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Adaptation of Farmers to Climate Change: A Multifaceted Commitment Involving Differentiated Justifications

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ABSTRACT

Agricultural policies have recently integrated climate issues and deploy a range of measures aimed at changing farming practices. Looking beyond the institutional discourse which emphasizes the difficulties of involving farmers in measures for dealing with climate change, the results of our research provide a basis for envisaging other lines of reflection. The adoption of new practices by farmers is only partially a response to the normative measures of government policy, but it depends above all on the way these actors integrate climate issues in their value systems. Based on a qualitative methodology involving semi-structured interviews, the results of the research presented here highlight the modes of decision-making of farmers, that they are based on their own professional and social networks. Whatever the changes put into practice, we show that they are based on a common core of perception, what is referred to by French rural sociologists as the peasant ideology with an attachment to the land and the need to protect it as a central value. Nevertheless, we shall nuance this result by distinguishing two forms of justification for the introduction of new practices: the reference to an ecological modernization versus an approach related to a global ecological approach. If the major part of farmers doesn't refer to a global view of earth, which represents the mainstream discourse about climate change, they take care of land on behalf of a heritage duty.

Keywords: *Climate Change, Farmer's Adaptation and Practices and Values.*

Introduction

Agriculture is a priority sector with regard to adaptation to climate change in that this economic activity depends more than others on the meteorological conditions and variations in them. The 5th report of the IPCC, published in 2014, for the first time highlighted the negative impact of climate change on agricultural productivity worldwide, noting the decline in yields (Brisson et al. 2010; IPCC 2014; Ruane et al. 2016). In their latest report, published in October 2018, the IPCC experts confirmed this tendency towards declining productivity, evidenced by numerous publications and models (Olesen et al. 2011; Teixeira et al. 2013; Dettori et al. 2017). In the light of these observations, the transformation of agricultural practices has today become a priority with regard to climate policy (IPCC 2018). At the scale of the Mediterranean region, the adaptation of agricultural systems to climate change involves specific issues. The consequences of climate change at regional scale are manifested in an increase in extreme climatic phenomena, rainfall and drought,

with an impact on the water resource and erosion of the soil (Goirgi et al. 2008; Lespinas et al 2014; Soubeyroux et al. 2015; Thiébault and Moretti 2016).

The Mediterranean region has been exposed in this respect to a more difficult situation than other regions. From the social and cultural point of view, Mediterranean farmers have for centuries had to deal with severe climatic conditions, resulting in the development of local solutions for water resource management, the adaptation of farming practices to drought or to flooding (Aspe et al. 2014, 2016) and particular agroforestry practices (Legay and Ladier, 2008).

This Mediterranean specificity would appear, according to the study by Reidsma et al. (2010) to explain at regional level the capacity for adaptation of farmers to the climatic variations already observed. Malek et al. (2018) emphasized that the Mediterranean regions will have to cope with an increase in water requirements that might be compensated by transformations in ways of tilling the soil.

The sustainability of Mediterranean agricultural systems involves on a two-fold challenge, integrating and implementing agricultural practices favourable to agricultural productivity, while maintaining the cultural and historic forms of management of resources, which are still today the guarantee of their survival, from both the economic and environmental points of view.

The aim of the sociological research programme we have carried out, AGROCLIM¹, is to contribute to this general reflection on the adaptation of Mediterranean agricultural systems to the impact of climate change, by analysing first how and through what transformations of their practices farmers adapt, and second what sense they give to these transformations. .

In the first part, we describe the research methodology adopted based on sociological interviews carried out at the scale of the Provence Alpes Côte d'Azur region. In the second part, we will show that the practices of farmers are for the most part in the process of transformation, even if a certain degree of reticence persists. Finally, we shall analyse in the third part the modes of justification that farmers offer for their practices, and also the way their perceptions reflect a more general concept of their profession almost like a vocation. The practices that they employ to adapt derive meaning both from traditional values specific to the farming community, and also within models of justification which integrate contemporary environmental imperatives.

Methods and Sampling

Our analysis is based on a qualitative investigation involving semi-structured interviews and a sample of 50 farmers. From the methodological point of view, this investigation is based on the analysis of social perceptions seen as elements that reflect value systems, offering insights into the motivation that incites individuals to act. Understanding the value systems above all offers the means to analyse the meaning that farmers attribute to their practices, and to measure their impact as the expression of a social and ideological relationship with their profession and with its transformation.

