Emergency and Disaster Reports

Monographic issue

Coastal floods and mudslides risk in Peru

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Letter from the editors

The Emergency and Disaster Reports is a journal edited by the Unit for Research in Emergency and Disaster of the Department of Medicine of the University of Oviedo aimed to introduce research papers, monographic reviews and technical reports related to the fields of Medicine and Public Health in the contexts of emergency and disaster. Both situations are events that can deeply affect the health, the economy, the environment and the development of the affected populations.

The topics covered by the journal include a wide range of issues related to the different dimensions of the phenomena of emergency and disaster, ranging from the study of the risk factors, patterns of frequency and distribution, characteristics, impacts, prevention, preparedness, mitigation, response, humanitarian aid, standards of intervention, operative research, recovery, rehabilitation, resilience and policies, strategies and actions to address these phenomena from a risk reduction approach. In the last thirty years has been substantial progress in the above-mentioned areas in part thanks to a better scientific knowledge of the subject. The aim of the journal is to contribute to this progress facilitating the dissemination of the results of research in this field.

This monographic issue is about the risk of coastal floods and mudslides in Peru one of the twentieth most vulnerable countries to multiple natural hazards, ranking in the top 33 for a high economic risk from multiple hazards and a high chance for a multiple hazard effect. The country's landscape variety allows multiple disaster subgroups to be present.

This risk profile analyzes the events occurred the past year through a detailed narrative, and the country's disaster risk management system and response.

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"It is more effective to learn what people tend to do naturally in disasters and plan around that rather than design your plan and then expect people to conform to it"

As Auf der Heide (2004)

INDEX

LIST OF ACRONYMS

CENEPRED	National Center for Estimating Prevention and Reduction of Disaster Risk
CEPLAN	Centro Nacional de Palneamiento Estrategico
CERF	Central Emergency Response Fund
COEN	National Emergency Operation center
COER	Regional Emergency Operation Center
DRM	Disaster risk Management
DRR	Disaster risk reduction
EDAN	Evaluation of Damages and Analysis of Necessities
ENFEN	Multisectorial comision for National Studies of "El Niño"
FEN	El Niño Phenomenon (Fenomeno del Niño)
GDP	Gross domestic Product
GEM	Global Earthquake Model
GRD	Gestion Riesgo de desastres / Management of Disaster Risk
IGP	Peru's National Geophysical Institute
INDECI	Instituto Nacional de Defensa Civil / National Civil Defense Institute
INEI	National Institute of Informatics and Statistics (Peru)
MEF	Finance and Economic Ministry
MINDEF	Ministry of Defense
MINSA	Ministry of Health
MRTA	Revolutionary Movement Tupac Amaru
MVCS	Ministry of Housing, Construction and Sanitation
NFORM	Index for Risk Management
NGO	Non-Governmental Organization
NOAA	National Oceanic and Atmospheric Administration
PCM	Presidency of the Council of Ministries
PLANAGER D	Plan Nacional de Gestion del Riesgo de desastres (National Plan for Disaster Risk Management)
SARA	South American Risk Assessment Tool
SENAMHI	National Service for Hydrology and Meteorology (Peru)

SINADECI   Sistema Nacional de Gestion de Riesgo y Desastres

SINAGERD   Sistema Nacional de Defensa Civil

SINPAD   Sistema de informacion nacional para la respuesta y rehabilitación

SNI   National society of Industries

UNDP   United Nations Development Programme

UNISDR   United Nations Office for Disaster Risk Reduction

WFP   World Food Programme

WHO   World Health organization

WRI   World resources Institute

WWF   World Wildlife fund

Executive Summary

According to the "World bank's study of Natural disaster Hotspots", Peru is among the twentieth most vulnerable countries to multiple natural hazards, ranking in the top 33 for a high economic risk from multiple hazards and a high chance for a multiple hazard effect.(1) The country's landscape variety allows multiple disaster sub groups to be present. Flooding and landslides have become an everyday fare for several Peruvians in the past years. According to UNDP, at least thirty percent of Peru's population lives in flood-prone areas and over fifty percent of Peru's land area is considered as in high flooding risk.

