Dolores after the tornado: collective mobilization, governance, and adaptations in Southwestern Uruguay

Session: Climate Change Adaptation in Coastal Towns and Small Cities

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Abstract

The natural and built environments of rural communities of southwestern Uruguay have recently experienced significant transformations due to climate change and intensification of agriculture. Governance and mobilization can influence how communities respond to challenges created by natural and anthropogenic changes. By deeply examining a small town (Dolores), this study analyzes the characteristics of governance and collective mobilization as well as responses before and after a tornado. Methods and data included semi-structured interviews with key informants, participant observation, and digital spatial analysis (between 2003 and 2016). Local mobilization occurred after the community experienced drastic challenges created by a tornado but results emphasize on the critical aspects of the adaptive responses. Recommendations center on the need to incorporate greater attention to the nature of post-disaster responses particularly housing for disadvantaged households affected by natural disasters.

Introduction

The natural and built environments of rural communities of southwestern Uruguay have recently experienced significant transformations due to climate change and intensification of agriculture (Thompson 2014; 2016; World Bank 2009). Recent developmental shifts and climate change have altered rural communities and their agroecosystems in this region (World Bank 2009). Driven by Foreign Direct Investment (FDI) in land for commodity crops such as GMO soybeans and pulp wood, changes in agriculture have significantly impacted small cities like *Dolores*. Dolores' local agricultural businesses now associated with international companies are among the most important exporters of the country.

Dolores, located in the Department of Soriano, has approximately 17,174 habitants (Instituto Nacional de Estadística (INE) 2011). Since 2002, Dolores and other rural communities located in Southwestern Uruguay, have faced multiple stresses[1], including pollution of rivers and creeks due to the use of agrochemicals and excess use of fertilizers, air quality deterioration due to the emissions of gasses and micro-particles from the construction of grain elevators and agricultural facilities, soil erosion, soil pollution by solid waste, reduction of biodiversity, and other problems related to formal and informal urban sprawl (Intendencia de Soriano 2010; Intendencia de Colonia 2012a, 2012b; Thompson 2014).

In addition to recent environmental stresses created by intensification and industrialization of agriculture, Dolores has been affected by severe weather events. On April 15th 2016, a tornado classified as level 3 in the Fujita- Pearson scale (Escala Dolores 2017) moved across the city from West to East, impacting and damaging infrastructure, public spaces, and buildings. Its major damages occurred in the historical downtown, mixed-use neighborhoods, formal residential neighborhoods, low-income neighborhoods with informal housing, and industrial agriculture facilities located in the periphery.

By deeply examining Dolores, this exploratory case study analyzes the characteristics and influences of governance and collective mobilization on addressing local post-disaster challenges and solutions. We begin the article reviewing the importance of social capital and governance for collective adaptation to environmental challenges. Next, we describe the methods and findings of the study. After describing the characteristics of governance and collective mobilization before and after the 2016 tornado, we highlight the need to incorporate greater attention to the nature of post-disaster responses particularly housing for disadvantaged households affected by natural disasters.

Governance, Social Capital, and Collective Agency on Adaptation

Community or collective agency can be defined as the capacity to make changes at local level through collective actions of individuals, groups, and/or institutions. Collective agency involves social capital, relationships of mutual acquaintance and recognition as a member in a group that provides to each member "the collectively-owned capital" (Bourdieu 1986: 249). Literature on social capital highlight that individuals' and communities' social capital can facilitate access to resources (Putnam 1993; Portes 1998; Putnam 2000; Putnam and Feldstein 2003). Resources provided through social relationships of individuals, groups, institutions, and/or communities can be critical for community adaptation or the mobilization (or use) of resources to reduce and/or adjust to environmental stresses or disruptions and associated risks (Wilson 2012).

