Risk Nexus

Morocco floods of 2014:
what we can learn from Guelmim and Sidi Ifni

Contents

Cover: An inlet and nearby harbour at Sidi Ifni (photographer: Getty Images/Michael Fay).

Foreword

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There is a saying that more people drown in the desert than die of thirst. Inhabitants of the arid regions of Morocco know this all too well. Morocco has experienced no fewer than 35 floods over the years from 1951 to 2015. Flash floods can fill dry stream beds, 'oueds' or 'wadis,' very rapidly, often taking a heavy toll in terms of human life. Floods also wreak havoc on property and destroy infrastructure, leaving a legacy of misery for those living in affected regions.

Floods are nothing new for Morocco, where traditionally floodwaters were welcomed as a source of essential irrigation for crops. But in recent years, rapid population growth and urbanization have put more people and vital infrastructure at risk. The impact of weather extremes and other factors have also created real challenges to those seeking to come to grips with ways to enhance flood resilience in the region.

This study focuses on the impact of extreme floods in Sidi Ifni and Guelmim, two regions in southwestern Morocco, in November 2014. We gained invaluable insights from extensive interviews with those directly involved, including residents and local administrators, and officials who directed response at the national, district and local levels.

We would especially like to acknowledge the efforts and contributions of time and knowledge by several individuals at Targa-AIDE, a non-governmental organization based in Morocco. Without their dedicated efforts and painstaking research, this study would not have been possible.

Floods, no matter where they occur, often share similar traits, so the knowledge we gain by studying one flood event can be applied to different locations. Learning is essential for increasing communities' resilience. It is not always easy to learn from events, but it is a key element that can be achieved through the right processes.

The findings presented here build on similar research in other countries, where communities regularly face flood risks. We believe these post event review capability, or 'PERC,' studies, can provide a valuable basis for taking the first, critical steps toward enhancing resilience. We want to share what has worked well so others can profit from it, but also what has not worked so well, was underestimated, forgotten or what has failed so it can be done better next time. We encourage anyone in Morocco and beyond to conduct such research in the future, and to benefit from implementing such an approach and the subsequent lessons learned.

Zurich's flood resilience alliance brings together organizations with complementary skills and expertise to find the best solutions to address flood risk. This helps to provide a basis for long-term resilience, saving more lives and mitigating the damage floods cause. We believe that working together, we can make a difference to mitigate the impact of floods, which affect more people each year – often the poorest people and communities – than any other natural catastrophes.

Executive summary

Morocco has experienced no fewer than 35 floods over the years from 1951 to 2015. Traditionally, floodwaters have provided irrigation in arid regions. But as infrastructure has been built up and the populations have increased, floods have become a menace and local knowledge to handle the situation has been lost, as a deadly flood in November 2014 in Morocco's southern region all too clearly showed.

The November 2014 flood is the subject of a study published by Zurich Insurance Group produced as part of its flood resilience alliance,[1] based on research carried out by Targa-AIDE, a non-governmental organization based in Morocco. The insights gained from the study are valuable not only for Morocco. The findings can also contribute to efforts in other countries to improve flood resilience.

Morocco provides an example of how the world is changing and the impact this is having on flood risk. As the country urbanizes, those floods once so important for irrigation have become a threat to the populations living in arid and semi-arid regions, where 'oueds' or 'wadis', the typical dry channels, can swiftly become raging torrents.

The floods that are the subject of the study had devastating consequences in two regions in southern Morocco: 47 people lost their lives, and countless others suffered long-term consequences, both material and psychological, due to damages to homes and critical infrastructure and support networks. Floodwaters knocked out communication lines and destroyed water and sewage systems. Months after the floods, the damage still affects peoples' lives and well-being.

This paper examines in detail events over two periods, from November 20-24, and November 25-30, 2014 based on information collected through surveys and interviews by Targa-AIDE; its research included surveying individuals, interviewing officials involved in response and recovery, and other efforts to gain insights on the situation leading up the floods, the disaster as it unfolded, and the aftermath. The findings offer insights on how to improve the area's resilience and reduce its vulnerability.

Flooding and response is examined in particular in two towns, Guelmim and Sidi Ifni. Guelmim was hardest-hit by the first phase of floods, and experienced over 30 deaths. Alerted by the tragedy in Guelmim, authorities in Sidi Ifni, where floods struck with fury in the second weather phase, had time to take steps that likely averted casualties. Even so, that region suffered heavy damage to critical infrastructure that still affects the lives of people living there.

The study discusses ways that the Moroccan government is working to improve its procedures and be more effective in terms of disaster response. More funding is being allocated that should contribute to efforts to find solutions. For example, Morocco's government has set up a disaster fund, the CAS-FLCN (Fonds de Lutte Contre les effets des catastrophes Naturelles), to deal with natural hazards. The fund aims to co-finance projects to better protect vulnerable people and properties at risk. It also seeks to make the country more resilient to disasters.

[1]For more on Zurich's flood resilience alliance, see: www.zurich.com/en/corporate-responsibility/flood-resilience

Importantly as well, prior to these floods, there had been little focus in Morocco on long-term risk prevention and mitigation. Most of the efforts dealt instead with responding once an event had already taken place. Among the insights gained as part of this study, the events of November 2014 may have contributed to a change in mindset in the country, leading it to place more emphasis on mitigating risks, rather than responding to a crisis once it happens.

The study includes recommendations to increase flood resilience: One urgently-needed way to address the risks would be to install early warning systems in Morocco's southern region.

Beyond that, improving data, flood maps, weather forecasting and disaster protocols would represent significant contributions in efforts to increase resilience.

Besides Morocco, other countries need to increase flood resilience. Among the requirements is an open mindset to address the root causes of floods. Accessing the 'Five Cs'[2] – five types of capitals that communities can draw on – will better enable them to cope with floods and improve resilience.

Any approach will require new thinking, and a willingness to address the root causes of problems. A mindset open to change is needed.

As part of Zurich's flood resilience program, the post event review capability (PERC) provides research and independent reviews of large flood events. It seeks to answer questions related to aspects of flood resilience, flood risk management and catastrophe intervention. It looks at what has worked well (identifying best practice) and opportunities for further improvements.

PERC analyses use a combination of two complementary conceptual frameworks: the ISET Climate Resilience Framework (http://training.i-s-e-t.org) and the Zurich flood resilience alliance framework (https://www.zurich.com/en/corporate-responsibility/flood-resilience).

[2]The 'Five Cs' or 'Five Capitals' refer to five core asset categories that can be drawn on to improve the lives of people living in communities: human capital, natural capital, financial capital, physical capital, and social capital. A key part of the work the flood resilience alliance does with communities involves measuring resilience. This helps to establish whether actions to increase resilience are effective. For more, see 'Enhancing community flood resilience: a way forward' at http://knowledge.zurich.com/flood-resilience/risk-nexus-enhancing-community-flood-resilience-a-way-forward/

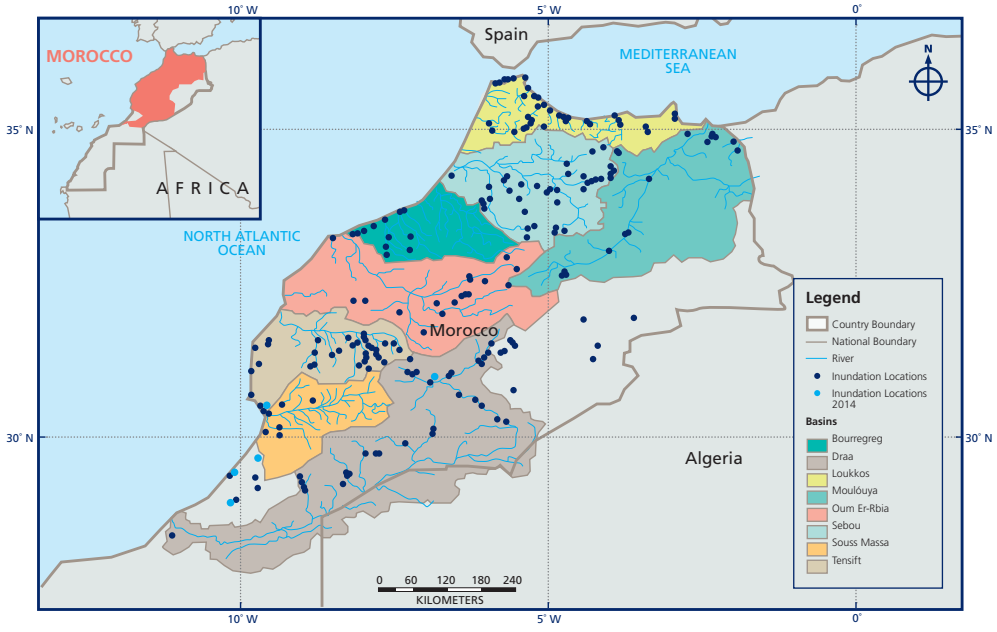
Overview

“The floods had dire consequences: 47 people died in the southern provinces, and losses totaled over 6 billion dirham. Roads were cut off, levees collapsed and power outages affected large parts of the population.”

