RESEARCH ARTICLE

Tacit working models of human behavioural change II: Farmers' folk theories of conservation programme design

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Abstract Community involvement may be essential for conservation programme success. We focus on farmers, asking how and why they believe conservation interventions will work, or not. Here we test models of folk theories of the human motivational factors required for behaviour change, in 3 rural central Chilean communities. We hypothesize that different models will be supported by farmers with different experiences with conservation programmes, and that socioeconomic and production system variation will explain further variation in who supports each working model. We use a multiple methods approach, combining a questionnaire with participant-observation. We find support for three of the working models of human behavioural change, among different socio-economic profiles of farmers. We believe that the schema of working models provides a boundary object to facilitate communication between conservationists and stakeholders, and can help improve conservation project design and implementation.

Keywords Behavioural change · Conservation · Farmers · Motivation · Values

INTRODUCTION

The involvement of local people in the design of community-based conservation (CBC) and similar conservation initiatives is increasingly common and widely viewed as better for conservation outcomes (Berkes 2004; Waylen et al. 2010). However, while there is research looking at

how communities (of place, practice and/or governance) form and how this affects project outcomes (e.g. Flint et al. 2008), there appears to be little research on the views of community members themselves as to how conservation programmes should be designed. While ecological indigenous and local knowledge (ILK) is increasingly attended to and integrated in the design of ecological research and conservation projects (Gadgil et al. 1993; Berkes 1999; Drew and Henne 2006; Thaman et al. 2013), the diversity of people's tacit and lay theories of how social institutions work and what motivates people are not formally incorporated in work on ILK contributions to conservation. That is to say, the ecological impacts of social institutions, rather than the local reasoning as to why certain social institutions are thought to be effective at affecting human behaviour, have been the usual focus of ILK incorporation in conservation work (e.g. Colding et al. 2003). Nevertheless, people's ideas of how social institutions work, and what makes people change behaviour or continue behaviour, are not uniform (e.g. Gibson et al. 2000; Gelcich et al. 2005). These might be called folk theories of behaviour and motivation (cf. Johnson-Laird and Oatley 1992; Kashima et al. 2009). By understanding the sociocultural variation in these folk theories and their local variations, we may be able to better design conservation projects that lead to behavioural change.

The motivation of behavioural change and its maintenance in conservation and environmental contexts is a long-standing issue. Some authors refer to a value-action gap, or a lack of correspondence between the values that many individuals claim to hold dear in discourse and the values they seem to act on (Blake 1999; Kollmuss and Agyeman 2002). This points to a widespread impression that significantly changing actions in line with conservation and environmental agendas have remained elusive and

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require further research (Rands et al. 2010; Tallis and Lubchenco 2014; Toomey et al. 2017; Castro de Hallgren and Root-Bernstein 2018). Yet many techniques and approaches to changing behaviour to be pro-environment or pro-conservation exist (e.g. Castro de Hallgren and Root-Bernstein 2018). Here, rather than attempting to test different academic models of behaviour or relations between beliefs, values and behaviours, we focus on understanding folk theories of behaviour and motivation. We also refer to “working models”. In our terminology, working models are particular formulations of folk theories; while a true folk theory corresponds to an emic representation, working models are boundary objects that different groups can have levels of agreement with, and use for communication. A schema of working models is developed and described in detail in the companion piece, Root-Bernstein (2020, this issue); we summarize it here below. In that study, we argue that even though conservation scientists are professional researchers, they use non-academic, untested models of human behaviour that amount to folk theories, and we consider how their ideas correspond to our proposed schema of working models. Here, we hypothesize that different groups (e.g. farmers in a particular region, or the international community of conservation researchers) should show differential support for, or appeals to, folk theories that can be described by the working models. The schema divides into four main working models (see Table 1). At the same time, this is a simplification, since working models with mixed or intermediate positions are entirely possible (Fig. 1).

The Persuasion Model combines the idea that people ignore or work around policies with the idea that people are influenced by their strongest values or emotions: thus persuasion—through education, appeals to emotion, or incentives—affects values and, in turn, actions. The Involvement Model combines the same idea that people ignore or work around policies with the idea that behaviour is mainly influenced by context and thus varies across different contexts. Contextual factors, such as local socio-ecological conditions, shape choices, preferences and habits: this implies the use of consultations, participatory processes, local governance and other devolved decision-making powers to adapt programme design to the local context if it is to be effective. The Normative Model combines the idea that policies directly influence practices and thus represent power over others’ behaviour, with the idea that people are motivated by their strongest values or emotions. Thus, norms guide people in understanding what to value or how to evaluate. Finally, the Uniformity Model combines the idea that policies directly influence practices and thus represent power over others’ behaviour, with the idea that personal behaviour is contextual. In this model, a project creates a uniform context, usually large and long-

lasting, to influence people’s choices at a relevant ecological scale. There are also possible null models, corresponding to the (unlikely) possibility that people believe that others have no personal motivations at all, and behaviour is believed to be either completely inconsistent or exactly corresponding to rules and regulations.

While Root-Bernstein (2020, this issue) examines how these working models inform conservation science-based interventions, the current study asks whether farmers’ folk theories can also be described with the same schema of working models, and whether the schema of working models can help to diagnose farmers’ ideas and preferences for local conservation project design. We focus on farmers because they are often considered both essential partners for conservation and at odds with conservation goals and practices (Morris and Potter 1995; Stoate et al. 2009; Pingali 2012).

Working with farmers in conservation interventions is considered important because of the potential negative (or positive) impacts of agricultural practices on the environment. The modern agricultural sector, through regional and international climatic, socio-economic, political and governance influences acting on it, is a leading cause of deforestation, grassland and arid land degradation, and other forms of habitat loss, through the conversion of natural habitats to cropland or mismanagement of natural resources (Lambin et al. 2001; Foley et al. 2005). By contrast, in many areas, historical traditions of farming have created cultural landscapes with high biodiversity value (e.g. Moguel and Toledo 1999; Xu et al. 2009; Agnoletti and Rotherham 2015; Rotherham 2015). The landscape and structural heterogeneity of traditional smallholder farming, including forms of pastoralism, provides habitat and species diversity (e.g. Perfecto and Snelling 1995; Benton et al. 2003; Smith et al. 2010; Frascaroli et al. 2014; Van Uytvanck and Verheyen 2014). Extensive and profound changes in agricultural practice occurred throughout the 20th and into the 21st centuries in Europe, with complex and evolving implications for biodiversity and ecosystem services (Stoate et al. 2009). Developing countries have also experienced the introduction of these farming techniques (Evenson and Gollin 2003), with mixed results for the environment (Pingali 2012). Reversing or mitigating these changes has been a focus of several kinds of conservation projects and policies. Although many of the factors that need to be reversed or mitigated are systemic, the focus of conservation interventions is frequently individual farmers or communities of farmers. Approaches to motivating farmers to participate in conservation initiatives either focus on providing direct payments to individuals or on engaging farming communities in sustainable development models (usually but not only in developing countries).

