

Article

Home Garden Ecosystem Services Valuation through a Gender Lens: A Case Study in the Catalan Pyrenees

Laura Calvet-Mir ^{1,2,*}, Hug March ², Daniel Corbacho-Monné ³, Erik Gómez-Baggethun ^{4,5} and Victoria Reyes-García ^{1,6}

¹ Institut de Ciència i Tecnologia Ambientals, Universitat Autònoma de Barcelona, Bellaterra, Barcelona 08193, Spain; Victoria.reyes@uab.cat

² Internet Interdisciplinary Institute (IN3), Universitat Oberta de Catalunya, Av. Carl Friedrich Gauss, 5. Parc Mediterrani de la Tecnologia, Castelldefels, Barcelona 08860, Spain; hmarch@uoc.edu

³ Sant Cugat del Vallès, Barcelona 08172, Spain; jogaddor@gmail.com

⁴ Department of International Environment and Development Studies (Noragric), Norwegian University of Life Sciences, (NMBU), Universitetstunet 3, Ås 1430, Norway; erik.gomez@nmbu.no

⁵ Norwegian Institute for Nature Research (NINA), Gaustadalléen 21, Oslo 0349, Norway

⁶ ICREA, Pg. Lluís Companys 23, Barcelona 08010, Spain

* Correspondence: lcalvetmi@uoc.edu or lcalvetmir@gmail.com; Tel.: +34-93-450-5410; Fax: +34-93-450-5201

Academic Editor: Helmut Haberl

Received: 23 March 2016; Accepted: 21 July 2016; Published: 27 July 2016

Abstract: Ecosystem services have become a critical issue in the environmental literature, however knowledge on whether women and men similarly value ecosystem services is still nascent. We aim at advancing the understanding of the relation between gender and environmental perceptions through the analysis of values assigned by women and men to ecosystem services supplied by home gardens in Vall Fosca (Catalan Pyrenees, north-eastern Spain). We found that women give a higher value than men to all ecosystem services. Overall, women's valuation of the full range of ecosystem services provided by home gardens was 7.55% higher than men's valuation. Gender socialization influences the way people interact with and value the environment, including highly managed environments such as home gardens. We argue that considering gendered differences in ecosystem services valuation may lead to policies more effective in enhancing ecosystem services provision.

Keywords: agroecosystems; allotments; gender socialization; social-ecological systems; socio-cultural valuation

1. Introduction

The study of gendered differences in environmental values, attitudes, knowledge, and behaviors have been an active field of research for the past two decades (see for instance Blocker and Eckberg, 1997; Davidson and Haan, 2012; Gustafson, 1998; Byrnes et al., 1999; Meinzen-Dick et al., 2014 for an extended review) [1–5]. Research on gendered differences in environmental attitudes has both dealt with general environmental aspects (Zelezny et al., 2000) [6] and with a large number of specific environmental issues including water scarcity (Larson et al., 2011) [7], climate change (McCright, 2010; March et al., 2014) [8,9], natural resource management (Meinzen-Dick et al., 2014) [5], environmental risks of technology (Davidson and Freudenburg, 1996) [10], and biotechnology (Simon, 2011) [11].

In this work, we examine gendered differences in the socio-cultural valuation of ecosystem services (e.g., Maestre-Andrés et al., 2016; Oteros-Rozas et al., 2014) [12,13] provided by a type of heavily managed ecosystems: home gardens. We focus on the provision of ecosystem services, i.e., the flows of benefits for human well-being provided by natural ecosystems (MA, 2003) [14], because although this field constitutes a rapidly growing research area, the study of gender issues

in the context of ecosystem services research is still nascent (for some exceptions see: Allendorf and Yang, 2013; Kalaba et al., 2013; Martín-López et al., 2012; Shen et al., 2015 [15–18]). Ecosystem services span from tangible goods like wood, clean water, or agricultural products to non-material benefits like landscapes' aesthetic features, climate regulation, and maintenance of soil fertility (de Groot et al., 2002 [19]; MA, 2003 [14]; Kumar, 2010 [20]). Specialized literature and international initiatives endorsing the ecosystem services approach, such as the Millennium Ecosystem Assessment (MA, 2003) [14] and The Economics of Ecosystems and Biodiversity (Kumar, 2010) [20], have emphasized the role that managed ecosystems play in the delivery and maintenance of critical services and in fostering social-ecological resilience (Barthel et al., 2010; Power, 2010; Biggs et al., 2012 [21–23]). In such context, we focus on the services provided by home gardens, defined here as small, fenced plots close to the farmers' homestead, where annual, biennial, and perennial cultivated species are grown in beds (Vogl and Vogl-Lukasser, 2003) [24]. The focus in home gardens not only contribute to fill a gap in the literature, but it might also have practical implications as home gardens are being promoted in many countries as a strategy towards sustainability and resilience (Langemeyer et al., 2016) [25]. Therefore, it is important for policy makers and managers to understand the multiple, differential (and gendered) perceptions of the services such ecosystems provide.

In this article, we aim at advancing our knowledge of how the services provided by family-managed home gardens are valued by women and men. Following the Oxford Dictionary, the conceptual framework of the Intergovernmental Panel of Biodiversity and Ecosystem Services (IPBES) (Diaz et al., 2014) [26] and recent literature on ecosystem service valuation, values are defined here as the 'importance, worth, or usefulness' people attribute to ecosystem services and valuation is used accordingly as the act of assessing, appraising, or measuring value or importance (Dendoncker et al., 2013 [27]; Gómez-Baggethun et al., 2016 [28]). Following previous research on non-economic valuation of ecosystem services (Kelemen et al., 2014) [29], we adopted a socio-cultural valuation approach to rank the perceived importance of ecosystem services (see Langemeyer et al., 2015 [30]; Martín-López et al., 2012 [17]; Oteros-Rozas et al., 2014 [13]; Maestre-Andrés et al., 2016 [12]). Our case study centers in the Vall Fosca, Catalan Pyrenees, Northeastern Spain.

