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Establishing a functional framework for monitoring protected landscapes; with a case study of English Areas of Outstanding Natural Beauty (AONB)

Emily Horswill*, John Martin†, J Adam Guy‡,§

* Sustainable Earth Institute, University of Plymouth, Drake Circus, Plymouth PL4 8AA, United Kingdom
† Department of Architecture, School of Art, Design and Architecture, Room 402, Roland Levinsky Building, University of Plymouth, Drake Circus, PL4 8AA, United Kingdom
‡ ORCID ID: 0000-0002-0974-6533
§ ORCID ID: 0000-0003-3363-8855

ABSTRACT

Protected landscape status is one of the highest designations afforded by the British legislature. To maintain consistent landscape quality, track environmental interventions, or measure the impacts of planned and unexpected events there is a need for co-ordinated national as well as local environmental monitoring. Conventionally indicators are used as monitoring proxies for tracking complex changes in landscape form and qualities, designation criteria, compliance against protective legislation, and the effectiveness of varying governance programmes. The regulatory agency of UK (English) environmental standards on behalf of the government, Natural England, monitors against a framework of indicators for the designation criteria of ‘natural beauty’ in 10 UK National Parks (NP) and 33 Areas of Outstanding Natural Beauty (AONB), and distributes data and analysis annually. This paper centres on an empirical case study that investigates environmental indicators used on-the-ground, as evidenced in AONB management plans. These bottom-up indicators are compared with top-down indicator frameworks from both Natural England’s monitoring programme (FMEOPL), and the emerging indicators associated with the UK 25-Year Plan to Improve the Environment (25YEP). A methodology is developed to collate diverse indicators from these three policy and governance sources and to recommend a synthetic list of 158 indicators with future potential as candidates of a national framework for monitoring environmental change in the UK at landscape-scale. Given the trans-national action of environmental stressors, this work is also considered to represent internationally significant findings.

1. Introduction

Environmental condition and sustainability issues are increasingly prominent in the media and public sphere (Calderwood, 2018), and thus strongly influence the politics of policy formulation (Campbell, 2008). Unfortunately, it is well documented that the concrete outcomes from environmental interventions are mis-aligned with the pace of political change and can often take years to manifest positive results (Koontz and Biddle, 2014). Annually reported datasets are often used as short term, proxy indicators of these longer-term objectives. (Bell and Morse, 2013). Such proxy indicators offer opportunities to both track and report on changes in environmental condition, quality or status in the short term whilst maintaining and working towards more aspirational long-term goals. This technique is evident in the United Kingdom.
(UK’s) government’s 25 Year Environment Plan (25YEP) (HM Government, 2018a) and in the adoption of the UK Climate Change Committee’s third carbon budget (Committee on Climate Change, 2019). Since 2013 the approach has been introduced to the UK Protected Landscape management cycle with bespoke datasets being provided annually by Natural England (NE) to both National Parks (NP) and Areas of Outstanding Natural Beauty (AONB).

This paper aims to illustrate a relevant and representative framework of indicators for monitoring environmental outcomes in English AONBs through an examination of the ways in which the concepts that underpin the designation of UK protected landscapes align with the theoretical contexts of existing indicators. The paper discusses a methodology for describing indicators and concludes recommendations for future research.

1.1. Protected landscapes

Both the Council of Europe and Natural England (NE) define a landscape as ‘an area, as perceived by people whose character is the result of action and interaction of natural and/or human factors (Natural England, 2015; ELC, Landscape Institute, 2019). Whilst the European Landscape Convention (ELC) asserts that ‘all landscapes matter’ the term commonly invokes a notion of unspoiled or ‘natural beauty’ that is generally held to imply a rural or wilderness areas distant from dense conurbations and characterised by special features that are often unique to a given locale (Tudor, 2014).

Over the last 70 years there has been a gradual transition in the character of the British countryside that reflects an integration of broader economic and cultural land uses with the formerly dominant drivers of agricultural production (Cantore et al., 2011), not least due to the legislative imperative to make the designated landscape more accessible to the broader public (HM Government, 2000). Managers of protected landscapes have sought to protect and enhance rural heritage and natural landscape character encouraging its commodification; an approach that is intended to accomplish conservation aims through linkage to local income generation (Shucksmith, 2012). However, the number of permanent residents in or near protected landscapes has increased (Natural England, 2013). It could be asserted that conservation priorities have been eclipsed by the effects of socioeconomic development (Bell and Stockdale, 2015) and the demand for recreation access. These pressures and their consequences have been acknowledged and addressed by the British Government in three ways:

UK Protected Landscapes are designated with two main priorities: the conservation and enhancement of ‘natural beauty’ (including wildlife and cultural heritage) and the promotion of opportunities for the understanding and enjoyment of the special qualities of National Parks by the public (HM Government, 1941, 1981, 1995, 2000). This includes the introduction the Sandford principle (Countrywide Agency, 2001) aimed to manage conflict through prioritising conservation of the cultural and natural environment over unconditional access for recreation and enjoyment.

There is increasing policy adoption of methodologies that aim to ‘value nature’ (UK Research Councils, 2015) through explicit quantification of the environmental sources of benefits, and the loss in derived well-being (for humans and non-humans) that would result from undervaluing, or ‘externalising’ in the terms of environmental economics (Spash and Aslaksen, 2015), these stocks (Natural Capital) and flows (ecosystem services) of value. Such approaches increasingly recognise cultural or intangible values (IPBES, 2019; Kenter, 2016; UNEP-WCMC, 2014) and that people must inhabit, work in, or visit high-value landscape to ensure the continuity of the more biotic ecosystem (supporting, provisioning, and regulating) services.

Among the recommendations of the 25YEP was an independent review of Protected Landscapes within England. This was known as the Glover Review (Defra, 2019b).

A balance must then be reached in protecting landscapes whilst simultaneously encouraging visitors and meeting the infrastructural needs of increasing populations (Natural England, 2013) of rural and peri-urban residents. Protected landscapes sit at the forefront of this balancing act and management trade-offs are inevitable. For example promotion of tourism supports rural livelihoods and meets the designation purpose of providing more access to non-residents but can lead to further environmental degradation, especially through increasing traffic. Housing development can enhance local services and stimulate local businesses yet without careful and well-resourced planning control often risks disrupting the perceived character of the landscape. Multiple stakeholders, each with distinct priorities leads to multiple or fragmented notions of ‘the environment’ dependent on occasionally contradictory claims to authority, expertise, or civil rights (Laurrell et al., 2018).

Protected landscapes comprise 28% of the United Kingdom (UK) land area and often operate across multiple local planning authority boundaries (Ordnance Survey, 2019; NAAONB, 2020). As a condition of designation managers of these landscapes are required to monitor and report on various natural beauty criteria, including indicators of environmental and cultural quality. Fig. 1 demonstrates that since protected landscapes exist throughout the length and breadth of the UK, and if the required monitoring is conducted regularly and effectively, they offer a unique opportunity to provide representative metrics of nationwide landscape change and public engagement with the natural environment.

1.2. Designation and differences

Currently there are 15 National Parks and 46 AONBs in the UK. Most were designated between 1949 and 1995 (HM Government, 1941), but there have been rare additions as recently as 2010, and the independent 2019 Glover Review of Protected Landscapes has recommended a policy of renewed designation (Defra, 2019b). Designation and compliance are overseen by Natural England, the watchdog body of Defra, the Department for Environment, Food & Rural Affairs.

The process for designation and subsequent monitoring in the UK differs from many international models in that the main protected landscapes are mostly working countryside, with multiple landowners and with uncontrolled access points rather than enclosed nature reserves (Natural England, 2017).

NPs and AONBs make up the key UK landscapes that are protected in law. There are other UK landscape-level designations, including Marine Conservation Zones, National Nature Reserves, and Heritage Coastlines (Natural England, 2018) although these do not follow the same government mandated designation process, or invoke the same degree of legal protection as do NPs and AONBs.

There are two main criteria to be considered before legally designating a protected landscape (Natural England, 2017):

1. Natural Beauty criterion,
2. Opportunities for enjoyment of recreation criterion.

AONBs and NPs are both required to meet the criteria for Natural

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3. It is important to note that since devolution of the UK (1998–2011) environmental management has been delegated in varying degrees to the devolved authorities of Scotland, Wales, and Northern Ireland. Natural England is formally the regulator for England only.

