

Participatory collective farming as a leverage point for fostering human-nature connectedness

Irene Pérez-Ramírez^a, Marina García-Llorente ^{a,b}, Clara Saban de la Portilla^c, Alejandro Benito^c and Antonio J. Castro^{d,e}

^aSocial-Ecological Systems Laboratory, Department of Ecology, Universidad Autónoma de Madrid, Madrid, Spain; ^bFRAGMENTAL Collective, Madrid, Spain; ^cDepartment of Applied Research and Agricultural Extension, Madrid Institute for Rural, Agricultural and Food Research and Development (IMIDRA), Alcalá de Henares, Spain; ^dBiology and Geology Department, Andalusian Center for the Assessment and Monitoring of Global Change (CAESCG), University of Almería, Almería, Spain; ^eDepartment of Biological Sciences, Idaho State University, Pocatello, ID, USA

ABSTRACT

Human-nature connectedness is key to foster environmental and socio-cultural sustainability in agricultural landscapes since it promotes the establishment of belonging, stewardship, and connections to nature. Cooperation, collective action, and the role of women at sustainable agroecological practices could be leverage points in which small interventions may hold great potential for system transformation. We analyse the different types of human-nature connectedness mediated by the Agrolab participatory collective farming initiative running in Madrid (Spain). Our results described and quantified a participatory collective farming initiative using the leverage point perspective, and identified factors explaining nature relatedness of participants (i.e. social importance of agricultural landscapes, linkages with farming activities, time spent outdoors, gender and a negative relationship with the rural residence). We found that women showed a stronger and broader worldview on the philosophical arguments about their connection with nature, while men identified themselves and nature through more cognitive responses. Our results give indication of participatory collective farming as a leverage point to foster human-nature connectedness. Finally, we discussed how participatory collective farming activities are suitable for introducing nature into people's daily lives and may help to identify pathways towards a stronger human-nature connectedness.

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1. Introduction

The structure and functioning of ecosystems have been exponentially modified by human activities during the last decades (Steffen et al. 2018). These activities have endangered the lives of plants and animals in terms of climate change, overexploitation, pollution, land-use change, change in nutrient cycles, etc. (Schlesinger and Bernhardt 2013; Carpenter et al. 2019). The biosphere of the Anthropocene is becoming increasingly fragile and unstable, as the current social, economics and health crisis has brought to light (Williams et al. 2015; Carpenter et al. 2019). So, people's lives are affected by the dynamics that subdue the biosphere, especially those who are under unfair and precarious conditions. Also, these dynamics leaves in a vulnerable position the way humans relate to nature in an everyday more urbanized environment (Castro et al. 2019; FAO 2019). Even so, resources to reverse the degradation of our natural world and social heritage in a significant way are still deficient. These realities make it difficult to understand the importance of relationships between people, and their environment (Pérez-Ramírez et al. 2019), more specifically in

agrarian landscapes (García-Llorente et al. 2016; Quintas-Soriano et al. 2018). Several investigations have confirmed the significance of human engagement with agrarian landscapes and stewardship practices in developing some level of human-nature connectedness (HNC; Brown and Raymond 2007; Bowman et al. 2011; Langemeyer et al. 2018). In recent years, there has been a significant increase in research that supports the need to strengthen HNC (Folke and Boyd 2011; Zylstra et al. 2014), and to study how the HNC influences human well-being (Capaldi et al. 2014; Shanahan et al. 2016; Bratman et al. 2019).

Agricultural landscape has changed drastically towards the modernization of farming systems with the intensification of agriculture, which has led to a loss of resilience and lack of sustainability in agroecosystems (Altieri et al. 2011; Bennett et al. 2021). In Europe, agricultural landscape are characterized by the use of external inputs, land concentration and difficulties in land accessibility for new farmers (Castro et al. 2019). Madrid is one of the most densely populated regions of Europe (6,662 million inhabitants) and its

CONTACT Marina García-Llorente  marina.glloriente@uam.es

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agricultural landscapes have been transformed over the last decades (Economic and Social Council, 2018). From traditional small-scale farming associated with cultural values (Pérez-Ramírez et al. 2019) to modern rural landscapes, more homogeneous and characterized by an ‘industrial agriculture’. These changes in the agriculture are highly connected with changes in social practices (e.g. abandonment of agricultural activity, practically non-existent self-sufficient consumer, rural areas as dormitory towns, unknown local and seasonal horticulture, disconnection with the landscapes). As proposed by Auer et al. (2017), agricultural landscapes are an important component of human well-being while influencing social capital, and bearing cultural values too. In this sense, the Madrid Regional Government of Agriculture and Environment created in 2015 an innovative, public initiative of participatory agricultural laboratories (i.e. Agrolab). The goal of the Agrolab initiative was to restore through agrarian activities the relations between rural, peri-urban, and urban areas and the environment (Figure 1; García-Llorente et al. 2019).

Participatory collective farming activities develop a wider sense of place and have the potential to enhance a greater concern for things other than oneself. Cooperation, collective action and fostering the role of women at sustainable agroecological practices may also lead to environmentally friendly behaviours and agrarian landscape stewardship (García-Llorente et al. 2019; Manlosa et al. 2019). Thus, the overarching goal of this study was to analyse the different types of HNC mediated by the Agrolab participatory collective farming initiative. With this aim, we settled three specific goals: (1) to assess the nature relatedness short scale (NR-6) of the Agrolab participants; (2) to analyse which factors explain the NR-6; (3) to assess the inclusion of nature in self (INS) as an indicator of the extent

to which an individual includes nature within his/her cognitive representation of self, considering five dimensions of connections to nature (material, experiential, cognitive, emotional and philosophical; as described by Ives et al. 2017), and the social understanding of what being connected or unconnected with nature means. We finally discussed the implications that gender may play in understanding connectedness with nature.