A large body of literature addressing human responses and adaptations to environmental stresses (Adger 2003; Tompkins and Adger 2004; Folke et al. 2005; Armitage 2008; Ensor and Berger 2009; Aldrich 2010; Ashwill, Flora, and Flora 2011a, 2011b; Bardsley and Rogers 2011; World Bank 2013) highlights the importance of mobilizing collective agency

[1] Stresses can be defined as significant disruptions of communities with negative consequences or impacts at the local level.

and/or social capital through multi-level relations that could enable decision making processes in regard to how resources are locally mobilized. Evidence from different parts of the world shows that strong relationships within and outside communities (*bonding* and *bridging social capital*, respectively) often improve access to resources prompting local adaptations and sometimes sustainable development (Adger 2003; Tompkins and Adger 2004; Ensor and Berger 2009; Ashwill et al. 2011a; 2011b; Bardsley and Rogers 2011; World Bank 2013). Strong and balanced bonding and bridging social capital in communities (Flora and Flora 2013) can promote active and collective participation at the local level and better access to resources such as scientific knowledge, infrastructure, or machinery used post-disasters. Therefore, it is important to explore how and why collective mobilization occurs at the community level, especially in communities that are at risk (Wright and Boudet 2012) or have already experienced dramatic disturbances such as tornados.

Climate change and resilience literature highlight that communities' perceptions of their own risks can motivate mobilization of social capital and collective agency (see Adger 2003; Tompkins and Adger 2004; Ensor and Berger 2009). This becomes clearly apparent after severe weather events or natural disasters, when communities experience significant stresses locally observed, entering into cycles of social reorganization and sometimes leading to collective actions. By exploring resilience and socio-ecological systems, Walker and Salt (2006) describe four variants for adaptive cycles, rapid growth and conservation of growth ('fore loop'), and release and reorganization ('back loop') when social mobilization may become important. Community 'fore loop' (also called 'forward' or 'front loop') is characterized by accumulation of capitals and conservation of dominant models in place (e.g., soybeans production) to maintain ('system') community well-being before communities experience significant stresses (Walker and Salt 2006). 'Back loop' can occur after significant stresses have been experienced, characterized by great potential for the initiation of creative change in the community, when collective mobilization can have biggest impacts (Walker and Salt 2006).

In summary, community experiences with stresses can either discourage a community from taking any collective action or facilitate mobilization of social capital for adaptation or restoration (Aldrich 2010; Stofferahn 2012; World Bank 2013). By analyzing Dolores before and after the 2016 tornado, we explore collective mobilization and governance as key mediators for the development of community adaptations but we highlight that the nature of developed local responses may represent short-term solutions but future challenges for communities experiencing consequences of climate change such as severe weather events.

Methodology

This study includes data collected during two phases: between 2011 and 2013 and in summer 2018. The first fieldwork (2011-2013) was conducted for one of the author's doctoral dissertation (see Thompson 2014). Preliminary data collected in 2011 and 2012 included newspapers, websites, and conversations with Uruguayan scholars and staff of the *Intendencia of Soriano* (the administrative home of Dolores). During the field work from November 2012 to February 2013, staff of *Intendencia of Soriano* provided contact information of local key actors. Purposive snowball sampling was used to identify and contact other market, state, and civic actors who provided diverse viewpoints of community matters in regard to how the community community was dealing with environmental stresses.

Data collection after the 2016 tornado was conducted by both authors, in June and July 2018. In total, 37 people were interviewed: 23 participants were interviewed before the tornado (November 2012-February 2013) and 14 participants were interviewed after the tornado (June-July 2018).

Before the tornado, data was collected using two semi-structured questionnaires[2], collected data provided information about stresses Dolores faced from increasing changes mainly in agriculture and its associated industries. For this, participants were asked whether the community faced environmental problems created either by humans or natural phenomena such as climate change.

After the tornado, data was collected using a semi-structured questionnaire. Participants were asked about the short-term and long-term impacts of the 2016 tornado on the social and urban fabric. Before and after the tornado, all participants were asked about whether the community developed any response to the environmental problems highlighted by interviewees. They were asked about emergency short-term actions that were taken immediately after stresses, long-term reconstruction plans, and how the different community actors were involved in decision making processes as well as on the mobilization of locally available resources. We explored collective agency by looking at which actors were involved and their roles at the community, and whether they mobilized or organized collectively to develop adaptations for the stresses described.

