

CLIMATIC AND SOCIO-ECONOMIC RISKS PERCEPTIONS AND ADAPTATION STRATEGIES AMONG LIVESTOCK FAMILY FARMERS IN THE PAMPA BIOME¹

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Introduction

Two important contemporary social theorists, Ulrich Beck (1998) and Anthony Giddens (1997) argue that there has been a rupture within modernity that put it away from the classical industrial society and has given rise to something different: the risk (or industrial) society. This break would be as profound as that one exerted by the industrial society upon the previous feudal organization. While the industrial society has put into question the typical social practices of tradition, the risk society, in turn, has challenged the assumptions of the industrial society. These two moments are called by Beck, respectively, the modernization of tradition (or simply modernization) and the modernization of the industrial society (or reflexive modernization). Most of the problems of the industrial society of risk were generated by technical-economic advancements. Through reflexivity, the modernization process turns to itself as subject and also as a problem.

In the context of this crisis of the industrial society, the growing challenges and opportunities presented by global changes create the need to reduce vulnerabilities and to enhance adaptive capacity (ADGER et al, 2003) of the potentially most affected communities, thus protecting their right to develop sustainably amid uncertainty (BURSZTYN, 2014). Ecological risks threaten humane beings in many ways, with climate change being a major concern. However, the “risk society” is not limited to environmental and health risks, since it also includes a whole series of changes in contemporary social life, such as changes in employment patterns in a growing level of job insecurity, declining influence

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of tradition and habits rooted in personal identity, erosion of traditional family patterns, and democratization of personal relationships.

In order to understand the main aspects of the risk society, it is necessary to understand the meaning of “reflexive modernity”, which according to Giddens (quoted in Beck, 1995, p. 12) is “the possibility of creative (self-) destruction for an entire epoch: that of industrial society”. It is emphasized “the ‘subject’ of this creative destruction is not the revolution, not the crisis, but the victory of Western modernization”. (BECK, 1995, p.12).

In this context of crisis, there is an urgent need for a planned improvement of the adaptive capacity of family farming to socioeconomic and climate risks (HOWDEN et al., 2007). This improvement can be only made possible through the integration of climate change-related risks with other risk factors such as market shocks, climate variability and the overcoming of the social barriers to adaptation (MOSEK & EKSTROM, 2010; ADGER, 2009b).

Bottom-up studies, which place targeted actors first, contribute to overcoming social and perceptual barriers to the identification of climatic and socio-economic risks and of the options to address the problem. Unfortunately, available funds have traditionally been invested in research on climate and the biosphere. In comparison, investments in interdisciplinary and social sciences research on topics such as mitigation and adaptation processes and perceptions have been quite modest. In the agricultural context, most of the recommendations by decision makers on what techniques to use or which seeds to choose are based on knowledge originated in the natural and earth sciences. But for scientific knowledge to be actually translated into action by stakeholders, it is necessary to generate another kind of knowledge, an instrumental knowledge able to promote the change of attitudes, not only of individuals but also of institutions. This is when the social sciences, along with the concern for understanding how people perceive changes in their environment and how they act about those changes, re-enter the scene. Fortunately, social barriers to adaptation are not absolute and can be overcome through concerted efforts, creative management, changes in thinking, the setting of priorities and changes in land use, resources, and institutions.

Gaicho ranchers are family farmersⁱ devoted to grassland beef production in the Pampas of Brazil, Argentina and Uruguay. Ruminant production on grasslands is widely accepted as an environmentally sustainable activity (TILMAN et al., 2002). However, the livelihoods of the families devoted to this activity are challenged by global changes, natural and anthropogenic. The reality of gaicho family farmers demonstrates the urgent need to integrate the analysis of climatic and socio-economic risks and to overcome the barriers to adaptation to global change.

It is important to notice that, different from livestock production in many developing countries, pastoral ranchers and their families in the Pampas are not limited to subsistence activities. They are usually inserted in local and regional beef markets and they do commercialize their beef. As a consequence, they suffer from the double exposure to climate change and the dramatic fluctuations in markets and institutions, as well as from oscillating sanitary norms (LEICHENKO, O'BRIEN, & SOLECKI, 2010). The economic dynamics of the three countries and their liberal (in the case of Uruguay and

Brazil) and interventionist (in the case of Argentina) policies targeting the agricultural sector define the kind of risks and uncertainties experienced by family farmers. Among others, those uncertainties include the dependence on the fluctuations of international markets and the frequent economic crises (1982, 1990, 2002); the disastrous economic consequences due to cattle sanitary problems (like the foot and mouth disease in 2001), pressures for the development of the cellulose and the soy industries (Western Uruguay), soy production (Central Argentina) and soybean and rice production (in Rio Grande do Sul, Southern Brazil) which causes the competition between agriculture and livestock activities for the access to land, thus increasing land prices and the concentration of land ownership by international corporations.

In Brazil, the Pampa biome has one of the lowest percentages of legally protected areas (IBAMA, 2006). The biome suffers from environmental liabilities that are considered serious due to its difficult reversibility, such as the desertification of large areas, changes in the native flora and fauna because of the invasion of exotic species and the suppression of extensive areas of native ecosystems (such as grasslands, wetlands and forests) for agricultural purposes. Several studies have revealed that the marginalization of extensive, low-input livestock production by the advancement of large-scale soy monoculture is threatening the rich biodiversity that had been protected by traditional livestock family farming (RIBEIRO, 2007; BILENCA & MIÑARRO, 2004).

Adding to all this, extreme weather events, such as the 2004-2006 droughts and 2007 floods of the Pampas, increase the vulnerability of family gaucho ranchers due to their natural mode of production (usually in the open and without stabling/feed-lot or supplementation strategies). Even if droughts are not necessarily linked to climate change, they remain representative of the extreme events that can occur more frequently due to climate change.

This paper describes the perceptions of gaucho family farmers of the climatic and socio-economic risks faced by their livelihoods. It also analyses the impact of farmers' perceptions on their adaptation strategies (SMIT et al 1996; BRKLACICH et al 1997; MADDISON, 2006). We depart from the fact that pastoral livestock production makes extensive use of ecosystem services and eliminates many of the problems of confinement (by the use of feed-lots) production. Pastured animals consume plants growing in a field, and plant growth is increased by animal wastes deposited and recycled in the field (TILMAN et al, 2002). Ruminant production on grasslands takes advantage of the high efficiency of ruminant guts to convert low-quality forage into high-protein human foods, including dairy products and beef. When appropriately stocked and managed, grassland-ruminant ecosystems are an efficient, sustainable method of producing high-quality protein with minimal environmental impacts (POWER, 1999).