4. Natural England’s role is to help protect England’s nature and landscapes, for their intrinsic value to the nation; for people to enjoy, and for the services they provide, both now and in the future. We have specific responsibilities for a range of landscape and biodiversity designations on land, coast and at sea’ (Natural England, 2012).
Fig. 1. The 33 AONBs and 10 National Parks (ArcGIS Community Database, 2020).
Beauty, but NPs additionally have to fulfil the recreation criterion (Countryside Agency, 2001). The two designation criteria were most recently clarified through the 2000 Countryside Right of Way Act (CRoW) (HM Government, 2000) which not only strengthened but further refined their role and purpose within the legislative context (Countryside Agency, 2001).

For AONBs the process of designation is initiated when Natural England receives a proposal from an alliance of relevant stakeholders. The agency then decide whether the proposal adequately defines a border that delineates enough features that meet the natural beauty criterion, and whether it is desirable to grant the landscape the protection that designation would afford. Natural England must also consult with the local planning authorities and make the proposal accessible through local and community publications and newspapers. Only after this process has been scrupulously followed, and any objections dealt with, can the order of designation be made (Natural England, 2017). The process has been criticised in the recent review of National Landscapes (Defra, 2019b) as overly lengthy and challenging to as-
diculate. The 2000 CRoW act stipulation for written protected landscape indicators are more effective if they represent or are aligned with the practical studies have demonstrated that policy makers are influenced by rational, evidence-based approach by policy makers without familiarity with all aspects of relevant and detailed scientific literature (McCool et al., 2003; Natural England, 2014). Although these publications cited a list of potential universal indicators it was noted that many of the datasets had probably changed since 2001 (Bell and Morse, 2013). Indicators are only as good as the data that underpins them; therefore it is imperative that robust and up to date data sets are generated, maintained, and used (Dahl, 2012).

To address the perceived lack of a reliable and widely-applicable indicator set, from 2010 to 2013 Natural England worked with the National Parks, AONBs and other partners to formulate and introduce a set of nationally agreed indicators that would largely draw on existing and ongoing monitoring programmes. These indicators could act as proxies for tracking landscapes change against the protection and enhancement designation obligations of National Parks and AONBs. An additional requirement was that the georeferenced data could be ‘cut’ by boundary to represent the spatial extents of the various protected landscapes.

The resultant Framework for Monitoring Environmental Outcomes for Protected Landscapes (FMEOPL) was intended to enable an annual snapshot of the state of the environment in each protected landscape to aid managers in identifying long-term trends and to inform strategic planning (Natural England, 2014). There was no desire to rank individual landscapes or their management teams on their environmental protection, or enhancement performance. There was however the ambition that the framework would provide guidance for management plans, and 100% of National Park and AONB respondents to a 2012 survey (Natural England, 2014) stated that they ‘we currently using, or plan to use’ the MEOPL data going forward. There is no guarantee that an indicator will be adopted or used, irrespective of the degree of their development (Bell and Morse, 2011). Therefore the FMEOPL indicator set might be considered by some intended users to be of limited local relevance in using data collated only at a national scale, without adequate fine-grained local resolution. Additionally these national metrics might not incorporate many of the indicators that are informed by data available to AONBs at a local level, but which are not systematically collated nationally. There are also questions around the actual completeness (in time and space) of the datasets upon which the FMEOPL indicator set relies and whether the annually published figures are always used when compiling AONB management plans (University of Plymouth (Natural England), 2020).

1.4. Why indicators?

Indicators can simplify scientific metrics by providing a less-complex message for non-expert data users with twofold benefits (Bell and Morse, 2011; Dahl, 2012; Vedung, 2010). Firstly, by informing a more rational, evidence-based approach by policy makers without familiarity with all aspects of relevant and detailed scientific literature (McCool and Stankey, 2004). Secondly, in allowing for messages to be more easily illustrated and communicated to the public (Lyytikäinen and Rosenström, 2008). Both asserted benefits are however disputed. Several studies have demonstrated that policy makers are influenced by more than the evidence and its indicators (Rinne et al., 2013; Sébastien and Bauler, 2013; Bauler, 2012; Holden, 2009). Dahl asserts that indicators are more effective if they represent or are aligned with the values of their target audiences (Dahl, 2012). Given that indicators simplify complex and dynamic data it is also suggested that
inconsiderate use might contribute to a disconnection between policy makers and those who generate the data (Bell and Morse, 2011). This implies that despite their best efforts policy makers continue to make decisions with incomplete data and analyses. Yet, indicators are still believed to provide convincing direction in policy formation and are useful tools in ensuring that achievable milestones are set, not only to track the progress of policy enactment, but also to ensure accountability.

Rinne summaries three ways indicators are used; instrumentally, conceptually, and politically (Rinne et al., 2013):

- **a) Instrumental use** – where a direct link between indicator and decision outcome is assumed operationally,
- **b) Conceptual use** – where indicators are used to communicate more complex messages and subtly influence decision outcomes,
- **c) Political use** – varies contextually, to sometimes of delay an intervention, to legitimise a naturalised position, or to combatively to discredit an emerging challenge to the status quo.

The possibility of clear instrumentality is disputed, and it is suggested that all usage is in reality conceptual or political (Bell and Morse, 2013). Some instances of practical indicator deployment have been critiqued as politically tactical in conferring differential benefits to those in authority with respect to their stakeholders and hence questionable in terms of equitable legitimacy (Gudmundsson et al., 2009).

Rimppi describes indicators as either normative (informing action) or descriptive (informing about states or changes); categories derived from considering the varying practical objectives that form the criteria for indicator definition, and data monitoring (Rimppi et al., 2016). Thus indicators can be used to provide context and information or to perform an evaluative function. This evaluative function is often prized when designing indicator frameworks that are acting as a proxy for overarching aspirational goals and objectives. Evaluative, or performance indicators are primarily used to measure the deviation of any given state from a set of reference situations. They are also effective in informing the degree of intervention required to move from an initial to a desired state (Moldan et al., 2012). Performance indicators can be single issue indicators, such as volunteer hours, or composite indicators, which aggregate and take account of several factors such as the water quality. Composite indicators communicate a greater wealth of information; however they can be more difficult to understand and analyse (Sébastien and Bauler, 2013). They can also lead to communication difficulties since they may not resonate with the public as clearly as single-issue indicators.

Natural beauty is a complex and subjective concept (Selman and Swanwick, 2010), yet it forms the basis of the legal underpinnings of worldwide protected landscape designation (Richardson et al., 2018). Despite this remarked upon but often unacknowledged ambiguity, the concept informs the core aims of UK AONBs and National Parks; to protect and enhance natural beauty. AONBs are large, mosaic landscapes that are challenging to manage, especially given that AONB managers act as mediators between many stakeholder interests. The consequences of such holistic environmental management that can overwhelm and overcomplicate management plans (Frank et al., 2012).

An emerging paradigm for characterising some of the diversity of landscape benefits and beneficiaries is through using the toolsets of Ecosystem Services, or Natural Capital (Defra, 2020). Although it has been argued that the ecosystem service concept might best be considered as a heuristic or conceptual rather than descriptive indicator set (Kirchoff, 2019) the categorisation of and breaking down of landscapes into their primary and secondary ecosystem services has for some commentators proven beneficial for analysis and subsequent management decisions (Pulz et al., 2012). These and similar approaches aim to dissemble complexity into more manageable components and goals and allow indicators to be developed and assigned (Frank et al., 2012). It is important to stress that through such deconstructive approaches the overall context should not be lost, and that all goals and indicators should align. Furthermore, an indicator is only as good as the data that sits behind it; therefore it is crucial to choose indicators that are policy relevant, mapped to a clear strategy and adaptable to changes over time (Dahl, 2012). Finally, a certain amount of natural selection of the indicators should be anticipated for and expected to take place (Bell and Morse, 2013). Thus, having a wide initial selection of representative indicators that can be used for different goals would be both prudent and practical.

Large organisations can often employ multiple members of staff to carry out monitoring and quality assurance as a matter of course. Such resource availability allows for more complete and up to date datasets upon which to base decisions (Bell and Morse, 2011). Smaller organisations with less resources rarely have the expertise, time, or financial backing to engage in sophisticated or longer-term monitoring strategies. Inevitably the result is incomplete datasets, further compounded by the following issues (Roontz and Biddle, 2014; Defra, 2018):

- **a) Management bodies are influenced by more than just ‘scientific’ evidence,**
- **b) Licensing issues or costs may cause difficulties in accessing some data sets,**
- **c) Difficulties in adequately ‘cutting’ data to protected landscape boundaries.**

Hence protected landscapes management bodies are often unable to control and subsequently disentangle the various compounding influences on landscape quality or condition.