Certain studies, which have analysed the social perceptions of climate change among farmers, have adopted a normative vision by assessing the gap that may exist between the perceptions of the farmers and the messages and dictates of the public authorities (Adger et al. 2008; Barnes et al. 2012). From this perspective, research has been carried out to identify the barriers and restrictions to the diffusion of knowledge and the adoption of good practices of mitigation or adaptation (Moser and Ekstrom 2010; Gordon et al 2013).

In the framework of the AGROCLIM programme, our aim is to promote a complex approach to the relation between social perceptions, changes in practices and value systems by the analysis of discourse and

¹ Research programme AGROCLIM, Analysis of the link between perceptions of climate change of farmers in the Provence Alpes Côte d'Azur region and changes in their practices. Research contract Aix-Marseille Université LPED - Région SUD (2018-2020).

justifications, which in addition to knowledge of the modes of perception of reality will provide insights into the meaning that the actors attribute to this reality, the way it is constructed within a broader framework of beliefs, references, sources of legitimacy, which give perceptions their robustness.

In this context, the planning of the interviews involves a two-fold process. In the first phase, the aim is to define on the basis of a linguistic categorisation of the discourse about climate change. In the second phase, we have sought by the analysis of the argumentation to account for the modes of thought within which the discourse of the farmers interviewed is structured. Qualitative data were content-analysed to identify theme and argumentation categories.

The logical basis of sampling in interview-based research is referred to as qualitative, and does not seek to achieve the statistical representativeness of the interviewees, but rather that of the discourse. The sampling is thus carried out by saturation of the discourse, that is, when there is redundancy of the discourse in each additional interview. This saturation was achieved with 50 interviews carried out and entirely transcribed.

To take into account the diversity of the agriculture in the region, we have integrated in the construction of our sampling by quota the type of agricultural production as a variable, that is: viticulture, arboriculture, livestock farming, cereals farming, mixed/livestock farming, horticulture and market gardening. The distribution is as follows in the table n°1:

Table No 1: Distribution in participant numbers and % of the sampling by type of production compared to the regional distribution of farmers by type of production (source for PACA: Agreste, census 2017)

Types of farming	PACA	Sample
Viticulture	5719 29%	14 28%
Arboriculture	4248 22%	10 20%
Livestock farming	2880 15%	7 14%
Cereals /Large-scale farming	2279 12%	6 12%
Mixed farming/ Livestock farming	1727 9%	4 8%
Horticulture	1239 7%	4 8%
Market gardening	1084 6%	5 10%
Total	19176 100%	50 100%

The construction of our sample did not aim for statistical representativeness, but in a qualitative approach, to integrate the type of activity as an element of interpretation of the forms of adaptation to climate change adopted by farmers. The aim was to integrate within our sample the diversity of types of production, which is one of the characteristics of the agriculture in the region. We assumed that the practices adopted by the farmers would depend on this variable, as has been highlighted already for certain quantitative surveys (Reidsma et al. 2010). We shall see further on that this hypothesis may be open to discussion.

Farming Practices in Transformation

Changes in Practices Linked to age and Educational Background

The majority of farmers encountered agreed that the observed climate changes represent a lasting trend which must be taken into account in their practices. This common perception of the perennial nature of climatic variations constitutes a common element, which justifies alterations in their practices. Among our sample, 39 farmers out of 50 had adopted at least one change in practices to adapt to climate change. The practices adopted are not homogeneous, may be cumulative and range along a gradient from occasional minor adjustments to a complete transformation of the mode of production of the farm. The responses proposed may be diverse (Table No 2).

Table No 2: Declared adaptations of farming practices for climate change, in numbered practices.

Type of practice	Viti-culture	Arbori-culture	Livestock farming	Cereals	Mixed farming	Horti-culture	Market gardening	Total
Saving water	2	7	4	4	2	3	4	26
Introduction of new species	4	2		1		1	2	10
New tillage techniques	5	3		1		1	3	13
Partial or total conversion of the farm	2	1	1				2	6

Among the 39 farmers concerned by a change in practices, the majority made adjustments by reducing the quantity of water used for irrigation (26 out of 39). For some of them, the reduction in water consumption may be accompanied by new farming techniques, ranging from the introduction of new species (for 10 farmers), in an experimental approach or not, or the introduction of new tillage methods (for 13 farmers).

