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Perception of change: Narratives and strategies of farmers in Madagascar



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1. Introduction

Smallholder farmers play a crucial role in the functioning of their countries, being responsible for 80 percent of food consumed in much of the developing world (IFAD, 2013). They are the ones who will be on the frontline of climate change in addition to already experiencing an array of instabilities, such as the effects of global and regional market fluctuations, policy changes, and environmental degradation (O'Brien et al., 2004; Morton, 2007; Olsson et al., 2014). These changes leave them increasingly vulnerable and often unable to escape poverty, as well as frequently leading to a depletion of the natural resources and ecosystem services upon which they depend (Morton, 2007; IFAD, 2013). This has placed smallholder farmers at the centre-stage of much research aimed at gaining a better understanding of the interactions and feedbacks within and between natural and social systems (Walker et al., 2004; Darnhofer et al., 2010; Folke et al., 2010; Bathfield et al., 2015). Furthermore, one of the key objectives of the United Nations' Sustainable Development Goals (SDGs) is the eradication of poverty (United Nations, 2015), placing smallholder farmers at the centre of UN action.

How farmers view their environment and events will impact their vulnerability, defined here as all “things outside people's control” (Adoto and Meinzen-Dick, 2002, p. 8). Their subjective

viewpoints will further affect their livelihood decisions, made in response to these stresses and shocks (Adoto and Meinzen-Dick, 2002). In this paper, subjectivity is understood as a person's point of view, with this distinct behaviour being based on the person's life experiences, values and opinions (Stephenson, 1968; Amin, 2000). This subjectivity has been shown to play a decisive role in climate change adaptation, as the societal context will influence how actions are perceived and are (un)successfully implemented. Considering these subjective factors may therefore help in carrying out adaptation responses tailored for specific contexts (Adger et al., 2009).

Bebbington (1999) put forward that rural livelihoods can be defined through farmers' access to five capital assets, namely natural, financial, physical, human and social, and the way they utilise these stocks. Physical and financial capitals are necessary to undertake any livelihood strategy, for example through an initial monetary investment, utilising existing infrastructure, or possession of machinery. Human and social capitals assist when multiple strategies are involved, as they represent individuals' capabilities, or social networks and relations, respectively. Lastly, natural capital represents the resources and environmental services that all livelihood strategies require (Scoones, 1998). Sustaining or increasing these capital stocks is necessary to maintain or improve people's standards of living, as well as to bring about sustainable development (Bebbington, 1999; Goodwin, 2003). It should be stressed that livelihood decisions are not solely made based on financial aspects, but that social, human and cultural factors further shape rural people's decision-making. Cultural practices in particular play a crucial role in the formation and strengthening of these capitals, as well as playing an empowering role in the daily lives of farmers (Bebbington, 1999) and in fostering sustainable livelihoods (Daskon and Binns, 2009).

Considering all sources of knowledge by understanding how farmers perceive and adapt to change is necessary to develop robust policies aimed at decreasing their vulnerability (Robbins, 2000; Adger and Vincent, 2005). At present, research has largely singled out climate change and its impacts on smallholder farmers (Mertz et al., 2009; Deressa et al., 2011; Below et al., 2012; Tambo and Abdoulaye, 2013). However, their experience of change in its

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entirety and its impacts on their asset base, due to economic, social, or environmental drivers, have been given little attention, despite the difficulty of clearly linking a specific change to a single driver (Millennium Ecosystem Assessment, 2005). This research sought to fill this gap by holistically inspecting 'change' from the point of view of smallholder farmers in Madagascar. Although addressing as broad a concept as that of change implies forgoing the in-depth analysis of each of its components, our aim was to develop a comprehensive representation of change as a whole; how it is understood and experienced by farmers. Specifically, the objectives of this study were to gain a better understanding of (i) smallholder farmers' perceptions of change, (ii) the links between these changes and capital assets, and (iii) the range of existing attitudes towards these changes, in order to identify the strategies used to maintain or increase livelihoods in an agrarian area where conservation and developing stakes are high. Furthermore, we explore how our results and used methodology can contribute to the political ecology and resilience thinking debate by integrating different elements of these two schools of thought.

A community's social resilience is dependent on the individual and collective strategies of its residents, their prospects regarding livelihoods, the existing social institutions, as well as on resource accessibility (Adger, 2000). This resilience can be affected by changes such as new or modified governmental policies, political unrest or environmental pressures affecting ecological systems (Adger et al., 2002; Eakin, 2005; Darnhofer et al., 2010). However, decisions regarding resource use are determined by more than the above mentioned social resilience factors, particularly in agrarian areas of Madagascar where culture plays a strong role in people's daily lives. Culture can take intangible forms, as in the case of local customs, taboos or seasonal agricultural calendars, as well as tangible forms such as crafts, ancestral sites, or geographical features, all of which may differ significantly between communities (Daskon and Binns, 2009). Furthermore, culture has been shown to affect the provision of ecosystem-services, with the well-being of communities determining the well-being of ecosystems (von Heland and Folke, 2014). In Madagascar, the importance of these cultural factors has been acknowledged by authorities, with there being a movement towards devolution of natural resource management. By employing *dina* (oral traditions and informal legal mechanism that guide social relations) as community governance tools, authorities hope to decrease conflicts between local customs and state regulations regarding natural resources (Andriamalala and Gardner, 2010). All of these cultural characteristics will in turn have an influence on the way individuals respond to change and are able to adapt to it (Adger et al., 2012; Goetter, 2016).

Changes can be defined as being either stresses or shocks, depending on their intensity, severity and temporality, with the former being less intense but taking place over a longer period, and the latter being of stronger intensity over a shorter span of time (Scoones et al., 2007; Darnhofer et al., 2010). However, the impacts that specific changes have on farmers will largely be determined by the state of their asset base after their occurrence, rather than by the above-mentioned characteristics of the change (Carter and Barrett, 2006).