### 1.5. Change on the horizon

Since the 2013 introduction of the MEOPL framework a great deal of change has occurred, thus a review of the FMOPI indicators is both timely and necessary. 2016 saw the British population vote to leave the European Union (Brexit) which has profound implications for the future of the UK agricultural sector. Principally through the abolition of the agricultural subsidies assured through adherence to the Common Agricultural Policy (CAP) (European Commission, 2019). The majority of AONB land is farmland, but this is only one aspect of emerging landscape challenges. Public awareness surrounding environmental sustainability has increased scrutiny of protected landscapes and their management (Carrington, 2019; Dickman and Mortimore, 2018). Finally, the 2018 publication of a governmental 25-year environmental management plan (25YEP) with marked emphasis on the enhancement (or restoration) of lost or degrading natural beauty (HM Government, 2018a) also initiated an independent national review of the protected landscapes; The Glover Report (Defra, 2019b). Among the detailed recommendations of the Glover report was a detailed review of existing AONB management plans and the indicators that inform or support environmental management judgements and decisions.

Despite the designation of AONBs being as early as 1956 (Quantock Hills AONB, 2019) there is a limited number of recent peer-reviewed literature describing monitoring frameworks. This may in part be due to recognition of AONBs as of ‘de facto lower status’ than National Parks (Burden et al., 2002). There might be disconnect between those indicators suggested by Natural England, and those that AONBs actually monitor actively. Therefore, an up to date analysis of the indicators used by the management bodies charged with looking after designated landscapes is both timely and of importance (University of Plymouth (Natural England), 2020).

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3 Using a key word search of ‘area of outstanding natural beauty’ in Elsevier Scopus database only 5 of the first 40 ‘most relevant’ files were dated later than 2000. (www.scopus.com)
This study adopted the case-study approach (Yin, 2014) in order to allow research focus and insights of greater quality rather than attempting to describe the whole field of potential environmental indicators. The 2000 CrW Act required AONBs to publish management plans every five years. Since 2018 the majority of AONB management teams have published new plans, these protected landscapes constitute a representative case study of current actions to monitor landscapes. The assumption was that management plans would demonstrate 'bottom-up' practical monitoring activity and active use of indicators and associated datasets. This empirical research was undertaken in the context of more generic national indicator sub-sets.

### 2.2. 25YEP indicators

The UK 25 Year Environment Plan (25YEP) was introduced in 2018 as an ambitious, strategic policy document that would drive upcoming environmental legislation (HM Government, 2018a). A 25YEP monitoring framework is under active development in order to facilitate the movement of policies into ‘on-the-ground’ environmental protection and enhancement actions. This emerging documentation was chosen as a key source for candidate directive, or ‘top-down’ indicator recommendations.

### 2.3. FMEOPL indicators

The FMEOPL indicator set was developed by Natural England as a pragmatic compromise between the aspirations of policy, and the realities of monitoring activity based on current funding and governance of the UK protected landscapes. These datasets reflect the monitoring that already occurs in relation to management against the two main statutory purposes of protected landscapes. It was envisaged that these datasets would inform management plans developed by the English AONB management teams (Natural England, 2014).

Natural England has been responsible for the annual distribution of the 22 datasets that inform the MEOP indicators since 2013. FMEOPL indicators rely on data that are already being collected at a national level and circulated to the management teams of the protected landscapes. For the full dataset indicator list see Fig. 2 in the Results section; or FMEOPL Report (Natural England, 2014).

Prior to the collection of any AONB indicators from management plans an audit of the circulated MEOP datasets was completed in order to ground-truth the utility of these resources to AONBs, or to other bodies wishing to perform or introduce landscape-scale environmental monitoring programmes. This was accomplished by noting:

- **a)** Which datasets actually had more than five years of data,
- **b)** The incidence of each MEOP indicator, in each candidate AONB management plan.

### 2.4. AONB indicators

AONB plans are developed by AONB management teams in consultation with local conservation organisations, and stakeholders and community groups (Countryside Agency, 2001). This collective process, in striving for full stakeholder representation, results in a plurality of policy aims (East Devon AONB, 2019). It is important to acknowledge that individual motives, understandings, and locally contextual issues

### Table 1

The 5 indicator themes identified in the FMEOPL (Natural England, 2014) with definitions, examples and supporting literature (developed in this research).

| Indicator theme          | Definition                                                                                                                                                                                                 | Example Indicator                                                                 |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------|
| Natural Beauty           | This is found in landscape quality, scenic quality, relative wildness, relative tranquility, natural heritage features, and cultural heritage (Natural England, 2011, p.26) | Contributing to tranquility – abundance of indicator birds or levels of traffic at certain points |
| Recreation               | Access to high quality landscapes, natural or cultural heritage features or cultural associations, good recreation provision, accessibility, and potential for enhancement (Natural England, 2011) | Opportunities to enjoy the landscape and potential to enhance enjoyment – number of AONB specific interpretation boards |
| Ecosystem services       | Final ecosystem services are components of nature, directly enjoyed, consumed, or used to yield human well-being (Royd and Banzhaf, 2007, p.619)                                                             | Features that enhance the human experience and potential health benefits above that of just enhancing the beauty – water quality |
| Engagement               | The process of working collaboratively with and through groups of people affiliated by geographic proximity; often involving partnerships and coalitions that help mobilize resources (Eder et al., 2018, p.149) | Evidence of interested persons being able to have a reciprocal relationship with the conservation board and AONB – participation in visitor surveys |
| Sustainable communities  | Suitable and adequate services, population, and access to safe housing to allow a community to continue to thrive without overt external interference (United Nations, 2019; specifically UNSDG 11 Sustainable cities and communities) | Factors that enhance and allow a community to flourish within the AONB – local employment rates |

5 This anthropocentric definition, although not representative of the entire literature, was taken to be the most appropriate for AONB management plans given that 80% of the plans analysed referred to the concepts of natural capital and ecosystem services.

6 Sustainable Development Goals (United Nations, 2015).
will necessarily shape the content of management plans leading to variation between the different AONBs. Recognition of the inevitability of such idiosyncrasies has indirectly influenced indicator usage across the AONB family (NAAONB, 2020), and the consequent indicator selection, analysis, and results and recommendations of this research paper.

Natural England is the regulator for English AONBs but not those of the devolved authorities. Therefore of the total 46 UK AONBs, only the management plans of the 336

English AONBs were considered as candidates for indicator collection. Only AONB management plans from 2018 onward were considered for analysis since these plans refer to the minimum acceptable span of five years of MEOPL data.

Management plans and their supporting documents, such as State of the Park reports (e.g. Arnside and Silverdale, 2019), were obtained by searching each of the AONB websites. Where a management plan was in draft, or due for renewal in 2019 the final or draft 2019 reports were requested by email. Documents representing 21 out of 33 English AONB’s were obtained and analysed; 39 separate documents in total (See Supporting Material).

The indicators for subsequent screening (coarse and then fine) were collated (in an MS Excel data file) after reading each AONB document through and using key word searches. It was anticipated that there would be duplicate indicators across the 21 AONBs. These were removed during the coarse screening. Candidate indicators in the AONB management plans were not always directly presented as environmental indicators, but occasionally as key performance indicators (KPI), success measures, or as figures quoted as headlines which were interpreted as having resulted from indicator usage (even if the indicators from which these figures were derived were not explicitly listed).

To enrich the data collection process, two further themes were investigated.

Firstly, did the management plan discuss, or refer to four current topics:

a) Climate change adaptation and mitigation strategies – as an indication that the management plan incorporated current scientific thinking (IPCC, 2018)

b) The UK 25 Year Environment Plan – demonstrating that the management team sought guidance from recent government policy in writing their plan?

c) Natural capital and ecosystem services – which underlie the core methodologies of the government’s emerging environmental strategy (HM Government, 2018b)

d) Sustainable development – or the Sandford Principle for managing conflicts between designation criteria (Defra, 2019b).

Secondly, which of the 22 FMEOPL indicators were referred to in each AONB management plan, either directly as actual indicators, or obliquely as supporting contextual data? This process also ensured that any FMEOPL indicators were not accidentally double-counted as AONB sourced indicators.

Once this process was completed for every document the indicators were transferred from their AONB specific data files to an Excel metadata and their source (AONB management plan) was anonymised. Cumulatively 600 AONB indicators were identified.