2. Conceptual framework

We applied the leverage points perspective (Meadows 1999; Abson et al. 2017; Fischer and Riechers 2019; Dorninger et al. 2020) to better understand the transformative potential of participatory collective farming activities on HNC from a qualitative perspective. According to Manlosa et al. (2019), we defined leverage points as domains for interventions that can result in observable changes within a system. Donella Meadows (1999) highlighted 12 places to intervene in a system, which were summarized by Abson et al. (2017) as: materials (e.g. mechanistic characteristics as standards or constants), processes (e.g. interactions between elements within a system of interest that drive internal dynamics, as feedback loops or length of delay), changes in system design (e.g. social structures as information flow, rules), and changes in the intent (e.g. goals, paradigms, world views). These interventions represent two types of leverage points (Fischer and Riechers 2019), ‘shallow’ interventions that are easy to implement but limited in their capacity to bring transformative change (e.g. the structure of material stocks and flows; the gain around driving positive feedback loops), and ‘deep’ interventions that are difficult to implement but have a great capacity to bring transformative change

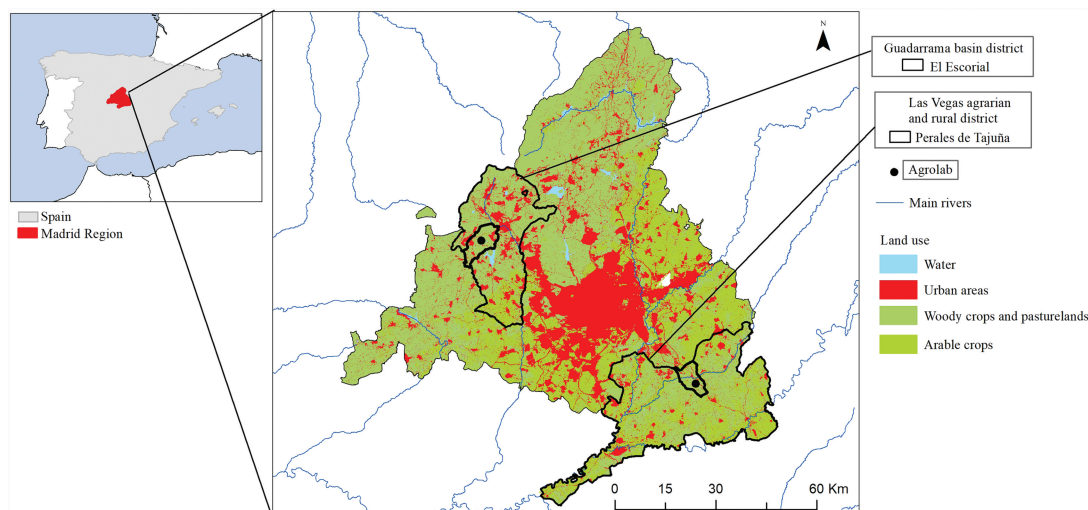


Figure 1. Location of the two Agrolab initiatives with the main land uses in the Community of Madrid.

(e.g. access to information, the mindset out of which the system arises). We used this framework to identify the different aspects and depths of leverage points in the participatory collective farming of the Agrolab initiative.

HNC provides leverage points that may be able to promote desired change toward sustainability. The HCN dimensions also can be relatively ‘shallow’ (Schultz 2002; Soga and Gaston 2016; Dorninger et al. 2017) and relatively ‘deep’ (Brown and Raymond 2007; Raymond et al. 2013; Pérez-Ramírez et al. 2019) as proposed by Ives et al. (2018): material on the shallow pole (i.e. consumption of goods/materials from nature), experiential (i.e. direct interaction with natural environments, such as parks or outdoor recreation areas), cognitive (i.e. knowledge or awareness of the environment and attitudes/values towards nature), emotional (i.e. feelings of attachment to or empathy towards nature), and philosophical on the deep pole (i.e. perspective or world view on what nature is, why it matters, and how humans ought to interact with it). We believe that the relationship between leverage points and a combination of different approaches to measure HNC could bring more plurality to the language (e.g. science–policy interfaces) and be able to face more intangible dimensions, such as philosophical or emotional relationships with nature.

We have used the HNC concept encompassing the different indicators analysed in this research (i.e. nature relatedness short scale, NR-6; and inclusion of nature in self, INS). These indicators were previously tested scales (e.g. Nisbet and Zelenski 2013; Bragg et al. 2013; Sahin and Alici 2019; Arbuthnott and Sutter 2019) that allowed us to evaluate the results empirically. We used the ‘relationship with nature’ scale proposed by Nisbet et al. (2009), and the single-item INS scale to deepen individually in how humans feel connected with nature (Schultz 2002; scales are described in detail in methods). However, to be consistent throughout the manuscript, we consider the HNC concept as an umbrella term including all these indicators. Through these scales, we analysed how participative agricultural activities can serve as leverage points for promoting HNC in the Madrid region (Spain).

3. Material and methods

3.1. Case study description: the Agrolab participatory collective farming initiative

Agrolab is a practical training initiative in agroecology based on the basic principles of living labs (García-Llorente et al. 2019). The initiative is run by the cooperation of a research institute, a university, the local authorities where the project is located, the local action group, agroecological trainers (i.e. local organic farmers

hired by the project to provide technical support and practical advice) and the participants themselves. Every year, an open call allows the registration of new participants who become part of a new edition of Agrolab initiative. The new participants fill in an application form that includes socio-demographic information, their motivation for taking part and the benefits of being involved in the project (García-Llorente et al. 2019). Following the principles of care and inclusive farming, the project prioritizes the inclusion of vulnerable participants, such as those who are unemployed or have a low income. For the project, the selection criteria were established on the basis of the project and are collected in the application form; from greater to lesser importance these criteria are as follows: long-term unemployment, minimum income beneficiary, interest in becoming professional in the agricultural sector, previous experience, motivation to participate, and residence in the project municipality. In addition, gender quotas were applied to ensure that 40–60% of participants were women. At each new edition, around 20/25 participants are registered. Agrolab initiative aims to be a scientific and scalable project, so instruments such as scales and surveys have been developed and are used to evaluate participants’ progress, in this case in terms of HNC.

