# A framework for integrating systematic stakeholder analysis in ecosystem services research: Stakeholder mapping for forest ecosystem services in the UK

Susanne Raum

*Centre for Environmental Policy, Faculty of Natural Sciences, Imperial College London, South Kensington Campus, London SW7 1NA, UK*

A R T I C L E  I N F O

A B S T R A C T

The concept of ecosystem services offers a useful framework for the systematic assessment of the multiple benefits ecosystems deliver. However, the anthropogenic focus of the concept also requires a detailed understanding of the stakeholders interested in the goods and services ecosystems provide. Indeed, linking ecosystem services to stakeholders and systematically mapping their potential stakes in these is essential for effective, equitable and sustainable ecosystem governance and management because it specifies who is in the system and why. This paper endeavours to provide a better appreciation of systematic stakeholder analysis in ecosystem services research by, first, presenting an illustrative stakeholder analysis example, using a key natural resource in relation to ecosystem services: forests in the UK. In this exploratory study, a qualitative approach was adopted, using a literature review and interviews to identify the stakeholders with a stake in the provisioning, regulating and cultural ecosystem services of forests, to distinguish their characteristics, and to examine their relationships towards each other on different levels. The illustrative example then informed the design of a conceptual framework for the systematic application of stakeholder analysis in ecosystem services research. The comprehensive framework consists of a three-phase model entailing the planning phase, the execution of the actual stakeholder analysis phase, and, finally the subsequent actions. The framework incorporates stakeholders and ecosystem services on a geographical, institutional and ecosystem level. Systematic stakeholder analysis can be used to develop future activities linked to ecosystem services, including new policy or instruments, stakeholder engagement activities, and decision-making processes.
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## 1. Introduction

Since the publication of the Millennium Ecosystem Assessment in 2005 (MA, 2005), the ecosystem services concept has become popular amongst academics, policy-makers, and practitioners (Seppelt et al., 2011, La Notte et al., 2017). The increasing use of ecosystem services thinking, however, requires not only the assessment of the goods and services different ecosystems provide, but also a detailed understanding of those who have a stake in such services and why. Until recently, most empirical ecosystem services research has focused either on the identification (e.g. Harrison et al., 2010, Vlami et al., 2017), mapping (e.g. Egoh et al., 2008, Kandziora et al., 2013), assessment (e.g. MA, 2005, NEA, 2011), or quantification or valuation of ecosystem services (e.g. Hein et al., 2006, Liv and Opdam, 2014). Those who did include stakeholders in their work tended to do this in a more general, unsystematic way, and mostly on a regional or local case study level (e.g. Bagstad et al., 2014, Garrido et al., 2017). However, in many cases, stakeholder interests in ecosystem services tend to intersect local, national and international levels. In the past, many efforts at governing and managing ecosystems and the goods and services they provide sustainably have been unsuccessful because the various stakeholders involved and their perspectives and potentially conflicting interests have not been given sufficient attention (Grimble et al., 1994). The governance, management, and use of ecosystem services involve a wide range of stakeholders with distinctly different but frequently interrelated stakes, which need to be taken into account as they may be fundamental.

Stakeholder analysis enables the systematic identification of these stakeholders, the assessment and comparison of their particular sets of interests, roles and powers, and the consideration and investigation of the relationships between them, including alliances, collaborations, and inherent conflicts. It examines "who these interested parties are, who has the power to influence what

happens, how these parties interact and, based on this information, how they might be able to work more effectively together" (Reed et al., 2009, p. 1947) to address environmental and/or natural resource management issues. Indeed, linking ecosystem services to stakeholders and systematically mapping their potential stakes in these will be essential for equitable and sustainable ecosystem governance and management. The findings of systematic stakeholder analysis can be used to recommend or develop future actions, such as new policies or policy instruments for ecosystem services or stakeholder engagement strategies. It can also aid land use planning linked to ecosystem services or support the design of communication tools for their management. Thus, I argue that making explicit the linkages between different stakeholders and their stakes in ecosystems and the various goods and services they provide, should be one of the main purposes of an ecosystem services framework. The increasing use of ecosystem services thinking requires a thorough understanding of the various stakeholders involved in ecosystem services, making a more systematic use of stakeholder analysis necessary.

## 2. Background

Systematic stakeholder mapping or analysis (hereafter used synonymously) is a particularly useful approach to assess the stakes of various interested parties in a system in more detail (Grimble et al., 1994). In recent years, this type of analysis has become increasingly popular in various fields and academic disciplines, including environmental management and governance, and is now regularly used by businesses, regulators, policy-makers and international organisations (Friedman and Miles, 2006, Reed et al., 2009). Its roots are in management theory and in political science, where it has evolved into a systematic tool with clearly defined applications and methods (Brugha and Varvasovszky, 2000). Stakeholder analysis can be seen "as a holistic approach or procedure for gaining an understanding of a system" and changes in it, "by means of identifying the key actors or stakeholders and assessing their respective interests in the system" (Grimble and Wellard, 1997, p. 175). Freeman (1984) initially distinguished stakeholders in a business context as "any group or individual who can affect or is affected by the achievement of an organisation's objectives" (p. 46). In a natural resource management context, Grimble et al. (1995) defines stakeholders as "all those who affect, and/or are affected by, the policies, decisions, and actions of the system" (p. 3). They can be individuals, or "any group of people, organised or unorganised, who share a common interest or stake in a particular issue or system" (Grimble and Wellard, 1997, p. 175). Stakeholder interests often tend to cut across political administrative, social and economic units at international, national, regional and local levels and are likely to include governmental departments, commercial bodies, national and international planners, professional advisers, communities, and individuals (Grimble and Quan, 1993). Stakeholder analysis enables the systematic assessment and comparison of their particular sets of interests, influences and roles, and the examination of relationships between them (Reed et al., 2009).

In natural resource management, stakeholder analysis represented a particularly valuable tool since it typically involves a wide range of stakeholders, using the same resource for different purposes (Reed et al., 2009). Initially, stakeholder analysis within natural resource management has mainly been used in developing countries (e.g. De Lopez, 2001, Mitchell, 1990, Grimble et al., 1995). There, the emphasis has largely been on participation and conflict resolution (IUCN and Lewis, 1995), following a more general trend towards the development of normative participatory approaches in resource management (Mitchell, 1990, De Lopez,

2001). Crucially, many past efforts at managing the environment and natural resources sensitively have failed because the various stakeholders involved and their potentially conflicting interests and perspectives have been given inadequate consideration by national policy-makers and regional or local planners (Grimble et al., 1994). This has frequently led to local resistance of policies and/or projects which then became unsuccessful (Grimble et al., 1994). Hence, it is essential to understand the different perspectives of the various actors involved and to specify who has an interest in the resource base and the goods and services it provides, to what level, and why (Reed et al., 2009). One of the earliest works on stakeholder analysis in a natural resource management context has been published by Grimble et al. (1994); it focuses on tree resources and environmental policy in Cameroon and Thailand. The article introduces a classification system which categorises broad stakeholder groups along a continuum from the micro to macro level. In more recent years, stakeholder analysis has become firmly established as a core component of natural resource management (Reed et al., 2009). A number of approaches have been used in different sectors, such as forestry (e.g. Sandström et al., 2016), marine planning (e.g. Maguire et al., 2012), energy policy (e.g. Elgin and Weible, 2013), water infrastructure (e.g. Lienert et al., 2013), and conservation management (e.g. Prell et al., 2010).

In many parts of the world, the important forest resource tends to involve a particularly large and diverse range of stakeholders, often with competing interests in different forest ecosystem services (Raum and Potter, 2015). Some may also exert considerable influence over forestry. In the UK, the stakeholder landscape linked to forestry appears to be complex and dynamic. Its complexity lies in the breadth of current and potential future interests involved, and in the way in which these interests span public and private domains from the national to the local level (Dandy et al., 2017). A systematic mapping of these stakeholders would allow a better understanding of their multiple stakes in ecosystem services which, in turn, could aid the design of equitable and sustainable ecosystem governance and management strategies because it provides a detailed understanding of who has a stake and why. However, although there have been several studies that have made extensive use of stakeholder analysis tools in relation to tree pests and diseases (e.g. Mills et al., 2011, Marzano et al., 2015), relatively few studies appear to have looked specifically at forest stakeholders within the ecosystem services framework. Those who have, have tend to concentrate on local case studies, often involving local communities (e.g. Agbenyega et al., 2009, Asah et al., 2012, Garrido et al., 2017), using stakeholder analysis in a general, somewhat unsystematic way. Garrido et al.'s (2017) study, for instance, has compared how stakeholders from different sectors perceived ecosystem services from the wood-pasture Dehesa landscape of northern Spain. The study compares civil, private and public sector stakeholders on the local and regional level. Agbenyega et al. (2009) applied, for the first time, an explicit ecosystem services framework to perceptions of woodlands in the UK. The authors classify the diverse range of functions and services generated by four community woodlands in Eastern England and link these with particular stakeholder interests and preferences (Agbenyega et al., 2009). However, comparatively little is known about the stakeholders in/of forest ecosystem services on the UK macro to micro level, leaving a considerable knowledge gap.

