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Demographic, natural and anthropogenic drivers for coastal Cultural ecosystem services in the Falkland Islands

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ABSTRACT

People of remote oceanic islands show a clear connection to their natural environment. Our study provides a case study example of how the location of coastal Cultural Ecosystem Services in small islands can be analysed, providing useful information to managers and conservationists alike. Using a series of analyses, we here show how groups of people place Cultural Ecosystem Services in different places driven by their socio-demographic identity and the environment that surrounds them. We found that a range of different socio-demographic factors affects the grouping of people and that both natural and anthropogenic infrastructure environments affect the location of recreational and aesthetic services. For recreation and aesthetic services, we found that a range of environmental features, including the travel distance and accessibility, habitat types, biodiversity indicators and proximity to Invasive Species impacted the location of these coastal services. As a result, our demographic identity can identify places where services are located.

1. Introduction

There are many benefits we gain from nature and the landscape that surrounds us. Whether we depend on the natural environment for work, for our recreational needs or simply to enjoy the scenery, the benefits that nature provides to us are widespread and varied (Daily, 1997; Mooney and Ehrlich, 1997). Nature provides a range of non-material benefits through spiritual enrichment, cognitive development, reflection, recreation and aesthetic experiences (Chan et al., 2012; Millenium Ecosystem Assessment, 2005; Plieninger et al., 2013), often referred to as Cultural Ecosystem Services (CES).

The most commonly studied CES in the environmental literature is recreational CES (Heal, 2000; Martínez Pastur et al., 2016; Milcu et al., 2013). These are often the easiest to quantify economically through the provisions for communities and related businesses of recreational activities (Hermes et al., 2018), and their contribution to physical and mental health and well-being (Haines-Young and Potschin, 2010). On the other hand, landscape aesthetics CES form an under-discussed part of ecosystem assessments despite their entanglement in broader environmental management (Dronova, 2019), and literature highlighting their importance as early as the 1960s (Linton, 1968). Aesthetic CES have been equated to terms such as "natural beauty" (Blake et al., 2017), "psychological benefit encounters with ecosystems" (Cooper et al., 2016) and "aesthetic appreciation" (Millenium Ecosystem Assessment, 2005).

Beyond the use of ecosystem services, and CES in particular, as a framework (Abson et al., 2014), there is increasing use of the concept of ecosystem services for applied conservation planning, based on identification of specific locations which provide services, and where these are used (Fisher et al., 2009). The location and value of CES in natural landscapes depends on the natural and man-made features in the landscape as well as the characteristics and socio-economics of the individuals placing them (Semmens et al., 2019; Zoderer et al., 2016a).

CES underpin our human value of an area and understanding what drives their location of CES can help our management of an area. CES are most frequently linked to the preference and appreciation of specific land use and land cover patterns (Daniel et al., 2012). Different types of land cover (Brown et al., 2012), biodiversity (Brandt et al., 2014), or even the presence of certain natural features (Martínez Pastur et al., 2016) can attract or detract the location of values. For example, Martínez Pastur et al. (2016) found that water features were a key attractant for the location of CES and van Zanten et al. (2016) found that mountain areas too attracted the location of CES. The provision of CES can vary from an entire ecosystem to a single sub-component (such as a single species) of an ecosystem (Liquete et al., 2016). In addition to this, the variety of natural features found in an area can positively affect the

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location of aesthetic services (Oteros-Rozas et al., 2016).

Another key component of an environment in provisioning for CES is the built anthropogenic infrastructure. Features such as roads and footpaths can increase accessibility to sites and so have a higher value and number of CES associated (Richards and Friess, 2015). The proximity of CES to population centres also has been shown to have a positive correlation (van Zanten et al., 2016) and places of CES value are often located near where people live' (Brown and Kyttä, 2014).

The interests and values of different stakeholder or demographic groups can provide a variability based on their social framing (van der Horst and Vermeylen, 2012) and so different social groups often have specific preferences for ecosystem services provided influenced by their social identity and demographic background (Castro et al., 2011; Gordon et al., 2010; López-Santiago et al., 2014; Zoderer et al., 2016a). Social and demographic characteristics can be split into a series of measurable properties such as our age, gender, education, employment and where we come from. However, relatively few studies have actually looked at the underlying socio-demographic determinants that influence the location of CES (Gao et al., 2014). Where studies have analysed these parameters, they often find that different demographic groups will respond differently both in the perception (Belaire et al., 2015) and the location of CES (Semmens et al., 2019; Stamps, 1999; Zoderer et al., 2016a). Our study assesses this in reverse, providing a unique insight into the location of CES and how this differs between different socio-demographic groups thus, providing a unique methodology driven by the location of CES. CES form a key component of land management decisions (Darvill and Lindo, 2016), being able to identify underlying drivers for the location of CES, can ensure that management decisions are inclusive of them.

Whereas the literature reviewed above is predominantly in western Europe and north America, the linkages between CES and socio-demographic drivers, the natural environment and man-made infrastructure are not well understood in island environments, which often have their own culture (Nunn, 2004). Remote oceanic islands' human histories show a clear connection to their natural environments, however fast changes in social and economic condition put an ever-increasing strain on their natural environments (Fernandes and Pinho, 2017).

Our study forms a case study for small oceanic islands; where small communities and the natural environment are closely linked (Kueffer and Kinney, 2017). Many islands are defined by their culture, although dependent on the mainland (Kaltenborn et al., 2017; Vallega, 2007), they are often culturally distinct from these (Pleasant et al., 2014). Islands often each with their peculiarities and local identities, share a systemic link between CES and human wellbeing (Kaltenborn et al., 2017). Owing to their nature as discrete socio-ecological units they lend themselves to studying the poorly understood (Kaltenborn et al., 2017) links between nature, CES and society (González et al., 2008). The Falkland Islands are a remote archipelago in the South Atlantic – often characterised by their rough and rugged appearance. The islands are historically a farming community of just under 3,400 people (Falkland Islands Government, 2016), though developments over the last three decades has seen commercial fishing become the dominant economic sector. Tourism too is a growing industry, attracted by the diverse coastal wildlife including penguins, sea lions and albatross. Since the late 1990s the road network has been constantly expanding, allowing access to more remote locations and settlements (Fig. 1).

This paper builds upon the work of Blake, Augé and Sherren (2017) on the Falkland Islands, and provides a deeper analysis of their data to determine the underlying demographic variations in the location of CES and the features of the natural environment which give rise to the location of CES. Based on the theory that CES arise from both factors of the ecosystem and the human value placed upon them, in this paper aims to understand the underlying demographic variability in the location of aesthetic and recreational CES in the Falkland Islands and identify the key demographic variants in affecting the placement of CES in a location based on human value. We also assess the variability in the location of CES by different groups in relation to geographical features to assess how preferences for CES arise.

2. Methodology

The methodology used in this research was conducted in a stepwise fashion and is described in detail here so that it may be of use to other authors willing to undertake similar analyses based on the location of CES. Using our method, once CES have been mapped, participants are grouped based on their location of CES. The different groups of participants are assessed for their demographic identity and the preferences of the environment around the location of their CES. The method requires a number of data including the location of CES, demographic data for participants and environmental/geographic data for the location of CES. Our methodology provides a novel approach, allowing the grouping of participants to be driven by the location of CES and then be assessed for demographic identity and environmental preferences. Using such a

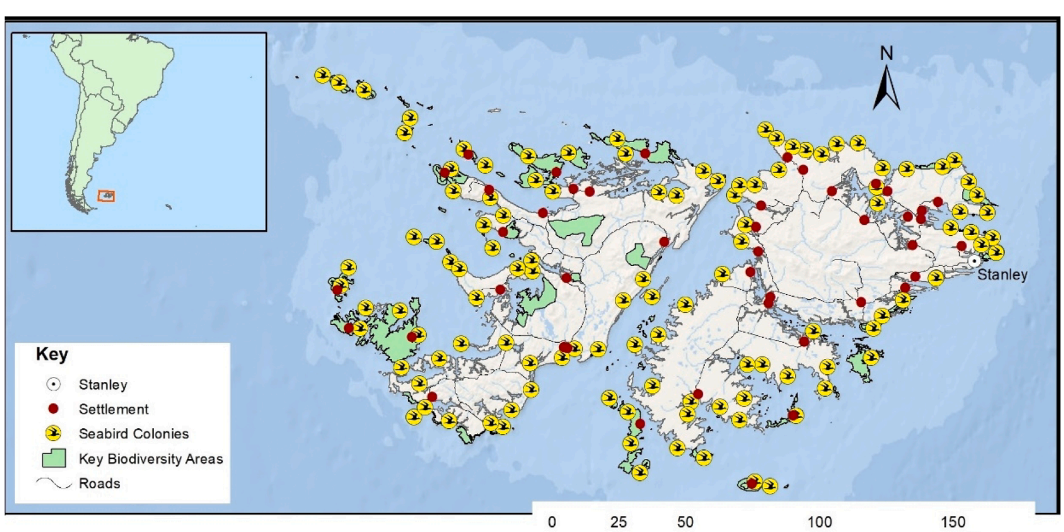

Fig. 1. Overview map of the Falkland Islands showing the location of settlements, roads, key biodiversity areas and seabird colonies; factors which were used in the analyses for environmental drivers of this study.

methodology is important where resources are scarce and stakeholder inclusion is important; enabling stakeholders to be identified as well as environmental patterns.