The Agrolab initiative training method focuses on practical, participatory, and long-term agricultural mentoring and support. practical training itinerary is composed of two stages. Each stage is undertaken for one year to complete an annual crop cycle. In the first stage, the participants work in collective orchards and the lessons aim at self-supply. Approximately four to six months after the beginning of the training (i.e. estimated time to have a solid and engaged group of participants), a survey was held to evaluate HNC. During the second stage, participants aim to professionalize and initiate small-scale marketing activities. In both stages, the trainings are carried out two days a week with an agroecological trainer. The initiative has had four editions (one per year, first edition was in 2015), with the addition of new participants each year. In total, it has involved 158 participants (57% women, average age 41) and six social organizations (Table 1). For more information, see García-Llorente et al. (2019).

3.2. Survey design and data collection

Each year, the Agrolab participants voluntarily filled a survey with a focus on their connectedness to nature. The survey addressed different scales and factors to measure HNC, as follows. Altogether, 72 surveys were completed after four to six months of participation in the program (46% of the Agrolab participants; Table 1).

Table 1. Agrolab participants and their activities (*individuals).

N° Participants of Agrolab 2015–2019	2015	27*; 1 organisation
	2016	20*; 1 organisation
	2017	31*; 2 organisations
	2018	48*; 4 organisations
	2019	32*; 4 organisations
Age (%)	< 30	19
	30–40	34
	40–65	47
	> 65	4
Gender (%)	Women	57
	Men	43
Residence (%)	Same municipality	45
	District	11
	Madrid city	44
Agricultural activity	Horticulture, aromatic and medicinal plants, fruit trees, red berries. Agrocomposting	
Surface	4 plots; 2 ha in total	

To capture the differences in the way people perceive their relationship with the natural world (Obj.1), we used a validated-scale NR-6 to assess subjective connectedness with nature (Nisbet and Zelenski 2013). The NR-6 comprises six items that are scored on a 5-point Likert scale, where 1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree. NR-6 items included: ‘My ideal vacation spot would be a remote, wilderness area; I always think about how my actions affect the environment; My connection to nature and the environment is a part of my spirituality; I am very aware of environmental issues; My relationship with nature is an important part of who I am; I feel very connected to all living things and the Earth’.

To analyse factors explaining the NR-6 (Obj.2), the survey included questions as independent variables that characterised connectedness to nature (Table 2). These variables included: (1) social importance of agricultural landscapes, (2) linkages with agricultural activities; (3) time spent regularly outdoors, and (4) sociodemographic aspects, such as gender, and rural residence (i.e. people with regular residence in a rural municipality). Other variables such as level of formal education, age, or landownership were also asked during the survey but did not appear as relevant variables in the regression model (Appendix 1).

Finally, to assess how an individual includes nature within his/her cognitive representation of self and the social understanding of what means being connected or unconnected with nature (Obj.3), HNC was addressed using the single-item INS. The self-nature connection is defined as ‘the extent to which an individual includes nature within his/her cognitive representation of self’ (Schultz 2002). The INS represents ‘nature’ and ‘self’ within two circles with participants selecting the level of overlap that describes their interconnection with the natural environment. The difference with other validated scales such as the NR-6 is that while NR-6 is verbalized and described by sentences, the INS is a graphical scale. The use of

these two items proved to be a way to help participants understand and address their own problems by incorporating a diversity of forms of knowledge. Then, we asked participants to explain their choices in order to better understand the INS graphical outcomes. We literally asked, ‘Could you explain in your own words why you chose that answer?’ Afterwards, we asked the respondents if they would describe a person who fully connected with nature and a person totally disconnected from nature. Specifically, we asked, ‘In your opinion, what words would you use to describe the situation of a person who maintains a total overlap with nature and that of someone who maintains a total disassociation with nature? This question can refer to any person or group and not particularly to how you feel.’ These descriptions were reclassified according to an overview of the key messages provided by the participants in the response set. Finally, we run an analysis to test gender influence on INS responses.

3.3. Data analysis

All analyses were performed using XLSTAT software. Descriptive statistics were reported for all specific objectives. To analyse factors explaining the NR-6 (Obj.2; Appendix 1) we used a linear regression analysis. Akaike information criteria (AIC) was used to select the best model from among all combinations of variables (Anderson et al. 1998). For testing explicative variables were used normality (Shapiro-Wilk), homogeneity of variance (Levene’s Test of Homogeneity), statistic of multicollinearity and Pearson product-moment correlation coefficient tests. To assess the INS expressed by the Agrolab participants (Obj.3), each open response was reclassified according to the dimensions of HNC following the definitions proposed by Ives et al. (2018; Table 3): including material, experiential, cognitive, emotional, and philosophical dimensions. Each of the literal speeches that the participants had provided was associated with one of the five types

Table 2. Description of the independent variables used at the linear regression to characterize human-nature connectedness.

Factor	Description	Question in the survey	Scored
Social importance of agricultural landscape	To analyse the importance of the conservation of anthropogenic spaces, valuing the landscape and its contribution to local communities	'For me, preserving an agricultural and rural landscape is just as important as preserving strictly natural areas'	5-point Likert scale (from 1 = strongly disagree to 5 = strongly agree)
Linkages with agricultural activities	To assess the degree of linkages of the participants with agriculture, whether by family heritage, closeness, friendships, or a non-material link	'How linked do you feel to the agricultural and/or livestock sector?'	5-point Likert scale (from 1 = strongly disagree to 5 = strongly agree)
Time spent regularly outdoors	To collect how much time each participant spends in a normal day in open spaces regardless of the degree of anthropization	'How much time do you spend outdoors on a typical day?'	Less than 0.5 h/day; Between 0.5 and 2 h/day; Between 2 and 4 h/day; More than 4 h/day
Female gender	To capture the role of gender in the connection with nature	'Male/Female'	Dichotomous (female = 1; male = 0)
Rural residence	To distinguish persons that have their regular residence in a rural municipality with less than 10,000 inhabitants	'What is your place of residence?'	Dichotomous (rural municipality = 1; not rural municipality)

Table 3. Codification of the responses about inclusion of nature in self scale (INS) from the Agrolab participants in relation to the five connections proposed by Ives et al. (2018).

