Disaster Risk Management and Territorial Governance: Lessons from Xynthia Storm in France

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Key words: Disaster risk management, Spatial planning

SUMMARY

Xynthia was a violent windstorm which crossed Western Europe in 2010. Its transit caused the death of 59 people in Europe. France was the hardest country hit by Xynthia: 47 people were killed, most of them from drowning, and direct losses amounted to more than 2.5 billion Euros. Strong gusts and waves of several meters of height, associated to high coefficient tides, caused a phenomenon of storm surge in the Atlantic coastal area of France, particularly in the Vendée and Charente-Maritime departments. Sea walls, lacking of maintenance and originally built to defend agricultural land, were not able to protect houses. Around 10,000 people were forced to evacuate after the inundation of their properties. Essentially, a restrictive construction policy is supposed to be applied to these areas. In actual practice, mayors are sometimes not able to resist the pressure of property developers and, since 1999, about 100,000 houses have been built in flood prone areas all over France. During the storm, uncontrolled urbanization was involved in the increase of stakes, as demonstrated by the fact that all the 29 victims in the city of la Faute-sur-Mer were living in houses built after 1980. There is also a very clear link between the type of building and mortality due to marine submersion: three-quarters of the victims died in houses without a second floor, where water reached heights over the ceiling elevation. After Xynthia transit, the government decided to destroy 1510 houses in the affected areas (called black zones). Most of the occupants did not agree with this decision, demanding further investigation, and eventually the government had to gradually revoke the policy for the black zones. We affirm that an attentive governance should include a balanced approach to risk protection, combining the reduction of natural hazard with broader measures of land management, to contemporary diminish vulnerability (e.g. by changing housing standards and building physical protections) and exposure (e.g. by zoning policies). Risk management includes a multitude of actors (national government, local authorities, communities) having different spatial scale and roles, and the difficulties relate to agents myopia, moral hazard problems, and conflicting interests. Moreover real estate market does not appropriately consider risk. We conclude that this complexity has to be accurately considered, and actors must be aware of the long term impact of their decisions. This could permit to improve actual risk governance and contemporary maintain the local economic dynamism.

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1. INTRODUCTION

Xynthia was a violent windstorm which crossed Western Europe between 27th February and 1st March 2010. Developed in the Atlantic off the Portuguese island of Madeira, it first struck the Atlantic coast of Europe, hitting the northern provinces of Spain and Portugal with torrential rain driven by winds of up to 140 km/h[1]. Then the storm moved northeast and crossed France's western coast, before losing intensity on its path through Belgium and Germany and eventually dissipating over the Baltic Sea.

The transit of Xynthia caused the death of 59 people in Europe. Most victims died from drowning or from falling trees and buildings. In France, Xynthia was the deadliest event since the storms Lothar and Martin of December 1999[2]: 47 people were killed, 41 of which from drowning. A further six people were killed in Germany, three in Spain, one in Portugal, one in Belgium and another one in England[3].

France was the country hit the hardest by Xynthia, with the storm uprooting trees, flooding houses, and wreaking havoc in the transport system. One million households lost electric power at the height of the storm in western France. In the Vendée department, on the Atlantic coast, the towns of La Faute-sur-Mer, L'Aiguillon-sur-Mer and La Tranche-sur-Mer were flooded, with water levels reaching up to 1.5 metres[4]. Flooding affected also part of the Charente-Maritime department (in the city of La Rochelle, and in Ré and Oléron Islands, high speed wind up to 160 km/h were registered[5]). Storm property damage was estimated by insurers to 157.7 million Euros (Mercier and Acerra, 2011).