2.5. Coarse screen

The coarse screen framework built on the methods used in the original 2013 FMEOPL project. During the consultation period for this project a statistical audit was conducted of multiple potential datasets. Only 22 datasets met the following criteria (Natural England, 2014,

\[A \text{ AONB, Wye Valley spans the border between England and Wales.}\]

p.29):

- Robust (i.e. we trust the results)
- Measure outcomes (not activity)
- Relevant to statutory purposes (designation)
- Useful (to protected landscape managers, Defra, Natural England, and others)
- Available (for all protected landscapes)
- Updatable (every 5 years or less)
- Affordable
- ‘Cuttable’ (to protected landscape boundaries)
- Global

Implicit in these criteria is that the data collected should pertain to, or act as a proxy for the natural beauty or recreation designation purposes of protected landscapes. This is understandable given that these are the primary legal requirements for managing these landscapes.

This research adapted the criteria to form a ‘broader’ or coarser screen (See Table 2 with reasoning given for selection of each criterion that ‘final’ indicators had to meet). Unlike the FMEOPL and 25YEP frameworks this coarse screen does not exclude data generated by AONB monitoring programmes that are additional to the nationally prescribed indicators, thus allowing for a bottom-up approach in augmenting ‘top-down’ policy goals.

The screening process took each of the candidate indicators and compared them against the derived coarse-screening framework presented in Table 2. If an indicator met all the coarse screening criteria, it was transferred to a new Excel data file. This process was then repeated with the 25YEP and AONB indicators.

Since duplication of indicators was expected across the 21 AONB management plans the only unique step for AONB indicators was the removal of these duplicates (i.e. if an indicator appeared in an AONB management plan it was not double-counted when it occurred in a subsequent plan). Candidate indicators at the end of this stage were therefore still held in 3 different MS Excel files, with some remaining duplicates expected across these separate files.

2.6. Fine screen and final indicator list

The main aim of the fine screen was to produce a single set of indicators held in a final (Excel) indicator list. This was achieved in three stages:

a) The final indicator list was structured using each of the 16 25YEP headline indicators (See Table 3). The FMEOPL and AONB indicators were added to their most closely aligned headline. Judgement was made questions outlines in Section B of the 25YEP framework indicator set questions (Defra, 2019a)

b) All of the 66 25YEP sub-indicators were added, but since many are still under development, and had not meet all criteria of the coarse screen, they were hidden from view in the final Excel spreadsheet.

c) Any further duplicates were removed. The only remaining duplicates at this stage were between the 25YEP indicators and either the FMEOPL or AONB indicators. Because the 25YEP was the most senior policy document, where there were any duplicates the 25YEP indicator was retained in the final results.

It was anticipated that this final indicator list would yield benefits in two main ways. Firstly, from the ‘bottom-up’, by providing protected landscape bodies a better range of grouped indicators that are relevant to current legislation. Secondly, from the ‘top-down’, by bringing together a wide-ranging list of indicators that are currently being used in at least one protected landscape across England and could contribute towards the national picture.
Firstly the presence or absence in AONB management plans of four topics (climate change, 25YEP, Natural Capital or ecosystem services, and sustainable development). The topics were discussed in at least 85% of the management plans, with arguably the most politically dominant current issue of climate change (IPCC, 2018) present in all plans (See Fig. 3).

Secondly, the use of any of the 22 MEOPL indicators as either indicators or contextual data points was noted. In the 21 AONB management plans and supporting documents analysed an average of 12 out of the 22 MEOPL indicators were present. Fig. 2 illustrates the frequency with which each MEOPL indicator occurs. It was beyond the scope of this research to investigate the reasons behind decisions by AONB management teams to include or exclude data points or how data are used internally.

3.4. Coarse screening

The coarse screening was primarily designed to reduce the number of indicators and to begin the process of harmonisation as a final single data file. The screening was performed in two tranches: a) AONB indicators; b) 25YEP and MEOPL indicators.

The coarse screening removed 474 of the AONB indicators which brought the total down from 600 to 126. Many of the indicators removed were duplicates, however it is not possible to state definitively how many were duplicated, or how many times, as many were worded in slightly different ways in each AONB plan.

In preparation of the set of 66 system indicators the 25YEP literature candidates were graded 1–6 with many noted as currently supported by ‘insufficient methodologies’. Therefore only 35% of the 25YEP indicators were included in the final indicator list, whereas 86% of the FMEOPL indicators passed the coarse screening.

Upon completion of the coarse screening there remained 23 25YEP

3.1. 25YEP indicators

The 25YEP sets 10 high level 25-year goals with progress to be tracked through 15 headline indicators (See Table 3). The headline indicators are informed by 66 system indicators, some of which are still under development (Defra, 2019a). These 66 system indicators were the initial candidate indicators for the subsequent coarse screening.

3.2. FMEOPL indicators

Of the 22 FMEOPL indicator datasets only 6 were found to have 5 years of continuous data points (See Fig. 2), however for the coarse screening all 22 of the indicators were considered as candidate indicators. Fig. 2 indicates the incidence of the 22 FMEOPL indicators in those AONB management plans examined in this study.

3.3. AONB indicator collection

33 English AONB management teams receive the FMEOPL data circulated by Natural England. Once the exclusions outlined in the methods section had been applied 21 AONBs remained as sample candidates for indicator collection. This sample generated 39 documents for analysis (management plans and supporting documents). Upon completion of the analysis 600 indicators were identified, with an average of 29 per AONB.

(The full spread of the 600 indicators found in each AONB is shown in the final indicator list in the Supporting Material)

As described in the Methods section 2 additional lines of investigation were applied to the detailed analysis of AONB management plans.

3. Results

Table 2

| Criteria | Reasoning |
|----------|-----------|
| Relevant | To policies within the management plan and legislative remit |
| Robust | To ensure data is gathered with a reliable methodology or from a reliable source |
| Regular | Updates must be planned and not ‘ad hoc’ or contingent on a single research project. Updates made at least every management plan cycle (5 years) |
| Cutable | Possible to limit data to the geographic area of any protected landscape (sometimes incorporating data from several administrative authorities) |
| Internationally transferable | Indicators should not be so locally contextual that there is no international relevance |
| Clear | The indicator should have a traceable foundation in an appropriate policy |
| Evaluative | The indicator must be suitable for comparison between current conditions and preferred conditions, or to track changes in landscape condition |

Table 3

| Headline indicator descriptions (1–16) | Relevant 25-year goals (10: A–J) |
|----------------------------------------|----------------------------------|
| 1 Changes in air quality that affect our health and ecosystems | A. Clean air |
| 2 Changes in greenhouse gas emissions from natural resources | G. Mitigating and adapting to climate change |
| 3 Changes in quality and quantity of water and the water environment that affect our lives and livelihoods | B. Clean and plentiful water |
| 4 Changes in the diversity of our seas that affect our lives and livelihoods | C. Thriving plants and wildlife |
| 5 Changes in the health of our seas that affect our lives and livelihoods | C. Thriving plants and wildlife |
| 6 Changes in wildlife and wild places that we cherish | E. Using resources from nature more sustainably and efficiently |
| 7 Changes in nature on land and water that support our lives and livelihoods | C. Thriving plants and wildlife |
| 8 Changes in production and harvesting of natural resources | D. Reducing risk of harm from natural hazards |
| 9 Changes in resilience to natural hazards | F. Enhanced beauty, heritage, and engagement with the natural environment |
| 10 Quality of our landscapes and waterscapes | F. Enhanced beauty, heritage, and engagement with the natural environment |
| 11 People enjoying and caring about the natural environment | J. Enhancing biosecurity |
| 12 Changes in the impact of exotic diseases and invasive non-native species | I. Managing exposure to chemicals |
| 13 Changes in the exposure of people and wildlife to harmful chemicals | H. Minimising waste |
| 14 Resource efficiency and waste | There are no specific goals in the 25 Year Environment Plan for this headline indicator |
| 15 Changes in domestic consumption that have impacts on the natural environment | There are no specific goals in the 25 Year Environment Plan for this headline indicator |
| 16 Changes in our contribution towards improving the environment overseas | |

3.1. 25YEP indicators

The 25YEP sets 10 high level 25-year goals with progress to be tracked through 15 headline indicators (See Table 3). The headline indicators are informed by 66 system indicators, some of which are still under development (Defra, 2019a). These 66 system indicators were the initial candidate indicators for the subsequent coarse screening.
indicators, 18 FMEOPL indicators, and 126 AONB indicators. At this stage they were held in 3 different MS Excel files, with some duplicates across the separate files.

During this coarse screening, the framework outlined in Table 2 had ensured a consistent approach. However, there were some potentially valuable indicators eliminated during the coarse screening. These missed opportunities were retained in an additional category some examples will be elaborated on in the discussion.