2.1. Data collection and sources

This work builds on the data collected by Blake, Augé and Sherren (2017) on the location of Cultural Ecosystem Services along the coastlines of the Falkland Islands. Blake et al interviewed 47 people across the Falkland Islands, 1.7% of the population (Falkland Islands Government, 2016), about their cultural preferences. All participants of this study were long-term residents and were invited to the interview through an advertising phone call (in outer lying settlements where everyone in the settlement was contacted) or through an advert in the local newspaper (in the main town of Stanley). During the study, participants were asked to trace on printed out maps their favourite areas of the coastline with the reason behind these areas (including either 'aesthetic' or 'recreational') and their level of attachment to these places (from 1 to 3 with 3 being most attached). Printed out maps used by participants simply showed the coastline, key settlements and the road network to ensure participants had a geographical point of reference. Those maps were later digitised and imported into a Geographic Information System.

Prior to the mapping approach each participant was asked to complete a survey asking them to identify their age, gender, level of education, sector of work, country of birth and how long they had been living in the Falkland Islands. The place of residence, the name of the settlement, of each participant was also recorded. For all the questions, participants had the option to not provide this information, however, all participants provided the required information. For the question relating to age, individuals were asked to select the range with age categories of: 18–30, 31–40, 41–50, 51–64, 65 + . No participant was younger than 18 in age to ensure consent in participation. For gender the options were male or female. For the level of education this was grouped into: no formal education, GCSE/O-level equivalent (Age 16), A-level equivalent (Age 18), a basal level tertiary degree or professional qualification (Age 18 +) or an advanced higher degree such as a masters or PhD. Sectors of work meant participants were able to identify whether they participated in the primary, tertiary or secondary sector or did not work. For the question relating to the country of birth participants gave their country of birth (as either Falkland Islands, Chile, UK or "other") and for the question on how long they had lived in the Falkland Islands this was categorised into 5–10 years, 10–20 years or 20 + years. All participants had been on the islands for longer than 5 years.

Environmental data used in the assessment of the location of coastal CES were collated from a variety of data sets. Factors that were assessed included the distance of lowest cost (to ensure travel was not across water) to the nearest road, settlement or airfield (for access to the site). The natural variables taken into account for testing the effect of location of both aesthetic and recreational ecosystem services was whether this was in the viewshed of a seabird colony, the distance from the nearest non-native species, the relief at the coastline, the habitat type and whether the point was in a key biodiversity area. Key biodiversity areas are areas which are designated as either a national nature reserve, Ramsar site, important plant area or an important bird area. For the use of seabird colonies, viewsheds were calculated from a digital elevation model (30 m DEM; curtesy of NASA LP DAAC (2017)) for the Falkland Islands for each known seabird colony (Gentoo Penguins, Southern Rockhopper Penguins, King Penguins, Giant Petrels and Black-browed Albatross), the presence or absence within these areas was used in the model. Both the factors of a visible seabird colony and whether an area of value is in a key biodiversity area are used as proxies for biodiversity. The slope at each point was calculated using the same 30 m DEM. All spatial data regarding roads, settlements, biodiversity area and seabird colony is courtesy of the Falkland Islands Governments Environmental Section (2017). The habitat types as classified by (Black, 2018. DPLUS0065: Coastal Mapping) was used to determine the relative percent of each coastal habitat for each group for both recreation and aesthetic value as well as the location of all areas where the habitat was identified as non-native.

2.2. Spatial grouping of participants

The first step in understanding the underlying drivers affecting the location of CES was to group; participants based on the spatial distribution pattern of their location of recreational and aesthetic CES. Here, participants were grouped based on the location of their recreational and aesthetic services separately.

To group participants based on the location of CES; digitized lines, which were the data product for the location of coastal CES, were buffered out to 500 m, which is the distance participants had been asked to consider by Blake et al. (2017), to create polygons. From these polygons, the pairwise dissimilarity between any two individuals was calculated by the intersecting the overlapping area for participants in ArcMap 10.5 (Esri, 2017). No normalisation was used as each participant had the choice to highlight the same area during the study. To understand the different spatial groupings a dissimilarity matrix was created from the pairwise comparison table. Data was then further analysed in using the *MASS* package in R (venables et al., 2002) to identify groups from a hierarchical cluster analysis based on the dissimilarity matrix. The elbow method (Thorndike, 1953) was used to identify the best number of groups. This was carried out. As a result of this step, each participant was assigned into a group based on the location of their recreational and aesthetic CES.

2.3. Demographic identity of groups

The groups identified during the previous step were next analysed to identify common demographic determinants. The demographic identity of each group was identified using a multinomial regression. This was run using all demographic determinants as factorial values; age, gender, level of education, sector of work, country of birth, place of residence and time of residence. The Akaike Information Criterion (AIC) (Akaike, 1973) was used in a backward stepwise selection to determine the best fit multinomial regression model, which identified the best suite of demographic identity for each group based on the location of values for recreational and aesthetic services. To assess the validity of each model, the predicted location outputs of the model was run against the real group results, cross-validating the result of the model's predicted outcome and those the model was trained on; accuracy of the resultant model was given as a percentage.

Using the best fit multinomial regression models, the demographic identity of each group was identified and described. This enabled the authors to create a descriptive identifying name for each group based on the demographic identity.

2.4. Environmental drivers for groups

To identify the environmental drivers that drive the location of CES for each of the groups, a further multinomial regression model was used. This was run based on the same groups identified in the spatial grouping of participants to determine the relationship of the spatial location of CES by groups with a suite of natural and anthropogenic environmental drivers. These drivers are the distance of lowest cost (to ensure travel was not across water) to the nearest road, settlement or airfield (for access to the site), whether the area was in the viewshed of a seabird colony, the distance from the nearest non-native species, the slope at the coastline, the habitat type and whether the point was in a key biodiversity area. Key biodiversity areas are areas which are designated as either a national nature reserve, Ramsar site, important plant area or an important bird area.

Only the environmental drivers of distance to nearest road, settlement or airfield for access; distance to the nearest patch of invasive species; and mean slope were statistically assessed using an ANOVA. This ANOVA was carried out between the different groups only, with the Falkland Islands average used as a reference value. Other environmental variables were described qualitatively and compared to the Falkland Islands average.

3. Results

3.1. Spatial segregation between participants' values

During the study by Blake et al. (2017), 34 participants marked areas on their maps of recreational importance and 47 participants marked areas of aesthetic importance. When the spatial overlap between participants was compared, a total of three statistical groups were found for recreational values and a total of five statistical groups were found for aesthetic values. The spatial segregation is clearly visible when the results from the different groups are placed on a map. For recreational services the three groups of participants are clearly using different areas for their recreational services (see Figs. 2 and 3), with only some overlap. Participants from Group A (n = 17) had most of their services found near Stanley and in the north of the west island with some smaller areas marked around the rest of the islands. This is different from Group B (n = 10), who although were also found around Stanley were also grouped around the south of the west island and in different isolated areas throughout both islands. Group C (n = 7) is probably the most diverse with seven locations found, three in the north of the West island and four in the north of the east island. Stanley was not marked for this group.