2. Gender and Environmental Attitude: An Inconclusive Debate

As noted, the empirical literature on gender and environmental attitudes presents divergent findings. A large body of research shows that women present a higher degree of pro-environmental attitudes than men. Reviewing research published between 1988 and 1998, Zelezny et al. (2000) [6] showed that women consistently reported more pro-environmental attitudes and behaviors than men. Using data from the General Social Survey in the USA for 2000 and 2010, Xiao and McCright (2015) [31] also found that women show greater pro-environmental views and higher levels of environmental concerns than men; and in another survey with US students, Nurse et al. (2010) [32] also observed that, when compared to men, women were more inclined to think that nature had inherent or intrinsic value, scored higher on the need to seek out nature-related experiences, and scored lower on environmental apathy. Similar results were found in other environmental topics, such as sensibility to climate change and concerns over water. For example, in another study in the USA, women exhibited slightly higher levels of climate change knowledge and concern than their male counterparts (McCright 2010) [8]. Similar results were identified by March et al. (2014) [9] who argued that women perceived that climate change would result in higher impacts for the Catalan tourist sector than men. Likewise, Larson et al. (2011) [7] showed that women were more concerned than men regarding water scarcity and resource governance in Phoenix, Arizona.

Scholars have often built on socialization theory to explain gendered differences towards the environment (e.g., Zelezny et al., 2000) [6]. Socialization theory posits that individual behavior is predicted by the process of socialization, whereby individuals are shaped by expectations within the context of gendered cultural norms (Eagly, 1987 [33]; Miller, 1993 [34]). Early childhood socialization and the learned expectations of their role in reproduction renders women more sensitive to

the feelings and needs of others and thus more willing to assume caring and nurturing roles (Gilligan, 1982 [35]; Mohai, 1992 [36]). The same culturally defined roles may make women more concerned about environmental problems and future generations (Eisler et al., 2003) [37] and also explain other gendered differentiated behavior such as higher levels of altruism (Dietz et al., 2002) [38], cooperation, and compassion (Beutel and Marini, 1995) [39]. On their side, socialization theory postulates that early childhood socialization makes men more prone to control their emotions, to value independence and achievement (Gilligan, 1982) [35], and to take more risks than women (Byrnes et al., 1999) [4]. This learned behavior may lead men to undervalue environmental problems.

Such research findings, however, are not without challenge. We have been able to locate only one study in which the authors found no gender differences in relation to environmental issues. In a study drawing on nationally representative survey data from Great Britain, Norway, The Netherlands, Germany, Japan, and the United States, Hayes (2001) [40] pointed out to the little or non-existent gender differences in attitudes towards the environment notwithstanding the major levels of scientific knowledge held by men. We found, however, several works in which the authors provide a more nuanced picture of these relations. For example, in an extensive literature review Davidson and Freudenburg (1996) [10] highlighted that while women display higher levels of concern towards technological risk and the environment than men, the differences are not found when examining results for wider environmental concerns. Similarly, drawing on data from the 1993 General Social Survey, including 40 items measuring environment attitudes, beliefs, and actions, Blocker and Eckberg (1997) [1] found that women show a higher degree of personal environmental concern than men, but that this concern was not translated into a higher level of engagement into environmental action.

On the same line, some studies demonstrate that gender differences or similarities in values and perceptions towards the environment may exist but are scale and context specific. For instance, in a study across 22 nations, Hunter et al. (2004) [41] found that women's behavior in the private sphere is more sensitive to environmental matters (e.g., recycling, driving less) than men's behavior. The statement, however, seemed to hold better for nations at the upper end of wealth distribution rankings. Similarly, Xiao and Hong (2010) [42] demonstrated that women have greater internalization of environmental behaviors than men in the private sphere (e.g., recycling); however, they also warned that this might not be the case for the public sphere (e.g., environmental organization donations). Meinzen-Dick et al. (2014) [5] reviewed 166 academic references on gender and natural resource management in the Global South and concluded that, although gender matters for sustainable resource management, sustainability is not intrinsic to women just because of their sex. The authors underscored the need to take into account other intangible and inherent motivations of both women and men and their material conditions.

As for other environmental issues, the literature also shows conflicting evidence regarding the existence of gender differences on the valuation of ecosystem services, although the conflict here refers to whether men or women perceive more ecosystem services. Some authors observed that women perceive more ecosystem services than men. This is shown, for instance, by Martín-López et al. (2012) [17] in a study covering eight protected and non-protected areas of Spain. Likewise, Shen et al. (2015) [18] reported that women in Japan showed a higher willingness to pay for open ocean services than men. Oteros-Rozas et al. (2014) [13] analyzing a transhumance social-ecological network in Spain also highlighted the existence of a gender differences in the valuation of ecosystem services, with women valuing more regulating services and men valuing more those related to raising livestock. Other studies, however found that men perceive and value more ecosystem services than women. In a study on the return of ecosystem services in replanted mangrove forests, Ronnback et al. (2007) [43] found that men were more positive on planting mangroves in the future than women. Similarly, in Myanmar, Allendorf and Allendorf (2013) [44] observed that women are less likely to show positive attitudes towards protected areas than men. Elsewhere, Kalaba et al. (2013) [16] found that in Zambia more male-headed households used forest-provisioning services than female-headed households as coping strategies to food stresses and shocks.

3. Vall Fosca and Its Home Gardens

Vall Fosca is a Pyrenean valley of glacial formation of 200 km² and about 1000 inhabitants lying along the Flamisell River, in northeastern Spain (Figure 1). High altitudes and rough terrain make the development of intensive agriculture difficult, which explains why the area lacks a strong agricultural sector. Traditionally, the predominant activity has been cattle ranching, and the most characteristic form of agriculture in the area was home gardening. More recently, local inhabitants started to combine traditional production activities with tourism services, offering accommodation and food for urban visitors especially in summer.