Connection	Description	Responses from Agrolab participants
Material	Consumption of goods/materials from nature	None of the answers were catalogued in this dimension
Experiential	Direct interaction with natural environments	'I enjoy my walks and readings in nature' 'I would like to dedicate myself to something related to agriculture and nature, which entails a large degree of involvement' 'I like to escape to nature in my free time, but it does not condition my usual life'
Cognitive	Knowledge or awareness of the environment and attitudes/values towards nature	'It is possible that my behaviour is due to living in an urban environment, but simultaneously I can have a connection with nature because of the knowledge I have received in university' 'I could do more to care for natural environments e.g. energy saving' 'Although I am aware of being part of the problem, I am aware of the extent to which my choices incorporate healthy and sustainable habits for my environment'
Emotional	Feelings of attachment to or empathy towards nature	'I feel connected because I live in the village, I need to be in nature to feel good' 'I'm very happy when I'm in nature' 'My feeling of connection with nature began at my childhood and has increased with age'
Philosophical	Perspective or world view on what nature is, why it matters, and how humans ought to interact with it (e.g. master, participant, steward)	'Nature is an important part of our lives. Our adaptation to the environment is essential' 'The natural environment is part of our lives, its conservation is vital because it is our children's heritage' 'I feel more animal than human and I think that animals are worthy of life on Earth because they respect it'

of connection. Finally, we explored the role of gender in both INS and NR-6 responses with a non-parametric Mann–Whitney U -test.

4. Results

4.1. Nature relatedness short scale (NR-6) of the Agrolab participants

The NR-6 score of the Agrolab participants ($n = 72$) was 4.13 ± 0.08 on average (confidence interval (CI) at 95%: 3.96–4.29), which showed a high connection with nature. Among the variables used that characterize HNC, we found that I4 ‘I am very aware of environmental issues’ obtained the highest score (4.30 ± 0.10), followed by I5 ‘My relationship to nature is an important part of who I am’ (4.24 ± 0.11). I3 ‘My connection to nature and the environment is a part of my spirituality’ obtained the lowest score (3.96 ± 0.12 ; Figure 2).

4.2. Factors explaining nature relatedness

The linear regression identified five factors that explained the NR-6 ($R = 0.47$; R^2 adjust = 0.41; $AIC = -79.66$; Table 4). Four factors (i.e. social importance of agricultural landscapes, time spent regularly outdoors, female gender, and linkages with agricultural activities) held positive scores, while one factor (i.e. rural resident) exhibited a negative relationship with the NR-6. The linear regression showed that the utilitarian factors, such as time spent regularly outdoors and giving importance to agrarian landscapes, were associated with higher NR-6 scores. Conversely, having a rural residence was related to

Table 4. Linear regression (standardised coefficients) of variables that explain human nature relatedness. † $p < 0.10$, * $p < 0.05$, ** $p < 0.01$. Error in parenthesis.

Variables	Coefficient	t-Value
Social importance of agricultural landscapes	0.37 (0.10)	3.67**
Time spent regularly outdoors	0.35 (0.10)	3.51**
Female gender	0.31 (0.10)	3.02**
Linkages with agricultural activities	0.21 (0.10)	2.07*
Rural residence	-0.23 (0.14)	-1.62
R2	0.468	
R2 adjust	0.409	
AIC	-79.660	

a lower HNC, however it was not statistically significant. The results also showed that gender (female) was a factor that also determined stronger levels of NR-6 or HNC. Considering the standard coefficients, we found rural residence to be less important than social importance of agricultural landscapes, time spent regularly outdoors, female gender and linkages with agricultural activities for Agrolab participants.

4.3. Dimensions of human-nature connectedness through inclusion of nature in self (INS)

The INS scores for the Agrolab participants ($n = 72$) were 4.01 ± 0.08 (CI at 95%: 3.84–4.18), indicating a high level of HNC, in coherence with NR6. We also found statistically significant differences with respect to gender, showing an average INS value for females of 4.16 ± 0.12 and of 3.85 ± 0.11 for males (Mann–Whitney, $U = 805$; p -value < 0.0001). Overall, 53% of the Agrolab participants identified themselves as ‘very much related to nature’ (INS 4), 25% as ‘completely connected with nature’ (INS 5) and 21% as