When faced with change, farmers will either employ coping strategies, allowing them to get by during the period of instability, or they will adapt, changing their livelihood strategies in a lasting way (Scoones, 1998). This type of adaptation has been defined as 'reactive', where actions take place after or while the effects of the change are occurring. Contrarily, 'proactive adaptation', i.e. planned adaptation, is defined as "the use of information about present and future (...) change to review the suitability of current and planned practices, policies and infrastructure" (Füssel, 2007, p. 268). This type of adaptation takes place at a larger scale, with actions being

taken before the effects of the change are experienced, often involving planned measures implemented by public institutions (de Bruin, 2011). Farmers therefore generally either cope with change, or adapt by implementing reactive measures often falling in one of these three categories: (i) intensification and/or extensification, i.e. increased output per unit area or increased labour input, (ii) diversification by having multiple sources of income, and (iii) migration, by changing place of residence and looking for employment elsewhere (Scoones, 1998; de Bruin, 2011). The adoption of one of these strategies does not prevent the use of another; farmers will often use a combination of them.

To conduct this research, we selected a case study in the Alaotra-Mangoro and Analanjirofo regions of Madagascar (Fig. 1). Both regions are agricultural hubs of the country, the Alaotra largely for its rice production, Madagascar's staple food (Andrianandrasana et al., 2005), and Analanjirofo for its cash crops (e.g. cloves, vanilla) (Alizany et al., 2010). Multiple changes affect the study area's natural resources and their users: firstly, socio-economic and political changes such as demographic growth (INSTAT, 2016), political instability due to the 2009 coup (Randrianja, 2012; Rendigs et al., 2015) and increasing food insecurity and poverty (Waeber, 2014; Rakotoarisoa et al., 2015). Secondly, environmental changes such as climate change, expected to be increasingly felt in the upcoming years (Hannah et al., 2008; Harvey et al., 2014), high levels of deforestation (Andrianandrasana et al., 2005; Kull, 2012), decreasing fish stocks in Lake Alaotra (Lammers et al., 2015; Wallace et al., 2016), as well as decreasing soil quality and

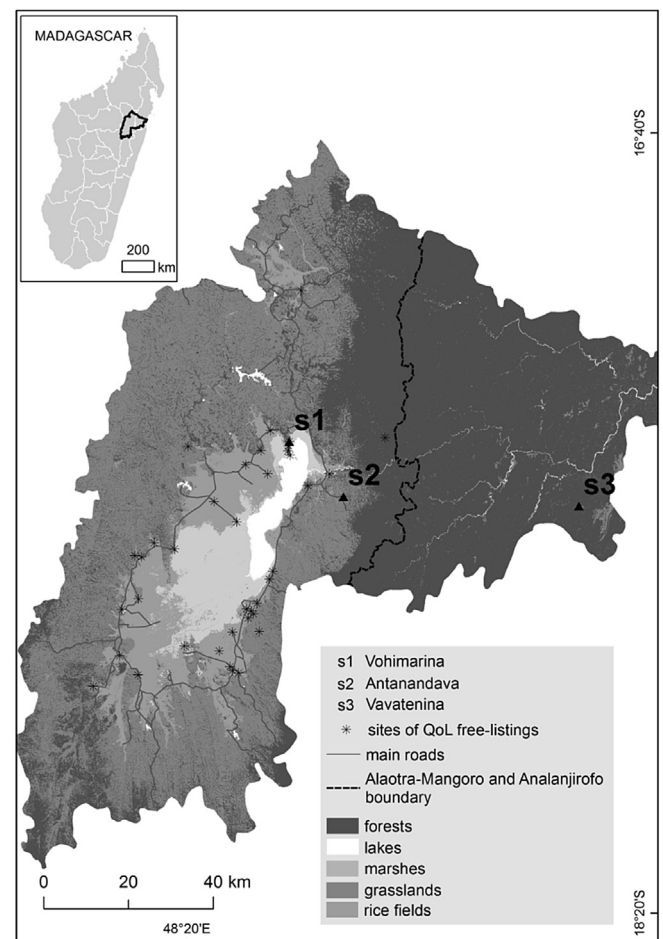


Fig. 1. Delimitation of the Maningory watershed and location of the three study sites.

increasing erosion (Randrianarisoa and Minten, 2001; Bakoariniaina et al., 2006).

2. Methodology

We used a mixed methods social science approach by combining focus groups (Kitzinger, 1995) and Q methodology, defined as a “foundation for the systematic study of subjectivity” (Brown, 1993, p. 93), allowing for a quantitative analysis of people’s viewpoints (Robbins and Krueger, 2000). Although this methodology does not eliminate researcher bias (Stainton-Rogers, 1995), it does allow researchers to “surrender the monopoly of control” (Robbins and Krueger, 2000, p. 636). In addition, between February and December 2015, 389 free listings focusing on quality of life (QoL) were performed in 49 sites around Lake Alaotra (Fig. 1).

The study was carried out during the months of October to December 2015, in three villages (*fokontany*) within the Maningory watershed (Wilmé et al., 2012), spread over the three main ecosystems of the region (Fig. 1): (s1) wetlands: Vohimarina on the north shore of Lake Alaotra, with a population of 855 in 2007, relies largely on agriculture and some fishing activity (Lammers et al., 2015); (s2) grasslands: Antanandava in the central region of the watershed, home to 2732 inhabitants in 2009 (Raboanarielina, 2012), is also the commune (*komoina*) centre of the same name, making it a trading hub, while agriculture remains the main activity; (s3) degraded forest: Ankazomianko, in the commune of Vavatenina in the northeast of the watershed, home to 6760 inhabitants in 2006. Unlike s1 and s2, its humid climate and easy access to the port town of Toamasina allows for the cultivation of cash crops (Ministère de l’Agriculture, 2012).