Although often thought of as semi-arid, Morocco is a country where floods are common (see Figure 1). Traditionally floods were considered to be a beneficial source of crop irrigation. But as the country develops and the population, particularly in urban centers, grows, floods have come to constitute a recurring hazard. This study reviews the flood events of the last ten days of November 2014 in two regions of southern Morocco, aiming to consolidate the information we gathered to improve the area’s resilience, reduce the regions’ vulnerability, and help people to be better prepared and better protected in similar events in the future.

Based on research carried out by the Morocco-based NGO Targa-AIDE,[3] we examined events and their consequences from severe floods that followed two successive periods of rain between November 20 and 24, and November 25 to 30, 2014. The resulting floods had dire consequences: 47 people died in the southern provinces, and losses totaled over 6 billion dirham (USD 600 million). Roads were cut off, levees collapsed and power outages affected large parts of the population. The impact on people’s lives was still being felt six months later when our research was conducted.

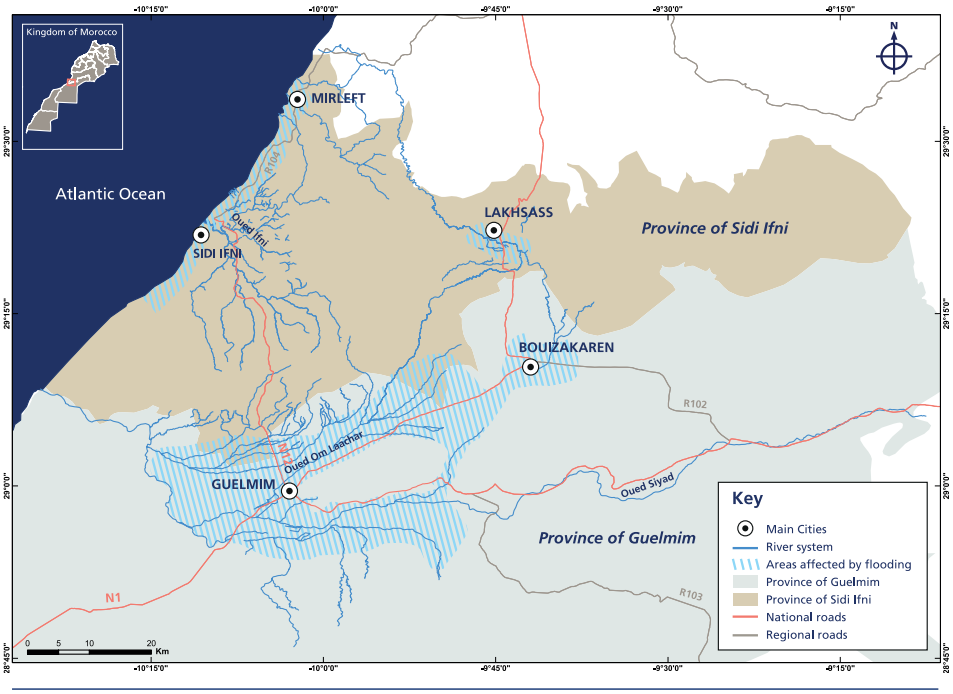
Figure 1: Historic flood location map. Source: Map updated based on World Bank report and data from the Ministry of Environment, Water Resources Department, Government of Morocco



A list of acronyms used in this report can be found on page 28.

[3]www.targa-aide.org/

Figure 2: Map of general area and flood situation. (Source: Targa-AIDE)



The study focuses in particular on Guelmim and Sidi Ifni, two provinces (with cities of the same names) in two different watersheds (see Figure 2). Because of their proximity, the two watersheds are often affected by the same thunderstorm or rainfall events. But such events can have a vastly different impact.

Guelmim province is a transitional zone between the Sahara and the plains of the Souss, and the capital of the province, Guelmim, borders on the oued Oum Laachar, which played a significant part in the November 2014 floods.[4] The first phase of flooding caused a number of deaths in Guelmim.

Sidi Ifni province along the Atlantic coast in Morocco's extreme southwest includes the town of the same name (see Figure 3). The city is located against the mountains of the Anti-Atlas on one side and spreads along the coast of the Atlantic Ocean on the other, which gives it a strongly rugged terrain. Crossed by Oued Ifni with its wide outlet, the city is divided into two parts (as shown in Figure 3). The part of the city with the most historic, economic and administrative activity has developed on the gently sloping left bank, which also attracted dense urban settlements. The majority of transport connections to neighboring cities also merge here. The right bank is dominated by a military district and a residential area. The houses on this side of the river are relatively far from the river and separated from it by a steep slope. Near the beach, the very wide bed of the oued is covered by surface waters during the short rainy period of the year. Four campsites and several small hotels and lodges are located there. In the vicinity there is a hill dam, Assif El Krayma, built in 2012, which serves as a buffer against floods. The November 2014 floods demonstrated the risks of relying on such structures for protection.

[4]In this report, the terms 'oued' and 'wadi' refer to channels that might be dry, but can quickly fill with water and become raging torrents when it rains. In the case of proper names, the word 'oued' precedes the specific name of the channel – for example, 'oued Oum Laachar' (or in French l'oued Oum Laachar) refers to the Oum Laachar wadi, or channel.

“In the mountainous areas near the coast, episodes of intense rainfall cause very high surface runoff, which generates floods in the wadis that can quickly reach high peak flow.”

Figure 3: Map of city of Sidi Ifni (Source: Targa-AIDE)

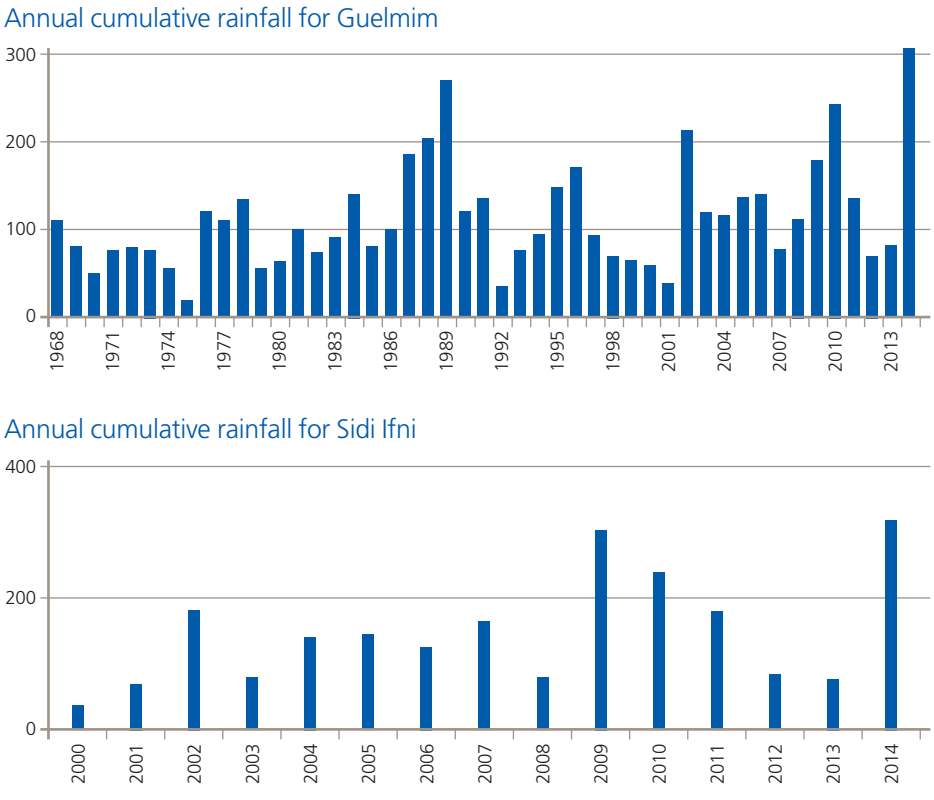
It is important to note certain factors in the area have a direct impact on the extent of the floods:

Rainfall intensity and duration: In the mountainous areas near the coast, episodes of intense rainfall cause very high surface runoff, which generates floods in the wadis that can quickly reach high peak flow; this is especially the case in the Sidi Ifni Basin, where slopes are steep. Rainfall can vary greatly from year to year, with a series of several dry years interspersed with years when precipitation can lead to significant floods (see Figure 4).The rainy season runs from September to April, with maximum rainfall typically occurring in November. Rain tends to fall from between five to more than 15 days per year. But there can be a series of several dry years, as was the case, for example, from 1992 to 1995, when annual rainfall totaled only 24, 52 and 72 mm, respectively.