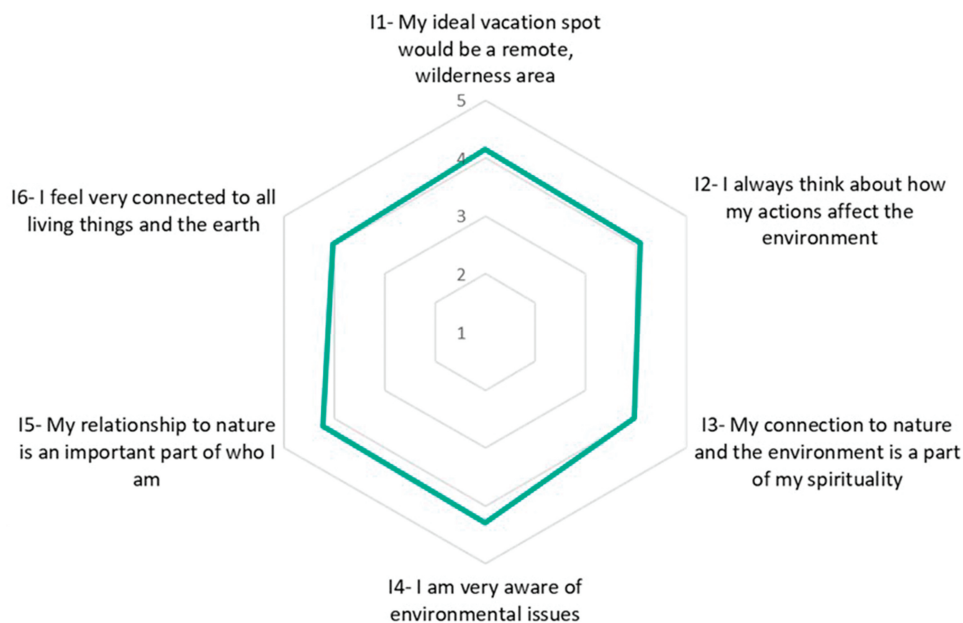


Figure 2. Nature relatedness short scale (NR-6) of the Agrolab participants. Spider diagram reflects the mean values.

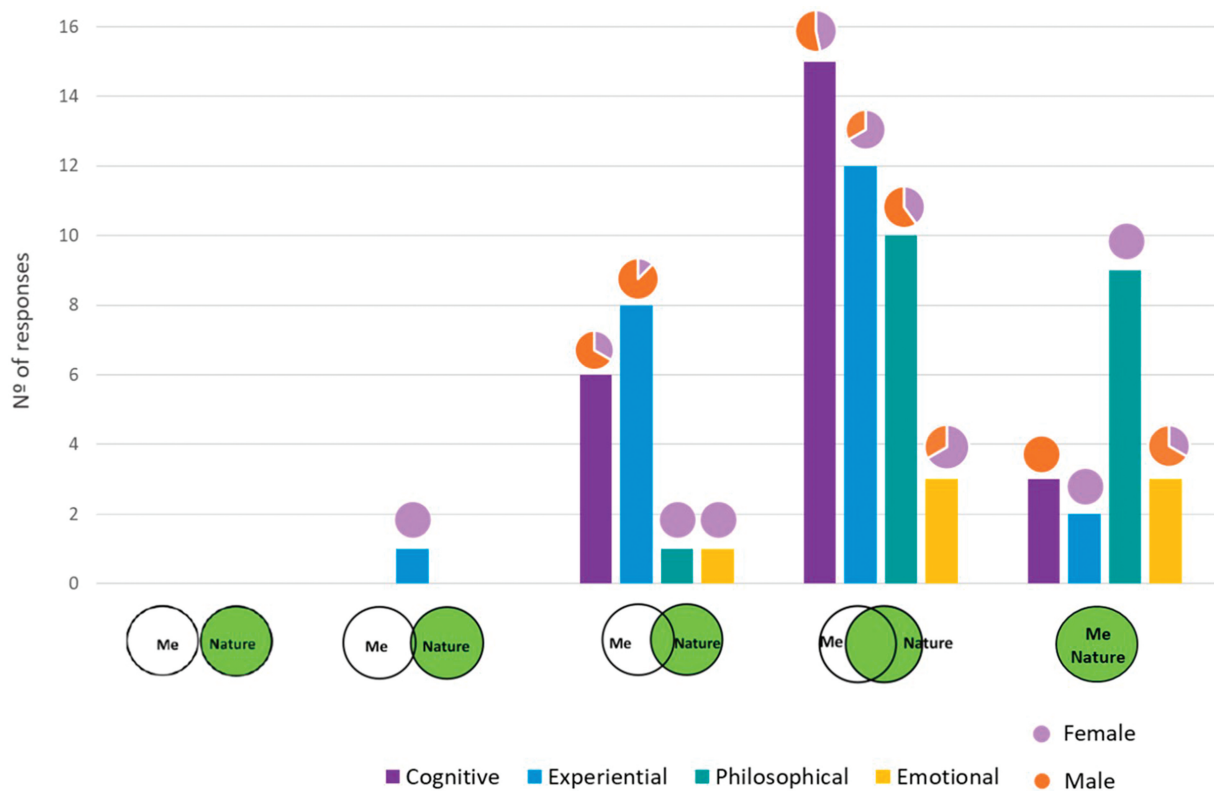


Figure 3. Agrolab participants' responses on inclusion of nature in self (INS) expressed as the five dimensions of human-nature connectedness (i.e. material, experiential, cognitive, emotional, and philosophical, based on Ives et al. 2017). The percentage of answers by gender is represented in the circular diagrams above the bars.

'something connected with nature' (INS 3). None of the Agrolab participants identified themselves as completely disconnected from nature (Figure 3).

According to the dimensions of HNC proposed by Ives et al. (2017), results showed that 33% of the respondents identified themselves with a cognitive relationship with nature, followed by experiential (32%), philosophical (28%), and emotional (10%). Cognitive relationships with nature were expressed as 'It is possible that my behaviour is due to living in an urban environment, but simultaneously I can have a connection with nature because of the knowledge I have received in university' (male, INS 3); 'I could do more to care for natural environments e.g. energy saving' (male, INS 3) or 'Although I am aware of being part of the problem, I am aware of the extent to which my choices incorporate healthy and sustainable habits for my environment' (female, INS 4). Experiential relationships with nature were expressed by reasons such as 'I enjoy my walks and readings in nature' (female, INS 4); 'I would like to dedicate myself to something related to agriculture and nature, which entails a large degree of involvement' (male, INS 4) or 'I like to escape to nature in my free time, but it does not condition my usual life' (male, INS 3). In the same way, the philosophical dimension was expressed by reasons such as 'Nature is an important part of our lives. Our adaptation to the environment is essential' (female, INS 4); 'The natural environment is part of our

