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The role of social learning in fostering farmers' pro-environmental values and intentions

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ABSTRACT

In interventions to achieve sustainability, social learning plays a prominent and growing role as a framework strategy in changing behaviors and intentions. Many interventions have been designed to achieve better performances in natural resource management, but the literature studying the effects on values and intentions is scarce. This paper studies the effects of the Local Agrarian Innovative Programme, which aims to promote sustainability, in two regions of Cuba. It is a long-term, on-going intervention in which learning, cooperation and social interactions play key roles. In this paper, outcomes and actions are considered a first category of learning (single loop learning), and subjective perceptions and intentions imply a superior category of learning (double loop learning). The data, mainly based on primary information collected from a representative sample, are analyzed in terms of differences in values and intentions, and reveal noticeable inter-regional diversity, while intervention duration appears as a decisive variable. From a policy point of view, this research calls into question the efficacy of short-term awareness projects and proposes the integration of social learning programmes when designing pro-environmental interventions.

1. Introduction

The relationship between rural societies and nature needs to be changed if sustainability is to be achieved. This is a big challenge that requires complex, interrelated changes, as well as involving legal, scientific and ethical issues. Sustainability cannot be achieved only through regulations (laws and sanctions) and technologies, mainly because it is a social engagement that is conditioned by individual and social conceptions about nature, ourselves, future generations and the inter-relationships of these (Vucetich and Nelson, 2010). According to Johnson et al. (2012: 1), "social and ecological challenges (…) require not only scientific and technological capabilities but also learning and adaptation", which has to do with actions, attitudes, perceptions, norms, values and governance. The strength of established attitudes and values can make them difficult to change. However, these changes are necessary because it is intentions that define our willingness to act in a particular way when facing change.

Many interventions aimed at achieving better socio-economic performance have been designed using participative approaches where learning, cooperation and social interactions play central roles (Chambers, 1997; United Nations, 2008; Almekinders et al., 2009). This is also true for natural resource management, where social learning as a framework strategy has a prominent and growing role in changing behaviors and intentions and influences values and norms in an effort to achieve sustainability. Its growing role in interventions may be because social learning is often considered "a higher form of learning", so facilitating adaptive management (Glasser, 2009: 47). The design of an intervention process should consider the existence or the promotion of 'communities of practice' or 'learning communities', which facilitate the social learning process, which promotes adaptation and innovation through social interaction (Wenger, 1998; Kilpatrick et al., 2003).

Although social learning is now recognized as a normative goal in environmental science, the definitions offered by the literature are vague, so the factors explaining it need to be considered (Armitage et al., 2008; Reed et al., 2010; Kristjanson et al., 2014). This paper sheds light on the learning process and its effects on attaining sustainability by analyzing two case studies. While many research works analyze the influence of attitudinal factors on pro-environmental behaviors (López-Mosquera and Sánchez, 2012; Rogers et al., 2012), the literature analyzing the impact of pro-environmental interventions on values and intentions is scarce. There is also recent literature highlighting a lack of supportive theories that foster pro-environmental behavior in agriculture, which seeks to fill this gap and asks for more quantitative analysis including socio-economic variables (Home et al., 2014; Price and Leviston, 2014). This paper advances in this necessary line of research by conducting a quantitative empirical analysis based on socio-psychological theories and social learning. Quantitative analysis allows us to assess whether there is a change in behaviors, attitudes and intentions, while the study of values and norms would require the use of ethnographic methods. Focusing on social learning and innovation also implies a step forward because, as Price and Leviston (2014) conclude, one appropriate intervention to foster pro-environmental behavior in farmers is the design and implementation of social learning programmes, that explicitly consider the role of innovation.

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The paper offers an exhaustive analysis, that combines qualitative and quantitative approaches with an interdisciplinary focus for data obtained from an understudied region in order to illustrate the effects of the Agrarian Innovative Local Programme (PIAL) in Cuba on outcomes, actions (single loop learning) and intentions (double loop learning) aimed at promoting sustainability. The objective of PIAL is to increase food security and sovereignty through a participative system of local agrarian innovation (Núñez et al., 2014; Ríos and Ceballos-Müller, 2016) by creating new institutions and spaces for interaction and learning. PIAL is a long-term intervention, initiated in 2000, and implies a process of co-production of knowledge between scientists and technicians, who designed the intervention, and farmers who redesign and implement it. Both groups interact in a new boundary organization (Local Centre for Farming Innovation -CLIA-) created to exchange and generate knowledge and take decisions. The members of the CLIAs, taking part in communities of practice, interact and develop their own understanding about agrarian and environmental challenges and work on attitudes and adopt decisions. One purpose of our research is to answer the following questions, referring to the two case studies analyzed: Has the intervention promoted by PIAL had a significant impact on pro-environmental intentions and values? What is the role of social learning in this process?

The literature reviewed highlights some very positive consequences of this programme, but they are restricted to actions and, therefore, to a first level category of learning. This literature has not considered changes in values or in intentions. We have addressed the effects on behavior by investigating farmers' actions on waste disposal, and on values and intentions by designing three specific questions about agrochemical use and environmental awareness. Waste management, the use of agrochemicals and, more generally, environmental awareness and sustainability have been approached in a transversal and integrated way in PIAL, with the main objective of finding solutions for the needs and difficulties of farmers (production, seeds, productivity, pest control and soil management, among others). Also an extensive review of the literature conducting empirical analyses shows a variety of positive outcomes of PIAL programme, although the papers are mainly restricted to actions and, therefore, to a first category of learning. Our main conclusion is that the effects of this intervention on a superior category of learning (intentions and values) have been positive although highly conditioned by time. An appropriate evaluation of its efficiency is therefore in order. The analysis of this particular intervention gives us a better understanding of the options available to the agricultural sector, and the rural societies in which it is embedded, when seeking a sustainable response to environmental change.

2. Social learning and social change

Social learning is best understood by comparing it with other kinds of learning. Within the context of resource management, Armitage et al. (2008) points to three main, complementary, learning theories: experiential, transformative and social learning. Experiential learning is, according to Kolb (1984: 38), "the process whereby knowledge is created through the transformation of experience" and it is an experiential and learning-by-doing process. Mezirow (1991) conceives transformative learning, or transformation theory, as a process of effective change in an individual's perception through reflection and critical engagement. Both learning theories are largely modelled as individual learning processes.

Social learning shares many aspects about how learning can happen with both experiential and transformative learning. There is, however, a main factor that differentiates it from the other two: the distinguishing role of interactions and personal communication. According to Reed et al. (2010: 4), social learning can be defined "as a change in understanding that goes beyond the individual to become situated within wider social units or communities of practice through social interactions between actors within social networks". A community of practice is a group of people sharing an interest or enthusiasm for something they do and learning how to do it better by regularly interacting (Wenger, 1998; Wenger et al., 2002). The three characteristics defining a community of practice are: the existence of a shared domain of interest, members interact and learn together, and members are practitioners. In the particular case of environmental management, communities of practice foster social learning and social change, understood as "the collective action and reflection that occurs among different individuals and groups as they work to improve the management of human and environmental interrelations" (Keen et al., 2005: 4).