Table 1 Table 1 shows the schema of four categories of working models of the human dimension of conservation. The images give examples of programmes and approaches following each model. The Persuasion Model suggests that individuals follow their own motivations, and thus, attempts to persuade them through appeal to emotions and environmental values, and to strengthen those values and emotions through education. The image of a sign urging people not to litter because the forest is beautiful is from Wli, Ghana (photo © MR-B). The Normative Model suggests that individuals are influenced by programme rules that provide a framework for normative values and evaluation. An example is organic production standards, here showing the Chilean organic label. The Involvement Model proposes that context determines people's preferences and choices and that people do whatever is in their self-interest in that context. The implication is that conservation decisions are best made from within the relevant context, by the same people who will live with those decisions. Devolution of decision-making, participative research and community-based conservation may all be examples of this model. The image shows parabiologists in Chile (photo © MR-B). The Uniformity Model proposes that programme norms and regulations provide a uniform context of choices and preferences that determine people's actions. Examples of this model can include protected areas and international programmes with large, stable spatial extents and durations such as the Man and Biosphere Reserves. Not shown, two null models in which the “personal factor” assumes that people have no personal motivations at all, and behaviour is either completely inconsistent or corresponds exactly to rules and regulations

	Systemic factors	
Personal factors	People ignore and work around policies to do whatever they want	Programmes and policies enshrine collective values that influence or control behaviours
Strongest values motivate actions	Persuasion Model sign: “Wli is beautiful, use the litter bins”	Normative Model
Context-dependent choices determine actions	Involvement Model	Uniformity Model
People are hypocrites or behave randomly	Indolence Model (null model)	Regulation Model (null model)

Agri-environment schemes, such as those through the CAP (Common Agricultural Policy) in the EU, and PES (payment for ecosystem services) programmes rely on monetary incentives to persuade farmers to adopt conservation-friendly practices. These programmes are often surprisingly unpopular, and many studies have attempted to identify the socio-economic correlates of programme uptake (Lobley and Potter 1998; Morris et al. 2000; Morris 2004; Siebert et al. 2006; Herzon and Mikk 2007; Defrancesco et al. 2008; Barreiro-Hurlé et al. 2010; Gómez-Baggethun et al. 2010; Ma et al. 2012; Schomers and Matzdorf 2013). Theories such as the theory of planned behaviour can also be used to understand why farmers take

up certain actions or not (e.g. Borges et al. 2014). The environmental values of farmers are less frequently examined in this literature, especially in developing countries, with the emphasis put on monetary incentives and development benefits (Gómez-Baggethun et al. 2010; but see Morris and Potter 1995).

Another pragmatic approach to motivating farmers to participate in conservation initiatives, rarely the explicit target of theorizing about behavioural uptake, can be observed in a number of landscape-based and community conservation-type initiatives, which try to preserve local heritages while developing a sustainable rural economy, mainly in developing countries. The focus of these

Fig. 1 The gradient space formed by the four working models

programmes is less on individuals and more at the community scale. Examples include IUCN's AbE or Adaptation based on Ecosystems programme, the FAO's GIAHS or Globally Important Agricultural Heritage Systems programme, UNESCO's Man and Biosphere Reserve programme and FAO's Bosque Modelo ("Model Forest") programme. In the present study, we will compare a Bosque Modelo site to a Conservation Landscape, in central Chile. The Conservation Landscape is a municipal land-use planning approach that evolved from a failed Global Environmental Facility (GEF, which implements the Convention on Biological Diversity) plan to introduce to Chile a protected area type similar to the French Natural Regional Parks which protect the rural heritage of inhabited landscapes.

The focus within the conservation literature, and to some extent practice, on how individual farmers or communities of farmers could be convinced to participate in conservation initiatives is arguably not the most appropriate focus for solving problems at the conservation–agriculture nexus that are essentially systemic. However, here, our focus is not to investigate scientifically what motivates personal actions by farmers (which would imply the assumption that personal motivation is a key area for intervention), but rather to investigate how and whether farmers' folk theories of motivation correspond to a schema of working models of motivation. Our investigation could show that farmers themselves believe that systemic factors are not something that their personal actions can overcome. Our investigation can reveal the design of

conservation interventions, e.g. systemic or personal, they themselves think would be most effective.

We use a mixed-methods approach to collect and describe the ideas of farmers, mainly smallholders, about how conservation initiatives should be designed to be most effective in their communities. We did so across three sites in a single geographic area, the Cordillera de Cantillana: the community of Alhué, with a new Conservation Landscape plan; the community of Doñihue, with the established Bosque Modelo Cachapoal; and the community of Pintué, which like most communities in Chile has no conservation and agriculture programme. We hypothesize that (1) the ideas of local farmers about how conservation programmes should be designed can be characterized by the four working models and (2) the frequency of model support will differ across communities depending on their experience with existing programmes and farmers' socio-economic profiles.