3.5. Final indicator list and fine screening

Once the coarse screening was complete there were no duplicates
within each of the 3 separate indicator lists, or between FMEOPL and AONB indicators. However, there did remain duplication between the 25YEP indicators and either the FMEOPL or AONB indicators. For example ‘ecological water status’ was included in both the 25YEP and FMEOPL indicator sets, whereas ‘concentration of PM2.5’ was present in the AONB and 25YEP sets, but not in the FMEOPL indicators. The aim of the fine screening was to remove these remnant duplicates and amalgamate all three sets of indicators as one set in a final indicator list organised under the 16 headline 25YEP indicators; aligned to the 10 25YEP goals (See Table 3).

Following fine screening 8 AONB indicators and 1 FMEOPL indicator had been removed as duplicates of the 25YEP indicators. The summary post-screening results, and figures for the intermediate stages are shown in Table 4.

After both coarse and fine screening 689 initial candidates had been reduced to 158 unique indicators. These results are summarised in Table 5.

In the final indicator list 24 indicators, all derived from AONB management plans, did not directly align with any of the 16 25YEP headline indicators. Whereas the 25YEP headline indicators were developed specifically for environmental policy action, the 24 additional indicators refer more to community, socio-economic or demographic aspects of landscape-scale management of AONBs. Indicators with potential to inform multiple AONB and 25YEP goals have been signified with a new headline indicator (number 17) in the final indicator set (Table 5). It is suggested that such multipurpose indicator types might well support monitoring in line with the European Landscape Convention (ELC) assertion that ‘all landscapes matter’ and that they should be valued for cultural as well as environmental qualities (Council of Europe, 2000).

Although the purpose of screening was to simplify the final indicator set it was considered important to retain information about duplication by source, since this shows that independent bodies have made similar value judgements about the usefulness of these indicators (See ‘Indicator Source’ column in Table 5).

It also was acknowledged that some of the 25YEP indicators are still under development, therefore rather than just deleting the indicators, where they are not relevant to AONBs 43 indicatorshave been ‘hidden’ in the final Excel spreadsheet, and are not represented in the results tables.

Table 5 also shows the data monitoring programme or body that underpins any of the final indicator set.

4. Discussion

The research conducted in this paper has 2 main outputs. Firstly a method has been illustrated that combines indicators from three sources: top-down policy, nationally available datasets, and on-the-ground (bottom-up) activity. Secondly, a comprehensive indicator list of 158 nationally relevant final indicators has been suggested. These indicators are categorised according to the latest iteration of the British Government’s most senior environmental policy, the 25-Year Environment Plan (25YEP). Several findings were made, methodological constraints are explored, and future research is suggested.

4.1. Key findings

4.1.1. Natural Selection’ of indicators

Research showed that retention or loss of indicator usage is not based on immediately perceptible criteria. For example one FMEOPL indicator, ‘Total annual values of agri of agri-environmental schemes’ (Final Indicator No. 59, See Table 5), should have been present in most management plans, since it is one of the 6 FMEOPL indicators identified as having 5 continuous years of data (FMEOPL indicator No. 1; See Fig. 2).

Of the 6 similar indicators (with 5 years of contiguous data) 5 were present in at least 80% of the management plans, whereas the above indicator was only present in 24% of the management plans reviewed. This is evidence of the ‘natural selection’ of indicators through the practices of AONB management teams. It is possible that this indicator has fallen out of use because the data it summarises is too complex for the intended audience of the management plan. Answering such
| No | 25YEP Headline Indicator* | 25YEP Goal* | Final Indicator | Indicator source | Monitoring body/data source |
|----|--------------------------|-------------|----------------|-----------------|----------------------------|
| 1  | 1                        | A           | Concentrations of fine particulate matter (PM2.5) | 25YEP/AONB         | Defra                      |
| 2  | 1                        | A           | Area exposed to damaging levels of ammonia in the atmosphere | 25YEP              | Defra                      |
| 3  | 1                        | A           | Roadside nitrogen dioxide (NO2) compliance (followed to nearest site) | 25YEP              | Daily Air Quality Index – Defra |
| 4  | 2                        | G           | Emissions of greenhouse gases from natural resources | 25YEP              | UK NAEI                    |
| 5  | 2                        | G           | Levels of traffic in/around AONB | AONB          | DFT count locations/LPA/ AONB survey |
| 6  | 2                        | G           | Mode of transport for visitors | AONB          | AONB survey                |
| 7  | 2                        | G           | % of settlements that have a daily bus service | AONB          | AONB/LPA                   |
| 8  | 2                        | G           | Average energy consumption per household | AONB          | DBEIS                      |
| 9  | 2                        | G           | Number of households in fuel poverty | AONB          | DBEIS                      |
| 10 | 2                        | G           | Number of renewable energy schemes permitted (Can extend to area or at sea) | AONB          | AONB/LPA                   |
| 11 | 2                        | G           | Number of wind turbines (Can extend to area or at sea) | AONB          | RESTATS                    |
| 12 | 3                        | B           | Ecological status of water | 25YEP/          | EA                        |
|    |                          |             | Condition of bathing waters | 25YEP/AONB      | EA                        |
| 13 | 3                        | B           | Waters achieving sustainable abstraction criteria | 25YEP          | EA                        |
| 14 | 3                        | B           | Area and condition of priority habitats or under active management | AONB          | AONB                      |
| 15 | 3                        | B           | Number of species recovery programmes delivered | AONB          | AONB                      |
| 16 | 3                        | B           | Hectares of land enhanced for geodiversity through work of AONB teams | AONB          | AONB                      |
| 17 | 3                        | B           | Condition of broad habitats within SSSIs | FMEOPL          | NE                        |
| 18 | 3                        | B           | % area of SSSIs in favourable or recovering condition | FMEOPL          | NE                        |
| 19 | 4                        | C           | Functional species including pollinators and freshwater invertebrates | 25YEP          | England Biodiversity Indicators |
| 20 | 6                        | C           | Condition of protected sites - land, water, and sea (Composite indicator of extent and classification) | 25YEP/AONB      | NE                        |
| 21 | 6                        | C           | Abundance and distribution of priority species (Data collected by individual conservation groups) | 25YEP          | England Biodiversity Indicators |
| 22 | 6                        | C           | Presence of indicator species | AONB          | RSFR/NE/other groups       |
| 23 | 6                        | C           | Area and condition of priority habitats or under active management | AONB          | AONB                      |
| 24 | 6                        | C           | Number of species recovery programmes delivered | AONB          | AONB                      |
| 25 | 6                        | C           | Hectares of land enhanced for geodiversity through work of AONB teams | AONB          | AONB                      |
| 26 | 6                        | C           | Condition of broad habitats within SSSIs | FMEOPL          | NE                        |
| 27 | 6                        | C           | % area of SSSIs in favourable or recovering condition | FMEOPL          | NE                        |
| 28 | 7                        | C           | Characteristic species (birds, butterflies, bats, plants) of farms, woods, wetlands, and coasts | 25YEP/AONB      | England Biodiversity Indicators |
| 29 | 7                        | C           | Length of hedgerow in active management (Can be expanded, created, restored, etc.) | AONB          | AONB                      |
| 30 | 7                        | C           | Length of verges in active management (Can be expanded, created, restored, etc.) | AONB          | AONB                      |
| 31 | 7                        | C           | Length of field margins in active management (Can be expanded, created, restored, etc.) | AONB          | AONB                      |
| 32 | 7                        | C           | Length of undeveloped estuary shoreline | AONB          | AONB                      |
| 33 | 7                        | C           | % of woodland ownership types | AONB          | PC                        |
| 34 | 7                        | C           | % under UK Woodland Assurance Scheme | AONB          | PC                        |
| 35 | 7                        | C           | Hectares of wildflower meadows planted | AONB          | AONB                      |
| 36 | 7                        | C           | Area of a particular feature e.g. orchards | AONB          | AONB – Aerial photography |
| 37 | 7                        | C           | % of woodland in the England Woodland grant scheme (AKA Forestry Commission Grant Scheme) | AONB          | AONB                      |
| 38 | 7                        | C           | Number of hedgerow trees and in-field trees managed under Environmental Subsidy Scheme (ES) | FMEOPL          | NE                        |
| 39 | 7                        | C           | Area of woodland managed and created under ES | FMEOPL          | NE                        |
| 40 | 7                        | C           | Area of land under ES for the management, restoration, or creation of lowland heathland | FMEOPL          | NE                        |
| 41 | 7                        | C           | Area of woodland that is managed | FMEOPL          | NE                        |
| 42 | 7                        | C           | Area and % of Ancient Woodland | FMEOPL          | NE                        |
| 43 | 7                        | C           | Area of woodland (Sub-divided into broadleaved, conifer, mixed, shrub land, young trees, felled woodland, ground prepared for new planting, coppice.) | FMEOPL          | NE                        |
| 44 | 8                        | E           | Farm types within AONB (Can also be expressed as % change) | AONB          | Defra                      |
| 45 | 8                        | E           | Farm sizes within AONB (Can also be expressed as % change or % of land in agricultural use) | AONB          | Defra                      |
| 46 | 8                        | E           | Agricultural land use types (Broken-down by area of arable, grassland, etc.) | AONB          | Defra                      |
| 47 | 8                        | E           | Breakdown of farm labour (Can also be expressed as a % change) | AONB          | Defra                      |
| 48 | 8                        | E           | Livestock numbers and types (Can also be expressed as a % change) | AONB          | Defra                      |
| 49 | 8                        | E           | Increase in average rural income | AONB          | Defra                      |
| 50 | 8                        | E           | % of land being farmed organically | AONB          | Soil Association Certification Group |
| 51 | 8                        | E           | Area of land under ES for soil management | AONB          | NE                        |
| 52 | 8                        | E           | Number of ‘land management schemes’ appraised (e.g. Woodland Management, Catchment Sensitive Farming, Countryside Stewardship, Natural Flood Management, etc.) | AONB          | AONB                      |