Accordingly, we depart from the hypothesis that gaucho family farmers devoted to pastoral beef production in grasslands perform an environmentally sustainable activity in the Pampas. We also assume that gaucho family farmers are *de facto* managers of the most productive lands on Earth. That said, their adaptive capacity is strongly conditioned by their short-termed perceptions of climate change and well as by other external shocks. Differently from daily weather events, most climate change events and the risks that

they entail happen in the long run. Policy-makers interested in supporting sustainable economic activities should understand that social and perceptual barriers negatively condition the passage from risk situations to the perception of risk. This fact complicates the generation of tailored adaptation strategies and the effective management of risk-related conflicts inherent to contemporary societies.

Conceptual Framework

Risk Management and Climatic Uncertainty

The concept of reflexivity (BECK, 1998; GIDDENS, 1997) is central to understanding the new phase of modernity as reflective. Reflexivity represents the possibility of reinvention of modernity and of its industrial forms. Through the radicalization of modernity, avenues for a new modernity are opened up. Reflexive modernization proposes that many modernities are possible, as opposed to the fatalistic idea that there is only one form of modernity: the industrial society. It is in this scenario of permanent tension and transformation that Gaucho family cattle ranchers face enormous socio-economic and climate challenges in order to continue existing without losing their cultural identity (LITRE, 2010). In order to survive, farmers usually only take into account *socioeconomic* uncertainties involved in decision-making. Only recently, and as a result the reinvention of modernity and its industrial forms, funding and environmental organizations have started to consider as priorities the integration of climate risk information in the planning of family farming adaptation strategies. Proper risk assessment by and for gaucho beef producers is a key element contributing to the social, economic and environmental sustainability of their livelihoods in the Pampa biome. In that regard, three factors must be considered while assessing the risk of extreme events: the probability of occurrence of the event; the damage; and the exposure to the damage.

Risk management is the process that aims to mitigate damage. There are four risk management components: (i) an assessment of the risk environment or context; (ii) an assessment of the risk according to this context, through the identification of threats, vulnerabilities and the impact of the consequences in the family production system; (iii) an identification of how the heads (or economic decision-makers, usually the father figure) of each family unit respond to hazards in coordination with available technical assistance, financial institutions such as banks, agricultural cooperatives etc.; and (iv) a monitoring of the evolution of risk over time.

The chances for a family production unit to effectively deal with conflict originated by the risk presuppose some features that the system must perform or have:

- The ability to analyse the vulnerability of the production system to social climatic and socio-economic risks
- The flexibility and adaptability of the head of the family unit to face new challenges
- The existence of contingency plans (to face droughts, frosts, floods, etc.)

– The existence of public policies aimed at strengthening family farming in general and low environmental productive activities in particular, such as extensive, low-input beef production.

The Role of Communication of Risk and Uncertainty

A clear and effective communication about the nature of risk plays a key role in the adaptation strategies of family farmers, especially because risk and uncertainty are often wrongly cited as synonyms. Making the conceptual distinction between risk and uncertainty is important for the effective risk management of natural resources. According to Knight (1921), risk is the *measurable* randomness of future events. Uncertainty, on the other hand, is the *non-measurable* randomness of future events. Since the future is, by definition, always “unknown,” then by that definition, there is always uncertainty. Ultimately, there will always be some uncertainty in all events because we will always be unable to precisely measure all the effects of future events. The probability distribution is unknown (or so extremely large as to functionally be the same as unknown).

For Giddens (2000), the concept of risk is inseparable from the ideas of probability and uncertainty, since one cannot say that someone faces a risk when the result of the action is fully guaranteed. Risk has quantifiable attributes, while uncertainty does not (RAFTERY, 1994 cited by VIEIRA, 2005).

Holton (2004) reports two factors that set risk. The first is the uncertainty about the likely outcome of an experiment, and the second is the fact that the results need to be relevant in terms of utility. As for Damodaram (2009), the definition of risk should include both the probability of occurrence and the consequences of this event. For instance, the likelihood for a major earthquake to happen can be quite small, but the catastrophic damage linked to the event could be classified as high risk.

The definition of risk also varies according to the context in which it is applied, but in general terms we can define it as the possibility of a potential damage to take place or that something bad happens. The concept of risk gained relevance in social theory through the contributions of Beck (1998) and Giddens, Beck and Lash (1997). In the opinion of these theorists, environmental and technological risks carry serious consequences and are key concepts for understanding social processes taking place in contemporary societies.

Although Beck does not offer a detailed definition of risk, he states that the concept embraces ecological, chemical, nuclear, and genetic (BECK, 1992). Risks can bring uncontrollable consequences, without spatial, temporal or social boundaries, thus presenting serious challenges to the institutions devoted to controlling them. In short, they are risks with global effects, frequently invisible and sometimes with irreversible consequences.

Beck and Giddens claim that it is necessary to develop new theoretical concepts to understand contemporary societies and place the analysis of risks as the centerpiece of their approaches. It is in the context of this need for the development of new theoretical concepts that we use the framework of *double exposure* to environmental and socio-economic risks offered by Leichenko et al. (2010). The *double exposure* concept is a useful

approach to understanding how users of natural resources, including gaucho family farmers, perceive and act regarding risk.

Depending on the focus of the analysis, the exposure framework can be territorial, political, ecological, economical or even institutional.