Building on this state of understanding, this paper intends to provide a better appreciation and promote discussion of a more systematic use of stakeholder analysis in ecosystem services research. Therefore, it aims to (1) present an illustrative stakeholder mapping example, using a key natural resource, namely forests, in the UK. An exploratory qualitative approach was adopted to provide a better understanding of current stakeholders in forest ecosystem services, their particular stakes, characteristics, and

relationships on the UK macro to micro level. Informed by this illustrative and exploratory example, the paper then (2) offers a conceptual framework for the systematic application of stakeholder analysis in ecosystem services research, and useful to academics, policy-makers, land use decision-makers, and conservationists.

## 3. Methods

### 3.1. Study area

Over the last 100 years or so, forest and woodland (hereafter used interchangeably) cover in the UK has increased from 4.6% at the beginning of the 20th Century to 13% today: 10% in England, 15% in Scotland, 15% in Wales and 8% in Northern Ireland (Forestry Commission, 2017). The UK National Forest Inventory defines woodlands as a minimum area of 0.5 ha; and a minimum width of 20 m; tree crown cover ≥ 20% or the potential to achieve it; and a minimum height of 2 m, or the potential to achieve it (Quine et al., 2011). All of the forested land in the UK, has, to some extent, been modified by management. The majority of woodland (66.8%) is classified as 'Productive Plantation', with 'Modified Natural and Semi-natural' representing 32% of the woodland area, and 0.7% being classed as 'Protective Plantation' (Quine et al., 2011). Productive plantation has been established for the production of wood or non-wood goods, the second cover areas under intensive management, thus leading to changes in the structure and composition of the forest, and the last group has been established for soil and water protection, pest control and conservation of habitats to biological diversity (FAO, 2005). Forest ecosystems, depending on their location, scale, and management, are one of the largest providers of ecosystem services (Raum, 2017). They frequently provide the full range of goods and services as defined, for instance, by the Millennium Ecosystem Assessment (MA, 2005). Thus, forests present a particularly useful case study example.

In the UK, the Forestry Commission and its devolving country equivalents own or manage 28% of the total woodland area, ranging from 16% in England to 55% in Northern Ireland (Forestry Commission, 2017). The other forest owners comprise approximately 43.6% private owners, 12% businesses, 3.6% charities, and 4.9% local authorities and other public owners (Smith et al., 2001). A more recent sample survey of ownership was undertaken as part of the National Forest Inventory from 2009, but the data are not yet available (Wong et al., 2015). It should be noted that due to the devolution of political administration which began in 1998, it has not always been possible to keep a clear UK focus in the illustrative stakeholder analysis presented in this paper. At the time of interviewing the newly devolved governmental organisations were at various stages of devolution and the administrative competencies were still evolving (Raum, 2018). Still, it is reasonable to assume, that once these are fully established, their objectives and powers will be broadly similar to the previous organisations.

### 3.2. Data collection – stakeholder mapping

#### 3.2.1. Stakeholder identification

In this study, an exploratory qualitative approach was adopted to uncover the stakeholders with an interest in forest ecosystem services and to analyse their particular stakes, roles and positions on different levels. The definition was adapted from Freeman (1984) and Grimble and Wellard (1997) as any organisation, group, or individual interested in or with an influence over woodland ecosystem services (in the UK). Such stakeholders can be identified through various methods, including documentary reviews, expert interviews, and focus groups. For the purpose of this study, I chose a combined approach, using literature review through a key word analysis of official websites of organisations (Duggan et al., 2013), and a stakeholder-led identification, based on expert interviews (Reed et al., 2009, Savin-Baden and Howell-Major, 2013). The idea was to provide a more general overview of the wide range of stakeholders with an interest in the various forest ecosystem services through a literature review. I then employed a more resource intensive research method (interviews), to provide a more detailed understanding of a much smaller number of key stakeholders through an empirical capture of qualitative information obtained from the interviews. The intention was to capture stakeholders in the UK from a macro to micro level, building on Grimble et al. (1994). The concept of a macro to micro continuum is useful for classifying stakeholders at different levels.

To begin with, a preliminary list was drawn up of stakeholders with a general stake in UK forests. It was based on a list of stakeholders compiled by the Forestry Commission (2008). Several other stakeholders were iteratively added from various other sources throughout the data collection. This resulted in 244 stakeholders, comprising a wide range of governmental, and not-for-profit organisations, businesses and industry, and individuals. 32 of the above 244 stakeholders on the preliminary list were either not found on the internet (20) or were part of a larger organisation already on the list (12). To be able to better distinguish their specific interests in the various ecosystem services, their interest in the provisioning, regulating and cultural woodland ecosystem services was then determined through a 'rapid' keyword analysis of the organisations' webpages: 'home', 'about us', or 'what we do'. Only stakeholders who specifically mentioned woodlands or forests and one or more ecosystem service listed in Table 1, on one or all of these three webpages, were kept on the final list (Appendix 1), leaving 83 stakeholders. For the purpose of this study, 'interest' in ecosystems services was defined simply as interest in the provisioning, regulating and cultural ecosystem services listed in Table 1.

The positions of a selection of key stakeholders in forest ecosystem services were further explored through semi-structured interviews (Savin-Baden and Howell-Major, 2013) with 12 UK based forestry and conservation experts who were familiar with UK forestry and the concept of ecosystem services. These interviewees were identified through a combined purposive snowballing technique (Bryman, 2012). This approach gave structure and coherence whilst also allowing for flexibility. The semi-structured interviews also allowed considerable focus and hence (comparable) data "with significant depth or richness" (Reed et al., 2009, p. 1944) for such an exploratory study. This notwithstanding, the scope of the study and its illustrative, exploratory and qualitative nature mean that the findings are illustrative rather than representative. The 20–40 min-long interviews were conducted either by telephone or in person between April 2013 and July 2014. They were, with the written and verbal consent of the interviewees, digitally recorded and then transcribed verbatim (Jupp, 2006). Respondents consisted of senior staff of a cross-section from academic institutions (n = 2), governmental organisations (n = 4), non-governmental conservation organisations (n = 4), and private sector forestry organisations (n = 2). The identification of the key stakeholders in forest ecosystem services was based on the following guiding interview questions:

1) Thinking about the provisioning, regulating and cultural services woodlands provide, who would you identify as key stakeholders in forest ecosystem services in the UK and why? (including your own organisation or group);
2) In which ecosystem service(s) are they interested in?

**Table 1**
Millennium ecosystem assessment ecosystem services classification.

| Provisioning Goods and Services *(products obtained from ecosystems)* | Regulating Services *(benefits obtained from the regulation of ecosystem processes)* | Cultural Services *(non-material benefits obtained from ecosystems)* |
|---|---|---|
| Fibre [timber, fuel wood] Food Fresh water Biochemicals Genetic resources Ornamental resources | Air quality regulation Climate regulation [global/regional/local] Disease regulation Erosion [soil] regulation Natural hazard regulation Pest regulation Pollination Water [flood] regulation Water purification and waste treatment | Aesthetic values Cultural heritage values Educational values Inspiration Knowledge systems Recreation and tourism Sense of place Social relations Spiritual and religious values |

*Source:* Based on MA (2005), p. 41–45. Information in brackets [ ] has been added by the author.

### 3.2.2. Stakeholder differentiation and categorisation

To further enrich stakeholder mapping, stakeholders are frequently differentiated between and categorised into groups. For the purpose of this analysis, I chose literature review, again through a key word analysis of stakeholders websites (Duggan et al., 2013), to distinguish between a wide range of stakeholders with an interest in the different ecosystem services, and a stakeholder-led categorisation combined with an extended interest-influence matrix for a more detailed differentiation of a number of key stakeholders (Reed et al., 2009). The partitioning of stakeholders into functional roles, such as according to their respective professional characteristics and interests in ecosystem services, may inform the design of a multi-user communication interface for ecosystem services management (Duggan et al., 2013). The clustering of stakeholders, based on similarities in

specific stakeholder characteristics, such as their roles, degrees of power, or their management objectives, may also assist land-use decisions, as it can differentiate more clearly between those who make the decisions and those who are affected by the decisions made, and in what way and to what degree (Grimble and Wellard, 1997).

A variety of methods have been developed for such differentiation and categorisation, including 'interest-influence matrices', 'stakeholder-led categorisation', and 'Q-methodology' (Reed et al., 2009). Here, first, I further grouped the formerly identified 83 stakeholders under provisioning, regulating and cultural ecosystem services and on a macro to a micro continuum. This comprised the UK national and regional level, using the county of West Sussex in southern England as a regional example. It was based on the web keyword analysis. The differentiation on the local level was based on the author's judgment (Table 2). This type of mapping is useful for classifying stakeholders at different levels and according to the broader groups of ecosystem services they are interested in. To be able to distinguish more clearly between the different groups of such a large number of stakeholders, I then classified them into groups according to their respective professional characteristics and interests in ecosystem services (Table 3).

