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# Understanding the integration of ecosystem services and natural capital in Scottish policy

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## Abstract

Despite the growing body of evidence highlighting how human activity both depends on and keeps deteriorating natural resources, traditional development models have failed to bring about conservation solutions to this contradiction. The twin concepts of ecosystem services and natural capital (ES/NC) have been coined to bridge this cognitive gap, by providing a framework to make the benefits that human societies derive from ecosystems more visible and intelligible for policy- and decision-making. As part as a global effort, European Union institutions have been promoting these notions over the last decade. The effective take-up of the ES/NC framework is therefore crucial to the success or failure of this attempted cognitive shift in influencing public decision outcomes. This article presents an assessment of the integration of ES/NC in Scottish policy, conceptually and operationally. Forestry is used as an exemplar policy sector to illustrate integration dynamics and limitations, but eight other policy areas were analysed: the environment, split up between its air, soil and water components, a broad category including agriculture, rural development and land use, fisheries and coastal matters, climate change, and bioenergy. The analysis of 224 policy documents, strategies and other policy-relevant documents demonstrates how Scotland has become an 'ES/NC-literate' polity through a proactive stance regarding global and European norms and requirements for nature conservation and the sustainable use of resources. The ultimate outcome of these policies requires further analysis given the substantial implementation challenges.

## Keywords

Environmental policy; policy review; ecosystem services; European Union; Scotland

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## 1. Introduction

Despite growing awareness of humanity's dependence on nature, attempts to halt its anthropogenic degradation and destruction have so far failed to reverse global trends. The apparent inability to solve this contradiction highlights the inadequacy of development models that have allowed the pursuit of ultimately self-damaging activities, notably by overlooking or completely dismissing nature's contribution to human well-being (Schumacher, 1973: 12-13; TEEB, 2009: 4, 7; Gómez-Baggethun *et al.*, 2010: 1211-1212). Fully acknowledging human-ecosystem interdependencies calls for a dilution of the somewhat artificial nature/culture divide (Latour, 2004). From an anthropocentric perspective, such an approach requires cognitive and practical tools capable of correcting the "fundamental asymmetry at the heart of [our] economic systems" between short-term decision-making and long-term stewardship of the natural environment (Guerry *et al.*, 2015: 7348).

The concepts of ecosystem services (ES) and natural capital (NC) bridge the environment/economy gap by phrasing nature's value to society in economic terms to make it more explicit. ES are the benefits people obtain from ecosystems, usually classified along functional lines, using categories of provisioning, regulating, cultural, and supporting services (de Groot *et al.*, 2002: 404; Millennium Assessment, 2003: 53-60). ~~These services are derived from ecosystem dynamics and function through varying levels of human mediation.~~ NC consists in the imperfectly substitutable and limited stocks of living and abiotic resources from which ~~ecosystem services~~ ES flows originate (Schumacher, loc. cit.; Wackernagel & Rees, 1997: 3-4; MA, 2003: 28-29; TEEB, 2010: 33; Kettunen *et al.*, 2014: 8). Since the publication of the Millennium Ecosystem Assessment (MA; MA, 2003), the ES/NC framework has been included into international agreements, such as the Strategic Plan 2011-2020 adopted by UN Convention of Biological Diversity and the so-called "Aichi Targets" it has set out (UNEP/CBD/COP/11/35). International recognition has in turn ~~paved the way for the~~ led to integration of ES/NC ~~at the national level~~ into concrete policies across the different sectors of governmental action (Guerry *et al.*, 2015: 7351-7354; Geijzendorfer *et al.*, 2017).

~~In the wake of the MA,~~ The European Union (EU) assumed a leading role in promoting ES/NC as a conceptual framework with practical implications for policy-making. In 2007, the German Ministry of the Environment and the European Commission jointly initiated further research with a stronger focus on potential applications, leading to The Economics of Ecosystems and Biodiversity (TEEB; TEEB, 2010). TEEB provided the case for a better integration of ecosystem science into economic decision making, and then formulated policy recommendations for the actual implementation of a coherent policy framework capable of addressing ES/NC (Daily *et al.*, 2009). The EU also took a proactive stance on the "Aichi targets". Targets 14 to 16 enshrine "enhance[ing] the benefits to all from biodiversity and ecosystem services" as one of five strategic goals (UNEP/CBD/COP/11/35: 103-104). The EU biodiversity strategy has adopted the 2020 deadline to "[halt] [...] the degradation of ecosystem services [...], and restor[e] them in so far as feasible", leading to an effort to improve

knowledge of ecosystems and their services in the EU through the Mapping and Assessment of Ecosystem Services by Member States (“MAES”, COM(2011) 244: 2.1, 4.1, Action 5 in Annex; Biodiversity Information System for Europe, online).

### ~~Assessing ES/NC integration at the European and Member State level: a Scottish case study~~

The ~~way the EU works, and more especially the~~ subsidiarity principle, implies that European institutions cannot directly implement their statements of intent regarding ES/NC. At the European level, fleshing out an effective ES/NC policy consists in integrating these notions into frameworks for decision-making in policy sectors where the EU has some authority over Member States. As such, the overall coherence of ES/NC integration and the extent to which policy is actually implemented both need to be assessed.

~~But talking about “integration” in the context of European environmental policy the term “integration” first~~ Integration is also often used to describe policy harmonisation between EU Member States (as in Jordan, 2002), and ~~in this study as noted above European institutions are pushing for the integration of the ES/NC concepts; it requires disambiguation because of conflicting takes on the term use in different strands of research related to the question. Here, the term refers specifically to the effective take-up of the ES/NC framework promoted by TEEB as the main “software” to address environmental concerns issues and formulate solutions in a given policy area (cf Fisher et al., 2008). This is (Fisher et al., 2008) similar to~~ Coined “integration” by the scholars and stakeholders of ES/NC, it corresponds to what the students of public policy would rather describe as “policy transfer” of a ~~in this case the transfer of a cognitive framework and associated long with the ideas and norms associated with it~~ (Stone, 1999; Dolowitz, & Marsh, 2000: 5). ~~Al~~ Even though the ultimate goal of thinking in terms of ES/NC is to have environmental considerations informing decision-making in all policy sectors, it is only one potential and partial route towards what some authors have dubbed environmental policy integration (EPI; Lafferty & Hovden, 2003). ~~Integration is also often used to describe policy harmonisation between EU Member States (as in Jordan, 2002), and as noted above European institutions are pushing for the integration of the ES/NC concepts. Yet it is indeed the adoption of these notions that was used as an entry point, evidence of endogenous dynamics having been looked for as well. In other words, the question of EPI is much broader than such an objective, which is to approach focusing on the ES/NC framework alone while EC/NC take-up may not exclusively be a matter of European policy integration.~~

A previous review evaluating the extent to which EU policy framework demonstrates ~~and articulates~~ a comprehensive and effective understanding of ES/NC concepts has revealed important discrepancies between different policy areas, including several opportunities for improved integration and policy coherence (Kettunen *et al.*, 2014). Furthermore, the translation of these EU policy directions into national and regional policies has been identified as a research gap requiring further investigation at different implementation scales. (*ibid.*: 11-12, 45).

