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Drought risk management: Pilot study on vulnerability and local coping strategies

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Abstract. During the worst drought in 5 decades in the central and southern Chile, FAO and the Chilean Ministry of Agriculture joined efforts to carry-out a pilot study to address the vulnerability context and identify local coping strategies. Two cases of study were chosen in drought-prone areas with rainfed agriculture. The different impacts caused by drought and coping strategies were evaluated using a survey and focus groups with rural communities. The results indicate that vulnerability of the rural livelihood is correlated to factors such as: source of income, age of the farmers, distance from urban areas, environment depletion, and lack of social network. The risk reduction measures implemented by farmers prove to be significantly different between the two areas studied, being both ineffective and reactive. The results of this study have supported the design of the National System for Agroclimatic risk management in Chile.

Keywords. Drought – Risk management – Vulnerability – Coping strategies – Rainfed agriculture.

Gestion des risques de sécheresse : Étude pilote sur la vulnérabilité et les stratégies locales de lutte

Résumé. Pour faire face à une des sécheresses les plus importantes qu'ait connu le Chili en 50 ans, la FAO et le Ministère chilien de l'Agriculture ont réuni leurs efforts pour mener une étude sur le contexte de vulnérabilité des agriculteurs quant au risque sécheresse. Cette étude a également servi à identifier différentes stratégies de lutte contre la sécheresse en milieu rural. Deux études de cas ont été menées dans des territoires liés à l'agriculture pluviale particulièrement affectés par la sécheresse. Les différents impacts de la sécheresse sur ces territoires ont été évalués au travers d'enquêtes par questionnaires et de focus groups auprès des communautés rurales. Les résultats indiquent que la vulnérabilité à la sécheresse des habitants ruraux est liée à différents facteurs tels que le type de revenus, l'âge des agriculteurs et des habitants, la distance par rapport aux principaux centres urbains, la raréfaction des ressources naturelles et la fragilité des réseaux sociaux. Dans les deux zones d'étude choisies, les mesures de réduction du risque sécheresse mises en place par les agriculteurs se sont révélées être sensiblement différentes. Les résultats de cette étude ont contribué à la conception du Système National de Gestion des Risques Agro-climatiques.

Mots-clés. Sécheresse – Gestion des risques – Vulnérabilité – Stratégies – Agriculture pluviale.

I – Introduction

In Chile droughts are cyclical and linked to the El-Niño Southern Oscillation (ENSO), causing impacts on agriculture particularly rainfed areas. Precipitations for the last 50 years show a decreasing trend especially where agriculture is being developed, and there is a desertification process affecting one third of the territory (DGF-Universidad de Chile, 2006; Gayoso and Gayoso, 2005). Moreover, climate change will bring important challenges to the agriculture sector, and therefore disaster risk management is becoming a major priority in public policies.

In 2008, the worst drought in 5 decades affected 220 communes that account for 80% of the country. FAO and the Chilean Ministry of Agriculture (MINAGRI) joined efforts to carry-out a pilot study to address the vulnerability context and identify local coping strategies developed by farmers. This was the starting point to promote risk reduction measures, and a more

comprehensive management of the phenomenon. This study is part of the cooperation umbrella between FAO and MINAGRI to develop the National System for Agroclimatic Risk Management¹.

The objectives of the research were: (i) promote the integration of agroclimate risk management in rural development; (ii) characterize the vulnerability context in the environment, social and productive dimensions including the local coping strategies used by the farmers; and (iii) develop an evaluation criteria and methodology to estimate drought impacts.

II – Conceptual framework

This pilot study used definitions from the International Strategy for Disaster Reduction (ISDR), the Sustainable Livelihood (SLV) approach and methodologies developed by the FAO. Risk is "the combination of the probability of an event and its negative consequences". The term hazard refers to "a dangerous phenomenon [...] that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage". Vulnerability is defined as "the characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard".