MATERIALS AND METHODS

Study site

Chile is an interesting country in which to consider the integration of conservation into farming. Its transformation into a developed country has entailed dramatic (and traumatic) modernization of the agricultural sector with corresponding environmental impacts (Echeverría et al. 2006; Armesto et al. 2010; Schulz et al. 2011). Land reform, started in the mid-twentieth century, divided up latifundia (*fundos*) and turned them over to smallholders and cooperatives (Wright 1982; Kurtz 2001; Murray 2003). During the dictatorship, this process was partially reversed through restitution and sale (Murray 2003). Smallholders are unable to compete in the export market and increasingly enter into dependent relationships with multinational agribusinesses (Kurtz 2001; Murray 2006). Ongoing conversion of forest and shrubland, reduction in extensive silvopastoral pasturing of livestock and incentives for industrial fruit and wine production in central Chile shape land conversion trajectories (Armesto et al. 2010; Schulz et al. 2011; Hernández et al. 2016). Nevertheless, smallholders in central Chile continue to practise subsistence agriculture. Chile does not have agri-environment schemes comparable to the ones implemented in the EU under the CAP. We only know of one effort to implement PES in Chile, on Chiloé Island, with the goal to improve water quality and quantity (Cabrera and Rojas 2010). Various institutions provide outreach, training and support to farmers, including the PRODESAL or government smallholder development office. In addition to the Conservation Landscape and Bosque Modelo programmes included in this study, Chile

also has 10 MAB Reserves (2 in central Chile), an FAO Globally Important Agricultural Heritage Systems site (in Chiloé, southern Chile) and an AbE programme (the EPIC project in Chillán).

Though mid-20th-century land reform attempted to correct rural socio-economic inequalities, strong economic disparities exist between farmers in contemporary Chile (Murray 2002; Boza 2016). This affects the range of farming strategies. Rural women are increasingly forming farming micro-enterprises, the success of which depends on access to training, formation of social capital and association with mirco-entreprise organizations (Fawaz et al. 2015). Access to training related to business management, organization and specific techniques, as well as involvement with farming organizations, young age, increased education and increasing farm size, productivity and income are all factors associated with the adoption of climate change adaptations, irrigation technologies or soil protection measures (Jaime and Salazar 2011; Huenchuleo et al. 2012; Roco et al. 2017). Access to meteorological forecasts and social media to share information was also associated with greater adaptation to changing weather and climate (Roco et al. 2015). Regarding uptake of contentious farming practices such as GM crops, actors in the Chilean farming sector expect farmers to respond primarily to economic incentives, but also want the government to actively regulate and intervene in GM production and sale (Tironi et al. 2013).

We are not aware of any similar studies of uptake by farmers of nature conservation or agri-environment schemes in Chile. While there is a broad literature on the relation between farmers and environment or conservation in other parts of the world (see above), the historical, sociological and environmental particularities of central Chile mean, in our view, that the global literature is not clearly applicable to the Chilean case. There is some research on Chilean practices, beliefs and attitudes regarding the management of the environment or the landscape, focusing on perception and valuation of ecosystem services (Cerdeira et al. 2013, 2014; Bidegain et al. 2019; López-Santiago et al. 2019). There is a wide variety of typical peasant natural resource-use practices in central Chile, some of which continue to be practised (Moyano Altamirano 2014). Many of these practices depended or continue to depend on informal institutions for their regulation, for example rotation of areas in which leaf litter, leaves (for herbal tea) and tree bark (for soap production) were collected (MR-B unpublished data). Woodcutting and leaf litter collection are now regulated by the state. However, the historical processes of social upheaval and landscape transformation have effected an erasure of traditional engagements with the landscape of central Chile, and public discourse suggests that development is good at any

price (Root-Bernstein 2014). Criticism of the social and environmental costs of economic development is only now becoming somewhat acceptable, with a wave of environmental activism in rural areas, opposing new mines and dams. Access to resources, such as water (Budds 2004), and traditional access rights to land now managed as private protected areas (PPAs) (Di Giminiani and Fonck 2018) are also typical sources of rural environmental conflict. Rural Chileans are not necessarily aware of the scale or impacts of environmental change (Alfonso et al. 2017) and may have negative attitudes towards some wildlife, e.g. wild endemic cat species and pumas (Hermann et al. 2013; Zorondo-Rodríguez et al. 2014).

The study was carried out in three communities in central Chile: Pintué, Alhué and Doñihue. These are located to the North-East, in the centre and to the South-East of the Cordillera de Cantillana (see Fig. 2). The locality of Pintué is part of the Municipality of Paine, Región Metropolitana, with a population of 72 759 inhabitants and a rural population of 25 975 inhabitants (35.6%; INE 2017). From the socio-economic perspective, the most important economic activity is agriculture (PLADECO Pintué 2014), mainly production of fruits and vegetables for domestic consumption and export. The majority of agriculture is in landholdings smaller than 10 ha (PLADECO Pintué 2014). Additionally, Pintué contains one of the most important areas for conservation in the region, managed by the private protected area Altos de Cantillana reserve with an area of 2743 ha.

The locality of Alhué has a population of 6444 inhabitants and a rural population of 3660 inhabitants (56.8%) (INE 2017). The main socio-economic activities are agriculture, livestock production and mining (CED 2013), with both an important gold mine and the tailings dam from the largest copper mine in Chile within the district. A plan funded by the GEF in 2010 developed a conservation landscape concept, later institutionalized in the Communal Development Plan in 2014 (PLADECO Alhué 2014). The plan aimed to integrate sustainability criteria and goals in a territorial management model into the communal land-use planning process of Alhue (PLADECO Alhué 2014). It is based on conservation priorities identified according to participative workshops with the local community. These planning tools focus on sites with cultural values as well as sites for conservation objectives, such as the San Juan de Piche Natural Sanctuary (1417 ha). The programme has a mixed record. Some members of the original Conservation Landscape team have quit, citing arbitrary application of the new programme. Turnover in Environmental Officers responsible for the programme may also contribute to uneven implementation.

The locality of Doñihue is part of the Municipality of Doñihue, Región de O'Higgins, with a population of

Fig. 2 The three study sites in the area known as the Cordillera de Cantillana, showing the landcover context within the concerned municipal boundaries

20 887 and a rural population of 4470 inhabitants (21.4%) (INE 2017). The main socio-economic activities of the locality are related to the agriculture sector and the forestry sector (PLADECO Doñihue 2012). There is a trend towards decrease in participation in these sectors and an increase in activities related to business and manufacturing industries. The Bosque Modelo Cachapoal, run by the National Forest Agency (CONAF) since 2008, includes Doñihue and two contiguous municipalities. The project's original goals were to fund local initiatives related to forest resources. While there is a component related to sustainability, the project also funds many entrepreneurial initiatives that are unrelated to biodiversity conservation, and there is no actual forest involved in the project.