The lower part of Fig. 1 shows how social learning can set off changes with impacts at various levels. When analyzing a pro-environmental intervention, it is important to know if it has had an impact on behavior (Single Loop Learning -SLL-), but also if it has led to a superior learning process, modifying intentions (Double Loop Learning -DLL-). SLL refers to changes in skills, actions or routines to adapt to changes in the internal and external environments, but maintaining the central institutional features. One example would be a change in farming techniques that has an impact on income and productivity, and finally affects sustainability. DLL refers to changes in intentions, motivations or assumption that could cause, or define, actions. According to Argyris and Schon (1978), SLL only solves problems and corrects errors by changing strategies and actions when the

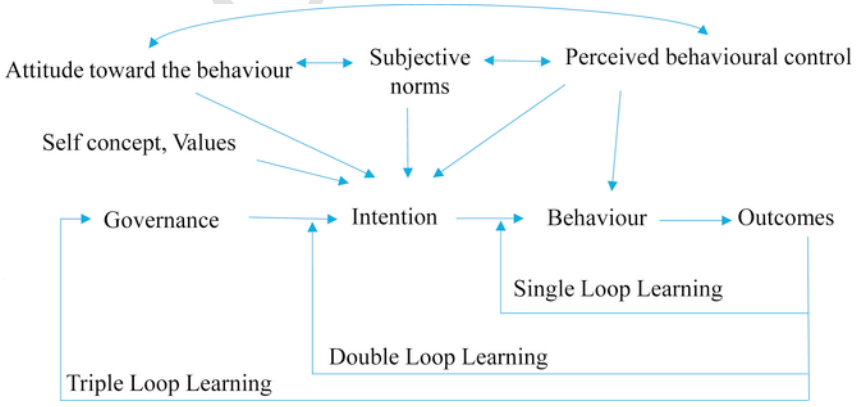

Fig. 1. Extended theory of planned behavior and multi-layered social learning (adapted from Argyris and Schon, 1978; Ajzen, 1991; Argyris, 1999).

framework of norms for performance is constant. DLL goes beyond that and implies the modification of norms and values leading to behavioral changes in order to correct errors and improve outcomes. One DLL example would be the implementation of an educational programme raising awareness for the environment that led to particular new actions, like not burning rubbish, and finally affecting sustainability. Triple loop learning (TLL) is the deepest level of learning and concerns the modification of the underlying governance system (Argyris, 1999; Armitage et al., 2008). An example would be a change in the law or in norms, with users recognizing its benefits, and finally enhancing sustainability.

The behavior of individuals and communities participating in learning processes are modelled by psychosocial factors. Price and Leviston (2014: 66) assert that "pro-environmental behaviour is best conceived as a combination of self-interest and pro-social motivation". The great difficulty in explaining the causes of and barriers for pro-environmental actions (Kollmuss and Agyeman, 2002) is revealed in the efforts made to integrate different non excludable theoretical frameworks (Oreg and Katz-Gerro, 2006; Steg and Vlek, 2009; Price and Leviston, 2014; Yazdanpanah et al., 2014; Muzaffar, 2015). The theoretical framework explaining how a change in intentions leads to modifications in behavior is explained in the upper part of Fig. 1, showing how behavior and intentions result from different factors and motivations (Steg and Vlek, 2009).

In this theoretically integrative effort, the Theory of Planned Behavior (TPB) is a widely used general behavioral theory in agrarian and environmental research (Beedell and Rehman, 2000; Burton, 2004; Yazdanpanah et al., 2014). According to de Snoo et al. (2013), it is one of the two most used theories within social sciences when providing a framework for research into farmers' responses to the EU's agri-environment schemes, and it dominates the literature on the useful socio-psychological models of social cognitive behavior. The central factor of the TPB (Ajzen, 1985, 1991) is the individual's intention to behave in a certain way. The theory affirms that attitudes, subjective norms and perceived control over the behavior predict intentions to perform behaviors. "Intentions are assumed to capture the motivational factors that influence a behavior" (Ajzen, 1991: 181). The TPB "postulates that behaviour is a function of salient information, or beliefs, relevant to behaviour" (Ajzen, 1991: 189) and points to three kinds of beliefs: behavioral beliefs, normative beliefs and control beliefs. The learning process can change these beliefs through new information and knowledge. Price and Leviston (2014) show that education is prior to norms, beliefs and behavior. The learning process can act on all variables and, therefore, also on intentions and behavior, and its influence can be reinforced through a social learning process. As an example, a good practice identified in an interactive and participative process by a learning community (making and using compost or incorporating biological pest control) is more likely to modify beliefs about the virtues of this good practice. Several authors have used the TPB to explain long-term changes in behaviors, motivations and intentions in which the relevant mechanisms involve social norms, social networks, trust, the role of leaders and the process of learning from other farmers (Home et al., 2014; Price and Leviston, 2014; Feola et al., 2015). The TPB is complemented with the Value Belief Norm (VBN) theory, by considering individuals' intentions but also pro-social schemes, as suggested by Price and Leviston (2014). In the VBN model (Stern et al., 1999; Stern, 2000) 'self concept' refers to biospheric and altruistic values that define moral and personal obligation toward the environment. This implies a pro-social behavior because the individual's motivation is not the search for personal benefit but the commitment to the environment and to human and non-human well-being for present and future generations.

The general context or situational factors (education, age, gender, infrastructures, economic situation, etc.) influences the whole framework and can facilitate or restrict pro-environmental behaviors (Steg and Vlek, 2009). More importantly, for the methodological approach adopted in this research, the social context, through interactions facilitating communication and the sharing of norms and values, is crucial in the configuration of intentions. In a social-ecological system, social learning is considered in the *users*' sub-system, and is one of the variables in the *interactions* group – 'information sharing among users'. In this context, communities of practice and educational institutions are, interestingly, immersed in educational processes based on the exchange of information and on the flow of diverse knowledge, which should, finally, lead to changes in individuals. Communities of practice play an important role in this social learning process, owing to experimentation and sharing experiences, as they are involved in a process of convergent attitudinal change and help to gain confidence (perceived behavioral control) and to feel the approval, or disapproval, of other people (subjective norms). All four variables included in the upper part of Fig. 1 are entry points to modify intentions and behavior. Interventions to promote pro-environmental changes, based on social learning, can influence all the factors shaping intentions. Social learning is a complex and comprehensive way of conceiving learning as a "multi-layered and iterative process that examines our actions, assumptions/values and learning processes" (Keen and Mahanaty, 2006: 499), which implies that adaptive capacities are boosted in a deliberative and systemic manner (Johannessen and Hahn, 2013).