We engaged with farmers and fishers, the main resource users of the region (Rakotoarisoa et al., 2015). Although this narrowed the field of identified changes to those relevant to this group of actors, these resource users are of particular interest as the sheer weight of their combined actions on the landscape leads to change (Copsey et al., 2009; Gorenflo et al., 2011; Kull, 2012). The criteria for inclusion in the study were their profession (farmer and/or fishers) and age (between 25 and 65). We sought to achieve a balanced gender representation of both males and females. These criteria were given to the head of each *fokontany* who managed the search for adequate participants from their communities. Although this sampling method opened the potentiality of bias, it was chosen to follow the cultural etiquette. Overall, this research followed the principals of ethical code of conduct as proposed by Wilmé et al. (2016), with participants giving their prior informed consent and their anonymity being respected.

2.1. Focus groups and free-listings

Six focus groups were conducted ($n = 30$) in the three study sites, either with men or women participants. These discussions were firstly to explore participants’ understanding of change—i.e. what changes they perceived as affecting them—and secondly to generate the statements forming the Q set about their coping strategies. The discussions followed a structured guideline, encompassing the definition of change, its dimensions (temporality, spatiality, degree of impact), and their behaviour when specific changes occur. The focus groups were facilitated by a native Malagasy research assistant, who also translated the notes that were then discussed amongst the research team.

To collect the QoL indicators, we used a free-listing technique (Puri, 2011; Zorondo-Rodríguez et al., 2012), stopping people in market squares and asking them to list keywords that they associate with QoL, assuming to encounter both fishers and farmers selling their products, as well as a broad representation of the

Alaotra agrarian society. The 389 respondents across 49 sites were asked to define their understanding of quality of life using a maximum of 10 keywords. We assumed that the most relevant keywords would be mentioned at the outset. Respondents’ basic demographic information such as age, place of residence and years of education was also collected.

2.2. Q methodology

The set of statements resulting from the focus group discussions—called ‘concourse’—is the pool from which the final Q set (set of statements to be ranked by participants) was developed by the researchers (Albizua and Zografos, 2014). In Q methodology, participants are asked to rank-order this set of statements (Q set) along a given dimension, most commonly ‘most agree’ to ‘most disagree’ (Burt and Stephenson, 1939; van Exel and de Graaf, 2005). Following this, the sorted statements (Q sorts) are intercorrelated and subjected to a by-person factor analysis. This allows the identification of the existing number of Q sort groupings (factors) based on their similarities and dissimilarities, with those participants loading on a same factor having sorted the Q set in an analogous way (van Exel and de Graaf, 2005). In the Q methodology, it is the persons that become the variables of interest, and the test items that are the study sample (Watts and Stenner, 2005), thereby describing a “population of ideas and not a population of people” (Risdon et al., 2003, p. 377).

Accordingly, once the focus groups were completed, the discussions were summarised into a series of statements forming the Q set. The two key characteristics to an effective Q set are “coverage and balance” (Watts and Stenner, 2012, p. 58). This firstly implies having statements that broadly cover all viewpoints, believed to be the case when there was a saturation of the strategies discussed during the focus groups. Coverage is also achieved by ensuring that there are no overlaps or redundancies in the developed statements. Secondly, a balanced Q set implies that there is no bias towards a viewpoint and that all opinions are covered. This resulted in 52 final statements developed in French, each written on separate randomly numbered cards. The statements were discussed by the research team to ensure that there was a common agreement about their meaning before the translations into Malagasy and English. The statements were translated into Malagasy by the research assistant and reviewed by a second translator to identify any dissimilarities. When this was the case, the research team discussed the differences and agreed on the most suitable term. The Alaotra and Analanjirofo regions use different dialects—Sihanaka and Betsimisaraka respectively—therefore the statements were translated by the Sihanaka research assistant and further back translated by a Betsimisaraka translator native to the Analanjirofo region to reduce possible misunderstandings in s3. Q sorting tests were performed in the village of Andreba Gare to ensure that the set of statements was comprehensible and exhaustive. The sample was comprised of 30 participants (ten per site, cf. Fig. 1), as one of the characteristics of the Q methodology is the small number of participants required, the number most often being smaller than the Q set (Brown, 1993; Watts and Stenner, 2005). Each participant performed the Q sorting individually, after which they were asked about their ranking decisions in a post-sorting interview to help contextualise and interpret the results at a later stage.

2.3. Statistical analysis

The 389 free-listings on QoL were analysed using SPSS (version 23), using frequency tables to identify the most important elements of QoL to the people in the Alaotra. The focus groups were analysed with Microsoft Excel (2011), by manually coding the discussion

notes using a conventional content analysis (Hsieh and Shannon, 2005). This was helped by asking participants to identify keywords during the discussions, for example by grouping identified changes into categories and giving a name to each of these categories.

The 30 Q sorts were intercorrelated and factor analysed using the open source statistical program PQMethod (Schmolck, 2002). The decision regarding the number of factors to extract was based on the Kaiser-Guttman criterion (Guttman, 1954; Kaiser, 1960), which states that factors with an eigenvalue (EV) of 1.00 or above should be kept. The factors were rotated using the varimax function, and the factor arrays calculated by weighted averages using the statements' z-scores: the Q sorts loading highly on a factor are given more weight in the final factor array than those that load less significantly (Watts and Stenner, 2012).

3. Results

3.1. QoL and perception of change

Below are the ten most frequently mentioned keywords when asked about the first thing that comes to mind when thinking of quality of life (Table 1). 'Money' was the most frequently mentioned, followed by 'Health' and 'Children'. These quality of life parameters can be classified into the five capital assets (Fig. 2), with the top five each representing one of the capitals: Financial ('Money'), human ('Health'), social ('Children'), physical ('House') and natural ('Land'). When considering the top ten parameters, the financial and physical capitals are most strongly represented (Fig. 2).

Classifying these keywords into capitals based on the impacts each would have on farmers' asset base reveals that all five are present (Fig. 2). The resource users' understanding of quality of life therefore appears to depend on all capitals, with particular weight given to financial and physical.