For aesthetic services a clear spatial segregation between groups (see Figs. 4 and 5) was also visible on the map. Group 1 (n = 24) had the widest spread of all groups with areas in the northwest of the east island, south of the east island and the smaller islands to the north of the west island. Group 2 (n = 3) is only found in a few locations in the central areas of both the east and west island and on the north coast of the west island. Group 3 (n = 13) predominantly marked areas on the west island and highlighted entire outer islands such as Weddell in the south west and Saunders and Pebble Island in the north-west. Group 4 (n = 3) only marked areas on West Falkland predominantly in the central/western region of the island. Group 5 (n = 4) also marked areas on West Falkland all which were either on the southern coast and a few on the outer islands in the north of the archipelago.

3.2. Demographic identity of groups

To ascertain the demographic determinants identifying the different groups in the location of CES a multinomial regression model was carried out. The best fit model was chosen in each case using AIC. It is important to note, that there are clear limitations due to the size of the group when assessing a regression model and this should be borne in mind.

For Recreational Services the best fit multinomial regression model to explain the group a participant was placed in was a combination of the age, birth place and education of the participants (this model predicted 68.4% of location of values) with all factors are highly significant (see Table 1). This allows us to identify the groups such that Group A, identified as "young diverse" members of the community, Group B as "mid-50 s and educated" and Group C as "British retirees".

For Aesthetic Services the best fit multinomial regression model combining the age, occupation sector and gender of participants was selected (this model predicted 72.5% of the location of values). Age and occupation sector together are the most statistically significant with gender less significant as a predictor, enabling us to identify the groups demographically (see Table 2). Group 1 identified as "educated late 50 s", Group 2 as "middle-aged farmers", Group 3 as "middle-aged women", Group 4 as "young, male farmers" and Group 5 as "elderly men".

3.3. Natural and anthropogenic features affecting the location of services:

The location of both aesthetic and recreational services between the different groups is affected by the cost-distance to the nearest infrastructure, whether it is in a key biodiversity area and the presence and absence of a seabird colony, distance from non-native species, habitat type and slope all highly significantly.

To further understand the variation observed between groups for these geographic determinants a global comparison was made between

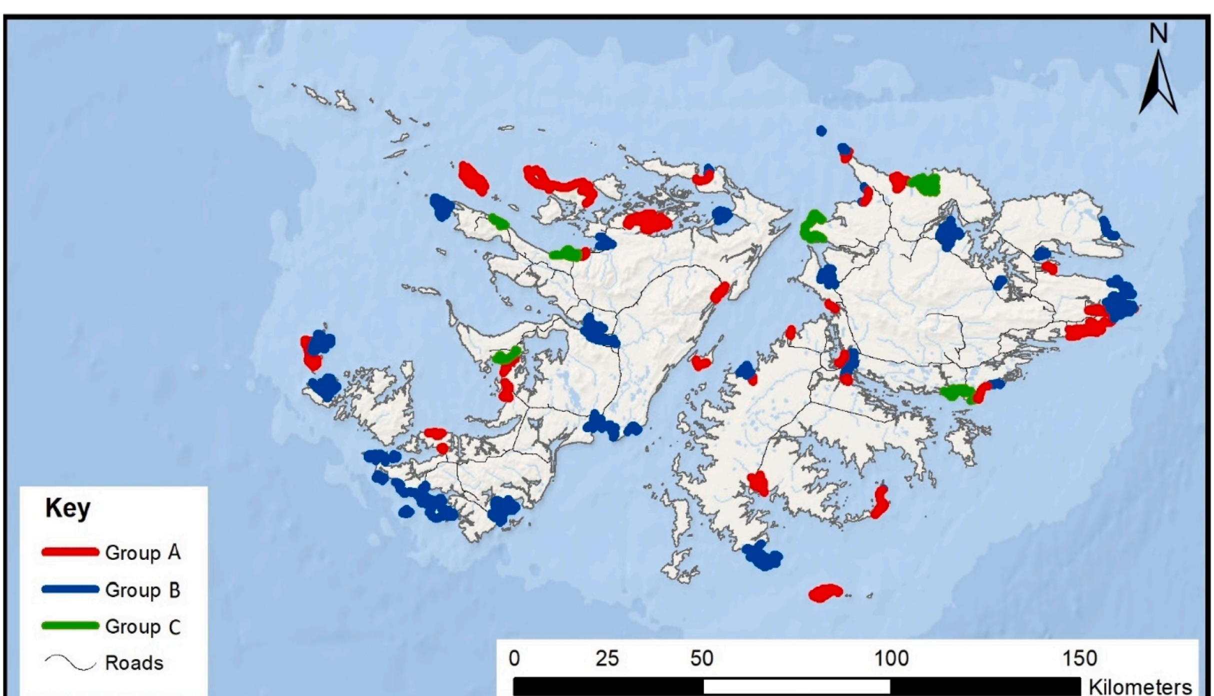

Fig. 2. Location of coastal Recreational Services for different groups showing clear spatial segregation. Table 3 provides a description of Groups A, B and C.

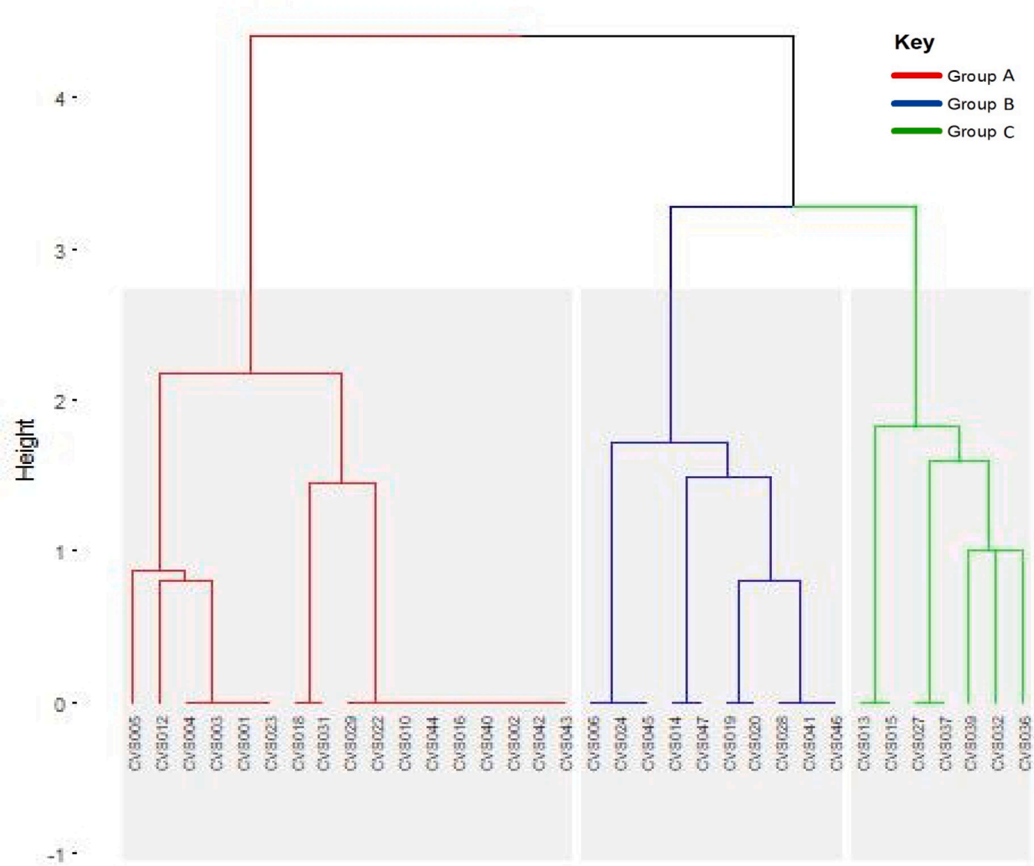

Fig. 3. Dendrogram of groups for recreational services, showing the level of dissimilarity between different participants and allowing for the identification of groups. Three clearly distinct groups were identified within this dendrogram.