Data collection

Our primary method was a questionnaire, which is described in detail below. Questionnaires are difficult to write so that questions are unambiguous and are always understood in the way intended, especially when working with populations with limited literacy, education and experience taking surveys. On the other hand, we felt that a quantitative approach was necessary to obtain broad legitimacy in the conservation literature, despite calls for the integration of qualitative social sciences into conservation science over the past two decades (Mascia et al. 2003; Büscher and Wolmer 2007; Sandbrook et al. 2013; Sutherland et al. 2018). When working with place-based social groups such as those to which farmers belong, there can be advantages to a qualitative, participant observation

ethnographic approach, due to the site-specific, nuanced and unanticipated material that this can generate (Marcus 1995; Reeves et al. 2008; Jorgensen 2015; Moon et al. 2016). We have thus also included material gathered from participant observation carried out in the three communities during and after the questionnaire was applied, while living in Pintué and Alhué, and while doing other fieldwork and outreach activities in the communities.

The questionnaire focuses on individual farmers, while the participant observation takes place within and focuses on a community scale. Thus, the questionnaire provides an individual-based analysis (which also incorporates community and socio-economic factors as explanatory variables, taking the statistical interpretation that farmers are nested within communities that may influence them). The participant observation complements this with an analysis at the level of the rural communities within which these same farmers live. The articulation between these two levels (individual/community) and methods takes the form of considering the participant observation as providing a qualitative backdrop that facilitates the interpretation of the questionnaires (Newing et al. 2011): the farmers are part of their rural communities, so their individual opinions can be understood in the context of the community-level diversity of views.

Questionnaire. We wanted to ask abstract questions about the working models and about how conservation projects should be designed in general—the general features of good projects and why those are expected to work. However, we did not feel that directly asking abstract questions would be an effective strategy, given the local

levels of literacy (around 80%), education and experience with surveys in the populations concerned. We thus attempted to find concrete examples from the lives and concerns of the communities in the study areas, which illustrated each abstract concept. At the same time, we recognized that concrete examples may incorporate specific biases and not necessarily be good representations of abstract principles. This is even more true in cases where concrete examples may split opinions. Some issues may have a normative interpretation, while others that seem to illustrate the same abstract principle may not have a normative interpretation in a given social group. Lack of normativity may represent shifting views in a transforming society, as well as the typical social divisions and inequalities within communities (Titz et al. 2018). Consequently, we built in response redundancy that could be cross-checked across questions to validate them by approaching each working “hypothesis” (Table 1) in different ways, and with different question formats. We then analysed separately both questions with normative answers, and those without one, as determined post hoc.

The question formats were based on feedback from a version of the questionnaire trialled on pastoralist farmers in Italy (Root-Bernstein and Frascaroli unpublished data). To develop central Chile-specific concrete examples for questions, we primarily drew on publically available data prepared by the team putting together the Conservation Landscape in Alhué (PLADECO Alhué 2014). This document provided the results of interviews, community workshops and census data, describing the ecological, geographical, cultural and socio-economic conditions in Alhué, including local perceptions of the most important cultural and natural sites, environmental concerns and quality of life issues. We did not find any similar material for Pintué or Doñihue. We thus developed a single questionnaire to use across all three sites and chose concrete examples that were not only applicable to Alhué, e.g. we avoided referring to specific local sites. The questionnaire was checked by several native Chilean Spanish speakers for clarity.

The first four sections tested the four working “hypotheses” that compose the four models, the two explaining individual motivation and the two explaining systemic factors (see Table 1). Each section had 5–7 questions. These questions were phrased along the lines of “How much do you agree that most people [do the following]...” with Likert scale responses (1–5). The fifth section directly asked questions about design features of conservation programmes that correspond to each working model. These were 13 statements phrased as “it is [very important, important, not important] that a conservation programme [have this feature]...” with three possible responses: Very Important, Important, Not Important. In this section, we

also included statements representing null working “hypotheses”, in other words that people are hypocrites, act randomly or are fundamentally lazy (see Root-Bernstein 2020). This section was illustrated with vignettes on cards that participants were asked to sort into three piles, corresponding to the three possible responses (see “Results”). Finally, we had sections on socio-economic and demographic factors, agricultural production and knowledge of forest conservation regulations. These last sections were intended to provide information that could be used to explain who supported which working models. The full questionnaire is available in Spanish and English in the Supplementary Information.

Questionnaires were read aloud to participants, with their answers recorded by hand by the interviewer. AB conducted the surveys in Alhué and Pintué, with assistance from MGG, and MGG carried out the survey in Doñihue with an assistant. Participants were orally informed that their participation was voluntary and anonymous, and given the contact number for the researcher carrying out the study in each municipality. The questionnaire was applied between February and December 2017.

Sampling. The criterion to be a participant for the questionnaire was self-identification as an active farmer, including apiculture and livestock raising. In total, we interviewed 98 farmers: all of the interviews were complete enough to use and thus none were excluded. The majority of farmers were interviewed at their farms. To find and access participants, we were helped by the local PRODESAL offices for Pintué and Alhué and by the public library in Doñihue. Following our initial contacts, we used snowballing to find further farmers with a range of farm sizes as indicated above. We used a stratified sampling strategy based on census information from the three municipalities. We attempted to obtain a proportional representation of farmers with < 10 ha, 10–100 ha and > 100 ha, in each municipality, based on data from the National Statistical Institute (INE 2007) (Table 2). However, we undersampled 10–100 ha farmers in Alhué and Pintué (though we do not have precise data for Pintué, only the larger multi-town municipality to which it belongs), and oversampled them in Doñihue. This is probably as a result of inherent bias in our snowballing method, though possibly also reflecting changes in farm size distributions in the 10 years since 2007, the latest date for which we can obtain statistics, or differences in how farm size is measured. Our farm sizes are ha held under land title by the farmer, not including rental or access to communal land or other land-access rights.

Analysis. Data analysis was carried out in R, version 3.3.3. For sections 1–4 of the questionnaire, addressing the four working “hypotheses” explaining personal and systemic factors, we used the *skewness* test in R to identify the

questions with the most skewed and least skewed responses. For each section, the question with the most skewed response was designated the “common sense” question, while the question with the least skewed response was designated the “divisive” question, since there were many answers at both extremes, and/or a normal distribution around “neither agree nor disagree”. For section 1, we were not able to use the most skewed question since this had accidentally been left off of the questionnaire for Doñihue; we thus used the second most skewed question. In this section, we also decided not to use the least skewed question since this was about livestock and we decided that the involvement of PRODESAL in facilitating the interviews could have led some participants to give a biased answer; we thus used the second least skewed question.