Watershed shape: For watersheds of roughly the same size, it takes less time on average from rainfall to flood onset in a rounded basin (as is the case for the coastal basin of Isni) than in an elongated basin (the Guelmim basin) (Refer back to Figure 2).

Vegetation cover and the soil absorption capacity: The heart of the lower plains has an arid climate with mild winters. Due to deforestation, today this area has almost no vegetation. Shallow, sandy, gravelly soil means both summer droughts and intense rainfall can have significant impact.

Figure 4: Historical annual cumulative rainfall records in Guelmim over 45 years[5] show how irregular rainfall can be, with years of drought or heavy precipitation; floods in 1968, 1985 and 2014 were declared to be a 'one-in-100-year' events. (Source: See footnote for full explanation)



[5]Data between 1968 et 1999 have been collected by the author from reports such as 'Evolution Climatique et Santé,' 2nd report UMR 144 LISAH – IAV, Hassan II, September 2005. Data between 2000 and 2014 originate from the National Meteorological Service (DMN).

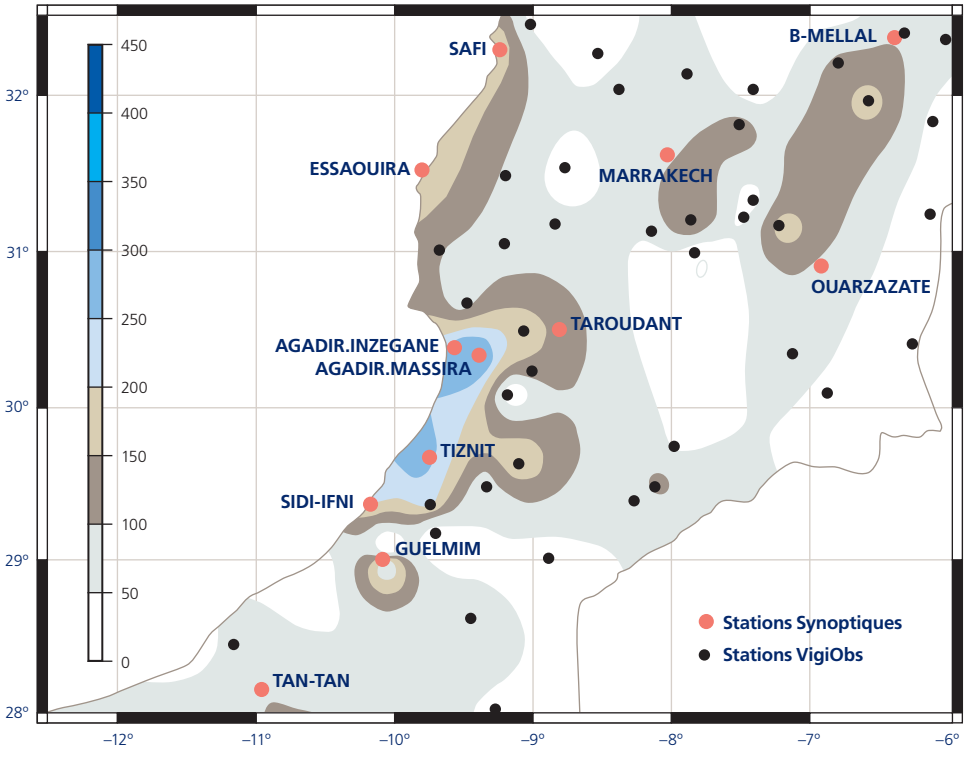
Section 1
Chronology of November 2014 flood events

The following descriptions, many based on field investigations, describe the flood events in the regions of Guelmim and Sidi Ifni during the period from November 20, 2014 to November 30, 2014 and include a brief update on the situation six months after the floods. Beyond explaining how the floods developed and the responses to them, these observations offer insights from people directly affected, as well as others involved in response or related roles.

The torrential rains from November 20 to 30, 2014 brought to the central, southwest and southeast regions of Morocco precipitation that was exceptional. Several records (both daily and monthly) were broken. In the axis of Guelmim to Sidi Ifni, between November 20 and 30 there were 10 days of rain, with a one-day pause in the middle of this period, on November 25. This dry day divides the event into two phases. It was during the second phase that the record of daily rainfall totals was beaten on November 28 with 78 mm of rain at Sidi Ifni and 39 mm at Guelmim. Both event phases had a very different impact on the territories of Sidi Ifni and Guelmim – barely 65 kilometers apart.

The map (see Figure 5) shows the distribution of accumulated rainfall during these last 10 days of November 2014. These measurements were provided by 11 stations within the national network, which are internationally accredited and 30 unlicensed stations, which supply the databases of the National Meteorological Service (DMN).

Figure 5: Geographic overview of the cumulative rainfall during the final 10 days of November 2014 supplied by 11 internationally-standardized weather stations ('synoptiques') from the national network and 30 local stations ('vigiObs') that supplement the data, allowing for more precise analysis by the National Meteorological Service (DMN).



Weather warning fails to draw attention: November 19

On Wednesday, November 19, 2014, Morocco's National Meteorological Service (Direction de la Météorologie Nationale, DMN) issued a weather advisory warning of rain. It was sent to nearly all Moroccan daily newspapers and broadcast on national television. But the warning failed to prompt any local authorities to immediately mobilize a response or warn people living in Morocco's southern regions of heightened risks, even though flooding constitutes a real hazard due to numerous 'wadis' (dry washes) crisscrossing the arid landscape in this region that can quickly become raging torrents when it rains.

Figure 6: Illustration of ways flood waters flowed in the oued Oum Laacher in Guelmim. (Source: Targa-AIDE)

The first phase of rain: November 20 – 24

The rains began on November 20. On the morning of November 22 in Guelmim, the 'deviation' dam built on the oued Oum Laachar near town had overflowed. This posed no immediate, serious risks. However, by early evening, the situation became more threatening as water reached a bridge a few hundred meters from the dike. The dike had not been built to a size adequate to take up the oued's flow. The river thus flowed into its old, natural bed around the city, rejoining the Sayed oued south of Guelmim.

As shown in Figure 6, the dike (yellow marker) was built to ensure that floods are not too severe, at least as long as floodwaters can be diverted to the retention area shown in blue small arrows. But on November 22, the dike was overwhelmed by the flows; most of the water thus ran straight through the old wadi bed (large blue arrows), causing flooding in the city; only a small part of the floodwaters could be diverted to a retention area.

Fatalities in Guelmim

Late in the evening on November 22, authorities began to receive word of the first flood fatalities. Guelmim suffered a heavy toll on human life: A large number of those killed were drivers and passengers swept away in their vehicles.

The national Monitoring and Coordination Center (CVC), one of two organizations mandated with dealing with floods on a national level, was alerted. Roads were all closed to traffic. By the morning of November 23 the news of the disaster had gained national attention, and Civil Protection Service reinforcements began to arrive by air from central Morocco.

On November 23, 2014, high-level meetings were held in the capital of Rabat to address the unfolding crisis. The Ministry of the Interior sent a dispatch on November 24 after severe flooding had already occurred in most southern provinces. By then, the disaster in Guelmim was not only making national news but also gained international media attention. In the Ministry of the Interior in the capital, a national crisis committee met under the leadership of

Even though the threat had grown more obvious, many residents refused to leave their property, believing it was an excuse on the part of the local authorities to permanently relocate them."

the Ministry's secretary general. The next day, the Ministry's instructions were dispatched to all provinces based on the weather alert in Sidi, and the provincial governor held a meeting of the commission responsible for monitoring and managing natural hazards.