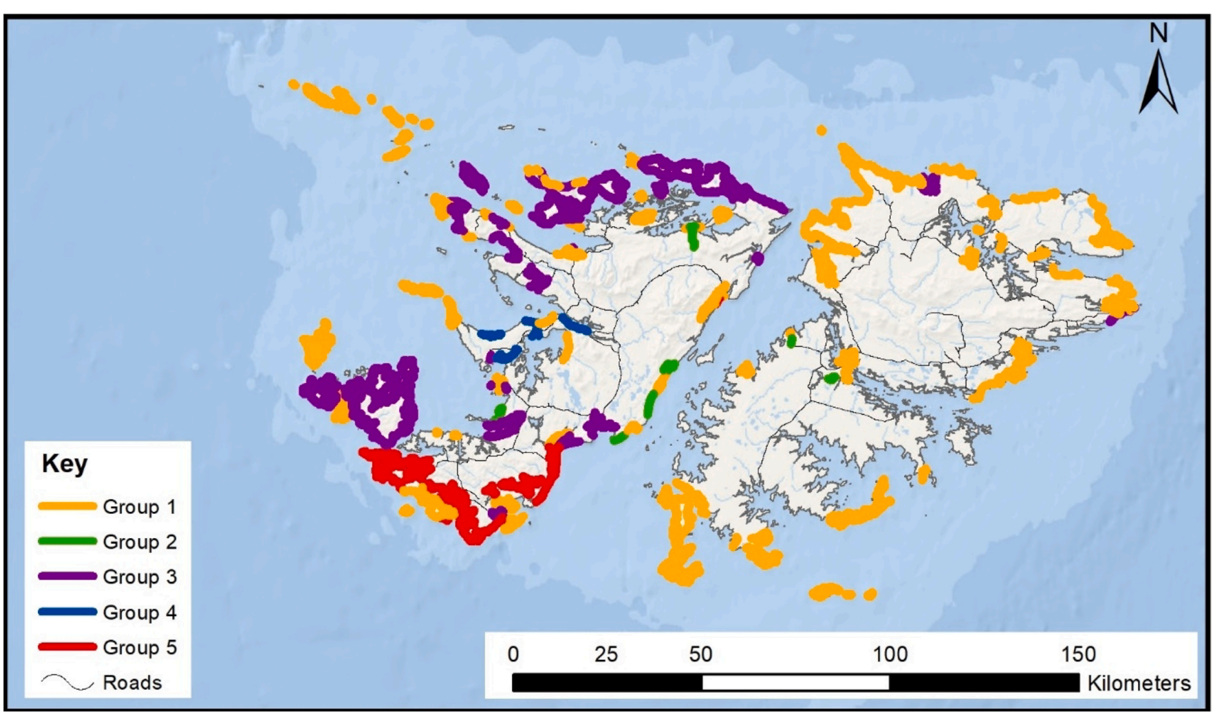

Fig. 4. Location of coastal Aesthetic Services for different groups showing clear spatial segregation. Table 3 provides a description of the 5 groups.

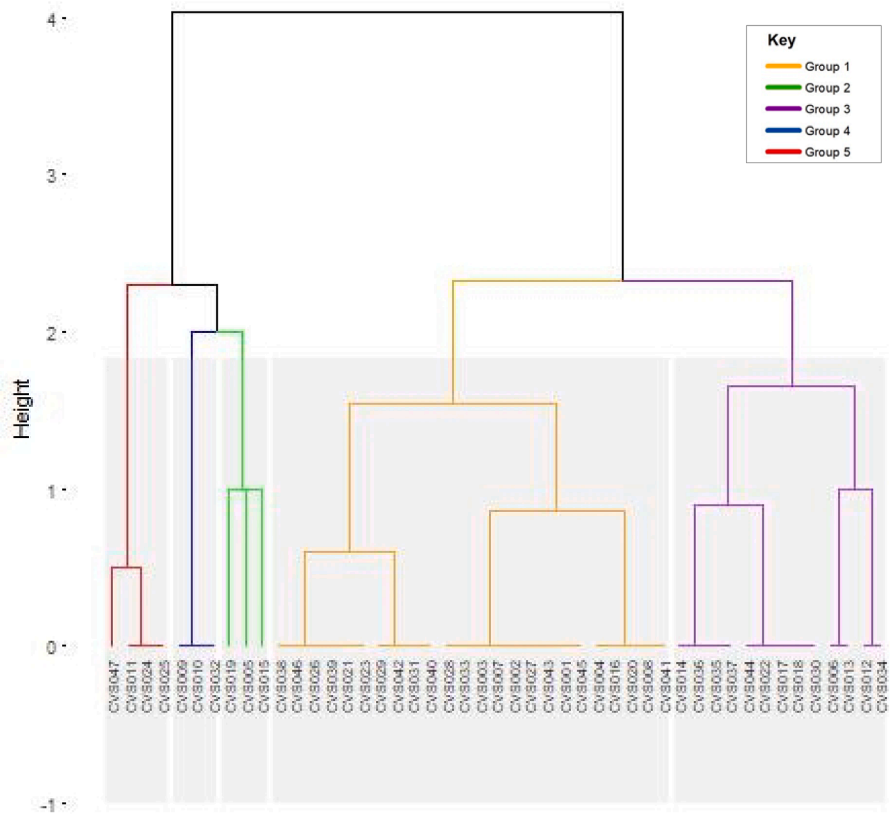

Fig. 5. Dendrogram of groups for Aesthetic Services, showing the level of dissimilarity between different participants and allowing for the identification of groups. Five clearly distinct groups were identified in this dendrogram.

Table 1
Significance of demographic determinants in a multinomial model of the location of recreational value, only best fit determinants were included in this table. Chi-squared values provide the difference in unexplained variance from the baseline value. Degrees of freedom take into account the different classes of predictor (c) of each group (n) such that the degrees of freedom are (c-1(n-1)).

	Chi-squared	Degrees of Freedom	p-value	Significance level
Age	27.060	8	0.0006903	<0.001
Birthplace	25.321	6	0.0002978	<0.001
Education	33.046	8	6.042E-05	<0.001

Table 2
Significance of demographic determinants in a multinomial model of the location of aesthetic value. only best fit determinants were included in this table. Chi-squared values provide the difference in unexplained variance from the baseline value. Degrees of freedom consider the different classes of predictor (c) of each group (n) such that the degrees of freedom are (c-1(n-1)).

	Chi-squared	Degrees of Freedom	p-value	Significance level
Age	48.476	16	3.997E-05	<0.001
Occupation Sector	33.530	12	0.0007999	<0.001
Gender	8.966	4	0.041964	0.05

the variation and values within each group and compared to the average for the coastline of the Falkland Islands (Table 3). For aesthetic services, both groups of farmers (n = 6) had all their areas of value within areas that were accessible from either a road, settlement or airstrip. The young farmers (n = 3) were also statistically more likely ($p < 0.05$) to choose areas closest to access points, whereas those who are educated late 50 s (n = 24) were more likely to choose areas further away from access points. All groups preferred “bare” habitats which equate to rocky or sandy shores over other habitat types. With a mixture of wetlands, heath and manmade habitats closely following. The amount of “bare” habitat for all groups was higher than the Falklands average. All groups apart from the middle-aged farmers liked placing their areas of value in or near areas where a seabird colony was visible, with those educated late 50 s (n = 24) doing so having the highest percentage of areas where a seabird colony is visible. All groups placed their areas of value closer to known areas of invasive plant species than the Falklands average except those who were educated late 50 s (n = 24), this group also preferred slightly steeper sloped places, however, the overall difference between groups was not significant. Middle-aged farmers (n = 3) were the only group who placed their areas of value more outside of key biodiversity areas than the Falkland Islands average.

For recreational services, as with aesthetic services, the values for each group were compared between groups and to the average of the Falklands coast. Those in their mid-50 s and educated (n = 10) placed their areas of value further from access points, however, all three groups had similar percent of areas which are accessible from an access point of either a road, settlement, jetty or settlement. As with aesthetic services all groups also preferred “bare” habitats more so than the Falkland Islands average. The youngest two groups (n = 27) placed their areas of value near seabird colonies whereas, the British retirees (n = 7), the oldest group, placed their areas of value in areas near seabird colonies in line with the Falkland Islands average. Similarly, the two youngest two groups (n = 27) also had a higher preference for key biodiversity areas than the eldest group, the British retirees (n = 7), who chose not to place their areas of value in a key biodiversity area. The British retirees (n = 7) however, placed their areas of value furthest from a non-native species as well, unlike the two younger groups. Although slope varied, the

Table 3
Overview of Environmental Drivers for different groups. Values shaded indicate there is a significant difference ($p < 0.05$) to at least one other group and those marked with an asterisk (*) indicate that there is a significant different ($p < 0.05$) compared to all other groups for the environmental driver.