This paper ~~evaluates~~ seeks to address this research gap, by ~~evaluating~~ ES/NC policy integration in Scotland, ~~and comparing results with those obtained at the EU level, potentially pointing at “inappropriate” transfers (Stone, 1999: 54). Since e~~ Environmental policy ~~is-being~~ a devolved ~~administration in the United Kingdom (UK) with its own competency for environmental policy. As an environmentally diverse country, it faces many of~~ matter, the ~~challenges encountered across Europe within one relatively small country. The analysis will illustrate~~ reveal ‘local’ specificities in the way ES/NC are understood and ~~implemented, and a comparison with the EU assessment will reveal~~ articulated, and the extent to which Scottish policy has been influenced by European requirements and opportunities. The latter is especially interesting now that the UK has decided to leave the EU. The specific research questions addressed in this paper are therefore:

- (1) How explicit and comprehensive ~~is~~ are Scottish policy ~~documents in considering, sustaining their use of the ES/NC framework, to formulate issues, needs and improving the benefits that humans derive from ecosystems~~ potential solutions?
- (2) How does Scottish policy echo corresponding European texts?

The analysis encompassed eight policy sectors ~~that are particularly relevant for Scotland for which the EU has clearly started promoting policies based on the~~ ~~TEEBES/NC framework~~: the environment, split up between its air, soil and water components, a broad category including agriculture, rural development and land use, forestry, fisheries and coastal matters, climate change, and finally bioenergy. ~~Unsurprisingly, these policies areas relate to either conservation or economic activities whose deriving products derive directly from ecosystem functions. By looking at them separately, the present analysis seeks to offer a “process-based account”, in which the distinctive histories, routines and actors of individual governmental departments are expected to result in different paces and patterns of integration (Jordan, 2002: 51-61; Stone, 2004: 550-552). Policy transfer can indeed take different guises as notions travel from one context to another and hybridise with “native” conceptions (Dolowitz & Marsh, 1996: 351). Following a description of the analytical framework we present This article describes the methodology used, before presenting the overall results of the study and detailed findings for the forestry sector. - as an illustration F—findings for the seven other sectors can be access are provided d as supplementary material Supplementary Material, but used to answer the research questions and. - These are then discussed to draw conclusions about the uptake of the EU-promoted ES/NC framework by Scottish authorities, and the relevance of the evaluation methods used.~~

## 2. Methods

**2. Analytical framework** ~~The~~ is evaluation of ES/NC integration in Scottish policy is based on a deductive qualitative content analysis of ~~212 policy documents, using specific criteria to identify four categories of policy integration. Purposively~~ A ~~purposively~~-selected sample of texts has been analysed using pre-established categories to make sense of its content with regards to the research question (Elo & Kyngäs, 2008: 109-112; ~~Bryman, 2012). The texts for each~~

policy sector are listed in the Supplementary Material. Implementing this type of research design relies on the completion of two successive steps, the “preparation phase” comprising document sampling, and the “organising phase” of content analysis using a categorisation matrix (Elo & Kyngäs, 2008: loc. cit.). Yet for each of these phases the specificities of Scottish policy documents somewhat resisted a deductive approach, calling for inductive correction mechanisms detailed in the following subsections. ~~For the sake of comparison, the documents sampled consisted in those spelling out Scottish policy for the eight “policy areas” listed above, identified as such by EU institutions (see Appendix A and Supplementary Material for a complete list of the texts reviewed). The categorisation matrix then used to assess the documents is detailed below, as well as how it got adapted inductively during analysis to accurately account for context specificities.~~

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## 2.0. Document sampling: putting together coherent, significant and comparable corpora

Assembling the texts to be reviewed constitutes the first step of content analysis requiring methodological attention, since the selected documents (i.e. the corpus) must be representative of all the ‘entire population’ of policy documents to produce robust results. At this stage, European assessments can use “EU policy documents and information available on official EU web pages” as sources, and then select the kind of documents to be reviewed based on their assumed significance and impact on decision-making (Kettunen *et al.*, 2014: 9). The key underlying assumption here is that all the publications of the specified types have been reviewed, annulling all risk of unrepresentativeness since the sample encapsulates the entire ‘population’, while benefitting from the relative online centralisation of official European publications.

Gathering equivalent Scottish data the same way is more challenging due to the scattering of policy sources across the websites of the various public bodies involved. In addition to this, the detail of what constitute a “policy area” and their articulation varies between Scotland and the EU, jeopardising the comparative aim of the study. The Scottish Government’s website ‘topics’ page has been used to identify Scottish policy themes that roughly correspond to the European “policy sectors” where ES/NC integration has been advanced, processing to de- and re-assembling when required (gov.scot/Topics). From there links towards the webpages of Non-Departmental Public Bodies in charge of particular policies can be accessed, providing early insights on the organisational distribution of policy functions alongside information on its sectorial divisions.

— ~~This systematic Criteria for assessing ES/NC uptake: the matrix~~

~~Drawing from the approach to identifying the relevant policy documents does not address the question of which publications to include in the review. This dimension of sampling turned out to be difficult to address ex ante, and inductive solutions this~~

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problem had to be found. Accessing policy documents through a multiplicity of interconnected websites creates obstacles to the collection of all the relevant texts, such as the obsolescence of redirection links caused by desynchronised updating known as “link rot”. Criterion sampling based on website arborescence has therefore been complemented with inductive methods referred to in the literature as emergent sampling, which consists in using inter-document references to identify relevant publications not yet included in the corpus (Patton, 2002: 237-240). Cross references and supporting notes also point at the key policies and how further publications build on them, which made it possible to select only those documents that proved significant for their respective sectors. The Water Environment (Shellfish Water Protected Areas: Environmental Objectives etc.) (Scotland) Regulations 2013 have for instance not been included in the review of water environment policy because they consist in mere technical provisions to implement a “higher tier” policy document, namely the Water Environment and Water Services (Scotland) Act 2003. Following

## 2.0. Content analysis: adapting pre-constructed categories

The second “phase” of qualitative content analysis consists in the characterisation of text content in relation to research objectives. To do so the main research question has Kettunen et al., at the EU level, effective integration of the TEEB framework to support policy and decision making has first distinction is made between been broken down into several two dimensions to form a categorisation matrix, following the approach applied by Kettunen et al. at the EU level. Two “levels” of ES/NC integration have been identified: “conceptual integration” and “operational integration”. The former Conceptual integration exists when the ES/NC framework is used refers to the focuses on the use of concepts to compute the situation of a specific sector, in order to identify and address environmental challenges and opportunities in a. This refers in practice to the correct understanding and correct use deployment of the concepts ES/NC framework within the reviewed policy documents and, consequently, within a given policy sector/area. Operational integration exists when dedicated policy instruments are in place to protect or restore. The latter identifies any concrete policy instruments addressing ES/NC within the policy sector, using this as an indicator for the policy sector’s concrete ability has to do with building on concepts to formulate ad-hoc policy solutions, by proposing ways to preserve and/or harness ES/NC. flagged out as sector relevant. Delving into this second dimension implies to look out for dedicated policy instruments. Note that analysing the significance or effectiveness and potential impact of the policy type of instruments proposed is not considered falls out with the scope of the present study. As an analytical concept, operational integration accounts for the articulation of policy instruments towards the specific goal of addressing issues made visible by conceptual integration. In other words, the integration of the ES/NC framework has been assessed distinguishing the use of its notions to establish diagnoses on the one hand, and prognoses on the other.