A pause, then rains resume: November 25 – 26

So far there had been little rain in Sidi Ifni but a meeting was organized there on November 26 at the request of the Rabat central crisis committee. This emergency meeting seemed to some at first to be more than the situation warranted. The commission discussed the city's emergency plan (ORSEC) and, as the meteorological service had forecast a second phase of rain, it put the CVC on standby.

Despite concerns, measures were not all put in place immediately on November 26; that day and the next, rainfall remained relatively modest, making it hard to imagine that a disaster on the scale of the one in Guelmim could unfold in Sidi Ifni. Local authorities issued some warnings to residents, and especially to tourists at a beach campsite near the mouth of oued Ifni. But neither those living in vulnerable neighborhoods, nor the tourists appeared to take these warnings very seriously, believing the authorities were simply being overly cautious. The national weather service continued to broadcast alerts on television.

Sidi Ifni braces for floods: November 27 – November 28

During the night of November 27 and into the morning of November 28, the rain intensified. Despite providing some protection, the Krayma dam (see also page 21) played a limited role in the first phase of precipitation. A portion of the total rain that fell over the entire catchment area of Sidi Ifni flowed into in a dammed-up reservoir. But as rain intensified, it proved too much for the structure: water began to spill over the dam, flowing into the city, which significantly contributed to flooding.

The city streets in Sidi Ifni became raging torrents. But the disaster and the trauma in Guelmim five days earlier had at least encouraged authorities in Sidi Ifni to mobilize in advance. At least five hours before the anticipated flood peak, authorities ordered the population to take measures to protect themselves, and immediately closed roads at risk of flooding.

Authorities forced tourists staying in the campsites to evacuate to higher ground: More than 140 caravans from three main camping sites were moved to hangars at the airport. People living in houses built more or less in wadi's bed also were moved. But even though the threat had grown more obvious, many residents still refused to leave their property, believing it was an excuse on the part of the local authorities to permanently relocate them (see also page 24).

Floods peak in Sidi Ifni

On November 28, the day of heaviest rainfall (see Tables 1 and 2), the Sidi Ifni station received 78 mm total rainfall, exceptional on daily and decadal scales, with a return period of one-in-40 years.

The measurement of the maximum flow of the wadi downstream of the dam by the Basin Agency was 1700 m^3/s, 12 times the average flow of Oued Sebou, the country's main river. This exceptional flow rate is considered a one-in-100-year flood. In 1985, the observed flow was only 1000 m^3/s. The violence of the 2014 flood deeply eroded the banks, taking all the surrounding infrastructure with it. The roads, often built along the wadi beds, were destroyed and isolated the city. Landslides also hampered roads not already destroyed.

Table 1: Overview of daily rainfall during November at two stations (mm).

Day	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Sidi Ifni	0	0	0	0	27.5	25.4	23.2	11.4	4.8	0	6.4	3.7	**78.4**	24.3	8.3
Guelmim	0	0	0	0	33.8	29.1	30.1	33.8	1.7	0	10.4	3.3	**39.4**	29.4	8.0

Table 2: Maximum and cumulative rainfall for the two areas forming the core of the study area (mm).

	Maximum daily rainfall (mm)	Cumulative
Sidi Ifni	78	220
Guelmim	39	224

In Sidi Ifni, probably the most paralyzing aspect hampering authorities' response was the loss of critical services, including the mobile phone network and power. During the flood, the two sides of the city were totally cut off from each other. Even though all districts on the right side of the river in Sidi Ifni are on higher ground and away from the flood waters, these were separated from the centers of decision-making and action. On the left bank, fifty houses were flooded. The people in these homes were forced to take refuge on terraces and wait for rescue.

But in contrast to Guelmim, there were just three deaths in the province at Sidi Ifni; these were in the douar[6] of Taddart where, tragically, a school suddenly flooded. Material losses were very high, however, and included extensive damage to vital infrastructure (roads, water, electricity and fixed-line and mobile telephone networks).

In the city of Sidi Ifni, three sturdy houses collapsed, 50 homes were severely damaged and 55 were partially damaged. Further damage occurred at the camping sites near the mouth of the wadi.

A disaster area: November 29 and beyond

On November 29, Guelmim province was declared a disaster area. This status allowed the state to mobilize all its resources, particularly those of the army and the national civil protection.

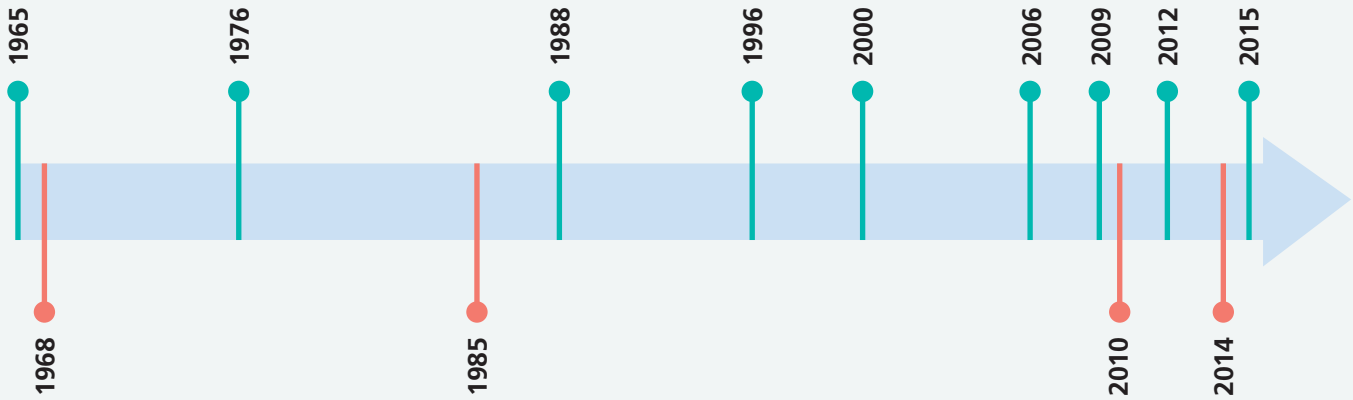
The human toll of these floods was catastrophic: by the time the floods had abated, a total of 47 people had died – 32 in Guelmim alone.

Sidi Ifni also faced problems mobilizing: "There were more than 20 blocked roads. It took four days to make the city of Sidi Ifni accessible," said the provincial director of the Department of Equipment.

The damage left by the floods was also seriously debilitating for people living in the regions affected. In Sidi Ifni, numerous administrative and cultural buildings were severely damaged. Drinking water for the entire city had to be transported by truck from Tiznit, 75 km away. The city's sewage pumping station and some districts on the right bank were washed out. Repairs and temporary arrangements to this facility posed a great inconvenience, and apart from noxious odors, provided a breeding ground for mosquitoes. Infrastructure and major equipment were destroyed in a quarry. When our survey was conducted six months later, the quarry still had not resumed operations. Local residents said repairs to these vital facilities had suffered delays.

[6]A douar is a village-like settlement, often a group of tents or huts arranged in a circle around an open space.

Timeline: Key developments in Morocco's flood protection efforts



Years in red: significant flood events with major damage in Sidi Ifni and Guelmim

1965: Work on Gabion structures to deviate water at Nkhilat in Guelmim (ONI)

1976: Study on how to protect Guelmim city against floods is launched by the Ministry of Public Works

1988: Studies for the protection of Guelmim city launched after the interministerial meeting of Oct 20, 1987

1996: Dam constructed to retain flood waters of N'Tiktane wadi (tributary of oued Oum Laachar)

2000: Dam constructed to retain flood waters of Daoud wadi (tributary of oued Oum Laachar)

2006: Establishment of the National Plan to fight flooding (Plan National de Protection contre les Inondations, PNI)

2009: National natural hazards risk management strategy implemented by the CVC

2012: Karyema dam completed in Sidi Ifni

2015: First call for proposals for FLCN

Section 2
The surveys, interviews, research

Our field work conducted as part of this study covers the province of Sidi Ifni. The research we were able to carry out here, including surveys, offers highly valuable insights that underscore the importance of learning from such events. Gaining access to key information will significantly contribute to Morocco's long-term goal of increasing flood resilience in communities. Along with 30 household interviews (for details on the households surveyed, see page 27), focus group interviews were held with members of 'civil society' (in particular local non-profit organizations), as well as people involved in an economic capacity, local elected officials and the authorities. Some individual interviews were conducted with commercial and political leaders of the province.