After identifying the common sense and divisive questions for each section, we recoded where necessary so that for each question the coding was such that higher numbers indicate more support for the working “hypothesis” being tested in that section. Specifically, we inverted the coding for questions 3.1 and 3.4 so that the higher numbers indicate more support for the idea that people avoid or work around policies to do whatever they want.

Next, we formed measures of each working model. As each model is formulated as the combination of a personal-factor working “hypothesis” and an institutional-factor working “hypothesis” (Table 1), we formed the measures by summing the responses, by individual, for the questions representing each working “hypothesis”. This was done separately for the divisive and the common sense

Table 2 Stratified sampling used for the questionnaire. The data from INE for Pintué include the larger area to which Pintué belongs, the municipality of Paine

Property size	Pintué			Alhué			Doñihue		
	< 10 Ha	10–100 Ha	> 100 Ha	< 10 Ha	10–100 Ha	> 100 Ha	< 10 Ha	10–100 Ha	> 100 Ha
No of people surveyed	27	2	1	33	0	1	15	11	8
Total no of people surveyed	30			34			34		
INE survey data 2007, no. of farms	68.4%	26.9%	3.7%	52.8%	31%	16.2%	87.6%	11.7%	0.7%

Table 3 Indices used to explain who supported each working model

Index	Formula	Interpretation
Education	Ag. training (0,1) $\times$ 4 + Knowledge of organic ag. (0, 1, 2) $\times$ 2 + Education level (0–4)	Technical and formal education and knowledge of environmental trends in agriculture (organic agriculture)
Age	Quantiles 1–4	Age group
Residency	Quantiles 1–4	Time living in the study site
Gender	1 = male, 2 = female	
Lifestyle	For cooking and heating, we order energy sources by level of integration into services/infrastructure, so that firewood = 1, gas and parafin = 2, electricity = 3. Number of people in household is by quantiles, 1–4, inverted so that 1 is the highest quantile (100%), thus larger families are at the low end of the scale. Index = household (1–4) + cooking (1–3) + heating (1–3) + internet (0,1) $\times$ 3	Higher numbers indicate greater integration in state/centralized services and infrastructures, lower numbers indicate a more traditional, independent/isolated lifestyle
Agricultural model	For own use diversity, counted the number of plant crops raised for own use (including own use and sale). Own use quantiles collapsed to 3 categories due to many 0 s. Added hectares rented and owned, took quantiles and inverted so that lower area goes with higher diversities. Index = production diversity (1–4) + own use diversity (1–3) + hectares in production (1–4) + number of other economic activities (1–3)	Higher numbers indicate a traditional, diversified smallholder strategy, while low numbers indicate a modern, intensified strategy
Capital	Sum of cattle, horses and mules, in quartiles (0–3) + hectares owned categories < 5, 5–20, > 20 (1–3) + water title (1,0)*3	Higher numbers indicate greater ownership of agricultural resources/livestock
Agricultural diversity	For production diversity, counted the number of plant and animal species raised, calculated quantiles (1–4) + mix livestock & crops (0,1)*2	Diversity of species raised on the farm
CONAF	Scored answers as correct or incorrect and calculated the sum of correct answers (total: 21)	Knowledge of native forest regulations (CONAF = National Forestry Corporation, in charge of forests and conservation)

questions, such that we produced two parallel sets of models, based on divisive and common sense data.

To explain who supported which model, we produced indices based on the socio-economic, demographic, agricultural production and forest regulation knowledge data. These indices are shown in detail in Table 3. We did not use our stratification variable, farm size, as an explanatory variable as observations and data collection suggested that within each size class, there was considerable heterogeneity in farming practices, which we attempted to better reflect with our indices.

Finally, we used linear models (*lm* function in R) to explain who supported each of the models, separately for the divisive and common sense data. We combined the data from the three municipalities into a single dataset and used “Municipality” as an additional explanatory variable. The other explanatory variables were the indices (Table 3).

For section 5 of the questionnaire, we used a multiple sample χ^2 test to see if the distribution of responses across

categories (Very Important, Important, Not Important) varied between statements and municipalities. The test was run in R using the *chisq.test* function.

Qualitative Material. Complementary qualitative material was collected in a participant observation mode (Jorgensen 2015) principally by AB in Pintué and Alhué between February and July 2017, and by MR-B in Alhué and Doñihue between August and November 2017 and again in Alhué during September 2018. Material was collected during scoping interviews to understand the local institutions and conditions, outreach events to communicate the results of this study to locals and participants in Alhué and Doñihue in 2017 and 2018, as well as other interactions with residents and stakeholders, and experiences while living in the Pintué and Alhué during the indicated periods (about 9 months in total). The sample of the qualitative material is thus broader than only farmers. The material has been anonymised.

Fig. 3 Indices data. For explanations of the indices see Table 3

Combined analysis of quantitative and qualitative material can be seen as coordinating between different approaches to knowledge creation. Our particular form of interdisciplinarity does not follow an explicit theoretical position and can be described as a form of pragmatic tinkering towards productive methods of knowledge creation serving various ends (e.g. Tangvald-Pedersen and Bongaardt 2017). In our view, multiple approaches bridge disciplinary knowledge communities and allow a richer conversation, and perhaps more interesting and productive future collaborations, between the various disciplines potentially concerned by these research issues.

RESULTS

Participant-observation material. We first contextualize the quantitative questionnaire results with observations of how residents of the studied communities spontaneously explained and qualified their peers' motivations for behaviour in general and environmentally friendly practices in particular. A common claim was that residents of the region were “too individualistic”, in the sense that they did not work together for the common good. It was also very common to hear people in the region express the opinion that “people have no consciousness about the environment/*la gente no tiene consciencia del medio ambiente*”. This opinion was voiced by individuals with a wide variety of levels of education or implication in the environmental sector. However, despite a supposed lack of environmental or social consciousness, farmers had opinions about whether practices had environmental impacts, and did not believe that the environment was a realm of “each for himself”. Farmers often complained about the lack of environmental consciousness revealed by the common practice of burning and burying trash—trash collection and recycling services in the region have only been established in the past 15 years and remain incomplete. Discussions of particular traditional practices, as well, often revealed that farmers followed specific principles (e.g. “keeping the forest clean”, see also Di Giminiani and Fonck 2018) or practices, such as community-managed rotation of forest product harvesting, crop rotation with fallows, and non-irrigated crop production (*de rulo*), which they believed were sustainable and not harmful. Several farmers reported having saved nesting animals when clearing fields by burning (which is no longer practised). Although these practices do not necessarily align with urban environmentalism, they formed a rural ethic of engagement with the natural landscape.