We worked on the hypothesis that the change in practices and the nature of the transformations undertaken would depend on the type of farming. If certain adjustments are more easily realisable for annual production such as market gardening or horticulture, it is not however the variable in the type of farming which is the most determinant. In our sample, the adoption of adaptive practices is rather linked to age and educational level.

Table No 3 below shows the distribution of the sample (in numbers) in function of age and educational qualifications achieved. To construct this table, we have adopted the diploma categories used in the treatment of the agricultural census. A first category includes farmers who obtained a short second cycle diploma or had no diploma (Sec.), the second category includes people who had obtained a long second cycle diploma (BEP, *Baccalauréat Professionnel* or *Baccalauréat*). Finally, the last category represents farmers who had obtained a higher education degree (Bac+).

Table No 3: adoption of adaptive practices or not in function of age and educational qualifications (numbers of people).

	25-40 years			41-59 years			60 years or more			Total
	Sec.	Bac	Bac+	Sec.	Bac	Bac+	Sec.	Bac	Bac+	
Yes	1	6	8	7	6	5	2	3	1	39
No	0	0	0	2	0	0	8	1	0	11
Total	1	6	8	9	6	5	10	4	1	50

We find in our sample trends that are close to those observed in the national statistics (Ministry of agriculture, census, 2017). The educational level of farmers is strongly correlated with their age. The under 40s have higher qualifications than the others. The condition of holding diploma to obtain financial subsidies for setting

up a farm partly explains the rise in the level of educational qualifications from one generation to another. The development of agriculture-related higher education courses also explains the general rise in the level of studies among farmers.

As we can see from this table, the educational level and age are determinant in the adoption of new practices. Of the 14 farmers with higher education qualifications, all have adapted their practices. Conversely, among the 11 farmers who have not changed their practices, 10 had the level of qualifications of a short secondary education cycle.

The diploma effect may be an explanatory factor for the position adopted by farmers with regard to the reality of climate change and of its causes. Of the eleven farmers who have not changed their practices, nine express a certain scepticism and relativism with regard to the origin and durability of the changes they have observed over recent years. They refer to past episodes of drought or extreme rainfall they have lived through, or that their forefathers have lived through, and that may be compared with what they observe today.

"Frankly, I don't know if it's climate change. Because my grandfather used to tell me, it's seven thin cows, seven fat cows. Now that's four years we've had a drought, after we'll see if it goes on or not. Maybe it's the climate changing, but after all climate change should be much slower". Wine-grower, 69 years old, no educational qualifications.

"I don't know if it's climate change, it's true there are periods which are very dry, but before there were already very dry periods, that's what the old folks say". Fruit farmer, 62 years old, short cycle secondary education.

The same scepticism is expressed with regard to the scientific discourse to which these farmers respond with a kind of empirical knowledge and the handing-down of traditional knowledge and know-how adapted to climatic conditions in Mediterranean regions exposed to extreme situations of drought or rainfall. Of the 11 farmers who have not transformed their practices, 8 indicated that they did not wish to change their methods (whether in terms of irrigation, tillage of the soil or inputs) since what they are doing today is an inherited family tradition which has shown its efficacy in terms of productivity. For the other three, it is above all the extra cost that any change would entail which is referred to as justifying their choice not to change.

The questioning of the scientific discourse is based in particular on the causes of climate change, attributed to the emission of CO₂ and to industrial activities, including agriculture. This reticence with regard to the scientific explanations for climate change is found among the farmers with the least educational qualifications. Of the 11 farmers who have made no changes, the six who explicitly questioned the scientific explanations have an educational level equivalent to the short secondary cycle.

The influence of the level of educational qualifications on the acceptance by the farmers of the scientific discourse is confirmed by the fact that even among the farmers who have adopted adaptive practices, when they have a lower educational level, the scientific argument has less influence on their choice than for the others. In contrast, the youngest and best qualified farmers accept more willingly the scientific discourse on climate change, and explain more directly the meteorological changes they observe as being the result of it.

"It's true that we can say that we've already seen droughts, heat-waves are nothing new, and our own impressions are not always enough. I think climate change should be left to the scientists, they're the ones that know. At our level, our personal impressions, they can be misleading". Market gardener, 48 years old, BTS diploma.

