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Biodiversity and cultural ecosystem benefits in lowland landscapes in southern England

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Evidence of the link between biodiversity and cultural ecosystem benefits (CEB) is scarce. Participatory workshops were used to explore perceptions of CEB attributable to biodiversity in lowland arable and semi-natural grassland landscapes in southern England. Increased biodiversity was found to be associated with greater perceived benefit, mainly at the habitat and landscape scale. It was, however, difficult to separate the effects of biodiversity from those of abiotic and human-made features, all of which combined to provide an important sense of place. Furthermore, CEB were strongly linked with supporting infrastructure, notably public access. It was observed that CEB were generated through socio-psychological 'pathways' as people interacted with environmental settings, such as acquiring knowledge, feeling regenerated and communicating with others. CEB were also attributed to provisioning and regulatory services, questioning the validity of partitioning cultural services. The findings have implications for practitioners designing programmes to enhance nature's contribution to people.

1. Introduction

While there is general acceptance of the potential benefits to people of interacting with nature and wildlife (MacKerron and Mourato, 2013; Russell et al, 2013; Wheeler et al, 2015), the relationship between biodiversity and benefits is less well prescribed (Clark et al, 2014; Lovell et al, 2014; Sandifer et al, 2015). In the ecosystem services framework (MA, 2005; UKNEA, 2011), biodiversity is considered to be a supporting service that underpins a range of final services, usually classified into provisioning (e.g. food supply), regulating (e.g. flood control) and cultural (e.g. aesthetics) services. Various assessments (e.g. MA, 2005; TEEB, 2010; UKNEA, 2011; UKNEAFO, 2014) have helped to improve knowledge on the links between provisioning and regulating ecosystem services and human wellbeing. However, the relationships between ecosystems, cultural ecosystem services (CES), and cultural ecosystem benefits (CEB)

are less well understood. More specifically, knowledge of the extent to which variation in biodiversity, and therefore potentially biodiversity loss, affect CEB is particularly scarce and constitutes an area of active research (Bullock et al, 2011; Keniger *et al*, 2013; Lovell et al, 2014). This is partly due to the challenge of defining the concept of CES and formulating a definition of biodiversity relevant for the measurement of nature-culture interactions and benefits.

According to Church et al (2014), CES comprise environmental spaces, customs and practices that define identities and underpin human capabilities and experiences. The nature-culture relationship (Fish, 2011) is mainly one of interpretation and interaction, shaped by the ideas, beliefs, values and knowledge that make up shared understanding at a point in time. Culture in the anthropological sense means 'shared modes of believing and doing' (Coates *et al*, 2014). Thus, the nature-culture nexus reflects a dynamic combination of inherited traditional and contemporary modern values, beliefs, understandings and behaviours, predicated on some interaction with the natural environment.

Despite the practical difficulty of valuation, CEB are perceived to be highly valued and present some of the most compelling reasons for conserving ecosystems (Holt *et al*, 2011; Calvet-Mir *et* al, 2012; Chan *et al*, 2012). CEB are diverse and include psychological restoration (Kaplan, 1995; Hartig *et al*; 2003; White *et al*, 2013), improved physiological health (English *et al*, 2008; Jordan, 2009; Hanski *et al*, 2012), better social relations (Kuo & Sullivan, 2001; O'Brien & Murray, 2006; Morris & Urry,

2006; Weinstein et al. 2015), and spiritual development (Bhagwat, 2009; Lewicka, 2011).

A particular challenge is to ascertain whether CEB are sensitive to variations in biodiversity. Biodiversity is formally defined as the "variability among living species from all sources ... and the ecological complexes of which they are a part; this includes diversity within species, between species, and of ecosystems" (CBD, 1992; 2013). From a cultural perspective the perception of value given to biodiversity is, as Church et al. (2014) suggest, likely to be strongly influenced by a plethora of environmental and human factors.

Various studies indicate that biodiversity plays a role in the appreciation of natural areas (Collar, 2003) and the provision of psychological stimulus (Fuller *et al*, 2007). Different people have different preferences for scenery and landscape (Kaplan & Kaplan, 1989) and generally respond more favourably to natural settings that possess a high level of complexity (Han, 2007). More specifically for example, Lindemann-Mattias et al (2010) showed that members of the public can detect changes in species richness and evenness in arrays of grassland plants, and expressed a preference for more diverse arrays.

Richness and coherency in environmental settings are shown to enhance the beneficial human experience of exposure to nature. Studies have indicated benefits associated with diverse nature views (Ulrich, 1984), nature smells (Burgess, 1995; Oreszczyn & Lane, 2000), nature sounds (Yamada, 2006; Irvine *et al*, 2009), taste (Weiss, 2011) and nature

contact (Macnaghten *et al*, 1998; Williams & Harvey, 2001; Bell *et al*, 2003). Exposure to 'natural settings' is known to help recovery from fatigue and stress (Kaplan, 1995).

Various psychological models attempt to explain human responses to the natural environment and its plants and animals (Gifford, 2014), identifying the extent to which these are inherited and/or learned. Cognitive models (Vaske & Manfredo; 2012) see human behaviour towards other species as formed by a hierarchy of beliefs, values, attitudes and norms, and a range of typologies of attitudes, perspectives, and responses to nature and wildlife have been proposed (Kellert, 1996; Attfield, 2003; Teel & Manfredo, 2009). Similarly, Jacobs (2009; 2012) considered the origins and function of emotion-based responses to wildlife, and how these interact with cognitive processes to explain why people may like or dislike certain animals. Manfredo and Vaske (1995) had earlier developed a model of recreational interactions with wildlife-based motivational forces that people acted upon in order to derive satisfaction and utility.

A range of theories have been developed to account for preference at the landscape scale. For example, evolutionary theories see preferences as mainly hereditary and innate (Appleton, 1975; Orians, 1980; Wilson, 1984), whereas cultural theories regard landscape preferences as socially produced (Tuan, 1974; Bell, 1999; Carlson, 2009). Landscape preferences are also linked to the concept of 'sense of place', representing the social and psychological relationships between people and particular environmental settings (Castree, 2009; Acott & Urquart, 2014; Gifford, 2014). The emotional meanings and attachment towards a particular place, often built up over time through processes of reciprocity (Eisenhauer et al, 2000), influence the value attributed to place-

specific landscapes, wildlife, heritage, memories, and activities. Furthermore, developing local identity and distinctiveness of place can help to support the sustainable management of natural resources (UKNEA, 2011 p666; Forest of Bowland AONB, 2013).

It is clear from the foregoing that much has been achieved to conceptualise the social and psychological interactions between people and nature, both at the landscape and species scales. The cognitive and emotional processes that underpin this interaction strongly affect perceptions of value and the benefits derived from encounters with nature and biodiversity. However, while there is some evidence to show links between biodiversity and CEB, it is not yet regarded as sufficiently complete or robust to inform environmental or health policy (Lovell *et al*, 2014; Cracknell et al. 2015).

In this context, the UK Natural Environment Research Council has sponsored research on the relationships between biodiversity and ecosystem services through its Biodiversity and Ecosystem Service Sustainability (BESS, 2014) Programme. Within this, as part of the Wessex-BESS project (Wessex-BESS, 2015), we are assessing the links between biodiversity and the generation of a range of CEB in lowland calcareous grasslands and farmed areas in the Salisbury Plains Area of Wiltshire in southern England. We report here on a series of exploratory workshops held in the study area with local residents, the objectives of which were to answer the following research questions:

- RQ1: What understandings do people have of biodiversity?
- RQ2: What are the links between biodiversity and the generation of CEB?
- RQ3: Do CEB vary along a gradient of biodiversity?

We first describe the methods used to address our research questions, including the use of a simple conceptual framework and the organisation of our workshops. We then present our key results, discuss their implications and draw conclusions regarding the relationship between biodiversity and human wellbeing in managed landscapes.

The subject matter is of specific interest to researchers focussed on CES as a relatively new topic of enquiry, and more generally for those interested in exploring the relationship between biodiversity and human wellbeing in the context of managed landscapes.

2 Methods and materials

2.1 Conceptual framework

Following an initial review of literature, we developed a broad conceptual framework to represent the links between ecosystems and CEB to people, with particular reference to biodiversity as a supporting service. Definitions of CEB vary mainly according to views about positioning and connectivity within the ecology-human interface. CES have been variously viewed as: non-material *benefits obtained by people from ecosystems* (de Groot *et al*, 2005 in Millennium Ecosystem Assessment); a *contribution by ecosystems*

to non-material benefits (e.g. capabilities and experiences) arising from human-ecosystem relationships (Chan *et al*, 2011 in Natural Capital Project); *environmental settings* (Church *et al*, 2011 in UKNEA); and environmental spaces and cultural practices *that give rise to* material and non-material benefits (Church et al, 2014 in UKNEAFO).

With an emphasis on economic valuation, UKNEA (2011: p647) distinguished between environmental settings, defined as broad landscapes and habitat types, as the final ecosystem *service* and the flows of cultural *goods* that generate *benefits* for people, with consequences for wellbeing. The UKNEA typology of cultural *goods* includes: leisure, recreation and tourism; health, heritage, education and knowledge, and religious and spiritual goods. The UKNEA (2011:654) reviews evidence to show the link between environmental settings, the provision of cultural goods, and the contribution to wellbeing.