Changes caused by learning at all levels imply an innovation process. Innovation has been described as a social process that occurs interactively. A process of these characteristics is necessary for another process (decision-making) to evolve. It is likewise necessary for advances in governance, especially when the aim is to implement sustainable practices at community level (Lundvall, 1988, 1992; Morgan, 1997). From the DUI-Learning perspective (learning-by-doing, learning-by-using and learning-by-interacting), the diffusion of an innovation often implies social learning that requires social interaction, and especially so when the innovation is based on personal experience (Jensen et al., 2007). In a social learning process, actors and organizations interplaying in particular social, institutional and geographical contexts shape interacting learning spaces and innovation systems (Asheim and Dunford, 1997; Morgan, 1997; Lundvall, 2005). Learning spaces can be created or can emerge naturally. In the first case, the role of a facilitator or a knowledge broker is crucial for its success. In the second, the participation of individuals with a propensity to innovate and to share the acquired knowledge can ensure the learning process. In both situations the participation of individuals with specific traits is a critical factor to be considered.

In any case the adoption of an innovation is always risky. Newness brings with it uncertainty and difficulties in evaluating its consequences, making it difficult to take decisions about it. This also refers to innovations to confront climate change, as perceived uncertainty prevents interventions and undermines efforts to change behaviors (Scheffer et al., 2015). Hence, it is necessary to know the factors influencing the rate of adoption, for both individuals and organizations, in social innovation processes when designing pro-environmental interventions. Rogers (2003: 221) defines the rate of adoption as "the relative speed with which an innovation is adopted by members of a social system" and it is determined by five variables: the perceived attributes of innovations, if adopters are individuals or organizations,

the communication channels, the nature of the social system and the extent to which change agents promote efforts.

Price and Leviston (2014) combine risk and innovation in a single variable, but also call for research to study them separately. Their study is based on the similarity of the two concepts. However, risk perceptions can be softened in a continuous innovation process. Since adoption and diffusion of innovations are social processes, the uncertainty from newness and other difficulties attached to complexity and observability can be reduced by taking advantage of the social capital existing in communities of practice. A community of practice is a social network which facilitates the innovation process if its members share norms and values and there is high trust and cohesion; that is, when the social capital in the network is of a high quality (Lesser, 2000; Pretty, 2003; Brondizio et al., 2009). Social capital helps in the process in which adaptation and shared understanding lead to sustainable development (Hogg et al., 2013). Contact, particularly direct contact, facilitates observation and reduces uncertainty; cooperation can minimize risks, as users make use of their complementary knowledge and share expenditures and risks; participants can also improve their access to resources by considering the relevance of their position in complex networks (Semitiel-García and Noguera-Méndez, 2012). The evaluation of the relative advantage that can be achieved by implementing an innovation can also be facilitated by interactions. Also, the possibility of the innovation being tested by potential adopters in communities of practice can be increased, based on the growth of material resources and on the opportunities to experiment with the innovation, which are more available in efficient social networks (Burt, 2000; Esser, 2008).

Time is a key factor in social change and in disseminating innovation. Many changes in motivations or attitudes associated with sustainability and environmental management are often very difficult and may necessitate long learning processes. "Research in various disciplines from economics to social psychology has shown that the adoption rate of a new practice (e.g. integrated pest management) increases during the intervention timespan, but the system bounces back to the initial state as soon as the active interventions stop" (Feola et al., 2015: 77). One main reason for this has to do with the difficulties individuals have in perceiving and internalizing the relative advantages associated to changes and innovation. The problem may lie in the difficulties of the incentives being seen to favor sustainability, since the resources individuals invest in the present may not have direct rewards for them in the short or medium term. The issue is nicely expressed with the concept of preventive innovations, which "are more difficult to diffuse than are incremental innovations. A preventive innovation is a new idea that an individual adopts in order to lower the probability of some unwanted future event" (Rogers, 2003: 235). Actors could have difficulties in perceiving the relative advantage of participating in an innovation project, because the reward is dispersed and delayed, benefiting only future generations. The attributes of innovation are considered the most important variable in the rate of adoption and in this case it could be that relative advantage and lack of 'observability' slow down changes (Rogers, 2003). Potential participants may even perceive a relative personal disadvantage, on account of risks and costs, with no observable benefits in their generation. According to Steg et al. (2014: 104), it is necessary to strengthen normative goals (biospheric and altruistic values) to encourage pro-environmental behaviors, when people need to incur in some costs to benefit the environment. All those barriers to the adoption and diffusion of innovations can also be present in communities of practice. However, their particular characteristics can help to overcome them when one or more of their members perceive a relative advantage of adopting it. This is achieved by sharing values, norms and perceived needs, and by experimenting and participating in demonstrations.

Overcoming uncertainty and management costs associated with innovations is sometimes better confronted in critical situations, under crises, extreme events or disasters, as these are windows of opportunity for change (Birkmann et al., 2010). In these situations, learning processes for adaptation and change to overcome several problems and necessities can be encouraged. Changes in environmental management are more easily observed, with higher rates of adoption of innovations. This argument is significant in understanding the commencement of the intervention analyzed in the following section. In this paper, the intervention was designed for a population in a situation of vulnerability to exert an influence on their adaptation process by fostering their social learning process through boundary institutions (Clark et al., 2011; Lemos et al., 2012). A social learning process took place in two newly created boundary organizations, where scientists and farmers exchanged knowledge and were involved in a continuous decision-making process.

3. PIAL in Cuba

The recent evolution of the Cuban agrarian sector has been determined by the consequences of the disintegration of the USSR in 1989, which initiated a new era that spelt the end of a privileged relationship. The scarcity of agrochemicals and energy resources and the reduction of export revenues were consequences of importance. This dramatic situation forced a fast change towards a lower carbon lifestyle. The Cubans experienced a situation of vulnerability, with deep agrarian and energy crises and a dramatic impoverishment of the country (Ríos and Wright, 1999). But these crises were also opportunities to change government policies and to improve self-sufficiency and sustainability. Ortiz et al. (2008) indicates that the Cuban government pushed towards the maximum sustainable agriculture and urban agriculture and supported production based on organic fertilizers and on organic pest-control.