Climate variability and the impact of droughts influence the range of producer's strategies to cop with disasters, especially in drought-prone areas (FAO, 2006). A perfect strategy for drought management would be given in a theoretical situation where the variability of climate is stable and known, with precipitations and water demands are more or less fixed. But while the climatic variability is unpredictable, the vulnerability of the system increases, and the range of coping strategies is reduced. This research focuses on the current vulnerability of farmers and rural communities facing droughts.

FAO uses the Sustainable Livelihood approach (SL) adapted to Disaster Risk Management (DRM) to define the vulnerability context for drought (Fig. 1). This framework helps to identify which types of households are likely to be particularly vulnerable by setting the family at the centre of the analysis and by identifying the inter-relationships between shocks, vulnerabilities and coping strategies, within the context of on-going policy, institutional and development processes (FAO, 2008).

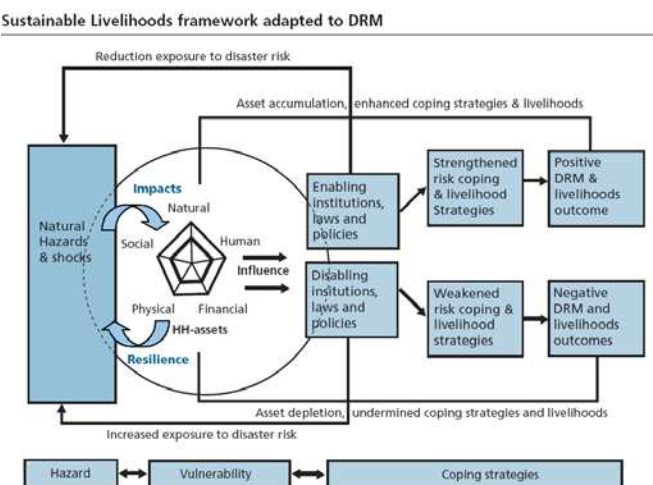


Fig. 1. Sustainable Livelihood framework applied to DRM. Source: FAO (2008).

III – Methodology

The study develops two major analysis: (i) drought impact evaluation; and (ii) vulnerability and coping strategies analysis. The tools used for the analysis are: (i) literature review (social, economic, productive and environmental information, legislation, maps, among other documents of public access); (ii) interviews with key actors (such as institutions and organizations linked to the DRM, farmers and rural people); (iii) survey; and (iv) focus groups with farmers and rural communities.

A surveys of 70 questions addressed to producers and rural communities of the pilot areas. There were a total of 278 surveys applied, 226 in the *Secano O'Higgins* and 52 in *Combarbalá*. The workshops involved the participation of 180 people.

1. Cases study description

This study was implemented in two areas with rainfed agriculture more likely to be affected by drought. These are located in the *Norte Chico* and the Central Valley of Chile, respectively. The first one is a commune named *Combarbalá* in the Region of *Coquimbo* (30°10'-31°15' S, 70°15' W). The second one is represented by a group of 8 communes in the Region of *Libertador General Bernardo O'Higgins*, composed by the following counties: *La Estrella*, *Litueche*, *Lolol*, *Marchihue*, *Pichilemu*, *Navidad*, *Pumanque* and *Paredones* from now on called *Secano O'Higgins* (33°51'-35°01' S, 70°02' E). *Combarbalá* has 12,800 habitants and its total area is 189,500 ha. The population of *Secano O'Higgins* is 54,150 habitants located in a territory of 436,200 ha.

A. Rural livelihoods

The areas studied are predominantly rural (over 60% of the population) and their livelihoods depend primarily on agriculture.

In *Combarbalá*, the prevailing production system is the goat production. The cultivated area amounts to just 2.45% to the total commune area in direct proportion to the irrigated land. In *Secano O'Higgins*, only a 5% of the total area is devoted to crops and plantations. The largest proportion of the land is occupied by grassland (27%), cereals (21%, mainly wheat), fruit (20%), grape vines and vineyards (25%) (INE, 2008). Livestock production is around 536,170 animals mainly sheep production.