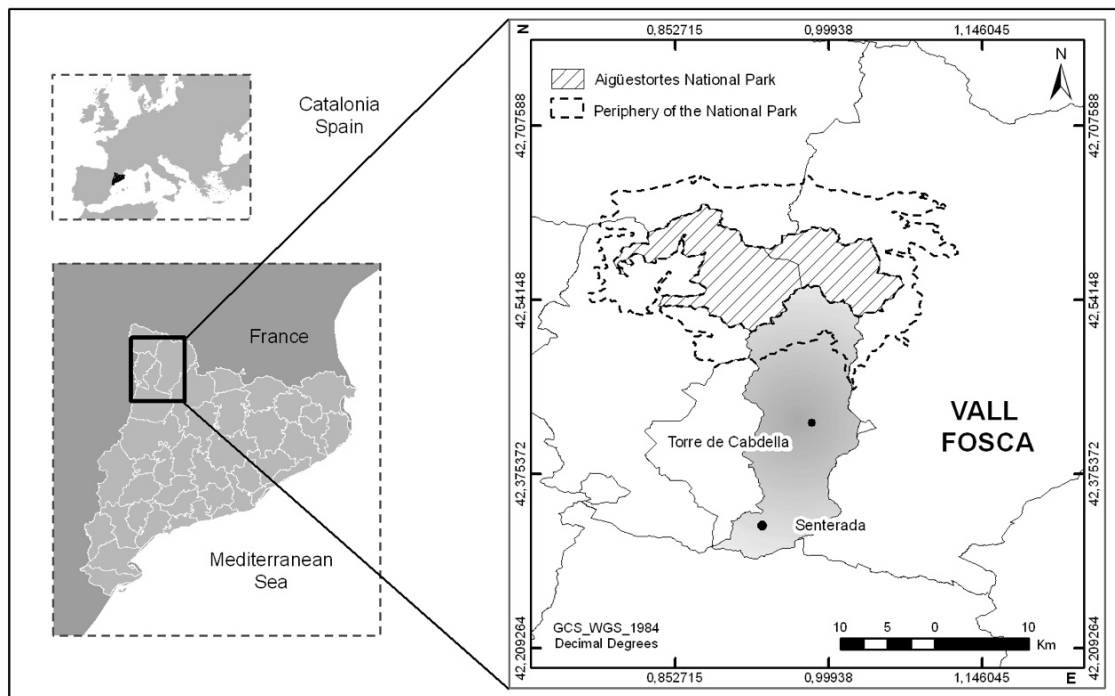


Figure 1. Map of the study area.

Customarily, women in Vall Fosca were in charge of home gardens as part of their household activities, as men spent much of their time outside the household in charge of cattle. However, this traditional division of work has been recently reversed for gardening. In previous research, we found that men managed 43.4% of the home gardens studied, whereas women managed 37.7%. Home gardens managed jointly represented the 18.9% of the studied ones (Calvet-Mir et al., 2012) [45]. Results are not specific to the area, as they concur with findings reported by Reyes-García et al. (2010) [46] for the Catalan Pyrenees.

Recent changes in gender roles on home gardening can be attributed to changes in livelihoods associated with the crises of traditional socio-economic activities in the countryside starting in the second half of the 20th century. The decay of the farming sector that followed the advance of industrialization in Spain forced many men to engage in non-farming occupations, such as service, manufacturing, and construction sectors (Naredo, 2004) [47]. Despite these changes in socio-economic structures and lifestyles, many households continued to maintain home gardens. Because farming tasks were considered men's domain, men who shifted to non-farming occupations probably also took a more prominent role in gardening (Brandth, 2002) [48]. Based in ethnographic observations, we also argue that the recent prominent role of men in gardening can be explained because retired men from non-farming sectors have started to manage a home garden as a hobby.

The average area of home gardens in Vall Fosca is 147.25 m². Despite their small size, home gardens contain 148 different species from 50 families. Most species grown in home gardens

are edible (41.9%) or ornamental (36.5%), although home gardens also host species used as medicines, fodder, and spices. We found 39 different local landraces, predominantly cultivated and maintained by women, retired people, people who manage organic gardens, or experienced gardeners (Calvet-Mir et al., 2011) [49].

Calvet-Mir et al. (2012) [45] identified and characterized 19 ecosystem services provided by home gardens in Vall Fosca, which constitute the basis for the analysis of gender differences developed here. Drawing on well-established categorizations (de Groot et al., 2002 [19]; MA, 2003 [14]; Kumar, 2010 [20]), the ecosystem services provided by the home gardens in Vall Fosca were classified as regulating (5), habitat (2), production (5), and cultural services (7) (Table 1). Cultural services were the most valued services among those provided by home gardeners, as people interviewed in the study felt that home gardens were a central element of Vall Fosca's landscape, and stated that home gardens had to be preserved as an important component of their cultural heritage (Calvet-Mir et al., 2012) [45].

Table 1. Definition and summary statistics of explanatory and control variables used in statistical analysis ($n = 151$).

		Definition	Total	Men	Women	
<i>Explanatory variable</i>			%	%	%	
Man	Dummy variable: 0 = woman, 1 = man		53.64			
<i>Control variables</i>						
Visitor	Dummy variable: 0 = resident in Vall Fosca; 1 = visitor		58.94	62.96	54.29	
Organic food	Dummy variable: 0 = never consume organic food; 1 = consume organic food		68.21	67.90	68.57	
ES	Dummy variable: 0 = do not know the term "ecosystem services"; 1 = otherwise		13.91	13.58	14.29	
Cultural heritage	Dummy variable: 0 = home gardens should not be preserved as cultural heritage; 1 = otherwise		94.70	93.83	95.71	
Secondary education	Dummy variable: 0 = the person has not completed secondary education; 1 = the person has completed secondary education		64.90	72.84	55.71	
Garden type	Garden type	0	No garden	49.01	41.98	57.14
		1	Non-organic garden	19.87	20.99	18.57
		2	Organic garden	31.13	37.04	24.29
			Mean (StD)	Mean (StD)	Mean (StD)	
Age	Respondent's age in years		52.21 (19.63)	48.59 (19.77)	56.39 (18.74)	

4. Methods

We collected data in Vall Fosca between July and November 2010. We first carried out participant observation and open-ended interviews with individuals or groups of stakeholders. Such information gave us a better understanding of gender roles in the valley, and particularly of the gendered division of labor in home gardening. For example, women usually reported that they liked to see flowers in their home gardens, so even women who did not manage a home garden would request that their husbands grow ornamental plants for them. These conversations gave us a wider understanding of people's perception of home garden ecosystem services, especially of services difficult to capture with highly structured methods or closed questionnaires.

Then, during July–September 2010, we conducted a survey among 151 adults who directly or indirectly benefited from the ecosystem services provided by home gardens. We used a stratified

sampling strategy to obtain a similar number of (a) men and women; (b) visitors and local inhabitants; and (c) people who owned a home garden and people who did not.

All the people in the sample answered the same survey questions. The first part of the survey captured information on the socio-demographic characteristics of the respondents, including our main explanatory variable. Other socio-demographic characteristics collected include whether the informant was a visitor, whether the person had completed secondary education, and the age of the person. Our survey also captured information on specific informants' behaviors that might relate to how they value home garden ecosystem services. The selected behaviors include (1) whether the person reported consuming organic products; (2) whether the person knew the meaning of the term "ecosystem services"; (3) whether the person considered that home gardens should be preserved as cultural heritage; and (4) which type of garden did the informant grow (where 0 = the person reported not to manage a home garden, 1 = the person reported using chemical fertilizers or agrochemicals and weed control techniques in the garden, and 2 = the person reported managing an organic garden) (Table 1).