Double Exposure to Socioeconomic and Climatic Risks

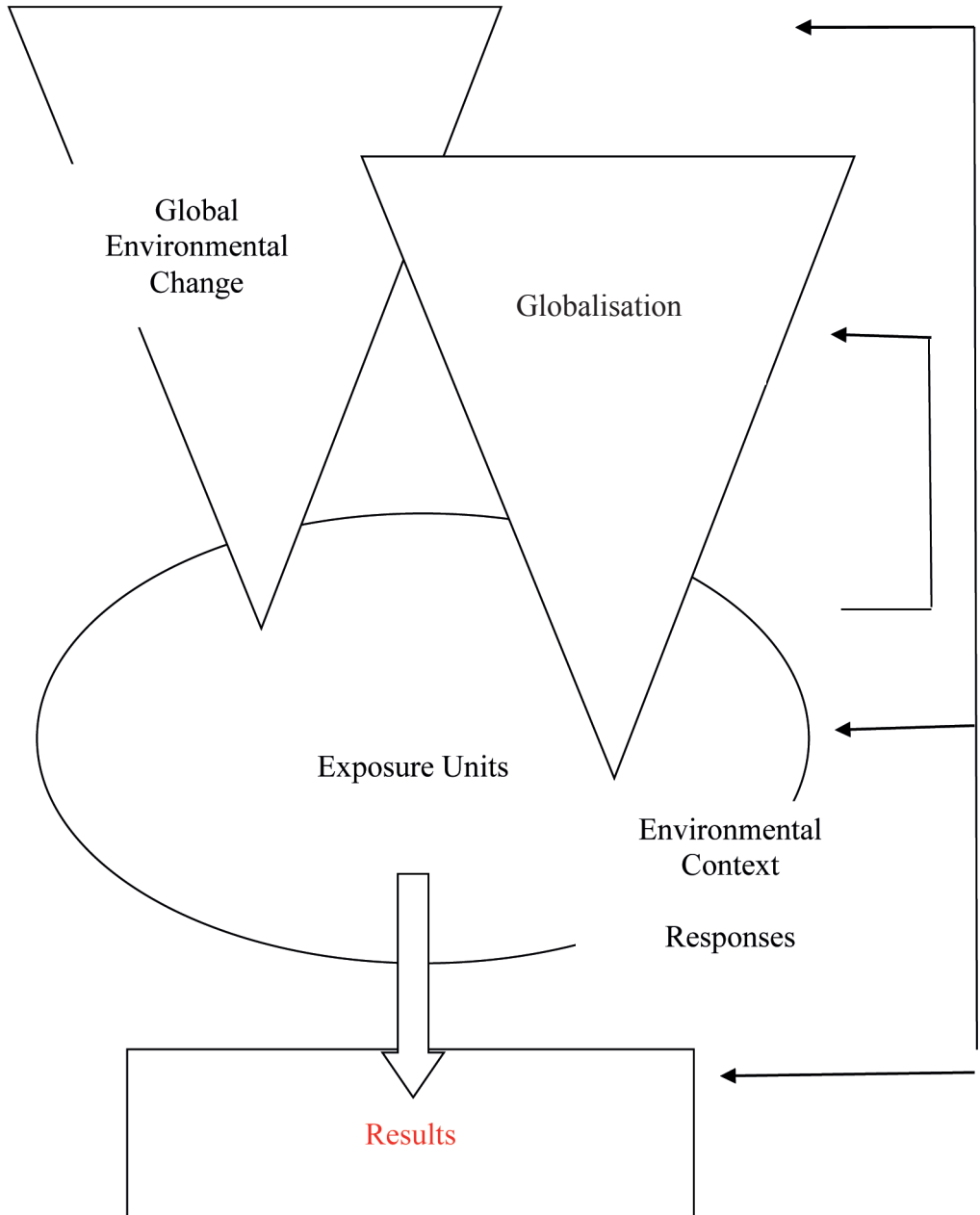
The degree to which a given system (family farming unit, social group, sector, region, country etc.) is affected by climate change and by socio-economic shocks depends on the system adaptive capacity. We understand the adaptation process or action within a system as the set of strategies seeking to reduce the system vulnerability and to improve its chances of tolerating, managing or adjusting to changes, stresses, shocks, risks or opportunities (SMIT & WANDERL, 2006; ADGER, 2009; MOSER & EKSTROM, 2010).

According to the moment it happens, adaptation strategies can be anticipatory or reactive, and depending on their degree of spontaneity, they can be autonomous or planned (HOWDEN et al, 2007). Social scientists suggest that adaptation is a consequence of the selection arising from changes in cultural practices (adaptations, in plural) that allow a culture to survive throughout history (O'BRIEN & HOLLAND, 1992).

Figure 1 provides a simple illustration of the main components of the double exposure framework. Processes of global environmental change and globalization are represented as partially overlapping triangles. These processes manifest in a specific contextual environment, portrayed as an oval. The extent or magnitude of exposure to the processes is depicted as the intersection between the triangles and the oval. An arrow leading from the contextual environment to a square representing outcomes symbolizes responses to the processes. Outcomes are depicted as separate from the contextual environment to emphasize that any outcome reflects measurable conditions at a specific point in time (LEICHENKO & O'BRIEN, 2008). The framework incorporates dynamic linkages between the components. Processes can alter the contextual environment, responses can affect the processes, outcomes can affect responses, and so forth. Dynamics are also incorporated in the framework through recognition that processes and outcomes are often reflexive. Within the figure, the arrow leading from responses and outcomes back to the process triangles depicts these types of circular linkages, which are termed "feedbacks." (LEICHENKO & O'BRIEN, 2008).

In our study case with gaucho family farmers, the exposure framework is double and includes: (i) climatic and ecological risks (the landmark is the biome Pampa Uruguay, Brazil and Argentina) and (ii) socio-economic, internal risks (within the family) and external (the framework are the gaucho ranchers and their families in all three countries). The social and cultural contexts seem to play an important role in the perception of individuals and in their eventual adherence to policies and actions designed to respond to shocks and stresses.

Figure 1. The Double Exposure Framework



Source: LEICHENKO & O'BRIEN, 2008

Social Barriers Adaptation

The way risk is incorporated by family farmers into their decision-making processes depends on the behaviour of the actors and therefore on their perception of risk, which can result in indifference, aversion or even propensity to risk. Perceptions about climate and socioeconomic risks make up the first of the three phases of the adaptation process: (i) understanding of risk; (ii) adaptation planning and (iii) management of adaptation (MOSER & EKSTROM, 2010). In step (i) - understanding of risk -, perceptions contribute to the identification of the problem and the creation of useful options for adaptation (MOSER & EKSTROM, 2010; GBETIBOUO, 2009) Social barriers (normative, perceptual and cognitive) that hinder the understanding of risk vary from region to region, and are based on values, objectives, characteristics and particular cultural perspectives, whose measurement is only possible from the fieldwork. Among the main barriers to adaptation to climate change challenges (real or perceived) can be mentioned:

- Limited knowledge of the nature and magnitude of climate-related risks and vulnerabilities - current and / or future;
- Decision-making and planning processes with a short-term focus;
- Lack of ability to deal with uncertainty;
- Lack or reduced awareness of the need to adapt by decision-makers;
- Belief that there is no urgency to start deciding on adaptation;
- Lack of knowledge and experience in implementing adaptation measures;
- Lack of policies, standards or guidelines that encourage the perpetuation of the *status quo*;
- Legal or regulatory restrictions that pose impediments to the adoption of measures;
- Lack of or limited access to appropriate technologies;
- Prohibitive costs of adaptation measures identified for the available budgets;
- Lack of leadership or capacity and human skills;
- Stiffness and social, cultural or financial conflicts and aversion to change (actual or perceived as such);

A better understanding of the values and processes involved in the relations between individuals, and between those individuals and their environment, sets a necessary step to overcome the real barriers to adaptation. This is especially true for family farmers from the Pampa biome, which selectively perceive the risks linked to climate changes and socio-economic shocks. Their risk perception is temporal, because it is a short-term phenomenon. This complicates the record of gradual changes that happen in the long run, such as climate change.