Using Geographic Information Systems (GIS) spatial analysis was conducted to identify changes in the built environment. This method included image digitization and classification in ArcMap using Google Earth (Digital Globe) images projected into the WGS-1984-UTM-Zone-21S coordinate system. We mapped and identified changes from 2005 to 2016 (before the tornado) of building facilities for agro-industrial purposes, public spaces, transportation (highways and primary roads), and housing (formal, social, and informal). Then, cross-referencing information from *Relevamiento emergencia Dolores* (MVOTMA 2016), we mapped the path of the tornado and its impacts on the built environment. This temporal-spatial analysis of Dolores allowed us to triangulate and verify the data obtained from the interviewees and the observations done during the site visits in June-July 2018. Secondary data included research materials, reports and presentations by non-governmental organizations (NGOs) and new laws and regulations from governmental institutions.

Pre-Tornado: Governance and Collective Mobilization for Adaptation

Previous to the tornado, collective agency described by interviewees included the work done by some civic groups where residents worked together to organize events (e.g., "*Fiesta de la Primavera*" (Spring Festival)) and support local institutions such as schools and the public hospital. In addition to these specific groups at the local level, key individual actors from the market and the state linked the community to diverse outside resources used for public infrastructure or specific initiatives. Before the tornado Dolores did not mobilize collectively to develop responses to environmental challenges (mentioned by interviewees in 2012) such as water quality deterioration of the *San Salvador River* or air pollution from grain elevators located within and outside urban limits of the community.

Interviewees from Dolores highlighted strong sociopolitical relationships between some local individual actors with actors from outside the community (e.g. *Intendencia* or national institutions) facilitated resources to solve some local problems (e.g. the sewer system). In accordance with the existing social capital literature, we found that in Dolores good relationships between the local *Municipio* (municipality), the *Intendencia*, and national institutions were critical for better access to resources from outside the community before and after the tornado. The fact that local and Departmental elected officials belonged to the same political party was described as a benefit for community's relationships with the *Intendencia*. Strong political relationships facilitated resources to address local problems such as urban traffic of heavy vehicles and consequent air pollution in the urban area. In 2010, the *Intendencia* and the

[2] One questionnaire for *Intendencia* staff and another (similar) questionnaire for other actors from the market, state, and civil society involved in the communities.

MVOTMA developed a territorial plan[3] which included regulations and preventive adaptations to mitigate environmental stresses as well as other negative changes. The *Municipio* worked in synergy with departmental and national governmental institutions and local and multinational private actors. However, the characteristics and nature of local responses depended on the local capability to decide about some community's resources. As Thompson (2016) highlights, the dependency of local institutions such as the local municipality on external institutions was seen as detrimental to the development of local responses based on local needs.

The lack of collective responses to address environmental problems, was in part, due to the positive perceptions by local residents of recent developmental changes, facilitated by the "conservation" of the (financial) community well-being. A local farmer highlighted the lack of collective agency to address environmental problems:

> "*Local environmental problems historically have been resolved through initiatives from individuals from the community like important farmers, sometimes in collaboration with the State*." (*Dolores* - Local Farmer, November 29th, 2012)

In Dolores, some resources for adaptation to environmental stresses were –individually- provided either by local agri-businesses (e.g. *ADP*, *Cadol*, and *Barraca Erro*) implemented as part of their social responsibility programs or by national institutions such as the MGAP. The political power of some individual local actors and their legitimacy in the national sphere were very important to facilitate better access to resources that could be used to improve the overall well-being of the community but without considering some of the environmental problems the community was experiencing, especially those related to intensification and industrialization of agriculture such as water deterioration (Thompson 2018).

Post-Tornado: Collective Mobilization, Challenges, and Solutions

The tornado occurred at 4.30pm on April 15th, 2016 in Dolores and it was categorized as F3 in the Fujita scale with winds speed between 250 km/h to 330 km/h. In its pathway from West to East, the tornado passed through three different neighborhoods: Barrio Cadol, Dolores downtown, and Barrio Los Altos de Dolores. Each of these neighborhoods has different demographics with diverse morphologies and building types.