The second part consisted of an assessment of the level of agreement with a series of statements about the importance of the 19 home garden ecosystem services identified by Calvet-Mir et al. (2012) [45] (Table 2). Specifically, we asked individuals to tell us how much they disagreed or agreed with each of the statements in a scale ranging from zero ("I completely disagree") to five ("I completely agree"). Each statement was presented orally but was also accompanied with visual means such as pictures from local ecosystems. We are aware that providing a pre-written positive statement to the gardeners might result in an overvaluation of the ecosystem services (Calvet-Mir et al., 2012) [45], but we see no reason why such overvaluation might be different between women and men, so the results of comparing women's and men's data will still hold validity.

We used the answers from the survey to create a set of variables for statistical analysis. The main variable of interest captures individual valuation of ecosystem services and was constructed using responses to the 19 questions on ecosystem services provided by home gardens. We first tested whether all the questions measured the same construct. The results from reliability factor analysis using Cronbach alpha suggested that there was internal consistency in the scale used to assess the perception of home garden ecosystem services, as all the items of the scale were positively associated with one another ($\alpha = 0.88$). Given this internal consistency, we aggregated the answers to the different questions to create five outcome variables: *Total*, *Regulating*, *Habitat*, *Production* and *Cultural*, where *Total* refers to the sum of all the responses and the other four variables correspond to the sum of individual responses to questions on each category of ecosystem services (Table 2).

To assess gender differences in the valuation of ecosystem services provided by home gardens, we ran a Wilcoxon rank-sum test of responses given by women and men to questions related to the 19 ecosystem services identified. We explored the importance of gender in the valuation of home gardens ecosystem services vis-à-vis other attributes of the informants (i.e., being a visitor, having secondary education, age) and vis-à-vis the selected behaviors (i.e., organic, ecosystem services, cultural heritage, and garden type). We did so by running ordinary least square multiple regressions using the variable that captures individuals' overall valuation of ecosystem services (*total*) as our dependent variable, gender as our explanatory variable, and the other variables as control. We then repeated the analysis using the score of the valuation of the specific categories of services (regulating, habitat, production, and cultural services) as dependent variables but kept the rest of the model unchanged. We used STATA 9 for Windows for the statistical analysis.

Table 2. Valuation of ecosystem services provided by home gardens in Vall Fosca ($n = 151$ informants).

Ecosystem Service	Average Valuation (from a Range 0 to 5)		
	A	B	C
	Men ($n = 81$)	Women ($n = 70$)	Overall ($n = 151$)
<i>Regulating</i>			
Flood prevention (when gardens are located near rivers)	1.61	2.13 **	1.85
Maintenance of natural, productive soils	4.36	4.60	4.47
Enhanced crop production	3.46	3.81	3.62
Enhanced water quality	2.01	2.56 **	2.26
Prevention/buffering of pests and diseases	1.88	2.36 **	2.10
Total average score of regulating services (from a range 0 to 25)	13.31	15.46 ***	14.30
<i>Habitat</i>			
Living space for wild plants and animals	3.48	3.86 **	3.66
Maintenance of landraces	4.58	4.70 **	4.64
Total average score of habitat services (from a range 0 to 10)	8.06	8.56 **	8.29
<i>Production services</i>			
Provision of quality food	4.90	4.91	4.91
Provision of fodder and green manure	3.99	4.66 ***	4.30
Crop improvement and material for medicinal proposes	3.88	3.97	3.92
Provision of medicinal plants	4.06	4.50 ***	4.26
Provision of resources for worship and decoration	3.56	4.46 ***	3.97
Total average score of production services (from a range 0 to 25)	20.38	22.50 ***	21.36
<i>Cultural services</i>			
Enjoyment of home garden aesthetic features	4.35	4.73 ***	4.52
Hobby	4.62	4.79 *	4.70
Use in folklore, art, and design	3.20	3.87 ***	3.51
Connection with spiritual feelings	4.06	4.47 **	4.25
Place to carry out environmental education and scientific research	4.40	4.63 *	4.50
Heritage value of home gardens and associated traditional ecological knowledge	4.57	4.73 **	4.64
Place for creating and enhancing social networks	4.12	4.60 ***	4.34
Total average score of cultural services (from a range 0 to 35)	29.31	31.81 ***	30.47
Total average score of all services (from a range 0 to 95)	71.06	78.33 ***	74.43

Wilcoxon rank-sum test comparing women's and men scores; * Significant at $\leq 10\%$; ** Significant at $\leq 5\%$; *** Significant at $\leq 1\%$.

At the end of fieldwork (November 2010), we organized a participatory workshop in a central local town, La Torre de Cabdella, in order (1) to communicate research results and (2) to validate and discuss them with respondents. Twenty people attended the workshop, including nine men and 11 women, ranging between 23 and 85 years old. Five participants were visitors and the rest were permanent residents in the valley; 12 of them managed a home garden (including two visitors managing a home garden in their hometown). At the onset of the workshop, we presented participants with results from the survey (see Table 2). Then, we asked them for their explanations of why they thought women attributed higher values to home gardens' ecosystem services than men. We recorded the discussion and have used participants' comments to support and enrich the findings from the survey.

5. Results

Table 2 presents the average valuation of ecosystem services given by men (Column A), women (Column B), and the whole sample (Column C). Our sample was similarly distributed between men (54%) and women (46%) (see Table 1 for other socio-demographic characteristics). On average, and for every ecosystem service, the score given by women was higher than the score given by men. The difference was statistically significant in a Wilcoxon rank-sum test for 15 of the 19 ecosystem services. The four services for which the difference was not significant in statistical terms include two regulating services ("maintenance of natural, productive soils" and "enhanced crop production") and two production services ("provision of quality food" and "crop improvement and material for medicinal purposes"). The largest differences in women and men's valuation of ecosystem services were found in two production services ("provision of resources for worship and decoration" and "provision of fodder and green manure") and in one cultural service ("use in folklore, art, and design"). For example, the average score given by women to the ecosystem service that presents the largest differences in valuation ("provision of resources for worship and decoration") was 0.90 points higher (18%) than the average score given by men ($p < 0.001$) (Table 1). When aggregating scores into categories (i.e., regulating, habitat, production, and cultural), we also found that the total average score given by women was 5% to 8.6% higher than the total average score given by men. Bivariate analysis shows that the difference was statistically significant for all the categories (Table 2).