These quality of life factors and capitals are being affected by a number of stresses and shocks. A total of 38 distinct changes were identified during the focus groups (n = 30). In Table 2, the identified changes are classified depending on the capital they impact, each change being assigned to a single capital based on the impacts participants perceived as stemming from the change. For example, the change 'increasing price of medicine' would impact an individual's health, and therefore his or her human capital, and 'increasing frequency of cyclones' was linked to damage or destruction of shelter, therefore affecting their physical capital. Certain changes such as 'increasing poverty' can influence multiple capitals. When this was the case, the change was assigned to the capital that participants most strongly associated it with. In the case of poverty, they largely discussed it in terms of financial difficulties, leading us to classify it as financial capital.

Table 1

Most frequently mentioned parameters that bring about a good quality of life, and the capitals that they represent. In parentheses are percentages. (n = 389).

	QoL parameter	Capital
1	money (13.1)	financial
2	health (9.5)	human
3	children (9.5)	social
4	house (8.7)	physical
5	land (8.7)	natural
6	livestock (8.0)	natural
7	food (6.9)	human
8	vehicle (5.1)	physical
9	working equipment (4.6)	physical
10	employment (4.6)	financial

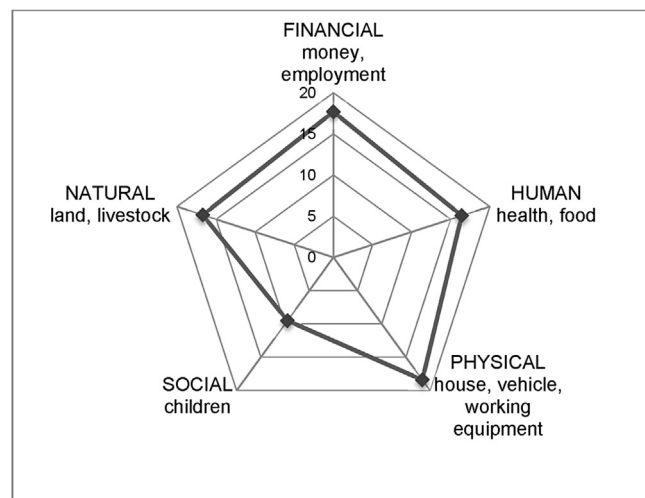


Fig. 2. Percentage of participants having mentioned the top ten most mentioned quality of life parameters (Table 1) classified into capitals (n = 389).

Table 2

Changes identified by participants and the capitals that these changes impact. Shocks are indicated in *italics*, with all other changes having been defined as stresses during the focus groups.

Change	Capital affected
Increasing deforestation	Natural
Decreasing quantity of rain	
Environmental degradation	Human
Decreasing variety of fish	
<i>Increasing frequency of flooding</i>	
<i>Increasing frequency of bush fires</i>	
Increasing fires/waste reaching land	
Decreasing yields	Social
Decreasing soil quality	
Decreasing fish stocks	
Increasing livestock diseases	
Decreasing life expectancy	
Increasing diseases	
Increasing price of medicine	
Educational problems	
Increasing number of people falling sick	
Increasing school dropout rate	
Decreasing quality of school results	Physical
Increasing parents not sending children to school	
Increasing discos	Financial
Increasing bad behaviour in youngsters	
Increasing crime	
Increasing corruption	
Increasing tensions between family members	
Increasing conflicts between acquaintances	
Decreasing free time available	
Increasing number of religions	
Increasing teenage pregnancies	
Deterioration of Malagasy customs	
<i>Increasing frequency of cyclones</i>	
Increasing transportation fees	
Decreasing road quality	
Increasing poverty	
Insufficient income	
Increasing difficulty to make a living from agriculture/fishing	
Increasing living costs	
Decreasing employment opportunities	
Increasing schooling fees	

Participants appear to experience a wide range of changes with all capitals being represented, as with QoL factors. The natural and human capitals are affected by the greatest number of changes. Whether each change was a stress or shock was determined when discussing the temporality of each change and its degree of impact on participants' daily lives during the focus groups. The great majority of identified changes were qualified as stresses, with their impacts appearing gradually over time (Table 2). Only flooding, bush fires and cyclones were classified as shocks, and when discussing these by asking participants what would be the impact of an unpredictable event affecting their main source of income, the great majority stated that such an event would lead to poverty, that they linked to consequences such as hunger, decreasing yields and indebtedness.

3.2. Coping with change

When discussing contingency plans in the case of an unpredictable event, 40% of Q participants stated they had some money and/or agricultural produce saved up, 24% stated they had no backup plan, 17% mentioned livestock breeding, and the remaining 20% were divided between brickmaking, renting out property, as well as crop and/or livelihood diversification.

The Q methodological process resulted in the extraction of five factors, i.e. attitudes towards change, together explaining 38% of the study variance. Nineteen of the 30 Q sorts loaded significantly on one of these five factors, using a significant level of ± 0.43 or above at the $p < 0.01$ level. Participants loading significantly on each of these factors are characterised by the set of strategies used and changes they see as being most crucial to them, illustrating the existence of diverse viewpoints about coping with change. The factor interpretation results in a holistic inspection of the viewpoints of the participants that load significantly on a factor. Although a certain subjectivity is unavoidable, this is not considered an issue as "(...) the aim is to reconstruct the subjective viewpoint that originally informed the Q sort" (Stenner et al., 2000, p. 444). The interpretations are in a narrative style, helped by the post-sorting interviews and always referring to the ranked items—for example (S24) refers to the ranking of the statement 24 (Tables 3–7).

The five factors can further be represented according to the five capitals (Fig. 3). Each factor has a different asset base composition, with individuals loading significantly on each placing different levels of importance on the five capitals depending on their priorities and on the changes they believed to be most important.