Recognising that exposure to natural environments has important social, psychological, and biophysical effects (Hanski *et al*, 2012; English *et al*, 2008), we build upon the UKNEA definition of environmental settings as contexts that comprise combinations of biological (biotic) and geophysical (abiotic) structures and processes, and human-formed interventions that make up distinguishable landscapes and habitats (UKNEA, 2011). Biodiversity, namely the type, mix and relative abundance of taxa and species, is a core component of the stock of biotic natural capital. Thus, the environmental setting is the context specific final CES. People interact, directly or indirectly, with

environmental settings as individuals or as members of communities. In so doing there is potential to co-produce a range of cultural ecosystem 'goods', that is all use or non-use outputs from ecosystems that have value to people (UKNEA, 2011: p17), such as a day's recreation in the countryside, an educational visit for grown-ups, or the preservation of a heritage site. Interaction in turn has potential to generate a range of socio-psychological and physical benefits for the individuals concerned, such as feeling knowledgeable, restored, or belonging. Conceptually, the latter are changes in 'state' that are generated through socio-psychological 'pathways' that transform ecosystem goods into CEB. Hence, we distinguish between pathways as a process and benefits as a state. In turn, CEB can contribute to human wellbeing, defined in terms of material needs, mental and physical health, social cohesion, security and resilience (MA, 2005; UNDP, 2015). Although much of the literature treats CEB as non-material, we argue that CEB can have an important material aspect associated, for example, with reductions in health care expenditure attributable to improvements in mental and physical health obtained through engagement with nature.

Whilst our approach adopts the ecosystem services framework, it is not constrained by the economist's interpretation of welfare gain or loss due to changes in biodiversity. Neither is it limited to an instrumental view of nature-human interactions of the kind criticised by Cooper et al, (2016) for failing to consider aesthetic and spiritual values. It does, however, purposely adopt a quasi-utilitarian approach (Perman et al, 2011) that explores how engagement with nature, and the avoidance of biodiversity loss, can make

people feel better off, thereby emphasising 'nature's contribution to people' in its broadest sense (Pascual et al, 2017).

Empirical research (Table 1) and document analysis show that CES benefits are gained through diverse pathways, akin to *interpretative repertoires* or themes that people repeatedly use to 'characterise and evaluate actions, events and other phenomena' (Potter and Wetherell, 1987: p149). We identify six recurrent benefit pathways in CES literature, namely: cognitive, creative, intuitive, retrospective, regenerative and communicative (Table 1), using them to explore interactions between salient aspects of lowland ecosystems in the study area and perceived benefits.

Table 1: Interpretative Pathways to CES benefits and associated recurring themes evident in research and related literature

CES pathways	**Associated themes by example source**						
	de Groot *et al*, 2002	**Alcamo, 2003**	**Chiesura, 2004**	**MA, 2005**	**Natural England, 2009**	**Church *et al*, 2011**	**Chan et al, 2012**
Cognitive	Science & education	Knowledge systems Education values	Norms & values		Learning	Education and ecological knowledge	Education and research
Creative	Aesthetic Information Artistic & Cultural	Aesthetic values Inspiration	Freedom	Aesthetic appreciation Inspiration	Inspiration		Artistic
Intuitive		Spiritual & religious value	Self-development Norms & values	Spiritual services	Spiritual Escapism	Religious and spiritual	Ceremonial
Retrospective	Historic & Spiritual	Cultural heritage	Ideals	Heritage values	Sense of history	Heritage	
Regenerative	Recreation	Recreation & Tourism	Recreation Psycho-physical health	Recreation & tourism	Leisure and activities Calm	Leisure recreation and tourism	Recreation Subsistence

Communicative	Cultural Diversity Sense of Place Social relations	Cultural Identity Social contact	Cultural identity	Sense of place

The *cognitive* pathway includes the development of knowledge and understanding that is gained through our interaction with nature. This ranges from learning experiences for children (O'Brien & Murray, 2006) to scientific understandings of ecological stability and dynamics (Bullock *et al*, 2011) and teaches us about ourselves, society, or the natural world. The *creative* pathway is associated with new and original experiences that inspire and support aesthetic appreciation, artistic expression and freedom (Ihsea and Lindahl, 2000; Zhang *et al*, 2014). The *intuitive* pathway is associated with human instincts, sensual experiences and feelings, often of a spiritual and religious nature, closely tied to the development of self, norms, and ideals (Williams and Harvey, 2001) and with diverse physical and mental experiences (Burgess, 1995; O'Brien, 2004) many of which are according to Collar (2003) 'essentially immeasurable'. The *retrospective* pathway provides benefits through personal memories and reflections on the past in which the environment is a living archive of human activities and cultural evolution (English Heritage, 2009). The *regenerative* pathway provides opportunities for recreation, psycho-physical health, leisure, tourism, escapism leading to restorative outcomes such as the alleviation of fatigue and emotional stress (Macnaghten *et al*, 1998; Kaplan, 1995; Berto, 2005; Korpela *et al*, 2007), and improved physical and mental wellbeing (Hanski *et al*, 2012; Natural England, 2014). Finally, the *communicative* pathway provides benefit through social relations and contact, cultural

identity, and sense of place. Here, social interactions are influenced by natural features (Coley *et al*, 1997; Kuo and Sullivan, 2001; Kuo, 2003) including opportunities for nature linked volunteering (Edwards *et al*, 2008).

Thus, we focus here on socio-psychological pathways to cultural benefit, exploring whether variations in ecosystem biota, that is biodiversity, both within and between environmental settings, result in variations in perceived CEB.

. 2.2 The study area

The Salisbury Plain area was selected as a suitable location to explore the links between biodiversity and ecosystems services in multifunctional landscapes, facing competing pressures of use and development commonly found in less exceptional landscapes (Wessex-BESS, 2015). The area comprises 1,400km^2 of rolling chalk land, small hilltop woodlands and rivers within narrow floodplains in the vicinity of Salisbury, England (Figure 2). The landscape contains a mix of arable land, improved agricultural grassland, extensively managed grassland undergoing biodiversity restoration, and species-rich ancient grassland. The latter, especially Salisbury Plain, accounts for 50% of all calcareous grassland in the UK, making it the largest expanse of chalk downland and semi-natural dry grassland remaining in Europe (English Nature, 2005). The area contains internationally important prehistoric ritual landscapes, earthworks and monuments, including the Stonehenge World Heritage Site designated in 1986 (UNESCO, 2016). Salisbury Plain has been used for military training since the Napoleonic Wars, helping to secure large tracts of natural grassland, although restrictions are imposed on public access.

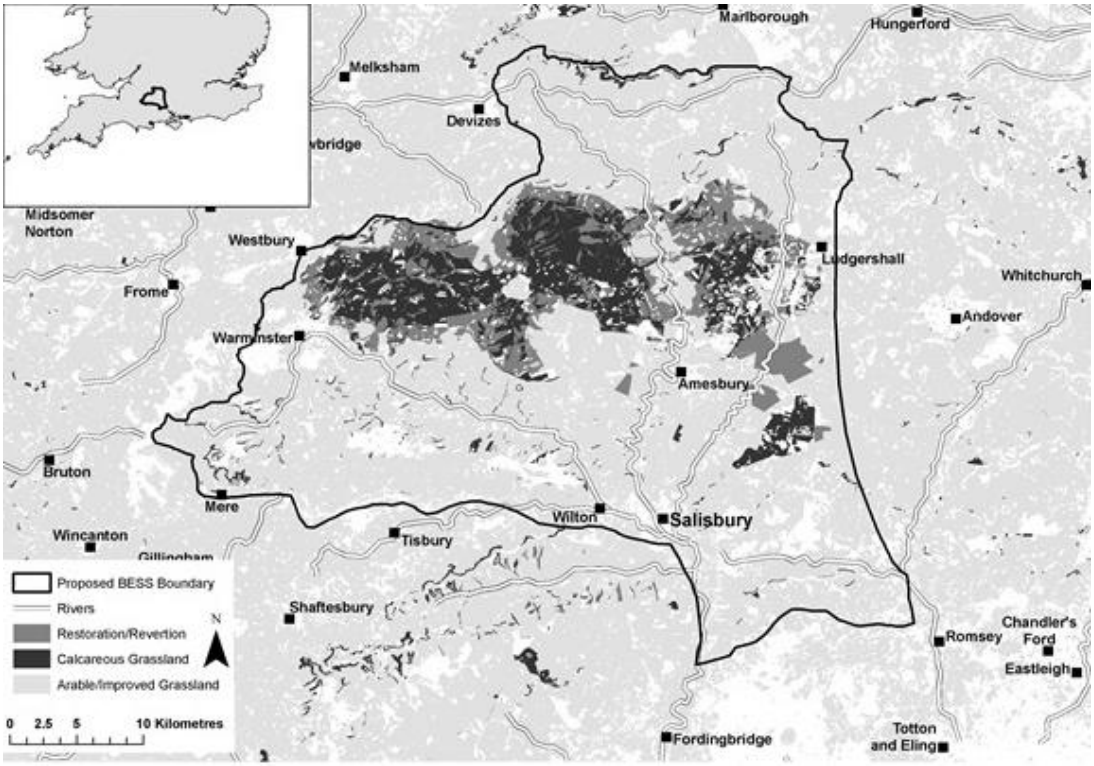

Figure 2: The Wessex –BESS study site in Wiltshire, southern England

For the purposes here, we explore the links between CEB and biodiversity with respect to two main environmental settings identified in UKNEA (2011), namely 'enclosed farmland', comprising arable and agriculturally improved grasslands, and 'semi natural grasslands'. In our study area, the latter are relatively undisturbed ancient grasslands that are mostly 'remnants of traditional farming practices and the product of thousands of years of human interaction with land and nature' (UKNEA, 2011: p172). We also considered 'restoration grasslands' as a transition between these two main settings, involving actions to reinstate lost or degraded ancient grasslands. In this context, we use arable land use, restoration grassland and ancient grassland to represent three gradients of low, medium, and high biodiversity in order to assess responses to variations in biodiversity.

2.3 Workshop organisation

Participatory workshops were considered an appropriate interactive method (Robson, 2010; Bryman, 2012) to explore perceptions, preferences and broad assessments of the value of biodiversity in the context of local environmental settings. They were designed to inform subsequent survey-based enquiry, including a web-based survey and formal face-to-face survey of the general public (Wessex-BESS, 2015).