The results from the multivariate analysis, presented in Table 3, corroborate that women are more likely to give higher valuation scores to ecosystem services than men. Results using the total score (adding the valuation given to each ecosystem service; column *Total*) suggest that, everything else being constant, on average, women value ecosystem services 7.17 points higher than men ($p < 0.001$). Since the variable *Total* ranges from 0 to 95 points, a difference of 7.17 points represents 7.55% of the total score. When considering specific categories of ecosystem services, the largest differences on valuation were found in regulating, production, and cultural services. On average, women valued home garden regulating services 2.38 points (or 9.52%) higher than men ($p = 0.004$), production services 1.97 points (or 7.88%) higher ($p = 0.003$), and cultural services 2.43 points (or 6.94%) higher ($p = 0.001$). The smallest difference was found in the category of habitat services. Women valued habitat ecosystem services only 0.38 points (or 3.80%) higher than men, and the difference was not significant in statistical terms ($p = 0.284$). None of the control variables used in the analysis were consistently associated with the different valuation of ecosystem services, although we found some statistically significant associations. For example, in general terms, informants who reported that gardens should be preserved as cultural heritage (variable *cultural heritage*) valued ecosystem services significantly higher than the ones who did not. This association was statistically significant in all the categories except the production category.

Table 3. Coefficient (StD Error) of ordinary least square multiple regressions results ($n = 151$).

	Total	Regulating	Habitat	Production	Cultural
Explanatory variable					
Man	−7.17 *** (1.98)	−2.38 *** (0.81)	−0.38 (0.35)	−1.97 *** (0.60)	−2.43 *** (0.80)
Control variables					
Visitor	4.80 * (2.46)	2.43 ** (1.01)	0.43 (0.43)	0.86 (0.75)	1.07 (0.99)
Organic products	3.72 * (2.11)	1.42 (0.86)	0.50 (0.37)	0.95 (0.64)	0.84 (0.85)
ES	−6.54 ** (2.85)	−2.92 ** (1.16)	0.44 (0.50)	−1.28 (0.86)	−2.78 ** (1.14)
Cultural heritage	9.87 ** (4.16)	3.48 ** (1.70)	1.99 *** (0.73)	1.48 (1.26)	2.89 * (1.66)
Secondary education	0.08 (2.76)	0.94 (1.12)	−0.07 (0.49)	−0.20 (0.84)	−0.60 (1.10)
Garden type (Excluded category: non-organic garden)					
No garden	5.24 * (2.84)	1.28 (1.16)	0.55 (0.50)	1.07 (0.86)	2.33 ** (1.14)
Organic garden	5.25 * (2.78)	1.66 (1.14)	0.88 * (0.49)	0.94 (0.84)	1.77 (1.11)
Age	0.03 (0.06)	0.01 (0.03)	0.02 (0.01)	0.01 (0.02)	−0.01 (0.02)

Regressions results include a constant (not shown). For definition of variables see Table 2. * Significant at $\leq 10\%$; ** Significant at $\leq 5\%$; *** Significant at $\leq 1\%$.

The workshop organized to discuss the outcomes of the survey with the respondents complements our results. When discussing possible explanations of why women gave a higher valuation than men to home garden's ecosystem services, workshop participants reached consensus around three key points. First, participants argued that in Vall Fosca, women have traditionally been in charge of managing home gardens. For instance, one respondent (female, 75 years) argued that: "Women are the ones that spent more time in the home garden". Second, participants also explained that the traditional division of labor and the gender roles assigned to women (i.e., taking care of the family and cooking) implied that women associated home gardens to the domestic sphere and to family well-being. For example, some respondents (females from 48 to 80 years old) explained that as they were in charge of cooking, it was always useful to have something to harvest in the home garden". Last, workshop participants argued that men consume less home garden products than women, and that—therefore—men value the nutritional contribution of home gardens less than women. During the workshop a participant (male, 67 years) stated that "men do not like the green", referring to men reluctance to consume vegetables as compared to meat. All participants backed this statement and they gave examples of some of the vegetables disliked by men such as cabbage and chard.

6. Discussion

The results of our research suggest, first and foremost, that women value home garden ecosystem services more than men. We ascribe such differences to the gender roles culturally assigned to men and women (Eagly, 1987 [33]; Miller, 1993 [34]). In this regard, for example, the difference in the valuation of the "provision of resources for worship and decoration" (i.e., the ecosystem service showing the highest contrast between women and men's responses) can be arguably linked to cultural roles assigned to women. During informal interviews, women explained that they planted Chrysanthemums (*Chrysanthemum indicum* L.) not only for aesthetic reasons, but also to bring them to the graveyard on All Saints Day (1 November), a social role not culturally assigned to men (for similar insights across the Spanish Pyrenees, see Reyes-García et al. (2010) [46]). Similarly, women in Vall Fosca have traditionally been in charge of feeding and taking care of domestic animals (e.g., hens, rabbits), a social function that might help explain the dissimilarities between men and women when it comes to valuing the "provision of fodder and green manure" (the ecosystem service ranking second in difference between men and women). Outcomes from the workshop also pointed out that, due to the traditional role of women in home garden management, women continue to value home gardens more than men, even if today many men are also involved in managing home gardens. Higher values were also attributed to the more direct use of home garden products by women through cooking, regardless of whether the woman managed a home garden or not.

Taken together, these insights suggest socialization plays a salient role in shaping the values and perceptions over ecosystem services provided by home gardens. The assignation of social reproduction roles to women, and the function of home gardens for the fulfillment of such a task drive women's motivations and understandings around home garden management. The social roles assigned to women (Zelezny et al., 2000; Meinzen-Dick et al., 2014) [5,6], women's responsibility for social needs (Eisler et al., 2003) [37], and their nurturing role (Mohai, 1992) [36] are likely to be important factors explaining gender differences in the valuation of home gardens ecosystem services.

One a priori striking exception to this clear-cut relationship between women's socialization and their higher valuation of home gardens ecosystem services is that men and women equally value the ecosystem service of "provision of quality food". Previous researchers have noticed that the most valued service provided by home gardens is the provision of quality food (Swinton et al., 2007) [50]. We add to this research showing that these results equally hold for women and men. We suggest that the lack of differences between men's and women's valuation relates to the fact that food supply is conceived as an intrinsic characteristic of home gardens. Two additional reasons can be highlighted as important. First, because of the absence of shops and the limited accessibility to market towns, especially in winter, home gardens in Vall Fosca have traditionally played an important role as a complement for the household food supply. Even nowadays, home gardens in the area host a wide diversity of species and varieties used for household consumption (Calvet-Mir et al., 2011) [49]. Second, previous work suggests that home gardens across the Spanish Pyrenees, including the Vall Fosca, are important in economic terms. Researchers have found that home gardens provide a non-negligible financial gross income of approximately 1691 €/year per tender, an amount equivalent to three minimum monthly salaries in Spain (Reyes-García et al., 2012) [51].