		Aesthetic Service Group					Recreational Service Group		
		Group 1	Group 2	Group 3	Group 4	Group 5	Group A	Group B	Group C
	Falklands Islands Average	late-50s & educated (n = 24)	middle-aged farmers (n = 3)	middle-aged women (n = 13)	young, male farmers (n = 3)	elderly men (n = 4)	young diverse (n = 17)	mid-50s & educated (n=10)	British retirees (n = 7)
Distance to nearest road, settlement or airfield for access (m) (± 1 SD)	8471 ± 7065	10073 ± 10419 *	8929 ± 4245	9353 ± 6899	5057 ± 4575 *	8157 ± 4857 *	5642 ± 7955	10530 ± 12034 *	5681 ± 4302
Percent of sites accessible by land	*73.4%*	*70.0%*	*100.0%*	*91.8%*	*100.0%*	*83.7%*	*91.3%*	*92.8%*	*93.3%*
Habitat Type	*Bare - 40.8% Manmade, Rocks - 20.0% Wetland - 15.7%*	*Bare - 47.9% Manmade, Rocks - 18.1% Wetland - 15.7%*	*Bare - 44.3% Manmade, Rocks - 20.8% Heath - 19.8%*	*Bare - 52.5% Wetland - 15.05% Heath - 13.52%*	*Bare - 52.7% Manmade, Rocks - 14.4% Heath - 12.5%*	*Bare - 45.1% Wetland - 17.1% Heath - 14.5%*	*Bare - 49.3% Manmade - 18.6% Wetland - 17.1%*	*Bare - 49.4% Manmade - 15.4% Wetland - 13.7%*	*Bare - 45.9% Heath - 18.5% Manmade, Rocks - 13.7%*
Seabird Colony is visible	*9.5%*	*30.1%*	*6.1%*	*12.9%*	*18.1%*	*14.9%*	*25.5%*	*24.2%*	*9.6%*
Is in a biodiversity area	*28.8%*	*71.5%*	*0.0%*	*83.9%*	*51.4%*	*37.3%*	*58.7%*	*43.6%*	*9.4%*
Distance to nearest patch of Invasive Species (m) (± 1 SD)	1143.6 ± 1207.2	714.1 ± 1040.8 *	570.7 ± 518.3	512.7 ± 651.6	465.7 ± 376.1	530.7 ± 535.9	717.1 ± 866.6	645.3 ± 898.2	1048.0 ± 843.5 *
Mean Slope (degrees) (± 1 SD)	4.7 ± 5.2	7.1 ± 9.1 *	5.7 ± 4.3	6.2 ± 6.9	5.8 ± 5	6.1 ± 6.3	5.7 ± 6.6 *	5.2 ± 6.5	5.2 ± 5.5

difference between groups was again not significant ($p > 0.05$).

4. Discussion

Large scale CES assessments are difficult and often costly and time-consuming to undertake (Semmens et al., 2019). Small oceanic island states present an interesting prospect for improving our understanding of the drivers that guide the location of CES; they almost always don't share a land border with another nation enabling national jurisdictions to apply "island-wide" and they are often understudied – in geographical terms (Plieninger et al., 2018). This is certainly true of the Falkland Islands, whose coastline fits within one national jurisdiction and are broadly understudied, owing to their remoteness (Upson et al., 2016). This has provided a unique opportunity for carrying out a large-scale assessment of CES, identifying priorities and filling a knowledge gap for the islands which can be replicated elsewhere.

Furthering our understanding of the location, demographic variation and environmental factors affecting CES can influence our management of an area. CES underpin our human value of an area. Using our method, one can not only identify groups of stakeholders for CES in a variety of areas but also identify those environmental drivers that drive the location of CES. The identification and inclusion of stakeholder CES during land management decisions has been deemed as a key factor (Darvill and Lindo, 2016), and as such, using our method this can aide in ensuring management decisions are inclusive of CES and the stakeholders that locate them. Our method enables the identification and subsequent inclusion of stakeholder views in management decisions, through the use of modelling, making it a practical and cost-effective tool. The use of such tools is ever more important in small oceanic islands, such as the Falkland Islands, where gaining further insight into the demographic and environmental drivers for the location of CES can help bridge the science-policy gap, which impacts the sustainability of islands (Cámara-Leret and Dennehy, 2019), identifies conservation prioritisation (Sy et al., 2018) and defining the necessary policies for managing CES (Pleasant et al., 2014).

4.1. Demographic variation in the location of CES

In sociology, the habitus principle accounts for the habits, skills and dispositions that people of similar backgrounds make (Lyons et al., 1980). Our backgrounds are influenced by our demographic identity; including our age, religion, nationality, gender or profession (Smith, 2007). Our results here fall in line with Bourdieu's habitus principle, identifying that people of a similar background, will select similar areas to which they attach their areas of value.

This study has shown that for both aesthetic and recreational services there are groups of people who place their CES in different places; these groups are defined by differing socio-demographic properties. However, it is difficult to identify a single socio-demographic property that identifies the grouping; rather this is caused by a combination of different demographic factors. Secondly, it is also possible to see variation in the natural and anthropogenic infrastructure features of the different areas in which these CES are found. The link between socio-demographic identity and location of CES is still poorly understood (Dronova, 2019; Nguyen et al., 2017) yet it is clear that, despite the limitations of this study, that this link influences the location of CES in a natural environment.

Previous studies mostly focus on the variation in the type of CES chosen in a defined area and the link to different demographic drivers rather than the location of CES (see for example Plieninger et al., 2013; Belaire et al., 2015; Zoderer et al., 2016b). The demographic drivers that identified the different groups were not the same ones for recreational nor aesthetic services in this study. Fischer et al. (2018) observed that the type of CES chosen in parks varied between different socio-demographic groups and that the type of demographic drivers that influenced the choices were also different between the different CES. We here, have shown a similar trend, identifying that the location of the two different CES was influenced by different demographic drivers.

Parallels can also be drawn between the findings of this study and other studies based on the demographic determinants. Age, gender and employment as well as education were the contributing factors determining the location of CES in this study which is also true of other studies (see for example Plieninger et al., 2013 or Ament et al., 2017). Environmental behaviours are generally embedded within an individual lifestyle and not necessarily only measurable by demographic determinants (Katz-Gerro and Orenstein, 2015). This raises a limitation for the sole use of demographic variables in determining the location of CES. Not only do demographic factors play a role in an individual's environmental behaviour (such as the location of CES (Semmens et al., 2019)) but also socio-psychological factors, such as values and beliefs, which on occasion, have been more successful in explaining variability in an individual's environmental behaviour (de Groot and Steg, 2008;

Dietz et al., 1998; Katz-Gerro and Orenstein, 2015). This could explain the accuracy of our multinomial regression models.

4.2. Environmental drivers in the location of CES

We were able to show here that the location of CES is influenced by a range of environmental drivers including the ease of access and a variety of natural factors. In fact, it is often a range of environmental factors that give rise to the provision of a service (Ridding et al., 2018). As Blake, Augé and Sherren, (2017) had already shown, and Plieninger et al. (2018) noted the location of CES was not influenced by a participants place of residence. This may be attributed to small oceanic islands where residents value the whole archipelago rather than on continents and larger countries where people generally value areas closer to home more than those further away (Brown and Kyttä, 2014). This shows that when considering the location of CES in small oceanic islands it is important for decision-makers and researchers alike to ensure that the whole archipelago is capture to avoid introducing a spatial bias.