Three workshops took place in 2013, in Salisbury City and in the villages of Seend and Amesbury respectively. Mail shots, posters, emails and social media postings were used to recruit participants, targeting the membership of local organisation and clubs, and inviting the general public through community centres and other meeting places. Participants were required to have lived or worked in the local area for at least two years and expected to be generally interested in the local countryside.

The workshops took participants through a series of planned individual and group activities, supported by visual material and response worksheets. Held in the early evening in convenient, comfortable and suitably equipped meeting rooms, the workshops facilitated knowledge exchange, participant interactions and shared insights, supported by two researchers throughout. The workshops were designed to inform subsequent survey-based enquiry, including a web-based survey and formal face-to-face survey of the general public (Wessex-BESS, 2015).

Forty two people volunteered to take part: Salisbury 17, Seend 14 and Amesbury 11. Sixty percent were men and 40% women, mainly aged between 30 and 60 years,

predominantly white adults of British origin (in line with over 95% of the area's adult population). The majority had direct interest in nature and the countryside, through employment, hobbies, group membership, or nature related qualifications (Table 2). Thirteen participants had graduate or equivalent qualifications. As such the participants probably exhibited relatively high interest in and knowledge of the study topic relative to the general population. While the responses of this self-selected and well informed group cannot be assumed to be representative of the whole population, it provided a valid cohort for exploring local CES-biodiversity interactions and informing subsequent approaches to assess perceptions of CEB amongst less nature-oriented respondents.

Table 2: Proportion of workshop participants involved in countryside/nature related employment, hobbies or groups

Workshop location	% who were members of countryside/ nature groups	% of participants employed in countryside/ nature sector	% of participants with countryside / nature education or training	% of participants with countryside/ nature hobbies and activities
Salisbury	76%	35%	29%	76%
Seend	71%	64%	57%	100%
Amesbury	82%	36%	46%	100%
Total	76%	45%	44%	92%

Each workshop lasted about two hours, beginning with a plenary session (20 - 25 minutes) to explain the purpose of the workshop, allow participants to introduce themselves, and help develop a broad understanding of 'CES' and 'biodiversity' (Photo 1). This was followed by three activities that generated qualitative assessments of biodiversity and environmental settings. Further details of the response sheets, visuals, and compiled responses are available in King *et al*. (2013).

Photo 1 : Workshop participants : Activities 1 and 2

Activity 1 (15-20 minutes) addressed aspects of RQ1 and RQ2 above by obtaining insights on preferences, values and perceived benefits of landscape and biodiversity. Participants were divided into two groups. Group One was given a set of six A4 size photographs of landscape features that are characteristic of the study area, namely wildflower meadow, clover pasture, cracked (dry) earth, hillside, white horse carved in chalk hillside, hedge and track (see King et al, 2013). Participants were asked individually to complete a tabulated response sheet with rows for each image and columns to be filled with key word or phrases indicating activities associated with each image (such as walking or farming), and whether the image engendered responses indicative of potential CEB pathways. These included: feeling inspired; learning about nature; having a sense of freedom; reflecting on the past; and feeling connected to nature. Group Two was given five photo montages of species found in the study area, with each montage comprising bees, spiders, birds, butterflies and moths, and mixed invertebrates. Using a one page tabulated response sheet with images as rows,

participants were asked to provide written key words or phrases in columns that asked: whether they preferred some, all or none of the particular creatures; whether they considered them friends or pests; whether the creatures had any useful role to play; whether they preferred to see, hear or touch them; how important it was to know they existed; and whether anything can be learned from the creatures. A sequential, tiered method was used to elicit key themes from Activity 1 (Silverman, 2006). The written scripts from the response sheets of each respondent (tier 1) were transferred verbatim into Microsoft Word format. These were then classified (tier 2) according to common responses, themes and descriptions, and transferred (tier 3) to a Microsoft Excel spreadsheet environment in order to classify and assess the type, frequency, and associations of self-reported responses, including CEB pathways.

Activity 2 (30 minutes) addressed RQ2 by collecting information on environmental features of importance to participants. Wall-mounted enlarged copies of Ordnance Survey maps and Google Earth photographs of the study area were provided. Participants placed numbered stickers on locations of interest. Using a one page tabulated response sheet they were asked to name and describe each numbered location and provide a written comment of anything of interest to them about the site, what they liked/disliked about it, what they did there, what experiences they had there, or any other issues such as perceived development pressure. This activity was relatively unstructured to allow issues of importance associated with place to emerge. Once again, a tiered approach, as reported above, was used to assess the type and frequency of

common themes and associations. Map points were digitised and used to support spatial analysis (not reported here).

Activity 3 (30 minutes) addressed RQ3 by gathering perspectives on biodiversity gradients in the Wessex-BESS study area associated with three 'countryside types' represented by arable farmland, restoration grasslands, and ancient grasslands. Large wall mounted landscape photographs of each were supported by short descriptions of key features such as land use, plant and animal species, soil condition and resilience to climate change. Participants were asked to place one sticker for each countryside type on a feature that in their view was particularly important. They then individually completed a response sheet, using key words or short phrases to identify self-assessed differences between the three types of countryside, what activities they associated with each, and whether some offered more or better options for recreation, learning, inspiration and other experiences. They were also asked about the importance of public access. A final question sought views about the current balance of the three countryside types in the area, and what they might like to see changed. The word contents of the response sheets were first transcribed into Microsoft Word format (tier 1) and then into columns of text in a Microsoft Excel spreadsheet (tier 2). They were then codified into key words and descriptors (tier 3) used to classify responses by type of activity, experience, and CEB pathway.

Following a 10 minute roundup, participants completed an evaluation of the workshop proceedings. They generally found the workshop stimulating and enjoyed its varied and

visually supported aspects. Some remarked that completing the response sheets was quite demanding, although overall completion rates exceeded 85%.

All activities involved individuals recording their own responses on worksheets mounted on portable clipboards. It was made clear that verbal or written responses were anonymous and non-attributable. Activities 2 and 3 involved free movement around the workshop room, with lots of discussion amongst participants, sharing both information and opinions. Tea and refreshments were provided between Activity 2 and 3. Response sheets were collected at the end of each activity. Results from the three workshops were combined for the purpose of analysis. Some of the verbatim responses are included in the tables below and in quotation marks as shown.

3 Results

3.1 RQ1: Understandings of biodiversity

With respect to RQ1, responses from Activity 1 (Group Two) showed relative preferences, perceptions of functionality, and potential benefit of selected species groups. For example, of the 42 participants who attendant the workshops, most expressed a liking for all butterfly and moth (37), bee (42), and bird (42) species shown in the images provided. About half (23) liked spiders, but ten stated they did not like them or were afraid of them. Invertebrates generated a mixed response, with preferences for those with bright colours, but against those perceived to be a pest. Some participants had well defined preferences for particular species of birds: nine people, for example, particularly liked owls.

Sight was the most common sense used for appreciating wildlife, with almost all participants (37) preferring sight to other sensory interactions with the different species groups. About half of the participants said they also liked to hear birds (22), and bees (19). Overall, most participants (37) generally felt that the existence of all species groups was important even if they could not be seen or heard. No more than five participants liked to touch the creatures in any of the species group, mainly because this was considered to be "inappropriate" and "interfering" with nature.

The most commonly perceived functions across all species groups were that the species were seen to be important as part of a "natural balance" or "balanced ecosystem", as well as important in "giving pleasure" to people. Functional homogeneity was perceived to be greatest for bees with nearly all the participants identifying honey production, pollination, and giving pleasure to people as important functions. About half of the participants (20) reported a functional role for spiders but did not say what this was.

Nearly all (at least 40) participants considered that butterflies and moths, birds, spiders and bees provided opportunities for learning, but only half (22) thought this in the case of mixed invertebrates. Opportunities included learning about ecosystem health and quality and interdependencies (including predator-prey relationships), with specific contributions such as the "complex life histories" of butterfly and moths, the "web construction" of spiders, and the "flight" of birds. Behavioural aspects such as the "perseverance" of spiders and the "work ethic" and "community living" of bees were also mentioned as learning opportunities.

Almost all (39) participants viewed butterflies and moths as ‘friends’, because they were “attractive” and “not harmful”. Bees were appreciated by almost all (41) participants because they were “crucial” and “beneficial”. Despite the mixed reactions to spiders, most participants considered them to be friends. However, whether mixed invertebrates and birds were considered friends or pests also depended on perceptions of the negative effect on agriculture (5 participants). Fifteen participants also made references to the plants shown in the photo montages, mainly with respect to supporting fauna (6), but only three respondents referred to the plant species by name. Three respondents said they specifically preferred the plants rather than the invertebrates that rested on them.

3.2 RQ2: Links between biodiversity and the generation of CEB

With respect to RQ2, responses from Activity 1 (Group One) showed a broad range of interactions and CEB pathways (Table 3). Wildflower Meadows, a key indicator of biodiversity, were associated with high rates of beneficial interaction, as were Hedge and Track, a landscape feature that combines biodiversity with human intervention. By comparison, many of the responses to the image of cracked earth indicated concern about environmental degradation and potential disbenefit. The Appendix contains examples given by participants of items associated with benefit pathways.

Table 3: Percentage of participants reporting CEB pathways* associated with selected environmental features

	Wildflower Meadow	Clover Meadow	Hillside	Cracked Earth	White-horse	Hedge and Track	Total
Cognitive	95	67	83	67	81	88	80
Creative	95	62	90	62	86	93	81
Intuitive	88	88	86	60	83	86	82
Retrospective	83	62	71	62	95	88	77
Regenerative	90	69	88	48	81	88	77
Total	90	70	84	60	85	89	80

(Total participants = 42, * including disbenefits, communicative pathways not assessed)

By way of example, Table 4 provides a synthesis of responses using verbatim written statement statements for Wildflower Meadows and Hedge and Track classified by CEB pathway.