B. Climate and drought frequency

The amount of rainfall is nearly twice as high in *Secano O'Higgins* (400-600 mm) compared to *Combarbalá* (150-300 mm) (CEAZA, 2005). They are concentrated during the months of winter (3 and 5 months respectively) followed by a very dry summer.

In Chile, there are not systematic records on frequency and intensity of droughts. The dry years are related to the El-Niño Southern Oscillation particularly La Niña, which creates conditions of extreme and prolonged drought. During a 400 years period, over one hundred of them were dry, half of which were very dry (Urrutia and Lanza, 1993).

Between 1921-1980, *Combarbalá* showed a reduction of the 28.6% on the amount of precipitation. The two major period of drought took place between 1968 and 1972 and between 1994 and 1997 with similar intensity in term of dryness (Kretschmer, 2008). *Secano O'Higgins* does not have records relating to frequency, duration and intensity of droughts. According to Urrutia and Lanza data (1993), there were five periods of drought during the nineteenth century, and six during the twentieth century for this geographical zone.

IV – Main findings

1. Vulnerability factors

Three main aspects identified as vulnerability factors relate to environmental degradation, social vulnerability and fragile productive system. Soil erosion and desertification, as well as unsafe conditions of vulnerable groups (aged population with low incomes, and migration processes), agriculture production limited by water availability, fragile local economies and livelihoods at risk, are the elements that characterize the vulnerability of the studied territories facing natural disasters.

The two case studies suffer from a fragility of their natural environment characterized by a process of desertification, erosion and loss of native vegetation. However, *Combarbalá* environmental situation is worst than in *O'Higgins*. The socio-economic conditions determines the way communities rely on natural resources, including their assets, capacity to save, access and control over land, water and some inputs (seeds), as well as their skills to address the impacts of climate variability. In both case studies, the proportion of rural population is high (over 60%). They have low incomes and a poverty rate higher than the average at the regional and national level. There is an ongoing process of rural migration, ageing communities and increase on the social vulnerability².

The population is economically linked to agricultural production. Small-scale agriculture has a major presence in the study areas. 87% of the land owners in *Combarbalá* and 85% in *Secano O'Higgins* are small. Its economy only has access to local markets and it is exposed to fluctuation of the commodity's prices. In both cases, three major issues for water management are observed: (i) an increase of the water demand by agriculture, electricity and mining sectors, growth of population and consumption per capita; (ii) the water rights³ are almost entirely assigned, which creates conflicts of use in times of drought; and (iii) there are few hydrological studies to account for the quality and availability of groundwater in rainfed areas. There may be causing an over-exploitation of groundwater.

The study produced an indicator of vulnerability to drought from which a vulnerability map was drawn as a first draft. The Drought Vulnerability Index (DVI) incorporated several sub indexes such as: (i) aridity; (ii) soil water retention; (iii) irrigation security; (iv) crop diversity; (v) farmers ability to adapt to technologies; (vi) unsatisfied basic needs; and (vii) social vulnerability linked to agriculture income. This first map presented the vulnerability of the territory by identifying where the most deprived population is located (usually the most isolated areas of territories).

2. Drought impact evaluation

The survey was designed to quantify the economic impacts caused by droughts setting a monetary value on it. However most of the interviewees avoid or did not answered properly the question reducing the validity of the results. This information is primarily qualitative showing general trends.

A. Perception of droughts

The following summarizes the main results related to local perceptions and reported drought impacts through the survey.

a) Previous drought and vulnerability self-perception

Most interviewees remembered the drought of the period 1994-1997, which is the alternative most frequently mentioned second to the 2007-2008 drought. The latest being considered the most important because of the harm caused among the informants.