These two aspects of ES/NC integration have then been assessed in terms of explicitness and comprehensiveness, in a continuum ranging from to ‘explicit and comprehensive and explicit’ to ‘no specific integration’ (see Table 1). The construction of categories before delving into the documents to review designates this methodological approach as an instance of analytic induction, which contrary to what the name suggests



is more deductive than other qualitative analysis strategies (Patton, 2002: 252–254). Documents can display explicit reference to the notions promoted in TEEB, yet in cases they overlook natural resources and dynamics known as relevant. As a criterion, comprehensiveness points at the extent to which a policy area has drawn on available ES/NC research when it explicitly does so. Documents can display explicit reference to the ES/NC framework, yet overlook relevant natural resources and ecosystem. Implicitness indicates the somewhat lesser a lower level of integration, where the environmental protection is reservation not being presented without considering as supporting human wellbeing. In some policy sectors, texts might resort to precursor concepts such as “nature valuation”, yet without necessarily allowing for the holistic vision linking natural capital/NC and ecosystem functions to the full range of human benefits they underpin.

Table 1: Categorisation of the level of policy integration in the IEEP report and the present assessment, adapted from Kettunen *et al.*, 2014: 11-12.

Level of integration	Level of integration	Conceptual integration	Operational integration
Conceptual integration	Conceptual integration	Conceptual integration	Operational integration
Comprehensive and explicit	Explicit recognition of all ecosystem services ES, including the recognition of ecosystem services ES and natural capital NC as underpinning elements of human wellbeing	Explicit mention of “ecosystem services ES”, “natural capital NC”, “green infrastructure”, and all the specific ES relevant to the policy sector. Explicit mention of “ecosystem services”, “natural capital” or “green infrastructure”, as well as a complete list of ES (or at least all those relevant to the policy sector in question).	Dedicated instruments comprehensively address ES/NC within the policy area. Dedicated instruments exist for addressing ecosystem services and natural capital in a comprehensive manner within a policy area.
Explicit but not comprehensive	Some explicit integration (e.g. some specific ecosystem services ES), including some recognition of ecosystem services ES and natural capital NC as underpinning elements of human wellbeing.	Some but not all of the terms are present.	Some instruments exist that proactively address / build on the understanding of ecosystem services ES and natural capital within the policy area.
Implicit and incomprehensive	Implicit and indirect integration, generally focus on preventing negative impacts of a policy sector on ecosystem services ES and natural capital NC	“Ecosystem services ES”, “natural capital NC” or “green infrastructure” not explicitly mentioned, but precursor or related concepts are present: “ecosystem approach”, “ecosystem benefits”, “multi benefits”, “multifunctionality”, “ecosystem/nature valuation”, “enhancement/improvement of nature” or other reference to nature’s contributions to human welfare. Precursor or related concepts are present: “ecosystem approach”, “ecosystem benefits”, “multi benefits”, “multifunctionality”, “ecosystem/nature valuation”, “enhancement/improvement of nature”, or any reference to nature’s	No dedicated instruments exist for directly addressing ecosystem services ES and natural capital NC. Some aspects – mainly focusing on avoiding negative impacts on (some) ecosystem services ES - integrated into sectoral instruments.

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No specific integration	No recognition (direct / indirect) of <u>ecosystem services</u> <sup>ES</sup> and <u>natural capital</u> <sup>NC</sup>	Contributions to human welfare that does not use ES/NC vocabulary. No recognition (direct / indirect) of <u>ecosystem services</u> <sup>ES</sup> and <u>natural capital</u> <sup>NC</sup>	No instruments exist that would in any way address <u>ecosystem services</u> <sup>ES</sup> and <u>natural capital</u> <sup>NC</sup> .
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Implementing such a matrix necessitates browsing policy

### Document interpretation

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Sampled documents to search for words or phrases that can be labelled were have been reviewed using the themes categorisation matrix described in Table 1. Explicit conceptual references—For each policy sector, a brief review of the existing ES/NC research literature was conducted to evaluate comprehensiveness – if possible using articles and reports referring to Scotland. (e.g. Aspinall et al., 2011)E—and explicitness was assessed based primarily on lexicon. However, a context-sensitive, inductive approach was This last point deserves further attention, as ES/NC concepts are obvious to identify explicitly mentioned, but what constitutes interpretation is required when looking for implicit references and operational integration needs to be specified to guarantee the falsifiability and therefore,

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Here, the solidity of the analysis. The “Conceptual context in which some expressions are used and some measures proposed becomes essential to assert whether or not it relates to some sort of ES/NC integration as operationalised for the Scottish policy assessment” column in Table 1 describes how content has been ascribed to each category.

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At this stage, the importance of context to assess if the use of some terms implicitly related to ES/NC reveals a form of integration must be stressed. “Nature enhancement” is, for instance, sometimes used to describe rather ‘passive’ conservation measures, whereas in other cases this term is used to describe the deliberate channelling and maximisation of targeted ES. Therefore, an occurrence mere occurrences of this phrase alone has have been deemed insufficient to determine the level of operational integrations it embodies, and subsequent in-text developments on this notion have been looked out for to assert which version of the concept the policy document reviewed articulates.

Inductive iteration has also been followed to some extent during the “organising phase”. The need to interpret documents supports the resort to “hand coding” over lexicometry or other computer assisted methods. Such a context sensitive, inductive approach also proved valuable to account Ffor some particularities of the corpus a. To acknowledge the specificity of the way Scottish authorities formulate policy, the categorisation matrix has been implemented somewhat flexibly. In the policy document reviewed, the sections associated with ES/NC, related concept or even the environment in general have been browsed in search of addition to terms not identified by during the literature review. Repeated, occurrences of an alternative vocabulary of more or less loosely connected terminology to ES/NC was developed within and even across policy

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sectors indicate qualitative saturation, validating the existence of a Scottish framing of the issue and lexicon that then fed back into the has been built on to adapt the categorisation matrix. This worked as a correction for assessing documents against categories initially constructed from outside sources.

