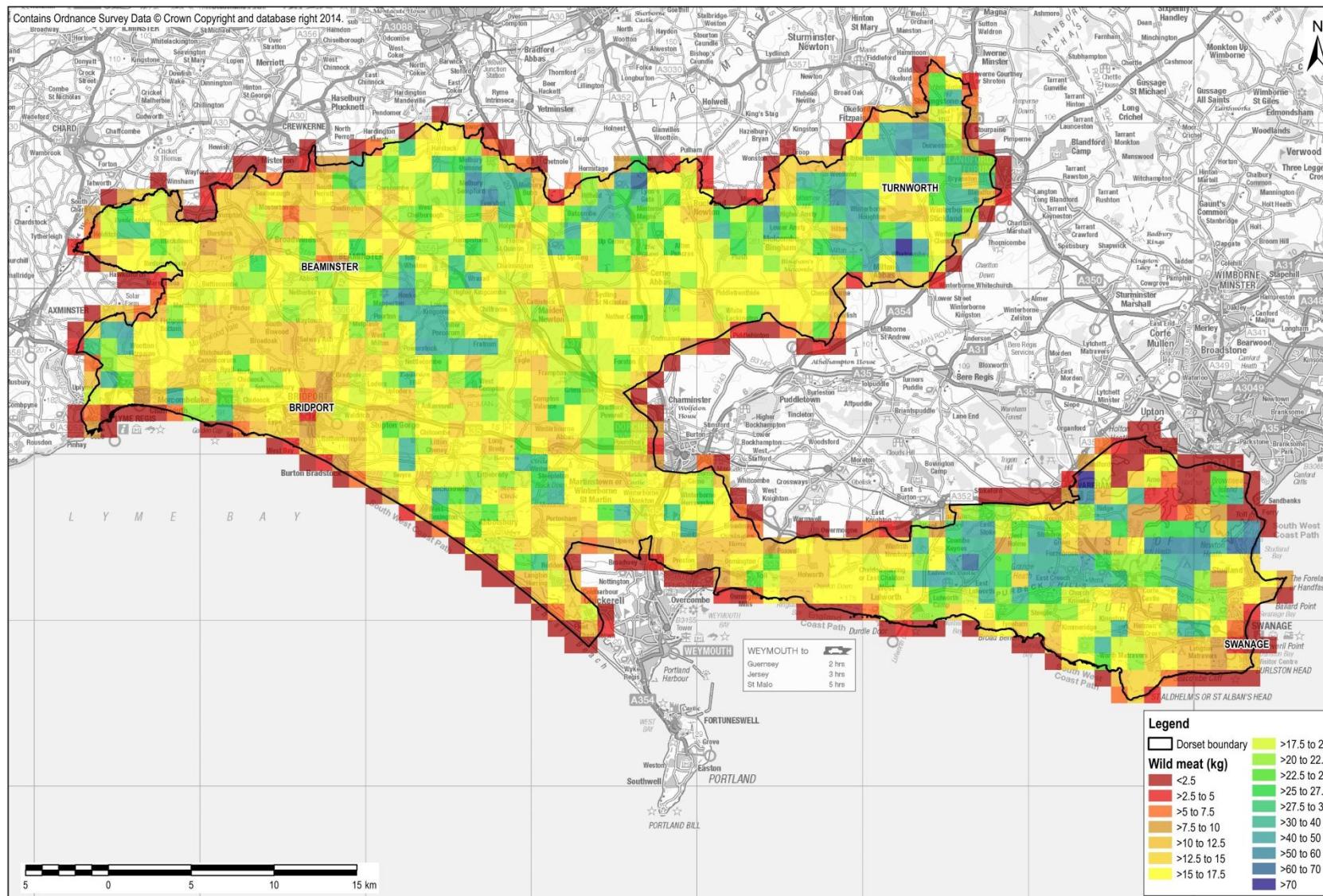
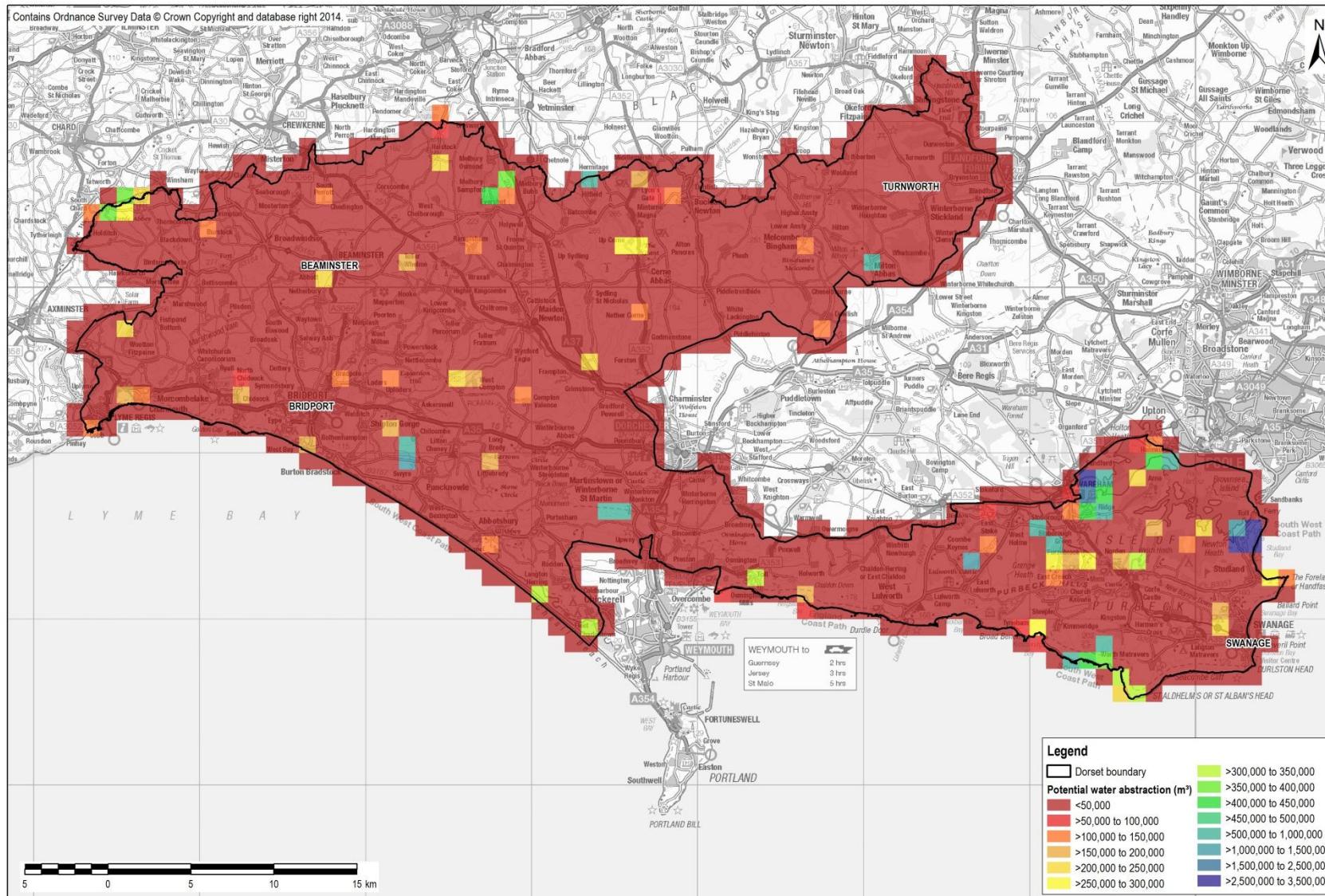


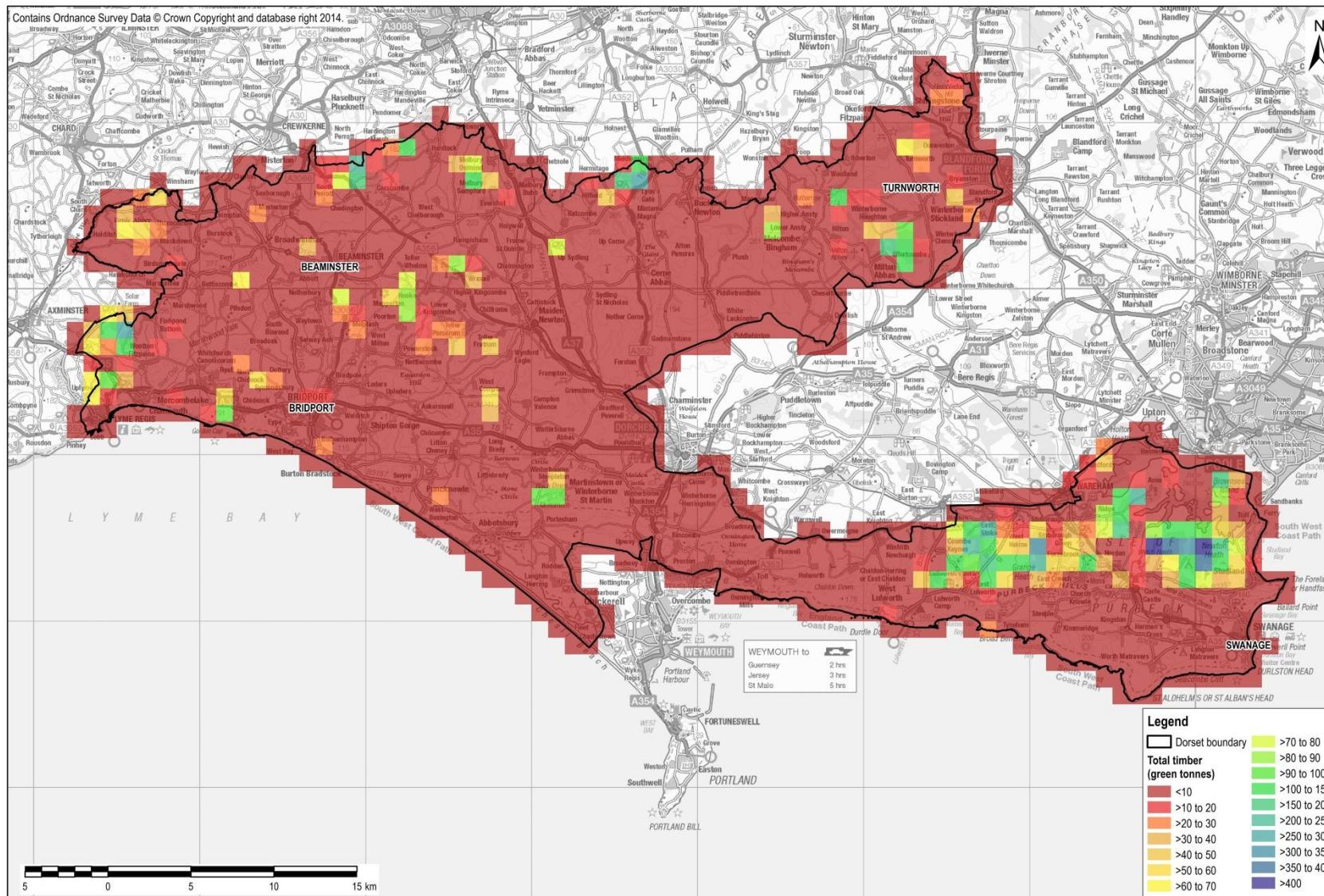
Figure 13. Wild foods harvested in Dorset AONB (kg harvested in 2013)



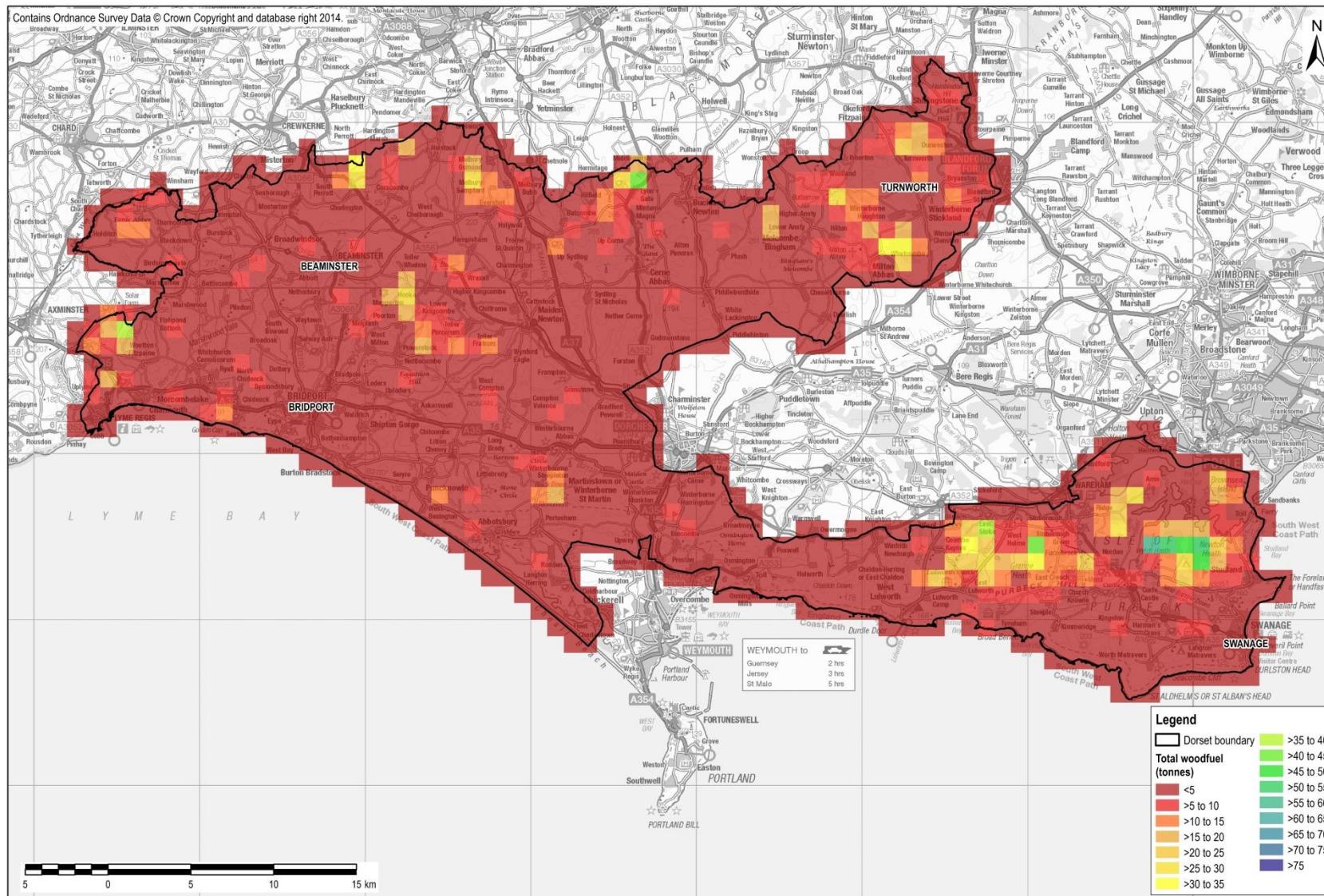
**Figure 14. Potential water abstractions in Dorset AONB (m<sup>3</sup> of water in 2013)**



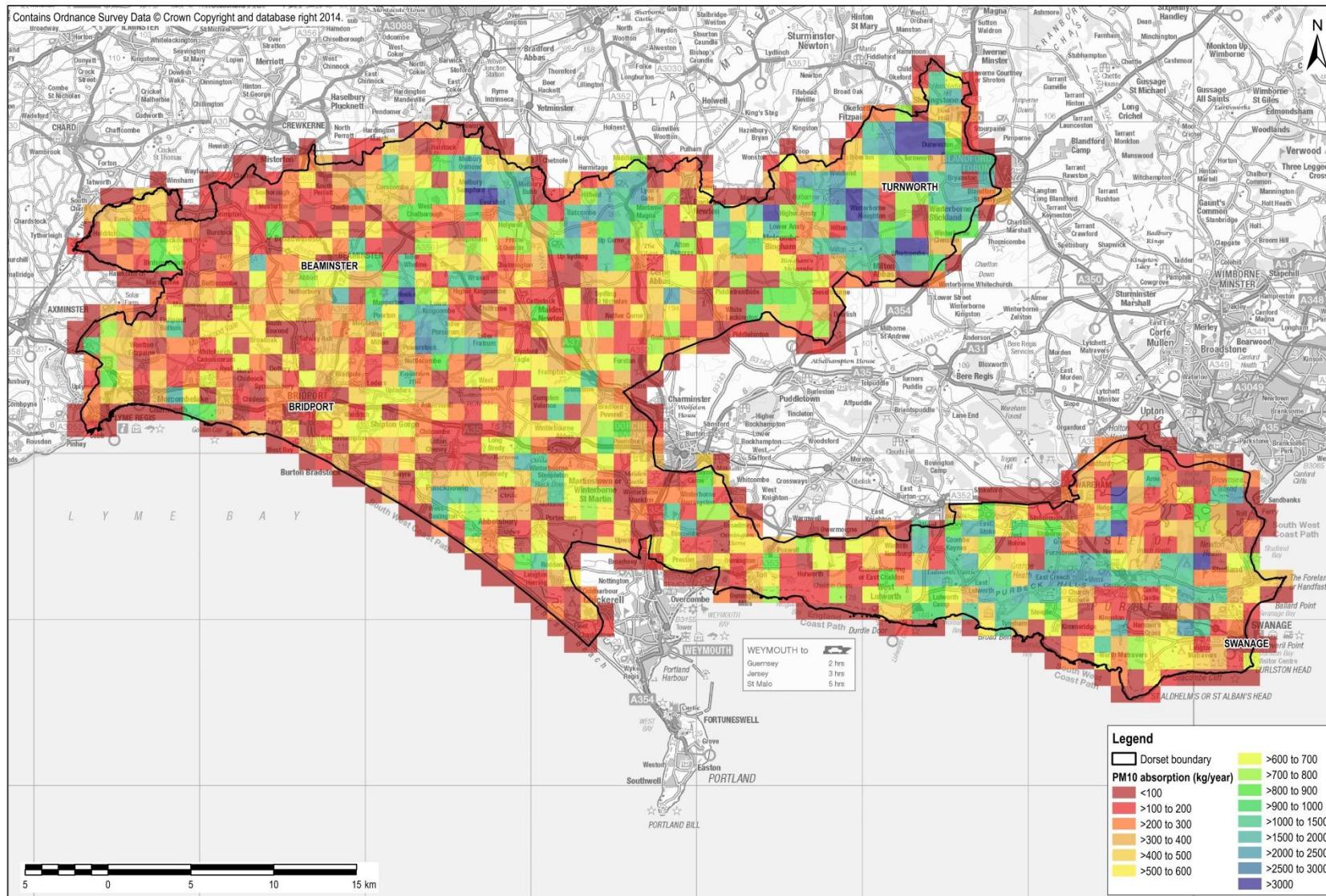
**Figure 15. Timber production in Dorset AONB (tonnes of timber in 2013)**



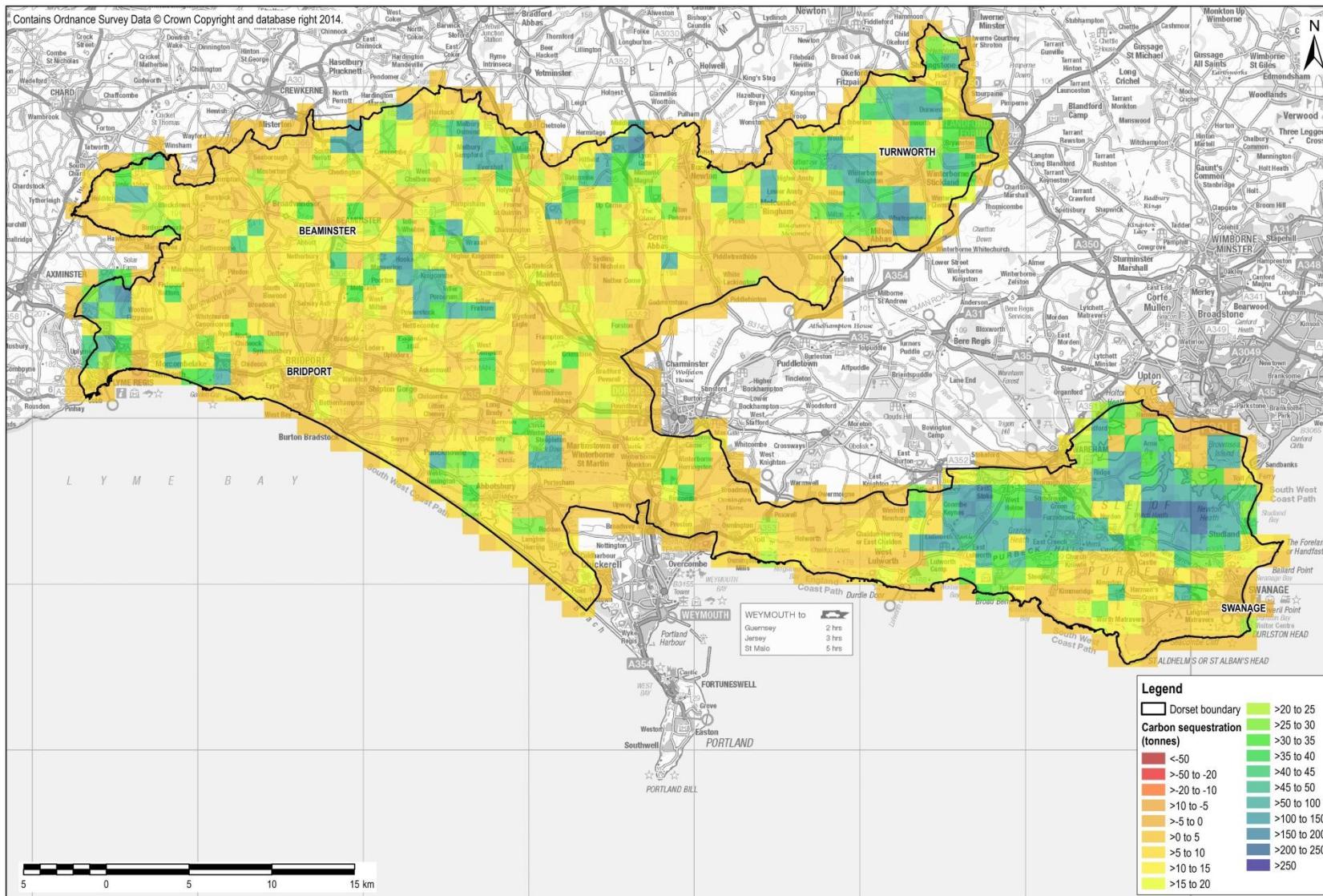
**Figure 16. Woodfuel production in Dorset AONB (tonnes of woodfuel in 2013)**



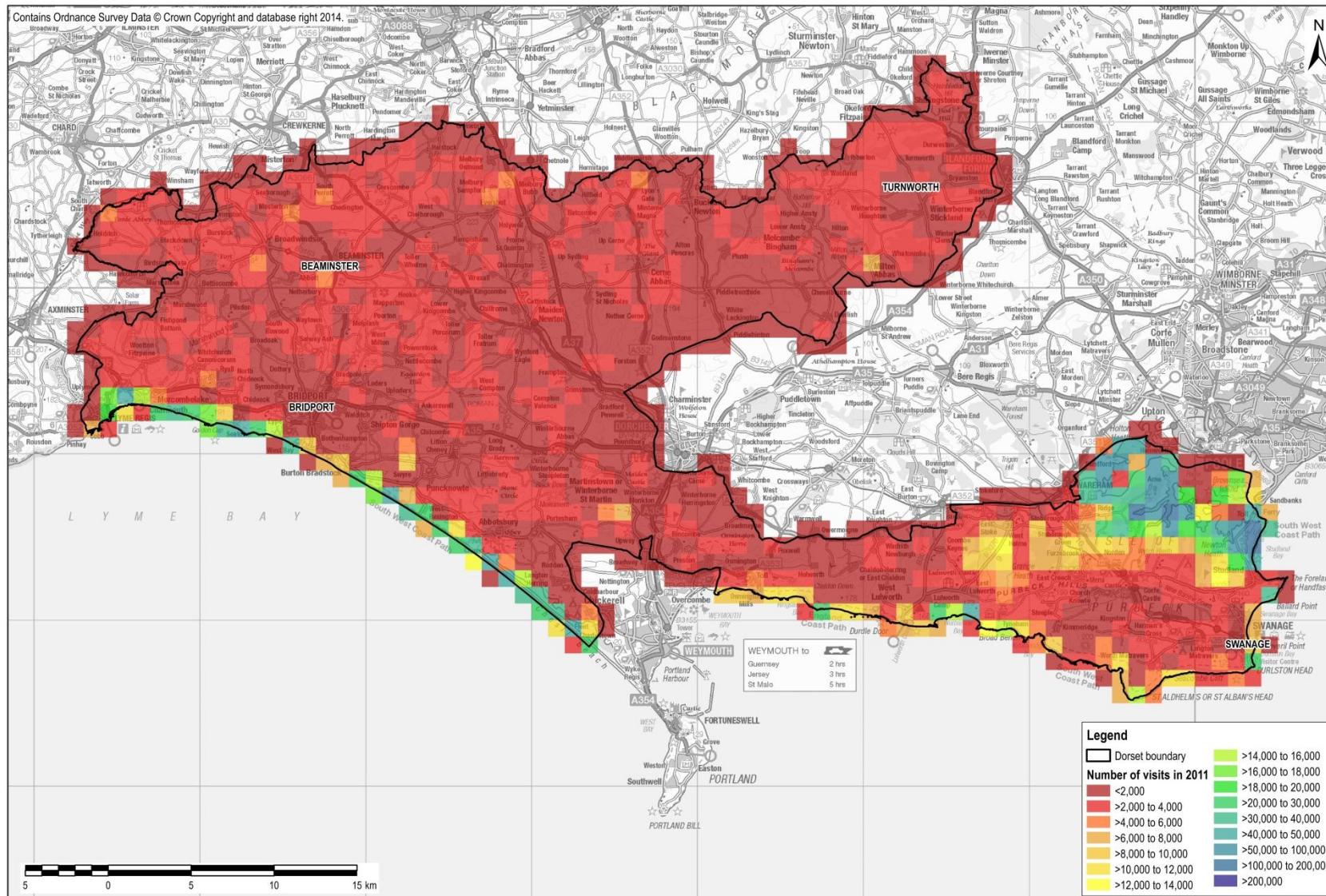