Secondly, to obtain a more detailed understanding of a selection of key stakeholders, I followed Reed et al.'s (2009) recommendation to use an extended interested-influence matrix approach. For this purpose, I asked interview respondents to assess the degree (low, medium, high) of interest in and influence over woodland ecosystem services of the stakeholders they had recorded, and the reasons for it. 'Interests', as defined under 3.2.1., included both primary (high interests) and secondary interests (low to medium interests) (Table 4). 'Influence' was defined as the ability to affect the provisioning of forest ecosystem services either directly through their use and/or management activity, or indirectly through policy and/or regulation (Table 5). The scores for the degrees of interest and influence were calculated using the mean

**Table 2**
Stakeholders in forest services on a macro to micro continuum – specific and generic examples.

| | Provisioning | Regulating | Cultural |
|---|---|---|---|
| National Level | British Horse Loggers Country Landowners and Business Association Confederation of Forest Industries DECC Forest Fuels Ltd Forestry Commission/FCS/NRW/NIFS Forest Stewardship Council National Coppice Federation Timber Trade Federation | Defra Environment Agency/NRW/SEPA/NIEA Forest Carbon Ltd National Forest Company Royal Society for the Protection of Birds The Woodland Trust | Acres Wild Woodland Ltd Association of National Park Authorities Forestry Commission/FCS/NRW/NIFS Forest Education Initiative Natural England/NRW/SNH/NIEA The National Trust Underwoodsman/Courses |
| Regional level | A&G Lillywhites Arbo Tree Surgeons Bioregional West Sussex County Council South East Forestry South East Wood Fuels Ltd. Surrey and Sussex Coppice Group The Balcombe Estate | The Balcombe Estate Sussex Wildlife Trust West Sussex County Council | Green Corridor – Education High Weald AONB Unit SE Woodland Archaeology Forum South Downs National Park Authority Sussex Wildlife Trust West Sussex County Council Woodlands Skills Woodcraft School |
| Generic /local Level | Builders Gardeners (wood chips) Home Owners (fire wood) Joiners and Cabinet Makers Mushroom, Berry Collectors Nurseries (wood chips) Woodland Owners Pole-makers Foresters Water Companies Wood Fuel/Heater Suppliers | Local Residents/Communities Woodland Owners Farmers Foresters Local Authorities | Archaeologists Cyclists, Joggers Deer Hunters Dog Walkers, Horse Riders Local Residents/Communities Mushroom, Berry Collectors Schools/School Children Tourists Woodland Owner Local Authorities |

NRW = Natural Resources Wales; SEPA = Scottish Environment Protection Agency; SNH = Scottish Natural Heritage; NIFS = Northern Ireland Forest Service; NIEA = Northern Ireland Environment Agency.

**Table 3**
Stakeholders in woodland ecosystem services by professional/functional roles – examples.

| Groups | Description | Stakeholder Examples | Examples of ES Stakes | ES Categories |
|---|---|---|---|---|
| Regulators/ Governors | National, regional and local governments involved in policy, law enforcement, and incentives | DECC Defra Forestry Commission | timber, fuel wood, fresh water climate (carbon), flood + air regulation recreation | Provisioning Regulating Cultural |
| Commercial ((Agro)business + Industry) | Private businesses involved in timber production, processing, (transport) and trade, as well as water companies, energy suppliers, etc. | Coppice Resources Ltd Euroforest Ltd Water Companies | fibre, fuel wood, timber, fresh water climate regulation (carbon) recreation | Provisioning Regulating Cultural |
| NGO's/Not-for-Profit Organisations | Broad group of mainly third sector organisations interested in conservation, the natural environment, social issues and education | Woodland Trust The Wildlife Trusts The National Trust | fuel wood, fresh water climate (carbon) + flood regulation education, aesthetic, recreation | Provisioning Regulating Cultural |
| Investors | Private individuals and businesses, interested in timber as a standing crop, carbon credits, biodiversity/habitat offsetting, and water credits | Forest Carbon Ltd | timber, (fresh water) climate regulation (carbon) | Provisioning Regulating |
| Professional Organisations | Provide specialist advice and support on a national level | ICF Royal Forestry Society ConFor | timber (fibre, fuel wood, fresh water) climate (carbon) + flood regulation education | Provisioning Regulating Cultural |
| Science (and Education) | Broad group of (individuals) and organisations conducting research on forest ecosystem related issues (and providing education) | Edinburgh University FC - Forest Research Oxford University | timber, fresh water climate (carbon), flood, pest regulation education, recreation/tourism | Provisioning Regulating Cultural |
| Woodland Owners | Broad group of individuals and organisations responsible for woodland management, thereby providing a wide range of services | Forestry Commission The National Trust The Balcombe Estate | timber, fuel wood, fresh water air, climate (carbon) + flood regulation aesthetic, recreation/tourism | Provisioning Regulating Cultural |
| Communities | Local groups involved in either a semi-formal or formal way to run and/or manage their local woodland | Vert Wood Community Woodland | (fuel) wood flood regulation education, heritage, recreation, spiritual | Provisioning Regulating Cultural |
| Individuals | Various (local) people who use (the near-by) woodland for numerous purposes | Cyclists, joggers Wild fruit collectors Walkers, horse riders | fuel wood flood regulation aesthetic, heritage, recreation, spiritual | Provisioning Regulating Cultural |

average from the interviews. The interviews were based on the following guiding questions:

3) How would you assess the degree of interest in forest ecosystem services? (low, medium, high); and
4) How would you assess the degree of their influence over these services? (low, medium, high);
5) What are the reasons for their interest in and influence over forest ecosystem services?

#### 3.2.3. Stakeholder relationships

A number of methods have been developed to investigate the relationships between stakeholders. Reed et al. (2009) identify three principal methods: i) Actor-linkages, ii) Social Network Analysis; and iii) Knowledge Mapping Analyses. These approaches are concerned principally with mapping flows of information, relationships and networks to provide a basis for reflection and action (ODI, 2004). Actor-linkage maps or matrices are generally seen as a useful starting point for discussing relationships and flows of information in a system (Denscombe, 2014). I used these in combination with a thematic narrative analysis (Savin-Baden and Howell-Major, 2013), based on the exploratory interviews, to examine the relationships between the key stakeholders. First, I divided the selected key stakeholders into 5 functional groups according to professional characteristics and then examined their different roles as providers, users, and regulators of forest ecosystem services and their relationships towards each other (Table 6). I defined providers/producers as those who provide or produce forest goods and services, such as timber products and landscape

amenity, users or other beneficiaries as those who use or otherwise benefit from them, and regulators or enablers as those with the capacity to set formal and informal rules and regulations which impinge on the behaviour and practices of others. Interviewees were also asked to give examples of synergistic and conflicting relationships between the key stakeholders and specifically around forest ecosystem services.

#### 3.3. Data analysis

The empirical analysis was based on textual data obtained from literature in form of web pages (Duggan et al., 2013) and interviews (Savin-Baden and Howell-Major, 2013). Web pages were searched and coded for the keywords of 'forest(s)', 'woodland(s)', 'wood(s)' and the full range of forest 'ecosystems services' (Table 1). Although this approach had its limitations, keyword analysis is a potentially useful and cost-effective, but often understated social science research method, particularly when used in combination with other methods (Jupp, 2006). The web pages and the interview transcripts were analysed through hand annotated codes (Savin-Baden and Howell-Major, 2013). In the first round of coding, the latter were searched and coded for stakeholders and the ecosystem services of interest to them. These were then further coded in terms of the level of interest and influence, functional/professional characteristics, and relationships. The findings were presented through a qualitative narrative (Denscombe, 2014), supported by verbatim quotes from the interview transcripts, and by summary tables and matrices.