A graffito dated 1994 at the shrine in Alhué, located on a hillside in a grove among several large rocks, states, “The Earth precisely is the ideal educative school for learning as

quickly as possible, as every moment offers us a lesson, a practice and an opportunity to dominate, overcome and purify ourselves”. Whether the “Earth” (*La Tierra*) here points to an engagement with nature as a moral theatre (as implied by the surroundings of the shrine) or simply refers to the travails that precede Heaven or Hell in the Catholic theology is not entirely clear. In Alhué, numerous legends and anecdotes recount encounters with the Devil in specific areas, the locations of which are still known, suggesting that the Earth, in a geographical and experiential landscape sense, is indeed understood as a moral realm where powers of good and evil are physically present. In any case, the quote points to a normative view that people should be motivated by their values (i.e. Catholic values) to act in a way that makes them more consistent with those values.

However, whether farmers were principled traditionalists or easily influenced by changing economic incentives was contested. An agricultural consultant claimed that, “The old people don't work for philosophical reasons. They don't do [integrated management] out of conviction, but because of incentives, because they receive money”. On the other hand, an *arriero* (cowboy) suggested that a plan, by the local PRODESAL (smallholders outreach office), to change cattle raising practices to make them more intensive and market-oriented was unlikely to work because this did not reflect traditional modes or motivations for cattle raising: as though sharing the kind of local secret that everyone knows but no one will admit to, he said, “No one will do it”. Rural values and practices were not easily transformed by the promise of more money, in his opinion.

At the same time, rural residents engaged with local institutions and generally appeared to be rule-following. Regulated activities such as charcoal production and litter collection had been significantly reduced because people did not have the means to obtain approved management plans to carry out these activities—and so, had largely stopped carrying them out. Some people claimed that locals were excessively dependent on state services such as the PRODESAL and rarely took the initiative to develop economic activities or other projects independently.

Finally, some rural residents felt powerless or at the mercy of external forces. This kind of attitude was expressed, for example by a farmer who claimed that a large landholding managed for conservation lacked true environmental values since it was involved in a land-use conflict: he believed that its real goal was to make money, and for reasons not entirely clear but that seemed to be rooted in social relations between *fundo* owners and smallholders, he felt it was simply not possible for the community to generate a dialogue with the landholding about the land-use conflict. A similar attitude of resignation was common regarding the impacts of mines in the area.

An individual who had formerly worked in reforestation claimed that multinational corporations forced normal people to give up their values and traditions by leaving them with no alternative—the local loss of agrobiodiversity, was, in his opinion, the fault of non-reproductive seeds and pesticides sold to farmers by a corporation whose name he had forgotten. Such global corporations, he claimed, imposed poor environmental practices on local farmers in order to make a profit. On the other hand, a member of an agricultural cooperative told a story about how her sister had taken up potato farming on a small plot of land and had resisted advice to use chemical products after a bad harvest; her crop improved the next year without chemical inputs. This, the storyteller thought, was an exemplary tale about how most people in that situation would react (resisting advice to use pesticides) and also about the rewards of doing so. Thus, principled smallholders might escape pressures to intensify production, even if they perceived themselves to be embedded in a system working on that logic.

Thus, broadly we observed a sense of a social expectation that local actors are value-driven, have what could be identified as environmental values and should be consistent in their values and actions. However, achieving this often

required negotiation with constraining socio-economic conditions, and this sometimes failed or seemed to be impossible, leading to the appearance, at least, of passive resignation.

Questionnaire results. The indices data are summarized in Fig. 3. The questions used to represent each working model are shown in Table 4.

The results of the linear modelling analysis that explain who supported each working model, derived from the data from sections 1–4 of the questionnaire, are shown in detail in the [Electronic Supplementary Material](#). Summaries of the models are shown in Table 5. Starting with the common sense data, we found no linear model that explained who supported the Persuasion Model. The Involvement Model was explained by the municipality (residents of Pintué supported it), gender (males supported it) and those with an “agricultural model” index indicating a more traditional, diversified smallholder strategy. The Normative Model was supported by those with less education. We found no linear model with significant variables that explained who supported the Uniformity Model.

For the divisive data, we found that the Persuasion Model was supported by those with a score on the “life-style” index indicating a more traditional, independent or

Table 4 English translation of the questions used to represent each working model for the statistical analysis of sections 1–4 of the questionnaire ([Electronic Supplementary Material](#)). * indicates that the question was recoded so that higher numbers supported the inverted question, now indicated by the negation in brackets

Working model	Common sense questions	Divisive questions
Persuasion	“People change their way of farming depending on their religion” + “It is preferable [not] to have a relationship with, and interact with, the Agricultural and Livestock Service”*	“Because they know more about flora and fauna, peasants [<i>campesinos</i>] manage their lands differently than those who know less” + “People [do not] follow the rules about the cutting of native trees”*
Involvement	“People whose families have lived for generations in the same rural area make different land-use decisions than recently arrived people” + “It is preferable [not] to have a relationship with, and interact with, the Agricultural and Livestock Service”*	“When a landowner has lots of money, they can dedicate themselves to nature conservation, but with little money, one cannot do so” + “People [do not] follow the rules about the cutting of native trees”*
Normative	“People change their way of farming depending on their religion” + “Regulations on the cutting of native forest exist because Chilean society values the existence of its forests”	“Because they know more about flora and fauna, peasants [<i>campesinos</i>] manage their lands differently than those who know less” + “In Chile, politics controls everything that happens in agriculture”
Uniformity	“People whose families have lived for generations in the same rural area make different land-use decisions than recently arrived people” + “Regulations on the cutting of native forest exist because Chilean society values the existence of its forests”	“When a landowner has lots of money, they can dedicate themselves to nature conservation, but with little money, one cannot do so” + “In Chile, politics controls everything that happens in agriculture”

Table 5 Summary of the results of the linear models showing the variables explaining who supports each working model. Muni (P) refers to Pintué, Muni (D) to Doñihue. Please refer to Table 3 and the text to interpret the other variables

Question set	Persuasion	Involvement	Normative	Uniformity
Common sense or normative	No model	Muni (P) Gender (M) Ag Model +	Edu -	No model
Divisive	Lifestyle -	Muni (D)	Muni (P) Lifestyle -	Muni (P) CONAF + Ag model -

isolated lifestyle. The Involvement Model was supported by residents of Doñihue. The Normative Model was supported by residents of Pintué and those with a score on the “lifestyle” index indicating a more traditional, independent or isolated lifestyle. The Uniformity Model was supported by residents of Pintué, respondents with a better knowledge of forest regulations and those with a score on the “agricultural model” index indicating a modern, intensified agricultural strategy.