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| No | 25YEP Headline Indicator* | 25YEP Goal* | Final Indicator | Indicator source | Monitoring body/data source |
|----|---------------------------|-------------|----------------|----------------|---------------------------|
| 57 | 8                        | E           | Number of farmers actively engaged in Catchment Sensitive Farming (CSF) | AONB | Defra |
| 58 | 8                        | E           | Area managed under agri-environmental agreement: Countryside Stewardship Scheme (CSS), Environmentally Sensitive Areas (ESA) and different levels of Environmental Stewardship (ES) (Expressed as a % of a protected landscape (PL), or as % Utilisable Agricultural Area within PL.) | FMEOPL | NE |
| 59 | 8                        | E           | Total annual values of agri-environment agreements (CSS, ESA, and different levels of ES) | FMEOPL | NE |
| 60 | 8                        | D           | Disruption or unwanted impacts caused by droughts | 25YEP | OFWAT security of supply index |
| 61 | 9                        | D           | Distribution of flood risk (Using EA defined flood risk envelopes) | AONB | EA |
| 62 | 9                        | D           | % of floodplain woodland and woodland features | AONB | FC |
| 63 | 9                        | D           | Length of river and adjacent habitat under active management | AONB | AONB |
| 64 | 9                        | D           | Number of new flood management schemes to aid water management/climate change | AONB | AONB |
| 65 | 10                       | F           | Heritage features of designated sites and scheduled monuments (Composite indicator of Geo SSSI condition and Scheduled Monuments at Risk. Both are discrete FMEOPL indicators.) | 25YEP | NE/HE |
| 66 | 10                       | F           | Condition of landscape/seascape | AONB | AONB Fixed point photography |
| 67 | 10                       | F           | Production of a publicly available Annual Report and Business Plan | AONB | AONB |
| 68 | 10                       | F           | Extent of geological designations | AONB | AONB |
| 69 | 10                       | F           | Hectares of landscape enhanced by the removal of overhead power lines | AONB | AONB |
| 70 | 10                       | F           | Hectares of land enhanced for natural beauty through work of AONB teams | AONB | AONB |
| 71 | 10                       | F           | Hectares of land enhanced for geodiversity through work of AONB teams | AONB | AONB |
| 72 | 10                       | F           | Area of land enhanced through AONB programmes (e.g. biodiversity, environmental and cultural protection, designation of habitats, etc.) | AONB | AONB |
| 73 | 10                       | F           | Increase in Historic Environment Records (HER) for woodlands and non-wooded habitats | AONB | County HER statistics |
| 74 | 10                       | F           | Number of historic ponds restored | AONB | AONB |
| 75 | 10                       | F           | Number of non-designated heritage sites identified and mapped | AONB | AONB |
| 76 | 10                       | F           | Scheduled parks and gardens (Can expand to ‘at risk’) | AONB | HE |
| 77 | 10                       | F           | Length of coastline in protective public ownership | AONB | AONB |
| 78 | 10                       | F           | Number and geographic spread of moorings and pontoons in undeveloped estuary areas | AONB | AONB |
| 79 | 10                       | F           | Number of accessible quays | AONB | AONB |
| 80 | 10                       | F           | Clear-felling rates | AONB | AONB |
| 81 | 10                       | F           | Location of recreation activities | AONB | AONB Survey |
| 82 | 10                       | F           | Length of cycle routes | AONB | AONB Ordinance Survey mapping |
| 83 | 10                       | F           | Number of AONB specific interpretation panels | AONB | AONB |
| 84 | 10                       | F           | Length of improved Public Rights of Way (PRoW) due to AONB activity | AONB | AONB |
| 85 | 10                       | F           | Number of walking routes developed and promoted by AONB (Can expand to include distance/proportion considered easily accessible) | AONB | AONB |
| 86 | 10                       | F           | Condition of AONB roads and road signs | AONB | LPA/AONB survey |
| 87 | 10                       | F           | Hectares of land where the heritage asset condition or setting has been conserved or enhanced | AONB | HE/AONB |
| 88 | 10                       | F           | Lengths of paths made accessible | AONB | NE/AONB |
| 89 | 10                       | F           | Area of land under ES specifically for the management and protection of archaeological features | FMEOPL | NE |
| 90 | 10                       | F           | Number of heritage assets (Including the number of listed buildings (including grade II listed) & structural scheduled monuments, scheduled monuments, registered parks & gardens, registered battlefields.) | FMEOPL | HE |
| 91 | 10                       | F           | % of heritage assets that are ‘at risk’ (Including buildings at risk (excluding grade II listed), monuments, registered parks and gardens, registered battlefields, and places of worship.) | FMEOPL | HE |
| 92 | 10                       | F           | Number of Geo SSSI unit features, and % in favourable or recovering condition | FMEOPL | NE |
| 93 | 10                       | F           | Length of Public Rights of Way (Sub-divided into footpaths, bridleways, Byways Open to Traffic and restricted byways) | FMEOPL | NE |
| 94 | 11                       | F           | Engagement in the natural environment (Cuttable to the region. Although sample size may not be sufficient to prove statistical significance, it may provide an indication of engagement.) | 25YEP | NE MENE |
| 95 | 11                       | F           | People engaged in social action for the environment (Cuttable to the region. Although sample size may not be sufficient to prove statistical significance, it may provide an indication of engagement.) | 25YEP/AONB | NE MENE |
| 96 | 11                       | F           | Environmental attitudes and behaviour (Cuttable to the region. Although sample size may not be sufficient to prove statistical significance, it may provide an indication of engagement.) | 25YEP/AONB | NE MENE |
| 97 | 11                       | F           | Number of users of accessibility enhancement tools (e.g. mobility scooter, etc.) | AONB | AONB |
| 98 | 11                       | F           | Number of people completing rural skills courses | AONB | AONB |
| 99 | 11                       | F           | Number of people trained in conservation techniques (Can expand to include traineeships, apprenticeships, warden, etc.) | AONB | AONB |
| 100| 11                      | F           | Total number of visitors | AONB | AONB Survey |
| 101| 11                      | F           | TripAdvisor or other equivalent rating for AONB | AONB | TripAdvisor/Google |
| 102| 11                      | F           | Total number of visitors in specific areas | AONB | AONB Survey |
| 103| 11                      | F           | Visitor centre enquiries | AONB | AONB |
| 104| 11                      | F           | Social media following | AONB | AONB |

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questions was beyond the scope of this project and would require detailed field interview-based research.