**Table 4**
Key stakeholders and their primary and secondary forest ecosystem services (ES) stakes.

| | Key Stakeholders in Forest ES | Primary Forest ES Stakes | Secondary Forest ES Stakes |
|---|---|---|---|
| National Level | Department for Environment, Food and Rural Affairs (Defra) | hazard regulation, air quality and pest regulation, fresh water, and biodiversity[*] | timber, fuel wood, recreation, aesthetic values, climate regulation |
| | Department of Energy and Climate Change (DECC) | climate (carbon) regulation | fuel wood, air quality regulation |
| | Forestry Commission (FCS/NRW/NIFS) | timber, recreation | aesthetic values, fuel wood, climate regulation, biodiversity[*] and health[*] |
| | Natural England (NRW/SNH/NIEA) | aesthetic values, and biodiversity[*] | recreation |
| | Environment Agency (NRW/SEPA/(NIEA) | fresh water, hazard (flood) regulation | air quality regulation |
| | Country Land and Business Association (CLA) | timber | climate regulation, aesthetic values, and biodiversity[*] |
| | Confederation of Forest Industries (ConFor) | timber | climate regulation, fresh water, and biodiversity[*] |
| | Forestry Stewardship Council UK (FSC) | timber | fibre, and biodiversity[*] |
| | The Woodland Trust | biodiversity[*] | fuel wood, fresh water, climate- and hazard (flood) regulation |
| | Royal Society for the Protection of Birds (RSPB) | biodiversity[*] | aesthetic values, fresh water, climate- and hazard regulation, habitat provisioning[*] |
| | The National Trust | recreation (access) | fuel wood, education, cultural heritage, and biodiversity[*] |
| | Insurance Companies | hazard regulation, timber | |
| | Corporates (e.g. Supermarkets/Retailers) | fresh water | climate and hazard (flood) regulation, and biodiversity[*] |
| | Energy Providers | fuel wood | |
| Local and Regional Level | Water Companies | fresh water | hazard (flood) regulation |
| | Developers | aesthetic values, recreation, noise regulation[*] | hazard (flood) regulation, and biodiversity[*] |
| | Local Authorities | air regulation, and health benefits[*] | noise regulation[*], recreation, aesthetic values, fresh water, and biodiversity[*] |
| | Wildlife Trusts | biodiversity[*] | fresh water, climate- and hazard (flood) regulation, education |
| | Private Woodland Owners | timber, fuel wood, aesthetic values, recreation, health[*], biodiversity[*] | hazard (flood/storm) regulation |
| | Local People/Local Communities | recreation, aesthetic values, health benefits[*] | timber, fuel wood, hazard (flood) regulation, noise regulation[*] |

[*] = these benefits are not part of the MA classification but were mentioned by the interviewees.

# 4. Results and analysis

In this section, I present the findings of the illustrative and exploratory mapping of stakeholders in forest ecosystem services in the UK. I begin with a general overview and differentiation of stakeholders with an interest in woodland ecosystem services, based on the literature. This is followed by a more detailed examination of a selection of key stakeholders and based on the interviews.

## 4.1. Broad identification and differentiation of stakeholders in forest ecosystem services

The identification and grouping of stakeholders with an interest in forest ecosystem services in the UK, through the literature in form of webpages, was not as straightforward as anticipated; it was, at times challenging to clearly link stakeholders with specific ecosystem services. For example, the review found over 50 voluntary groups and organisations concerned with nature and rural or landscape conservation, many of which were interested in woodlands, yet their specific interest in forest ecosystem services was less clear. These organisations all varied considerably in their significance and objectives, and their goals were not always clearly stated on the organisations' websites. Moreover, stakeholders' interests in woodland ecosystem services were frequently rather hidden or indirect and therefore not specifically mentioned. Stakeholders with an interest in certain cultural and regulating services were particularly difficult to identify. For example, there was a large number of stakeholders with tourism or recreation related concerns. However, even though many of these were likely to have an interest in forests and specific services, these were not explicitly stated on the three websites used for the rapid web analysis. It was even more difficult to identify stakeholders with a specific stake in regulating services. Thus, the final list of 83 stakeholders with a stake in woodland ecosystem services presented here should be seen as indicative (Appendix 1). Table 2 provides examples of these stakeholders grouped into those interested in the provisioning and regulating services, and those whose interests are primarily cultural in nature. On the national and regional levels specific stakeholders are identified; on the local level, examples are more generic.

In Table 3, based on the information provided by the key websites, stakeholders are divided into nine groups of functional roles, according to their respective (professional) characteristics and interests in ecosystem services. The differentiation of stakeholders into meaningful functional clusters can shed further light on the ever-increasing complexity in the management of woodland ecosystem services. Stakeholders are listed according to their estimated influence in descending order. A cautionary note is warranted here; the boundaries between these groupings are not always entirely clear.

**Table 5**
Key stakeholders in forest ecosystem services (ES): extended interest – influence matrix.

| Main Stakeholders in Forest ES | Reason(s) for Interest in ES (Why?) | Level of Interest | Reason(s) for Influence (How?) | Level of Influence |
|---|---|---|---|---|
| Department for Environment, Food and Rural Affairs (Defra) | • deals with land use issues<br>• leads on international forestry issues | med/high | • has policy lead on domestic forestry issues<br>• has statutory responsibility for several ES | high/med |
| Department of Energy and Climate Change (DECC) | • deals with GHG emission targets<br>• claims international carbon credits<br>• deals with wood fuel to meet renewable energy targets | med | • has policy lead on climate change (carbon) + renewable energy (wood fuel)<br>• has statutory responsibility for these ES | med |
| Forestry Commission (FCE/FCS/ NRW/NIFS) | • has statutory obligation to provide a range of ES<br>• because of public pressure to provide certain ES | high | • through felling and planting licences<br>• through its UK Forestry Standard<br>• through its grants | high |
| Natural England (NRW/SNH/ NIEA) | • leads UK Biodiversity Strategy<br>• is primarily interested in using ES as a tool to deliver biodiversity | med | • has statutory duty to ensure delivery of certain ES<br>• through its (stewardship) grants | med |
| Environment Agency (NRW/ SEPA/NIEA) | • is interested in water quality/flood management and woodlands/trees play a role in this | high | • has statutory responsibility over several ES<br>• but relies on cooperation of land owners | med |
| Country Land and Business Association (CLA) | • is mainly interested in timber production, but also several other ES to call on public funds | med | • 35ooo members → voting power<br>• has some fairly influential members<br>• has political influence and does lobby | high |
| Confederation of Forest Industries (ConFor) | • is interested in continuous timber supply<br>• its members are commercial businesses and thus interested in financial aspects of ES | high | • lobbies government MP's<br>• has certain amount of influence over its members | med |
| The Forestry Stewardship Council UK (FSC) | • is interested in sustainable timber management and production | high | • has influence over forest owners through its certification requirements | high/med |
| Woodland Trust | • produces ES as forest owner<br>• potential income streams through ES to plant and manage more land with native species | med/high | • has large land ownership → control of land<br>• has large membership → voting power<br>• has political influence and does lobby | high/med |
| Royal Society for the Protection of Birds (RSPB) | • is mainly interested in biodiversity<br>• but also other ES, partly to access public funds for management + conservation activities | med/high | • has large membership → voting power<br>• is quite wealthy, has large land ownership<br>• has political influence and does lobby | high |
| National Trust | • to justify access to public funding for woodland management<br>• in fuel wood to lower fuel dependency | med | • has large land ownership → control over land | med |
| Insurance Companies | • have keen interest in land use and its impact on risk, in particular mitigating natural hazards | low med | • have financial cloud over insured individuals and organisations | low med |
| Corporates (Supermarkets/ Retailers) | • increasingly interested in sustainability and the resilience of their supply chain<br>• for reputational/marketing purposes | low med | • can have influence over their suppliers, especially farmers | low med |
| Energy Providers (Users) | • individuals, farmers and smaller energy providers are interested in fuel wood to lower fuel dependency, reduce heating costs, and to make a profit | med | • have relatively little influence at present<br>• but may threaten timber supplies and affect prices | low |
| Water Companies | • water from forested land may require less treatment which can lead to considerable cost reductions | med | • are quite big players in catchment areas<br>• and have influence over tenant farmers | med |
| Developers | • have a strong commercial interest<br>• woodlands might increase property value and facilitate development | low high | • use policies to facilitate developments,<br>• but also to override the conservation value of woodlands | low high |
| Local Authorities | • have statutory responsibilities for green infrastructure,<br>• development control, and<br>• public health | med | • have a reasonable amount of influence over land owners and developers<br>• due to statutory controls<br>• control of own woodland | med |
| Wildlife Trust(s) | • partly interested in ES to justify access to public funding for conservation and woodland management<br>• produce ES as forest owners | med | • because each Trust is separate they work more on the local level,<br>• hence have less influence nationally<br>• control of own land | low med |
| Private Woodland Owners | • produce a wide range of ES for different reasons | low high | • control of own land<br>• can lobby government either directly or through their umbrella organisations | low high |
| Local People/Local Community/ The Public | • there are a wide range of local people who are interested in an equally wide range of ES for different reasons | low high | • individuals usually have little influence<br>• but can have strong voice in local development cases, particularly if they join forces with media or through NGO's | low high |

## 4.2. Identification and differentiation of key stakeholders in forest ecosystem services and their positions

In this section, I explore several key stakeholders with an interest in forest ecosystem services in more detail through expert interviews. 15 prominent stakeholders or groups were perceived as particularly important players by the interviewees in UK forestry and in the context of woodland ecosystem services (Table 4). These include both specific organisations, and more generic groups, spanning the public and the private domain from the UK national to the local level. They comprise two government departments, the Department for Environment, Food & Rural Affairs (Defra) and the former Department of Energy & Climate Change (DECC[1]), followed by the statutory country regulators, the Forestry Commission and the Environment Agency, and the statutory country nature conservation agency Natural England. Umbrella membership organisations, such as the Country Landowners and Business Association (CLA) and the Confederation of Forest

**Table 6**
Main stakeholder groups and their relationships.

| | Group | Main role | Power/Influence over |
|---|---|---|---|
| 1 | Governmental Organisations | regulators/ enablers | businesses, forest owners, users |
| 2 | Membership Organisations (production)/ | (producers/ providers)* | government, forest owners, businesses, members |
| | Membership Organisations (conservation) | producers/ providers | government, members |
| 3 | Corporates/Businesses | producers/ providers | government, producers, users |
| 4 | Private Forest Owners | producers/ providers | users/beneficiaries |
| 5 | Local People/the Public | users/ beneficiaries | government, forest owners, corporates/businesses |

* Their members tend to be the producers/providers, rather than the umbrella organisations themselves.