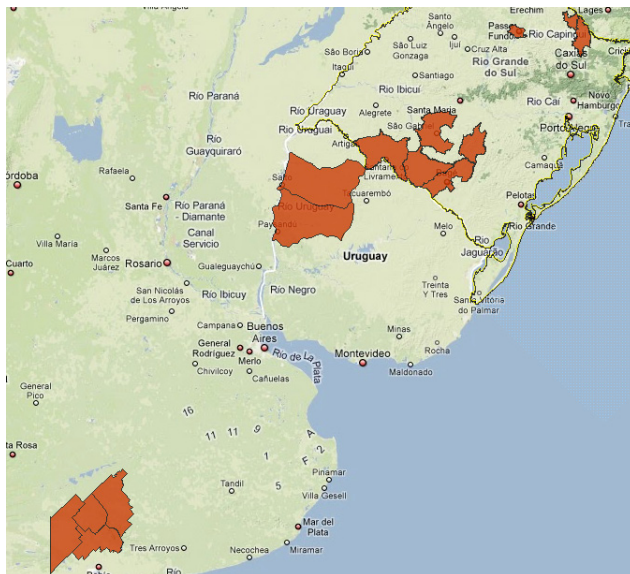
At the same time, the ways individuals carry out the process of perception depend on their previous experiences, needs and individual motivations (LITRE, 2010; RAO & al, 2011.). It is difficult for any actor, including farmers, to perceive new factors against which the subject has no previous experience, such as climate change (SLOVIC, 2000).

Nor is it easy for the producer to perceive and react to subtle changes that take years to show their productive impact. This is particularly true in the case of extensive livestock production activities, because unlike agriculture, extensive cattle raising leaves few marks on the landscape and is, at first, somehow less dependent on climate variations. There is also what could be called a «perceptual self-protection» strategy: most people naturally deny or ignore what does not suit them, unconsciously avoiding unpleasant stimuli. They can even distort the incongruous information to adapt it to their needs, values and beliefs (SLOVIC, 2000). So one of the goals of this work is to understand the reasons of not only the efforts made to adapt to climate variations, but also the reasons of those who do not make any adaptation effort, or that directly do not perceive climate changes.

Study Context

The intersection of climate change and socio-economic risks creates new types of vulnerability and inequality, undermining local capacities to adapt to changes. The reality of family farmers from the Pampa biome illustrate this problem. The Pampa biome is located in the three countries in our study: Central Argentina, almost the whole Uruguay and Southern Brazil. Also called “*pastizales*” (grasslands) of the La Plata River, the Pampa covers more than 750,000 km² in the continent. In Brazil, the Pampa biome occupies only 2% of the national territory in its Southern part. In Uruguay, it covers virtually the entire country. In Argentina, it represents around 20% of the country surface. For this study, representative cities were chosen from each country (Map 1). More information about the selection of the sample is presented in the Methodology.

1. Map - Municipalities of farmers interviewed in Brazil, Uruguay and Argentina.



Source: 2006-2007 data, extracted from LITRE, 2010.

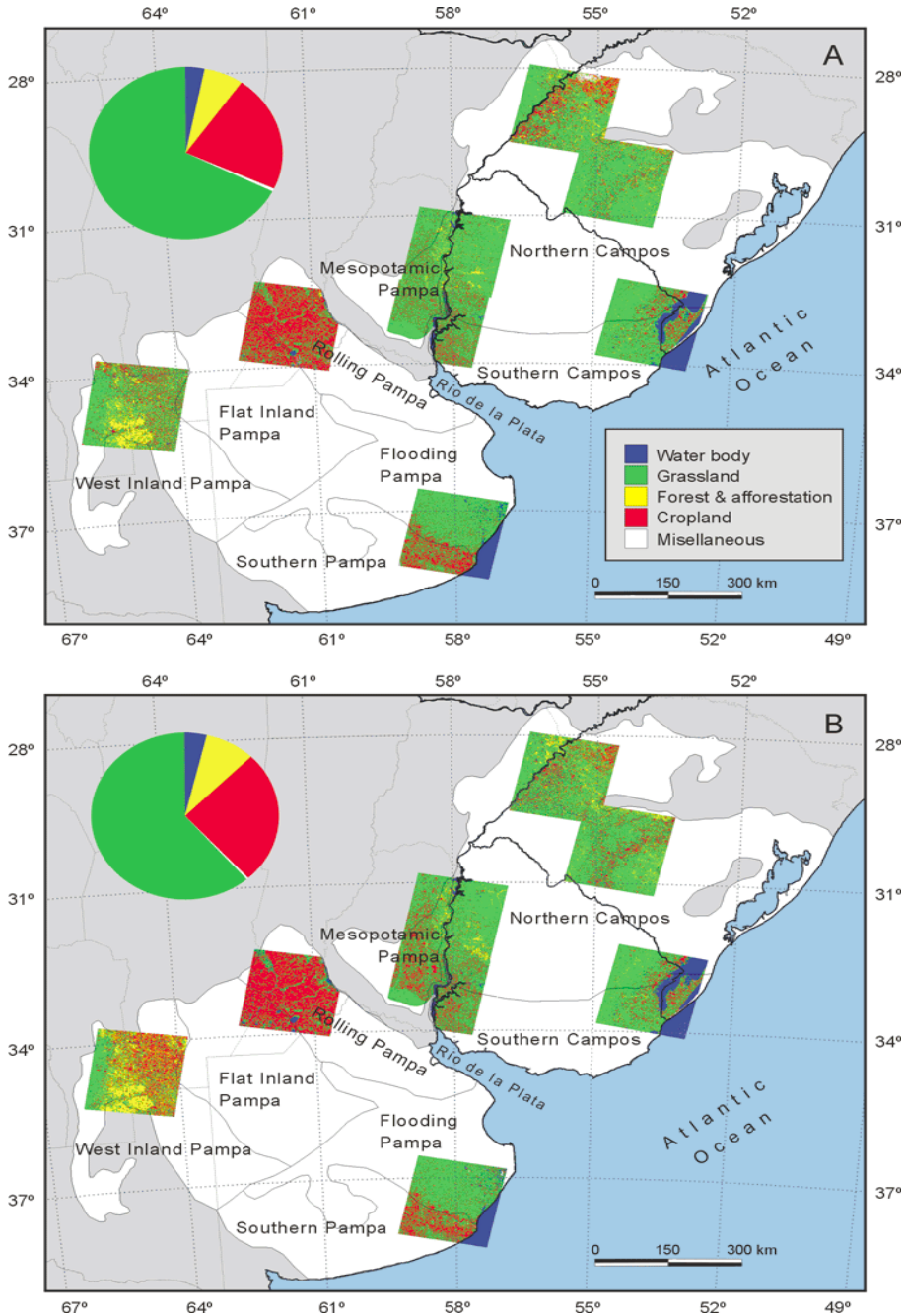
The climate in the Pampas is temperate, with rainfall levels ranging from 600 mm to 1200 mm distributed more or less regularly throughout the year, making the soils very suitable for agriculture and cattle raising.