Our study found that there was a variation in the age of the group and the access distance to the nearest area of value for aesthetic services. The same is true for recreational services where the youngest and the oldest groups were closer to areas of access. Aesthetic services can be experienced from outside the environment in which they are found whereas, recreational services require active visits (Casado-Arzuaga et al., 2014). This can explain why older participants, for whom ease-of-access is important (Boyd et al., 2018) would choose areas closer to access points. Surprisingly, for both recreation and aesthetic services, the youngest group also preferred areas closer to areas of access. Young adults often have less time available for leisure (Payne, 2017) and so may not have the time available to access areas further from access points or even be able to see these areas such as to influence their aesthetic preference. Furthermore, as the population of the Falkland Islands increasingly moves to Stanley and away from rural areas (Falkland Islands Government, 2016), the younger population are less likely to need to travel to now inaccessible coastlines and so are not able to experience these. For aesthetic services, it is also likely that older members of the community would have had more opportunity to travel to (or even past) these places throughout their lives (Oppermann, 1995).

For aesthetic services, the employment sector of participants varied with biodiversity factors. Groups where participants are employed in the tertiary sector; service providers, were more likely to place their areas of value in known key biodiversity areas and more likely within the viewshed of a seabird colony than those employed in the primary sector. The primary sector in the Falkland Islands consist predominantly of farmers, who construct their landscape opinion out of a land management aspect (Beilin, 2005; Stotten, 2016). In contrast, those who are not farmers, preferred areas known for their biodiversity or with keystone species such as seabirds, both of which can be an indicator for a healthy environment. Across the literature there is a common link between the aesthetic value of an ecosystem and its ecological value (Tribot et al., 2018), although the exact links are still poorly understood. However, a difference in the perception of landscape aesthetics between farmers and non-farmers is well documented (Stotten, 2016; Włodarczyk-Marciniak et al., 2020).

Bare habitats were the most prevalent habitat type for all participants across both aesthetic and recreational services. This habitat equates to sandy or rocky beaches in the coastal environment. Beaches are an attractant for aesthetic ecosystem services particularly where they are in their most natural state (Morgan, 1999), this is also corroborated by our findings. The same is true for recreational ecosystem services, where beaches are also a key attractant for their location (Coombes and Jones, 2010; Hynes et al., 2018). Beaches are the most traversable of all coastal landscapes, which plays a key role in impacting the location of both recreational and aesthetic CES. Traversable foregrounds and vistas attract the location of aesthetic CES (McGranahan, 2008; Ulrich, 1984), whereas for recreational CES, the traversability and accessibility of an environment attracts the location of the service (Dudek, 2017).

Knowledge gaps can mean that the evidence base for necessary policy and actions can often be overlooked, this is particularly true in small oceanic islands (Caujapé-Castells et al., 2010; Churchyard et al., 2016). Although invasive species on the Falkland Islands are known to be harmful to our ecosystems, these may form an important part of the cultural ecosystem here (Falkland Islands Government, 2016), though there is not enough information to ascertain this. From this point of view, it is interesting to note that all areas of value, for all groups, including both recreational and aesthetic services were located closer to identified areas of invasive species. Invasive species patches that are identified and used in this study predominantly consisted of flowering plants (Black, pers. Comm.). Flowers are generally seen as highly aesthetically pleasing (Goodness et al., 2016) and are not commonly found in the Falkland Islands. On the flip side, invasive species are also linked to the proximity of human activity (O'Reilly-Nugent et al., 2016), providing an alternative theory for this observation. And so, it is likely that these, though not as a main factor, may have attracted the location of some of CES and impacted the community's perceptions of the landscape, however, it is also likely that the location is also entirely incidental. Further work would need to be undertaken to understand the impact that flowering, invasive plants species have on the provision of CES directly and through wider ecosystem impacts (Tribot et al., 2018). This understanding of the community perception of these invasive plant species forms part of a vital evidence-base in an ecosystem-based management approach which takes into account social and cultural perceptions (Daniels and Walker, 1996).

The Falkland Islands are a case study for remote and rural islands, where the understanding of CES is limited (Blake et al., 2017). As other authors, such as González et al. (2008) on the Galapagos Islands and Kaltenborn et al. (2017) in the Lofoten Islands had found, that though islands do share similarities and are connected with the mainland, they are also distinct in the connection between society and nature. One key consideration is that residents of islands will consider the whole islands, or in this case the whole archipelago, for selecting areas of importance. Distance and accessibility to areas of service provision is a key factor for the provision of CES, in particular recreational CES in many parts (Maes et al., 2012; Paracchini et al., 2014). We found that this varied considerably between demographic groups and areas of value are generally located further away from points of access and some even in non-accessible areas. Plieninger et al. (2018) showed that this too was true on the Faroe Islands and links this to the more natural landscapes located further from areas of access. However, as previously noted, islands all have their peculiarities and exhibit differences from each other and whilst the attraction to more natural landscapes may have played a key component on the Faroe Islands, and likely here too, the rural land-use patterns in the Falkland Islands provide an additional explanation. Large scale extensive sheep farming enables access to more remote areas for participants and also drives a willingness to travel further afield.

4.3. Methodological considerations

Blake et al. (2017) carried out their study to cover viewpoints from across society capturing those viewpoints from residents in most geographic regions. Though (Blake et al., 2017) included a significant proportion of the population, the small number of participants in this study form a considerable limitation. The sample size of 1.7% of the population was also larger than that normally found in similar studies across Europe or North America (see for example, Müller et al., 2019). However, we were able to show that both the demographic identity and the landscape impacted the location of recreational ecosystem services and provide a method for analysing trends herein. As such, though there are some trends in our findings, which do corroborate with findings in the wider literature, caution must be applied in the interpretation of these results and the validity of their assignment to the population as a whole.

A further limitation of the trends presented herein is that though factors such as residence time may have played a role, it was unlikely that these were likely to have been significant; only longer-term residents were sampled. Thus no differences were detected between individuals of different residence times (such as tourists, contract/seasonal workers and longer-term residents) who were not sampled, exploring this across a wider and more varied group of participants may cause clearer trends to become visible (Eisenhart et al., 2019). This was however intentional of Blake, Augé and Sherren (2017), who were predominantly interested in the perceptions of long-term residents.

5. Conclusions

In this study, we showed the potential of using a modelling approach to identify groups of stakeholders and the environmental drivers that drive their placement of CES, ensuring that the importance of the inclusion of CES in management decisions (Darvill and Lindo, 2016) is not forgone. Using the Falkland Islands as a case study, we showed how target groups of stakeholders, based on their demographic can be identified from the location of CES and how this location relates to the surrounding environment. This knowledge and exploration of CES is ever more important for remote oceanic islands, where bridging the science-policy gap is vital to the management of CES (Pleasant et al., 2014) and sustainability (Cámara-Leret and Dennehy, 2019).

We showed that groupings according to the location of CES by members of a community are linked to underlying demographic identity drivers. It is however important to note that it is a combination of demographic factors and a variety of backgrounds that lend us our preferences (Lyons et al., 1980). In this study we saw the variation in location of CES between participants in different groups, this is unsurprising as the perceptions of CES can be highly variable particularly amongst different demographic groups (Hirons et al., 2016). Although our results do show trends that are associated with certain demographic factors, we have also noted that there are a number of limitations contained in the study, including the small size. Nonetheless the application of our methodology shows that the location, and even preferences for CES can be predicted from a demographic identity of an individual and that there are clear differences in the preferences between different demographic sub-groups in the same community. In due course this knowledge has potential to reverse engineer the problem, providing an opportunity for modelling and predicting the location of CES across an entire population. Finally, we have also shown that in general distances to the nearest patch of invasive flowering plant was closer for all groups including recreational groups than the Falkland Islands average. This identifies a further study area, relating to the perception of CES for invasive species; forming a potentially interesting prospect and challenging implication for managers of invasive species.

CRediT authorship contribution statement

Denise Blake: Conceptualization, Data curation, Methodology, Project administration, Writing – original draft, Writing - review & editing. **Stephen Carver:** Conceptualization, Methodology, Writing - review & editing. **Guy Ziv:** Conceptualization, Methodology, Project administration, Resources.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

Abson, D.J., von Wehrden, H., Baumgärtner, S., Fischer, J., Hanspach, J., Härdtle, W., Heinrichs, H., Klein, A.M., Lang, D.J., Martens, P., Walmsley, D., 2014. Ecosystem services as a boundary object for sustainability. Ecol. Econ.

Akaike, H., 1973. Information theory and the maximum likelihood principle. In: 2nd International Symposium on Information Theory.

Ament, J.M., Moore, C.A., Herbst, M., Cumming, G.S., 2017. Cultural ecosystem services in protected areas: understanding bundles, trade-offs, and synergies. Conserv. Lett.