1.1 Meteorological context

From a meteorological point of view, the wind speeds of Xynthia were generally not as intense as other storms, notably Lothar and Martin in December 1999 and Klaus, which struck southern France in January 2009[6]. Meteorological conditions were favourable for Xynthia's development because the storm formed south and therefore was able to tap into an unusually warm and moist air mass. Enhancing the amount of available humidity for Xynthia was the presence of unseasonably warm sea surface temperatures of 14 degrees Celsius[7]. Even if

1 http://news.bbc.co.uk/2/hi/8544002.stm

2 http://france.meteofrance.com/france/actu/actu?portlet_id=50150&document_id=22089

3 http://news.xinhuanet.com/english2010/world/2010-03/03/c_13194575.htm

4 http://www.lemonde.fr/planete/article/2010/02/26/violente-tempete-attendue-ce-week-end-sur-la-france_1311983_3244.html#ens_id=1311986

5 http://france.meteofrance.com/france/actu/actu?portlet_id=50150&document_id=22089

6 Direction Départementales des Territoires et de la Mer de la Charente-Maritime, Élaboration d`un Document «Éléments de Mémoire et Retour d`Expérience» de l'Evénement Xynthia.

7 http://www.air-worldwide.com/NewsAndEventsItem.aspx?id=19015

Xynthia was initially defined as "explosive storm", as indicated in the report of the French Senate of June 2010[8], actually it had the characteristics of a classic winter depression (a decrease of 20 hPa in more than 24 hours)[9].

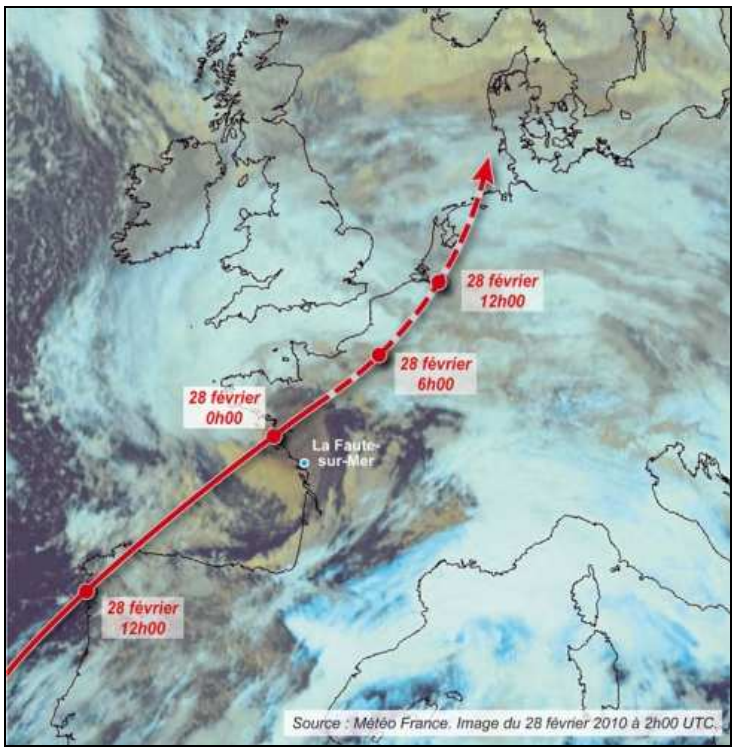

Figure 1: Xynthia storm trajectory on France.

If the storm was trivial in meteorological terms, the area of generation in the open Atlantic and the trajectory of Xynthia are atypical. Atlantic depressions rarely develop themselves at low latitudes and evolve to storms while going up to Western Europe. Moreover, Xynthia arrived on the French coast with simultaneously a high tide coefficient (coefficient of 102 against 77 of Martin storm in 1999[10]) and a very low pressure[11]. The rare combination of these aggravated parameters generated a storm surge and severe marine flooding to French coastal areas, particularly in Vendée and Charente-Maritime departments (Chauveau et al., in Mercier and Acerra, 2011).

2. THE EVENT IN FRANCE

Around 500,000 people were affected by Xynthia in France as the storm uprooted trees, flooded homes and disrupted transportation. The worst of the damage was caused by coastal storm surges: around 10,000 people were forced to evacuate their homes on the Atlantic coast after storm surge flooding inundated their properties. Several sea walls, including those around the Ré Island, were damaged or washed away. The storm surge generated 8 meters waves on Vendee and Charente-Maritime coasts, destroying sea walls and flooding coastal

8 http://www.senat.fr/rap/r09-647-1/r09-647-12.html
9 http://france.meteofrance.com/france/actu/actu?portlet_id=50150&document_id=22089
10 http://actualite.lachainemeteo.com/actualite-meteo/2010-02-27/inondations-littorales---le-danger...-5685.php?
11 Xynthia : zones d`ombre sur les zones noires. Etudes foncieres n. 145, mai-juin 2010.

towns[12]. Reports estimate at more than 9,000 French firefighters and emergency workers backed by helicopters, the deployment on 1st March to reach residents stranded on rooftops, mostly in Vendee and Charente-Maritime (Figure 2). Hundreds of families in coastal regions were forced to seek refuge in shelters that were set up in schools and public buildings[13].