The Pampa biome has privileged natural conditions for the implantation of extensive cattle raising and agricultural activities – in fact, the two activities usually co-exist and/or compete for the access to land. In this scenario, the livelihoods and identities of gaucho family farmers are deeply linked to nature and livestock production (LITRE, 2010). A result of this bond between man (and women) and nature – a bond that is transmitted from generation to generation-, are farmers' efforts to understand the natural and climatic cycles affecting their cattle and to preserve their environment (flora and fauna).

This openly contradicts frequent reports about the alleged negative environmental impacts of livestock production, such as the one issued by the LEAD program of FAO in 2006 (FAO, 2006). The LEAD report from FAO states that livestock production is one of the major causes of the world's most pressing environmental problems, including global warming, land degradation, air and water pollution, and loss of biodiversity. However, other comprehensive studies have shown that there exist pastoral, *extensive* livestock systems (low-input and low-capital livestock) that may in fact contribute to the preservation of grassland and its biodiversity (POWER, 1999, TILMAN et al., 2002, KAULE, 2005). Pastoral livestock production makes extensive use of ecosystem services and eliminates many of the problems of confinement production. Pastured animals consume plants growing in a field, and plant growth is increased by animal wastes deposited and recycled in the field (POWER, 1999, TILMAN et al., 2002). Ruminant production on grasslands takes advantage of the high efficiency of ruminant guts to convert low-quality forage into high-protein human foods, including dairy products and beef. When appropriately stocked and managed, grassland–ruminant ecosystems are an efficient, sustainable method of producing high-quality protein with minimal environmental impacts. At the same time, the benefits of agriculture have been immense. Before the dawn of agriculture, the hunter–gatherer lifestyle supported about 4 million people globally. Modern agriculture now feeds 6,000 million people (TILMAN et al., 2002)

The recent intensification of agriculture and the height of the phenomenon of large-scale monocultures for the production of soy and biofuels in areas historically dedicated to extensive cattle ranching have caused the landscape of segregation, fragmentation of forests and pastures natural and abandonment of areas considered marginal (ARBELETICHE, LITRE & MORALES, 2012). The direct consequence of this trend is a threat to the gaucho way of life. Family farmers (especially young farmers) from the three study regions are massively abandoning the countryside to live in urban areas (WOORTMANN & WOORTMANN, 1997).

Maps 2 and 3. Land use and land cover for (A) 1985-1989 and (B) 2002-2004. The fine lines of gray indicate the limits of each subunit. The pie chart indicates the percentage of each type of land use and land cover for each considered period.



Source: BALDI & PARUELO, 2008.

According to Viglizzo et al. (2005), the Pampa provides ecological services that are currently threatened by profound territorial transformations favouring large-scale monoculture (especially soybean monoculture). When the ecological services of an ecosystem are affected or destroyed, this impairs the quality of life of local populations (MILLENNIUM ECOSYSTEM ASSESSMENT, 2003). Even when the Pampa biome has not the same natural exuberance than the Amazonia or the Pantanal biomes, it still offers services of high ecological value. Among those services, there are environmental services (climate regulation, erosion control, flood prevention, nutrient recycling, conservation of natural species), cultural services (gaucho traditions and values, and ways of life related to livestock activity), and services linked to the aesthetics of nature and landscape (such as recreation and tourism). Even if often undervalued, some of these services are already beginning to acquire economic and market value, as it happens with agro tourism and ecotourism, atmospheric carbon sequestration and the ecological certification (green labelling) of products and production processes (CHAMPREDONDE, BENEDETTO & BUSTOS CARA, 2011, CHAMPREDONDE & MUCHNIK, 2012), such as beef from the Pampa biome and the “green cattle” (*boi verde*, in Portuguese).

Methodology

A bottom-up approach was chosen to describe the perceptions of family cattle ranchers on the accelerating, globalisation-driven changes in climate, markets and landscapes. We conducted 75 semi-structured interviews with family ranchers from the Pampas, 25 located in the state of Rio Grande do Sul (Brazil), 25 in Western Uruguay and 25 in the province of Buenos Aires, Argentina. Ranchers were considered family farmers according to self-definitions and through direct observation. This allowed checking if cattle (bovine) ranching was the main source of income in the productive unit (PU) even if often combined with other types of farming and livestock production (mainly wheat and sheep).

To be defined as a “family” farm and included in the research sample, the boss or leader of the PU, along with his or her family, should be the main source of the PU labour force. This criteria did not exclude the occasional presence of hired rural employees, working permanent or temporarily in the farm, although they could not outnumber family members. For instance, in a family of four economically productive members, hired employees could be four or less. After a careful reflection, the criteria of the size of PU, usually leading to the well-known concept of smallholder, was excluded from the selection list, since farm size can be tricky in the Pampas: soil quality and productive levels vary significantly between areas and among production systems in each selected country. As a result, family as the main source of work force in the PU acted as a natural selector. This led to the identification of farms with a mean size of 150 hectares and never exceeding 500 hectares (larger farms would become unmanageable by a single family and without the support of several rural employees). The sample selection was done in conjunction with rural extensionists from each country (the Agricultural Planning Institute - IPA in Uruguay, the National Institute of Agricultural Technology – INTA, in Argentina, and

EMATER in Brazil). The sample selection criteria was aimed at illustrating the heterogeneity of family ranching and to identify producers who were willing to share sensitive information with the interviewer, such as their life trajectories, histories and personal crises (health and financial difficulties, for instance). Results are not representative of all gaucho family farmers, but illustrate the heterogeneity of family farmers devoted to extensive beef production of the Pampa biome.

The analysis of the interview transcriptions was performed using thematic content analysis (BOYATZIS, 1998). Such an analysis allowed identifying patterns or themes within the available qualitative data. Thematic analysis minimally organises and describes collected data in detail. The results of the thematic analysis of the interviews were compared with secondary data (mainly official statistics on the demographic evolution of family farming). The saturation point was obtained by interview 15 or 20 in each country, with five additional interviews performed.

Results

Research results proved that family farmers devoted to low-input (extensive) beef production in the Pampas perceive with clarity the *internal* shocks with a *direct impact* on their everyday realities, – mostly family, economic and institutional risks. On the other hand, their perceptions of long-term, gradual climate change-related risks appear to be strongly conditioned by the limitations of perceptive processes, such as selectivity, perceptual self-protection and the difficulty to perceive non-immediate sensations. Accordingly, family beef ranchers showed far more concern about weather-related events (meteorological events such as unexpected frosts or droughts) than about the future of Humankind or the possibility of climatic catastrophes in remote locations. Results were similar in the three regions of our study.

Farmers were invited to mention some of the main risks threatening their livelihoods. Most of the interviewed farmers pointed out, in the first place, to risks threatening their *productive* activities (including *external* risks such as economic shocks and the market fluctuations of commodity prices, and *internal* risks, such as health problems of family members affecting the much-needed work force). They only referred directly to *environmental* risks (including climatic risks) in the third place. Placed secondly in the list were the “cultural and aesthetic loss” risks resulting from the destruction of “the gaucho/ Pampa landscape” due to the advance of large-scale monoculture over pastoralist livestock. This pattern was consistent among respondents from all age groups and educational levels in the three countries. In the case of women leading productive units, they tended to be more worried about the aesthetic and environmental losses and risks caused by climate change than about the potential economic and production losses linked by climate alterations.