Households

Two-thirds of the households surveyed for this study were informed of the risks of an impending flood by the media (40 percent) or by the authorities (27 percent). During the three days leading up to the disaster, the authorities relayed an alert to the inhabitants, but despite these warnings, the floods' magnitude exceeded all expectations. Of those surveyed, 64 percent had experienced several floods since a major flood in 1985 – some had even experienced five or six floods; but none was as severe as the November 2014 flood. The majority of families surveyed believed that the November 2014 flood's intensity was associated with the effects of climate change, implying that most believe more floods of similar magnitude can be expected in the future. But they also cited lack of the maintenance of the river bed and the development as reasons for the devastation. Urbanization has come at the expense of limiting rivers' freedom to establish their own beds. The spaces where wadis can expand without damage at flood stage and where beds can meander to meet the constraints of extreme flows, and change course, are gone.

People surveyed believed that local authorities' priorities should be to: i) install an effective early warning system; ii) improve the education and information of the communities to better prepare them for such disasters; iii) prepare a community emergency plan to manage these risks and provide all the necessary instructions to residents.

The floods mobilized public response. Since the disaster, 45 percent of those surveyed said they have organized petitions and public protests demanding compensation or that measures be taken to protect them against future floods. Respondents expect more floods in the winter of 2015, believing the impact would be more catastrophic than the 2014 floods. And nearly all respondents (95 percent) said they were ready to personally better prepare for future disasters, for example, by taking basic first aid training, or by helping to improve community risk management in their neighborhoods.

Asked if they could make changes to avoid having to relive the same situation again, two-thirds of households surveyed said they were unable to make changes – but if the opportunity arose, they would indeed move to safer neighborhoods or leave the city of Sidi Ifni completely, at least during the winter.

Elected officials and representatives of external agencies and civil society agree that there is a need for more information and training on risk management."

Civil society, local officials, authorities and others

Focus group interviews were held with the civil society (essentially local non-profit associations), local elected officials, authorities and others. Local elected officials and the local authorities who participated in the interviews for this study cited constraints due to problems with infrastructure and aid distribution.

A supervisory commission of such aid was established, chaired by the secretary general of Sidi Ifni. The commission decided that the goods would be sold by the merchants of the city at nominal prices to avoid logistical and organizational constraints, and to help establish a support fund for the rural population. For people in more remote, rural areas however, aid was distributed more typically by air.

"We met many constraints to distribute this aid, for example the lack of logistics. We faced two choices, the distribution of aid or the use of the local market," one local official said.

During the event, the Civil Protection Service found itself with limited means. A scenario of what could potentially happen had never been drawn up and thus the need for a mobilization from other cities never anticipated. When it was necessary to call in reinforcements, all the lifelines in Sidi Ifni were down: At the most crucial moment the failure of telephone networks and the lack of electricity made coordination difficult. To prevent or reduce the impact of possible future flooding, it identified several areas for improvement. The most important include: (i) installing early warning systems on the rivers; (ii) establishing a communication and coordination plan that takes into account the constraints experienced during the last floods in November; (iii) preparing the population through training and simulations; (iv) carrying out a better study of the Ifni watershed and protecting the city with hillside dams.

In interviews conducted in the field, elected officials and representatives of external agencies and civil society agree that there is a need for more information and training on risk management. All those with whom we spoke advocated establishing a genuine risk management strategy involving all local actors.

For the future, elected officials and local authorities believe it will be important to be strict in identifying 'non aedificandi' areas –'no-construction' zones where any new construction will be prohibited. They are also convinced that a modern early warning system is urgently needed for the main wadi at Sidi Ifni and its two tributaries. A city official in Sidi Ifni said that an application has been submitted to get co-financing for a major project to install an early warning system. The financing would also go toward training and preparing the population to improve community flood risk management. The application has already been submitted to the disaster fund (CAS-FLCN) (see page 17).

According to some officials, two or three more hill dams are also needed to store floodwaters, to help delay and thus reduce peak flood levels in the city. (for further discussion on these dams see page 21).

Local associations

Representatives of local associations took part in two sets of interviews in the form of focus groups. These associations served as representatives of civil society only well after the disaster struck, starting with aid distribution in Sidi Ifni in the week after the floods. Some associations helped to repair roads and transport people affected by the floods to the safe places. This was done by local groups. There are no non-governmental organizations (NGOs) active in the provinces of Sidi Ifni or Guelmim that work in, or have specific competencies in risk management.

Merchants and business people, taxi drivers, farmers

Merchants and business people interviewed who could recall the 1985 floods said the 2014 floods were worse. Some suffered property damage, losing their stock and/or production facilities. Some said sales fell by up to 80 percent, and others said their stores were closed for up to one month before business could gradually resume.

Taxi drivers reported business was interrupted for two weeks, and the city felt isolated for two months. The president of the taxi association said taxi companies were left to recover on their own. Demand for taxi rides to other cities dropped significantly, in many cases by as much as 75 percent. Shops and merchants depending on the business generated by travelers and taxi drivers also suffered.

Farmers were particularly hard hit. About 80 farms are located on either side of the Ifni wadi, ranging in size from many hectares to small farms of just a few hundred square meters. Flooding damaged all of them, eroding farming terraces, destroying equipment and carrying away animals. Some land parcels were totally destroyed. Farmers said they were not warned about the imminent floods, probably because they live some distance from the city. They are requesting compensation in the form of land outside the flood zone.

Section 3
Public policy under construction

A clear public disaster policy is needed in Morocco. Because of its geographic situation and its bioclimatic diversity, Morocco is directly affected by climatic changes and by events triggered by natural hazards.

During the last decade, the country was hit by a number of major disasters: the Al Hoceima earthquake (February 24, 2004), the Talembot landslide (2010), and catastrophic flooding that affected even large cities such as Casablanca (November 2010 and January 2013), Mohammedia (November 2002), Tangier (October 2008, December 2009, January 2013) and all the other regions of the country such as the Gharb[7] (almost every year, but particularly in 2008) and the floods in the south in November 2014 that are the subject of this paper.

Progress to date

Prior to 2008, the Civil Protection Service was responsible for overseeing all risk management within Morocco. In a first step toward reform, at the central government level, two institutions were established putting new governance structures in place to address the need for nation-wide crisis management:

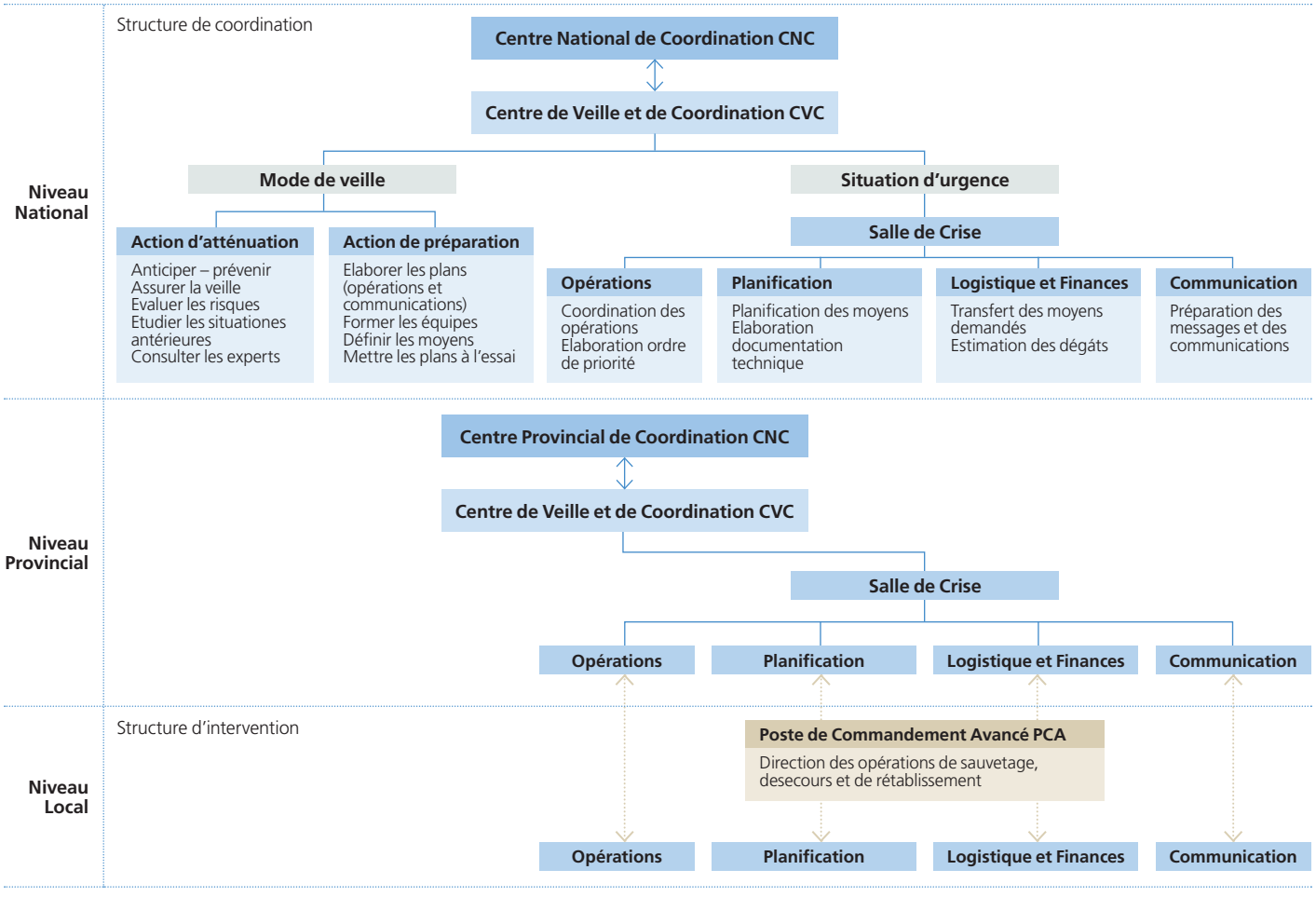
- **The National Committee for Monitoring and Coordination** (Comité National de Veille et de Coordination)
- **Monitoring and Coordination Center** (Centre de Veille et de la Coordination or 'CVC')

Provincial monitoring centers under the authority of the governors liaise with the central CVCs and are authorized to deploy resources and coordinate response to catastrophes. At communal level, all of Morocco's 1,502 communities have set up monitoring and coordination committees, which comprise local representatives from ministerial departments.

The Interior Ministry has instructed governors of the provinces and presidents of community councils to establish an institutional risk management framework in line with one shown here (Figure 7). This directive also defined a procedure for emergency organizations that respond in emergencies to follow (the ORSEC plan, 'organisation des secours'). However, the system has no provision for managing prevention, preparedness and risk mitigation.

[7]The Gharb is a region in the north of Morocco north of Kenitra at the Atlantic coast, heavily affected by that flood event and an important milestone politically for the risk management system.

Figure 7: Organizational overview for disaster intervention (Source: Targa-AIDE).



Long-term strategy

In 2008, following heavy rains that caused flooding in some regions of Morocco, particularly in the Gharb, Saudi Arabia donated USD 100 million to support efforts to mitigate the impact of adverse weather events. Morocco's government decided to set up a disaster fund, the CAS-FLCN (Fonds de Lutte Contre les effets des catastrophes Naturelles), to deal with these hazards. The Minister of Interior has the lead role in managing the fund.

This fund aims to co-finance projects to better protect vulnerable people and properties at risk. It also aims to make the country more resilient to disasters. The Ministry of Interior called it a first step in the process to implement sustainable public policy for more integrated disaster risk management. Plans call for developing a long-term strategy, together with short and medium-term projects for reducing such risks.

The strategy will be implemented through a grant program; it includes two calls per year for proposals on actions to prevent risks to make Morocco more resilient to natural hazards. The plan is being carried out with the World Bank, which provides technical and financial support.

The fund has already financed projects amounting to more than 2 billion dirhams (USD 200 million); most of these efforts are centered on resilient infrastructure improvements.

In 2015, the fund committed 251 million dirhams (USD 25 million) to co-finance 23 projects selected from hundreds of applications. Over 90 percent of these projects focus on addressing flood impact. Among the 23 projects selected, one small project in the province of Sidi Ifni totaling 19 million dirhams (USD 2 million) is aimed at installing an early warning system, and financing community training and preparedness activities.

Section 4
Insights

> Roads flooded but were kept open so people drove into raging flood waters and were subsequently swept away."

An overarching problem: A focus on reaction instead of action or prevention

The account of the events in Guelmim and Sidi Ifni and the perception of respondents in Sidi Ifni highlight several shortcomings in terms of pre-event preparation, intervention during the event and post-flood recovery. Before the 2014 floods, the focus on preventive risk reduction was very low. Most procedures and processes dealt with the intervention phase of an event, when it had already taken place.

Early warning systems, weather alerts, protocols and information were ill-adapted to the needs

Lack of early warning capabilities: Neither the Guelmim nor Sidi Ifni basins are equipped with early warning systems, although one project is being funded to install such a system in Sidi Ifni (see page 18). As experience showed in Ourika, where an early warning system was successfully implemented after devastating floods in 1995, these mechanisms can be invaluable in saving lives and reducing losses from floods. The available monitoring and early warning systems are mostly located in the largest river basins and the economic key regions, particularly in the north of the country, leaving the most vulnerable population without early warning.

Measurement stations and the National Meteorological Service's (DMN) weather radar coverage are insufficient: Currently the country relies on a global network to identify potential threats for life and property.

The quality and accuracy of the weather information produced by the DMN may also lag information produced by weather monitoring institutions in Europe or North America. Météo-France, for example, aims to improve rainfall detection using radar devices adapted to mountainous areas, and wants to refine the prediction of natural hazard events, floods in particular, through its RHYTMME project.[8]

The alert scheme also remains one of simply providing information: The alerts, like normal daily weather reports published on the website of the DMN, are also sent to the Moroccan News Agency and national television. The DMN is not responsible for initiating actions in the field. It believes this to be the job of local authorities. In the 2014 event, heavy rainfall had been announced and broadcast. However, it sparked only a modest reaction by local actors. Roads flooded but were kept open so people drove into raging flood waters and were swept away, often with fatal consequences.

Lack of resources, procedures and training

Civil Protection Service lacking resources: Among the 30 households surveyed in Sidi Ifni, many believed that the Civil Protection Service had made commendable efforts, but it did not have adequate resources for the November 2014 floods. For example, when the system supplying drinking water failed, it had only 21 water trucks available for distribution, each carrying 11 tons of water. Inhabitants had to make do with the simple tools they had at hand: they struggled with shovels and brooms to clean up major mudslides.

In Sidi Ifni there is only one fire station in the lower part of the city on the left bank of the wadi. It was affected by the flooding but, luckily, suffered only minor damage. In the other parts of the city, however, there are no fire stations, despite the fact that one part of the city might be cut off from the other during flooding.

[8] www.meteofrance.fr/videos/risques-meteo/49323-rhytmme-mieux-anticiper-les-risques-naturels-lies-aux-precipitations-en-montagne

Most people surveyed said the biggest problem they faced during the floods was a feeling of being abandoned and isolated."

Critical infrastructure unavailable: When it became necessary to call in reinforcements, all the critical infrastructure in Sidi Ifni was down: having no telephone networks and/or electricity at the crucial moment made coordination difficult and made it harder for people to get timely warnings.

Local response teams are poorly prepared: Members of the local CVCs were found to be ill-equipped to manage extreme events. In 2012, the World Bank, in partnership with the General Directorate of the local authorities and the Ministry of the Interior, developed risk management courses for field agents. For logistical reasons, however, these courses have not yet been carried out.

Public risk misperception and ill-dimensioned structures increased risk

People are unaware of risks: In some places, people seemed to behave irrationally, driving into flooded rivers, for example. Based on their past experience during floods, they believed this was safe practice, unaware of the risks this particular flood posed. The danger became clear after news of deaths in Guelmim; Sidi Ifni managed to close roads. But problems arose because critical communication lines went down, making it extremely difficult for authorities to intervene. Also, orders to evacuate were often resisted by families that feared permanently losing their home, convinced that these evacuation orders were a trick by the authorities to make them leave.