Barrio Cadol is a middle-income and low-income neighborhood that is located in the West part of the town next to an industrial agriculture storage and processing facility. The overall neighborhood has access to potable water supply system, public sewage system, electricity grid, and public street lighting. This is a formal neighborhood with both formal and informal housing. According to the interviewees, this neighborhood has severe overcrowded conditions, having cases of more than one family living in one house and/or more than one house built per site. Most of the housing constructions do not have safe structural systems and are built with brick walls and mud mortar, and light roofing materials (DINOT and Intencia de Soriano 2017, 12).

The downtown is a mixed used neighborhood with commercial, residential, institutional, and religious buildings. It is located in the center of the town and includes the main historical buildings, plaza and cathedral. The housing constructions in this neighborhood range from medium to high quality but the majority of the historical institutional buildings have light roofing materials. Institutional buildings such as the High-school, Union Club, and a church (among others) suffered severe damages and they were in danger of collapse after the tornado (DINOT and Intencia de Soriano 2017, 12).

The Barrio Los Altos de Dolores is a new development located in the periphery of the town and it has access to basic infrastructural services like drinking water supply, electric grid,

[3] Promoted by the national law Nº 18.308: *Ordenamiento Territorial y Desarrollo Sostenible* (2008).

and public street lighting. Like the Cadol neighborhood, Barrios Los Altos de Dolores also had severe overcrowded housing conditions. Most of the housing and land tenure is informal with very precarious housing constructions.

Based on the analysis of all the interviews, it is clear that residents and institutions in Dolores were not prepared to deal with consequences of a tornado. However, unlike attitudes towards environmental stresses before the tornado -characterized by lack of collective mobilization-, immediately after the tornado, collective mobilization for adaptation occurred with the participation of multiple local and outside groups and institutions. The disruptions created by the tornado that destroyed the community, were collectively addressed by different actors from within and outside the community, creating multi-level governance initiatives for immediate responses, with participation of multiple institutions from the regional and national government. As the resilience literature highlight, the community entered into a 'back loop' period after significant stresses have been experienced but when collective mobilization may occur and there may exist a great potential for the initiation of creative change in the community (Walker and Salt 2006) which could not only address immediate problems but also seek long-term sustainable solutions.

Right after the tornado, the immediate actions taken by the municipal government in collaboration with local residents and groups focused on removing all potential safety hazards like the power from the electricity grid, street lighting power, trees, and building debris. A staff from the municipal government stated:

> *"Our first action was to try to get out of danger because of everything that was electrical networks, with respect to the lighting that was all thrown away, cables on the ground, mixed ... we had to make exits and clean the city, remove everything what was fallen, trash, therefore, everything that was danger through which it could fall, electrical networks, trees (…) and we also had to start looking at what the state and situation of housing (of the people affected). "* (Dolores - Staff from the municipal government, June, 2018)

The day after the tornado, the municipal government along with a group of local architects, and other national and local organizations started to survey the damage on housing units and public buildings. The governmental institutions involved in the survey were: Agency of Social Development[4] (MIDES); Agency of Housing, Planning, and Environment[5] (MVOTMA); and municipal government. In addition, there were professional associations involved: Uruguayan Association of Social Workers[6] (ADASU) and the Uruguayan Association of Architects[7] (SAU). The post-disaster relief work of all of these organizations was coordinated by the Departmental Emergency Coordination Center[8] (CECOED) (DINOT and Intencia de Soriano 2017, 12) . The first housing damage survey was conducted by several teams. Each team included an architect and a social worker who worked together throughout the survey process. This first survey allowed to identify a dynamic spatial boundary of the affected urban area which was able to be adjusted with the information collected on site. A staff from the municipal government stated:

[4] Agency of Social Development stands for Ministerio de Desarrollo Social (MIDES)
[5] Agency of Housing, Planning, and Environment stands for Ministerio de Vivienda Ordenamiento Territorial and Medioambiente (MVOTMA)
[6] Uruguayan Association of Social Workers stands for Asociacion Uruguaya de Asistentes Sociales (ADASU)
[7] Uruguayan Association of Architects stands for Sociedad Uruguaya de Arquitectos (SAU)
[8] Departamental Emergency Coordination Center stands for Centro Coordinador de Emergencias Departamentales (CECOED).