Overall, our findings contribute to ongoing debates on the role of gender in shaping values, attitudes, and behavior towards global and local environmental issues (e.g., Hayes, 2001 [40]; Nurse et al., 2010 [32]). Valuation based on subjective preferences on ecosystem services is widely acknowledged to be a suitable tool for capturing many of the social values people attribute to the environment (Bryan et al., 2010) [52]. In this regard, our results suggest that gender is indeed an important variable that helps to explain people's different attitudes towards the environment. Moreover, in our particular case, gender showed to be more important than any of the other variables considered. However, as many authors have argued in multiple research areas (Agarwal, 1992 [53]; González-García, 2008 [54], Meinzen-Dick et al., 2014 [5]), it would be misleading to assume that "women" constitute a homogeneous social category. Paying attention to the diversity of women is a crucial requirement for both an adequate understanding of the factors influencing human-environment relationships and for the identification of areas and strategies for intervention. Moreover, as Kollmuss and Agyeman (2002) [55] highlight, although altruism and pro-social models can explain specific gender differences in environmentalism, there are also external (i.e., economic, cultural) and internal (i.e., motivation, values, attitudes) factors that influence pro-environmental attitudes. Meinzen-Dick et al. (2014) [5] concluded that while gender is a crucial dimension affecting natural resource management, this is not automatically translated into women being inherently more resource-conserving than men. Instead, the authors underscore the importance of taking into account other tangible and intangible factors, including local environment, context, culture, material conditions, power structures, knowledge, ideology, etc. that may intersect with gender in building people's perceptions and abilities and practices of sustainable and resilient natural resource management.

Building on the argument of Iniesta-Arandia et al. (2014) [56], we argue that environmental knowledge is produced and mobilized by women because of their practices in the context of traditional gender socialization (with a sex-based division of labor), this knowledge should be valued, shared and conserved by all society.

7. Conclusions

Our research suggests that the ecosystem services provided by home gardens in Vall Fosca are more valued by women than by men. We argue that socialization may be a relevant factor in shaping the values and perceptions of home garden ecosystem services. This context-specific finding highlights the global importance to understand how gendered valuation can produce barriers and options to the provision and management of ecosystem services, a critical issue for social-ecological systems (Folke et al., 2002 [57], Biggs et al., 2012 [23]). We contend that gender should be transversal in any process of assessment and valuation of ecosystem services in order to create institutional solutions that are gender sensitive.

We acknowledge that as a social construct, gender is both fluid and context specific but heavily shaped by the asymmetrical roles held by men and women in social reproduction tasks. If we aim to enhance ecosystem services provision, we need to implement policies that contribute to turning these gendered and often marginalized values, knowledge, and practices into widely shared ones. While home gardens reproduce these inherited (and sometimes unacknowledged) dynamics, they might be a modest, yet powerful, tool to disrupt them. Thus, we sustain that home gardening could contribute to transcending the unequal role of men and women in social reproduction, via promoting the sharing of values, knowledge, and practices among gardeners. There is an increasing recognition of the importance of ecosystem services provided by gardening to enhance social-ecological resilience (Langemeyer et al., 2016) [25]. In this context, it is crucial to integrate the gender perspective in the process of planning, design, implementation, and managing of ongoing and future garden projects (both in urban and rural settings).

Acknowledgments: Research was funded by the Programa de Ciencias Sociales y Humanidades del Ministerio de Educación y Ciencia (MEC-España) (SEJ2007-60873/SOCI), the Programa de Ciencias Sociales y Humanidades del Ministerio de Ciencia e Innovación (CSO2011_27565), the Agència de Gestió d'Ajuts Universitaris i de Recerca (AGAUR) and the Centre de Promoció de la Cultura Popular i Tradicional Catalana (CPCTC) (Generalitat de Catalunya). L. Calvet-Mir acknowledges financial support from a FPU grant of the MEC-España (AP-2006-01849). We thank all the tenders who collaborated in the project. We also thank Maria Calvet-Mir and Laia Echániz-Pou for help during fieldwork and in the elaboration of the figures. Thanks also go to Irene Iniesta-Arandia, Federica Ravera, Berta Martín-López and Concepción Piñeiro for their valuable revision of a previous version of the article.

Author Contributions: Laura Calvet-Mir and Victoria Reyes-García with the collaboration of Erik Gómez-Baggethun designed the experiment; Laura Calvet-Mir with the help of Daniel Corbacho-Monné conducted the fieldwork; Laura Calvet-Mir performed the statistical analysis; Laura Calvet-Mir, Hug March and Daniel Corbacho-Monné lead the literature review on gender and the environment with the collaboration of Victoria Reyes-García and Erik Gómez-Baggethun; Laura Calvet-Mir and Hug March were the leading authors in the writing of the paper with the help of Victoria Reyes-García and Erik Gómez-Baggethun.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Blocker, T.J.; Eckberg, D.L. Gender and environmentalism: Results from the 1993 general social survey. *Soc. Sci. Q.* **1997**, *78*, 841–858.
2. Davidson, D.J.; Haan, M. Gender, political ideology, and climate change beliefs in an extractive industry community. *Popul. Environ.* **2012**, *34*, 217–234. [[CrossRef](#)]
3. Gustafson, P.E. Gender differences in risk perception: Theoretical and methodological perspectives. *Risk Anal.* **1998**, *18*, 805–811. [[CrossRef](#)] [[PubMed](#)]
4. Byrnes, J.P.; Miller, D.C.; Schafer, W.D. Gender differences in risk taking: A meta-analysis. *Psychol. Bull.* **1999**, *125*, 367–382. [[CrossRef](#)]
5. Meinzen-Dick, R.; Kovarik, C.; Quisumbing, R. Gender and sustainability. *Annu. Rev. Environ. Resour.* **2014**, *39*, 29–55. [[CrossRef](#)]
6. Zelezny, L.C.; Chua, P.; Aldrich, C. New ways of thinking about environmentalism: Elaborating on gender differences in environmentalism. *J. Soc. Issues* **2000**, *56*, 443–457. [[CrossRef](#)]