lives, its conservation is vital because it is our children's heritage' (male, INS 4) or 'I feel more animal than human and I think that animals are worthy of life on Earth because they respect it' (female, INS 5). And finally, the emotional relationship with nature was expressed by reasons such as 'I feel connected because I live in the village, I need to be in nature to feel good' (female, INS 4); 'I'm very happy when I'm in nature' (male, INS 5) or 'My feeling of connection with nature began in my childhood and has increased with age' (male, INS 4). The material dimension was not defined by any of the Agrolab participants. Regarding the influence of gender, all dimensions showed significant differences between female and male, cognitive (Mann-Whitney; $U = 514$; p -value < 0.0001), experiential (Mann-Whitney; $U = 641$; p -value < 0.0001), philosophical (Mann-Whitney; $U = 770$; p -value < 0.0001) and emotional (Mann-Whitney; $U = 657$; p -value < 0.0001).

By combining the INS scale with the different dimensions of HNC (see Figure 3), we found that only one participant found herself as 'little connected with nature' (INS 2) through an experiential connection. Sixteen participants found themselves as 'something connected with nature' (INS 3); eight of them described experiential connections and six responses were described in terms of cognitive values. Following a similar pattern, among those participants who identified themselves as 'very much related to nature' (INS 4), 17 responses were related with

experiential connections, 15 responses described cognitive values and 10 responses described philosophical values, while only three showed emotional values. Finally, the perception of oneself as ‘completely connected with nature’ (INS 5) reports mainly philosophical values (nine responses), having emotional and cognitive dimensions three responses each. Results also showed that a stronger HNC was associated to the philosophical dimension.

Regarding how respondents described a context of a person totally overlapped (nature-me overlapping) or disconnected with nature (nature-me scarcely touching; Figure 4), 48% of the responses were assigned as nature-me overlapping and 52% were assigned as nature-me scarcely touching. Among the responses describing the context of nature-me overlapping, results identified feelings such as empathy with the natural environment, a sense of life-balanced and adapted to the environment. On the contrary, we found that disconnected people were described in most surveys as isolated, oppressed, and unbalanced, with incomplete lives, feelings of sadness and stress, as well as people with negative environmental behaviour (e.g. *living without any respect for the natural world; not caring about the damage they do to the environment; a person who pollutes irresponsibly without recycling, using the car for everything*). Comparing both scenarios, we can see that, in seven of the cases, the reasoning was dominated by opposed descriptions such as: isolated, oppressed, unbalanced and detached (29.16%) vs. integrated, adapted, balanced, empathic (51.38%); lack of understanding of nature (13.88%) vs. respect and environmental concern (34.72%); incomplete life, sadness,

illness, stress (26.38%) vs. healthy, fulfilled life, freedom (23.61); urban (13.88%) vs. rural community (11.11%); individualistic, selfish (11.11%) vs. sense of collective (8.33%); materialistic consumer (13.88%) vs. self-sufficient consumer (6.94%); negative environmental behaviour (20.83) vs. willing to act for environment (5.55%). On the other hand, two reasonings were offered to describe a context of nature-me scarcely touching, including short-term mind (2.77%; e.g. *‘people who don’t care about the ecological cost of their actions and whose only goal is short-term personal gain’*) and technologically confident (1.38%; e.g. *‘a person with a blind faith in technology’*). In the same way, we found that two answers were given for nature-me overlapping without finding opposites: away from real life (2.77%; e.g. *‘the evolution of humanity tends to take us away from nature and that is not intrinsically bad; being totally linked to a sector is not always good because we need to relate our knowledge and experiences to other aspects of our life’*), and radical (1.38%; e.g. *‘if you only see nature, you can become very radical and not very conciliatory with those who do not think like you’*).

5. Discussion

5.1. Collective farming actions to foster human-nature connectedness

As stated by Stallman (2011), collective action, as the Agrolab initiative, often provides stability to natural resource management and may play a crucial role in the sustainable management of agricultural systems. The Agrolab initiative created