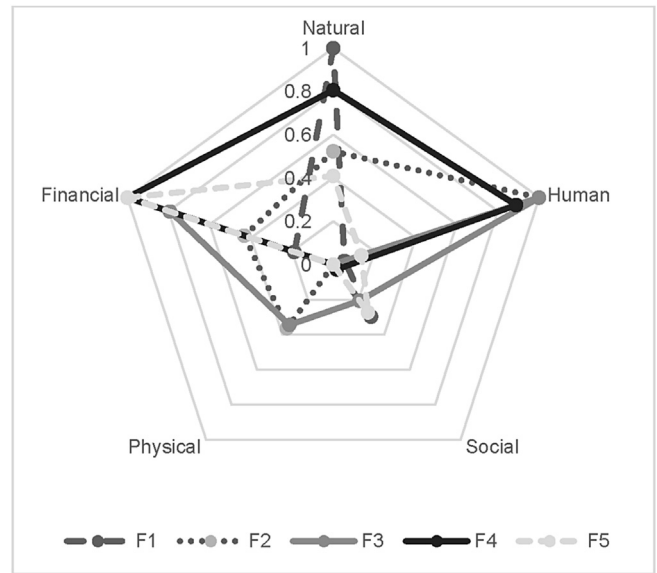


Fig. 3. Representation of the five factors based on the five capital assets. The 52 Q statements were classified into capitals, and the factor scores of each capital's statements summed and normalised to 1.

Factor 1: Responsibility makes a man

"Corruption prevents development, so it is up to everyone to do whatever they can to not take part in it. Because if it continues, it will lead to more and more poverty in the country, and we are all responsible for that." (Participant 11).

Farmers associated with Factor 1 are all men, and although they value the environment, they do not have a strong sense of duty towards its protection (S03, S05, Table 3). Increasing difficulties tied to agriculture and securing their livelihood is their main concern. In this regard, they are willing to try various methods in the hope of improving their situation, including agricultural intensification and extensification (S04, S27, S36, S28). Morally wrong behaviour is an important issue to them: they believe that each person is responsible for his or her actions (S25). Furthermore, they are more cautious with increasing crime and try to keep their children busy so that they do not follow down this growing path of criminality

Table 3

Statements and factor scores used in Factor 1 interpretation, arranged according to their appearance in the text.

S03	As a landowner, I have a duty to reforest part of my land.	+1
S05	The environment protects us, so we need to protect the environment.	+1
S04	I must use additional sources to water my crops as the quantity of rain decreases.	+5
S27	Using chemical/inorganic fertilizer is a good way of dealing with decreasing yields.	+4
S36	I have had to plant additional crops to compensate for decreasing yields.	+2
S28	Decreasing soil quality and/or quantity of rain have pushed me to change the crops I grow.	+4
S25	It is up to each person to make the right decision and not play into the growing corruption game.	+3
S19	I keep close watch over my possessions as crime increases.	+2
S46	Having a community alarm system in place in case of bandits is becoming increasingly necessary.	+1
S51	Parents must push their children to get informed about family planning from a young age so that the number of teenage pregnancies stops growing.	-2
S18	It is my duty as a parent to inform my children about the importance of abstinence before marriage in the light of the increasing number of teenage pregnancies.	+3
S01	Hard work is the solution to increasing poverty.	-4
S16	Those who are wealthier have a duty to help the increasing number of people in financial difficulty.	-4
S23	It is up to the Government to solve the country's educational problems.	-3
S15	Increasing prices of medicine sometimes leads to having to sell personal possessions.	-5
S37	I sometimes must sell personal possessions to pay for increasing transportation fees.	-4
S10	I walk more as transportation fees increase.	-5

Table 4

Statements and factor scores used in Factor 2 interpretation, arranged according to their appearance in the text.

S03	As a landowner, I have a duty to reforest part of my land. +3
S05	The environment protects us, so we need to protect the environment. +4
S27	Using chemical/inorganic fertilizer is a good way of dealing with decreasing yields. 0
S28	Decreasing soil quality and/or quantity of rain has pushed me to change the crops I grow. 0
S36	I have had to plant additional crops to compensate for decreasing yields.
S50	Using alternative agricultural techniques is a good way of fighting decreasing quantities of rice. -1
S13	I am pushed to diversify my sources of income to make enough money every month. -2
S39	I no longer have time for other interests or activities outside farming and/or fishing. -5
S41	I am constantly looking for new job opportunities as the price of life increases. 0
S06	Vaccinations are a good way of dealing with the increasing number of livestock diseases. +5
S34	Putting a stop to the increasing number of diseases starts by keeping your surroundings and yourself clean. +3
S32	Every fisher must make sure others do not kill the small fish. -4
S23	It is up to the Government to solve the country's educational problems. +3
S43	As school results get worse, it is my duty as a parent to motivate my children to go to school. +4
S44	Extra lessons are a good way of ensuring my children do not suffer from degrading school results. +2
S45	I take it upon myself to put pressure on the increasing number of parents who do not want to send their children to school. +5
S31	Children's education is crucial in ensuring that Malagasy customs do not continue deteriorating. -3
S37	I sometimes must sell personal possessions to pay for increasing transportation fees. -3
S15	Increasing prices of medicine sometimes leads to having to sell personal possessions. +4

(S19, S46).

Family planning is frowned upon as a prevention measure against teenage pregnancies, with abstinence believed to be the wiser choice (S51, S18). These men do not see hard work as being a way out of poverty (S01), as they associate it with manual labour. They take responsibility when problems arise, illustrated by their refusal to ask for financial help (S16), and their belief that both citizens and government have a responsibility to solve current issues (S23). Furthermore, selling their possessions or traveling less is not seen as being a solution to increasing transportation fees (S15, S37, S10), and they rather try their best to insure that life continues as usual despite these changes.

Factor 2: Let's be realistic

"If you do not concentrate on a single activity, you will not be able to do them all properly and look after them all well. You will therefore not get good results from any of them and it will have been a waste of time." (Participant 18)

Factor 2 farmers have a strong sense of environmental responsibility (S03, S05, Table 4), and do not believe in intensification and extensification methods (S27, S28, S36, S50), as these are seen as useless if there is not enough rain, something out of their control.

They are not inclined to diversify their sources of income, preferring to focus their efforts on a single activity despite having a lot of free time (S13, S39, S41). Vaccinations against livestock diseases are of high importance (S06), in line with their general sense of hygiene (S34). They do not see putting a stop to the killing of small fish as being a viable solution towards decreasing fish stocks, as poorer families will then be unable to afford this commodity (S32).