Table 4: CEB pathways and word descriptions used by participants for Wildflower Meadow and Hedge and Track images in the study area

CEB pathways		Wildflower Meadows	Hedge & Track
Cognitive		Learn about: biodiversity, abundance, rare species, functions of plants, botany, how to obtain pleasure, feel comforted	Learn about: nature, birds, botany, wild edibles, the origins/history of the track and about peacefulness,
Creative:	Inspired to	Paint, draw, take photos, be active/get out, conserve, manage, protect.	Discover, explore, be active-walk, paint, draw, make wine (from berries) take photo, reminisce, think about things. Find out what lies over the hill
	Inspired by	Beauty, colours, diversity of species, variety of flowers, shape and texture	Beauty, attractiveness, scenery, patterns, trees, woodlands, sky, shapes within the landscape), diversity of habitats, the track
Intuitive		Connected to nature, to God, to life, and to the area	Connected to nature, to people who have passed this way, to the area
Retrospective		Places visited, past summers, childhood, previous land-use, the origins of the wildflowers, the past and potential for habitat degradation	The past, places visited, childhood, identity, people of the past, previous land-use and the origins of the track and hedge
Regenerative:	A sense of	Rejuvenating, upliftment, nostalgia, absorbing, interest,	Exploration- where the track leads, relaxation losing yourself,

		dreaming, getting away from it all	being in touch with nature
	From	Vibrancy, beauty, colours, sounds, smells, diversity, wildflowers, meadows, nature, blue skies, the feeling of enjoyment	Finding what lies over the hill that is unseen, peaceful surroundings, open space, nature, activity people are involved in

(Communicative pathways not assessed)

Further exploring the relationship between environmental settings and the generation of CEB pathways in study area (RQ2), unprompted responses from Activity 2 identified common features considered by participants to be important (Table 5). The results confirm the importance of sense of place and constituent anthropological and ecological features.

Table 5: Broad type of environmental features in the study area regarded as important

Feature and % of map points*	**Typical features**	**Sample of location names marked on map**	**Example descriptors used by participants**
Urban 24%	Settlements, housing, greenspace, roads	'Salisbury City', 'Bulford Camp'; 'A303 (Stonehenge) road works	Historical towns, my home, gardens, military camps, traffic
Recreational 13%	Viewpoints, nature reserves	'Pewsey Downs'; 'Salisbury Plain'	Footpaths, fields, views, wonderful walking
Heritage 12%	Monuments, hill forts, memorials	'Long Barrow'; 'Old Shaftesbury Drove'; 'Old Sarum'	Atmospheric, beautiful views, archaeology
Hydrological 9%	River, stream, lake	'Source of Wylye'; 'The 9 Mile River'; 'Waterways'	Peaceful places, bird watching, fishing, listening to water
Geological 9%	Chalk, hill, scarp, soil	'Old quarry (chalk pit'); 'Tan Hill'; 'Woodford Valley'	Inspiring scarp slope, Wiltshire's White Horses

Military areas 9%	Training areas, impact zones, airstrips	'Imber village'; 'Impact zone'; 'Military/Porton down training area'	Out of bounds, 'fossilized landscape'
Grasslands 8%	Plains, downlands, grassland	'The plain'; 'Coate-meadows'; 'Unimproved grass'	Wonderful wild dry grassland, fabulous walking
Woodlands 7%	Woods, plantation, trees	'Fargo Plantation'; 'Grovely Wood'; 'Savernake forests'	Birds, bluebells, walks. Superb ancient trees
Spiritual 2%	Churches, cemeteries, cathedrals	'Wilton church'; 'Devizes cemetery'	Architecture, history, writers, meeting places

* Based on total 284 points, excludes 20 (7%) unclassified map points

Assuming that the number of points indicates the relative importance of a type of feature, anthropological features (urban settlements, cultural, heritage and military) dominated perceptions of places of interest within the study site. Abiotic environmental features (hydrological, geological) were of next highest importance, whilst biotic features (grasslands and woodlands) appeared to be less strongly associated with places of interest. Participants found it difficult to differentiate CEB pathways associated with distinct heritage, biotic, or abiotic features. Ninety five percent of responses, however, mentioned some biotic feature of importance (on differing spatial scales) within the map point commentaries.

In addition to land-based biotic and abiotic features of the natural environment, participants referred to atmospheric features such as "light", "space", "fresh air", "open skies", "temperature", "weather", and "wind". A number of participants also mentioned "altitude" linked to distant views and past experiences, especially during youth, such as "rolling down hills" and "tobogganing".

Furthermore, participants reinforced the association between CEB pathways and sense of place that combines human and ecological features, as shown by a sample of respondent statements in Table 6. Overall, geographical place was the prime criterion for classification of points of interest, with habitats and biodiversity of secondary importance

Table 6: CEB pathways associated with places of interest in the study site referred to by workshop participants

CEB pathways	Examples of written responses
Cognitive	Where training takes place Where you notice change over time Interesting landscapes and chalk land SSSIs and reserves where research is carried out
Creative	Viewpoints or places with magnificent views Ancient grasslands Varied military areas Heritage and cultural sites
Intuitive	Ruins and remains - atmospheric Historic monuments - magical Nature reserves that feel special
Retrospective	Hill-forts and earthworks Listed buildings and historic estates Ancient ceremonial sites Tombs, and memorials to those no longer alive Farmland that supports traditional activities
Regenerative	Different and varied habitats Tranquil nature reserves Designated land e.g. Special Areas of Conservation, National Nature Reserves
Communicative	Land under different ownership and use Military zones used for different purposes Developments and settlements (existing and proposed) Heritage and cultural sites Transport infrastructure

The results from Activity 2 also revealed the scale at which people interact with environmental settings and the salient aspects of biodiversity. For the mapped points of interest, all participants (42 out of 42) recorded observed differences at the landscape and habitat scale. Many reported differences between species, especially referring to plants (34), birds (17), invertebrates (9), and mammals (5). There was little unprompted reference to diversity within species groups, other than from participants with specialist knowledge and mainly with respect to birds and plants.

It is worth noting that CEB pathways were also associated with a range of contextual, sociological, and psychological factors. Contextually, the timing of an interaction with an environmental setting was mentioned frequently as a factor contributing to value. This included time of day, lunar cycle, season, and epoch, often in combination with skyscapes. Seasonal land cover, migratory birds and summer evening walks were cases in point.

Sociological variables such as group membership, activities and interactive processes were important components of communicative pathways. Respondents reported that many interactions with nature had a social dimension such as organised events, family outings, and educational trips.

Participants emphasised the importance of public access for the generation of CEB because, for example “there is nothing quite like first-hand experience” and “access makes the ancient grasslands of Salisbury Plain better for recreation and learning”. Access was perceived to be “vital to promote understanding” of, amongst other things, “the pros and cons of conflicting issues”, and as a means of “ensuring the public has a

stake in the landscape". Participants also showed awareness of essentialness ("I do not need to walk in a wheat field to eat bread") and potential conflict of interest in a multifunctional landscape ("If we had access to all the landscape the disturbance to wildlife would be disastrous").

Psychological and personal factors were strongly associated with benefit pathways, especially familiarity with particular places and features. Frequent reference was made to personal experience and childhood memories: "I used to get out onto Broughton Down to look out across the landscape on moonlit nights or listen to the hill-top trees roar in a gale".

3.3 RQ3: The relationship between biodiversity gradients and CEB

Focussing on RQ3, the results from Activity 3 explored perceptions of associations between biodiversity and benefit pathways along the biodiversity gradient implied by arable farming, restoration grassland and ancient grassland. Responses (82) were classified by CEB pathway and whether these were viewed positively (85% of responses) or negatively (15% of responses) by participants (Table 7). Cognitive, creative, and regenerative pathways provided the main socio-psychological associations with environmental settings. Of all reported negative associations, 78% were attributable to arable farmland, mainly linked to wildlife impacts.

With respect to arable farming, cognitive pathways were associated with "experiencing" arable land so that "people know how their food is produced", and creativeness with the achievements of productive farming. Farming scored highly on positive regeneration benefits mainly because its contribution to food production was initially classified under

this heading. Arable farming implied food security and nutrition: "where our food comes from" and "directly linked to the food chain", although as one participant noted, "pollution and loss of pollinators will affect our ability to grow quality food".

Both restoration and ancient grasslands, had mainly positive associations, particularly for creative, intuitive, and retrospective CEB pathways. Restoration semi-natural grasslands demonstrated "what can be achieved with human focus". For some, these areas represent "innovation", in some cases "rectifying our mistakes". Easy access enabled "people to get closer to nature" and opportunities "to see environmental projects in action". Ancient grasslands were described as "versatile", offering "all round better options for experiencing nature". Responses included: a sense of inspiration from ancient grasslands, citing the "colourful displays of wildflowers", insects and wildlife; "links with the past" through historic artefacts; and positive refreshing feelings about landscapes described "wild", "raw" and "natural", reflecting the relative absence of human intervention.

Table 7: Pathways for cultural ecosystem benefits (+) and disbenefits (-) for three biodiversity gradients associated with environmental settings reported by participants

		Environmental settings			
		Arable farming	Restoration Grassland	Ancient Grassland	
Biodiversity		Low	Medium	High	
Total no. of responses		67	60	58	185
Benefit pathways		**Number of responses**			**% of total responses**
Cognitive	+ve	11	12	12	19%

	-ve	8	0	0	4%
Creative	+ve	12	17	15	24%
	-ve	5	0	1	3%
Intuitive	+ve	1	8	9	10%
	-ve	1	1	0	1%
Retrospective	+ve	1	5	9	8%
	-ve	0	0	0	0%
Regenerative	+ve	16	9	6	17%
	-ve	3	3	0	3%
Communicative	+ve	5	5	2	6%
	-ve	4	0	4	4%
% of total responses		36%	32%	31%	100%

* +ve indicates perceived benefit, -ve indicates perceived disbenefit

4 Discussion

Our exploratory workshops provide useful insights into perceptions of the relationship between biodiversity in an environmental setting (CES), the generation of cultural ecosystem goods and the various pathways by which these are transformed into CEB that affect human wellbeing.