"I read a lot about these questions because I'm interested, but personally, I've studied biology, and it's true that I can see that it's a problem, for us as farmers, but it's above all an issue that concerns me as a citizen, for the future". Wine-grower, 42 years, BSc in biology.

"Personally, it's something I think of as very important, as a farmer, but above all as a citizen. I read, I find out about it, on scientific websites, blogs, I think we really have to get to grips with this problem".
 Horticulturalist, 52 years old, engineering degree.

This observation led us to consider the circulation of information on climate change, the way it is integrated in the decision-making processes of farmers, and in what way it might influence the adoption and transformation of their practices. We have therefore developed this point further, on the basis of 39 interviews with farmers who have transformed their practices.

Decision-Making Related to Insertion within Professional Networks

The adoption of new practices by farmers mimics the known classical forms of processes of innovation and changes in techniques specific to the farming community. The pioneering work of Henri Mendras in this field remain of significance today, notably that the spread of new practices among the farming community is based on the collective capacity of this professional group to recognise the utility of these changes, and on the driving role of pioneering farmers in a position to ensure their spread (Mendras 1970). He also emphasizes the role played by the professional farmers' organisations (chambers of agriculture, cooperatives, sector organisations) as vectors for the spread of information.

The analysis of our interviews confirms this mode of functioning and organisation. We have through the characterisation of the farmers' decision-making networks determined the main sources of information mobilised by farmers. The first is neighbourhood network, constituted by parents, friends and neighbours. The second decision-making network is marked by the predominance of information derived from the technical and professional networks of the farming community and representatives and salespersons for intrants or agricultural machines. Finally, a last category includes the sources of information related mainly to actors outside the farming community, whether through researching and reading documents and scientific information or the media. While aware that these different categories are not hermetically separate and may overlap at the point of decision-making by the actors, we have in the analysis of the interviews ranked the order of appearance of the sources of information cited by the farmers. Our sample is distributed as follows in the table No 4:

Table No 4 : Typology of networks of decision-making of farmers who have changed their practices, in numbers of citations.

Decision-making network	Neighbourhood network	Professional farming community	Outside farming community
Cited 1 st	14	18	7
Cited 2 nd	19	11	9
Cited 3 rd	6	10	11
Total	39	39	27

We note in this table two main results.

Firstly, the vectors of information which most influence the decision-making process of farmers are linked to the networks of the professional farming community and local networks. These two networks are cited by all the 39 farmers as the source of information concerning their changes of practices. We find here the traditional forms of the diffusion of innovations in agriculture, with one particularity as regards climate change, that of favouring the professional networks: cooperatives for the wine-growers, seed suppliers and phytosanitary product salespersons for the market gardeners and wine-growers. The local network remains the most important for the livestock farmers or those engaged in diversified farming (mixed farming or mixed/livestock farming).

Secondly, and concomitantly, the external source information (issued from scientific circles or the media) carries relatively little weight. This source of information is not cited by the whole of our sample (27 out of 39), and when it is cited, it is often in third position. It is mainly the farmers with higher education qualifications who take the trouble to seek information from sources external to the farming community and likely to influence their decisions.

The integration of the challenges of adaptation to climate change by farmers is assessed, in the application of public policy by the yardstick of acceptance of scientific discourse or the adoption of norms and prescriptions established on the basis of their application. A recent work paper of the European Commission estimated at only 1% the farmers who were committed to changing their practices with a view to adapting to climate change (Lyotat 2017) though this assessment only took into account the adoption of the practices envisaged by the Agro-environment and Climate Measures. Nevertheless, many research studies and sociological surveys show that within the professional practices of farmers, the integration of adjustments to environmental issues is quantitatively much more widespread (Lamine 2011; Roussary et al. 2013; Aspe and Jacqu e 2015).

One of the limitations to the assessment of farming practices within institutional schemes which seek to encourage them lies in the fact that it is focused on the effects of measures of inducement, and conceives of changes in practices as the virtually exclusive result of public policy. From this point of view, the dichotomic vision of the ecologisation of farming practices, which contrasts an intensive productivist model with the development of biological agriculture or alternative systems of agro-ecology, does not take into account the diversity of the practices deployed by farmers and of the continuum of adjustments and integration of environmental priorities in their professional practices (Deverre and De Sainte Marie 2009; Mzoughi and Napol eone 2013; Mormont 2014). The results of our investigation offer grounds for envisaging a different line of thinking. The practices adopted by farmers are not the result of a normative acceptance of the inducements of public policy, but depend essentially on the meaning that farmers attribute to these adaptive practices with regard to their professional activity, but also and above all the value systems of which they are the vectors.