A significant percentage of users feel they have a high or very high degree of vulnerability being affected by drought. 60% of informants perceived themselves as a vulnerable population to drought. The main impacts of a drought are the lack of food for livestock, livestock mass loss, and problems with drinking water and irrigation.

b] Impacts on water supply

Farmers with low economic income are those who claim to be the most affected by drought on their water supply. These are families whose monthly income is around US\$ 600. About 80% of the informants, who use well water, reported that this supply was affected by drought.

94.6% of producers declared a decrease in water sources. *O'Higgins* recorded a fall on the levels of water sources of over a 40% than average. Regarding the impact linked to drinking water, 25% of informants reported problems of access to drinking water in their homes.

c] Impacts by type of production

The groups with the highest economic losses were cattle producers; this economic activity reports the highest relative income. 49.6% of this affected group were low income families. The crops that were mostly affected, according to the average surface losses were: wheat, irrigated grasslands, cereals and legumes. As for the economic losses caused by drought to crops, 50% of informants reported having financial losses in their crop due to drought, most of them lost up to US\$ 2000.

91.9% of farmers with livestock had problems on feeding their animals because of drought. In addition, 17.4% of farmers reported diseases in the livestock because of drought. 60.4% of those who reported impacts on livestock also note the death of animals. Of all sick and dead animals, sheep was the species most affected. 60% of sheep growers reported having sickness and deaths because of drought, followed by a 30% on cattle.

d] Household income

Regarding the relation between family income and economic losses, people who declare economic losses – regardless of amount – are mostly (72.9%) of family income below US\$ 600 per month. 18.6% of the interviewees farmers declared to have needed an additional job. Apparently income is an important variable in determining the degree of susceptibility to the damaging effects of drought. Consequently, families of producers of scarce resources were the most impacted ones on the various edges of the disaster. These families had negative impacts on their water sources, livestock and agricultural production. Thus, the higher the economic capital is, the better the condition to confront extreme climatic events.

B. Survey as a tool for quantifying impacts

Proper application of the instrument should allow a more accurate evaluation of the level of economic losses caused by drought. At the same time, it can be used in the design of a baseline to assess the degree of effectiveness of mitigation and adaptation measures for future drought events. The survey with the improvements suggested can be a useful tool for assessing the impacts of drought and thereby targeting public policies.

3. Coping strategies and drought risk management

There are some similarities between coping strategies that farmers develop in the two study areas. Among these are: reduction of sown surface and crops prioritization, irrigation management (accumulate, recycle and water right shifts), drill and deepening wells, use of public resources, nomadic summer pastures, do not cross-breed animals and sell cattle in

advance, store fodder, building drinking trough, use of weak sheep for jerky, seek an alternative source of income (i.e. mining activity and agricultural temporary work), use of government aid, community support (social networks). Long term measures to reduce vulnerability are: (i) community training (via radio and peer to peer support); and (ii) increase of production alternatives (i.e. handcrafting, tourism).

Agricultural insurance was rarely mentioned as a coping strategy. Insurance coverage is limited to certain geographic areas and types of production. Farmers informed that they prefer to use the money it would cost to pay insurance to buy seeds, fertilizers and other inputs for production.

Farmers develop strategies to cope with droughts from a contingent perspective in *Secano O'Higgins*. The production systems and farmers in *Combarbalá* implement a large number of coping strategies, as a result of greater exposure to droughts. However, in both cases the set of strategies and adaptation measures are limited. They prove to be insufficient considering the migration process, environmental depletion, limited production alternatives and the high dependency on public assistance, with instruments such as a drought subsidy.

V – Policy recommendations for risk reduction

Based on revised data, we propose a set of actions to take to improve drought risk management, improving preventive measures and accelerating the recovery of livelihoods as follows:

(i) Training of farmers in irrigation and crop techniques adjusted to drought conditions, such as maintenance irrigation, crop reduction, water saving during drought, especially by peer-to-peer experiences. Improve water management efficiency in agriculture, including treatment and safe re-use of waste water for irrigation.