4.1 Understandings of biodiversity

Whilst our workshop participants understood that biodiversity describes the variety of the natural world, for the most part, biodiversity was perceived rather coarsely in terms of broad habitats at the landscape scale. This was typically characterised by environmental settings such as farmland, grassland or woodland, rather than by species abundance and diversity (Dallimer *et al,* 2012). Our participants were, however, familiar and positively disposed towards distinctive species (Lorimer, 2007; Ducarme et al., 2012) whose cultural visibility (Correia et al., 2016) and generally pleasing characteristics appeared to be symbolic of a broader range of less detectable species.

Furthermore, in a few cases, lack of appeal or fear of some species appeared to override consideration of ecological functionality. Except for those with specialist knowledge, understandings of biodiversity mainly rested on visually distinguishable features of the landscape and its more charismatic wildlife, and this is likely to be the best case scenario for the population at large.

Although it seems that *understanding* of biodiversity varies considerably according to acquired knowledge and ecological training, it is not clear whether the type and extent of CEB obtained from different environmental settings and their biodiversity vary according to prior knowledge and perceptions of biodiversity.

As noted earlier, perceptions of biodiversity appeared to be strongly shaped by cognitive processes, whether hereditary or learned (Vaske & Manfredo, 2012). This may involve conceptual structures or 'frames' that are learned through personal experience, role playing, acquired knowledge and skills, and external influences. According to Lakoff (2010), 'eco-frames' are developed by individuals that define the emotional relationship with the environment. They affect the way we think, feel and behave with respect to the environment, and become fixed over time. There was some evidence of eco-framing amongst our participants, with expressions of relatively fixed views about, for example, the importance of different gradients of biodiversity within different environmental settings, and the scope for reconciling agriculture and ecology. As might be expected, the relationship between biodiversity and CEB appeared to be framed very differently by conservationist and farming interests amongst our participants. What is of interest here is the extent to which these frames are hardwired,

inflexible, and resistant to change: a topic worthy of further enquiry. An issue of interest to conservation managers is whether framing mainly based on emotion and intuition can limit the potential effect of knowledge building, evident for example in the tensions between Kahneman's fast and slow thinking (2009). Campaigns that develop emotional feelings of pleasure, or disgust, with respect to environmental features and change may be more effective than exclusively providing yet more information.

Many participants said they needed more information to give opinions on biodiversity and habitat options. Expressions of well-being have been more related to *perceived* rather than actual richness (Tilt *et al*, 2007; Dallimer *et al*, 2012). This suggests that the results of objective ecological surveys should be combined with assessments of the subjective importance or salience of ecological features as these trigger responses with potential to generate a change in perceived wellbeing, whether positive or negative. Here, salience is a key cognitive driver of the relationship between people and the natural environment, shaping perceptions of the relevance and value of biodiversity. Furthermore, knowing the extent which salience is hereditary or acquired through experience and knowledge (Vaske & Manfredo; 2012), is motivated by potential utility (Manfredo & Vaske, 1995; Attfield, 2003), and varies according to context, personal attributes and circumstances (Tuan, 1974, Kellert, 1996; Jacobs 2012). This is likely to be critical in the design of CEB pathways to wellbeing.

Our workshops confirmed the importance of sense of place as a focus of interaction between people and environmental settings. Place involves a mixture of biotic and abiotic features, human artefacts from the past, and processes of ongoing human

activity, including farming and conservation. Although ecological features in themselves were not the primary or sole focus in the importance of place they featured strongly alongside other non-biotic features such as heritage or vista. Sense of place and attachment, particularly linked to place-based *activities*, appears to have more resonance where people perceive continual benefits from an environmental setting and its biodiversity (Castree, 2009; Acott & Urquart, 2014). As we observe here, familiarity, reinforced by childhood experience, appears to influence attachment to particular habitat types (Morgan, 2010).

Our participants seemed disinclined to separate ecological and anthropological components of culturally important landscapes. Biotic features such as ancient grasslands and hilltop beech plantations provided additional descriptive detail to locations recognised mainly by anthropological identifiers. These relatively rare or locally distinctive natural and cultural heritage assets (Sagoff, 2008) are an important component of the cultural ecosystem goods in the study area. This is consistent with Barton *et al, (*2009) who reported increased self-esteem and mood from respondents after walking in sites with recognised natural and heritage value such as Sites of Special Scientific Interest (SSSI) and Areas of Outstanding Natural Beauty (AONB). The presence of designated sites provides an indicator of potential CEB, obtained through diverse pathways as shown in Table 6 above.

These insights point to the difficulty of separating the 'natural' from the 'cultural' or 'social'. Different human perspectives consider people either as set apart from nature, or as a part of nature (Thomas, 1983; Schultz *et al*, 2004; Teel & Manfredo, 2009) and

wellbeing effects are often dependent upon individual perceptions of naturalness (Van den Berg *et al*, 2014). In this respect, 'natural' environments are sometimes conceptualised as those devoid of human interference (Vining *et aI*, 2008), such that naturalness can be compromised by human intervention or presence. Demeritt (2001) and Castree (2005), however, challenge this apparent nature-culture dichotomy, questioning the idea of a 'pure' nature unsullied by human activity or presence. Nevertheless, the idea of 'wilderness' has a strong hold on the imagination (Cronon, 1995) and the 're-wilding' option is favoured by some restoration ecologists and conservation organisations (Sutherland *et al*, 2010).

Our workshop observations suggested the assessment of biodiversity may need to be considered within broader social and environmental settings in order to obtain a more complete understanding of what is meaningful and beneficial to people. This may require greater attention to biophysical *and* socio-cultural diversity (Dansereau, 1997; Corral-Verdugo *et al*, 2009) and more context and place specific, nature-people interactions (Murdoch, 2006).

4.2 Biodiversity and the generation of CEB

The results revealed interesting insights into CEB pathways. We found evidence of a positive association between biodiversity and cognitive pathways associated with ecological (eg indicators of environmental health) and cultural (eg species behaviour and predator: prey relationship) learning opportunities: as one participant reported - "the more diversity there is, the more there is to learn".

Creative pathways were closely linked to sensory stimulation (Lorimer, 2007: Ducarme et al, 2013), especially sight and sound, in many cases prompting a creative activity. For example landscape features ("the slopes of the chalk downs bellow out like waves") and the "busyness of bees" promoted further engagement involving photography or simply stopping to "to see and hear". It was also apparent that a decline in diversity and poor ecosystem health led to restorative innovation to compensate and reinstate balance.

Intuitive pathways were apparent in the connectedness to nature expressed by our participants, linked to emotional responses of awe, wonder and privilege (Curtin, 2009). Here biodiversity is linked to the theme of holism, with biodiversity seen as part of a whole, making connections between living things, rather than as a disaggregated phenomenon (Vaske and Malfredo, 2012).

Retrospective pathways were mainly associated with participants' own history and those connected to people of the past. Ancient woodlands and grasslands provided a "window into the past". Arable farmland was associated with traditional activities such as game bird rearing, hunting, thatching and foraging, "Drovers' roads" linked historic routes to current public rights of way. Our participants linked retrospective pathways to historic artefacts known to have the salutogenic potential (de Jong *et al*, 2012) of moving people towards good health (Antonovsky, 1996). Although it was not possible to identify a clear relationship between biodiversity and retrospective pathways, we did note that environmental stimuli provided by diversity seemed to promote absorption, reflection and retrospection, especially associated childhood memories (Carver, 1979; James, 1983).

Not surprisingly, regenerative pathways were commonly associated with psychological and physical processes in the outdoors, associated with relaxation, refreshment, "switching off in natural places" and the "freedom of open spaces". We observed strong links between regenerative pathways and species abundance and richness, provoking a sense of rejuvenation and restoration, as supported by other evidence (Fuller *et al*, 2007; Grahn & Stigsdotter, 2010).

Communicative pathways were particularly important for generating CEB. Increased understanding of and access to environmental settings and biodiversity were achieved through guided walks, educational visits, signage, or information boards provided by a range of organisations. Social interaction and supporting networks were shown to be particularly crucial, consistent with the findings of Huby *et al, (*2006), Lachowycz and Jones (2011) and Keniger *et al, (2013*). Public access to the countryside was shown to be an important antecedent for the co-generation of user-based CEB. Participants were aware of potential conflicts between different interests, and the disbenefits of exceeding capacity thresholds. This applies whether the dominant interest is biodiversity in the case of natural grassland, or agricultural production in the case of enclosed farmland. The management of public access to the countryside is a critical component of any strategy to enhance biodiversity based CEB (Morris et al, 2009).

Interestingly, our nature-oriented workshop participants also highlighted the cultural importance of non-tangible aspects of provisioning and regulating ecosystem services. For example, they valued the productivity of enclosed farmland, also seeing this as an indicator of "human achievement". They attached cultural significance to the

stewardship not only of nature itself but also of natural resources to meet human needs, including food production and food security. This was heightened by concern about climate change, employment, and livelihoods.

In this respect, the definition of CEB should be extended to include the non-material benefits of provisioning and regulating services that, especially locally, may be different from those implied by, for example, the tangible market price of traded farm commodities. This reinforces the notion by Church et al (2014) of CES as environmental spaces, customs and practices that underpin human capabilities. Such a definition allows for important interactions between natural capital and other forms of capital, physical, human and social, in order generate a wide array of benefits (UKNEA, 2011). The importance of public access further reinforces the importance of investment in non-natural capitals for the realisation of the CEB. The idea of including the non-tangible aspects of provisioning and regulating services as cultural services provides an interesting challenge to the widely accepted MA (2005) and UKNEA (2011) CES typologies.