Although these farmers believe the government should play a greater role in education (S23), they have taken on a certain responsibility in ensuring that children get a good upbringing (S43, S44, S45). However, they do not put a great emphasis on the importance of customs, less vital in ensuring a good future for their children (S31). Selling possessions to pay for transportation fees is not seen as a good option (S37), as they would have nothing to sell the next time. However, selling possessions to pay for medicine is sometimes necessary (S15).

Factor 3: Children are the future

"Life just has so many difficulties. I want my daughter to achieve her goals and have a good future, so I push her to study hard and to go to family planning to make sure she does not fall pregnant

too young. If she were to fall pregnant, we as parents would have failed in a certain sense." (Participant 27)

Factor 3 farmers are all women, and their priority is the well-being and future of their children. Dealing with changes affecting their offspring comes before worrying about anything else, including agricultural issues (S04, S21, S28, S50, Table 5). They employ many methods to combat changes affecting the younger generation, from avoiding events potentially leading to bad behaviour, to attributing high importance to education (S14, S31, S44, S47). They nevertheless remain realistic, as they do not particularly advocate abstinence (S18) but rather encourage family planning (S51) despite attaching importance to religion (S49).

Home remedies and preventions are regularly used to keep their families healthy in the light of increasing diseases (S11, S12). Harsh punishments against crimes are unwelcome (S22, S48), with violence and retribution thought to be unnecessary and disturbing. Thieving is believed to be a reality of life, with not much to be done about it (S19). These farmers share a sense of responsibility towards common spaces, with infrastructure needing to be improved by all individuals (S20). Finding new sources of income is always a worry, and they are always alert about employment opportunities (S13, S41).

Factor 4: Good things come to those who work hard

"If you never really make an effort and work hard, you will never become rich, and poverty will set in. Before, I did not have enough money, so I got many jobs and now earn more, which helps me accomplish all my plans." (Participant 26).

Factor 4 farmers believe that everyone has a responsibility towards improving the environment (S03, S05, Table 6). Regarding agriculture, farming seems to be getting worse, with decreasing and uneven yields. This is pushing them to plant additional crops and use fertiliser (S27, S36). There is a sentiment that insufficient quantities of rain can only be helped by faith (S35), although further agricultural changes are pushing them to diversify their sources of income or even consider changing sector (S13, S40, S41).

These farmers believe in the value of hard work, key to bringing them out of poverty (S01). This implies traveling when necessary, regardless of the costs (S10). They do not think that the authorities are currently doing their duties, may it be regarding infrastructure or education (S23, S38). They believe communication is key to insuring that youngsters behave well (S47), as well as emphasising

Table 5

Statements and factor scores used in Factor 3 interpretation, arranged according to their appearance in the text.

S04	I must use additional sources to water my crops as the quantity of rain decreases. –2
S21	Increasing frequency of flooding is pushing me to move my home and/or crops to higher lands. –2
S28	Decreasing soil quality and/or quantity of rain has pushed me to change the crops I grow. 0
S50	Using alternative agricultural techniques is a good way of fighting decreasing quantities of rice. –3
S14	I avoid going to balls and discos so as to discourage them. +5
S31	Children's education is crucial in ensuring that Malagasy customs do not continue deteriorating. +2
S44	Extra lessons are a good way of ensuring my children do not suffer from degrading school results. +2
S47	My children's education is a priority in making sure they do not follow the trend of increasing crime. +1
S18	It is my duty as a parent to inform my children about the importance of abstinence before marriage in the light of the increasing number of teenage pregnancies. –1
S51	Parents must push their children to get informed about family planning from a young age so that the number of teenage pregnancies stops growing. +5
S49	With the increasing number of religions, you must stick to what you know and not be tempted by other faiths. +2
S11	Decreasing life expectancy can be eased by healthy eating. +4
S12	Drinking herbal tea is a good way to avoid being affected by the increasing number of diseases. +4
S22	Harsh punishments for those caught starting bush fires help stop their increasing numbers. –4
S48	Those caught stealing must be punished harshly to set an example. –5
S19	I keep close watch over my possessions as crime increases. –5
S20	Everyone must help put a stop to decreasing road quality by not throwing waste onto the road. +3
S13	I am pushed to diversify my sources of income to make enough money every month. +3
S41	I am constantly looking for new job opportunities as the price of life increases. +3

the importance of education rather than trying to 'keep them busy' (S17). However, this does not apply to sexual intercourse, as family planning is seen as something reserved for married couples (S51). People should be more cautious in their lives and stick to what they know (S33), and although they do not feel personally threatened by crime, they are not opposed to harsh punishments for those caught stealing (S07, S19, S48).

Factor 5: Better safe than sorry

"Agricultural yields are dependent on the climate, but the climate is unpredictable so it is important to have something to fall back onto. If I were to only have a single activity, life would stagnate. But finding work is very challenging, so it is best to create work for yourself." (Participant 25)

Factor 5 farmers see the importance of reforestation, as trees are thought to attract rain and protect the soil (S03, Table 7). They apply alternative agricultural methods to increase yields, thereby intensifying their farming (S50). These farmers feel the need to diversify their sources of income, also to ensure that they have a safety net should an unpredictable event arise (S13). They are forward thinking, alert about job opportunities and entrepreneurial (S41, S52). They are not inclined to ask for financial help (S16), but rather

rely on hard work to improve their standard of living (S01). Health is not of primary concern to these farmers (S11, S12, S33, S34), as they will rather take medicine when they are sick than take preventive measures, in contrast to their forward-thinking attitude in other areas of their lives.

Factor 5 farmers are weary of increasing crime (S19), and believe that those caught stealing should be punished harshly (S48). To keep their children from exhibiting bad behaviour, they keep them busy and emphasise the importance of education (S17, S47), as well as informing them about abstinence before marriage (S18). Furthermore, children's education is a financial strain (S24) and they know that some families simply cannot afford it (S45).