### 3. Results

The method described in the above section has been applied to eight policy areas, which are outlined in Figure 1. The names of the documents forming the corpus and detailed content analysis can be found in the Appendices A to I. This section presents summarised results for all the analysed Scottish policies, as well as in-depth findings for forestry, because it provides a snapshot of several dynamics at play across all the thematic areas. Details findings for the other policy areas, structured in the same fashion as the forestry example, are also included in Appendices B to H. The detailed review of the eight policy sectors is included as Supplementary Material 2. Here a summary overview is provided, followed by a summary of The following section first presents the specific findings for the Scottish forestry policy sector. This sector was chosen to illustrate the sectoral policy analyses because it provides a snapshot of several dynamics at play across the different policy areas reviewed sectors. A summary overview of all eight policy sectors is then provided (which are detailed reviews comparable to the forestry analysis are included as Supplementary Material Supplementary Material). Subsequently, a summary overview of all eight policy sectors is then provided along with comparison with the European analysis by Kettunen *et al.*, 2014).

#### 3.1. A sectoral close-up: forestry

##### 3.1.1. Forest-related ES/NC in Scotland: opportunities and threats

Scottish woodlands contribute to human wellbeing through numerous ES, yet the ability of existing indicators to capture their value varies greatly from one to another (for an overview see Ninan & Inoue, 2013: 138). Provisioning services such as timber production or water supply are relatively easy to quantify and well documented (Aspinall *et al.*, 2011: 897, 947-948). Yet Scottish forests also procure spiritual and recreational as well as regulating services (e.g. including climate regulation through carbon sequestration), which are difficult to quantify (Ninan & Inoue, 2013: 147). Further difficulties arise from an incomplete understanding of underpinning ecological relationships. Due to uncertainties regarding the interactions between water and nutrient cycling, soil formation, biodiversity and primary productivity, we lack sufficient data about relevant ES-supporting mechanisms.

Such an uneven understanding of forest ecosystems has led stakeholders to prioritise increasing forest cover. ES directly linked to the extent of woodlands like carbon sequestration have benefitted from this expansion, while subtler structural changes such as the fragmentation of native forests have had an adverse impact on others such as soil formation and biodiversity (Aspinall *et al.*, 2011: 917-919). Undifferentiated forest expansion in the name of carbon capture is indeed based on total benefits rather

[than a marginal analysis, and therefore potential opportunity costs can arise as plantations simply cannot provide as many ES as biodiverse native woodlands \(Thomas \*et al.\*, 2015: 151\).](#)

[The successful integration of ES/NC into forest policy implies the recognition of potential trade-offs between the different benefits society derives from woodlands, and, when applicable, the promotion of sustainable forestry practices to maximise ES provision. To implement a truly integrated forestry model, management approaches must articulate a comprehensive vision of woodland ES to support decision-making \(Sing \*et al.\*, 2018\). Challenges to the achievement of this goal include the non-commensurability of market and non-market values and the accounting of disservices like fire hazard or invasive alien species \(Patterson & Coelho, 2009\).](#)

### [3.1.2. Assessing forest policy: governance levels and ES/NC integration](#)

[Despite the recognition of woodland ES in official publications, limitations in the EU's formal competencies for forestry and hence scope of action have prevented the development of a dedicated European forest policy based on binding legislative acts \(Kettunen \*et al.\*, 2014: 17, 28\). Two Strategies have been issued by the Commission \(COM\(1998\) 649; Council Resolution 1999/C 56/01\) and 2013 \(COM\(2013\) 659\), "set\[ting\] a framework for co-operation on forestry issues among member states", but ultimately Treaties do not confer prerogatives on the matter upon the Community bodies \(SE, 2006: 69\). Scottish policy recognises the principles of "sustainable forest management and the multifunctional role of forests" promoted in these action plans with the active support of the Forestry Commission \(FC\), yet it is ostensibly designed to comply with other relevant European rules \(such as agriculture and land use, environmental protection, or habitats and biodiversity; \*ibid.\*\). It is the responsibility of member states to articulate these different policies and their own into coherent national frameworks adopting an integrated approach to the multiple services supplied by woodlands.](#)

[Thirty-seven policy documents directly related to forestry have been reviewed \(listed in the Supplementary Material\), complemented by several rural development frameworks such as the recently reviewed Land Use Strategy for Scotland. Those mostly originate from Forestry Commission Scotland \(FCS\), which acts as the Scottish Government's directorate on forest-related issues while remaining part of the Britain-wide Non-Departmental Public Body, the FC. Conceptual integration proves explicit and comprehensive in the most recent documents. ES/NC are not mentioned in the main document of reference, the 2006 Forest Strategy, which is imputable to its publication date. There seems to be a "turning point" in policy around 2009, with a gradual generalisation of the framework in the documents. In terms of comprehensiveness, 'sub-sectoral' documents \(e.g. The right tree in the right place, or Deer Management on the National Forest Estate\) only provide a partial account related to their scope. The latest implementation strategies with a general purpose are both explicit and comprehensive \(WEAG reports, The role of Scotland's National Forest Estate and strategic directions for 2013-2016\). "Refreshing" the Forest Strategy is one of the main policies outlined in the](#)

[2016 Land Use Strategy \(SG, 2016: 20\)](#), a framework heavily relying on the ES/NC notions, so completely comprehensive integration is expected in the coming years.

[In terms of operational integration](#), a series of overall strategies and implementation plans articulates measures for the management of multiple ecosystem benefits. FCS manages the government-owned national forest estate (NFE) through its corporate branch, Forest Enterprise Scotland (FES). The extent of the NFE, which covers [32.7% of Scottish woodlands \(Wightman, 2012: 5\)](#), makes forestry quite distinct from other land-based industries affecting ES/NC provision in the sense that public authorities can have a significant impact on the sector through direct action on the woodlands they own. FCS-issued frameworks serve as the basis for thematic sub-sectoral plans articulating directions for the NFE with incentives towards private woodland owners and communities. Policy texts offer a proactive operationalisation of the ES/NC framework, [emphasising not only on reducing damage to benefit-providing ecosystems, but indeed using their functions to maximise outputs](#). This reformed vision arguably built on the pre-existent, explicit understanding of forestry as the management of natural systems for the provision of goods and services. Yet gaps in the available data limit action with regards to some ES (see for instance the abandon of indicators for flood resilience in 2015). Forestry stands out as a policy sector in which ES/NC integration is relatively advanced, yet the full implementation of the explicit and comprehensive policy objectives it sets face significant practical limitations.

### 3.1.3.2. ES/NC integration in Scottish policy: ~~summary results~~ for all reviewed sectors

	Environment: Air	Environment: Soil	Environment: Water	Agriculture & Rural Dvpt	Forest	Marine/coastal environment, fisheries	Climate	Bioenergy
Conceptual integration	+	=	-	=	=	=	=	-
Operational integration	+	+	=	+	+	+	+	+

**Overall level of ES/NC integration**

- Explicit and comprehensive
- Explicit but incomprehensive
- Implicit and incomprehensive
- Policy sector in transition
- Policy area with subsectors displaying uneven levels of ES/NC integration

**Comparison with EU policy**

- +** Integration in Scottish policy superior to what has been observed for the EU
- =** Integration in Scottish policy roughly equivalent to what has been observed for the EU
- Integration in Scottish policy inferior to what has been observed for the EU

Figure 1. Summary Summarised overall assessment of the conceptual and operational integration of the ES/NC framework into Scottish policy text, and an indicative comparison to EU policy.