7. Larson, K.L.; Ibes, D.C.; White, D.D. Gendered perspectives about water risks and policy strategies: A tripartite conceptual approach. *Environ. Behav.* **2011**, *43*, 415–438. [[CrossRef](#)]
8. McCright, A. The effects of gender on climate change knowledge and concern in the American public. *Popul. Environ.* **2010**, *32*, 66–87. [[CrossRef](#)]
9. March, H.; Saurí, D.; Llundés, J.C. Perception of the effect of climate change in winter and summer tourist areas: The Pyrenees and the Catalan and Balearic coasts, Spain. *Reg. Environ. Chang.* **2014**, *14*, 1189–1201. [[CrossRef](#)]
10. Davidson, D.J.; Freudenburg, W.R. Gender and environmental risk concerns: A review and analysis of available research. *Environ. Behav.* **1996**, *28*, 302–339. [[CrossRef](#)]
11. Simon, R.M. Gendered contexts: Masculinity, knowledge, and attitudes toward biotechnology. *Public Underst. Sci.* **2011**, *20*, 334–346. [[CrossRef](#)] [[PubMed](#)]
12. Maestre-Andrés, S.; Calvet-Mir, L.; van den Bergh, J.C.J.M. Sociocultural valuation of ecosystem services to improve protected area management: A multi-method approach applied to Catalonia, Spain. *Reg. Environ. Chang.* **2016**, *16*, 717–731.
13. Oteros-Rozas, E.; Martín-López, B.; González, J.A.; Plieninger, T.; López, C.A.; Montes, C. Socio-cultural valuation of ecosystem services in a transhumance social-ecological network. *Reg. Environ. Chang.* **2014**, *14*, 1269–1289. [[CrossRef](#)]
14. MA (Millennium Ecosystem Assessment). *Ecosystems and Human Well-Being: A Framework for Assessment*; World Resources Institute: Washington, DC, USA, 2003.
15. Allendorf, T.D.; Yang, J. The role of ecosystem services in park-people relationships: The case of Gaoligongshan nature reserve in southwest China. *Biol. Conserv.* **2013**, *167*, 187–193. [[CrossRef](#)]
16. Kalaba, F.K.; Quinn, C.H.; Dougill, A.J. The role of forest provisioning ecosystem services in coping with household stresses and shocks in Miombo woodlands, Zambia. *Ecosyst. Serv.* **2013**, *5*, e143–e148. [[CrossRef](#)]
17. Martín-López, B.; Iniesta-Arandia, I.; García-Llorente, M.; Palomo, I.; Casado-Arzuaga, I.; del Amo, D.G.; Gómez-Baggethun, E.; Oteros-Rozas, E.; Palacios-Agundez, I.; Willaarts, B.; et al. Uncovering ecosystem service bundles through social preferences. *PLoS ONE* **2012**, *7*, e38970.
18. Shen, Z.; Wakita, K.; Oishi, T.; Yagi, N.; Kurokura, H.; Blasiak, R.; Furuya, K. Willingness to pay for ecosystem services of open oceans by choice-based conjoint analysis: A case study of Japanese residents. *Ocean Coast. Manag.* **2015**, *103*, 1–8. [[CrossRef](#)]
19. De Groot, R.S.; Wilson, M.A.; Boumans, R.M.J. A typology for the classification, description and valuation of ecosystem functions, goods and services. *Ecol. Econ.* **2002**, *41*, 393–408. [[CrossRef](#)]
20. Kumar, P., Ed.; *The Economics of Ecosystems and Biodiversity: Ecological and Economic Foundations. An Output of TEEB: The Economics of Ecosystems and Biodiversity*; Earthscan: London, UK, 2010.
21. Barthel, S.; Folke, C.; Colding, J. Social—Ecological memory in urban gardens—Retaining the capacity for management of ecosystem services. *Glob. Environ. Chang.* **2010**, *20*, 255–265. [[CrossRef](#)]
22. Power, A.G. Ecosystem services and agriculture: Tradeoffs and synergies. *Philos. Trans. R. Soc. Biol. Sci.* **2010**, *365*, 2959–2971. [[CrossRef](#)] [[PubMed](#)]
23. Biggs, R.; Schlüter, M.; Biggs, D.; Bohensky, E.L.; BurnSilver, S.; Cundill, G.; Dakos, V.; Daw, T.M.; Evans, L.S.; Kotschy, K.; et al. Toward principles for enhancing the resilience of ecosystem services. *Annu. Rev. Environ. Resour.* **2012**, *37*, 421–448. [[CrossRef](#)]
24. Vogl, C.R.; Vogl-Lukasser, B. Tradition, dynamics and sustainability of plant species composition and management in Homegardens on organic and non-organic small scale farms in Alpine Eastern Tyrol, Austria. *Biol. Agric. Hort.* **2003**, *21*, 349–366. [[CrossRef](#)]
25. Langemeyer, J.; Latkowska, M.J.; Gómez-Baggethun, E. Ecosystem services from urban gardens. In *Urban Allotment Gardens in Europe*; Bell, S., Fox-Kämper, R., Keshavarz, N., Benson, M., Caputo, S., Noori, S., Voigt, A., Eds.; Routledge: London, UK, 2016; pp. 115–141.
26. Díaz, S.; Demissew, S.; Carabias, J.; Joly, C.; Lonsdale, M.; Ash, N.; Larigauderie, A.; Adhikari, J.R.; Arico, S.; Baldi, A.; et al. The IPBES conceptual framework—Connecting nature and people. *Curr. Opin. Environ. Sustain.* **2014**, *14*, 1–16.
27. Dendoncker, N.; Keune, H.; Jacobs, S.; Gómez-Baggethun, E. Inclusive ecosystem services valuation. In *Ecosystem Services: Global Issues, Local Practices*; Jacobs, S., Dendoncker, N., Keune, H., Eds.; Elsevier: San Diego, CA, USA, 2013; pp. 3–12.