Another indicator, ‘relative tranquillity’ investigated as a candidate for the FMEOPL, but not adopted, was however present in 67% of management plans. That the indicator was present in two thirds of management plans would suggest it is of significance to management teams and their stakeholders. A possible reason for the high incidence is that ‘relative tranquillity’ is recognised as a ‘Factor related to Natural

Table 5 (continued)

| No | 25YEP Headline Indicator* | 25YEP Goal* | Final Indicator | Indicator source | Monitoring body/data source |
|----|---------------------------|-------------|-----------------|-----------------|-----------------------------|
| 105 | F | Website interactions | AONB | AONB |
| 106 | F | Interactions with downloadable material | AONB | AONB |
| 107 | F | Type and demography of visitors | AONB | AONB survey |
| 108 | F | Visitor perception/value of AONB | AONB | AONB survey |
| 109 | F | Number of attendees at events/initiatives organised by AONB | AONB | AONB |
| 110 | F | Number of educational visits conducted | AONB | AONB |
| 111 | F | Level and awareness of AONB designation and purpose | AONB | AONB survey |
| 112 | F | Membership numbers of groups associated with AONB (e.g. conservation trusts, etc.) | AONB | AONB |
| 113 | F | Reason for visiting | AONB | AONB survey |
| 114 | F | Number of events/initiatives held by AONB | AONB | AONB |
| 115 | F | Number of practical tasks completed by volunteers | AONB | AONB |
| 116 | F | Number of volunteers | AONB | AONB |
| 117 | F | Value of volunteer work | AONB | AONB |
| 118 | F | Volunteer days | AONB | AONB |
| 119 | F | Number of planning applications commented upon (Can be expanded to: recommendations adhered to; % of objections over-ruled; supported with plan.) | AONB | AONB |
| 120 | F | % of settlements that have appropriate plans (e.g. neighbourhood plans. Can also include shoreline plans.) | AONB | AONB/LPA |
| 121 | F | Number of dwellings built that year (Can expand to include ‘affordable homes’, or proportion in small scale developments.) | AONB | AONB/LPA |
| 122 | F | Number of ‘major development schemes’ appraised - LPA planning applications | AONB | AONB/LPA |
| 123 | F | Number of ‘non-major development schemes’ appraised – LPA planning applications | AONB | AONB/LPA |
| 124 | F | Number of businesses associated with local ‘green tourism’ scheme | AONB | AONB/LPA |
| 125 | F | Number of caravan pitches | AONB | LPA |
| 126 | F | Number of community groups engaged | AONB | AONB |
| 127 | F | Total value of work delivered directly or secured by the work of AONB Teams | AONB | AONB |
| 128 | F | Number of other ‘development schemes’ appraised (Public Sector e.g. Highways Agency, EA, etc.; Private sector e.g. British Telecom, etc.) | AONB | AONB |
| 129 | F | Number of press mentions | AONB | AONB |
| 130 | J | % of woodland managed to remove invasive species | AONB | AONB |
| 131 | I | Emissions of nationally significant substances to the environment | 25YEP | Pollution inventory reporting – Gov.uk |
| 132 | I | % area designated a nitrate vulnerable zone | 25YEP/AONB | EA |
| 133 | H | Waste crime | 25YEP | Defra |
| 134 | H | Municipal waste recycling rates | 25YEP/AONB | LPA |
| 135 | N/A | Tourism contribution to local economy (Using STEAM methodology or local tourist board figures.) | AONB | AONB survey |
| 136 | N/A | Tourist bed space capacity | AONB | AONB survey |
| 137 | N/A | Value of external projects substantially influenced/generated by the AONB Team | AONB | AONB |
| 138 | N/A | Value of other ‘external’ grants or contributions received for projects/non-core activity | AONB | AONB |
| 139 | N/A | Index of Multiple Deprivation (IMD) score (AKA level of deprivation. Can also be expressed as % change.) | AONB | IMD – MHCLG |
| 140 | N/A | Health deprivation and disability score (Can also be expressed as % change) | AONB | IMD – MHCLG |
| 141 | N/A | Barriers to housing and services score (Can also be expressed as % change) | AONB | IMD – MHCLG |
| 142 | N/A | Income score (rate) (Can also be expressed as % change) | AONB | IMD – MHCLG |
| 143 | N/A | Employment rates (Can also use inverted for unemployment, or retirement rate.) | AONB | ONS mid-year statistics |
| 144 | N/A | Number of local population | AONB | ONS mid-year statistics |
| 145 | N/A | Age distribution of population | AONB | ONS mid-year statistics |
| 146 | N/A | Gender distribution | AONB | ONS mid-year statistics |
| 147 | N/A | % of houses above county/national average (Can include affordability ratio) | AONB | HM Land Registry |
| 148 | N/A | % employed due to tourism | AONB | AONB survey/census |
| 149 | N/A | % AONB that has access to faster broadband | AONB | AONB/Think Broadband website |
| 150 | N/A | % of AONB villages that have a shop, pub, Post Office service or community building | AONB | AONB/LPA |
| 151 | N/A | Amount (£) awarded in small grants | AONB | AONB |
| 152 | N/A | Amount (£) invested in local companies | AONB | AONB |
| 153 | N/A | Amount of funding brought in by the AONB team | AONB | AONB |
| 154 | N/A | Number of partnerships where the AONB Team promotes the delivery of the Management Plan (Partnerships e.g. steering groups, research projects, etc.) | AONB | AONB |
| 155 | N/A | Number of partnerships where AONB promote delivery of Management Strategy (Partnerships e.g. steering groups, research projects, etc.) | AONB | AONB |
| 156 | N/A | Number of partnerships where the AONB Team is a supporting partner (Partnerships e.g. steering groups, research projects, etc.) | AONB | AONB |
| 157 | N/A | Number of partnerships where the AONB Team is part/lead of the project/team/steering group (Partnerships e.g. steering groups, research projects, etc.) | AONB | AONB |
| 158 | N/A | Number of National Infrastructure Projects appraised | AONB | AONB |

* See Table 3 for lists of 25YEP headline indicators and goals; † Indicators with potential to inform multiple AONB and 25YEP goals.
Beauty’ (Natural England, 2011) and is therefore important to monitor. However, the dataset that informs the indicator was derived in a one-off national study in 2007 by the Campaign to Protect Rural England (CPRE) (CPRE, 2019). There has only been one subsequent localised study, and no further proxies have been suggested. This is an example of an indicator that should have naturally fallen from use yet is still prevalent due to a lack of suitable replacement indicators. In this study the indicator failed to meet the coarse-screening criteria and is not represented in the final indicator list (See Table 5).

To overcome emerging monitoring challenges, including replacement of irrelevant indicators it is important that new or novel indicators are regularly developed. Existing indicators must also be managed to maintain continuity and ensure the production of longitudinal datasets to track trends in environmental condition. To meet these objectives the FMEOPL indicators were agreed upon by Natural England in collaboration with the AONB and National Park management teams. The results of this research however revealed that on average only 12 of the 22 FMEOPL indicators were present in any single AONB management plan. This suggests that the no matter how well intentioned or designed an indicator is, there is no guarantee that it will be used, and indicators are continually lost to natural selection (Bell and Morse, 2011). This finding may also suggest that AONB managers had not engaged with the FMEOPL data as actively as Natural England had initially projected. Further research is suggested to gain a better understanding of why the use of some indicators has ceased, whilst others have remained prevalent and what informs these decisions.

4.1.2. Beyond the primary purpose of designation

AONBs are designated with the main purpose of ‘Conserving and enhancing natural beauty’, whereas National Parks are designated with the extended purpose of ‘Conserving and enhancing natural beauty, and promoting understanding and enjoyment of special qualities by the public’ (Countryside Agency, 2001). With an average of 29 indicators per AONB document, it is clear that many AONB management teams have moved beyond these limited original designation purposes and the phenomena monitored by the initial 22 FMEOPL datasets suggested in 2013. Of the 158 final indicators selected through this research, 118 were collated from solely AONB management plans, illustrating the breadth of indicators that AONB teams have developed or adopted (See Table 4). Use of such indicators as ‘TripAdvisor rating’, ‘amount invested in local companies’, or types and demography of visitors, demonstrates the AONB management team concerns with issues additional to the initial designation criteria and purposes.

The Glover Review of Protected Landscapes highlighted that AONBs appear to ‘do a great deal with very little’ (Defra, 2019a,b). Furthermore, The National Association of AONBs acknowledges that AONB teams not only conserve the landscape but also ‘advance education, understanding and appreciation’ (NAAONB, 2019a). Such statements acknowledge that AONB management activity has incorporated aspirations beyond the minimum mandatory requirements, whilst simultaneously absorbing and overcoming reductions in guaranteed funding (Mendip Hills, 2019). Although there is clearly investment in wider positive outcomes for landscapes and communities, management teams increasingly need to fund these additional activities from sources beyond the core income from central government and local authorities, often through pursuing additional grants and fundraising.

Additional grants are usually conditional upon meeting novel or contextual funding criteria. For example, the National Lottery Heritage Fund offers a substantial grant with which to form a Landscape Partnership (NLHF, 2020) in order to conserve and enhance a specific landscape. However, approval of funding stipulates additional monitoring requirements, and hence new indicators, that must be evidenced. The diversification of funders and consequent indicators has expanded the expected workload of already-stretched AONB management teams.