**Figure 17. Regulation of air quality in Dorset AONB (kg of PM<sub>10</sub> absorbed in 2013)**



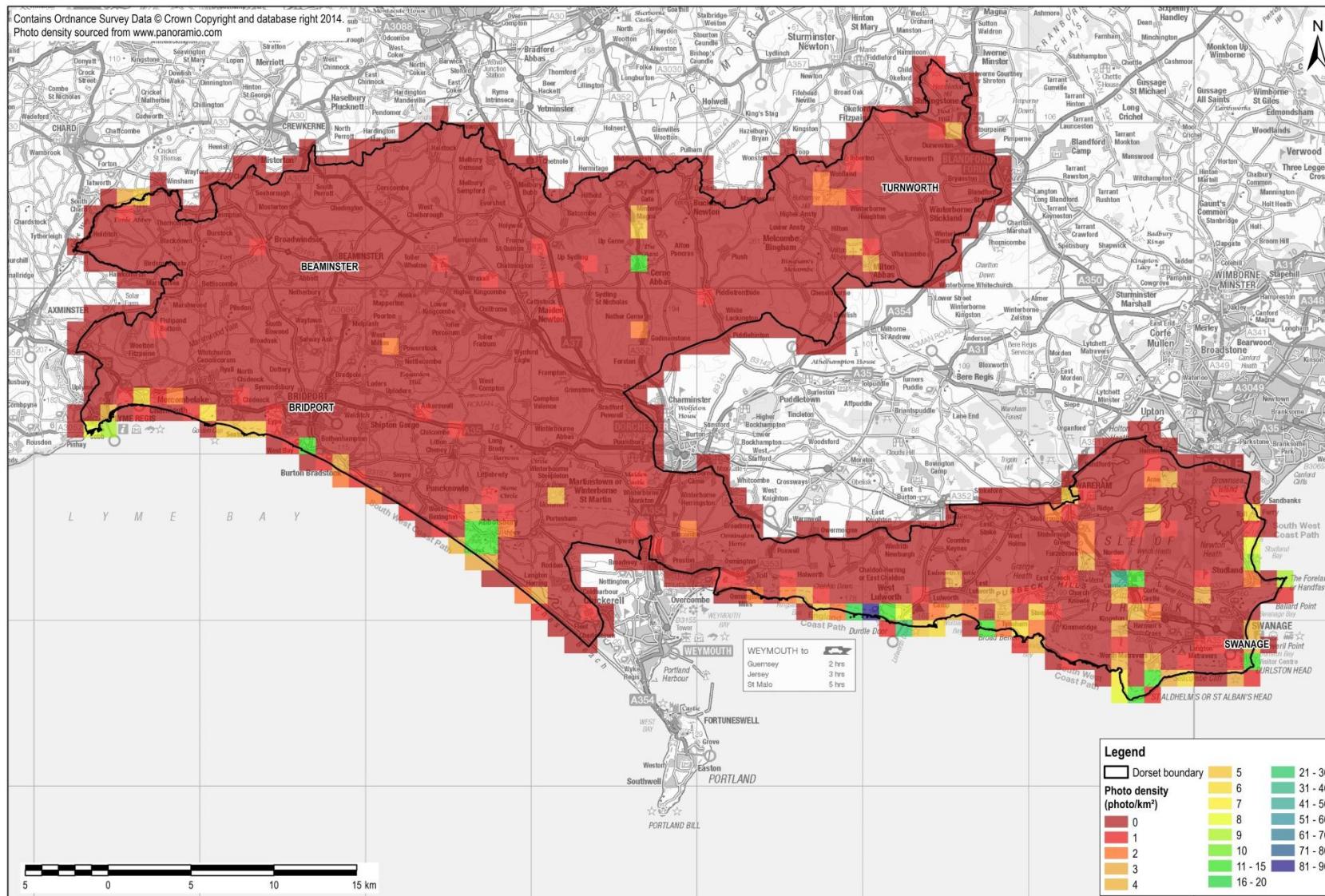
**Figure 18. Regulation of climate in Dorset AONB (tonnes of carbon sequestered in 2013)**



**Figure 19. Recreational visits to Dorset AONB (number of visits in 2013)**



**Figure 20. Aesthetically valued landscapes in Dorset AONB (number of photographs from 2005 to 2015)**



## APPENDIX C. METHODOLOGY

The following table sets out the methodology used to develop the estimates of physical and monetary flows for each of the fifteen ecosystem services. Further details on