4.3 Responses to biodiversity gradient

As with other literature (Huynen *et al*, 2004; Dean *et al*, 2011; Annerstedt *et al*, 2012; Lovell *et al*, 2014) we have not found a conclusive relationship between the gradient of biodiversity and the generation of cultural ecosystem benefits, beyond the presence of iconic and charismatic species and differences in habitat and broad landscapes. The workshops showed that enclosed farmland, restoration, and ancient grassland can all generate CEB of some kind. The responsiveness of perceived benefit to biodiversity

change, however, remains elusive and is worthy of further assessment given well-documented changes in biodiversity, not least in the UK lowland agricultural context (Burns et al. 2016). Nor can biodiversity gradients be assessed in isolation: the type and mix of biotic and abiotic features are clearly important determinants of cultural ecosystem goods and the generation of CEB , particularly where public access and direct use are involved. There is a need to move beyond environmental determinism and discrete models that assume simple causal relationships between biodiversity and CEB. As our results imply, a broader perspective on environmental connectedness is required (Beery & Wolf-Watz, 2014).

Although people may respond to the greater levels of diversity, they may not, as noted above, be doing so knowingly. Rather, they may be responding to increased complexity (Han, 2007), variety of sensory stimuli (e.g. Oreszczyn & Lane, 2000; Ulrich, 1984; Bell *et al*, 2003), and charismatic species and landscapes (Lorimer, 2007; Correia et al., 2016). Therefore, it is crucial for conservation organisations promoting the health benefits of engagement with green space (Annerstedt and Währborg 2011; Bragg & Atkins 2016) to understand better which conservation priorities and targets (whether species, habitats or landscapes) are likely to have most beneficial impact in these aspects. Simultaneously, they may then find that they can secure less appealing, but more functionally important species alongside highly visible charismatic species that meet with public approval.

5 Conclusions

Drawing on our study in the chalk grasslands of southern England, we make a number of broad conclusions that have general implications for policy and practice.

First, biodiversity and associated CEB tend to be perceived at the habitat and landscape scales rather than in terms of the detailed abundance and/or mix of plants and animals in a place.

Second, knowledge and understanding of biodiversity appears to be a critical cognitive pathway for the realisation CES cultural benefits. Emotional, intuitive attachments between people and species, habitats and landscapes are likely to be just as, if not more important, than formal understandings of biodiversity.

Third, it is difficult to partition the cultural significance of biotic and abiotic features in environmental settings. We emphasise the importance of, and the attachment to, place as a focal point of human–nature interaction. Actions to enhance biodiversity and CEB are probably best done by simultaneously promoting sense of place.

Fourth, the provisioning of material agricultural goods and regulation of ecological processes has cultural value that goes beyond market values. This questions the validity of arbitrarily separating CEB from other ecosystem services in valuation frameworks.

Fifth, the realisation of many CEB depends on enabling institutions and infrastructure, notably public access and facilities. Thus, it appears essential to consider the CEB of biodiversity as part of wider multi-resource commitments.

Finally, our exploratory enquiry suggests that an understanding of the socio-psychological pathways by which people transform ecosystem goods into benefits can

help to design interventions that promote nature's contribution to the wellbeing of people.

References

Acott, T. and Urquhart, J. (2014) Sense of place and socio-cultural values in fishing communities along the English Channel, in Urquhart, J., Acott, T., Symes,D. and Zhao, M. (eds) *Social Issues in Sustainable Fisheries Management*. Springer: London, 257–278.

Annerstedt, M., &Währborg,. P. (2011). Nature-assisted therapy: Systematic review of controlled and observational studies. *Scandinavian Journal of Public Health* 39: 371–388.

Annerstedt, M., Ostergren, P. O., Björk, J., Grahn, P., Skärbäck, E., & Wahrborg, P. (2012). Green qualities in the neighbourhood and mental health- results from a longitudinal cohort study in southern Sweden, *BMC Public Health*, 12:337.

Antonovsky, A. (1996). The salutogenic model as a theory to guide health promotion. *Health Promotion International,* 11, 1, 11-18.

Appleton, J. (1975).*The experience of landscape*. New York: Wiley .

Attfield, R. (2003).*Environmental Ethics*. First Edition. Cambridge: Polity Press.

Barton, J., Hine, R., & Pretty, J. (2009). The health benefits of walking in green spaces of high natural and heritage value. *Journal of Integrative Environmental Sciences,* 6, 4, 261-278.

Beery, T. H., & Wolf-Watz, D. (2014). Nature to place: Rethinking the environmental connectedness perspective. *Journal of Environmental Psychology,* 40, 198-205.

Bell, S. (2012). *Landscape - pattern, perception and process*. First Edition. Abingdon: Routledge.

Bell, S., Morris, N., Findlay, C., Travlou, P., Montarzino, A., Gooch, D., Gregory, G., & Ward-Thompson, C. (2003). *Nature for people; the importance of green spaces to East Midlands communities.* ENRR 567. Peterborough: English Nature

BESS. (2014). Biodiversity and ecosystem service sustainability: http://www.nerc-bess.net/. Accessed 01.02.17

Bhagwat, S. A. (2009). Ecosystem services and sacred natural sites; reconciling material and non-material values in nature conservation. *Environmental Values*, 18, 417-427.

Bragg, R., & Atkins, G. (2016). *A review of nature-based interventions for mental health care*. Natural England Commissioned Report Number 204. Peterborough: Natural England.

Bryman, A. (2012). Social Research Methods. 4th edition. Oxford: Oxford University Press.

Bullock, J., & et al. (2011). Semi-natural grasslands. In *The UK National Ecosystem Assessment Technical Report.* The UK National Ecosystem Assessment. Cambridge: UNEP-WCMC, 161-198.

Burgess, J. (1995). *Growing in confidence: understanding people's perceptions of urban fringe woodlands.* Cheltenham: Countryside Commission,.

Burns, F., Eaton, M.A,, Barlow, K.E., Beckmann, B.C., Brereton, T., & Brooks, D.R. (2016). Agricultural management and climatic change are the major drivers of biodiversity change in the UK. *PLoS ONE* 11(3): e0151595. doi:10.1371/journal.pone.0151595

Calvet-Mir, L., Gómez-Baggethun, E., & Reyes-García, V. (2012). Beyond food production: Ecosystem services provided by home gardens. A case study in Vall Fosca, Catalan Pyrenees, North-eastern Spain. *Ecological Economics*, 74, 153-160.

Carlson, A. (2009). *Nature and landscape: An introduction to environmental aesthetic.* New York: Columbia University Press.

Carver, C. S. (1979). A cybernetic model of self-attention processes, *Journal of Personality and Social Psychology*, 37, 8, 1251-1281.

Castree, N. (2005). *Nature*. London. New York: Routledge.

Castree, N. (2009).Place: Connections and boundaries in an interdependent world. In Clifford, N. J., Holloway, S. L., Rice, S. P., & Valentine, G., (Eds.), *Key concepts in geography*, London: SAGE, 153-172.

CBD. (1992). The Convention on Biological Diversity. New York: United Nations.

CBD. (2013). *Ecosystem Approach*. Montreal: Convention on Biological Diversity. Available at: http://www.cbd.int/ecosystem/. Accessed 01.07.2016

Chan, K. M. A., Satterfield, T., & Goldstein, J. (2012). Rethinking ecosystem services to better address and navigate cultural values. *Ecological Economics*, 74, 0, 8-18.

Chan, K., Goldstein, J., Satterfield, T., Hannahs, N., Kikiloi, K., Naidoo, R., Vadeboncoeur, N., Woodside, U., Jianzhong, M., Tam, C., & Wong, H. (2011). Cultural Services and Non-use Values, in Kareiva, P. (Ed.). *Natural capital: theory & practice of mapping ecosystem services.* Oxford: Oxford University Press.

Church, A., Burgess, J., & Ravenscroft, N. (2011). Cultural Services. In *UK National Ecosystem Assessment, Living with Environmental Change Programme*, http://uknea.unep-wcmc.org/, 633-693.

Church, A., Fish, R., Haines-Young, R., Mourato, S., Tratalos, J., Stapleton, L., Willis, C., Coates, P., Gibbons, S., Leyshon, C., Potschin, M., Ravenscroft, N., Sanchis-Guarner, R., Winter, M., and Kenter, J. (2014). UK National Ecosystem Assessment Follow-on. *Work Package Report 5: Cultural ecosystem services and indicators*. Cambridge: UNEP-WCMC.

Clark, N. E., Lovell, R., Wheeler, B., Higgins, S. L., Depledge, M. H., & Norris, K. (2014). Biodiversity, cultural pathways, and human health: a framework. *Trends in Ecology and Evolution*, 29, 4, 198-204

Coates, P., Brady, E., Church, A., Cowell, B., Daniels, S., DeSilvey, C., Fish, R., Holyoak, V., Horell, D., Mackey, S., Pite, R., Stibbe, A. & Waters, R. (2014). Arts and Humanities Working Group (AHWG). UK National Ecosystem Assessment Follow-on. Cambridge UNEP-WCMC, LWEC,

Collar, N. J. (2003). Beyond value: biodiversity and the freedom of the mind. *Global Ecology and Biogeography,* 12, 265-269.

Cooper, N., Brady, E., Steen, H. & Bryce R. (2016). Aesthetic and spiritual values of ecosystems: Recognising the ontological and axiological plurality of cultural ecosystem 'services'. *Ecosystem Services,* 21, 218–229.