In this crisis context, in the first stage of PIAL, a Participatory Seed Diffusion Programme was coordinated by the National Institute for Agricultural Science (INCA) and implemented by two universities (Pinar del Río and Central de Las Villas) and by the Unit for Agricultural Extension and Research in Holguín, with funding from international subsidizers. It started its tasks to increase and diversify agrarian production in Cuba mainly through a participatory technology diffusion process. The first stage of PIAL (2000–06) started with the introduction of genetic diversity through diversity seed fairs. At the same time, the links between farmers in the first communities of practice were being strengthened through their participation in fairs and thanks to the work developed by facilitators. In a second stage (2007–2010), PIAL was redefined with more ambitious objectives. The influence area also grew significantly and more institutions were incorporated (ministries, research centres, farmer groups from other provinces and more international subsidizers).[1] In this second period two institutions were created by PIAL (Table 1): CLIAs and the Primary Centres for Genetic and Technology Diversity (CPDGTs). The process implemented in PIAL to achieve its objectives gives relevance to social learning, as it is based on the creation of interacting spaces and communities of practice.

[1] The Swiss Agency for Development and Cooperation (SDC) and the Canadian International Development Agency (CIDA) have been participating in these programmes from the beginning. Since 2007, the German Agro Action Allemande and the UNDP's Local Human Development Programme (PDHL) have also been involved.

Table 1
Institutional framework of PIAL.

	Actors in the social network	Management	Objectives	Expected outcomes
CLIA	Farmers Technicians Scientists	Local facilitator	Learning promotion Promotion of innovations in local productive systems Promoting CPDGTs	Increase economic, environmental and social benefits in the community
CPDGT	Farmers	Community of practice	Promote a learning process by interacting, discussing and diffusing seeds, knowledge and experiences	Introduce, build, experiment, adopt and disseminate best practices and innovations

A CLIA is a social network made up of local, national and international actors, coordinated by a local facilitator, where knowledge is exchanged and generated, to promote continuous changes in local productive systems in order to increase economic, environmental and social benefits in the community. CLIAs are organizational structures that evolve through learning-by-doing and learning-by-interacting. In CLIAs farmers, technicians and scientists assess organizational performance, which might constitute a trigger for learning (Dauber et al., 2012). One of their missions is to promote CPDGTs, located in the producers' farms and made up of one or more farms with the capacity to incorporate, build, experiment and disseminate genetic diversity and innovations on the basis of the decisions of the farmers involved. The programme started working with the four CLIAs indicated in Fig. 2 (Pinar del Río, La Habana, Villa Clara and Holguín) and the twenty CPDGTs linked to them. In CPDGTs – usually referred to as 'innovation groups' – farmers develop a learning process by interacting, discussing, experimenting, adopting and diffusing their seeds, knowledge and experiences.

A basic principle in PIAL is that the solutions offered only by scientists and experts are not effective when trying to respond to the complex necessities of social-ecological systems (Brondizio et al., 2009; Ostrom, 2009). Local people should be involved to make sure that the most vulnerable are benefiting from science and to allow for the transfer of science and technology (Rochmyaningsih, 2015). In PIAL, the learning process is based on the participation of farmers in research and innovation processes, as they are the ones experimenting, evaluating and selecting practices and solutions that adapt best to the farm's conditions. Farmers are the protagonists of change and they are empowered when they identify their problems to analyze their causes and consequences and implement the solutions chosen. Scientists, technicians and farmers work together and are coordinated through horizontal linkages. In this process, special personal skills are necessary for the researchers to work with the farmers and gain their trust.

PIAL has been working to strengthen the Cuban agrarian system of innovation, recognizing the leading role of farmers in the processes of innovation and social change. Around its main initial focus (the participatory diffusion of seeds) groups of organized farmers have been working as communities of practice to improve food security and sovereignty, with many relevant aspects of agriculture, livestock, food and environmental practices being taken into consideration. With sustainability and agro-ecology among its courses of action, PIAL includes actions on environmental education about the emission of greenhouse gases, water use, waste management, energy, forestry issues, environmental education and biodiversity (Ríos et al., 2011). In 2010 PIAL was working in 9 out of 14 Cuban provinces and it has spread, as planned, during 2012–2016 to benefit 50,000 people in 45 municipalities of 11 provinces.

Universities and research institutions, as part of CLIAs, have participated from the start of this intervention by supporting and studying the process and the changes promoted by PIAL in actions and routines (SLL). Many reports and papers document the outcomes of this participatory process and all of them indicate the significant progress made by the agricultural sector: growing surface, production, productivity, income and agro-diversity, including plant breed-

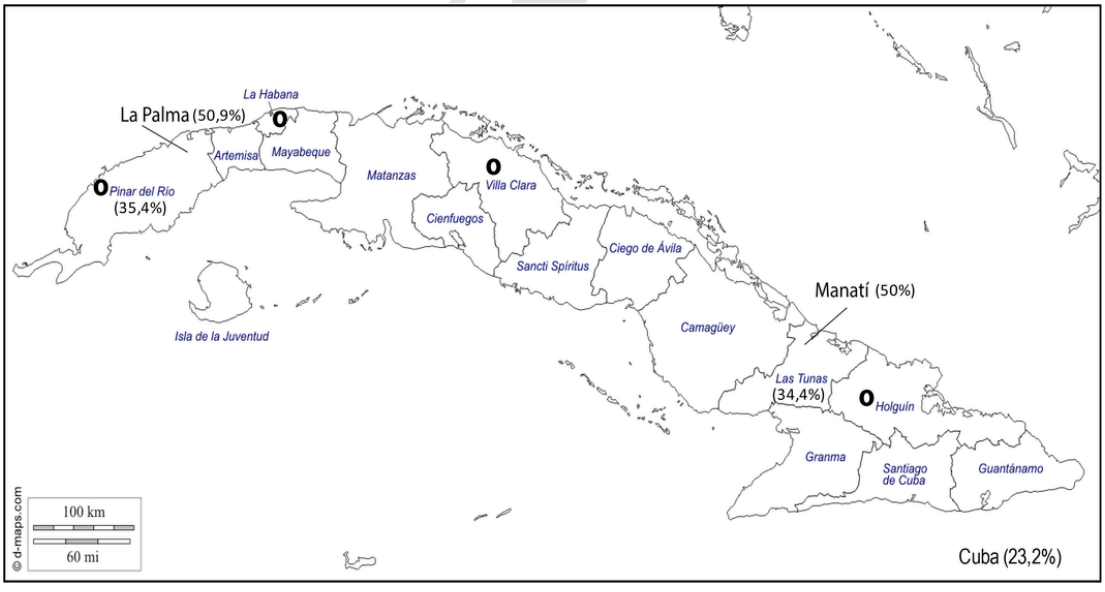

Fig. 2. Map of Cuba with provinces. Circles indicate the location of the four original CLIAs. Values in brackets indicate the percentage of rural population (Cuban National Office for Statistics and Information).

ing (De la Fé and Martínez, 2003; Ortiz et al., 2003a, 2003b, 2009, 2010; Valdés et al., 2008; Márquez et al., 2009; Martín, 2009; Ríos, 2009; Guevara-Hernández et al., 2012); improved land management (Valdés et al., 2008; Martín, 2009; Guevara-Hernández et al., 2012); ecological and sanitary control (Martín, 2009); reduction of greenhouse emissions (Vargas et al., 2009); improvement in living conditions and of self-esteem and gender equality (De la Fé and Martínez, 2003; Ortiz et al., 2009, 2010; Guevara-Hernández et al., 2012).