Perceived risks

The main risks perceived by producers interviewed in the three countries, in order of priority, were (from most to less mentioned):

1. Production risks:

- Changes in the seasons (such as warmer winters and misplaced rain) anticipating earlier blooms and late frosts affecting pastures;
- An increase in the intensity of extreme weather events, such as floods and droughts that destroy crops and pastures for animals;
- Increased crop and cattle vulnerability to attacks by plagues and sanitary diseases;
- Soil depletion resulting in the loss of productive areas.

2. Cultural / Aesthetic Risks:

- Loss of the symbolic value of the Pampa landscape as a free horizon, open and without limitation, so dear to the gaucho culture;
- Elimination of wild species considered beautiful or / and remembered as a permanent part of your surroundings and your life experiences.

3. Environmental risks:

- Local extinction of native flora and fauna as a result of habitat loss (crop-plated area conversion, field area of conversion in Mato Area or forestry, etc.);
- Soil depletion or «exhaustion», erosion, fertility loss, and death by poisoning of soil microorganisms by chemicals applied to the area (chemical fertilizers, agricultural poisons, etc.);
- Changes (chemical or physical) in the water regime of the productive unit and their surrounding areas;
- More intense and frequent extreme weather events. In this regard, farmers perceive indicators of climate change, such as variations in the frequency and amount of rainfall levels; temperature increases in winter and early plant flowering. Consulted about their strategies to adapt to those changes, however, most of them revealed uncertainty.

Most of the above-listed risks and shocks could be defined as *external* to the family unit. But they are not the only ones in an activity where the family group members (including the children) are the main source of labour. Numerous interviewees reported risks that were clearly *internal* to the productive unit, linked to family conflicts between parents and children or with permanent employees, health problems, etc. In the case of women leading the productive unit, the problem is intensified due to the need to take care of the home and of young children and the frequent resistance of employees (permanent or temporary) to accept orders from a woman (COURDIN, LITRE & CORREA, 2014).

The transfer of land ownership from parents to children was another source of important internal stress due to the risks perceived by respondents. With most of the respondents already retired or almost reaching the age of retirement, the need to divide and share small-sized productive units among several children (and maybe their own

families) generated conflicts and endangered the continuity of the economic activity. Table 1 summarizes some of the major internal and external risks perceived by the interviewed farmers.

Table 1. Internal and External Risks.

INTERNAL RISKS	DESCRIPTION
Production Risks	Risks linked to farmers' uncertainty about natural processes regarding their crops and livestock, such as climatic risks, sanitary risks, plagues, and any other factors affecting the quality and/ or the amount of produced goods.
Financial Risks	Financial risks arise when a farmer takes a loan in order to cover other debts or to invest in capital goods, thus creating an obligation to pay. An increase in interest rates and the difficulties in accessing new loan lines also qualify as financial risks.
Human Risks	Human risks are linked to health hazards and interpersonal relations having a potential negative impact on production. This kind of risk is especially significant in family farming systems, where the available workforce depends to a high degree on a complex network of family relations. Factors such as increase or a fall in the availability of family resources devoted to education and health purposes, family migration, divorces, conflicts among family members and conflicts linked to inheritances, accidents and deaths can threaten the productive unit.
EXTERNAL RISKS	DESCRIPTION
Market risks/ Prices	Market risks consist mostly of farmers' uncertainties about commodity and input prices. Those risks vary greatly from good to good.
Institutional Risks	Institutional risks depend on the uncertainty about public policies. They include new taxes and sanitary and pesticide related norms (including compulsory animal traceability), and government-led exportation controls seeking to lower local beef prices (such as in Argentina). This is the most geographically bound risk, since it depends on the institutional framework studied – high risk in the highly interventionist Argentine administration, and moderate and low in Brazil and Uruguay, respectively (at the time of this research).

Economic Risks	Land prices, land concentration and pressure (originated with smallholders selling or renting their land to large-scale producers or even international commodity companies), currency exchange oscillations.
Sanitary Risks	Foot and mouth disease and tuberculosis affecting livestock, crop plagues, etc.
Environmental Risks	Drought, floods, and an increase in the frequency and intensity of extreme climate events.

Source: LITRE, 2010.

Adapting (or Not) to Perceived Risks

Adaptive capacity is the ability or potential of a system to respond successfully to climate variability and change, and includes adjustments in both behavior and in resources and technologies. The presence of adaptive capacity has been shown to be a necessary condition for the design and implementation of effective adaptation strategies so as to reduce the likelihood and the magnitude of harmful outcomes resulting from climate change (BROOKS & ADGER, 2005). Adaptive capacity also enables sectors and institutions to take advantage of opportunities or benefits from climate change, such as a longer growing season or increased potential for tourism. Adaptation is an on-going process that forms part of effective risk management, in which the potential damage triggers are identified and their impact on the system are assessed (HOWDEN et al, 2007). In this constant adaptation process, decisions are taken from the actors' perceptions of the environmental context, the resources available and their own preferences and attitudes regarding the risk (HARDAKER et al, 1997). However, as we already mentioned, the passage from risk situations to the real perception of those risks is conditioned by social and perceptual barriers, which in turn hinder effective adaptation strategies. There are many complex types of strategies to cope with uncertainty and risk. In general terms, our results fit into the typology created by Levroux et al. (2007), who classified the attitudes of gaucho ranchers into three categories: (i) proactive; (ii) defensive or reactive, and (iii) neutral. However, we prefer to call these strategies as follows (i) adaptation; (ii) adjustment, and (iii) coping/tolerance. As showed in Table 2, risk management strategies, as identified by the interviewed farmers, have been distributed into one each of these three categories, including immediate risk management responses to long-term strategies (like the establishment of family goals and family well-being). It is noteworthy that an increase in the family financial income is never described as a top priority, even if it is mentioned in all answers.