~~Figure 1 illustrates outlines. The overall, summarised performance of Scotland of~~ these eight policy areas is summarised in Figure 1, against both using the dimension and criteria derived from the research questions and presented above listed in Table 1. Several sectors appear to be in a transitional state, as ‘upper tier’ policies are still in the process of being translated into concrete norms, projects and practices depending on policy cycles and agendas in each area. The pace at which the Scottish water environment policy integrates ES/NC for instance depends on how the River Basin Management Plans review and implementation processes are timed. In the case of soil policy, significant changes are ongoing due to the relatively recent rise of soil ecological quality as a public issue. In other cases, the subdivisions of a policy sector can display significantly dissimilar level of ES/NC framework uptake. Climate change prevention appears for instance more advanced than mitigation when it comes to take advantage of ecosystem function, as policy puts a particular emphasis on carbon capture. Such examples call for continued monitoring of these policy sectors.

Both ‘translation’ delays and intra-sector imbalances reveal that despite the voluntarism of Scottish policymakers, European authorities play a leading role in promoting ES/NC thinking. The temporality of policy cycles is partly influenced by the time needed to rephrase and adapt EU guidance or requirements once issued for their implementation in Scotland. Similarly, the disparities between specific items within policy sectors mentioned above tend to mirror those found in European texts.

~~The full analysis across the eight policy sectors (see Supplementary Material) reveal parallels between sectors. By analysing the documents associated with the eight policy areas assessed in the same manner as forestry, parallels between sectors became apparent.~~ The following discussion draws on pieces of evidence gathered during the entire review summarising and summarized in Table 2, putting it in perspective to highlight the general dynamics and trends of ES/NC integration in Scottish policy.

#### 17.1.4.1. Scottish policy and European requirements: striving to become an exemplar

The assessment of conceptual integration designates Scotland as an overall ‘ES/NC-literate’ polity ~~(see Table 2)~~, with discrepancies between policy sectors often reflecting differences in integration at the European level. ~~Traces of transfer mechanisms seem to indicate that~~ The numerous references present in Scottish documents demonstrates how much the EU has had a leading role in promoting this terminology and the cognitive framework it relates to, raising questions about the future of British environmental policy in the wake of ‘Brexit’. However, several European policies that

try to operationalise the ES/NC agenda have limited influence due to Member States' freedom in setting their own objectives among several possible priorities, given subsidiarity.

~~The review of Scottish policy indicates a particularly proactive stance regarding~~ Regarding this kind of non-compulsory ES/NC-oriented provisions of European policies, Scotland has proven particularly proactive. The Scottish Rural Development Programme explicitly takes up the fourth European Agricultural Fund for Rural Development (EAFRD) priority of “restoring, preserving and enhancing ecosystems” and provides for the allocation of some Pillar 2 funding to promote sustainable forestry (Regulation (EU) No 1305/2013, Article 5; SG, 2015[2014]: 84, 248-250). Documents also testify the role of Scottish authorities in pushing UK-wide policies to go beyond minimal requirements within the framework provided by European sectoral policies (see for instance the request to refine Land Use, Land-Use Change and Forestry (LULUCF) sector emission scenarios, Thomson & Hallsworth, 2012: 2). These orientations are revealing of a policy-politics interface, as the behaviour of the Scottish Government reflects its claimed commitment to position Scotland as a pro-EU, environmentally-friendly exemplar (SG, 2014, 2015a). ~~The uncertain post-Brexit position regarding European norms of both the UK as a whole and Scotland in particular are likely to emphasise even further the influence of Britain's European politics on environmental policy. Indeed, while the British government is likely to try and differentiate its political priorities from “Brussels”, Scottish authorities might be tempted by over-performing along the lines of European policy as a sign of good-will.~~

This stance is also reflected in overarching Scottish policies echoing directly the transversal frameworks adopted by the European authorities. The EU biodiversity strategy to 2020 has led to the publication of the 2020 Challenge for Scotland's Biodiversity in 2013 and the Route Map to 2020 in 2015. These texts update Scottish objectives in accordance with the Aichi Targets, articulate the overall vision for biodiversity with recent policy and scientific developments, and further inter-departmental coordination through the creation of new working groups. Environmental assessments constitute another type of horizontal tool potentially contributing to the integration of ES/NC into Scottish policy, since they are designed to prevent development projects to have negative impacts on the environment. The Environmental Assessment (Scotland) Act 2005 transposed the European Directive 2001/42/EC making provision for Strategic Environmental Assessments. Here Scottish authorities once more go beyond mere compliance, opening the door to an approach in line with the ES/NC framework by demanding the assessment of projects with regards to:

“biodiversity; population; human health; fauna; flora; soil; water; air; climatic factors; material assets; cultural heritage, including architectural and archaeological heritage; landscape; and **the inter-relationship between [these] issues**” (Schedule 3, section 6, emphasis added)

However, according to some stakeholders, the EASA 2005 has ~~so far~~ not lived up to its potential ~~according to stakeholders~~, being also reduced to a “prevention and control” role (Bailey, 2010: 30-31; Scottish Environment LINK, 2011: 22).

Nevertheless, the operational integration of ES/NC is often significantly more limited than conceptual uptake despite the voluntarism of Scottish authorities. Gaps in available and accessible data and more generally in the evidence base for the design of appropriate instrument is a recurring theme in policy, including the latest Land Use Strategy (SG, 2016: 20-22). The emphasis put upon further research funding in many strategies and action plans sounds like an admission of the limits faced by environmental scientists when they try to provide decision-makers with evidence-based recommendations, as well as an indicator of the actual costs associating with the development of such 'governance knowledge'. ~~Stretched public funding, and the possible loss of EU research funding post-Brexit beg the question how much further this effort will be carried out.~~

#### 17.2.4.2.      A distinctive policy approach to ES/NC: terminology, policy articulation and political preferences

Recurring phrases categorised as implicit references to ES/NC during the content analysis reveal the existence of a British/Scottish terminology adding ~~up~~ to the vocabulary developed in international academic and policy. Part of these lexical differences can be explained by an 'incomplete' integration of the 'standard' ES/NC framework and ~~by~~ path dependency, with the persistence of equivalent phrases that predate the development of those related to ~~ecosystem services~~ ES such as "ecosystem benefits", "natural assets" or "natural beauty and amenity". Despite the beneficial role of precursor notions that helped to introduce the ES/NC framework, the publication of clarification notices such as the briefing authored by Waylen & Blackstock (2015) also points towards a risk of confusion among practitioners caused by the transition to a new terminology.