4. Materials, methods and results

4.1. Study area

In order to interpret the data and the context of the cases analyzed here, it should be understood that Cuban farmers work in cooperatives, of which there are three types, with *Créditos y Servicios* (CCS) being the most important. In these CCS, the farmers maintain individual ownership of the land and form groups for the purpose of trading and accessing machinery and services.

This study was performed through questionnaires to the farmers associated with the CCSs, or with a family member associated, in the municipalities of La Palma and Manatí (Fig. 2). The relevance of farming activities in those areas leads to their vital influence in their rural societies. One criterion when choosing which cases to study was that the communities should have very different characteristics, so as to take in diversity and avoid bias. In La Palma, PIAL has been running from its very beginning (2000). It was implemented by the national leader of the programme and farmers sign up individually. The economic activities are predominantly agricultural and the area is mainly rural. In Manatí, the project was incorporated later (2007) and it is run by delegated members of the community who did not participate in its design. Farmers join in groups through their cooperatives, and livestock is an important industry. Although the percentage of rural population is above the provincial and national averages and similar to that in Pinar del Río (Fig. 2), the activity is more urban and suburban.

According to the Cuban National Office for Statistics and Information, in Manatí 62% of the total area is cultivable land and in La Palma 88% of aggregated value added correspond to the farming sector. The two areas are quite far apart and differ in their physical geography, recent economic history, main crops and their relation to the PIAL project. La Palma lies in the westernmost region of the island (Pinar del Río). It has a surface area of 621 km^2 and its main physical geographical feature is its hilly and mountainous terrain, which offers fertile valleys, although the northern part is much flatter. The fairly dispersed population in 2012 stood at a stable 35,000 inhabitants (ONE, 2013a). The climate is tropical with a mean annual temperature of 24 °C and rainfall between 1800 a 2000 mm. The town's economy is based on forestry (wood, in the main), sugar cane, tobacco, coffee, various crops and beef.

Manatí is situated in the eastern area of Las Tunas. It has a surface area of 942 km^2 and a population in 2012 of 31,302 inhabitants living mainly in rural areas (ONE, 2013b). The area is mainly flat with a tropical climate. The mean annual temperature is 25.5 °C and rainfall is 966 mm. Its economy has been marked by intense deindustrialisation in the last decades brought about by the fall in sugar production. Sugar cane, various crops, livestock and dairy farming constitute its main agrarian production. One noticeable difference between the two areas studied is the greater importance of livestock farming in Manatí. Another key difference is the length of time each has participated in PIAL.

4.2. Data

The research conducted in this paper draws on questionnaires and also on key informants' interviews and workshops. Moreover, the research team participated in agro-biodiversity fairs, training actions and other activities organized by CLIAs in Manatí and La Palma. A survey was carried out in 2010 in eight cooperatives, four in La Palma and four in Manatí, to study various aspects related to PIAL, including attitudes towards the environment. Several meetings with main actors led to the design of a specific questionnaire asking about issues they consider relevant, like waste disposal, which had not been addressed specifically in previous studies. In both locations a random sample was selected, using a confidence level of 95% and a margin of error of 5 percentage points, for individuals involved and not involved in PIAL. Four groups of individuals have been defined in La Palma on the basis of how long they have been involved in the project. Some individuals have been participants for very different lengths of time (up to eleven years), while others are not enrolled but share a CCS with enrolled members (and are possibly subject to influences from the latter). In contrast, in Manatí participation in the PIAL project is more recent (few people are involved, and for a maximum of just four years) and a whole CCS either is or is not involved in the project. Finally, 922 useable questionnaires in La Palma and 662 in Manatí were obtained that included information on socio-economic features, attitudes and actions in relation to the environment and to sustainability (Table 2).

4.3. Methodology and results

In order to test the hypothesis that environmental awareness is higher for people involved in the PIAL project, some regressions estimating the impact of the project on several aspects of environmental attitude and behavior were obtained, controlling for other factors that could be relevant, such as socioeconomic and demographic characteristics, whose importance had been reported in previous research (Stern et al., 1993; King et al., 2009; Hirsh, 2010). Depending on the scale for each dependent variable, a different statistical technique was

Table 2
Socioeconomic features in La Palma and in Manatí, according to the survey.

	LA PALMA				MANATÍ	
	Non PIAL	Non PIAL sharing[a]	PIAL ≤4 years[b]	PIAL >4 years[c]	Not PIAL	PIAL ≤4 years[b]
Average per capita income[d]	96.61	107.48	116.94	198.03	187.23	227.49
Mean age	51.24	47.97	48.41	53.62	44.25	41.50
Male (%)	55.16	49.06	58.28	75.68	56.89	54.88
Incomplete primary education (%)	31.37	21.21	20.00	21.92	15.27	8.62
Complete primary education (%)	22.55	22.35	22.66	30.13	22.76	16.92
Complete secondary education (%)	17.40	16.29	16.67	28.77	28.14	25.85
Higher studies[e] (%)	28.68	40.15	40.67	19.18	33.83	48.61

[a] Non PIAL members sharing CCS with PIAL members.

[b] Individuals involved in PIAL for a maximum of four years.

[c] Individuals involved in PIAL for more than four years. In Manatí there were no individuals in PIAL for over 4 years at the time of the data collection.

[d] Average monthly household per capita income in Cuban pesos.

[e] Pre-university, polytechnic and university studies.

used (multinomial logit for nominal response categories and ordered logit for ordinal ones, Hosmer and Lemeshow, 2000). In all cases, the analyses explained in the Appendix have been carried out using the statistical package R.

In relation to actions, behaviors or routines (SLL), participants in the survey were asked about how they dispose of garbage (waste), because traditionally this has been a problem in Cuba, especially in rural areas, where polluting methods like burning or dumping in the courtyard, the river or the sea, are quite usual. The information obtained through this type of specific questions, directed at individuals, is appropriate and relevant. Nagendra and Ostrom (2012) assert this by explaining how nested externalities occur when specific actions are taken within one decision-making unit; one example is investment in better waste disposal facilities. Management variations at individual farmer level contribute to biodiversity patterns at a regional scale (Home et al., 2014). Dietz et al. (2009) also identifies several actions that can be undertaken within a home or a business facility that can cumulatively have a major impact on climate change and sustainability, which are global problems for collective action.