the methods used can be found in the accompanying **Main Report** and **Technical Appendix**.

Ecosystem service	Physical flows	Monetary flows
Crops	The volume of crops harvested each year was estimated by multiplying the area of thirteen crop types within the pilot areas by the yield per crop. A breakdown of crop areas was obtained from the Defra June Survey and Scottish Government RESAS Statistics (Agriculture). National and, where available, regional crop yields were obtained from Defra datasets, supplemented by industry publications where necessary.	Market prices were obtained from Defra datasets although these values include the returns to human inputs such as machinery, fertilisers, and labour which therefore leads to an over estimation of the ecosystem service value (the bundle of inputs such as pollination, pest control, nutrient cycling etc.). As such, the market values were converted to resource rents i.e. the value of crop production after all human-related inputs have been subtracted.
Livestock	Livestock numbers were estimated using data from the Defra June Survey and RESAS Statistics. These were then converted to Livestock Units and allocated to different ecosystems based on the carrying capacity of each ecosystem, which was calculated by multiplying the area of each ecosystem with a stocking rate for each ecosystem type.	Yields for different livestock were obtained from Defra datasets. These were differentiated for lowland and upland livestock enterprises. Livestock production was estimated by multiplying livestock numbers (by type) by the appropriate yields. As for crops, market prices were obtained from Defra datasets and were converted to resource rents.
Wild foods	Data on the number of deer and game birds killed within the pilot areas was provided by the Game and Conservation Wildlife Trust. Data on the number and weight of salmon and sea trout caught from rivers flowing through the pilot areas was extracted from EA and Scottish Government data.	Market prices were used to estimate the value of the meat harvested from wild foods. It was assumed that the resource rent was similar to the market price due to the limited human inputs required to support provision of wild foods.
Drinking water & Other water uses	Annual volumes of water abstracted from surface and ground water resources within the pilot areas was provided by the EA and SEPA. Agricultural water use was excluded from the analysis in order to avoid double counting of water as an input to agricultural production. It was assumed that all water abstracted for the public water supply is classed as drinking water, while all other water uses are classed as other water uses.	The resource rent approach was used to quantify the monetary flows of water abstractions for drinking water. The resource rent was calculated using Annual Business Survey (ABS) data on the revenues and costs for 'water collection, treatment and supply' businesses. Due to a lack of data, it was only possible to develop a resource rent estimate for water abstracted for the public water supply.