Beilin, R., 2005. Photo-elicitation and the agricultural landscape: 'Seeing' and 'telling' about farming, community and place. Vis. Stud.

Belaire, J.A., Westphal, L.M., Whelan, C.J., Minor, E.S., 2015. Urban residents' perceptions of birds in the neighborhood: Biodiversity, cultural ecosystem services, and disservices. Condor 117 (2), 192–202.

Blake, D., Augé, A.A., Sherren, K., 2017. Participatory mapping to elicit cultural coastal values for Marine Spatial Planning in a remote archipelago. Ocean Coast Manage. 148.

Boyd, F., White, M.P., Bell, S.L., Burt, J., 2018. Who doesn't visit natural environments for recreation and why: A population representative analysis of spatial, individual and temporal factors among adults in England. Landsc. Urban Plan.

Brandt, P., Abson, D.J., DellaSala, D.A., Feller, R., von Wehrden, H., 2014. Multifunctionality and biodiversity: ecosystem services in temperate rainforests of the Pacific Northwest. USA. Biol. Conserv. 169, 362–371.

Brown, G., Kyttä, M., 2014. Key issues and research priorities for public participation GIS (PPGIS): a synthesis based on empirical research. Appl. Geogr.

Brown, G., Montag, J.M., Lyon, K., 2012. Public participation GIS: a method for identifying ecosystem services. Soc. Nat. Resour. 25 (7), 633–651.

Cámara-Leret, R., Dennehy, Z., 2019. Information gaps in indigenous and local knowledge for science-policy assessments. Nat. Sustain.

Casado-Arzuaga, I., Onaindia, M., Madariaga, I., Verburg, P.H., 2014. Mapping recreation and aesthetic value of ecosystems in the Bilbao Metropolitan Greenbelt (northern Spain) to support landscape planning. Landsc. Ecol.

Castro, A.J., Martín-López, B., García-LLorente, M., Aguilera, P.A., López, E., Cabello, J., 2011. Social preferences regarding the delivery of ecosystem services in a semiarid Mediterranean region. J. Arid Environ. 75 (11), 1201–1208.

Caujapé-Castells, J., Tye, A., Crawford, D.J., Santos-Guerra, A., Sakai, A., Beaver, K., Lobin, W., Vincent Florens, F.B., Moura, M., Jardim, R., Gómes, I., Kueffer, C., 2010. Conservation of oceanic island floras: Present and future global challenges. Perspect. Plant Ecol. Evol. Syst.

Chan, K.M.A., Satterfield, T., Goldstein, J., 2012. Rethinking ecosystem services to better address and navigate cultural values. Ecol. Econ.

Churchyard, T., Eaton, M.A., Havery, S., Hall, J., Millett, J., Farr, A., Cuthbert, R.J., Stringer, C., Vickery, J.A., 2016. The biodiversity of the United Kingdom's Overseas Territories: a stock take of species occurrence and assessment of key knowledge gaps. Biodivers. Conserv.

Coombes, E.G., Jones, A.P., 2010. Assessing the impact of climate change on visitor behaviour and habitat use at the coast: A UK case study. Glob. Environ. Change.

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'. Ecosyst. Serv.

Daily, G., 1997. Nature's Services: Societal Dependence On Natural Ecosystems: Gretchen Daily: Island Press, Corporate Environmental Strategy.

Daniel, T.C., Muhar, A., Arnberger, A., Aznar, O., Boyd, J.W., Chan, K.M.A., Costanza, R., Elmqvist, T., Flint, C.G., Gobster, P.H., Gret-Regamey, A., Lave, R., Muhar, S., Penker, M., Ribe, R.G., Schauppenlehner, T., Sikor, T., Soloviy, I., Spierenburg, M., Taczanowska, K., Tam, J., von der Dunk, A., 2012. Contributions of cultural services to the ecosystem services agenda. Proc. Natl. Acad. Sci. 109 (23), 8812–8819.

Daniels, S.E., Walker, G.B., 1996. Collaborative learning: Improving public deliberation in ecosystem-based management. Environ. Impact Assess. Rev.

Darvill, R., Lindo, Z., 2016. The inclusion of stakeholders and cultural ecosystem services in land management trade-off decisions using an ecosystem services approach. Landsc. Ecol.

de Groot, J.I.M., Steg, L., 2008. Value orientations to explain beliefs related to environmental significant behavior: How to measure egoistic, altruistic, and biospheric value orientations. Environ. Behav.

Dietz, T., Stern, P.C., Guagnano, G.A., 1998. Social structural and social psychological bases of environmental concern. Environ. Behav.

Dronova, I., 2019. Landscape beauty: a wicked problem in sustainable ecosystem management? Sci. Total Environ. 688, 584–591.

Dudek, T., 2017. Recreational potential as an indicator of accessibility control in protected mountain forest areas. J. Mater. Sci.

Eisenhart, A.C., Crews Meyer, K.A., King, B., Young, K.R., 2019. Environmental Perception, Sense of Place, and Residence Time in the Okavango Delta, Botswana. Prof. Geogr.

Esri, 2017. ArcMap 10.5. ESRI.

Falkland Islands Government, 2016. Biodiversity Framework 2016-2030. Stanley, Falkland Islands.

Fernandes, R., Pinho, P., 2017. The distinctive nature of spatial development on small islands. Prog. Plann.

Fischer, L.K., Honold, J., Botzat, A., Brinkmeyer, D., Cvejić, R., Delshammar, T., Elands, B., Haase, D., Kabisch, N., Karle, S.J., Lafortezza, R., Nastran, M., Nielsen, A. B., van der Jagt, A.P., Vierikko, K., Kowarik, I., 2018. Recreational ecosystem services in European cities: Sociocultural and geographical contexts matter for park use. Ecosyst. Serv.

Fisher, B., Turner, R.K., Morling, P., 2009. Defining and classifying ecosystem services for decision making. Ecol. Econ. 68 (3), 643–653.