Regarding the results obtained in this research, in La Palma the most used option to eliminate waste is 'dumping' in the courtyard, the river, the sea or other places, although the percentage is lower when the commitment to PIAL is higher (54% in PIAL more than four years, versus 82% in non PIAL). From the multinomial model (Table 3), being related to PIAL decreases the likelihood for each of the two non-environmentally friendly options for disposing of waste ('dumping' and 'burning') against the more environmentally friendly ones ('municipality service' and 'compost'). Furthermore, income decreases the probability of dumping versus that of using the municipality service or making compost, and the same occurs with higher levels of education. For burning, income is significant but education is not. In Manatí, being in PIAL diminishes the likelihood of burning the garbage versus using the municipality service or burying. Also the likelihood of burning versus those options decreases with age and level of education, and is lower for women. The results are quite similar for the comparison between dumping and the most environmentally friendly options, except that PIAL membership is not significant here. In any case, the most usual choices in Manatí are burning (mainly among people not in PIAL, with approximately half using this option) and the municipality service (more common in PIAL, where 36% choose this alternative). It is notable that in La Palma a quarter of farmers belonging to PIAL for more than four years make compost from waste, 5% of farmers belonging to PIAL for less than four years do so, while in Manatí no farmer does.

As regards intentions (DLL), attitudes towards a hypothetical use of agrochemicals have been studied (Table 3). The access to agrochemicals is limited and farmers receive them from their cooperative, they can also be obtained through the market, but they are expensive. Their use was very common in Cuban agriculture before the disintegration of the USSR and this may influence current attitudes and usage. Three possible choices arise: some individuals would support the use of pesticides if they were available and, among those who would not, some would recommend their neighbors not to use them, while others would not. In La Palma, the most common option is to use agrochemicals if possible, although the percentage is lower when the commitment to PIAL is higher (from 90% for not PIAL till 27% for people in PIAL for more than four years), whereas in Manatí the higher percentage is accounted for by individuals not using agrochemicals and also recommending their non use (56% in non PIAL and 45% in PIAL). Results show that, in La Palma, being involved in PIAL for more than four years increases the chances of not using pesticides (recommending or not recommending not to use them), and

Table 3
Influence of PIAL on pro-environmental attitudes and behaviors.

LA PALMA			MANATÍ		
Multinomial logit for the way of disposing of the garbage[a]					
	Dumping	Burning		Dumping	Burning
Non PIAL sharing[b]	−1.5849***	−1.7206***			
PIAL ≤4 years[c]	−0.9610***	−1.0741**	PIAL	0.0828	−0.4467**
PIAL >4 years[d]	−2.3352***	−3.0824***			
Male	0.2573	0.1381	Male	0.4124*	0.3477*
Age	−0.0089	−0.0042	Age	−0.0300***	−0.0221***
Incomplete primary education	0.7481*	0.4367	Incomplete primary education	3.1044***	2.2550***
Complete primary education	0.6490**	0.2253	Complete primary education	2.5633***	1.8588***
Complete secondary education	−0.0034	0.4752	Complete secondary education	1.4195***	1.3730***
Per capita income[e]	−0.0027**	−0.0043**	Per capita income[e]	0.0010	0.0003
Intercept	3.0908***	1.3797***	Intercept	−0.5321	0.3308
Residual Deviance: 1215 AIC: 1255			Residual Deviance: 1269.08 AIC: 1301.08		
Multinomial logit for the use of agrochemicals					
	Not use advise[f]	Not use but not advise[g]		Not use advise[f]	Not use but not advise[g]
Non PIAL sharing[b]	−0.1458	0.3473			
PIAL ≤4 years[c]	0.5728	2.3091***	PIAL	−0.5297***	−0.7006**
PIAL >4 years[d]	3.1427***	4.4762***			
Male	−0.1284	0.4005	Male	−0.6120***	−1.1444***
Age	−0.0174	0.0065	Age	−0.0067	−0.0030
Incomplete primary education	−0.9619*	−1.8466***	Incomplete primary education	−0.3725	−0.0795
Complete primary education	−1.5230***	−1.0883**	Complete primary education	−0.0706	0.6400
Complete secondary education	−0.7698*	−0.6324	Complete secondary education	0.0170	−0.6829
Per capita income[e]	0.0019	0.0007	Per capita income[e]	−0.0004	−0.0023*
Intercept	−1.5554***	−3.8260***	Intercept	1.3479***	−0.0313
Residual Deviance: 666.50 AIC: 706.50			Residual Deviance: 1083.89 AIC: 1115.89		

LA PALMA		MANATÍ	
Ordered logit for the similarity to a person who takes care of the environment			
Non PIAL sharing[b]	0.8499***		
PIAL ≤4 years[c]	1.0702***	PIAL	0.2055
PIAL >4 years[d]	1.6591***		
Male	0.0905	Male	0.4469
Age	0.0064	Age	0.0211*
Incomplete primary education	−0.9492***	Incomplete primary education	−0.4532
Complete primary education	−0.2110	Complete primary education	−0.6922
Complete secondary education	−0.3116	Complete secondary education	−0.6566
Per capita income[e]	−0.0031***	Per capita income[e]	−0.0010
Intercept 1|2	−4.253***	Intercept 1|2	−3.5896***
Intercept 2|3	−1.124***	Intercept 2|3	−2.0903***

Table 3 (*Continued*)

LA PALMA		MANATÍ	
Residual Deviance: 968.62 AIC: 990.62		Residual Deviance: 347.55 AIC: 365.55	
Ordered logit for the willingness to devote money/work to fight environmental pollution			
Non PIAL sharing[b]	1.1736***		
PIAL ≤4 years[c]	0.4298**	PIAL	0.0775
PIAL >4 years[d]	1.2313***		
Male	0.5530***	Male	0.5734**
Age	0.0049	Age	−0.0040
Incomplete primary education	−0.5640**	Incomplete primary education	0.2210
Complete primary education	−0.5554***	Complete primary education	0.0253
Complete secondary education	0.1566	Complete secondary education	−0.1109
Per capita income[e]	−0.0011	Per capita income[e]	−0.0001
Intercept 1|2	0.068	Intercept 1|2	−3.4685***
Intercept 2|3	1.034***	Intercept 2|3	−1.5916***
Residual Deviance: 1771.92 AIC: 1793.92		Residual Deviance: 625.24 AIC: 643.24	

*Significant at 10%; **significant at 5% and ***significant at 1%.

[a] 'Dumping' and 'burning' against other more environmental friendly options, including 'municipality service' and 'compost' in La Palma and 'municipality service' and 'burying' in Manatí.

[b] Non PIAL members sharing CCS with PIAL members.

[c] Individuals involved in PIAL for a maximum of four years.