Changes in Practices Integrated in the Value Systems Specific to the Farming Community

In order to understand the social scope of the transformations of farming practices, we have developed a discourse analysis aimed at evidencing the value systems which they engender, and which constitute structure-building references of their discourse. The aim is to reintroduce the meaning of their motivations, perceptions and practices in the framework of an interpretation in terms of value systems, that is the organising model through which farmers give meaning to their practices.

A common Reference to the Peasant Ideology

The core values which structure the peasant ideology are those derived from the traditional family farm: decision-making autonomy, ownership of the land and the means of production, the preservation of the patrimonial land, independence with regard to intermediaries. This model of production, characteristic of small and medium sized farms, predominant until the end of the second world war, has been gradually integrated within a modernized production-based form of agriculture (Mendras 1970; Eizner 1972; Jollivet 1978; M uller 1982).

The analysis of our interviews offers evidence of this permanence of the values specific to the peasant ideology within the farming community. This constitutes a determining factor to explain the unity of the farming community, which although structurally marked by economic and social differences, is united around common ideological values and common references.

The permanence of the peasant ideology is apparent in the discourse on the link made between the preservation of the land (by tilling of the soil), the farmer's decision-making autonomy and the family inheritance of the farm.

"Here, as far as buying land goes, I'm the fourth generation, and it's true I can see that since I was small, I can see that here we're blessed with a corner where nothing could happen to us, but over there, you can feel the flak, louder and louder. So we have to think about that and not lose what my family has built up for so many years". Wine-grower, Var.

"It's true, I tried to move on a bit to something else, I turned to biological phytosanitary products, because after all, I can't hand down these orchards like that, I'm sure it's better. So it's an investment, but it's not lost for the future, my children will have the benefit". Fruit farmer, Bouches du Rhône.

The question of the transmission of the family patrimony is a value common to virtually the whole of our sample, regardless of age, educational qualifications and type of farm.

Where the farmers are differentiated from each other is over the question of tilling the earth. Certain manage to transform their practices for tilling the soil, whereas for others new practices would too much call into question the know-how they have inherited. Knowledge acquired by reiteration, or 'inherited' down through the family, is today set against new information proposed by agro-ecology that has a different conception of the dynamic of soils. This is at the core of the policy of agro-ecological transformation adopted by the ministry of agriculture.² To this end, this project is based on a set of practices 'compatible' with the principles of agro-ecology, among which soil tillage is the key issue.

The question of climate change, and more broadly, environmental issues, induce certain farmers to adopt new practices: less tilling, less intrants, no use of herbicides. Changes in tilling practices, which seem to be particularly difficult in the farming community because of the inheritance and transmission of knowledge within the family, may also become an acceptable practice, precisely because it reflects the value of the land and its quality.

"It's true that some people don't till the land like before, me, my grandfather used to say two ploughings are worth one day's rain. So roughly speaking, the land, it needs ploughing. It's true, I didn't make that up, this is the way things have always been done, so if you ask why, it's to retain the water. So if today you say I preserve the soil if I don't plough it, it's a bit difficult, but why not? It's true, I've talked to my neighbour, he's got a theory, don't plough the soil on all the part that may be in contact with decomposition. I don't entirely agree with this theory, at the same time if it works, why not?" Wine-grower, Vaucluse

In the course of our interviews, the reference to the value systems of the peasant ideology is what forges the link between farmers, in that it can justify both a change in the farming model as the reinforcement of ecological practices, or on the contrary, the intensification of the use of the soil.