For section 5, we found that there were significant differences between the number of responses in each category (Very Important, Important, Not Important) ($\chi^2 = 511.9$, $df = 96$, $p < 2.2e-16$). However, a Wilcoxon rank sum post-tests indicated that the differences were not explained by “municipality”. We thus combined the data across statements for all the municipalities and redid the analysis. We again found that there was a significant difference between the number of responses in each category across questions ($\chi^2 = 274.67$, $df = 24$, p value $< 2.2e-16$). “Very Important” was by far the most common response across all questions. Of the seven statements most often listed as “Not Important”, two described the Uniformity Model, one described the involvement model and one the Normative Model; the other three described features of programmes based on null working models. These most “Not Important” statements are listed in Table 6. A summary of all the statements is shown in Fig. 4.

DISCUSSION

The different approaches and approximations yielded different perspectives on how farmers in the three municipalities think that conservation programmes should be designed to be most effective. Here, we will discuss the commonalities between them.

A first remark is that there was only minority support for the working “hypothesis” that people work around policies

Table 6 The seven statements that were most indicated as Not Important across the three municipalities

Working model	Statement: It is Very Important/Important/Not Important...
Uniformity	That the project be applied in a large geographic zone
Uniformity	That the project have a long-term duration
Normative	That the rules for the project be very clear
Involvement	That we should be able to participate in the decision-making of the project
Null	That there not be too much paperwork to be included
Null	That it not be necessary to learn and apply new agricultural techniques
Null	That there be supervision and checks of the standards regularly

and rules to do whatever they want to do. To form the models based on this explanation of systemic factors (the Persuasion and Involvement Models), we inverted questions in which most respondents actually agreed that people generally follow the rules. There were, of course, still individuals, for both the common sense and divisive questions, who believed that it is normal to avoid the rules and regulations, but they were not the majority. This is supported by our participant observation material. Thus, the farmers in our sample follow regulations, engage with institutions (even if only passively) and perceive that their peers do so as well. Given this caveat, our strongest claim to be able to form common sense representations of the working models is for the Normative and Uniformity Models.

Our linear modelling analysis of who supported common sense understandings of the working models was incomplete, with this explained only for the Involvement Model and the Normative Model. We could not explain who supported the other two working models (which is not entirely unexpected since, as they were chosen to represent common sense positions, they should be supported by most respondents with little variance between subgroups corresponding to different factors). The group with the least experience of participative processes, residents of Pintué, was most convinced of the Involvement Model, along with men and more traditional farmers from all three municipalities. Men, more than women, may have supported the particular common sense questions—long-term residents take different decisions and one should avoid the Agricultural and Livestock Service—as men may be more likely to take the farm management decisions (we have no data on this), and men are more likely to hold the kind of environment-related place-based knowledge that is likely to inform long-term residents; we observed and were told that women are less likely to engage in either work or leisure out in the hills, in nature. ‘Traditional smallholders’

Fig. 4 The cards depicting the statements representing the working models. The most frequent response for all statements was “Very Important”. On the left, the statements most often categorized as “Not Important”. Images drawn by AB

is nearly synonymous with ‘long-term residents’, who are also likely to support this model with its emphasis on contextual, place-specific knowledge, since they are the main holders of this kind of knowledge. It does seem surprising, however, that residents of Pintué, who have no conservation programme that aims to value and develop their local agricultural heritage or practices, are more convinced that local difference is important—or does this reflect that Pintué, which is closest and has better connections to the capital Santiago, has a more urban rule-bending outlook? This is not clear. For the divisive data, it is residents of Doñihue who support the Involvement Model. This may reflect the nature of the Bosque Modelo Cachapoal, which funds local “green” entrepreneurs, and which may have contributed to a local mindset of independent initiative.

The divisive data showed that respondents with a more traditional, independent or isolated lifestyle were more likely to support the Persuasion and Normative Models—

those that posit that people are motivated by their values. The Uniformity Model was supported, for divisive questions, by residents of Pintué, those with a better knowledge of forest regulations, and those with a modern, intensified agricultural strategy. Again, this seems to make sense, since knowledge of forest regulations, and high-input, high-investment agricultural strategies both suggest a certain knowledge of and investment in the socio-economic institutions of the *status quo*—the profile of a group that might be expected to prize predictable regulatory regimes as expressed by the Uniformity Model. Pintué farmers are also better integrated with national distribution networks and markets, due to their geographical position, compared to the other two municipalities. Specifically, supporters of this model were those who believed that politics controls agriculture and that you need lots of money to do conservation. These are both clearly contentious claims, but farmers who produce for the export market may have experience that lends support to them.

Finally, the common sense version of the Normative Model was supported by people with lower levels of education. This might be interpreted as people with less education being less aware of how to manipulate the rules. This also squares with the lines of evidence we discuss above that farmers appeared to generally follow forest regulations, and seemed, at least to some stakeholders, not to develop individual initiatives.

Turning to the results from section 5 of the questionnaire, where participants sorted cards depicting different statements about project design, the tendency across all municipalities for all respondents to choose “Very Important” for all the statements does not tell us very much. This may reflect a poorly differentiated scale for responses. Alternatively, the lesson may be that the ideal conservation project accounts for all possible working theories of human behaviour (see also Root-Bernstein 2020). The statements most often considered “Not Important” suggest slightly less support for the Uniformity and Involvement Models. They also indicate at least a marginal rejection of the null working models that people will make little effort or have no self-motivation. The Persuasion and Normative Models by contrast are almost uniformly supported.