~~But~~ beyond lexical adjustments, framing specificities can denote a distinct policy style implying preferences for a certain way of understanding the concepts and the implementation methods associated with it. Policy through which ES/NC have been operationally integrated in Scotland revolves around strategic planning with particular attention given on consultation, public participation ~~The policy instruments through which ES/NC have been operationally integrated in Scotland form a rather coherent ensemble revolving around strategic planning with particular attention given on consultation, public participation~~ and shared benefits. Access policy, funding incentives, decision-support indicators, targeted research and best-practice promotion all correspond to a political will to use the ecosystem approach "as a mechanism for developing partnerships and collaborations to foster sound environmental management at local, regional and national scales" (Aspinall *et al.*, 2011: 955). This reflects the general tendencies of Scottish governance methods (Keating, 2010: 24, 203). Conversely, Scottish authorities prove reluctant to resort to the monetary valuation of ES paired with market-based instruments compared to the governments of other Member States or



European regions (see for instance Bauler & Pipart, *in Jacobs et al.*, 2013: 124-125) as well as the rest of the UK<sup>b</sup>.

These preferences also transpire from the way Scottish policy relating to ES/NC has been articulated and hierarchised because of the potential trade-offs existing between ES. [Scottish stakeholders and policymakers are using policy documents and position statements to present their respective visions what the overall architecture should look like \(see for instance Scottish Environment LINK, 2009: 7\). The climate change and land use strategies currently stand out as higher tier policies setting the objectives the other “productive” and resource management sectors must jointly contribute to \(SG, 2016; SG, 2009a: 21\). This precedence originates from the large-scale, overarching goals that these frameworks pursue, namely the reduction of net national GHG emissions and an overall balance in land use patterns. On the other hand, biodiversity and environmental standards seem to influence other policy areas in a more “horizontal”, diffuse and somewhat passive way by homogenising practices to limit detrimental effects on ecosystems. Note that water policy, the environmental subsector that promotes the most proactive approach to ES/NC management, combines protective regulations and land use planning through River Basin Management Plans. Implementation tools and challenges are most likely to be observed as developments of the most ‘hands-on’ policy sectors and subsectors: river basin management, forestry, agriculture and rural development and bioenergy. Scottish stakeholders and policymakers are indeed using policy documents and position statements to present their respective visions what the overall architecture should look like \(see for instance Scottish Environment LINK, 2009: 7\).](#)

~~Figure 2 represents the articulation of the different ES/NC related policies according to the documents reviewed, and more especially cross-references (see Appendices A to I, especially E and G). The climate change and land use strategies stand out as higher tier policies setting the objectives the other “productive” and resource management sectors must jointly contribute to (SG, 2016; SG, 2009a: 21). This precedence originates from the large-scale, overarching goals that these frameworks pursue, namely the reduction of net national GHG emissions and an overall balance in land use patterns. On the other hand, biodiversity and environmental standards seem to influence other policy areas in a more “horizontal”, diffuse and somewhat passive way by homogenising practices to limit detrimental effects on ecosystems. Note that water policy, the environmental subsector that promotes the most proactive approach to ES/NC management, combines protective regulations and land use planning through River Basin Management Plans. Implementation tools and challenges are most likely to be observed as developments of the most ‘hands-on’ policy sectors and subsectors: river basin management, forestry, agriculture and rural development and bioenergy.~~

<sup>b</sup> As stated by a participant to the ESCom conference, Scottish agencies are “less obsessed by monetary valuation” than their homologues from other British public bodies.

Figure 2: General architecture of the policy reviewed

In addition to path dependency effects in the phrasing of a “national” terminology, the sequential analysis of the data highlights intra- and inter-organisational transfer dynamics. The progressive integration of the ES/NC concept and terminology is salient in the case of organisations that have published a significant volume of documents on related policy topics, making possible the establishment of an internal diffusion chronology. The numerous strategies and reports issued by FCS provide a telling example of such step-by-step assimilation. 2009-2010 stands out as the pivotal period for this organisation. Prior to this date, publications resort to ‘in-house’ vocabulary somewhat equivalent to the ES/NC lexical framework (see for instance the documents supporting the Woods in and Around Towns programme, which use phrases such as “forestry resource” or “woodland benefits” until 2008; FCS, 2008a: 7, 11), while most of the documents released since 2010 contain explicit and comprehensive references to ES. This inflection in the wording of FCS policy also illustrates the role of inter-organisational ‘mimicry’, as the transition towards ES/NC seems to have been initiated by a 2009 statement from the SG, The Scottish Government’s rationale for woodland expansion.

The combination of concept diffusion between and within organisations, with their own pre-existing ‘cultures’, also contributes to the development of sectoral variations on the general framework. Forestry publications have for instance given birth to an extensive jargon that reflects stakes specific to this policy area and its actors, with phrases such as “productive woodlands”, “sustainable forest management” or “forest restructuring”.

#### 17.5.4.4. Implementation challenges: delivery through and beyond instruments

The formulation of concrete policy measures to tackle the issue of ES/NC management in policy documents does not guarantee their full implementation ‘on the ground’, not to mention the delivery of the desired outcomes. The extent to which the adoption of dedicated policy instruments translates into decisions and actions corresponding to policy objectives requires observing the actors in charge of enacting the texts in practice.

The development of an integrated policy response in a context of functional and spatial governance divisions points at a consequent obstacle to delivery. ES/NC issues have implications across Scottish policy areas and at different scales, calling for coordination between multiple schemes, decision processes and competent authorities. The integration and hierarchisation of the different topical frameworks mentioned in subsection 4.2 partly addresses this challenge, but non-concordance between management scales and agencies remain because of the specificities and historical construction of each policy sector. Comparing how the different territorial divisions mentioned in the policies reviewed overlap vividly illustrates persistent coordination

difficulties (SG, OnlineA; SNH, non-dated: 19). The streamlining policy and coordination initiatives launched by the Scottish Government are part of a general effort towards integrated delivery. Yet this solution has shown its limits, the cross-departmental Scottish Environment and Rural Services being replaced in 2011 by the less inclusive Scottish Government Environment and Forestry Directorate (Pack, 2013: 3-7).

Regional Land Use Strategy (LUS) pilots in Aberdeenshire and the Borders as part of the review of the Scottish LUS have led to the publication of reports on these local attempts to apply an ecosystem approach to planning ([Scottish Borders Council, 2014](#); [Davidson, Birnie, Irvine, et al., 2015](#)). Secondary sources like these cannot replace first-hand field investigations, but they can nevertheless provide preliminary answers as to how policies are actually implemented and offer insights about the way in which different policies and guidelines interact to shape outcomes. When asked to adopt an ecosystem approach to produce regional strategies, the two local authorities followed the 2011 Information Note on the topic, which identifies SEA as “a pragmatic means” to “make a greater use of an ecosystems approach without adding complexity to existing plan and policy making processes” (SG, 2011: 7; Scottish Borders Council, 2014: 8; Aberdeenshire Council, 2015a: 25). In doing so, the two councils were forced to use SEAs to its full strategic potential, which public bodies are usually reluctant to achieve as the process “appears to be treated often as a barrier to policy making rather than an aid” (Scottish Environment Link, 2011: 22). As a matter of fact, both faced difficulties in effectively integrating an ecosystem approach to SEAs, expressing doubts about the usefulness of this way of using SEA as an instrument and stressing the cost of developing new procedures (SBC, 2014: 8, 49; Aberdeenshire Council, 2015a: 25-26). The Scottish Borders Council even concluded that due to the costs of the operation and the lack of obligation mechanisms the enactment and monitoring of their pilot is unlikely (SBC, 2014: 47, 23). The lesson to be drawn here in terms of instrument design is that the policy mix for concretely implementing ES/NC concepts requires reflecting subsidiarity between the different actors involved, both in terms of decision structures proposed to local authorities via incentives and/or constraint, and of consequent capacity transfer and building to ensure that they are equipped to formulate end flesh out these informed decisions.