Table 2. Farmers' Attitude Towards Risk

Farmers Attitude Towards Risk	Immediate Response	Long-Term Strategy
Proactive / Adaptation	<ul style="list-style-type: none"> - Loan taking to keep the productive system working or to invest in new technologies. - Loan taking to pay for children migration to urban areas, especially for educational and health-care purposes. - Generation of <i>off-farm income</i>, with family members working in and off the farm (mainly in nearby urban areas) to guarantee a stable source of income. 	To continue growing and to face crises as opportunities for adaptation. To seek for vulnerability reduction and for mitigation options. Income increase. This kind of long-term strategy is more common among those beef-producers who show bigger resources (larger productive units, larger herds, social capital through farmer participation in dialogue networks with experts and colleagues, farmers with middle or high education levels, etc.).
Defensive or Reactive / Adjustment	<ul style="list-style-type: none"> - Accumulating savings to continue growing (through an increase in the number of animals and farm hectares) without taking loans/creating debts. - Reduction of costs and life expenses (even when leading to a decrease in the family's quality of life, such as cutting-off health plans or delaying medical treatments). 	To survive by <i>tightening the belt</i> . To keep the productive system/family livelihood working through a decrease in risk-taking and family and production costs. To reduce and mitigate, within possible, any risks and future vulnerabilities. This is the most frequent risk-related long-term strategy among interviewed farmers from the three countries- even when they clearly envision risk, they avoid any financial loan to face it.
Neutral / Coping or Tolerance	<ul style="list-style-type: none"> - No loan taking for paying for children's education. Children usually have the same educational level than their parents (low to middle). - Rejection of most technical innovations. 	No reaction or response to risk. Risk is not perceived at all, or, if perceived, the farmer feels powerless and with no chances to control / manage it. Deliberate decision not to plan ahead and to take day by day. High traditionalism, doing things as the ancestors did, with pride.

Sources: Field research (2009), Litre (2010) and Levrouw et. al. (2007).

The interviews revealed a strong link between farmers' life trajectories/personal histories and their attitude and responses towards risk. Farmers who had started their productive activity with significant difficulties (gradual and slow purchase of small parcels of land, expensive leases, lack of initial capital, family tragedies, health problems, poor soils, health crises, etc.) showed a more defensive attitude towards risk, such as activity diversification, defined as the combination of agriculture and several types of livestock production, in order to minimize market and climate-related risks as well as production costs. Farmers having life trajectories with a somewhat easier start showed a clear ten-

dency to display a more offensive attitude towards risk, such as taking loans to pay for technical improvements, food supplements for cattle, etc. However, the decision to face a productive or financial risk cannot be attributed to only one reason. The management of drought-related threats includes an analysis of a mix of simultaneous risks – for instance, the option of replacing crop production for livestock production in order to escape the severe impacts of drought on plantations cannot be separated from additional risks such as cattle sanitary problems (foot and mouth disease, tuberculosis), cattle theft, the family's and permanent employees' ability to adjust to the new production system, uncertainties about beef-related public policies and the oscillations of beef market prices.

The ability of farmers to respond to risks also depends on the range of options and opportunities available in their daily contexts (social, economic and environmental contexts) (HOWDEN et al, 2007).

The long-term strategies outlined by interviewed farmers are classified into some of the following categories: tolerance/coping strategies, risk adjustment, and adaptation strategies. The long-term strategies included in the last two categories also aim to mitigate risks and future vulnerabilities.

As it happens in most livestock production systems, respondents described their reactions to internal and external shocks through some of the following strategies: (i) a change of the stocking (*carga animal por hectarea*, in Spanish) of cattle depending to availability of pastures; (ii) a modification of the cycles and schedules of grazing and cattle breeding; (iii) a change of the animal breed (rather infrequent, due to a certain loyalty of the family rancher towards the traditional *raza*, in Spanish, of the herd) or the type of pasture (more frequent); (iv) the use of fertilizers and / or nutritional supplementation (rather uncommon among family farmers, due to the high cost of inputs) and the control of water availability.

It is important to underline that the expressed valorisation of the symbolic assets of the Pampa biome and the farmers' proclaimed concerns for its environmental and cultural preservation have not been consistently translated into concrete, sustainable adaptation strategies. To the contrary, in some cases, interviews and direct observation revealed the existence of practices displaying a negative environmental impact, such as overgrazing (typical of smaller productive units with large amounts of animals), the use of toxic pesticides and the burning of unwanted grasses and to increase soil fertility (burning is an illegal activity in all three countries).

Despite the apparent importance of climate risk-related factors in the decision-making process of interviewed farmers, when asked specifically about the reasons for their productive choices, climate was mentioned only marginally. Most farmers said their production strategies responded to (in order of importance) (i) the financial situation of the productive unit (existence of debts, savings, etc.); (ii) market prices, (iii) soil quality (depth of humus or vegetal soil layer); and (iv) the availability of workforce within the family (children, spouse, and even permanent employees, etc.). Thus, production choices such as the low-input breeding livestock system (*cria* and *recria*, in Spanish) at the expense of the high input fattening livestock system, with confinement and food supplements (*engorde*, in Spanish) are motivated not only by the lower cost of cattle breeding in the

open field and with no inputs, but also by the reduced need for manpower necessary to artificial feeding and animal confinement.

When questioned about their management strategies of productive risk, farmers also mentioned climate information as an important factor for decision-making. However, the majority of respondents in the three countries demonstrated that farmers focus on the short-term weather changes rather than on the longer-term climate change and variability. Accordingly, farmers showed no clear perception and understanding of the long-term, frequently intangible challenges created by climate change over their productive units, and preferred to focus on urgent, short-term demands such as deciding on planting and harvesting dates.

Due to their traditional lack of financial security – caused by the difficulty of access to credit and to insurance in affordable prices, most Gaucho beef producers choose to face the double exposure to socio-economic and climatic risks using changes in their production system (switching from livestock to crop production and vice versa, according to the type of soil and climatic characteristics), leasing their land to third parties to ensure a steady financial income without having to face climatic risks, and diversifying their income via the establishment of pluri or multifunctionality (for instance, working in town as a teacher or real state agent, besides being a farmer, or adapting the productive unit for touristic visits). Many of the rural extension services available in the three study regions propose support through the acquisition of new technological packages, new crops with seeds provided by the state, insurance mechanisms, irrigation, supplementation or animal confinement, etc. However, interviewed family farmers considered that these innovations are not always reliable due to their high costs and their difficult implementation (mainly bureaucracy, frequent – and costly - trips to town, technicalities).

Overall, interview results showed that, in the face of climatic uncertainties, proper risk assessment might become an important factor for achieving food security and sustainability of family production unit (Porto and Porto, 2014).

Final Considerations

The questions of how to quantify and communicate risk and uncertainty in the climate change arena are currently subject to intense debate, especially within government spheres. It takes more and more responsibility to regulate or control risk, incurring in political and legal responsibilities when things go wrong. While uncertainty points the way to new challenges for scientists, for politicians it tends to generate indecision. Focusing on voters, many policymakers generally invest funds only after receiving a complete set of facts and after the complete elimination of uncertainty, trying to ensure the results of the use of public resources. However, this is an idealistic situation and, in most cases, the scientific community is not able to provide the required level of certainty. Uncertainty, on the other hand, is an inherent part of science, but this is not always easy to explain when it comes to sharing scientific results to the general public.

The reality of family farmers, who survive in the context of the double exposure to market fluctuations and climate change, changes at a faster rhythm than science.