Corral-Verdugo, V., Bonnes, M., Tapia-Fonllema, C., Fraijo-Singa, B., Frıas-Armentae, M., & Carrus, G. (2009). Correlates of pro-sustainability orientation: The affinity towards diversity. *Journal of Environmental Psychology,* 29, 34-43.

Correia, R.A., Jepson, P, R., Malhado, A.C.M. & Ladle, R. J. (2016). Familiarity breeds content: assessing bird species popularity with culturomics. *PeerJ 4:*e1728; DOI 10.7717/peerj.1728

Cracknell, D., M. P. White, S. Pahl, W. J. Nichols, & M. H. Depledge. (2015). Marine Biota and Psychological Well-Being: A Preliminary Examination of Dose–Response Effects in an Aquarium Setting. *Environment and Behavior*, 1–28, DOI: 10.1177/0013916515597512

Cronon, W. (1995).*Uncommon ground: Toward reinventing nature*. New York: Norton.

Curtin, S. (2009). Wildlife tourism; the intangible, psychological benefits of human-wildlife encounters. *Current Issues in Tourism,* 12, 451-474.

Dallimer, M., Irvine, K., Skinner, A., Davies, Z., Rouquette, J., Maltby, L., Warren, P., Armsworth, P., & Gaston, K. (2012). Biodiversity and the feel good factor; understanding associations between self-reported human wellbeing and species richness. *Bioscience,* 62, 47-55.

Dansereau, P. (1997). Biodiversity, ecodiversity, sociodiversity – three aspects of diversity: Part 1. *Global Biodiversity,* 6, 2-9.

de Groot, R., Ramakrishnan, P. S., van de Berg, A., Kulenthran, T., Muller, S., Pitt, D., Wascher, D., & Wijeuriya, G. (2005). Cultural and Amenity Services. In *Millennium Ecosystem Assessment*: *Ecosystems and human well-being: Current states and trends assessment volume one,* 457-474). Washington: Island Press.

de Jong, K., Albin, M., Skärbäck, E., Grahn, P., & Björk, J. (2012). Perceived green qualities were associated with neighbourhood satisfaction, physical activity, and general health: Results from a cross-sectional study in suburban and rural Scania, southern Sweden. *Health and Place,* 18, 1374-1380.

Dean, J., van Dooren, K., & Weinstein, P. (2011). Does biodiversity improve mental health in urban settings? *Medical Hypotheses,* 76, 877-880.

Demeritt, D. (2001). Being constructive about nature. In Castree, N., & Braun, B., (Eds.), *Social nature: theory, practice and politics*. Oxford: Blackwell Publishers.

Ducarme, F., Luque, G.M. & Courchamp, F. (2013). *What are "charismatic species" for conservation biologists. BioSciences Master Reviews,* 10:1-8

English, J., Wilson, K., & Keller-Olaman, S. (2008). Health, healing and recovery: Therapeutic landscapes and the everyday lives of breast cancer survivors. *Social Science and Medicine,* 67, 68-78.

English Nature. (2005). *Salisbury Plain Special Area of Conservation Citation UK0012683*. Peterborough: English Nature

Eisenhauer, B.W., Krannich, R.S. & Blahna, D.J. (2000) Attachments to special places on public lands: An analysis of activities, reason for attachments, and community connections. Society and Natural Resources, 13, 421–441

Fish, R.D. (2011). Environmental decision making and an ecosystems approach: Some challenges from the perspective of social science. *Progress in Physical Geography,* 35, 671-680.

Forest of Bowland AONB. (2013). Sense of Place Toolkit. Preston: Forest of Bowland AONB
http://forestofbowland.com/files/uploads/pdfs/sense_of_place_final2.pdf.
Accessed 1.7.2016

Fuller, R. A., Irvine, K. N., Devine-Wright, P., Warren, P. H., & Gaston, K. J. (2007). Psychological benefits of green space increase with biodiversity. *Biology Letters,* 3, 390-394.

Gifford, R. (2014). Environmental psychology matters. *Annual Review of Psychology, 65*, 541-580.

Grahn, P., & Stigsdotter, U. K. (2010). The relation between perceived sensory dimensions or urban green space and stress restoration. *Landscape and Urban Planning,* 94, 264-275.

Han, K. (2007). Responses to Six Major Terrestrial Biomes. *Environment and Behaviour,* 39, 4, 529-556.

Hanski, I., von Hertzen, L., & Fyhrquistc, N. (2012). Environmental biodiversity, human microbiota, and allergy are interrelated. *Proceedings of the National Academy of Sciences of the United States of America,* 109, 21, 8334–8339.

Hartig, T., Evans, G. W., Jamner, L. D., Davis, D. S., & Garling, T. (2003). Tracking restoration in natural and urban field settings. *Journal of Environmental Psychology,* 23, 109-123.

Holt, A. R., Godbold, J. A., White, P. C. L., Slater, A., Pereira, E. G., & Solan, M. (2011). Mismatches between legislative frameworks and benefits restrict the implementation of the Ecosystem Approach in coastal environments. *Marine Ecology Progress Series,* 434, 213-228.

Huby, M., Cinderby, S., Crowe, A. M., Gillings, S., McClean, C. J., Moran, D., Owen, A., & White, P. C. L. (2006). The association of natural, social and economic factors with bird species richness in rural England. *Journal of Agricultural Economics,* 57, 295-312.

Huynen, M., Martens, P., & de Groot, R. S. (2004). Linkages between biodiversity loss and human health, a global indicator analysis. *International Journal of Environmental Health Research,* 14, 13-30.

Irvine, K. N., Devine-Wright, P., Payne, S. R., Fuller, R. A., Painter, B., & Gaston, K. J. (2009). Green space, soundscape and urban sustainability: An interdisciplinary, empirical study. *Local Environment,* 14, 2, 155-172.

Jacobs, M. H. (2009). Why do we like or dislike animals? *Human dimensions of wildlife,* 14, 1, 1-11.

Jacobs, M. H. (2012). Human emotions toward wildlife. *Human dimensions of wildlife*, 17, 1, 1-3.

James, W. (1983 (originally published 1890)). *The principles of psychology*. Massachusetts: Harvard University Press.

Jordan, M. (2009). Back to nature. *Therapy Today*, [Online], 20, 3, 19.10.10 available at: http://www.therapytoday.net/article/show/105/

Kahneman, D. (2012) Thinking, Fast and Slow. London: Penguin Books,

Kaplan R., & Kaplan K. S. (1989). *The experience of nature: A psychological perspective.* New York: Cambridge University Press.

Kaplan, S. (1995). The restorative benefits of nature: towards an integrative framework. *Journal of Environmental Psychology*, 15, 169-182.

Kellert, S. R. (1996). *The value of life: Biological diversity and human society*. Washington, DC: Island Press.

Keniger, L. E., Gaston, K., Irvine, K. N., & Fuller, R. A. (2013). What are the benefits of interacting with nature? *International Journal of Environmental Research for Public Health.* 10, 913-935.

King H., Graves, A.R., Morris J., & Bradbury, R.B. (2013) Exploring cultural ecosystem services in the Wessex region. *Wessex-Bess WP5 Project Report I: Exploratory Workshop Results*. November, 2013. Available at http://wessexbess.wixsite.com/wessexbess (location on site to be confirmed, pdf of Report sent to JEP editor)

Kuo, F. E., & Sullivan, W. C. (2001). Aggression and violence in the inner city: Impacts of environmental and mental fatigue. *Environment and Behavior*, 33, 4, 543-571.

Lachowycz, K., & Jones, A. P. (2011). Greenspace and obesity: A systematic review of the evidence. *Obesity Review*, 12, 183-189.

Lakoff, G. (2010). Why it matters how we frame the environment. *Environmental Communication*, 4, 1, 70-81.

Lewicka, M. (2011). Place attachment: How far have we come in the last 40 years? *Journal of Environmental Psychology*, 31, 3, 207-230.

Lindemann-Matthies, P., Junge, X., & Matthies, D. (2010). The influence of plant diversity on people's perception and aesthetic appreciation of grassland vegetation. *Biological Conservation*, 143, 195-202.

Lorimer, J. (2007) 'Nonhuman charisma'. *Environment and Planning D-Society & Space*, 25(5), 911-932.

Lovell, R., Wheeler, B.W., Higgins, S.L., Irvine, K.N., & Depledge, M.H. (2014). A systematic review of the health and well-being benefits of biodiversity. *Journal of Toxicology and Environmental Health, Part B: Critical Reviews*, 17:1, 1-20.

Macnaghten, P., Grove-White, R., Weldon, S., & Waterton, C. (1998). *Woodland Sensibilities: Recreational Use of Woods and Forests in Contemporary Britain*. Bristol: Forestry Commission, www.forestry.gov.uk/.

MacKerron, G. &Mourato, S. (2013) Happiness is greater in natural environments. *Global Environmental Change-Human and Policy Dimensions*, 23(5), 992-1000.

Manfredo, M. J., & Vaske, J. J. (1995). Human dimensions of wildlife management: Basic concepts. In Knight, R. L., & Gutzwiller, K., (Eds.), *Wildlife and recreationists: coexistence through management and research*, Washington DC: Island Press, 17-49.

MA (2005). *Ecosystems and Human Well-Being: A Synthesis.* Millennium Ecosystem Assessment. Washington DC: Island Press.

Morgan, P. (2010). Towards a developmental theory of place attachment. *Journal of Environmental Psychology*, 30, 11-22.

Morris, J., & Urry, J. (2006). *Growing places: A study of social change in The National Forest.* Farnham: Forest Research,

Morris, J. Colombo, S. Angus, A. Parsons, D. Brawn, M. Stacey, K., and Hanley, N., (2009) The value of public rights of way: a choice experiment in Bedfordshire, England. *Landscape and Urban Planning*. 93, 1, 83-91

Murdoch, J. (2006). *Post-structuralist geography: A guide to relational space.* London: Sage.