[d] Individuals involved in PIAL for more than four years.

[e] Average monthly household per capita income in Cuban pesos.

[f] "I would not use and I would recommend not to use".

[g] "I would not use but I would not recommend not to use".

being involved less time increases only the probability of not using but not of recommending not to use (both versus being willing to use). In general, a lower level of studies increases the likelihood of using pesticides. In contrast, in Manatí participating in PIAL diminishes the probability of not using pesticides (recommending or not recommending not to use them) relative to that of being willing to use. Also, men seem more willing to use agrochemicals if they are available.

There were two questions in the survey directly devoted to attitudes in relation to the care of environment (DLL): "Can you tell me how similar you are to a person who takes care of the environment" and "I would devote part of my money or my work if I was sure that it would be used to fight environmental pollution" (Table 3). The answers to the first question were measured on a scale from 1 (very different) to 5 (very similar) and those for the second on a 1 (strongly disagree) to 4 (strongly agree) scale. As some authors point out, these kinds of attitudinal scales are ordinal in nature and must be treated as such in statistical analyses (Golob and Hensher, 1998; Golob, 2001). Therefore, the two attitudinal variables were modelled using ordered logit regressions. Moreover, as very few respondents marked the lowest scores, the categories were reduced to three in both cases, in order to prevent the problem of empty cells.

In La Palma, individuals involved in PIAL are more likely to perceive themselves as being more committed to taking care of the environment, and this is the case even for those not in the project but who share CCS with farmers in PIAL, although possibly to a lesser extent. In addition, people with lower level of studies tend to show lower levels of identification with this attitude, and the degree of affinity also decreases as income rises. In contrast, in Manatí belonging to PIAL seems not to influence identification with care of the environment. In fact, of the considered socioeconomic variables, only age seems to increase the chances of having more in common with people who take care of the environment. A similar situation can be observed for willingness to devote money or work to fighting pollution. This is higher in La Palma for individuals related to PIAL (involved in the project or even just sharing CCS with PIAL members), and also for men and those with higher studies. In Manatí it is only gender that is significant, with men showing more willingness to pay or work for the environment.

The results suggest a positive influence of participating in PIAL on learning processes for the case of the interviewed individuals in La Palma: for being involved in the programme for a long time and for being an educated person. Assessments on these questions concerning the environment in Manatí were higher than in La Palma, suggesting that people in Manatí are generally more sensitive to environmental issues. In fact, the CSSs interviewed not involved in PIAL in Manatí participated in a project focused on sustainability and agro-ecology in 2005. Another possible explanation for these differences between the two places is that in Manatí there are more people devoted to raising livestock and therefore do not actually need pesticides.

The information and experiences gathered also allows us to confirm the commitment and participation of farmers involved in PIAL in various spaces for discussion and interaction, where trust and networks are strengthened, so building social capital and shaping shared views and solutions, and thus providing the conditions for social learning to occur. It has been reported that a priority aim in CLIA in Pinar del Río is the debates in the organized meetings in order to transmit experiences and capabilities among farmers (Angarica et al., 2013). This is supported by some results from the questionnaires conducted in both places, as 47% and 50% of responses in Manatí and La Palma, respectively, indicate that attendance at meetings and activities organized by PIAL is medium, and 13% and 39% that it is high-very high. When asked about participation in events to buy or exchange seeds, technology or knowledge, 37% of PIAL members in Manatí and 86% in La Palma provided affirmative responses (13% and 4% in each site for non PIAL members). Farmers were also asked if they had made or adopted any innovation in the last two years, and results reveal a clear distinguished innovative attitude for PIAL members (73% and 23% PIAL members in La Palma and Manatí respectively made or adopted an innovation while these percentages are 8% and 16% for non PIAL members). Farmers also perceive themselves as having a high level of participation in the decisions adopted in PIAL (in La Palma, 54% medium, 28% high and 8% very high and in Manatí 48% medium, 8% high and 2% very high). There are also several publications describing the organization of agro-diversity fairs and how farmers experiment, interact, build learning networks and develop capabilities in PIAL (Ortiz et al., 2008; Ríos, 2009; Ponce et al., 2011).

5. Discussion

Changes in pro-environmental attitudes and behaviors have been studied, from the information collected through a representative survey in La Palma and Manatí (Cuba) in order to ascertain the effects of a persistent intervention (PIAL), through its advances in SLL and DLL processes. The information analyzed is very valuable: it allows us to study a pro-environmental intervention that has been working for fifteen years; it comes from a country where it is rare to find wide and representative survey data; and it refers to a worldwide recognized intervention for its impacts in SLL terms but requiring evaluations that consider long-term impacts. The literature focused on agricultural decision-making related to sustainability claims for quantitative analyses, including a representative number of interviewee and social variables, such as age and gender (Home et al., 2014). This pa-

per responds to these demands as all these aspects are included in its methodological design. More interestingly, PIAL serves as an empirical example of adaptation, acting through boundary institutions where scientists, technicians and farmers interact, create and exchange knowledge, and therefore bridge the gap between useful and usable information and knowledge that could be affecting their decision making. It is also a case where science empowers people, a main issue demanded when designing interventions whose objective is sustainable development (Rochmyaningsih, 2015).

The permanent impact is being addressed because the main issue in this analysis is whether environmental intentions and behaviors are different among people belonging to PIAL compared to outsiders. If the intervention has been effective, the analysis should reveal a greater environmental engagement among people that are part of PIAL. The literature consulted indicates that adherence to the program has led to better seeds, more agro-diversity, higher production, improved land management, the promotion of sustainable farming practices and improved living conditions (Section 3). Our results about waste disposal are consistent with the literature reviewed, asserting that, in terms of SLL, PIAL has supposed pro-environmental changes in farmers' behaviors and routines.

However, analyzing how a persistent intervention expecting to have an impact on sustainability shapes values and intentions is more complicated, and more analyses are needed to improve our knowledge here. The results obtained in this paper offer a richer understanding of learning processes through pro-environmental interventions. The most important finding is that time is revealed as a determinant factor in a DLL process, but is not so important in a SLL process acting directly or through other processes:

1) The programme started in La Palma in 2000, seven years earlier than in Manatí. PIAL participants in La Palma show changes in intentions and behaviors, unlike those not participating. In Manatí, however, the same cannot be concluded.
2) Commitment to the environment in La Palma increases with the number of years participating in PIAL. This is true for changes in both SLL and DLL.
3) A positive relation is found for the level of studies in both types of learning (SLL and DLL) in La Palma, but only in SLL in Manatí. Intervention through education is one of the most efficient means of bringing about lasting changes, but it does require a lot of time for the results to become apparent.