Industries (ConFor), both trade bodies, and the Forestry Stewardship Council UK (FSC), an international non-profit, multi-stakeholder organisation with a division in the UK, also emerged from the analysis of the interviews with a significant interest in forest ecosystem services. So did several non-governmental membership organisations concerned with nature conservation, namely the Woodland Trust, the Royal Society for the Protection of Birds (RSPB), and the National Trust on the national level, and woodland owning Wildlife Trusts active more on the sub-regional or local level. Private forest owners were identified by the interviewees as another key stakeholder group. The analysis of the interview transcripts suggests that these stakeholders had a wide range of frequently multiple, and at times competing interests in forest ecosystem services, likewise with less clearly defined stakeholders, including the public, local people or local communities (Table 4). For the purpose of this study, these less well defined ones were amalgamated into one group (Tables 4 and 5).

An additional five generic stakeholder groups, all belonging to the private sector, were also cited by the interviewed experts with reference to the forest ecosystem services of fresh water, hazard regulation, timber and fuel wood. These comprised water companies, energy suppliers, other corporates, developers and insurance companies all of which appear to have an increasingly important stake in UK forestry, arguably as a result of the promise of new financial opportunities linked to ecosystem services. The analysis suggests that many of the above stakeholders tended to have both a range of one or more primary, as well as secondary interests in ecosystem services. While the boundaries between these interests were not always entirely clear, an attempt was made to summarise them in Table 4. Moreover, during the interviews, it was frequently difficult to tease out the actual ecosystem services the selected range of key stakeholders might be interested in, as some of the interviewees were struggling to think within the 'ecosystem services box'. For example, several interviewees spoke about general 'access' (to woodlands) without mentioning the recreational purpose of such access. Moreover, there was a considerable range of opinions and perceptions on what constituted an ecosystem service amongst the interviewees. This was especially the case amongst those respondents who were less involved in formal policy work. On the other hand, many interviewees, including foresters, seemed unaware of the full range of ecosystem services provided by forests, especially of the less tangible services, such as erosion control, temperature regulation, air quality regulation, hazard regulation and disease regulation. These were rarely mentioned during interviews.

The selected key stakeholders were found to have not only a range of different interests in woodland ecosystem services but also different roles and powers. In fact, the analysis suggests that several of these stakeholders exerted considerable influence over the management of forest ecosystems in general and over the provision of specific ecosystem services in particular. These include governmental organisations, especially Defra and the Forestry Commission, but also several more influential umbrella organisations, namely the CLA, the RSPB, and, increasingly, the Woodland Trust. The influence of the governmental departments and the Forestry Commission over forest owners appeared considerable, involving both direct powers through regulation and indirect influences through various incentive schemes; the latter primarily impacting grant holders. Interestingly, their regulative powers frequently appeared to be linked to formal (and informal) transnational commitments, such as the 2009 EU Renewable Energy or Water Framework Directives. Amongst the umbrella membership organisations, the analysis identified a clear distinction between those stakeholders chiefly motivated by commercial and production concerns and those with more explicit biodiversity conservation agendas and other public interests. Crucially, stakeholders with wider conservation interests comprised a diverse set of organisations with differing primary objectives for their woodland management. The National Trust, for example, manages its woods particularly for public access, whereas the RSPB operates its woodlands primarily for biodiversity as do the Wildlife Trusts. Nevertheless, most also tended to manage their woods for a whole range of other ecosystem services enjoyed by the public.

In terms of influence, the analysis of the interview transcripts suggests that the powers of certain membership organisations were due in part to their involvement in policy development, campaigning and lobbying, but also to their control over the actual management of their wooded land. This includes umbrella organisations with production and conservation interests. One of the interview respondents, for example, noted that: "The big organisations, the big NGO's, such as the RSPB, and the Woodland Trust, also have reasonable amount of influence … Where these sorts of organisations score when it comes down to influence is because they, as organisations, also get involved in lobbying and trying to influence things politically, …". Private forest owners emerged "as the most important stakeholders", as one respondent put it, in their capacity as providers of forest ecosystem services, including those enjoyed by the public. They also exert control over their land. However, the analysis suggested that they also represented a diverse group with an equally diverse range of management objectives and interests in ecosystem services. One interviewee noted that they were ranging from "everything from the estates right down to hobby owners who have just got a few acres of woodland. …. And then you got the … slightly larger farms, which have got woodlands". Local people and communities, as principal users of forest ecosystem services, appeared to be an even more complex group, especially because they include direct and indirect users or beneficiaries, comprising the entire forest supply chain. A summary of the above stakeholders and the extent of their interest in, and influence over forest ecosystem services are shown in Table 5.

### 4.3. Relationships of key stakeholders in the context of ecosystem services

The analysis of the interviews revealed that stakeholders tended to have different roles, either as producers, users or regulators, or a combination of these, of a range of different forest ecosystem services. To gain a better understanding of these multiple relationships, the above key government, civic, and private stakeholder groups have been analysed in relation to who makes decisions about ecosystem services either as enabler or regulator or as producer or provider, and those who use ecosystem goods and services and are affected by the decisions made (Table 6). From

the analysis of the interview transcripts, it emerged that, with the exception of the Forestry Commission and forest owning local authorities, the governmental stakeholder organisations examined, tended to be primarily enablers or regulators of forest goods and services. The woodland owning conservation NGOs were found to be mainly service providers whereas the trade bodies tended to be ecosystem services producers through their woodland and business-owning members. Certainly, all of these were also users or beneficiaries of forest ecosystem services in one way or another.

### 4.3.1. Conflicts and trade-offs between key stakeholders

In the UK, even though forest and woodland cover has increased substantially over recent decades, pressure on the forest resource has also grown. The analysis of the interview transcripts indicated that this may have resulted in growing competition in this intensively used and highly valued natural resource. Interestingly, particular tensions seemed to have arisen amongst the selected key stakeholders around transnational obligations associated with climate and natural hazard regulation, fibre, and fresh water. For example, several respondents mentioned a particular dispute over carbon ownership. One of them explained: "*the government claims ownership of all the carbon in UK woodlands as part of its Kyoto commitments. So, that is not available for the actual owners to trade because, effectively the government is trading it intergovernmental, internationally as a government*". Another area of tension seems to have occurred as a result of the 2009 EU Renewable Energy Directive. The directive required member states to increase their use of renewable energy to 20% by 2020; woody biomass was expected to play a key role in this. However, the analysis indicated that the established timber industry was increasingly concerned that the electricity generators would take timber from their feedstock and turn it into fuel wood. In fact, one of the respondents claimed that "*there is quite a lot of tension at the moment*".

The analysis suggests that there were competing interests among several members of the Defra family because they all had different international commitments linked to forest ecosystem services to fulfil. Upland heathland areas emerge as a particularly pertinent example. Natural England had been aiming to restore former heathland to fulfil its international biodiversity target. However, some of the targeted areas had only been afforested by the Forestry Commission 30–50 years ago in order to fulfil the governments' then afforestation target; the Commission seems to prefer to retain the trees to achieve the governments EU Renewable Energy and Kyoto obligations. Similarly, the Environment Agency and some water companies appear to be increasingly interested in upland tree planting to help ameliorate flooding events and to fulfil their own Water Framework Directive targets on water quality.

### 4.3.2. Collaborations and synergies between key stakeholders

The analysis also suggests that, partly due to the ever-widening scope of forestry, some of the key stakeholders were increasingly drawn into partnerships or wider networks linked to ecosystem services. This includes policy remits linked to water regulation, and renewable energy, i.e. woody biomass, and biodiversity. Catchment partnerships to improve water quality and to reduce flooding in response to the 2000 EU Water Framework Directive and networks to increase woody biomass production and usage in response to the 2009 EU Renewable Energy Directive were particular examples mentioned during the interviews. The former generally tended to be catchment scale project partnerships, often involving the Woodland Trust, the Environment Agency, the Wildlife Trusts, water companies and private landowners. The latter were local networks, frequently initiated or led by the Forestry Commission to promote wood fuel through the utilisation of existing supplier relationships between retailers, local farmers, and

other suppliers. The analysis of the interview data showed that new health-related partnerships are also beginning to form on the local level, involving local authorities, the Forestry Commission, and other public health providers.