In March 2017, Peru was suffering the worst flooding reported in years. El Niño phenomenon drove an unusual set of heavy rains which affected several of Peru's vulnerable areas. The highest precipitation recorded in decades extended from the Amazon and Highlands, which led to massive destruction through mudslides and flooding, even reaching the high-density population areas in the central and northern coastland. Flooding provoked by river overflows produced severe mudslides which affected both rural and urban areas in 24 of the 25 departments, this triggered secondary effects in security, shelter and health which worsened the situation.
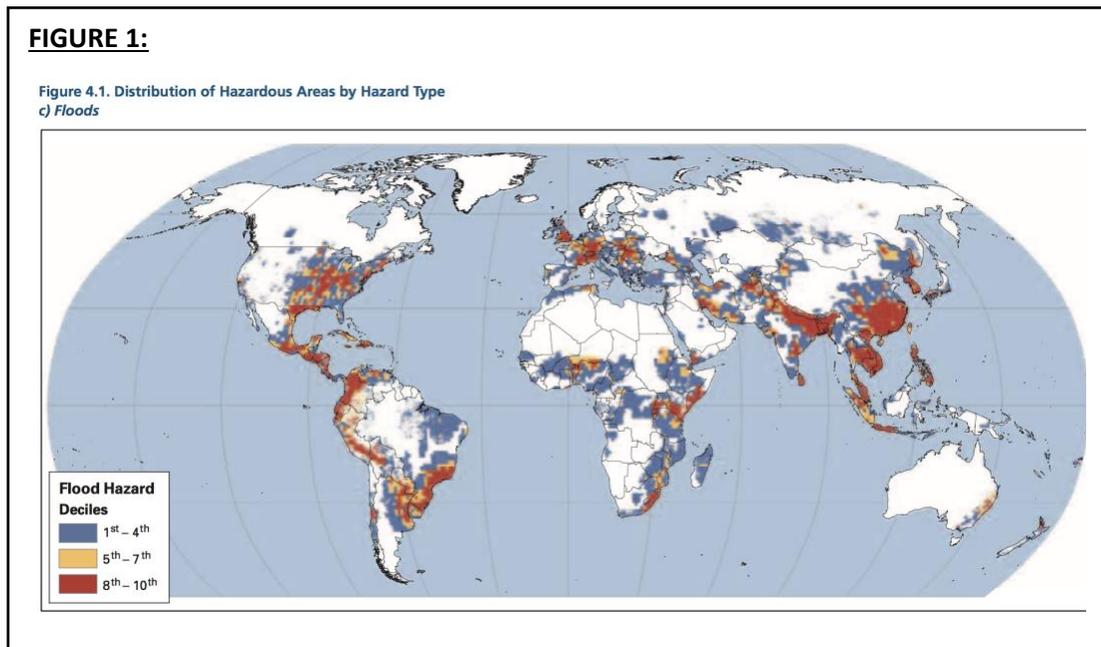
In the past years, Peru has increased its mitigation efforts and has been applying tools for disaster prevention and management with decentralization efforts. A cooperation plan which enables collaboration between governments and non-government organizations is currently being developed as field activity has demonstrated that certain efforts are delayed due to burochratic issues.

The purpose of this risk profile is to analyze the events occurred the past year through a detailed narrative. Highlighting the flaws, progress and strengths of the country's disaster approach by describing the timely events will allow us to analyze the country's disaster risk management and response from both a public health and anthropological perspective. The intention is not to criticize but to foster recommendations from innovative and unnoticed simple efforts with potential impact and that working towards them may lead us to better outcomes.

Introduction: Overview

Flooding is described as a temporary submersion of normally dry land due to the unusual contribution of a volume of water in a given area normally dry land covered by water temporarily.