Timber & Energy	The average productivity of timber on public and private woodlands was estimated by dividing the total UK production of softwood and hardwood by the area of coniferous and broadleaved woodland in private and public ownership. These average productivity values were combined with data from the Land Cover Map to estimate the total annual hardwood and softwood production within the pilot area boundaries. Forestry Commission data was then used to estimate the share of this wood production that was allocated for timber versus that allocated for woodfuel.	For softwood timber, annual data on the standing price per cubic metre of overbark (or 'stumpage' price) was used, assuming that the stumpage price is broadly equivalent to the unit resource rent for a tonne of timber. For hardwood timber, a constant market price of £35 per cubic metre of overbark was used due to data limitations. The value of woodfuel was estimated using an approximate resource rent based on the market price of woodfuel minus the harvesting, extraction, processing, and transportation costs.
Air quality	Defra data on annual background concentrations of PM <sub>10</sub> for 1 km grid squares across the UK was combined with ecosystem coverage for each 1 km grid square from the Land Cover Map dataset. The quantity of PM <sub>10</sub> absorbed each year was then estimated using the formula: $\text{ABSORPTION} = \text{FLUX} \times \text{SURFACE} \times \text{PERIOD}$ $\text{FLUX} = \text{deposition velocity for ecosystem} \times \text{pollutant concentration}$ $\text{SURFACE} = \text{area of ecosystem} \times \text{surface area index of ecosystem}$ $\text{PERIOD} = \text{period of analysis} \times \% \text{ dry days} \times \% \text{ in-leaf days}$	Defra air quality guidance was used to calculate the avoided damage cost for absorption of PM <sub>10</sub> . In particular, the central estimate of IGCB air quality damage costs per tonne for emissions of PM <sub>10</sub> in rural areas was used to estimate monetary benefit of the avoided damage due to storage of PM <sub>10</sub> in vegetation within the pilot area boundaries.

Ecosystem service	Physical flows	Monetary flows
Flood protection	The UK NEA identifies woodland, OWWF, MMH, and coastal margin ecosystems as playing an important role in storing and slowing the flow of surface water runoff. However, there is a lack of scientific understanding in terms of quantifying the role such ecosystems play in reducing flood risk.	Due to the lack of a physical indicator for this service it was not possible to develop estimates of the monetary value although this could potentially be done in future through estimates of the avoided damage costs of a reduction in flood risk.
Climate regulation	Average carbon sequestration rates for each ecosystem were combined with data from the Land Cover Map to estimate the annual tonnes of carbon sequestered. In order to account for emissions from degraded peatlands, SSSI data was extracted from Natural England and SNH datasets and was combined with the Land Cover Map data to identify the area of peatland in favourable and unfavourable condition.	The monetary value of this service was estimated using the non-traded DECC carbon values for the period 2008-2015 which are calculated based on the abatement cost per tonne of carbon. As such, this approach focuses on the financial benefits of carbon sequestration, rather than the avoided impacts on ecosystem functioning.
Recreation	The number of recreational visits was estimated using local data on visitor numbers, typically based on the STEAM model. From the total visitor numbers, the number visiting the natural environment was calculated based on visitor feedback surveys. The proportion of visitors to each ecosystem type was then estimated using MENE survey data which asks respondents the types of ecosystem they have visited.	The value of visits to each of the ecosystems was estimated by multiplying the number of visits allocated to each ecosystem with a monetary value per visit. This value was based on a meta-analysis of around 300 previous estimates of values for recreational visits to broad ecosystems in the UK.
Education	It was difficult to develop a comprehensive picture of the number of educational visits to the pilot areas, as there are many different organisations that organise field trips for educational purposes and a lack of data collected on the different types of educational visits.	Due to the lack of a physical indicator for this service it was not possible to develop estimates of the monetary value, although this could potentially be done in future through using estimates of the cost of travel for school visits.
Heritage	A number of approaches were looked at for quantifying the physical flows of this service although it was not possible to identify a clear, measurable indicator which could be included in the accounts.	Due to the lack of a physical indicator for this service it was not possible to develop estimates of the monetary value, although this could potentially be done (at least in part) through hedonic analysis of the impact of proximity to different ecosystems on house prices in terms of amenity value.
Aesthetic	The website <a href="http://www.panoramio.com">www.panoramio.com</a> hosts photographs of aesthetically beautiful natural landscapes. A program was developed to extract data on the photos uploaded to the site, such as the date a photo was uploaded, the latitude and longitude of where the photo was taken, and the unique user ID of the account that uploaded the photo. This data was extracted to identify the number of photographs taken of each ecosystem type.	Due to the lack of available approaches for monetising flows of this service, it was not possible to develop estimates of the monetary value. This could potentially be explored in future through the use of willingness-to-pay surveys.
Existence	Interviews were held with representatives from each of the pilot areas in order to identify which species are considered to be 'charismatic' or to have important existence value to that area. Local data sources were then collected to monitor changes in the populations of these species over time. No data was available for Dorset AONB.	Due to the lack of available approaches for monetising flows of this service, it was not possible to develop estimates of the monetary value. This could potentially be explored in future through the use of willingness-to-pay surveys.