"We started a survey together, social workers together with architects. What we did that same afternoon, was practically delimiting what sector it had gone through, and in principle we were all clear about what was affected, that later, let's say, that limit was a bit running and adapting, but if we were clear the place of action, in fact, we created plans, we printed each one of the blocks, we printed some cards which were part of the departmental emergency committee already used as a survey. We had used them successfully for cases of floods." (Dolores - staff from the municipal government, June, 2018)

Once the affected blocks were identified, maps with different levels of building damages were developed. In order to assess the different levels of damages, architects and social workers used three categories: green(A), yellow(B), and red(C). The green (A) category was comprised by buildings with roof damage and load-bearing structure damage. The yellow (B) category was comprised by buildings with roof damage, load-bearing structure damage, and partial damage of the interior and exterior walls. The red (C) category was comprised by buildings with 100% damage of the roof and walls. See Table 1

Table 1: Number of buildings damaged. Source: Documento Diagnóstico Dolores_1504

	Houses	Commercial and Institutional Buildings	Totals
Green (A) category	1022	81	1103
Yellow (B) category	304	55	359
Red (C) category	606	72	678
Totals	1932	208	

Emergency Housing

During the first days after the disaster, an emergency shelter was improvised in the municipal stadium to accommodate the residents of housing units that had suffered substantial damage. After a week of tornado event, these residents started to be resettled in shipping container emergency homes provided by MVOTMA. The majority of these shipping containers were placed in three municipal and public sites: two sites were owned by the municipality (one across the School 97 and another on the Prado Park), the third site was on the land of the elementary School 102. Residents that did not have tenure of the land that they were originally occupying, were relocated in shipping container homes placed in public and municipal sites. For the residents that had tenure of their land, the container homes were place on their own parcels of land.

All these shipping container emergency homes had one room with a bathroom but no kitchen so the residents were not able to cook for themselves. This caused a challenge to the emergency response because food needed to be provided for the residents living in the shipping container homes. Some of the residents lived for more than a year in the shipping container homes and food and meals were provided by the collaborative work organized by governmental institutions and groups of volunteers. This involved multi-level efforts across different groups and institutions.

Another challenge of the shipping container homes solution was that it did not recognize the different numbers of family members per households. Some of the original overcrowding conditions of the informal housing were reproduced by the shipping container emergency homes solution.

Housing Reconstruction

There were around 2000 parcels of land affected by the tornado which is around a third of the entire town. The survey of the damaged buildings (see table 1) allowed to quantify the damage and estimate the costs of reconstruction to identify financial solutions from outside the community. The greatest part of the housing reconstruction was done by the Agency of Housing, Planning, and Environment (MVOTMA) and MEVIR[9].

> *"There were 60/70 new houses of MEVIR, and 180 new houses in total, which were built by MEVIR and a private company. The Intendencia gave the land for the construction of 86 new apartments (multifamily housing) built by a private company." (Dolores, June, 2018)*

There were different solutions for housing reconstruction based on residents' land tenure. For those who owned a parcel of land, the reconstruction was done through self-building housing with materials and technical advice provided by governmental institutions. MEVIR was involved in most of these reconstruction housing solutions which are typically called "MERVIR homes". The MEVIR home is a subsidized housing solution and it consists in a basic core of a total of 30 square meters which includes a single room with a bathroom and an integrated kitchen. They are called basic evolving core[10] because later families could add more rooms according to their needs. However, when families struggle to get the resources to add rooms and to expand the MEVIR basic evolving core, this housing solution tends to reproduce existing overcrowding condition of informal housing. There are additional long-term sustainability and durability issues of the MEVIR basic evolving core that are associated to the low quality of construction materials used to build these types of homes. The MEVIR homes have very low building performance because of lack of appropriate envelope and roof insulation.

Another type of housing solution was implemented for the low-income families that did not own the land that they were occupying. The majority of these families slowly transitioned from the shipping container emergency homes to a social housing complex called *"Complejo el Prado".* This social housing complex was subsided by the MVOTMA and built by Ebital construction company hired by the MVOTMA.