## 5. Discussion

In this section, I first discuss some of the findings of this illustrative and exploratory study in the light of existing work, highlighting this papers' contribution. I then propose a conceptual framework for the use of systematic stakeholder analysis in ecosystem services related work. In the exploratory study presented here, stakeholder mapping was applied explicitly in order to link multiple ecosystem goods and services with particular stakeholders, using UK forestry as an example. It focused on a range of civic, public, and private stakeholders or stakeholder groups with different spheres of interests, priorities, and concerns on different scales and levels. The case study, whilst providing a useful illustrative example to promote discussion of the idea of a more systematic use of stakeholder analysis in ecosystem services research, also fills an important gap in the literature. Here, especially its attempt to assess stakeholders in forest ecosystem services on a macro to micro level addresses a gap, as most studies who include stakeholders in ecosystem services research, do so on the local level only (e.g. Asah et al., 2012, Garrido et al., 2017). Indeed, both, in ecosystem services and forestry sciences, relatively little attention has been given to the users, providers, and regulators of the various forest ecosystem goods and services on different scales.

The scope of forestry in the UK has widened considerably over recent years, continuously adding new stakeholders with a direct or indirect stake in forest ecosystem services. The alignment of these, and in a way that it sustainably balances the environmental, social and economic needs of current and future generations is complex, and requires a sound understanding of all the stakeholders involved. Thus, the forestry sector provides a particularly useful example to illustrate the importance of systematic stakeholder analysis in ecosystem services research.

### 5.1. Linking specific ecosystem services to stakeholders

The illustrative stakeholder analysis presented in this paper has highlight a number of challenges involved in clearly linking specific ecosystem services with stakeholders. In particular, the complexity involved in ecosystem services research and the relative novelty of the ecosystem services concept makes it, at times, difficult to identify stakeholders in the context of forest ecosystem services. Crucially, at the time of data collection, there was still a lively debate on what exactly constituted an ecosystem service within the academic community. A review of ecosystem services related literature by Seppelt et al. (2011), for instance, illustrates an abundant use of the term which gave rise to concerns about its arbitrary application. This difficulty is reflected in the exploratory stakeholder analysis example by the considerable range of opinions and perceptions on what constituted an ecosystem service amongst those interviewed. Comparable observations have been made by other researchers in empirical studies on the local level (e.g. Agbenyega et al., 2009, Asah et al., 2012). Asah et al.'s (2012) work, for instance, illustrates how people identify benefits in many of the same ways and categories as in the MA but also merge, or expand existing MA categories in novel ways. Accordingly, several authors (e.g. La Notte et al., 2017, Raffaelli and White, 2013) have emphasised the need for new or improved definitions and classifications. Even the latest comprehensive, collaborative global initiative to create a detailed classification and

organisation of provisioning, regulation, cultural, and supporting ecosystem services, the Common International Classification of Ecosystem Services (CICES), struggles to settle on a common operational definition and classification of ecosystem services (Danley and Widmark, 2016). Thus, other scholars have called for the use of different classifications for different purposes, adding to the complexity (Fisher et al., 2009, Costanza, 2008). Consequently, in any systematic stakeholder analysis linked to ecosystem services, it is important to set clear boundaries at the outset.

The results also suggest that most of the interviewed forestry and conservation experts are unaware of the full range of ecosystem services provided by forests, especially of the less tangible regulating services. A similar lack of awareness is also apparent as regards to cultural ecosystem services, confirming findings by other scholars (e.g. Garrido et al., 2017, Oteros-Rozas et al., 2017). Indeed, the importance of cultural ecosystem services has been described by Oteros-Rozas et al. (2017) as particularly highly context specific. While the findings of these scholars were based on local cases studies, the study presented in this paper considers the UK at a macro level, down to a micro level. Notwithstanding, as stakeholders gain more awareness and understanding of ecosystem services, their interests may change and may include ecosystem services not considered here. It is, therefore, very likely that similar stakeholder analyses will reveal more or different stakeholders. To accommodate such evolution in interests, and to better reflect the versatile nature of here, forestry, stakeholder analysis should be seen as a continuous process.

### 5.2. Multiple and competing interests and roles

The illustrative analysis is useful in highlighting the wide range of frequently multiple primary and secondary interests of an equally diverse range of stakeholders in forest goods and services, with some of them being users of services, and others producers or regulators, or a combination of these, creating interesting dynamics. The issue of multiple objectives among multiple or even the same stakeholder groups has also been reported by other scholars in different environmental management contexts (e.g. Smith et al., 1999, Duggan et al., 2013). Duggan et al. (2013), for instance, proposed that in the context of fisheries, stakeholders "were not exclusively interested in one objective but often showed dominant interests amongst fluctuating interests" (p. 65). This, however, can be a source of bias, particularly if the multiple objectives appear to be in conflict (Duggan et al., 2013). Similarly, the results of the exploratory study presented in this paper suggest that the multiple interests in forest ecosystem services of several government departments and organisations appear to have caused tensions. Conversely, there is also some evidence for increasing collaboration between several of the key stakeholders. Interestingly, the findings suggest that both conflicts and synergies frequently link to transnational obligations. Thus, it will be of interest to further map out and analyse the conflicts and synergies on various scales, in more detail.

Significantly, the findings also suggest that in the UK there is a particularly wide range of woodland owners, spanning governmental organisations, conservation NGOs, and commercial and non-commercial private owners, all of which also tend to have numerous interests in forest ecosystem services. Previous reports (e.g. IDPF, 2012) and academic articles (e.g. Lawrence and Dandy, 2014, Urquhart, 2010) have highlighted the diversity of woodland ownership in the UK, however, these were concentrating on private woodland owners. Therefore, there is still a need to examine and classify the entire range of woodland owners in more detail,

including the management objectives of public, community, and NGO ownership, as these groups also own considerable quantity of forests. This exploratory study makes a start in looking into the latter in more detail, through a more thorough investigation of the National Trust, the Woodland Trust, the RSPB, and the Wildlife Trust(s), all of which own substantial woodland. Still, further work would be useful. Similarly, there is a wide range of users of ecosystem services. However, these might be in distant locations or may belong to different functional groups on different spatial levels, necessitating a more systematic examination in future studies that transcends the local realm and encompasses different geographical and governance scales (Muradian and Rival, 2012).

### 5.3. Framework for systematic stakeholder analysis in ecosystem services research

Drawing on the illustrative example, I propose a conceptual framework for the systematic inclusion of stakeholder analysis in contemporary ecosystem services research (Fig. 1). The framework combines and builds on Hein et al.'s (2006) typology of ecological and institutional scales for ecosystem services provision and Reed et al.'s (2009) schematic representation of key steps for stakeholder analysis in natural resource management. The latter provides a three-phase model, entailing 1) the context or planning phase, 2) the application of stakeholder analysis methods phase, and 3) subsequent actions which is further developed here. However, these phases frequently overlap with potential links in different directions between the different steps. There may be feedbacks between the execution of the stakeholder analysis and the context in which it is done, or even between the different applications of stakeholder analysis methods. For example, investigating stakeholder relationships, using social network analysis, could be used to further differentiate between and categorise groups from which stakeholders can be selected for future actions (Reed et al., 2009).