## 18.5. Conclusion

The ES/NC concepts have been promoted as a framework to integrate the contributions nature makes to human wellbeing into decision-making, complementing the intrinsic value driven rationale for environmental protection with a more anthropocentric and utilitarian approach to justify and enhance environmental protection, nature -The final objective of this has been to improve the overall level of, and willingness for, conservation and restoration. Effective uptake and implementation by policymakers at the national scale is essential for the success or failure of these concepts that are now commonly endorsed by international organisations to influence our models of development. Through its sectoral policies, the EU is actively pushing its Member States to translate notions of ES/NC into policy measures and guidelines at the national

level. However, the responsibility for implementing these concepts in concrete terms remains, to a large extent, at national level.

This study assessed the integration of the ES/NC ~~cognitive and operational~~ framework into Scottish policy by reviewing several sectors known for their relation to ecosystems and biodiversity. The content of the 212 texts reviewed reveals good levels of conceptual integration of the concepts but persistent difficulties in turning the patchy knowledge of ecosystem functioning into proactive policy intervention and concrete measures. The recurrent emphasis on the need for further research highlights the cost of developing reliable “information” policy instruments such as databases or monitoring frameworks (~~Kettunen & ten Brink, 2015~~). ~~A brief foray into policy implementation also highlighted potential difficulties in delivering the existing concrete measures building on ES/NC science.~~ Further work on the practical administration of these plans and programmes is therefore required to ~~draw~~ fully assess these policies. The observed incentivising – or constraining in the case of formal obligations – role of European schemes and regulations due to various transfer rationales and dynamics also ask for continued scrutiny now that the UK is ~~on its way out of~~ leaving the EU. In the wake of Brexit, ~~it remains uncertain the question of~~ how British environmental policy will fare without such “European nudging” ~~remains open~~.

On a methodological note, the assessment methods used here to identify policy strengths, needs and opportunities with regards to integrating the ES/NC referential require some slight modifications to consider national variations on the way ~~ecosystem services~~ ES-related issues are framed. Building on these findings and extending the analysis to other countries would not only complete the bigger picture by documenting alternative ES/NC integration patterns (for instance without the influence of any organisations comparable to the EU), but also contribute to refining the methods to achieve greater accuracy and detail in the analysis. Neither would such a widening in scope be complete without a deeper focus, and again the need for further work into local, actual implementation processes must be stressed.

## 19.6. Acknowledgements

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## References

- Aberdeenshire Council (2015a) Aberdeenshire Land Use Strategy Pilot: SEA Environmental Report. Report, Inverurie, 24 March.
- Aspinall R, Green D, Spray C, *et al.* (2011) Status and Changes in the UK Ecosystems and their Services to Society: Scotland. In: UK National Ecosystem Assessment. The UK National Ecosystem Assessment Technical Report. Report for the UNEP-WCMC.
- Bailey, T (2010) Scotland's environmental laws since Devolution – From rhetoric to reality. Report, Edinburgh: Scottish Environment LINK, December.
- Bauler, T and Pipart N (2013) Chapter 12 - Ecosystem Services in Belgian Environmental Policy Making: Expectations and Challenges Linked to the Conceptualization and Valuation of Ecosystem Services. In: Jacobs S, Dendoncker N and Keune H (eds) *Ecosystem Services*. Boston: Elsevier, pp. 121–33.
- ~~[Bryman, A \(2012\) \*Social Research Methods\*. Oxford: Oxford University Press.](#)~~
- Davidson J, Birnie, I, Irvine R, *et al.* (2015) Aberdeenshire Land Use Strategy Pilot Final Report. Report for Aberdeenshire Council, Inverurie, March.
- de Groot, RS, Wilson MA and Boumans RMJ (2002) A Typology for the Classification, Description and Valuation of Ecosystem Functions, Goods and Services. *Ecological Economics* 41(3): 393–408.
- ~~[Deal RL, Cochran B and LaRocco G \(2012\) Bundling of Ecosystem Services to Increase Forestland Value and Enhance Sustainable Forest Management. \*Forest Policy and Economics\*, 17: 69–76.](#)~~
- ~~[——— \(2000\) Learning from abroad: the role of policy transfer in contemporary policy making. \*Governance\*, 13\(1\): 5–24.](#)~~

Elo S and Kyngäs H (2008) The Qualitative Content Analysis Process. *Journal of Advanced Nursing* 62(1): 107–15.

~~Emery M, Martin S, and Dyke A (2006) Wild Harvests from Scottish Woodlands Social, Cultural and Economic Values of Contemporary Non-Timber Forest Products. Report, Edinburgh: Forestry Commission.~~

——— (2011) Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions: Our life insurance, our natural capital: an EU biodiversity strategy to 2020. COM(2011) 244, Brussels.

——— (2013a) Communication from the Commission to the European Parliament, the Council, the Economic and Social Committee and the Committee of the Regions: A new EU Forest Strategy: for forests and the forest-based sector. COM(2013) 659, Brussels.

European Council (1999) *Council Resolution of 15 December 1998 on a forestry strategy for the European Union*. 1999/C 56/01, Brussels.

European Parliament and European Council (2001) *Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment*. Brussels.

~~Fisher B, Turner T, Zylstra M *et al.* (2008) Ecosystem services and economic theory: integration for policy-relevant research. *Ecological Applications* 18(8): 2050–2067.~~

Forest Enterprise Scotland (2013) The role of Scotland's National Forest Estate and strategic directions for 2013-2016. Report, Edinburgh: Forestry Commission Scotland, April.

Forestry Commission Scotland. (2008a) WIAT Woods in and Around Towns: Phase II. Report, Edinburgh.