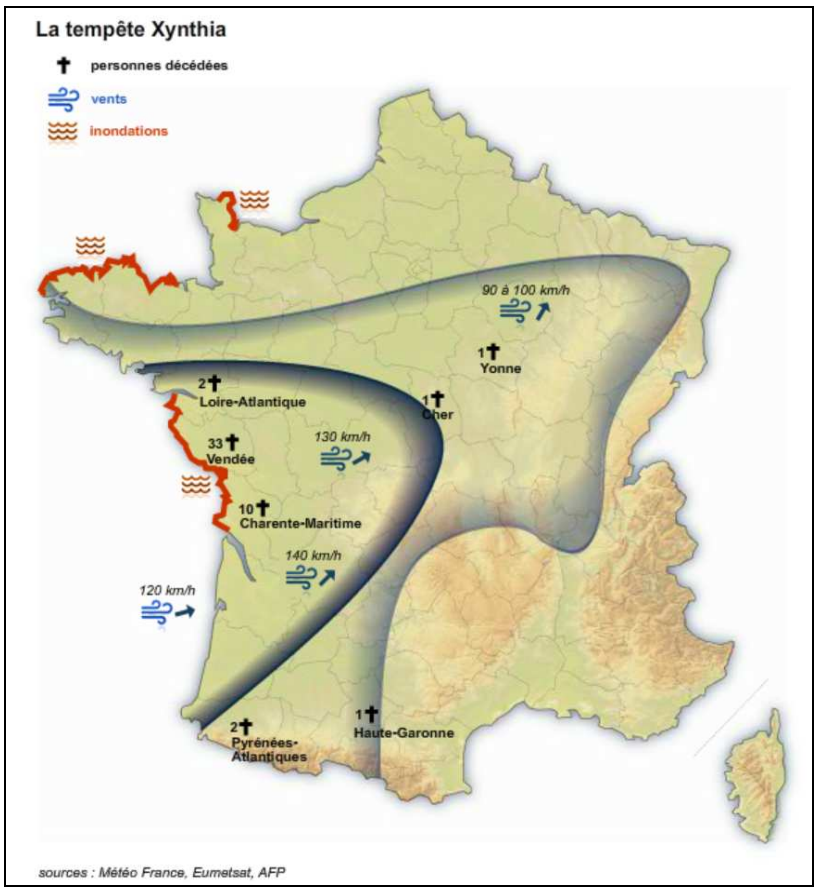

Figure 2: Localisation of the most affected regions in France.

The tourism sector has been hardly hit in the Charente-Maritime and the Vendee where campsites, hotels and many restaurants have been severely damaged[14]. In La Rochelle, a major touristic seaside town, the area around the old harbour encountered serious problems due to the flood. Particularly in the port of Minimes in La Rochelle, the sea inundated the levees: all businesses located in the industrial area were drowned and twenty companies in the sector of shipbuilding were severely damaged[15]. Houses surrounding the harbours were also flooded. A total of 500,000 French people suffered material damages due to the storm. (Genovese et al., in Przyluski and Hallegatte, 2012).

12 http://www.lefigaro.fr/actualite-france/2010/03/01/01016-20100301ARTFIG00009-quinze-vendeens-sont-morts-noyes-dans-leur-maison-.php

13 http://www.guycarp.com/portalapp/publicsite/catdocument.pdf?instratreportid=1921

14http://www.latribune.fr/depeches/associated-press/xynthia-la-charente-maritime-tente-de-panser-ses-plaies.html

15 http://www.allboatsavenue.com/tempete-xynthia-bilan-et-consternation-dans-la-zone-artisanale-du-port-des-minimes-a-la-rochelle

3. EMERGENCY MANAGEMENT

On 27th February 2010 the warning bulletins of Meteo France announced storm Xynthia. In the afternoon a red code (the highest possible alarm code) became effective for various departments, i.e. Charente-Maritime, Vendée, Deux Sèvres and Vienne. Due to the strong wind and probably also due to the possible flooding, various camping sites in the Charente Maritime were evacuated. Meteo-France forecasted the possibility of rising water levels in the coastal area, but could not determine exactly the height of the water.