#### 5.3.1. Phase 1 – planning phase

Any stakeholder analysis needs to start out by understanding the context in which it is to be conducted, by setting clear boundaries, and by having a clear purpose (phase 1) (Reed et al., 2009). The illustrative empirical example showed that in ecosystem services research it is particularly important to establish a clear focus of the issues under investigation due to the high level of complexity involved. Researcher are now not only dealing with a potentially wide range of stakeholders, but they also need to consider numerous ecosystem goods and services. Moreover, ecosystem goods and services are generated at all ecological scales and their supply affects stakeholders' at all institutional levels (Hein et al., 2006). However, institutional and ecological boundaries rarely coincide and stakeholders in ecosystem services frequently cut across a range of institutional and ecological zones and scales (Hein et al., 2006). Crucially, some types of ecosystems provide more ecosystem goods and services than others. Similarly, the same ecosystem type in one location may not provide the same services in another place. Stakeholders may also greatly vary from location to location, and scale. It is thus vital to have a clearly defined focus and purpose of the stakeholder analysis from the outset with clear system boundaries for the analysis. This phase frequently involves the participation of stakeholders. In Fig. 1, Hein et al.'s (2006) typology has been incorporated into Reed et al.'s (2009) stakeholder analysis context phase, now called planning phase.
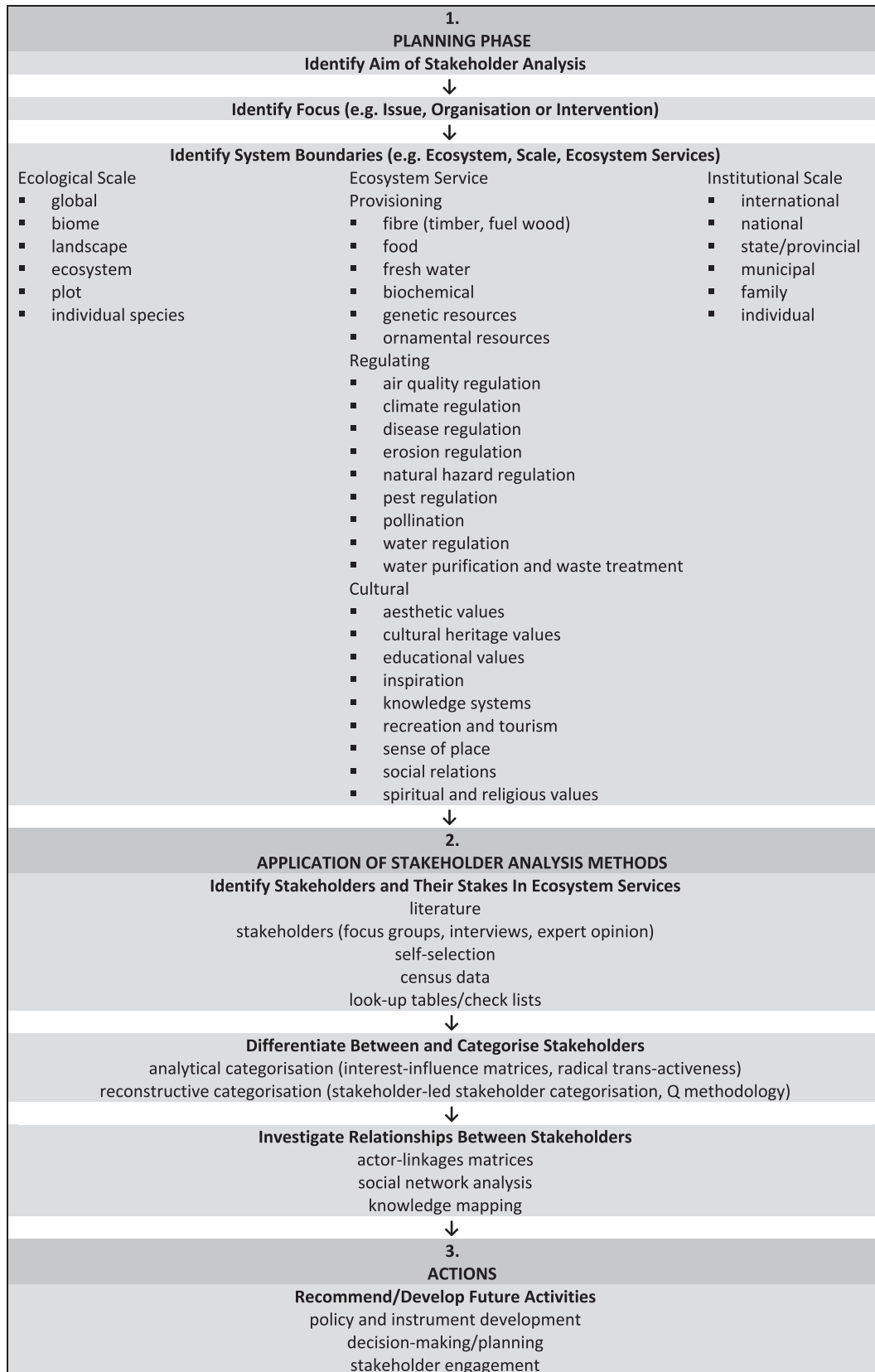
| 1. |
|---|
| **PLANNING PHASE** |
| **Identify Aim of Stakeholder Analysis** |
| ↓ |
| **Identify Focus (e.g. Issue, Organisation or Intervention)** |
| ↓ |
| **Identify System Boundaries (e.g. Ecosystem, Scale, Ecosystem Services)** |

| Ecological Scale | Ecosystem Service | Institutional Scale |
|---|---|---|
| ▪ global | Provisioning | ▪ international |
| ▪ biome | ▪ fibre (timber, fuel wood) | ▪ national |
| ▪ landscape | ▪ food | ▪ state/provincial |
| ▪ ecosystem | ▪ fresh water | ▪ municipal |
| ▪ plot | ▪ biochemical | ▪ family |
| ▪ individual species | ▪ genetic resources | ▪ individual |
| | ▪ ornamental resources | |
| | Regulating | |
| | ▪ air quality regulation | |
| | ▪ climate regulation | |
| | ▪ disease regulation | |
| | ▪ erosion regulation | |
| | ▪ natural hazard regulation | |
| | ▪ pest regulation | |
| | ▪ pollination | |
| | ▪ water regulation | |
| | ▪ water purification and waste treatment | |
| | Cultural | |
| | ▪ aesthetic values | |
| | ▪ cultural heritage values | |
| | ▪ educational values | |
| | ▪ inspiration | |
| | ▪ knowledge systems | |
| | ▪ recreation and tourism | |
| | ▪ sense of place | |
| | ▪ social relations | |
| | ▪ spiritual and religious values | |

| ↓ |
|---|
| 2. |
| **APPLICATION OF STAKEHOLDER ANALYSIS METHODS** |
| **Identify Stakeholders and Their Stakes In Ecosystem Services** |
| literature |
| stakeholders (focus groups, interviews, expert opinion) |
| self-selection |
| census data |
| look-up tables/check lists |
| ↓ |
| **Differentiate Between and Categorise Stakeholders** |
| analytical categorisation (interest-influence matrices, radical trans-activeness) |
| reconstructive categorisation (stakeholder-led stakeholder categorisation, Q methodology) |
| ↓ |
| **Investigate Relationships Between Stakeholders** |
| actor-linkages matrices |
| social network analysis |
| knowledge mapping |
| ↓ |
| 3. |
| **ACTIONS** |
| **Recommend/Develop Future Activities** |
| policy and instrument development |
| decision-making/planning |
| stakeholder engagement |

**Fig. 1.** Conceptual framework for the inclusion of ecosystem services in stakeholder analysis. Adapted from Hein et al. (2006) and Reed et al. (2009).

## 5.3.2. Phase 2 – applying stakeholder analysis methods

Once foci and clear boundaries have been set, researchers can move on to the actual stakeholder analysis phase. Reed et al. (2009) distinguishes between three different levels of stakeholder analysis applications. These are, first, the identification stage, followed by the differentiation and categorisation stage, and finally the investigation of relationships between stakeholders. These three stages have been usefully illustrated in this paper through the empirical example of stakeholders in woodland ecosystem services in the UK. Reed et al. (2009) also propose a range of available methods for each application stage and when best to use them[2]. These include literature, interviews, and focus groups for the identification of stakeholders, interest-influence matrices and Q methodology for the differentiation between and categorisation of stakeholders, and actor-linkages matrices and social network analysis for investigating relationships between stakeholders. The choice of methods used depends on the exact purpose of the stakeholder analysis, the resources available, and the skills of the researcher(s) (Reed et al., 2009). Methods range from those that can be used easily and rapidly with little technical expertise or resources (e.g. interest–influence matrices and actor linkage matrices) to methods that are highly technical and rely on specialist computer software (e.g. social network analysis). Illustrations of the former have been given in the exploratory empirical example. Although the less technical methods often offer less precision, this may be deemed acceptable in some circumstances (Reed et al., 2009). In fact, the illustrative example presented in this paper, showed that even simple exploratory approaches can provide very useful insights. Moreover, stakeholder analyses may be undertaken with or without the involvement of stakeholders or with part involvement in certain aspects of it.

## 5.3.3. Phase 3 – future actions

The findings of systematic stakeholder analysis in ecosystem services research can then be used to recommend or develop future activities, such as new policies or policy instruments linked to ecosystem goods and services or decision-making strategies. For example, a systematic stakeholder analysis can help specify who should be involved in a specific policy or decision-making process and why. Ecosystem service users/beneficiaries and providers are dispersed horizontally across sectors and vertically at multiple governance levels (Loft et al., 2015), requiring a thorough understanding of all those involved. Moreover, ecosystem services related decisions frequently involve trade-offs between different objectives and values held by different groups of stakeholders or individuals, and at different scales, some of which may not be well represented in the process (Jacobs et al., 2016). Others may not even be recognised or acknowledged at all. However, only when all the stakeholders and their differing economic, social and environmental interests in ecosystem services are fully recognised, can stakeholders be more equally represented or involved in decision-making and land use planning. For example, specifying and mapping the demand and supply of ecosystem services amongst different stakeholders may aid locally beneficial, balanced, and equitable multi-functional land use decisions (Sarkki et al., 2017). Only when there is a clear understanding of which ecosystem services are provided and where (Paavola and Hubacek, 2013), and who produces and/or uses or otherwise ben-efits from them, can synergies and trade-offs between ecosystem services be assessed and addressed. Moreover, the partitioning of stakeholders based on their similarities in specific stakeholder characteristics, such as their roles, degrees of power, their management objectives, or their level of operation can assist a range of ecosystem services governance and/or management processes and strategies. For example, the partitioning of stakeholders into functional groups, for instance, according to their respective professional characteristics and interests in ecosystem services may inform the development of policy instruments, such as payments for ecosystem services (PES). It may also inform the design of a multi-user communication interface for ecosystem services management (Duggan et al., 2013).