No single AONB team can be expected to collect data for 118 indicators on an annual basis. However, with a selective, nationally coordinated approach, some of this set could become regular features of all AONB landscape monitoring strategies. Although introducing such a ‘best practice’ indicator subset would require additional resources initially, a consistent methodology could be developed and shared across the entire network of 46 AONB teams that operate in the UK. Consequently up to 18% (NAAONB, 2019) of the UK could be consistently and comparatively monitored for key environmental criteria. A coherent approach to monitoring protected landscapes by NE and the NAAONB could provide a strong foundation for ‘AONB family’ level (national) funding for monitoring that would address landscape quality issues.

4.2. Methodological constraints

One of the main outputs of this paper is a suggested method that amalgamates different levels of policy to suggest one coherent list of indicators that could be of use for policy makers and practitioners. The research encountered some methodological constraints, but also suggested solutions.

4.2.1. Duplicate AONB indicator removal

Applying the coarse screening criteria was relatively simple (as set out in Table 2). Although it had been foreseen that there would be duplicate indicators from the 39 AONB documents it had not been anticipated how time consuming it would be to remove them. To overcome this it is suggested that an additional criterion of ‘uniqueness’ should have been included at this screening stage, rather than through the fine-screening process. The criteria would be met by answering the following questions:

a) Is this indicator an exact duplicate? – For example, ‘volunteer hours’. The first occurrence will pass the coarse screen, whereas any further instances are redundant.
b) Is this an inverse of another indicator? – For example, ‘rate of unemployment’ and ‘rate of unemployment’. Simple inverses count as only one indicator, although this might raise the question of which of the inverse pair to retain.
c) Is this indicator an extension of another indicator? Could it be amalgamated with another one? For example, ‘number of houses built’ and ‘number of houses built, of which proportion were affordable’. Although these indicators highlight subtly different issues they could be combined and the extension attribute ‘of which proportion were affordable’ could be added. See Table 5 for more examples.

An additional suggestion that might enrich future iterations of similar data collection exercises and subsequent analysis might be to pay closer attention to the frequency of duplication and the analytical reason for removal. This step could help raise further research questions concerning over or under-representation of certain indicator types.

4.2.2. Final indicator list construction

Whilst constructing the final indicator list some value judgements were required when categorising the AONB and FMEOPL indicators. For most there was a strong link with one of the 16 25YEP headlines. In some cases however one of the 22 FMEOPL indicators or an AONB sourced indicator aligned with more than one headline indicator. In such a case the indicator was ascribed to the most-related headline indicator. This judgement was aided by reference to the ‘Questions’ associated with each of the 16 25YEP headline indicators laid-out in Section B of the May 2019 document: ‘Measuring environmental change: outcome indicator framework for the 25 Year Environment Plan (Defra, 2019a,b).

For example, an AONB management report derived indicator such as ‘Number of new flood management schemes to aid water
management and climate change' (final indicator No. 64, Table 5) might have at first sight belong under 25YEP headline indicator No. 3: ‘Changes in quality and quantity of water and the water environment that affect our lives and livelihoods’. But on examination of the associated policy questions, headline indicator No. 3 was shown to be inappropriate, and the derived indicator could only be associated with headline indicator No. 9; ‘Changes in resilience to natural hazards’.

It was more difficult to ascribe some of the derived indicators to any single 25YEP headline indicator. For example, ‘length of hedgerow in active management’ (final indicator No. 31, Table 5) could, even after reference to the associated policy questions, be ascribed to any of three headline indicators:

(6) Changes in wildlife and wild places that we cherish,
(7) Changes in nature on land and water that affect our lives and livelihoods,
(10) Quality of our landscapes and waterscapes.

However, when considering the policy questions for each of these three headline indicators the choice was to associate the final indicator with headline indicator number 7 because:

‘This headline focuses on the wider benefits provided to society by thriving plants and wildlife as a fundamental part of ecosystems that deliver multiple benefits, and endow resilience on natural systems,’

And answers the policy questions:

‘Are plants and wildlife that contribute to important ecosystem functions (e.g. pollination) thriving? Are wildlife habitats increasing in their extent, quality, and connectivity? Are wildlife habitats becoming less vulnerable to climate change impacts? Are the populations of widespread species that characterise our farmland, woodlands, wetlands and coastline increasing?’ (Defra, 2019)

Although this process was time consuming it was an important step to ensure that the indicators were categorised as logically as possible.

One of the difficulties in combining indicators derived from top-down legislation and bottom-up activity was the differences between intended audiences for each set of documents. The 25YEP is intended for both domestic and international audiences, whereas AONB management plans are written primarily for those who reside within or near the AONB boundaries. For example there are two 25YEP Headline Indicators that focus on UK foreign policy aspirations, for which AONB derived indicators might prove inappropriate. It is important to note however that the UK government has yet to suggest any indicators with which to monitor progress against these policy aspirations. Furthermore one 25YEP headline indicator; ‘changes in exposure of people and wildlife to harmful chemicals’ (See Table 2) related to few AONB-derived or FMEOPL indicators since regulation for this set of risks falls under several legal frameworks that are not within the direct management remit of AONB or NP management teams.

In addition to the difficulties in reconciling the intended audiences there was also the complication of variance between the purpose and scope of the 25YEP headline indicators and the AONB management plans. The 25YEP was written to directly address environmental issues, whereas AONB management plans take account of the wider landscape-scale concerns of local communities and stakeholders. Hence 24 of the indicators that are of importance to AONBs do not align directly under the 16 25YEP headline indicators. An additional headline category (No. 17, See Table 5) was hence developed for the final indicator list. This additional headline category predominantly reflects the economic ‘sustainability’ concerns of resident communities, captured through indicators such as ‘percentage of people employed due to tourism’ or ‘percentage of AONB that has access to faster broadband’ (final indicators No. 148 and 149, Table 5). Such a headline indicator aligns well with the European Landscape Convention, which stresses the importance of landscape quality to both people and the environments that they inhabit.

4.2.3. Missed opportunities

The screening exercises employed might have excluded some potentially useful indicators. Therefore these were only bracketed (or hidden in the initial coarse screening Excel file) and retained as indicators that might pass future, wider screening criteria. One such indicator outlined a methodology to track the amount of carbon stored within the landscape; measured in terms of carbon tonnage and economic benefit. Since this indicator was developed in a one-off study by Defra (Defra, 2019a,b), and had not been updated, it was eliminated by the coarse screening criteria. Failure to develop indicators beyond initial research stages is a persistent issue. Despite the publication of excellent candidate indicators and insights, some of the best practices and learnings are not adopted into a coherent monitoring network.

Another potentially valuable indicator concerned dark night skies which are identified as a special quality of several AONBs, and an aspect of the natural beauty criterion (Countryside Agency, 2001). As an indicator the quality or extent of dark skies was present in several of the management plans as a map overlay that gave a good visual representation of change over a number of years (CPRE, 2019). It is possible that these maps may contribute to planning applications. It was eliminated by the coarse screening criteria due to it not being updated since 2016, as CPRE took the decision to no longer repeat the survey.

Some proxy or combinative indicators would be challenging for AONB management teams to replicate at a local level whilst ensuring the degree of comparability and accuracy that would be required to contribute to a cumulative national dataset. A network approach across all 46 AONBs (UK wide) might then provide sufficient data to generate a coherent national picture.

5. Conclusion

Ultimately this paper has highlighted the necessity for a pragmatic approach to landscape monitoring and acknowledges how variances in funding regimes and ambitions of individual management teams has influenced the monitoring strategies followed by organisations entrusted with managing UK landscapes. For reasons explained in the methods the study was limited to AONBs and future research could extend to National Parks and other designated or quasi-legally protected landscapes.

Future research should address an empirical investigation of the reasons for indicator usage or loss, the degree of actual monitoring carried out as distinct from monitoring aspirations, the mesh between local and national organisations with respect to data collection, analysis and dissemination and the on-the-ground utility of datasets to busy landscape managers. Also the impact and extension of the 25 Year Environment Plan and its systematic relationship to FMEOPL would be important to follow. Finally, an investigation in to what proxies would meet the requirements of the 25YEP and how AONBs can help meet these requirements, through innovation and collaborative working.

Such research is timely considering such emerging national and international challenges to environmental management as responses to the climate change emergency, the UK withdrawal from the European Union, threats to long-established environmental legislation in the USA, and potential environmental and governance impacts on a global scale as a consequence of a post-Covid-19 economic downturn.

CRediT authorship contribution statement

Emily Horswill: Conceptualization, Methodology, Formal analysis, Investigation, Data curation, Writing - original draft, Writing - review & editing. John Martin: Writing - review & editing. Supervision. Adam Guy: Writing - review & editing, Data curation.
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