4. Discussion

Results from this study show the widespread use of income diversification, with the majority of farmers from the region having diversified their economic activities, taking up secondary and sometimes tertiary activities to reduce their resource dependency. However, this strategy is not sufficient to shield them from the negative impacts of change, despite economic diversification having been found to reduce resource dependency (Bailey and Pomeroy, 1996). Proactive adaptation, orchestrated by authorities

Table 6

Statements and factor scores used in Factor 4 interpretation, arranged according to their appearance in the text.

S03	As a landowner, I have a duty to reforest part of my land. +3
S05	The environment protects us, so we need to protect the environment. +2
S27	Using chemical/inorganic fertilizer is a good way of dealing with decreasing yields. +4
S36	I have had to plant additional crops to compensate for decreasing yields. +2
S35	If there is no rain, the only thing to do is pray it will come soon. +3
S13	I am pushed to diversify my sources of income to make enough money every month. +5
S40	I am pushed to change sector as farming/fishing becomes harder and harder. +2
S41	I am constantly looking for new job opportunities as the price of life increases. +3
S01	Hard work is the solution to increasing poverty. +5
S10	I walk more as transportation fees increase. –5
S23	It is up to the Government to solve the country's educational problems. +1
S38	Every user of the road must try to put a stop to the decreasing road quality by stopping other drivers who do not respect the rules. –4
S47	My children's education is a priority in making sure they do not follow the trend of increasing crime. +4
S17	Youngsters must be kept busy to put a stop to the increasing amount of bad behaviour. –3
S51	Parents must push their children to get informed about family planning from a young age so that the number of teenage pregnancies stops growing. –5
S33	The increasing number of people falling sick can be stopped by sticking to what you know and not trying new things. +1
S07	With increasing violence, I try to make myself as discreet as possible at night. –2
S19	I keep close watch over my possessions as crime increases. –2
S48	Those caught stealing must be punished harshly to set an example. –1

Table 7

Statements and factor scores used in Factor 5 interpretation, arranged according to their appearance in the text.

S03 As a landowner, I have a duty to reforest part of my land. +3
S50 Using alternative agricultural techniques is a good way of fighting decreasing quantities of rice. +5
S13 I am pushed to diversify my sources of income to make enough money every month. +5
S41 I am constantly looking for new job opportunities as the price of life increases. +4
S52 If you cannot find a job, you must create work yourself. +3
S16 Those who are wealthier have a duty to help the increasing number of people in financial difficulty. -1
S01 Hard work is the solution to increasing poverty. +3
S11 Decreasing life expectancy can be eased by healthy eating. -1
S12 Drinking herbal tea is a good way to avoid being affected by the increasing number of diseases. -5
S33 The increasing number of people falling sick can be stopped by sticking to what you know and not trying new things. -4
S34 Putting a stop to the increasing number of diseases starts by keeping your surroundings and yourself clean. 0
S19 I keep close watch over my possessions as crime increases. +2
S48 Those caught stealing must be punished harshly to set an example. +2
S17 Youngsters must be kept busy to put a stop to the increasing amount of bad behaviour. +2
S47 My children's education is a priority in making sure they do not follow the trend of increasing crime. +4
S18 It is my duty as a parent to inform my children about the importance of abstinence before marriage in the light of the increasing number of teenage pregnancies. +4
S24 I have to start saving early on to be able to afford my children's increasing schooling fees. +3
S45 I take it upon myself to put pressure on the increasing number of parents who do not want to send their children to school. +1

and requiring an initial investment before benefits are seen (de Bruin, 2011), is currently absent. This is in line with other studies that put forward a lack of proactive adaptation in low-income countries relying on reactive responses, shown to be less effective (Berrang-Ford et al., 2011). In the case of the Alaotra and Analanjiroro regions, the impacts of the 2009 coup are still felt by rural populations (Waeber, 2014; Rendigs et al., 2015; Waeber et al., 2015), and many participants corroborated this by expressing their disenchantment with the government, often when discussing schooling fees and deteriorating roads. There appears to be a barrier to the implementation of proactive adaptation by governmental entities due to this political instability. Ministers and other functional levels often do not stay in their positions for long, meaning little stability and opportunity for long-term visions. Local and regional government bodies lack the financial and logistical means to successfully implement new policies established at the federal level, as well as having little capacity to monitor those already established. An example is the establishment of the two-month closed fishing period in response to decreasing fish stocks in Lake Alaotra: this policy takes away the main source of income of many people around the lake. The regional government is aware of the need for accompanying measures to protect these families, such as sensitisation and training in order for them to find other employment during this period, or information regarding storage of fresh good. These measures have however not been able to be implemented due to financial constraints, leading many people to continue fishing during this period (Ministry of Fisheries, pers. comm., 20 October 2015; Ministry of the Environment, Ecology, Seas and Forests, pers. comm., 23 October 2015). This lack of action by authorities forces farmers to be entirely dependent on their own adaptive capacities, constrained due to constant uncertainties and scarcity of assets (Eakin, 2005; Gioli et al., 2014).

Research has shown it is first necessary to perceive a change before being able to adapt to it (Maddison, 2006; Tambo and Abdoulaye, 2013). The majority of changes identified by participants in this study were qualified as stresses, and participants either cope with the change as best they can, or spontaneously resort to reactive adaptation strategies in response. The contingency plans identified by participants in the case of the occurrence of a shock highlight their strong resource dependency, with a large percentage of them stating that such an event would have devastating effects for them and their families. Many are not able to put

resources aside as a safety net, and realise that they will have to deal with the repercussions as best they can if the time comes.