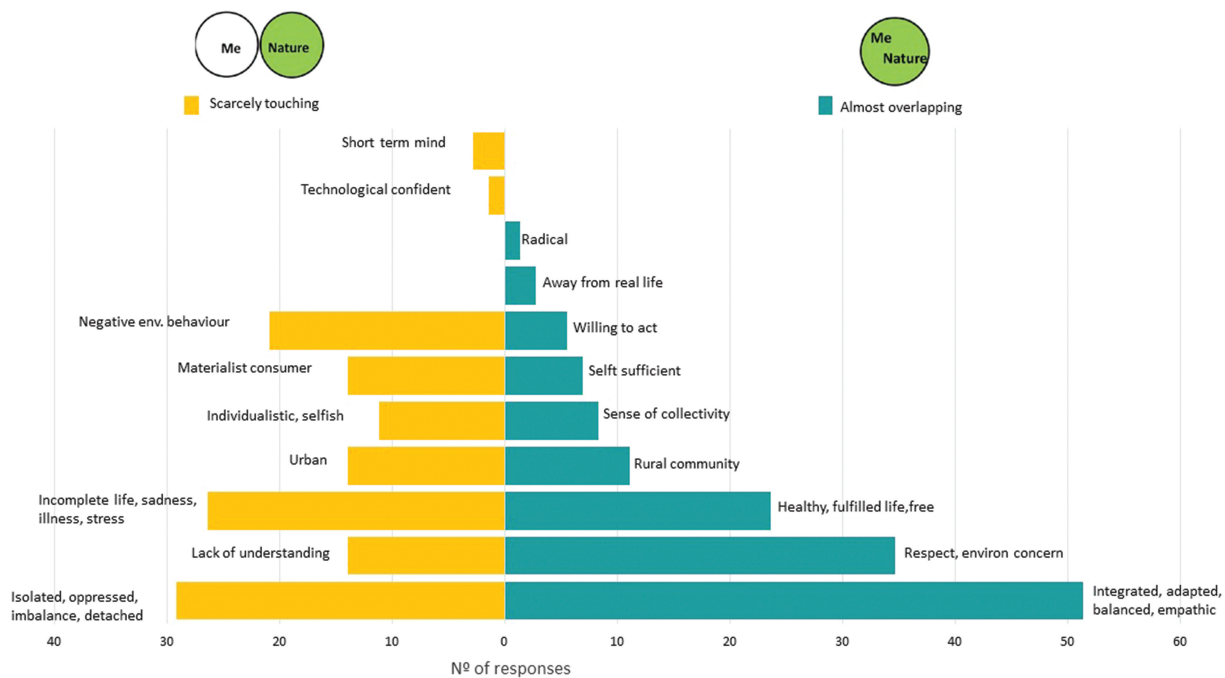


Figure 4. Agrolab participants’ responses on reasoning for context of me and nature almost overlapping (right) and me and nature scarcely touching (left).

a collective space for dialogue and connection with agricultural lands that can be an inspiring seed (sensu Bennett et al. 2016) for fostering connectedness between people and nature. Previous research has demonstrated that a strong HNC is often related to environmentally more aware people and happier people (Nisbet and Zelenski 2013). In this sense, our results identified a high diversity of responses describing why people are connected or disconnected with nature (Figure 4), which is consistent with previous research documenting HNC in agricultural landscapes (Balázs et al. 2019; Riechers et al. 2019). Some examples highlighted the importance of the human-nature connection were ‘having an integrated and balanced relationship with nature’, ‘being concerned for environmental degradation’, ‘a healthy and fulfilled life’, or ‘having a broad sense of collectivity’ (Figure 4). On the other hand, responses also identified that disconnection from nature were mainly related with negative individual feelings such as isolation, oppression, and imbalance, incomplete lives, and sadness, which had been previously described by Brown and Kasser (2005). These results support that strengthening interactions between people and nature may enhance human well-being and environmental sustainability through the formation of relational values (Capaldi et al. 2014; Shanahan et al. 2016; Bratman et al. 2019).

5.2. Factors underlying human-nature connectedness

Our study identified five societal factors (i.e. social importance of agricultural landscapes, linkages with agricultural activities, time spent regularly outdoors, female gender, and rural residence) that determined the ways of HNC in the context of farming practices. Among them, we found that the human values associated to agricultural landscapes (i.e. social importance of agricultural landscapes: t -value 3.67**; linkages with farming activities: t -value 2.07*) might explain a stronger connection between humans and nature. This finding is consistent with previous research that showed a strong relationship between sense of place (i.e. based on personal roots, community membership, landscape, and nature) and their sense of environmental responsibility (Gosling and Williams 2010; Balázs et al. 2019). Other authors have identified how time spent on outdoor actions can act as a component for enhancing a deeper relationship with nature (Schultz et al. 2004; Miller 2005; Taniguchi et al. 2005). Our results are in accordance with these findings and indicate how people’s connection with nature is strengthened through a meaningful interaction with nature (i.e. time spent outdoors: t -value 3.51**). Interactions through linkages with farming activities can promote

landscape stewardship and worldviews closer to more sustainable agricultural practices (e.g. local consumption, appreciation of traditional agricultural landscapes, importance of carbon footprint, or assessment of the impact of land use changes; Langemeyer et al. 2018).

Regarding the role of the urban-rural origin in increasing HNC, several studies have found that urban inhabitants in certain cases are more strongly connected with nature than rural communities through the use or benefit of specific ecosystem services, such as air purification, climate regulation, ecotourism, aesthetic appreciation, or existence of values (Castro et al. 2016; García-Llorente et al. 2020). However, other studies support the idea that rural communities maintain a strong connection associated with life-supporting ecosystem services related to extractive activities, food-provisioning services, and rural traditions (Martín-López et al. 2012; Pérez-Ramírez et al. 2019). In this context, our results identified that rural residence was not a factor that promotes a stronger connection with nature, although they may feel linked to ecosystem services, such as food-provisioning and rural traditions (García-Llorente et al. 2019). As Auer et al. (2017), we consider that promoting a change in the social actors involved in the territory can have an impact on the identity and sense of place, since it is linked to social practices. In addition, our results showed the critical role that gender plays in understanding the extent to which people include nature within their cognitive representation of self (i.e. INS scale). We specifically found that women are likely to express connectedness with nature in a broader philosophical sense than men. This is widely supported by previous research documenting women’s greater pro-environmental behavior (Zelezny et al. 2000; Schultz 2002; García-Llorente et al. 2011; Manlosa et al. 2019) and recognition of the ecosystem’s capacity to deliver regulating services (Martín-López et al. 2012). Based on the results found, we suggest that HNC is gender-sensitive and should therefore be explored independently and not from a one-size-fits-all approach. Our findings can therefore be used to guide science and practitioners to better understand the role of gender in their interaction with nature, and to identify pathways that integrate gender-sensitive approaches toward a more sustainable people and nature connection (Galiè et al. 2013; Oteros-Rozas et al. 2019).