"We were very efficient technically, we had a good yield, in the region it's true, we set an example in terms of productivity and yield, but after it got a bit out of hand. We said we'll produce more, to save by scaling up, we buy greater quantities and then at the least problem, it's a meltdown. So it got to the point, it was either we stop farming, or we change. So we decided to do things differently. Gradually, we diversified, we did some direct seeding, we stopped tilling". Market gardener, Bouches du Rhône

"So for me, the important thing is the soil, I do direct seeding under vegetal cover, a permanent coverage of the soil and a rotation of crops. That way you get a living soil, I save on the intrants, for the environment it limits the greenhouse gases. I've really started to enjoy my job again, protecting the earth for agriculture". Cereal farmer / Mixed farming, Alpes de Haute Provence

"Perhaps 50 years ago, we were better adapted than now. Because 50 years ago, there were animals and the humidity of the soil was greatly influenced by the quantity of humus. Before we put the manure on the vines. At the same time, if we want to go on adding value to our land, we have to produce, and for that, we feed the soil artificially". Wine-grower, Var

The conservation and the preservation of the earth remain for the farmers interviewed essential values at the core of their profession. The relation with the soil relates to traditional models of agricultural production, which today may persist in certain aspects, but which have also seen structural transformations which have profoundly altered them.

This core of common values takes shape in the varied forms of integration of climate and environmental issues. One form that which seeks to improve through technical advances the environmental efficiency of agricultural production. This value system is related to the trend for ecological modernization (Mol 1999), and concerns most of the farmers in our sample who have adapted their practices. The second, which concerns a minority, involves redefining the agricultural production model, taking inspiration from the analytical model of scientific ecology, and proposes alternative systems of production.

A Differentiated Appropriation of the Reference to Ecology

Ecological Modernization: Integration within Modernity

The integration of environmental issues in agricultural policy is reflected in the increasing standardisation of farmers' practices. Ecological criticisms of productionist polluting agriculture, the increasing power of environmental lobbies, have gradually induced the public authorities to introduce new standards. The introduction of the MAE (*Mesure Agro-Environnementale* - Agro-Environmental Measures) as part of the CAP in 1992 marked in this respect a turning point in the spread of environmental standards. The MAE became in 2015 the MAEC, adding a new dimension to their field of application: climate change. *"The Agro-environmental and Climatic Measures (MAEC) provide a basis for accompanying farmers who are committed to the development of practices combining economic performance and environmental performance, or in the maintenance of such practices when they are at risk of disappearing. It is a key tool for the implementation of an agro-ecological project for France".*³

Neglected initially by the farming community, these measures, and especially the environmental issues, have been progressively integrated in farming practices (Alphandéry and Billaud 1996; Mormont 2009; Candau and Ginelli 2011). This integration has involved in particular the ecological updating of modernising trends in agriculture and agronomy.

Ecological modernization is a political and economic trend that came into being in the 1990s, the aim of which is to reconcile preservation of the environment and economic growth by making environmental actions a source of economic growth. The first texts to define this notion insist on the central role of technological progress as an ecological response to economic growth. *"Focusing on technologically induced developments within the industrial system, the theory of ecological modernization exposes an evolutionary and technologically deterministic view of social development that is characteristic of the theories of industrial society. The ecological switchover is analysed as a logical, necessary, and inevitable next stage in the development of the industrial system - the system correcting itself for the construction fault of neglecting ecology. In the 'system evolutionary' view of historical developments, technology and technological innovations are the motor for socio-ecological change »* (Spargaren and Mol 1992).

³ Ministère de l'Agriculture et de l'Alimentation, <http://agriculture.gouv.fr/maec-les-nouvelles-mesures-agro-environnementales-et-climatiques-de-la-pac-2015>, consulted 31st January 2019

In the field of agriculture, the implementation of a policy of ecological modernization has given rise to practices which derive their legitimacy from the idea that technical and technological progress can provide a set of responses to the environmental impact of agricultural production (Sevilla et al. 2012).

In the contemporary context, the ecological modernization of agriculture is based on a reference to agro-ecology, the historic use of which possessed a dimension of contestation and represented an alternative to the productionist model (Dumont 1974). Paradoxically, it is today used to spearhead the model which it was intended to oppose.

Since the 2000s, agro-ecology has been redefined on the basis of the criteria of 'ecologically intensive agriculture' (*Loi Grenelle* in 2010⁴, *Plan d'action globale pour l'agro-écologie* in 2014⁵), and has become since 2010 a priority topic for research in agronomy in France (Aigrain et al. 2016). Ecological modernization functions as the continuation of the post-war productionist model, and the forms of institutional and political support. The changes in practices of the farmers are then organised in phase with a professional dynamic structured around the agricultural institutions, which relay these new methods of modernization (Lémery et al. 2005; Compagnone 2014).