Meteo France classification of the storm has been contested by local residents and some media reports, with some people claiming the classification should have been of an explosive storm, leading to higher precautions. Therefore no large scale evacuation was carried out since this procedure is not usually carried out in case of storms, which would have saved most of the lost lives. The lack of knowledge about flood scenarios had a negative effect on the warning activities (Maurer et al., 2012).

What has been lacking is not so much information about the windstorm, but rather information about the flooding and the combination of factor, what is usually described as 'coastal event'. Indeed, most of the casualties did not occur in houses facing the ocean but facing the estuary in the inland direction.

3.1 Vulnerability factors

During the storm, flood defences failed at numerous points over more than 300 kilometres along the coastline between Bordeaux and the Loire Estuary. 120 km of dikes in the Charente Maritime department and 75 km in Vendee needed to be rebuilt[16]. Most flood defences were from the 18th and 19th century and were originally built to defend agricultural land. Finally, the dikes may even have been one of the mortality factors instead of being an efficient prevention tools (Vinet et al., in Mercier and Acerra, 2011).

Despite legislation, many houses were built in flood prone areas. They include mainly secondary houses. The structures of the building have had an important role in the vulnerability. Three-quarters of the victims died in homes without a second floor. These houses frequently do not have an exit on the roof and moreover they are often equipped with electric roller shutters, therefore, during a power failure, they become traps. Moreover, the casualties of Xynthia belonged to a vulnerable group: among the 29 victims in La Faute-sur-Mer, 22 were more than 60 years old (Genovese et al., in Przyluski and Hallegatte, 2012).

Essentially, a restrictive construction policy is supposed to be applied to these areas (Chadenas et al., in Mercier and Acerra, 2011). In actual practice, mayors are sometimes not able to resist the pressure of property developers and, since 1999, about 100,000 houses have been built in flood prone areas all over France. During Xynthia storm, uncontrolled urbanization was involved in the increase of stakes, in particular secondary houses were recently built. All the 29 victims in the city of la Faute-sur-Mer were living in houses built after 1980 (Vinet et al., in Mercier et Acerra, 2011).

16 http://www.ffsa.fr/sites/upload/docs/application/pdf/2011-06/bilanxynthia28022011.pdf

4. ADAPTATION STRATEGIES

In order to avoid future similar tragedies, different types of adaptation strategies have been followed: direct, institutional and crisis management measures. Immediately after the event a "defensive" plan was put in place to secure the seawalls that were affected by the storms partially and entirely. A plan of protection has been decided. It includes a data collection and an action to reinforce the dikes on the French coastline.

Xynthia is an important case of relocation both to permanently and temporarily. In April 2010 the government decided to destroy 1510 houses in the affected areas: 915 in the Vendée and 595 in Charente-Maritime. A full compensation was promised to home-owners, based on the real estate value of the properties before the storm. The government first declared these areas to be "black zones". In addition to the black zones the government announced yellow zones, where houses can be built but are subject to appropriate protection. The relocation plan turned out to be really controversial. People felt excluded from the decision-making process and decided not to leave their houses[17]. For the same reason, the mayor of Charron also refused to cooperate[18]. The council of Charente-Maritime unanimously signed a motion requiring further investigation to determine the possibility and costs to protect flood prone areas, before declaring them as unfit for living[19]. At the beginning, the government confirm its decision and was unwilling to re-examine the allocation of the black zones. Later, it started to gradually revoking the black zones policy. Since May 2010, these areas are called solidarity zones and, since June 2010, properties are no longer compulsorily expropriated (Kolen et al., 2010).