O'Brien, L., & Murray, R. (2006). *A marvellous opportunity for children to learn: A participatory evaluation of Forest School in England and Wale.* Farnham: Forest Research.

Oreszczyn, S., & Lane, A. (2000). The meaning of hedgerows in the English landscape; different stakeholder perspectives and the implications for future hedge management. *Journal of Environmental Management*, 60, 101-118.

Orians, G. H. (1980). Habitat selection: General theory and applications to human behaviour. In Lockard, J. S., (Eds.). *The evolution of human social behaviour*. Chicago: Elsevier.

Pascual, U., Balvanera, P., Diaz, S., Pataki, G., Roth, E., Stenseke, M., Watson, R.T., Desanne, E.B., Islar, M., Kelemen, E., Maris V. & Quaas M. (2017) Valuing nature's contributions to people: the IPBES approach. In Brondizio, E.S., Leemans R. & Solecki, W.D (Eds.). *Current Opinion in Environmental Sustainability*, Vol 26–27, p7-16

Perman, R., Ma, Y., Common, M., Maddison, D. & McGilvray, J. (2011). *Natural Resource and Environmental Economics*, 4th Edition. Harlow: Pearson.

Potter, J. & Wetherell, M. (1987). *Discourse and social psychology: Beyond attitudes and behaviour*. London: Sage

Robson C. (2011). *Real World Research.* 3rd edition. Chichester: Wiley

Russell, R., Guerry, A. D., Balvanera, P., Gould, R. K., Basurto, X., Chan, K. M. A., Klain, S., Levine, J.& Tam, J. (2013). Humans and Nature: How Knowing and Experiencing Nature Affect Well-Being. In Gadgil, A.& Liverman, D. M., (Eds). *Annual Review of Environment and Resources, Vol 38*, Palo Alto: Annual Reviews, 473-502.

Sandifer, P. A., Sutton-Grier, A. E. & Ward, B. P. (2015). Exploring connections among nature, biodiversity, ecosystem services, and human health and well-being: Opportunities to enhance health and biodiversity conservation. *Ecosystem Services,* 12, 1-15.

Sagoff, M. (2008). On the economic value of ecosystem services. *Environmental Values,* 17, 239-257.

Schultz, P. W., Shriver, C., Tabanico, J. J., & Khazian, A. M. (2004). Implicit connections with nature. *Journal of Environmental Psychology*, 24, 31-42.

Silverman (2006). *Interpreting qualitative data: Methods for analysing talk, text and Interaction . 3rd edition.* London: Sage

Sutherland, W. J., Albon, S. D., Allison, H., Armstrong-Brown, S., Bailey, M. J., Brereton, T. et al. (2010). The identification of priority policy options for UK nature conservation. *Journal of Applied Ecology*, 47, 5, 955-965.

TEEB (2010). *The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations*. London: Earthscan.

Teel, T. L., & Manfredo, M. J. (2010). Understanding the Diversity of Public Interests in Wildlife Conservation. *Conservation Biology*, 24(1), 128-139.

Thomas, K. (1983). *Man and the natural world: changing attitudes in England 1500-1800*. London: Penguin.

Tilt, J., Unfried, T., & Roca, B. (2007). Using objective and subjective measures of neighbourhood greenness and accessible destinations for understanding walking trips and BMI in Seattle, Washington. *American Journal of Health Promotion,* 21, 371-379.

Tuan, Y. (1974). *Topophili: A study of environmental perception, attitudes and values*. Englewood Cliffs, NJ: Prentice-Hall.

Ulrich, R. S. (1984). View through a window may influence recovery from surgery. *Science,* 224, 420-421.

UKNEA. (2011). *UK National Ecosystem Assessment Technical Report*. Cambridge: UNEP-WCMC. Available at http://uknea.unep-wcmc.org/. Accessed 01.07.2016

UKNEAFO. (2014) *UK National Ecosystem Assessment: Follow on Synthesis of Key findings*. Cambridge: UNEP-WCMC. Available at http://uknea.unep-wcmc.org/. Accessed 01.07.2016

UNDP. (2015). *Sustainable Development Goals: The 2030 Agenda for Sustainable Development*. New York: United Nations Development Programme.

UNESCO.(2016). Stonehenge, Avebury and Associated Sites. Paris: UNESCO. Available at http://whc.unesco.org/en/list/373. Accessed 01.07.2016

Van den Berg, A. E., Jorgensen, A., & Wilson, E. R. (2014). Evaluating restoration in urban green spaces: Does setting type make a difference? *Landscape and Urban Planning*, 127, 173-181.

Vaske, J. J., & Manfredo, M. J. (2012). Social psychological considerations in wildlife management' in Decker, D. J., Riley, S., & Siemer, W. F., (Eds.). *Human dimensions of wildlife management*. Batimore: John Hopkins University Press, 43-57.

Vining, J., Merrick, M. S., & Price, E. A. (2008). The Distinction between Humans and Nature: Human Perceptions of Connectedness to Nature and Elements of the Natural and Unnatural. *Research in Human Ecology*, 15, 1, 1-11.

Weinstein, N., Balmford, A., DeHaan, C.R., Gladwell, V. Bradbury, R.B. & Amano, T. (2015). Seeing community for the trees: links between contact with natural environments, community cohesion and crime. *BioScience*, 65, 1141-1153.

Weiss, B. (2011). Making pigs local: Discerning the sensory character of place. *Cultural Anthropology*, 26, 3, 438-461.

Wessex-BESS (2015). *Biodiversity and Ecosystem Services in Current and Future Mutifunctional Lowland Landscapes*. http://wessexbess.wixsite.com/wessexbess. Accessed 01.02.17

Wheeler, B. W., Lovell, R., Higgins, S. L., White, M. P., Alcock, I., Osborne, N. J., Husk, K., Sabel, C. E. & Depledge, M. H. (2015). Beyond greenspace: An ecological study of population general health and indicators of natural environment type and quality. *International Journal of Health Geographics*, 14(1):17.

White, M. P., Pahl, S., Ashbullby, K., Herbert, S., & Depledge, M. H. (2013). Feelings of restoration from recent nature visits. *Journal of Environmental Psychology*, 35, 40-51.

Williams, K., & Harvey, D. (2001). Transcendent Experience in Forest Environments. *Journal of Environmental Psychology*, 21, 249-260.

Wilson, E. O. (1984). *Biophilia*, Cambridge, MA: Harvard University Press.

Yamada, Y. (2006). Soundscape based forest planning for recreational and therapeutic activities. *Urban Forestry and Urban Greening*, 5, 131-139.

Appendix: Cultural ecosystem benefit pathways associated with biodiversity in the study area according to workshop participants.

Benefit pathway	Associated items	Examples given by workshop participants
Cognitive	Ecological learning	Species as indicators of the health of ecosystems, monitoring and surveying activities, impacts and interdependencies, species behaviour and relationships
	Learning from mistakes	Restoration grassland and stewardship areas represent learning from and correcting our mistakes
	Cultural learning	Observing species behaviour offers opportunities to learn about perseverance, a good work ethic and well-functioning communities
Creative	Artistic inspiration	Inspired by markings on insects and different flora, and (at a larger scale to the mosaic effect of landscape diversity
	Innovation	Restoring grasslands represent creative benefits linked to innovation and a sense of achievement
	Link between creativity and stimuli	Creativity linked to visual stimuli- colours, texture, and patterns. Some reference to the sound of insects, birds and the wind
	Desire to conserve	Artistic creativity associated with beautiful scenes linked to a desire to conserve the environment/ species
	Beauty in adversity	Patterns in cracked earth were perceived by some as interesting and beautiful. Surviving species inspire creative ways to fix or improve circumstances
Intuitive	Insight into life	Biodiversity represents the cycles of life, is that which sustains life, and is the basis of life
	Grounded-ness	Natural images provoked sensations of simplicity and belonging which help people feel grounded to the earth
	Religious variation	Buddhist perspective - biodiversity as part of an interconnected and complete totality. Pagan perspective- biodiversity gradients/ habitats offer different energy thresholds. Christian perspective- stewardship responsibilities for biodiversity. Atheist perspective- associating biodiversity with God is inappropriate. Agnostic- connectedness to biodiversity and God is the same thing.
	Connectedness	Biodiversity an inseparable part of a whole, a unified feature. Connections between things, relationships to the wider universe, something greater
Retrospective	Social /personal benefits	Two aspects: participants' own history/childhood, and that connected to people of the past
	Cultural linkages	History is a deeply embedded feature of the study-site. Ancient woodland, ancient grassland and historic features give insights into human history
	Ability to interpret	Participants with the relevant skill sets can gain insight into past human activities through observing current land

	landscape	cover
	Associations with past	Seeing a landscape feature previously experienced invoked memories of past visits. Associations stronger when the feature experienced during childhood
	Pondering origins	Semi-natural features with an obvious manmade element sparked curiosity in the origins of that feature
Regenerative	Physical fitness	Benefits of exertion and exercise related to outdoor activities
	Mental restoration	Natural places enable people to dream, use their imagination, get away from it all, and become absorbed in their surroundings. Relaxation and switching off
	Rejuvenation	Rich stimuli (colours, sounds, smells, diversity, wildflowers, meadows) led to a sense of rejuvenation, 'upliftment', nostalgia, absorption, and day dreaming
	Reassurance	Connected to the continued and plentiful supply of ecosystem services, e.g. arable and food supply (nutrition); ancient grassland biodiversity and vital services
	Disservices	Lack of resource: the converse of regeneration: not growing enough food to feed a growing population.
Communicative	Supporting institutions	Group membership, employment in the countryside sector, hobbies and activities, nature-related education, language
	Training and shared knowledge	Linkages between training and the scale at which biodiversity is recognised. Training provides language to identify within/between species diversity.

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