## 6. Conclusion

In this paper, I endeavoured to corroborate ecosystem services research with systematic stakeholder analysis. Although the scope and exploratory nature of the systematic stakeholder mapping/analysis presented here means that the findings are illustrative rather than representative, they still provide useful information of a wide range of stakeholders in forest ecosystem services on different levels, filling a gap in the forestry literature. The results also provide a baseline for further investigations linked to forest ecosystem services in the UK and using more complex participatory or quantitative techniques. These may include a more detailed analysis of the new communities of interests in forest ecosystem services and of the conflicts, synergies, and trade-offs linked to forest ecosystem services. Moreover, the research found that there is still a general need for a clear and common definition and classification of ecosystem services inasmuch as it has been challenging to work with those currently available.

The increasing use of ecosystem services thinking requires a thorough understanding of the various stakeholders involved in governing or managing ecosystem services, making a more systematic use of stakeholder analysis necessary. However, due to the high level of complexity involved, the application of systematic stakeholder analysis in ecosystem services research needs careful consideration and planning. The comprehensive framework presented here assists the systematic and detailed identification of stakeholders in ecosystem services, the assessment, and comparison of their particular sets of interests, influences and roles, and the consideration and investigation of relationships between them. It is hoped, that this paper will stimulate further discussion and work on a more systematic use of stakeholder analysis in ecosystem services research.

## Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.ecoser.2018.01.001.

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[2] See Reed et al., (2009), p. 1936, for a schematic representation of the rationale, typology and methods for stakeholder analysis, and p. 1937 for the resources required, the level of stakeholder participation, and the strengths and weaknesses of each of the methods identified in the typology.

**Appendix 1**

Stakeholders Interested in Woodland Ecosystem Services in the UK.[*]

| NATIONAL LEVEL ORGANISATIONS | Interest/ES stakes |
|---|---|
| 1. Acres Wild Woodland Ltd | tourism |
| 2. Association of National Park Authorities | recreation, landscape aesthetic values |
| 3. Bangor University | education |
| 4. British Horse Loggers | timber, education |
| 5. Community Forests (England) | recreation, education, hazard (flood) regulation, fuel wood |
| 6. **Confor – Confederation of Forest Industries** | timber, climate regulation, fresh water, and biodiversity |
| 7. Coppice Resources Ltd | timber |
| 8. **Country Landowners and Business Association** | no mention on website…, but reinstated by interviewees…timber, climate regulation, aesthetic, + biodiversity |
| 9. Crops4Energy | fuel wood |
| 10. **DECC** | climate regulation (carbon), fuel wood, air quality regulation |
| 11. **Defra** | no mention of …, but reinstated by interviewees – fresh water, air-, climate-, hazard-, and pest regulation, timber, fuel wood, recreation, aesthetic, and biodiversity |
| 12. (Drax Power Ltd) | fuel wood, however, at the time they used primarily timber from abroad |
| 13. **Environment Agency** | no mention of …, but reinstated by interviewees - air-, water and hazard regulation, fresh water |
| 14. Euroforest Ltd | timber, fuel wood |
| 15. Forest Carbon Ltd | climate regulation (carbon) |
| 16. Forest Education Initiative | education |
| 17. Forest Fuels Ltd | fuel wood |
| 18. **Forest Stewardship Council** | timber, fibre, and biodiversity |
| 19. Forest Tree Seed Consultancy | (education) |
| 20. **Forestry Commission** | timber, fuel wood, climate regulation, landscape aesthetic, recreation, and biodiversity and health benefits |
| 21. Forestry Contracting Association | timber, fuel wood, fibre |
| 22. Fountain Forestry Ltd | timber |
| 23. Iggesund Paperboard (UK) Ltd | fibre |
| 24. Institute of Chartered Foresters | education, recreation, knowledge systems |
| 25. Logshed Ltd | timber, fuel wood |
| 26. National Coppice Federation | fuel wood |
| 27. National Forest Company | climate regulation (carbon), landscape aesthetic, recreation |
| 28. **Natural England** | no mention of …, but reinstated by interviewees – aesthetic values, recreational access, and biodiversity |
| 29. Renewable Energy Association | fuel wood |
| 30. Royal Forestry Society | timber, education |
| 31. **Royal Society for the Protection of Birds** | aesthetic values, fresh water, climate and hazard (flood) regulation, and biodiversity and habitat provisioning |
| 32. Small Woods Association | timber, recreational access |
| 33. Stove Industry Alliance | fuel wood |
| 34. Strawsons Energy | timber, fuel wood |
| 35. Sylva Foundation | timber, education |
| 36. **The National Trust** | recreational access, education, heritage, fuel wood, and biodiversity |
| 37. The Royal Forestry Society | education |
| 38. The Tree Council | education |
| 39. The University of Edinburgh | timber, education |
| 40. **The Wildlife Trusts** | education, fresh water, climate and hazard (flood) regulation, and biodiversity |
| 41. **The Woodland Trust** | climate and hazard (flood) regulation, fuel wood, fresh water, and biodiversity |
| 42. Timber Auctions | timber |
| 43. Timber Trade Federation | timber, education |
| 44. UK Forest Products Association | timber |
| 45. UK Timber Ltd | timber, fuel wood |
| 46. Underwoodsman | timber, education |
| 47. University of Aberdeen | education, knowledge systems |
| 48. University of Oxford/Forestry Institute | education, knowledge systems |
| 49. Willowcraft and Woodlands | timber, education, inspiration |
| 50. Wood for Good | timber |
| 51. Wood Panel Industries Federation | timber |
| 52. Woodland Heritage | timber |
| 53. Woodland Ways | education, recreation |
| *EXAMPLE REGION – West Sussex* | |
| 54. Absolute Arboriculture (tree surgeons) | fuel wood |
| 55. A&G Lillywhites (sawmill) | timber |
| 56. Arbo Tree Surgeons (West Sussex) | fuel wood |
| 57. Bioregional | timber, wood fuel |
| 58. Broadleaf Tree Surgeons (West Sussex) | timber, fuel wood |
| 59. Cimitree Furniture Ltd (West Sussex) | timber, fuel wood |
| 60. County Tree Surgeons | fuel wood |
| 61. Green Corridor (West Sussex) | education, recreation |
| 62. High Weald AONB Unit | landscape aesthetic values |

**Appendix 1** (*continued*)

| NATIONAL LEVEL ORGANISATIONS | Interest/ES stakes |
|---|---|
| 63. Kevin Twelvetrees (tree surgeons) | timber, wood fuel |
| 64. KPS Contractors Ltd (tree surgeons) | fuel wood, pest- and water regulation (wood mulch) |
| 65. Northwood Forestry (sawmill) | timber, fuel wood |
| 66. South Downs National Park Authority | aesthetic values, heritage value |
| 67. South East Forestry | timber |
| 68. South East Wood Fuels Ltd | fuel wood |
| 69. South East Woodland Archaeology Forum | heritage |
| 70. Sparks Farm Tree Surgery | fuel wood |
| 71. Stubbs Copse Wood Yard | fuel wood |
| 72. Storrington Sawmill | timber, fuel wood, pest- and water regulation (wood mulch) |
| 73. **Sussex Wildlife Trust** | education, fresh water, climate and hazard (flood) regulation, and biodiversity |
| 74. Surrey and Sussex Coppice Group | timber, education |
| 75. The Balcombe Estate (Hayward's Heath) | timber, fuel wood, cultural- and spiritual values (Christmas trees) |
| 76. Twineham Timber (sawmill) | timber, fuel wood |
| 77. Uridge Tree Surgeons | fuel wood, pest- and water regulation (wood mulch) |
| 78. Vert Wood Community Woodland | education, timber, social relations |
| 79. West Dean Estate | timber, fuel wood |
| 80. **West Sussex County Council** | air regulation, recreation, aesthetic values, fresh water, and noise reduction, health benefits, and biodiversity |
| 81. W L West & Sons Ltd (Petworth, Surrey) | timber |
| 82. Woodcraft School | education, recreation |
| 83. Woodlands Skills (Sussex) | education, recreation |

\* Please note that only stakeholders who specifically mentioned woodlands or forests, and one or more ecosystem services from Table 1, on one or all of the three webpages at the time of data collection, were kept on this list, except for those who were added by the interviewed experts.

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