Local knowledge is lost: The indigenous populations in arid climates possessed a true culture of flood risk management. Before the recent urbanization in Guelmim, flooding had always been considered a blessing of nature that met the vital needs of the economy and the well-being of the local people. Irrigation techniques using flood waters were common and mastered by the Moroccan farmers. The practice of dikes designed to erode in a controlled manner during floods and spreading the water was perfectly suited. But with the onset of urbanization and the disappearance of traditional agriculture, floods came to be considered a nuisance limiting modern development. Traditional methods were discarded; the old 'fusible dikes' were replaced with permanent gabion structures.

Aid and infrastructure lacking: Most people surveyed said the biggest problem they faced during the floods was a "feeling of being abandoned and isolated." People in Sidi Ifni suffered due to destruction of the drinking water and the sewage systems. Water tanks were supplied for nearly two months until the drinking water system was working again. People also lost personal possessions. Several days after the disaster, authorities and numerous donors distributed food and some basic items such as mattresses and blankets. But residents still struggled for seven months after the flood due to the damage to the sewage system.

Drainage networks in urban areas did not work: The second flood that struck Sidi Ifni on November 28 was exacerbated by surface runoff that accumulated on impermeable surfaces in various neighborhoods of the city. In these neighborhoods with steep slopes, runoff can be devastating.

Urbanization exacerbates problem: Although there is a law that requires risks to be considered in urban planning, in Sidi Ifni the houses most affected by floods were situated near the bed of the wadi. City officials believe that these dwellings should be raised seven meters above the main river bed, thus meeting standards required. But they still remain in the wider river bed, which can flood.

Protective structures may not always provide the ideal solution: Aiming to eliminate risk by controlling the hazard has proved to be not only a very expensive option, but was shown to be largely ineffective. In Sidi Ifni, for example, proposals are currently being considered to build more dams to protect the city. These dams would be in addition to the Krayma dam: Construction of a second dam, Assif Iboudrane, will begin in 2015 and a feasibility study for a third dam, Assif Ounder, is also being conducted.[9]

Dams, whether existing or planned, may reduce flood impacts only in the short-term, and relying only on physical structures built to address flood risk is dangerous.

Focus is still on response, but starting to shift to resilience

Public policy still lacks focus on prevention and resilience: Efforts to put more emphasis on prevention, as is the case with implementation of the disaster fund (CAS-FLCN), are commendable but remain insufficient to really shift local focus toward prevention. Prior to the 2014 floods there had been little focus on ways to prevent and reduce risks. However, the wide-scale damage caused by the floods appears to have had an impact on how authorities view flood risk. They now seem to recognize more clearly the need for a more comprehensive risk management policy focused on reducing people's vulnerability and addressing the identified weaknesses.

Local support networks can offer assistance: Left to their own devices, neighbors and volunteers established small 'solidarity networks' and organized support for the poor. Lacking NGOs active in risk management in Guelmim and Sidi Ifni, efforts by local associations in these areas to develop new skills that could support disaster preparation and reduce the local population's vulnerability make sense, both in the short and medium term.

Lack of compensation and/or state insurance plans: There are neither short-term nor long-term recovery and compensation plans in place; the focus has been on response alone. Those people affected pinned their expectations on government subsidies to address their immediate needs to help them recover, or to help them move out of hazardous areas. When the families were able to return home, they found furniture, clothing, and household appliances damaged. By and large there was no insurance or compensation available from the state.

[9]www.oujdacity.net/national-article-97242-fr/

Section 5
Recommendations

This post-event review has identified the potential but also the existing weaknesses in monitoring and managing climate risks in remote and arid zones of the country. With points of strength and weakness identified and analyzed, in this section we aim to improve flood resilience by providing the following suggestions:

- **Improve data quality and dissemination:**[10] Producing high-resolution data and linking tools and technologies would allow reliable early warning systems to be set up. The observation and data networks are presently sparse. Improved forecast data (now only published as raw data in a newsletter) need to be linked to historical data on the river systems and local digital terrain models (MNT, Modèle Numérique du Terrain).
- **Provide better flood maps:** Better data would allow accurate local flood maps and maps identifying the hazards of surface flooding to be produced. These maps should be considered decision-support tools and could help authorities better target prevention and preparation efforts.
- **Improve measurement density and data links:** Satellite and radar data, already used in some areas, need to be used throughout the country. Observations of rainfall and from river gauges need to be linked to weather models for the next few days to allow an increase in lead times of flood forecasts: This would give people more time to prepare, and supply them with 'probabilistic' information about the nature, intensity and duration of expected events. This would also improve the accuracy of local forecasts.
- **Activate critical networks earlier:** The Monitoring and Coordination Center (CVC) becomes operational only in a confirmed crisis. The crisis cells, which were created in 2009 across all provinces, are only activated when the governor (wali) decides to activate them. In the case of Guelmim, and especially in Sidi Ifni, these cells were brought together quite late. Only the Ministry of Interior can decide which measures will be taken on the basis of alerts, and such decisions are taken only after the crisis has already begun. The process needs to be initiated earlier, triggered by a clearly measurable indicator. It also needs to be shared among a number of institutions, including the Equipment Ministry and the Water Basin Agency.
- **Include local communities in the process:** Any shift to favor more prevention would require a concerted community-based approach, involving local elected officials, local authorities, the main institutions dealing with response and the technical functions such as the Ministry of Equipment, the Water Basins Authority and the Weather Service. It also needs support from the local public, be it directly or indirectly through civil societies.

[10]Technology already exists that would allow for better observation, simulation and probabilistic flood risk assessment, and important strides have been made with regard to preparing for, and monitoring events. In particular, to address earthquakes the seismic monitoring network has been strengthened at the national level.

There should be a dedicated function to look at past events, analyze them, draw the right conclusions and use these to improve the whole disaster management system."

- **Educate the public to understand risk and take the right action ahead of and in times of crisis:** According to authorities, it was people's willingness to take risks – perhaps because of their prior experience in less severe floods – that led to a high number of casualties in Guelmim. A local risk management system needs to make the local population aware of the immediate risks they face and also provide training, for example in first aid, and in ways to reduce risks at an individual level. This should include education in schools on flood hazards and flood risks.
- **Learn from past flood events:** The knowledge gleaned from events like the November 2014 floods is too often wasted. There should be a dedicated function to look at past events, analyze them, draw the right conclusions and use these to improve the whole disaster management system. Setting up a center dedicated to these aims would provide a source of open and honest learning. Efforts could also include producing consolidated risk maps, and collecting confirmed data and/or information about what happened. While compiling information for this study, we realized that there is an impressive amount of information available – pictures, videos, event reports, etc. However, this information is presently scattered and little use is made of it.
- **Consider future events, increase redundancy:** Levees and hill dams will provide very little protection if their construction only takes into account historic data. Structural devices can provide protection only up to a certain level. For high-intensity events, structures can actually increase risk by providing a false sense of security. Protection structures in isolation (i.e., without redundancy) can be overwhelmed and fail catastrophically. Poor management, siltation and degradation will quickly render structures obsolete. Planning needs to take into account not only average events, but also those with a higher return period: one-in-40 years and one-in-100 years.
- **Better manage watersheds:** Dams may serve as a solution to offer protection, but their long-term effectiveness will depend in large measure on managing the watershed, and especially on reforestation of its slopes. Channels such as oued beds must also be cleared and vulnerabilities properly identified. If the watershed is not managed and reforestation is not part of the plan, the dams will not be as effective as they could be. They should always be part of integrated solutions with redundancies built into them.
- **Improve drainage capacities in urban areas:** the water drainage network in urban areas should be resized to be able to handle the expected magnitude of future downpours, taking into account the experiences of the recent floods. Under the current conditions and with projections of climate change, future losses seem obvious and unavoidable if no action is taken.
- **Find the solutions that fit the location:** In Guelmim, the floods from oued Oum Laachar had the greatest impact, but runoff from a nearby mountain, Mount Tayyert, contributed to the flooding in the central and northern districts. Mitigating this type of risk requires a different solution from what is needed to address wadi floods. Floodwaters need to be channeled, diverted or drained while runoff is still in the foothills; or, alternatively, storm retention basins on the flanks of the mountain are needed – constructing this type of retention alongside roads would complement reforestation efforts.