In our sample, the changes in practices which relate to the ideology of ecological modernization are of two kinds: those that derive from a form of constraint both normative and economic, and those that are part of an innovative process of investment in technological solutions for adaptation.

For some farmers, the environmental measures and inducements are seen as constraints that are accepted more or less willingly, which are part and parcel of the regulation of farming activities. They say they are ready to make an effort with regard to certain practices, to the extent that does not radically alter their activity. In general, they integrate these practices from the perspective of saving money, paying more attention to the use of phytosanitary products or cutting costs with regard to irrigation.

"There, I use a little less phyto, for sure, it's not bad for the environment and it lets us spend a little less. That's the principle that was called 'integrated agriculture', now they say something different. But the idea, it's that, we have to use it reasonably, and it's good for the soil, the water, and for the purse". Market gardener, Bouches du Rhône.

"It's true these last years, we've had to be a bit careful about the water, there have been some restrictions during the summer. Well that's over, we all made an effort so that by using a bit less, then we all had some. For some crops, I also changed to micro-irrigation, after all that was a way of using less water". Fruit farmer, Vaucluse.

The farmers who integrate more economical practices in their professional activity are those who do not wish to abandon the productivist agricultural model. They have accepted the dictates regarding saving water as a new technical norm which they gradually integrate into their practices willingly and without resistance, as long as it does not involve calling into question the productivist agricultural model.

In the Mediterranean region, the irrigation network makes it possible to envisage an adaptation to climate change by means of a more systematic use of irrigation for crops that were traditionally not irrigated (Aspe et al. 2015). Irrigation would appear to be a technical solution and an investment which today is being developed at the scale of the PACA region, including and especially for what are referred to as 'dry' crops, the vineyards and olive plantations. Outside those areas that dispose of traditional gravitational irrigation networks, the cooperatives and chambers of agriculture increasingly provide support for farmers in installing these systems, enabling them to maintain their level of production and not suffer a decline in productivity.

⁴ Grenelle II legislation, or *loi no 2010-788 du 12 juillet 2010*, regarding the national policy for the environment.

⁵ Ministère de l'Agriculture et de l'Alimentation, <https://agriculture.gouv.fr/le-plan-daction-global-pour-lagro-ecologie>, consulted 31st January 2019

The question of the economic yield of their farms remains in this case a determining factor in the farmers' choices.

The principle of making use of technological or even genetic innovations by the adoption of new GMO crops and/or the development of hydroponic cultivation does not give rise to any serious opposition and indicates a relation of trust regarding the possibilities of adaptation to future climatic variations.

"It's true that we should let the soil recover, but we have to replant it more quickly, so we deplete the soil. Later we can always find solutions. We could make plants that can stand the heat better, which can stand drought, and then for the soil, if we use the right fertilizers, even in depleted soil, things grow !". Wine-grower, Var

"Yes, well there's research in genetics, in particular, and we're starting to get species which can stand the heat better, plants that are specially adapted. I've already tested some, on some plots, for the moment it's difficult to say, we'll have to see in the long term". Market gardener, Bouches du Rhône

The use of a technological or genetic innovation may be pushed to its limits within certain sectors with high added value, for which the investment needed for adaptation offers the means to maintain the productivity and the profitability of the farm. In the PACA region, one of the most innovative sectors is that of greenhouse horticulture, which is an economic niche but which is also a kind of 'soil-free laboratory' for experimenting the capacity for adaptation to change, through the total control of climatic conditions. This is in any case the discourse we hear from the greenhouse horticulturalists:

"Well here, it's all bio, 100%. For us, climate change, we adapt to it, in as much as everything is controlled. We have total control over the heat, the humidity, the light, and so in function of the changes, we can adjust by technical means. We have a soil-free production system, which also means we can perfectly control the growth of the plant". Horticulturalist, Var

The ideology of ecological modernization is expressed here in the complete artificialisation of agricultural production as a means of adapting for biological agriculture, and which takes into account the impact of climate change. Thus around these values of ecological modernization, there coexist the pursuit of economic profitability and the integration of environmental practices, thus responding to the demand of consumers and the market.