CONCLUSIONS

Altogether, our results show that farmers in this region of central Chile are value-driven and expect their peers to act consistently with their values. They are also generally rule-following. They engage with institutions, if not very proactively, and want training and technical assistance in acquiring new agricultural practices (see also Vargas 2018). At times, these two motivations conflict and farmers may find themselves forced to give up traditional practices (which they largely believe are harmless or beneficial for the environment), and/or to adopt environmentally harmful practices, in the face of institutions and norms that they perceive themselves as unable to influence. Thus, the most supported model for this region is the Normative Model. At the same time, we did find differential support for other models along socio-economic/farming factors, and varying by municipality. Principally, men and traditional smallholders were more likely to support the Involvement Model, and modern intensified farmers and those with better knowledge of forest regulations were more likely to support the Uniformity Model—when considering contentious issues. Interestingly, but inconclusively, farmers from the municipality with no conservation programme (Pintué) believed in three of the working models, while farmers from the municipality with a relatively new

conservation programme with few concrete impacts (Alhué) did not, as a group, believe in any.

A strength of our approach is the use of multiple lines of evidence. We believe that the participant observation material allows us to add depth and insight while the multiple forms of analysis of the questionnaire contribute to cross-validation of results.

The framework provided by the four working models of human dimensions of conservation helps to characterize the beliefs of farmers in central Chile in ways that can guide conservationists. We do not claim to have revealed the emic folk theories of these farmers (which would require a more in-depth ethnographic analysis than we provide), but the correspondence of farmers’ ideas to our schema of working models serves, we argue, a communicative role as a boundary object. For example, we have recommended to stakeholders on the basis of our results that they adapt their project design strategy to the farmers’ profile, focusing on aligning with peasant values (rather than urban environmentalist values) when working with smallholders with larger households and less connection to state infrastructures and services, on creating stable and defined normative regimes when working with intensified producers and on training farmers in modes of participative organization and governance in order to improve their ability to pro-actively engage the institutions regulating conservation and farming and act on their environmental values. As a concrete example, an alignment with peasant values implies supporting sustainable non-market production of cattle in woodlands, rather than encouraging intensification and removal of cattle from woodlands. It can also include promoting sustainable harvest of non-timber forest products such as leaf litter, which farmers believe is good for the forest and part of their engagement with it (see Root-Bernstein et al. submitted). We are currently planning ethnobiological and ecological research projects to support local institutions in developing projects on these themes. Thus, we have used this result to argue that smallholders have distinct values and understandings of what works for them: it would be fundamentally counter-productive to expect or encourage this profile of farmer to take up intensified farming techniques as a way to disentangle their production from the landscape and create a more ‘pristine’ forest. Further, projects about forest uses for smallholders in these communities are likely to be least motivating if they are implemented as zonation (Uniformity Model) and most motivating if they are implemented through a set of norms that farmers can choose to qualify for, and help to design (e.g. a hybrid of Normative and Involvement Models). At the same time, a similar idea in the form of an official ‘set-aside’ zonation programme might be useful and motivating in the context of industrial fruit producers in the same communities.

The tensions between traditional smallholder farming and pressures from outside institutions and economic forces reported here are in line with trends in Latin America in general (FAO 2014). Farmers' assessments of opportunities to farm environmentally and sustainably differ across Latin America according to farm type and socio-ecological conditions (e.g. Ellis-Jones and Mason 1999; Porro 2005; Calle et al. 2009; Lima and Costa 2011). However, research in this area has focused on post hoc analysis of socio-economic factors and conditions associated with adoption of specific programmes or practices, rather than developing a framework for assessing acceptance of or confidence in proposed programmes. The results about who supported what working model reported here are in no way claims about farmers as some kind of universal socio-economic group. We argue that these particular folk theoretical orientations among different profiles of farmers, which we represent with the working models, in this particular region form part of their ILK (indigenous and local knowledge), and as such is suitable to integrate into place-based approaches to conservation. We also do not claim that we have proved that all farmers everywhere agree with all or any of the possible working models. Nevertheless, the schema is intended to be a generalizable boundary object, which can be tested on other communities. The schema of working models might be shown to be subdivided, differently divided, expanded or inapplicable in other communities. We believe that such a potential finding of limited generality of the schema would itself be very enlightening in terms of understanding variations in ILK about motivations to engage with conservation, and provide nuanced insight into how to engage with farmers or farming communities in different particular communities around the world. This is important since most conservation programmes that engage with farmers are designed at global, continental or regional scales of applicability. Detection of patterns of human-biodiversity relationships requires scientific knowledge built on data that are sufficiently fine-grained to reflect complex dynamics at local scales, but that are consistent and comprehensive enough to enable analysis on the base of established theories. This also requires an analytical approach based on empirical data that contributes to robust already established theories or to the formulation of new ones.

One prevalent assumption in the conservation literature is that value-driven behaviour and persuasion as a means to change values are key to successful conservation interventions (e.g. Jepson and Canney 2003; Chan et al. 2016). In this case study, we demonstrate that while many people may share this view in a given community, it may coexist alongside other views of what motivates behaviours, including ideas about the role of systemic factors. We believe that the schema of working models we illustrate

here has heuristic or diagnostic value. For example, it could help focus conservationists on the existence in a particular community or farmer profile of assumptions about human motivation that may contradict their own working models (e.g. the Persuasion Model). We also demonstrate that at the level of concrete examples of what people are expected to do under various circumstances, members of a community will have both normative and contentious interpretations. Communities are not uniform (Titz et al. 2018), and we have shown variation along socio-economic factors in typical models of human behavioural change among farmers in a relatively small geographical area. Beliefs and perceptions affect actions and relationships, and thus lived reality (e.g. Geertz 1973; Kuehne 2014). We predict that incorporating ILK not only about the environment but also about society into place-based conservation approaches will help create successful socio-ecological interventions that meet the expectations of local farmers and inspire their confidence. Finally, the schema of working models has been illustrated here in the context of farmers, but is not limited to this context. It can also be applied to a wide range of other kinds of conservation actors, which might facilitate communication about 'what is expected to work' across stakeholder groups during the design and implementation of conservation projects and programmes.

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