- **Increase communication, including during non-crisis periods:** Mistrust also stemmed from a lack of communication between the government and people, as expressed by various people with whom we spoke, including those who had settled in the middle of the wadi. Communication should be ongoing and not confined to crisis periods. Communication also needs to be 'holistic,' meaning it also should take into account, for example, how evacuation procedures can be communicated and carried out for those living in unofficial housing who fear eviction.
- **Use local resources to strengthen communities:** As noted already, Morocco often faces floods. An increase in the number of floods over the past two decades has made authorities aware of how exposed the country is to these natural hazards, and brought home the urgent need for an integrated public policy to increase prevention and improve resilience of territories and inhabitants. Efforts to strengthen prevention through physical structures alone is not enough. Communities also play a role; risk management actions at the national level must be linked to local communities. For communities, it is important to draw on local, available resources, sometimes referred to as the 'five capitals' or 'Five Cs'[11] to achieve a sustainable progress and integrated risk management process.
- **Increase cooperation in the region:** The majority of Northern African countries – Algeria, Morocco and Tunisia – are similar in terms of their geography, ecosystems sociology. These three countries are bisected by the Atlas mountain chain, dividing them into a relatively humid oceanic zone and a semi-arid to arid zone that borders on the Sahara desert. But there is no regional cooperation or exchange of experiences related to natural hazards management between the three countries, nor shared access to resources. This needs to change.

[11]The 'Five Cs' or 'Five Capitals' refer to five core asset categories that can be drawn on to improve the lives of people living in communities: human capital, natural capital, financial capital, physical capital, and social capital. A key part of the work the flood resilience alliance does with communities involves measuring resilience. This helps to establish whether actions to increase resilience are effective. For more, see 'Enhancing community flood resilience: a way forward' at http://knowledge.zurich.com/flood-resilience/risk- nexus-enhancing-community-flood-resilience-a-way-forward/

Section 6
Conclusions and global context

The Zurich flood resilience alliance has developed and is currently testing a flood resilience measurement framework in keeping with the 'Five Cs' to strengthen community resilience."

Due to its geography and topography and the strong variability of precipitation, the Kingdom of Morocco has been and remains subject to devastating flood events. In the 2014 event analyzed in this paper, several dozen people lost their lives. In the case of Ourika in 1995, there were more than 700 victims. This clearly calls for action and for a pathway to systematically address and increase flood resilience.

Since 2009, various instruments have already been put in place, largely to improve intervention capabilities. The national plan to fight flooding (the Plan National de Lutte contre les Inondations, PNI) has inventoried 391 flood zones across the country's eight main river basins, the two sites of the present study included. However, improvements need to be intensified.

Beyond remedies that, while difficult to achieve, can at least be easily described and quantified in terms of numbers, localities and cost, there are other considerations that involve how problems are approached to achieve long-term solutions. These require new thinking, and a willingness to address the root causes of problems. A mindset open to change is needed. A 'hardware' logic, based on adding physical protection infrastructure alone, cannot protect the population against the effects of natural hazards. It must be complemented by a 'software' approach that links risk management actions at the national level to the local community level.

As part of today's mindset, we must learn to see not only the immediate problems but also consider the bigger picture in solutions. This includes adapting to changes happening in the environment and the needs of modern populations to promote well-being and livelihoods.

While considering solutions from many different perspectives, we also need to go deeper to the level of individual communities. Communities need to carry out and own risk management strategies. This works only if the local context and the physical, human, social, natural and financial characteristics – the so-called 'five capitals' or 'Five Cs' – are included in strategies. Working together and learning from each other can truly function at global scale only if the local context is observed and methodologies, which may be universally applicable, are adapted to the locality where they will be put into practice.

The Zurich flood resilience alliance has developed and is currently testing a flood resilience measurement framework in keeping with the 'Five Cs' to strengthen community resilience. This will allow us to provide further evidence that resilience can be built prior to events to reduce casualties and financial losses. It will also allow us to measure what is achieved in our efforts to increase resilience. That such practices can be effective was demonstrated in Peru, for example, where a community-based risk management project allowed communities in the Amazonas basin to avoid the impact of floods in January 2010 (World Bank, 2010).

We need to share and use the knowledge we gain from flood events to explore new approaches, challenging decision-makers to focus on more long-term resilience."

Ultimately each community needs to explore its own particular avenues to address risks in a way that complement growth and take into account the economic needs of people living there. This approach can provide a solid basis for national policies on risk management but needs to go beyond the national level. International events help to introduce important changes to national risk-management strategies. Those where Morocco has played or will play a role include the third UN World Conference on Disaster Risk Reduction, which was held in Sendai, Japan, in March 2015, to which the Moroccan government sent a delegation. In September, the UN will host a Sustainable Development Summit 2015, a special plenary General Assembly meeting in New York, with the goal of adopting a new program and an overall set of goals in several key areas, including climate change. France is preparing the Conference of Parties or 'COP21' climate summit taking place in Paris in November-December 2015, and Morocco will host the COP22 in November 2016 in Marrakesh.

All these international engagements, and the most recent program of the World Bank, which debuted in Morocco in September 2015, should help install a new national risk management strategy centered around the financing of resilience-increasing projects and the reduction of risks. It should also provide the opportunity to globalize and integrate policies to improve the country's resilience long term and to reduce the population's vulnerability to natural hazards and climate change.

Critical to this process, we need to share and use the knowledge we gain from flood events to explore new approaches, challenging decision-makers to focus more on long-term resilience. We hope that this study in some small way contributes and provides insights to encourage this process.

Interviews and acknowledgments

Overview of interviews conducted

Household interviews were based on a detailed questionnaire aimed at assessing families' attitudes and perceptions before, during and after the floods – in particular, how households viewed the flood itself, and local and national governments authorities' actions in response to the disaster.

The sample for the household survey was made up of families that were present during the flood event. The interviewees are two thirds men and one third women. Nearly 70 percent have attended either primary or secondary school, 13 percent have a university degree and only 17 percent did not attend school. Two-thirds of those surveyed were between 30 and 60 years of age, and 70 percent of households have fewer than five children per household. A large portion (70 percent) consider themselves as low income and they have nearly no financial reserves (83 percent). Most people are employees or small traders (over two thirds). They live mostly in masonry houses, but only 37 percent of these families are owners.

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List of acronyms and definitions

ABH: Water Basin Agency – L'agence des bassins hydrauliques

CAS-FLCN: A special fund to fight natural hazard events – fonds de lutte contre les effets des catastrophes naturelles

CRTS: Centre Royal de la Télédétection Spatiale

CVC: Monitoring and Coordination Center – Centre de Veille et de Coordination

DMN: The National Meteorological Service – Direction de la Météorologie Nationale.

DPA: Direction Provinciale de l'Agriculture

FAO: Food and Agriculture Organization of the United Nations

ONEE: National Office of Electricity and Water – Office Nationale de l'Electricité et de l'Eau

ONI: National Office for Irrigation – Office Nationale d'Irrigation

ORMVA: Office Régional de Mise en Valeur Agricole

ORSEC: the emergency organization plan – organisation des secours

oued: A valley, gully, or stream bed that remains dry except during the rainy season when it is often exposed to flooding

PNI: National plan to fight flooding – Plan National de Lutte contre les Inondations

PNUD: United Nations Development Programme – Programme des Nations Unies pour le développement

About the Zurich flood resilience alliance

An increase in severe flooding around the world has focused greater attention on finding practical ways to address flood risk management. In response, Zurich Insurance Group launched a global flood resilience programme in 2013. The programme aims to advance knowledge, develop robust expertise and design strategies that can be implemented to help communities in developed and developing countries strengthen their resilience to flood risk.

To achieve these objectives, Zurich has entered into a multi-year alliance with the International Federation of Red Cross and Red Crescent Societies, the International Institute for Applied Systems Analysis (IIASA), the Wharton Business School's Risk Management and Decision Processes Center (Wharton) and the international development non-governmental organization Practical Action. The alliance builds on the complementary strengths of these institutions. It brings an interdisciplinary approach to flood research, community-based programmes and risk expertise with the aim of creating a comprehensive framework that will help to promote community flood resilience. It seeks to improve the public dialogue around flood resilience, while measuring the success of our efforts and demonstrating the benefits of pre-event risk reduction, as opposed to post-event disaster relief.

International Institute for Applied Systems Analysis
IIASA www.iiasa.ac.at

Wharton
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