The "Complejo el Prado" is located in the North-Eastern part of the town and it was built on land that was previously preserved as a green space and public park designated by the Dolores Master Plan. The selection of this site for this social housing complex presented a challenge and a controversy within the community. There were community members concerned about the long-term impact of building on a designated green space and public park and community members concerned on giving a timely housing solution to the families that were living in the shipping container emergency homes.

The construction process of the "Complejo el Prado" took more than one year and it involved the construction of eight housing building blocks of one and two stories. There are 86 families and a total of 300 people living in this housing complex. There is a total of 86 units in this complex and each unit is around 40 square meters and has an open floor living-room, a kitchen, two bedrooms, and a bathroom.

The multi-family housing solution did not contemplate specific household characteristics: all the units have the same typology, same square footage and two bedrooms, exposing some large families to overcrowding conditions. Residents in this complex expressed that although

[9] MEVIR (Movimiento para la Erradicación de la Vivienda Rural Insalubre) is a governmental commission for the eradication of the unhealthy rural housing.

[10] Basic evolving core stands for Nucleo Basico Evolutivo (NBE)

they improved their housing conditions, they were experiencing issues trying to adapt to a multi-family housing environment with shared services and prescribed building policies.

The “Complejo el Prado” presented several severe building pathologies within its first year of being built. Some of the pathologies included rain water leaking through walls, windows, and roofs, wall cracking, and bathroom leaking, among others (Notes from the field work). The majority of these building pathologies are caused by the quality of the materials, the lack of quality control during the construction process as well as the lack of appropriate design. These building pathologies could jeopardize the long-term sustainability of this post-disaster housing solution.

Conclusions

This case study stresses the importance of collective mobilization, social capital, and multi-level governance on the access to resources for adaptation to environmental challenges. Like other studies have shown, communities’ perceptions of their own vulnerability and risks influence mobilization of social capital and collective agency and their abilities to facilitate access to resources for adaptation at the local level (Adger 2003; Tompkins and Adger 2004; Ensor and Berger 2009). Despite the multiple environmental problems that Dolores was experiencing before the tornado, local residents and groups lacked of collaborative initiatives to address critical challenges such as deterioration of water and/or air quality. Local residents perceived some of these environmental challenges created by intensification and industrialization of agriculture but their positive perceptions of the overall well-being of the community undermined the existence of potential collective efforts to address them (Thompson 2014).

Local attitudes and responses towards environmental challenges dramatically changed after the community experienced the 2016 tornado with significant damages especially among low-income residents who were living in poor and/or informal housing conditions. The consequences of the tornado affected the overall well-being of the community, prompting collective mobilization of multiple local groups which worked in collaboration with outside individuals, groups, and institutions to facilitate resources for the immediate restoration of the community. Collective mobilization for adaptation occurred when multiple aspects of the community (not only environmental ones) were negatively affected by the tornado.

Most collective efforts focused on minimizing danger and vulnerable situations for residents, rebuilding public infrastructure, and solving housing challenges among low-income residents. Although the immediate collective mobilization and multi-level governance that erupted after the tornado was described as successful by the actors involved, the nature of the solutions or adaptive responses were seen as critical. The consequences from the tornado created a housing dilemma of short-term post-disaster relief which could be characterized as a resilient strategy but with long-term sustainable challenges and critical implications. One of the main challenges is the risk of re-implementing vulnerable construction materials and systems to mitigate pressing needs which will not solve long-term housing needs of those affected by the tornado. These adaptive responses could put people involved in vulnerable situations under similar natural phenomena.

This case study illustrates how and why collective actions and multi-level governance for adaptation may take place, emphasizing on their importance for better access to resources that communities can use to mitigate potential risks or solve problems from environmental challenges. Communities may not respond to ongoing and slow environmental changes if they do not perceive risks and/or other problems created by them. When collective mobilization and collaborative efforts emerge to solve phenomena such as tornados, it is critically important to explore the characteristics and nature of the adaptive solutions which could represent future challenges for communities facing natural phenomena such as climate change.

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