5.3. Leverage points to foster human-nature connectedness through participatory collective farming

Our hypothesis is supported by the idea that participatory collective farming initiative can serve as a leverage points to foster environmental

sustainability. Our findings suggest that a deeper HNC (i.e. INS 5) was associated with specific philosophical values, while shallower HNC was related to intuitive and individual experiences. These findings support the ‘chains of leverage’ hypothesis (Fischer and Riechers 2019) that describes how one type of change in a system precipitates another, across different depths of leverage. In this sense, through the Agrolab farming initiative, we were able to see how particular interventions were easy to implement but limited in their capacity to produce transformative change (e.g. time spent to develop an agroecological project), while other interventions that were more difficult to implement indicated a greater capacity to bring transformative change (e.g. working on the agroecological paradigm). Therefore, the Agrolab farming initiative could be understood from the leverage points perspective as it is described and quantified in terms of the four realms of leverage proposed by Abson et al. (2017), and previously postulated by Meadows (1999), i.e. materials, processes, design, and intent (Figure 5). In this sense, materials that refer to the modifiable and measurable parameters can be the number of Agrolab participants, number of ecological crops, number of traditional varieties, orchard productivity, or the number of pollinators attracted by the flower margins. In relation to processes that provide information about the desired results of the Agrolab initiative (i.e. the efficiency of the project), we identified the amount of time spent by the participants in setting up their agroecological project, the workshops

aiming to explore HNC, and the evaluation surveys of the project conducted annually. The design (Abson et al. 2017), referred to characteristics related to the information flow and self-organization (Fischer and Riechers 2019), could be expressed in the Agrolab initiative context through the collective development of a practical educational plan that included the land organization and workshops on educational planning. Additionally, Agrolab participants had a possibility to include new social associations in the program. Between all the actors involved and within the design realm, the Agrolab initiative promoted a horizontal and hybrid dialogue and facilitated shared visions. Finally, the characteristics of intent relate to the norms, values, and objectives embodied in the system of interest and the underlying paradigms from which they arise (Fischer and Riechers 2019). The intent through the Agrolab initiative lens includes its ideological foundations based on the paradigm of agroecology as a practice, scientific discipline, and socio-political movement. The Agrolab initiative supports the local recognition of agroecology and proposes a critical analysis of the agricultural production model to combat rural abandonment (García-Llorente et al. 2019). Therefore, the Agrolab initiative has transformative potential and works towards action and participation to improve the transition from current models.

Our findings do not provide empirical evidence that participatory collective farming activities can increase HNC, but they suggest that the incorporation of participatory collective farming practices can

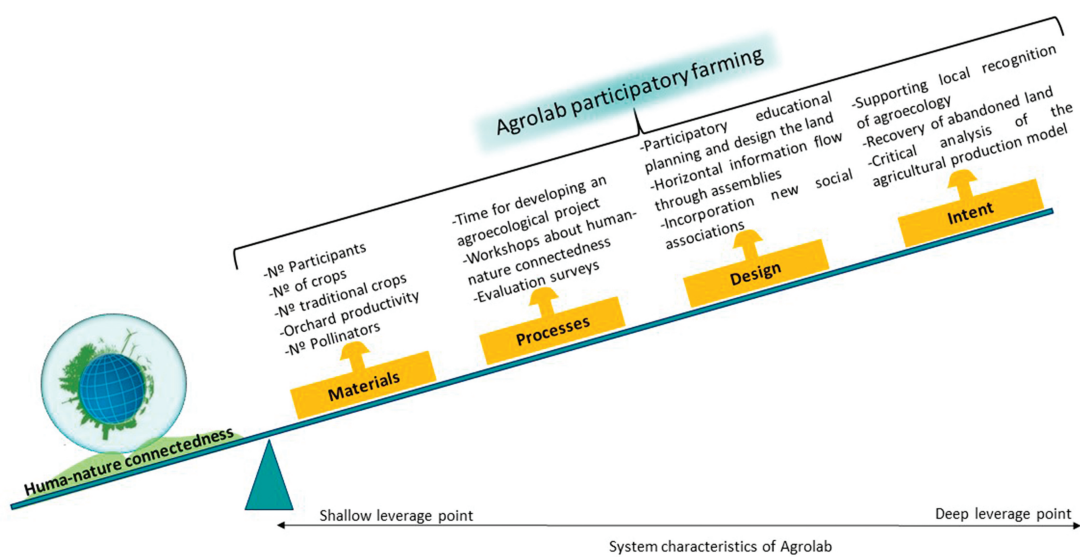


Figure 5. Schematic illustration of Agrolab’s activities as leverage points to improve human-nature connectedness, in the four realms proposed by Abson et al. (2017). The activities represent a gradient of leverage points from shallow to deep.

act as a leverage point to move towards a deeper HNC. We suggest that exploring the complexity, uncertainties and disputed values of people involved in new collective farming initiatives is key to appreciating different ways of knowing and acting, using alternative forms of dialogue. Studies show that the effects of nature on people may go deeper, not only providing a sense of well-being but also opening spaces to understand social patterns towards positive emotional, physical, and mental health, and well-being (Bratman et al. 2019; García-Llorente et al. 2019). Our analysis illustrated that the participatory collective farming activities have characteristics that make them very suitable for introducing nature into people's daily lives. We suggest that future research must evaluate how to drive a paradigm shift in science and decision-making that promotes a stronger connection between people and nature. This paper supports the idea that farming practices can help advance in this direction and act as a leverage point to broaden the awareness in decision-making in the face of a constantly changing reality.

6. Conclusions

Understanding the factors that drive human-nature connectedness in the Anthropocene is key to fostering environmental and cultural sustainability of agricultural landscapes. A challenge in the Anthropocene is to include the core components for a desirable future, as alternative economies and new metrics to measure human wellbeing within the biophysical limits of the planet. We applied the leverage points perspective to better understand the transformative potential of participatory collective farming activities on human-nature connectedness. Insights of this research reveal that collective and participatory farming strategies, such as the Agrolab initiative, may foster human-nature connectedness through the interventions on different leverage points simultaneously. Thus, shallow leverage points also fostered interventions that were more difficult to implement, which showed a deeper leverage for transformative change. From this analysis, we learnt about the importance of considering different perspectives when dealing with human-nature connectedness. Emerging research challenges indicate the need of exploring human-nature connectedness from an emotional and relational perspective. We call the need for inspiring farming strategies that promote more inclusive and diverse relations between people and farmlands.

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ORCID

Marina García-Llorente  <http://orcid.org/0000-0002-3527-9318>

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