A Global Ecological Approach

In counterpoint to this model, another recourse to ecology has been developing. This aims to completely rethink agricultural practice not from the point of view of technical and technological control of natural processes, but by 'working with nature'. The farmers in our sample who referred to this production model are relatively few. Within our sample, they were 6 out of 50. Their sociological profile is relatively homogeneous and their biographical background heterodox with regard to the farming community. Young, academically well-qualified, four of them were not from a farming background. Working on small-sized farms, what they have in common is not the type of crops but the process that led them to become farmers. Among the six farmers interviewed, two are market gardeners, two are in mixed crop - livestock farming, one is a wine-grower and the last combines fruit farming with market gardening.

For these farmers, a change in the agricultural model constitutes the only alternative to the maintenance of biological agriculture in the context of climate change. In opposition to a technology-focused vision of ecological modernization, these farmers present their orientation as a political and militant choice, but also as a necessary condition for the development of resilient agriculture.

"When we took over the farm, it was a choice of lifestyle, so for us there was no question of compromising on certain values. To begin with, you have to start tilling the soil again, to bring it back to life so it could provide the plant with what it needed. Then you work on the pruning and the ecological associations with

other plantations. For us, the condition for being wine-growers is to respect the ecological balance to allow the vine to become more resistant". Wine-grower, Vaucluse

"We came to a site that was heavily planted in vegetal terms, walnut trees, nettle trees, truffle oak, it was this biodiversity that we wanted to preserve, or even develop, by livestock farming and a market gardening and fruit growing business. So we grew walnuts, we got laying hens, small fruit and market gardening. I did some market gardening under the trees with a rotation between vegetables that need heat or shade. For the berries, the walnut trees are an advantage because of the leaves which make a cover for the soil in winter". Mixed farming - livestock, Vaucluse

These agricultural practices also involve a series of alternative networks for exchanges, whether for the distribution of products (by direct selling, the AMAP – *Association pour le Maintien d'une Agriculture Paysanne*, the spread of outlets of the farmer's market type (*'épicerie paysanne'*)), and also for training, exchanges of seeds or farming techniques. Numerous alternative training organisations have been set up over the past 20 years, offering technical and militant support for setting up or converting an ecological farming business (*Association Française de Biodynamie, Association Française d'Agroforesterie*, etc.). These farmers are also in contact, often through the intermediary of militant networks, with researchers whose priority is to assess the ecological basis of these systemic agricultural practices, and are rather embedded in the networks of environmental institutions, such as for example the regional natural parks, than agricultural networks.

The experiments undertaken in agroforestry, associating complementary agricultural activities, such as market gardening and fruit farming, or more classically forestry and livestock grazing, are the focus of a discourse which takes these practices as models of resilience for agriculture. Agroforestry (the association of market garden and tree growing) thus creates an interdependent ecological system which ensures the sustainability of cultivation in a context of hydric stress⁶.

The integration of ecological priorities and agricultural practices thus reveals a reconfiguration of the farming world with regard to these issues. In some cases, they become the focus of the updating of the modernization project which has underpinned the development of agriculture since the second world war. In others, it represents the rethinking of this model. Between the two approaches to taking into account environmental issues, farmers adjust and adapt their practices on a continuum which depends as much on their insertion in the local professional networks as on the environmental issues they are confronted with in the daily exercise of their profession.

Conclusion

The qualitative methodology adopted here has offered a basis for updating the motivations and reasoning which incite farmers to change their practices on the basis of the meaning they attribute to them with regard to their own specific value systems. This methodology might be used in other fields and transposed to a quantitative process in order to broaden the scope on the basis of statistical validity.

We have shown that the understanding of the forms of adaptation to climate change within the farming community requires their restitution with regard to the farmers' value systems. The power of the reference to the peasant ideology constitutes an indicator of the persistence of the unity of this socio-professional group, on which depends too its capacity to evolve and transform its practices. Its strength is to be able to reconcile and justify ideologies which might be thought of as fundamentally contradictory: on one hand, the ecological modernization of agriculture which, anchored in the modernising paradigm of the agriculture inherited from the post-second world war period and from the CAP, makes the environment a new source of growth, and on

⁶ <http://www.inra.fr/Grand-public/Rechauffement-climatique/Tous-les-magazines/Agroforesterie-productivite-et-changement-climatique>

the other hand the global ecological approach which seeks to overturn this model and presents agriculture as an example of an alternative model of society.

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