- (2010a) The right tree in the right place: Planning for forestry & woodlands. Report, Edinburgh, May.
- (2014) Deer Management on the National Forest Estate: Current Practice and Future Directions – 1 April 2014 to 31 March 2017. Report, Edinburgh, July.
- Geijzendorfer IR, Cohen-Shacham E, Cord AF, et al. (2017) Ecosystem services in global sustainability policies. *Environmental Science & Policy* 74:40-48.
- Gómez-Baggethun E, de Groot R, Lomas PL, et al. (2010) The History of Ecosystem Services in Economic Theory and Practice: From Early Notions to Markets and Payment Schemes. *Ecological Economics* 69(6): 1209–18.
- [Great Britain \(1919\) \*Forestry Act 1919\* \(9 Geo. 5, c. 58\).](#)
- [Hobbs, RJ, Arico S, Aronson J, et al. \(2006\) \*Novel Ecosystems: Theoretical and Management Aspects of the New Ecological World Order. Global Ecology and Biogeography\* 15\(1\): 1–7.](#)
- Keating M (2010) *The Government of Scotland: Public Policy Making After Devolution*. Edinburgh: Edinburgh University Press.
- Kettunen M, ten Brink P (2015) Towards a framework for assessing current level of and future opportunities for ES/NC integration at different levels of governance. Report for the EU FP7 OPERAs project, D3.3, Grant Agreement No 308393, January. Available at: <http://operas-project.eu/sites/default/files/resources/d3-3towards-framework-assessing-es-nc-integration-different-levels-governance-final-draft-4-feb-2015.pdf>
- Kettunen M, ten Brink P, Underwood E, et al. (2014) Policy needs and opportunities for operationalising the concept of ecosystem services. Report for the EU FP7 OPERAs project, D4.1, Grant Agreement No 308393, May. Available at: <http://www.operas-project.eu/sites/default/files/resources/policy-needs-and-opportunities.pdf>



[Lafferty W and Hovden E \(2003\) Environmental policy integration: towards an analytical framework. \*Environmental Politics\* 12\(3\): 1–22.](#)

Latour B (2004) *Politics of Nature: How to Bring the Sciences into Democracy*. Cambridge: Harvard University Press.

Millenium Ecosystem Assessment (2003) *Ecosystems and Human Well-being: A Framework for Assessment*. Washington DC: Island Press.

Natural Environment Research Council (2014) Highlight Topics. Available at: <http://www.nerc.ac.uk/research/portfolio/strategic/topics/>

Ninan KN and Inoue M (2013) Valuing Forest Ecosystem Services: What We Know and What We Don't. *Ecological Economics* 93(C): 137–49.

Pack B (2013) Doing Better Initiative to Reduce Red Tape in Agriculture: Interim Report. Report for the Scottish Government, Edinburgh, July.

Patterson TM and Coelho DL (2009) Ecosystem Services: Foundations, Opportunities, and Challenges for the Forest Products Sector. *Forest Ecology and Management* 257(8): 1637–46.

[Patton MQ \(2002\) \*Qualitative Research and Evaluation Methods. Third edition. Thousand Oaks, Calif; London: Sage.\*](#)

Scotland (2005) *Environmental Assessment (Scotland) Act 2005*. Elizabeth II. Asp 15 (2005). London: The Stationery Office.

Scottish Borders Council (2014) Scottish Borders Council Pilot Land Use Strategy. Strategic Environmental Assessment: Environmental Report. Report, October.

Scottish Environment LINK (2009) Living with the Land: Proposals for Scotland's First Sustainable Land Use Strategy. Report, Edinburgh, December.

—— (2011) GOVERNANCE MATTERS - The Environment and Governance in Scotland. Report, Edinburgh, October.

Scottish Executive (2006) The Scottish Forestry Strategy 2006. Edinburgh: Forestry Commission Scotland, October.

Scottish Government (2009a) National Planning Framework for Scotland 2. Edinburgh, June.

—— (2009b) The Scottish Government's rationale for woodland expansion. Edinburgh: Forestry Commission Scotland.

—— (2011) Applying an ecosystems approach to land use: Information Note. 16 March.

—— (2013) 2020 Challenge for Scotland's Biodiversity. 19 June.

—— (2014a) Scottish Government's Environmental Policy, Updated 2014. 10 April. Available at:  
<http://www.gov.scot/Topics/Government/18823/GreenGovCon/ScottishGovernmentsEnvironmentalPolicyupdated2014>.

—— (2015a) Scotland's International Policy Statement. March 25. Available at:  
<http://www.gov.scot/Publications/2015/03/7071/2>.

—— (2015b) Scotland's Biodiversity - a route map to 2020. Edinburgh, 25 June.

—— (2016[2014]) Scottish Rural Development Programme: United Kingdom – Rural Development Programme (Regional) – Scotland. 9 June.

—— (2016) Getting the best from our land: A Land Use Strategy for Scotland 2016-2021. Edinburgh, 22 March.

—— (OnlineA) Rural Development Contracts - Rural Priorities. Website Section.  
Accessed August 17 2015.  
<http://www.gov.scot/Topics/farmingrural/SRDP/RuralPriorities>.

Scottish Natural Heritage (N.d.) Natura. Report, Inverness.

[Sing L, Metzger MJ, Paterson JS, Ray D \(2018\) A review of the effects of forest management intensity on ecosystem services for northern European temperate forests with a focus on the UK. \*Forestry\* 91: 151-164.](#)

[Stone D \(1999\) Learning Lessons and Transferring Policy across Time, Space and Disciplines. \*Politics\* 19\(1\): 51-59.](#)

—— (2004) [Transfer agents and global networks in the ‘transnationalization’ of policy. \*Journal of European Public Policy\* 11\(3\): 545-566.](#)

The Economics of Ecosystems and Biodiversity (2009) The Economics of Ecosystems and Biodiversity for National and International Policy Maker – Summary: Responding to the Value of Nature. Report, Wesseling, November.

—— (2010) The Economics of Ecosystems and Biodiversity: Mainstreaming the Economics of Nature: A Synthesis of the Approach, Conclusions and Recommendations of TEEB. Report, London: Earthscan, October.

Thomas HJD, Paterson JS, Metzger MJ, *et al.* (2015) Towards a research agenda for woodland expansion in Scotland. *Forest Ecology and Management* 349: 149-161.

Thomson A and Hallsworth S (2012) Projections of emissions and removals from the LULUCF sector to 2050. Report for the Department of Energy and Climate Change, Penicuik: Centre for Ecology and Hydrology, 31 August.

United Nations Environment Programme, Convention on Biological Diversity (2011) *Decisions adopted by the conference of the parties to the convention on biological*

*diversity at its eleventh meeting*. Hyderabad, India, 8-19 October 2012.  
UNEP/CBD/COP/11/35.

Wackernagel M and Rees WE (1997) Perceptual and Structural Barriers to Investing in Natural Capital: Economics from an Ecological Footprint Perspective. *Ecological Economics* 20(1): 3–24.

Waylen K and Blackstock K (2015) Eco-what?! The need for clarity and consistency in communication using ecosystem terminology. Briefing paper for Ecosystem Services Community Scotland, Dundee: The James Hutton Institute, 4 May.

Wightman A (2012) Forest Ownership in Scotland: A Scoping Study. Report for the Forest Policy Group, February.

Woodland Expansion Advisory Group (2012) Report of the Woodland Expansion Advisory Group to the Cabinet Secretary for Rural Affairs and Environment, Richard Lochhead MSP. Report, June.