Gao, J., Barbieri, C., Valdivia, C., 2014. Agricultural Landscape Preferences: Implications for Agritourism Development. J. Travel Res. 53 (3), 366–379.
González, J.A., Montes, C., Rodriguez, J., Tapia, W., 2008. Rethinking the Galapagos Islands as a complex social-ecological system: Implications for conservation and management. Ecol. Soc.
Goodness, J., Andersson, E., Anderson, P.M.L., Elmqvist, T., 2016. Exploring the links between functional traits and cultural ecosystem services to enhance urban ecosystem management. Ecol. Indic. 70, 597–605.
Falkland Islands Government, 2016. Falkland Islands Census Report 2016.
Gordon, L.J., Finlayson, C.M., Falkenmark, M., 2010. Managing water in agriculture for food production and other ecosystem services. Agric. Water Manag.
Haines-Young, R., Potschin, M., 2010. The links between biodiversity, ecosystem services and human well-being. Ecosyst. Ecol. A new Synth. 110–139.
Heal, G., 2000. Valuing ecosystem services. Ecosystems 3 (1), 24–30.
Hermes, J., Van Berkel, D., Burkhard, B., Plieninger, T., Fagerholm, N., von Haaren, C., Albert, C., 2018. Assessment and valuation of recreational ecosystem services of landscapes. Ecosyst. Serv.
Hirons, M., Comberti, C., Dunford, R., 2016. Valuing cultural ecosystem services. Annu. Rev. Environ. Resour. 41 (1), 545–574.
Hynes, S., Ghermandi, A., Norton, D., Williams, H., 2018. Marine recreational ecosystem service value estimation: A meta-analysis with cultural considerations. Ecosyst. Serv.
Kaltenborn, B.P., Linnell, J.D.C., Baggethun, E.G., Lindhjem, H., Thomassen, J., Chan, K. M., 2017. Ecosystem Services and Cultural Values as Building Blocks for 'The Good life'. A Case Study in the Community of Røst, Lofoten Islands, Norway. Ecol. Econ.
Katz-Gerro, T., Orenstein, D.E., 2015. Environmental tastes, opinions and behaviors: Social sciences in the service of cultural ecosystem service assessment. Ecol. Soc.
Kueffer, C., Kinney, K., 2017. What is the importance of islands to environmental conservation? Environ. Conserv.
Linton, D.L., 1968. The assessment of scenery as a natural resource. Scott. Geogr. Mag.
Liquete, C., Cid, N., Lanzanova, D., Grizzetti, B., Reynaud, A., 2016. Perspectives on the link between ecosystem services and biodiversity: The assessment of the nursery function. Ecol. Indic.
López-Santiago, C.A., Oteros-Rozas, E., Martín-López, B., Plieninger, T., Martín, E.G., González, J.A., 2014. Using visual stimuli to explore the social perceptions of ecosystem services in cultural landscapes: The case of transhumance in Mediterranean Spain. Ecol. Soc. 19.
Lyons, A.P., Bourdieu, P., Nice, R., 1980. Outline of a Theory of Practice. ASA Rev. Books.
Maes, J., Paracchini, M.L., Zulian, G., Dunbar, M.B., Alkemade, R., 2012. Synergies and trade-offs between ecosystem service supply, biodiversity, and habitat conservation status in Europe. Biol. Conserv. 155, 1–12.
Martínez Pastur, G., Peri, P.L., Lencinas, M.V., García-Llorente, M., Martín-López, B., 2016. Spatial patterns of cultural ecosystem services provision in Southern Patagonia. Landsc. Ecol. 31 (2), 383–399.
McGranahan, D.A., 2008. Landscape influence on recent rural migration in the U.S. Landsc. Urban Plan.
Milcu, A.I., Hanspach, J., Abson, D., Fischer, J., 2013. Cultural ecosystem services: a literature review and prospects for future research. Ecol. Soc. 18, 44–88.
Millenium Ecosystem Assessment, 2005. Ecosystem and Human Well-Being: Synthesis. Isl. Press 1–59.
Mooney, H., Ehrlich, P., 1997. Ecosystem Services: A Fragmented History. In: In Nature's Services: Societal Dependence On Natural Ecosystems. pp. 11–19.
Morgan, R., 1999. Some factors affecting coastal landscape aesthetic quality assessment. Landsc. Res. 24 (2), 167–184.
Müller, S.M., Peisker, J., Bieling, C., Linnemann, K., Reidl, K., Schmieder, K., 2019. The importance of cultural ecosystem services and biodiversity for landscape visitors in the biosphere reserve Swabian Alb (Germany). Sustain. 11 (9), 2650. https://doi.org/10.3390/su11092650.
Nguyen, V.D., Roman, L.A., Locke, D.H., Mincey, S.K., Sanders, J.R., Smith Fichman, E., Duran-Mitchell, M., Tobing, S.L., 2017. Branching out to residential lands: Missions and strategies of five tree distribution programs in the U.S. Urban For. Urban Green.
Nunn, P.D., 2004. Through a mist on the ocean: Human understanding of island environments. Tijdschr. voor Econ. en Soc. Geogr.
O'Reilly-Nugent, A., Palit, R., Lopez-Aldana, A., Medina-Romero, M., Wandrag, E., Duncan, R.P., 2016. Landscape Effects on the Spread of Invasive Species. Curr. Landsc. Ecol. Reports.
Oppermann, M., 1995. Travel life cycle. Ann. Tour. Res. 22 (3), 535–552.
Oteros-Rozas, E., BertaMartín-López, B., Fagerholm, N., Bieling, C., Plieninger, T., 2016. Using social media photos to explore the relation between cultural ecosystem services and landscape features across five European sites. Ecol. Indic.
Paracchini, M.L., Zulian, G., Kopperoinen, L., Maes, J., Schägner, J.P., Termansen, M., Zandersen, M., Perez-Soba, M., Scholefield, P.A., Bidoglio, G., 2014. Mapping cultural ecosystem services: A framework to assess the potential for outdoor recreation across the EU. Ecol. Indic.
Payne, C.S., 2017. Leisure time in the UK: 2015. Off. Natl. Stat.
Pleasant, M.M., Gray, S.A., Lepczyk, C., Fernandes, A., Hunter, N., Ford, D., 2014. Managing cultural ecosystem services. Ecosyst. Serv.
Plieninger, Tobias, Dijks, Sebastian, Oteros-Rozas, Elisa, Bieling, Claudia, 2013. Assessing, mapping, and quantifying cultural ecosystem services at community level. Land use policy 33, 118–129.
Plieninger, T., Rana, H.Á. av, Fagerholm, N., Ellingsgaard, G.F., Magnussen, E., Raymond, C.M., Olafsson, A.S., Verbrugge, L.N.H., 2018. Identifying and assessing the potential for conflict between landscape values and development preferences on the Faroe Islands. Glob. Environ. Chang.
Richards, Daniel R., Friess, Daniel A., 2015. A rapid indicator of cultural ecosystem service usage at a fine spatial scale: content analysis of social media photographs. Ecol. Indic. 53, 187–195.
Ridding, L.E., Redhead, J.W., Oliver, T.H., Schmucki, R., McGinlay, J., Graves, A.R., Morris, J., Bradbury, R.B., King, H., Bullock, J.M., 2018. The importance of landscape characteristics for the delivery of cultural ecosystem services. J. Environ. Manage.
Semmens, D.J., Sherrouse, B.C., Ancona, Z.H., 2019. Using social-context matching to improve spatial function-transfer performance for cultural ecosystem service models. Ecosyst. Serv.
Smith, T.W., 2007. Social identity and socio-demographic structure. Int. J. Public Opin. Res. 19 (3), 380–390.
Stamps, A.E., 1999. Demographic effects in environmental aesthetics: A meta-analysis. J. Plan. Lit.
Stotten, R., 2016. Farmers' Perspectives on Cultural Landscapes in Central Switzerland: How Landscape Socialization and Habitus Influence an Aesthetic Appreciation of Landscape. Soc. Nat. Resour.
Sy, M.M., Rey-Valette, H., Simier, M., Pasqualini, V., Figuières, C., De Wit, R., 2018. Identifying Consensus on Coastal Lagoons Ecosystem Services and Conservation Priorities for an Effective Decision Making: A Q Approach. Ecol. Econ.
Thorndike, Robert L., 1953. Who belongs in the family? Psychometrika 18 (4), 267–276.
Tribot, A.S., Deter, J., Mouquet, N., 2018. Integrating the aesthetic value of landscapes and biological diversity. Proc. R. Soc. B Biol. Sci.
Ulrich, R., 1984. View through a window may influence recovery from surgery. Science 224 (4647), 420–421.
Upson, Rebecca, Williams, Jennifer J., Wilkinson, Tim P., Clubbe, Colin P., Maclean, Ilya M.D., McAdam, Jim H., Moat, Justin F., Carcaillet, Christopher, 2016. Potential impacts of climate change on native plant distributions in the Falkland Islands. PLoS One 11 (11), e0167026.
Vallega, A., 2007. The role of culture in island sustainable development. Ocean Coast. Manag.
van der Horst, D., Vermeylen, S., 2012. Ownership claims, valuation practices, and the unpacking of energy-landscape conflicts. Int. Rev. Sociol.
van Zanten, Boris T., Van Berkel, Derek B., Meentemeyer, Ross K., Smith, Jordan W., Tieskens, Koen F., Verburg, Peter H., 2016. Continental-scale quantification of landscape values using social media data. Proc. Natl. Acad. Sci. U. S. A. 113 (46), 12974–12979.
Venables, W.N., Ripley, B.D., 2002. Modern Applied Statistics with S Fourth edition by, World.
Włodarczyk-Marciniak, Renata, Frankiewicz, Piotr, Krauze, Kinga, 2020. Socio-cultural valuation of Polish agricultural landscape components by farmers and its consequences. J. Rural Stud. 74, 190–200.
Zoderer, Brenda Maria, Lupo Stanghellini, Paola Sabina, Tasser, Erich, Walde, Janette, Wieser, Harald, Tappeiner, Ulrike, 2016a. Exploring socio-cultural values of ecosystem service categories in the Central Alps: the influence of socio-demographic factors and landscape type. Reg. Environ. Change 16 (7), 2033–2044.
Zoderer, Brenda Maria, Tasser, Erich, Erb, Karl-Heinz, Lupo Stanghellini, Paola Sabina, Tappeiner, Ulrike, 2016b. Identifying and mapping the tourists' perception of cultural ecosystem services: A case study from an Alpine region. Land use policy 56, 251–261.