(ii) Increase the investment on irrigation. Building rainwater storage dams, night shifts in dams and mountain river water storage dam. The small reservoirs increase the irrigation capacity, and in term of cost have more feasibility in the rainfed area. Canal lining, well deepening, and others through public tender that acknowledge and prioritize vulnerable territories and those more prone to droughts.

(iii) Introducing and integrating of forage and crop species that tolerate better drought conditions.

(iv) Provide livestock feeding alternatives, such as agroindustrial subproducts. Creation of fodder reserves by producers, government and other associations.

(v) Increase the coverage of agriculture insurance to cover the main production systems at risk.

(vi) Strategies of local development and public policy should integrate vulnerability to specific climate related disasters. Define and implement a diagnosis to serve as a baseline.

(vii) Link public actions towards drought to other regular development programs from various institutions. There is a need for a multidisciplinary and inter-agency drought management task force.

(viii) Diversification and crop rotation and new productive alternatives. Introduce a certain level of flexibility of the water demand enabling agricultural systems to absorb the shock of drought regarding production (yield) and economic return. So to ensure more resilience of agricultural systems.

(ix) Improvement of information and training and re-evaluate the requirements in terms of competitive funds and other programs.

(x) Strengthen local organizations, so as to generate facilitating organizations during drought events (gathering information), which serve as a linkage between community and government institutions at communal, regional and national level. The participation of the community should be given at levels of information, consult and decision.

(xi) Promotion of strategic alliances between the scientific world, public institutions, and local organizations.

(xii) Organizational strengthening and access to information on projects and studies (i.e. through a database), aspects which affect the smooth running of the points previously developed in this paper.

Finally, in order to ensure institutional stability and long term creation of resilience of communities and productive systems, it is necessary to design and implement a National System of Agroclimatic Risk Management which considers public actions in each stage of disaster risk management. It should also take into account different hazards through the heterogeneous Chilean territory, differences in the vulnerability factor and regional and local stakeholders.

References

- CEAZA, 2005.** Levantamiento de la situación Base para el Programa Territorial Integrado, Cuenca Limarí. Informe Final. Chile. 83 p.
- DGF-Universidad de Chile, 2006.** *Estudio de la Variabilidad Climática en Chile para el Siglo XXI*. Chile. 63 p.
- FAO, 2006.** *Livelihood Adaptation to Climate Variability and Change in Drought-prone Areas of Bangladesh: Developing Institutions and Options*. Italy. 56 p. By Selvaraju R., Subbia A., Baas S., and I. Juergens.
- FAO, 2008.** *Disaster Risk Management System Analysis: A guide book*. Italy: United Nations Publications. 78 p. By Baas S., Ramasamy S., Dey de Pryck J., and Battista F.
- Gayoso J. and Gayoso M., 2005.** *Eventos Extremos, Revisión del Caso de Chile 1985-2005*. Chile: Ediciones Universidad Austral de Chile, 35 p.
- INE. 2008.** Compendio Estadístico. Chile, 473 p.
- ISDR, 2004.** *Living with Risk: A Global Review of Disaster Reduction Initiatives*. Switzerland. United Nations Publications. 126 p.
- Kretschmer N, 2008.** Los eventos extremos históricos y futuros: Análisis de riesgo y apoyo a la toma de decisiones – Ejemplo de la cuenca del Limarí. Jornadas de Hidráulica Francisco Javier Domínguez. Chile.
- Urrutia R. and Lanza C., 1993.** *Catástrofes en Chile 1541-1992*. Chile: Editorial La Noria, 440 p.

Notes

¹ This System is part of the actions defined for agriculture sector within the National Action Plan on Adaptation to Climate Change.

² Social Vulnerability is defined by the Chilean Ministry of Planning (MIDEPLAN) as the conditions that increase the probability of being poor.

³ In Chile water rights are separated from land and they could be trade at the market. The government assigns the rights free of charge. When all the water rights are assigned the river or aquifer is declared exhausted.