This work concludes that there has been an impact of PIAL on SLL and DLL. The advantage of social capital existing in communities of practice, and other spaces of interaction and learning promoted by PIAL facilitates innovation. A valid explanation for this is linked to Rogers (2003: 15), because relevant characteristics, or attributes, like compatibility, complexity, trialability or observability, have been favorably affected. These results are in accordance with numerous research works that, while not analyzing changes in intentions, do find similar results in terms of the effectiveness of social learning and the role of motivations, values, the social context and the creation of learning groups in the diffusion of agri-environmental practices. Those works highlight that the consideration of social learning in environmental programmes is still insufficient; social learning can be effective in inducing deep, lasting changes, but that it is expensive for farmers in terms of time and demanding in terms of the length of the intervention (Duveskog et al., 2011; de Snoo et al., 2013; Price and Leviston, 2014; Feola et al., 2015; Taylor and Van Grieken, 2015). "Only once new social norms have been embedded within the peer group there is (sic) a chance that the desired behaviors will last for generations … in the words of Ahnström (2009), we should aim to place "farmland biodiversity in the hands and minds of farmers" (de Snoo et al., 2013: 67, 70). Moreover, Measham (2013) conducts a longitudinal study in Australia to focus on social learning time frames and their implications for research management. The author's conclusions are in accordance to the results obtained in this paper for Cuba, concluding that social learning requires persistent interventions and indicating that "comparable social learning programs focused on complex problems should allow at least three years in order to develop not only an increased understanding of mutual problems but also practical responses to address them" (Measham, 2013: 1476).

The challenge faced by interventions aimed at making permanent changes lies in the modification or creation of incentives that will continue to be adhered to once the project ends in an area. The new incentives and motivations must also provide guidelines of behavior in an environment that evolves and requires adaptation. The change in intentions, attitudes and motivations implying a higher compromise with the environment ensures a lasting impact. Yet projects that seek to promote pro-environment habits tend to ignore the sphere of intentions (DLL) and even more so the factors affecting them. The design of interventions can, therefore, be improved, as they do not have to act directly on behavior. Interdisciplinary teams will also be necessary to consider the complexity of the process when designing an intervention, including its psychological, managerial, social and economic aspects. Analyzing complex social-ecological systems, considering actions but also motivations and intentions and working with multidisciplinary teams will serve to train leaders who will facilitate the adoption and dissemination of innovations, to develop a continuous evaluation process, to transmit the knowledge on technical advances through experiences and also through educational programmes by applying a programme of environmental education to raise awareness, and to attain good practices at several levels and by promoting a culture of participation. Communities of practice and learning spaces that formal education represents, where the environment would be addressed across subjects, are suitable for these purposes, given their scope and continuity.

Five political implications can, therefore, be highlighted. One is the need to consider the underlying fundamentals of behavior and, in particular, the incentives and motivations related to subjective norms and valuations when designing pro-environmental social intervention strategies. A second is that social learning processes must also be considered, as they support collective action and the adoption of innovations and can increase the efficiency of interventions. Third, it is urgent to evaluate the effectiveness and the efficiency of the resources used in any such interventions over the mid and long term, since changes in intentions take a long time and changes to routines that are not supported by changes in intentions are, perforce, more transitory. Fourth, it is necessary to design and improve existing educational programmes in formal and informal institutions to increase the education level of individuals, to increase their awareness, and to favor the diffusion of knowledge. Lastly, the complexity of social intervention that fosters pro-environmental innovations requires a systemic perspective and the work of interdisciplinary teams that can take into consideration the interrelations of all the elements making up social-ecological systems.

6. Conclusion

The main aim of this paper was to explore the effects of a long-term intervention in Cuba on actions (SLL) and intentions (DLL) in order to promote sustainability. Although there are many research works studying the influence of attitudinal factors on pro-environmental behavior, they rarely analyze the impact of pro-environ-

mental interventions on values and intentions. Publications considering social learning, where the diffusion of knowledge and of new values and intentions is favored by communities of practice, are even scarcer. The design of interventions to achieve an effective change of environmental intentions must deal with resistances and difficulties that cannot be passed over. Social learning can increase their efficiency through its effect on the factors underlying values and intentions.

Public and private institutions around the world devote resources to education and awareness raising programmes and to introducing new practices or routines to improve the management of natural resources. Their effectiveness is often limited due to various reasons, among them the one-off nature of these projects and their short duration. Evaluations are often based on participation and attendance indicators and not on the measurement of changes in behavior that are brought about. The tool rather than the aim is evaluated. It is even less common to evaluate changes in attitudes and motivations. However, permanent, deep-set changes that increase the capacity to adapt require changes in attitudes and values. We have concluded that PIAL, by using social learning as a framework strategy, has had a significant impact, not only on behaviors, but also on pro-environmental values and intentions. This study reinforces the idea of the difficulties besetting any attempt to modify attitudes and intentions, and how success is influenced by the length of the intervention. Time is a determinant factor in the social learning process when trying to change values and attitudes. It is also necessary to increase efforts to evaluate changes in pro-environmental attitudes and intentions, because this will allow interventions to be redesigned accordingly. In order to accelerate the journey towards more sustainable lifestyles and relationships with our planet, long-term interventions must be planned that take into consideration population values, attitudes and motivations and that treat learning and innovation as a complex social process.

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Appendix.

Multinomial logit and ordered logit models: methodology

In the multinomial logit model it is assumed that the odds for each pair of categories of the dependent variable do not depend on the others. When establishing a reference category, the log odds comparing the probability of any category versus that of this baseline is given by

$$\log \frac{P(Y_i = m_j)}{P(Y_i = m_0)} = \beta_{0j} + \beta_{1j} x_{i1} + \cdots + \beta_{pj} x_{ip}, \quad i = 1, ..., n; \quad j = 1, ..., J;$$

where n is the number of individuals, $J + 1$ is the number of categories and m_0 the baseline. Thus, there are J vectors of coefficients, one for each comparison.

Otherwise, ordered logistic models assume proportional odds, that is, each explanatory variable has the same coefficient for the J comparisons,

$$\log \frac{P(Y_i \geq j)}{P(Y_i < j)} = \beta_0 + \beta_1 x_{i1} + \cdots + \beta_p x_{ip}, \quad i = 1, ..., n; \quad j = 1, ..., J;$$

where n is the number of individuals and $J + 1$ the number of levels in the ordinal scale for the dependent variable. Therefore, only one vector of coefficients is estimated.

In regressions, the variable measuring the relationship to PIAL has 'non PIAL' as a reference category. Some control variables are continuous (age and per capita income of the household) and others are categorical (gender, with female as baseline, and education, with four levels and higher studies as the reference). Although it will be omitted for the sake of brevity, it should be understood that the interpretation of each coefficient is made keeping the rest of the variables constant (*ceteris paribus*) in both multinomial or ordered logit.

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