And although on-going research is producing new scientific evidence, the decisions of producers, as well as those of public officers that have them as targets, have to be taken in real time and based on only preliminary estimates.

The present article has proven that family farmers, just as most policy makers, often base their decisions not on scientific evidence, but on their own experiences / life trajectories (tacit knowledge) or even on information provided by non-scientific parties (including the media).

Conflicts often arise from the different points of view on how a problem should be defined – in other words, politicians and scientists approach problems from different perspectives. There are also language and cultural barriers (for example, the fact that much of the cutting-edge scientific production is in English or of difficult understanding for a non-academic audience).

As a matter of fact, and in the context of reflexive modernity, we must accept that one will be never able to completely eliminate uncertainty. In fact, scientific discoveries about risk often create new uncertainties. That does not mean, however, that there is an unbridgeable disconnection between science and policy. Just because a scientist admits he or she does not know everything, does not mean that we do not know enough to act. But the exposure to risk and uncertainty can be very uncomfortable in contemporary societies. Socioeconomic risks linked to globalization and the uncertainties of climate change are difficult to convey. They vary in type and meaning. Communicators and decision makers need to put risk and uncertainty in their correct context and help family farmers to understand what scientists know with a high degree of trust and what not. Without this understanding, many of the adaptation options to global changes remain within the hypothetical field and are not really adopted by target actors. Studies on the climate impacts in developing countries assume the effectiveness of certain adaptation strategies without really understanding the target audience's point of view or without providing explanations on how, when, why and under what conditions adaptation strategies actually happen.

As this study confirms, risk is subjective and climatic risk is related to its perception. This, in turn, determines the attitude of the individual and of his or her community regarding a potential danger. In order to ensure that a politically planned adaptation strategy is fully applicable and applied, it is necessary that the involved actors possess a complete and accurate knowledge about future climate conditions. In other words, they should be "clairvoyant" farmers or even have the ability to predict the future without uncertainty or without perceptual limitations, something which, of course, impossible.

Existing uncertainties and perceptual limitations should not, however, be used as excuses for inaction or as synonymous with no knowledge: the analysis of climate perceptions certainly allows to gather significant information that could bring new elements for actors and institutions to rethink their understanding of risk and to plan better answers. The study of the perceptions of climatic and socioeconomic risks allows us to understand the structure of thought that shape individual and collective behaviours, facilitating the tailoring of public policies.

The present research attempted to demonstrate that it is possible to overcome the barriers created by the subjectivity and limitations of risk perceptions through the creation of an appropriate dialogue and communication between policy makers and family farmers. Effective communication of climate and socioeconomic changes becomes critical to understand, educate, provide continuity and engage constructively decision makers and the most vulnerable sectors. But in order to be effective, communication about climate and socioeconomic risks must begin with a more refined understanding (and recognition) of the social barriers to adaptation, including cultural values and the perceptual limitations of any target audience.

Note

i The size of the productive unit (PU), usually leading to the well-known concept of smallholder, was not a determinant indicator for the selection of the present research sample. Farm size can be a misleading indicator when studying the livelihoods of extensive beef producers in the Pampas grasslands: soil quality and productive levels may vary significantly between areas and among production systems in each of the three studied country. As a result, family as the main source of work force in the PU was chosen as a better indicator for the selection of the study sample (See Methodology).

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CLIMATIC AND SOCIO-ECONOMIC RISKS PERCEPTIONS AND ADAPTATION STRATEGIES AMONG LIVESTOCK FAMILY FARMERS IN THE PAMPA BIOME

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Resumo: No contexto da modernidade industrial em crise, a capacidade adaptativa aos novos riscos climáticos e socioeconômicos passa pelo estudo da percepção e da compreensão desses riscos. Por meio de entrevistas com bovinocultores familiares da Argentina, Brasil e Uruguai, o presente trabalho descreve suas percepções e as estratégias de adaptação face aos riscos climáticos e socioeconômicos que enfrentam no bioma Pampa. Os resultados confirmam que não existe um “pecuarista *clarividente*” que seja capaz de realizar previsões totalmente corretas sobre os futuros cenários climáticos. As famílias entrevistadas percebem com muito maior facilidade os riscos familiares, econômicos e institucionais que ameaçam diretamente a sustentabilidade de sua atividade no curto prazo. Confirmamos que a passagem das situações de risco à percepção do risco está condicionada por barreiras sociais e cognitivas, e isso dificulta as formas de se adaptar e equacionar os conflitos inerentes às mudanças globais nas sociedades contemporâneas.

Palavras-chave: Mudanças climáticas; Agricultura familiar; Risco; Percepções; Modernidade reflexiva.

Abstract: In the context of the crisis of industrial modernity, adaptive capacity to new climatic and social-economic risks depends on the study of the perceptions and understanding that the involved actors have of those risks. Through interviews with family farmers from Argentina, Brazil and Uruguay, this paper describes how they perceive and respond to social-economic and climatic risks. Results confirm that social and perceptive barriers limit the understanding of climatic risks, which are experienced gradually and in the long term. Accordingly, farmers are not farseeing (“*clarividente*”) actors, and are thus unable to accurately foresee future climatic scenarios. On the other hand, beef producers from the South American Pampas do perceive family, economic and institutional risks threatening their productive activities and their livelihoods in a more direct, short-term manner, and do act to face them. This study confirms that the passage from risky situations to an effective

perception of the risk is conditioned by social and cognitive barriers, which negatively affects the management of global change-related conflicts in contemporary societies.

Keywords: Climate change; Family farming; Risk; Perceptions; Reflexive modernity.

Resumen: En el contexto de la crisis de la modernidad industrial, la capacidad adaptativa a los nuevos riesgos climáticos e socioeconómicos solamente se hace posible por medio de la percepción y de la comprensión de esos riesgos. Por medio de entrevistas con ganaderos de carne bovina de corte como principal fuente de ingresos, este trabajo describe las percepciones de ganaderos familiares del bioma Pampa de Argentina, Brasil y Uruguay sobre los riesgos climáticos e socioeconómicos que enfrentan. La investigación confirmó que no existe un ganadero *clarividente* y que sea capaz de realizar previsiones totalmente correctas sobre los escenarios climáticos futuros, que suceden a largo plazo. Las familias ganaderas entrevistadas perciben con mayor facilidad los riesgos familiares, económicos e institucionales que amenazan la sustentabilidad de su actividad y de su modo de vida manera mas directa, en el corto plazo, e actúan para enfrentarlos. Este trabajo confirma que el pasaje de situaciones de riesgo a la efectiva percepción de esos riesgos está condicionada por barreras sociales y cognitivas, lo que dificulta las formas de adaptarse y administrar los conflictos inherentes a los cambios globales en las sociedades contemporáneas.

Palabras Clave: Cambio climáticos; Agricultura familiar; Riesgo; Percepciones; “Modernidad reflexiva”.