Multiple attitudes regarding change exist in the study region, with differences in farmers' values and aspirations explaining these variations in strategies used within a same community or region (Guillem et al., 2012). Certain individuals place emphasis on livelihood strategies with the objective of reducing agricultural risks and preserving their natural and financial capitals, while others see social and human capitals as most important. The issue of inequality in the face of resource degradation is a concern to certain families, as authorities and fishers have tried to establish size restrictions to fishing (Wallace et al., 2015), leading lower income households to bear the burden of the environmental policy (Raboanarielina, 2012; Waeber et al., 2016). Two broad attitudes appear regarding educational changes: a more controlling approach versus a trusting one, where children are believed to become honest and make good decisions if they receive a good education (cf. Reibelt et al., 2014). Although the small number of participants in the Q methodology means that we cannot upscale results to the population level, some patterns are nevertheless interesting to note, such as those regarding gender, where results of this study are in line with the literature: the different attitudes illustrate how gender can shape priorities, with women showing strong concern about education and children's future well-being, and men showing most concern about changes affecting their livelihood, thus exhibiting a gender bias. Women have been shown to be more vulnerable to shocks, and often have fewer livelihood opportunities to fall back onto and are more involved in household activities (Nelson and Stathers, 2009; Timko et al., 2010; Bradshaw and Fordham, 2014). The results of this study may explain this to a certain extent, as men's focus on livelihood challenges may lead them to be more prepared in the occurrence of an unpredictable event as opposed to women who focus on the well-being of their kin, leaving them more vulnerable.

By considering change in its entirety, these results illustrate how stresses and shocks from all fronts impact resource users' asset bases. The numerous changes affecting their natural capital have repercussions on farmers' livelihoods by making their main source of income riddled with uncertainty. The various existing attitudes towards coping with these changes lead to different livelihood decisions and levels of livelihood resilience. Improving farmers' adaptive capacity implies expanding their asset base (Bebbington,

1999). The changes experienced by study participants affect the five capitals that make up this base, and this decrease in capital stocks negatively affects their quality of life, their livelihood options, decisions, and subsequently their behaviour towards these changes and therefore vulnerability (Adoto and Meinzen-Dick, 2002). Farmers place most importance on physical and financial capitals—necessary to put any livelihood strategy in place—before considering human or social capitals, needed to further develop their livelihood basis. The possession of financial capital such as income, natural capital such as livestock that can be transformed into financial capital, and physical capital such as shelter, vehicles or working equipment is seen as the foundation needed to have a good quality of life. These capitals allow for a certain level of autonomy and therefore stability in the face of change (Ellis, 2000; Schneider and Niederle, 2010). Although only one factor relating to social capital was in the ten most frequent QoL keywords, many changes affecting social capital such as criminality and conflicts amongst family members were identified, suggesting that although not key when discussing QoL, participants do appreciate the importance of this capital and the negative impacts its deterioration has on their lives (Stoudmann et al., 2016). Customs play a vital role within Malagasy society and family life (Jones et al., 2008; Andriamalala and Gardner, 2010; Tengoe and Heland, 2014). Although few elements regarding culture were explicitly discussed by participants, many of the subjects covered are imbedded within local culture. The daily decisions of farmers, may it be regarding agricultural practices, health, or education, are all culturally mediated, based on various socio-cultural and ancestral practices. This illustrates the certain limitation of the empirical methods used in this study, as a concept such as ‘culture’ can be somewhat lost when trying to place rural resource users into prescribed models, and should be taken into account when considering our results.

A shift from the current dependence on reactive adaptation to one where authorities take a share of the responsibility in easing the burden needs to take place. If current trends continue, farmers will become increasingly dependent on a small set of resources and shrinking asset base, making them susceptible to even minor stresses or shocks. This governmental involvement and investment could be through improved access and communication routes, allowing farmers to trade more easily as well as giving them the opportunity for information and knowledge sharing. Furthermore, farmers need to be aware about the potentiality of stresses or shocks to be able to adequately prepare for them. This implies information sharing and awareness raising in rural areas where people are most resource dependent and vulnerable. With farming being part of these populations’ cultural identity, they need to be given tools to be able to prepare for change, for example by improved financial products such as microcredits tailored for rural environments, and improved access to modern agricultural techniques and technologies in order to increase their output and decrease their vulnerability.

Taking a resilience approach, policies need to consider context-specific factors, and farmers’ decision-making must be given room in the context of policy making to keep options as open and manifold as possible. However, issues surrounding governance are a critical challenge to the implementation of any of these recommendations. From a political ecology perspective, there is a clear power imbalance between the different stakeholders involved, implying that these recommendations are unrealistic without a fundamental change in the current institutional framework (Kull and Rangan, 2016), particularly in such an intransparent context

as that of Madagascar (Waeber and Wilmé, 2013). Although methods allowing the study of participants’ viewpoints such as Q methodology does not allow to bridge the divide between resilience thinking and political ecology, it does give people a voice to formulate their perceptions and attitudes towards change, and generate a better understanding of the social context that is often lacking in the former approach (Gallardo et al., 2017). The results of this study show that the coping and adaptation methods of farmers are not sufficient to shield them from change, despite the high levels of diversification and multitude of identified strategies. These local actors who are experiencing the changes first-hand are defenceless, with their future depending on authorities and institutions who hold the power, illustrating the system’s inequalities that need to be considered when devising solutions (Schoon et al., 2015).

5. Conclusion

This research aimed to gain a better understanding of farmers’ definitions and experiences of change. What changes they perceive as affecting them, how they deal with them, and how these changes affect their quality of life. Results show that these resource users are confronted with stresses and shocks impacting all aspects of their lives and affecting their five capital stocks. The coping and reactive adaptation strategies currently implemented are insufficient to sustain their asset base considering the high levels of resource dependency and inability of a large portion of participants to prepare for the unexpected. Although proactive adaptation measures such as improved infrastructure and education are needed, these seem unlikely to be put in place by authorities due to the country’s current political and economic situation, making farmers’ prospects bleak when considering the fast pace of change taking place.

Although there is a large amount of research having been done on agrarian populations’ perception of climate change, this driver is often singled out. The broader change-context affecting agrarian communities should be considered in developing responses to issues likely to become increasingly pronounced. Further research encompassing the broader change-context that affects agrarian communities is required to be able to better understand how to increase their resilience towards changes stemming from all fronts.

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Appendix A. Supplementary data

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.jrurstud.2017.09.001>.

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