5. RISK GOVERNANCE

Risk increase because of the spread of building activities in places not suitable for building. At the same time potential climate changes are likely to cause an increase in number and intensity of natural events. Consequently, the responsible authorities are required to adapt their policies in order to combine flood management measures, spatial development and new strategies on protection standards. Legislation, land use planning, zoning policies, financial disincentives, and flood insurance are some examples to modify the vulnerability of the urban environment to flood damage (Genovese, 2006). The implementation of these measures is confronted with two difficulties. The first comes from the different spatial scales in risk management. The second comes from local dynamics and development.

It is important to distinguish the various stakeholders and their spatial scale and roles in risks management. The State is responsible for the risk definition and for the respect of risk policies. The mayor is the main decision-maker on his jurisdiction territory and defines the Local urban plan, which integrates the plans of Risks Prevention. Several national decentralized technical services serve local public stakeholders, such as territorial communities, inter-municipality structures (e.g. for coastal management), basin committees, and other structure of protection ad hoc. Moreover, transverse stakeholders regroup individuals responsible for local economic dynamism (e.g. for tourism).

17 http://www.lejdd.fr/Societe/Actualite/Xynthia-L-Etat-face-a-la-colere-184963/
18 LEMONDE.FR avec Reuters, 09-04-10: un maire conteste la liste des destructions.
19 http://www.charente-maritime.pref.gouv.fr/actualite/f_xynthia.htm

In terms of risk management, the private land market does not take satisfactorily into account the risk, mainly because of two “market weaknesses”:

- myopia: stakeholders are unable to correctly integrate the risk into their decision-making process and they are unable to take into account the long term consequences in a coherent way;

- moral risk: sometime individuals who make decisions concerning risks are not the same individuals subject to long term consequences (Przyluski and Hallegatte, 2012).

Furthermore, the economic dynamism is strictly related to the land market and it is a driver of urban growth. The valorisation of the land revenue induces economic and services dynamism, increases the possibility of investment in infrastructure, and thus increases the amenities of the territory. In coastal areas, the tourist activity generates employment (trade, services) and increases the number of residents in the area. Beyond the idea of the incapacity of the mayors to resist the electoral and property developers pressure, it is well clear that economic development is responsible for risky decisions. It is therefore a collective system of driving forces, and not only the pursuit of private interest against the public interest, explaining the magnitude of the disaster.

6. CONCLUSION

Xynthia has been one of the deadliest natural events ever occurred in the France history. It has been a storm showing quite trivial characteristics, meteorologically speaking, and has become an absolutely rare event due to a remarkable combination of factors. The storm had effects in population movements, since some damaged areas became non-buildable as part of the plan to prevent flooding. Urbanization in risk areas was involved in the increase of stakes, as demonstrated by the fact that all the victims in la Faute-sur-Mer lived in houses built after 1980. The large number of fatalities in France raised the issue of coastal urbanization, maintenance of dikes and obsolete warning systems. The improvement of land use and coastal development policies is therefore necessary to reduce hazards in these areas.

For a municipality or a local authority, a key issue is maintaining the economic dynamism. Current developments are the direct result of the pressure stakeholders are subject to. Moreover, the stakeholders are not aware that their decisions may have future impacts. A way out to this impasse is a question of democratization of risk, with decision arenas, negotiation and visible and explicit responsibilities, plus the integration with other decision arenas.

We conclude that this complexity has to be accurately considered, and stakeholders must be aware of the long term impact of their decisions. This could permit to improve actual risk governance and contemporaneously maintain the local economic dynamism.

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BIOGRAPHICAL NOTES

Elisabetta Genovese is a researcher in environmental economics and urban development at CIRED, in the team on Vulnerability and adaptation policies to climate change. She has a PhD in Development Policies and Territorial management, and a master degree in Environmental Economics. Her research activities include: quantification of potential monetary impact of extreme events; development of spatial indicators of sustainable development; assessment of risk of natural hazards; mapping of flood risk areas, using GIS.

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Stéphane Hallegatte is a researcher in environmental economics and climate sciences for Météo-France and CIRED. He is lead author of the IPCC Special Report on managing the risk of extreme events to advance adaptation and contributing author of the working groups I and II of the IPCC fourth assessment report. He participates in the French inter-ministerial working group on the assessment of climate change impacts, and has been consultant for the OECD. His research interests include the economic consequences of natural disasters and the development of public or private strategies to adapt to climate change.

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