28. Gómez-Baggethun, E.; Barton, D.; Berry, P.; Dunford, R.; Harrison, P. Concepts and methods in ecosystem services valuation. In *Routledge Handbook of Ecosystem Services*; Potschin, M., Haines-Young, R., Fish, R., Turner, R.K., Eds.; Routledge: London, UK; New York, NY, USA, 2016; pp. 99–111.
29. Kelemen, E.; García-Llorente, M.; Pataki, G.; Martín-López, B.; Gómez-Baggethun, E. Non-monetary techniques for the valuation of ecosystem service. In *OpenNESS Reference Book*; Potschin, M., Jax, K., Eds.; ECNC-European Centre for Nature Conservation: Tilburg, The Netherlands, 2014.
30. Langemeyer, J.; Baró, F.; Roebeling, P.; Gómez-Baggethun, E. Contrasting values of cultural ecosystem services in urban areas: The case of park Montjuïc in Barcelona. *Ecosyst. Serv.* **2015**, *12*, 178–186. [[CrossRef](#)]
31. Xiao, C.; McCright, A.M. Gender differences in environmental concern. Revisiting the institutional trust hypothesis in the USA. *Environ. Behav.* **2015**, *47*, 17–37. [[CrossRef](#)]
32. Nurse, G.A.; Benfield, J.; Bell, P.A. Women engaging the natural world: Motivation for sensory pleasure may account for gender differences. *Ecopsychology* **2010**, *2*, 171–178. [[CrossRef](#)]
33. Eagly, A. *Sex Differences in Social Behavior: A Social Role Interpretation*; Hillsdale, N.J., Ed.; Erlbaum: Hillsdale, NJ, USA; London, UK, 1987.
34. Miller, B.D., Ed. *Sex and Gender Hierarchies*; Cambridge University Press: New York, NY, USA, 1993.
35. Gilligan, C. *In a Different Voice: Psychological Theory and Women's Development*; Harvard University Press: Cambridge, MA, USA, 1982.
36. Mohai, P. Men, women, and the environment: An examination of the gender gap in environmental concern and activism. *Soc. Nat. Resour.* **1992**, *5*, 1–19. [[CrossRef](#)]
37. Eisler, A.D.; Eisler, H.; Yoshida, M. Perception of human ecology: Cross-cultural and gender comparisons. *J. Environ. Psychol.* **2003**, *23*, 89–101. [[CrossRef](#)]
38. Dietz, T.; Kalof, L.; Stern, P.C. Gender, values, and environmentalism. *Soc. Sci. Q.* **2002**, *83*, 353–364. [[CrossRef](#)]
39. Beutel, M.; Marini, M. Gender and values. *Am. Sociol. Rev.* **1995**, *6*, 436–448. [[CrossRef](#)]
40. Hayes, B.C. Gender, scientific knowledge, and attitudes toward the environment: A cross-national analysis. *Political Res. Q.* **2001**, *54*, 657–671. [[CrossRef](#)]
41. Hunter, L.M.; Hatch, A.; Johnson, A. Cross-national gender variation in environmental behaviors. *Soc. Sci. Q.* **2004**, *85*, 677–694. [[CrossRef](#)]
42. Xiao, C.; Hong, D. Gender differences in environmental behaviors in China. *Popul. Environ.* **2010**, *32*, 88–104. [[CrossRef](#)]
43. Ronnback, P.; Crona, B.; Ingwall, L. The return of ecosystem goods and services in replanted mangrove forests: Perspectives from local communities in Kenya. *Environ. Conserv.* **2007**, *34*, 313–324. [[CrossRef](#)]
44. Allendorf, T.D.; Allendorf, K. Gender and Attitudes toward Protected Areas in Myanmar. *Soc. Nat. Resour.* **2013**, *26*, 962–976. [[CrossRef](#)]
45. Calvet-Mir, L.; Gómez-Baggethun, E.; Reyes-García, V. Beyond food production: Ecosystem services provided by home gardens. A case study in Vall Fosca, Catalan Pyrenees. *Ecol. Econ.* **2012**, *74*, 153–160. [[CrossRef](#)]
46. Reyes-García, V.; Aceituno-Mata, L.; Vila, S.; Calvet-Mir, L.; Garnatje, T.; Jesch, A.; Lastra, J.J.; Parada, M.; Rigat, M.; Vallès, J.; et al. Gendered home gardens. A study in three mountain areas of the Iberian Peninsula. *Econ. Bot.* **2010**, *64*, 235–247.
47. Naredo, J.M. *La Evolución de la Agricultura en España (1940–1990)*; Universidad de Granada: Granada, Spain, 2004.
48. Brandth, B. Gender identity in European family farming: A literature review. *Sociol. Rural.* **2002**, *42*, 181–200. [[CrossRef](#)]
49. Calvet-Mir, L.; Calvet-Mir, M.; Vaqué-Nuñez, L.; Reyes-García, V. Landraces in situ conservation: A case study in high-mountain home gardens in Vall Fosca, Catalan Pyrenees, Iberian Peninsula. *Econ. Bot.* **2011**, *65*, 146–157. [[CrossRef](#)]
50. Swinton, S.M.; Lupi, F.; Robertson, G.P.; Hamilton, S.K. Ecosystem services and agriculture: Cultivating agricultural ecosystems for diverse benefits. *Ecol. Econ.* **2007**, *64*, 245–252. [[CrossRef](#)]
51. Reyes-García, V.; Aceituno-Mata, L.; Vila, S.; Calvet-Mir, L.; Garnatje, T.; Jesch, A.; Lastra, J.J.; Parada, M.; Rigat, M.; Vallès, J.; et al. Home gardens in three mountain regions of the Iberian Peninsula: Description, motivation for gardening, and gross financial benefits. *J. Sustain. Agric.* **2012**, *36*, 1–22.
52. Bryan, B.A.; Raymond, C.M.; Crossman, N.D.; Macdonald, D.H. Targeting the management of ecosystem services based on social values: Where, what, and how? *Landsc. Urban Plan.* **2010**, *97*, 111–122. [[CrossRef](#)]

53. Agarwal, B. The gender and environment debate: Lessons from India. *Fem. Stud.* **1992**, *11*, 149–164. [[CrossRef](#)]
54. González-García, M. Habitando los espacios naturales en cuerpos sexuados: Género y responsabilidad medioambiental. *Arbor* **2008**, *184*, 115–126.
55. Kollmuss, A.; Agyeman, J. Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? *Environ. Educ. Res.* **2002**, *8*, 239–260. [[CrossRef](#)]
56. Iniesta-Arandia, I.; Piñeiro, C. Women and the conservation of agroecosystems: An experimental analysis in the Río Nacimiento region of Almería (Spain). *Psychology* **2014**, *5*, 214–251.
57. Folke, C.; Colding, J.; Berkes, F. Synthesis: Building resilience and adaptive capacity in social-ecological systems. In *Navigating Social-Ecological Systems: Building Resilience for Complexity and Change*; Folke, C., Colding, J., Berkes, F., Eds.; Cambridge University Press: New York, NY, USA, 2002; pp. 352–387.



© 2016 by the authors; licensee MDPI, Basel, Switzerland. This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution (CC-BY) license (<http://creativecommons.org/licenses/by/4.0/>).