According to the World Resources institute, about 80 percent of the world population lives in flood-prone areas and an estimation of 21 million people are affected by flooding every year, number which is more likely to increase to 54 million by 2030 mainly due to climate chance and socio-economic development.(3) Covering around one third of the world's land area, including several parts of Asia, Midwestern United States, Central America, coastal South America, Europe and coastal Africa as shown in figure 1.(1)

FIGURE 1:

Figure 4.1. Distribution of Hazardous Areas by Hazard Type
c) Floods

Flood Hazard Deciles
1st – 4th
5th – 7th
8th – 10th

The rampage of global disasters is not a surprise for researchers. Global warming and climate change have been impacting the whole world in different ways. Several studies have proven the rise of global temperature over time and how this effect leads to more chance of global hazards. These hazards enlarge their impact when affecting more vulnerable population areas and turn into disasters, something no different for Peru.

According to the "World bank's study of Natural Disaster Hotspots", Peru is among the twentieth most vulnerable countries to multiple natural hazards. Ranking in the top 33 for a high economic risk from multiple hazards and a high chance for a multiple hazard effect. The country's landscape diversity allows multiple disaster sub groups to be present. This high potential risk ranks the country in second place after Guyana for percentage of the country's population living at risk for several disasters and the country in Latin America most affected by natural disasters. (1)

In the past years, flooding and landslides have become an everyday fare for several Peruvians. According to UNDP, at least thirty percent of Peru's population lives in flood-prone areas and over fifty percent of Peru's land area is considered as in high flooding risk(4). El Niño phenomena has been present in Peruvian minds since the Spanish colonization in the fifteenth century. Where a request to the viceroyalty of Perú from Alonso de Lucio described torrential rainfalls, destruction of crops, homes and the harsh situation people where faced in northern coastal Peru(5). has been present in Perú for centuries, unleashing several catastrophes such as 1993 world-known Cholera outbreak, 1998 massive losses and recently 2017's massive flooding and Dengue Outbreak.

By March of 2017, over half of Peru was declared in emergency. The northern coastal areas were the hardest hit. Livelihoods of over a million people where affected and killing over a hundred, more than 200,000 families where left homeless with an uncertain future after mud covered more than 58,000 hectares of crops affecting the livelihoods of thousands of families who rely on the farming activities. Several villages where isolated when more than 3,000 km of roads where affected leading to isolated villages with desperate disaster affected population(6).

A wide-range of health impacts can be attributed to flooding. The privation of basic services such as water, solid waste disposal and hygiene management increase the risk of communicable diseases which was probably the main factor that led to Peru's 2017 Dengue outbreak. Despite MINSA's (Peru's health Ministry) action and efforts following the national plan for attention in emergencies and disasters to prevent possible outbreaks, social vulnerability factors of communities at risk kept rising and capacity was not enough leading to eight of the eleven emergencies declared regions to report several dengue cases which kept rising since the beginning of 2017.

In the past years, Peru has been working in increasing its mitigation and recovery efforts, but it seems every time new planning begins, a new threat appears. Time constrains, constant onset of wide-ranging events and political distress directly and indirectly disserve the country's ability to successfully apply disaster risk reduction and a proper recovery that has already been worked on.

Livelihoods of over a million people where affected and over a hundred deaths were reported. More than 200,000 families were left homeless with an uncertain future after mud covered more than 58,000 hectares of crops affecting the livelihoods of thousands of families who rely on the farming activities. Several villages where isolated when more than 3,000 km of roads where affected leading to isolated villages with desperate disaster affected population. In November 2017, than a year after these events, the national weather service; the SENHAMI has already reported similar precipitations as last year and a warning alert of precaution for the upcoming months which has been underestimated due to the current political crisis in the country. As 2017 ends, the country remains affected and in the middle of a recovery process. Nevertheless, the National Emergency Operation Center (COEN) has already began new water level rising alerts, even higher than last years. When reconstruction plans have finally been approved, a new threat might lead to chaos.
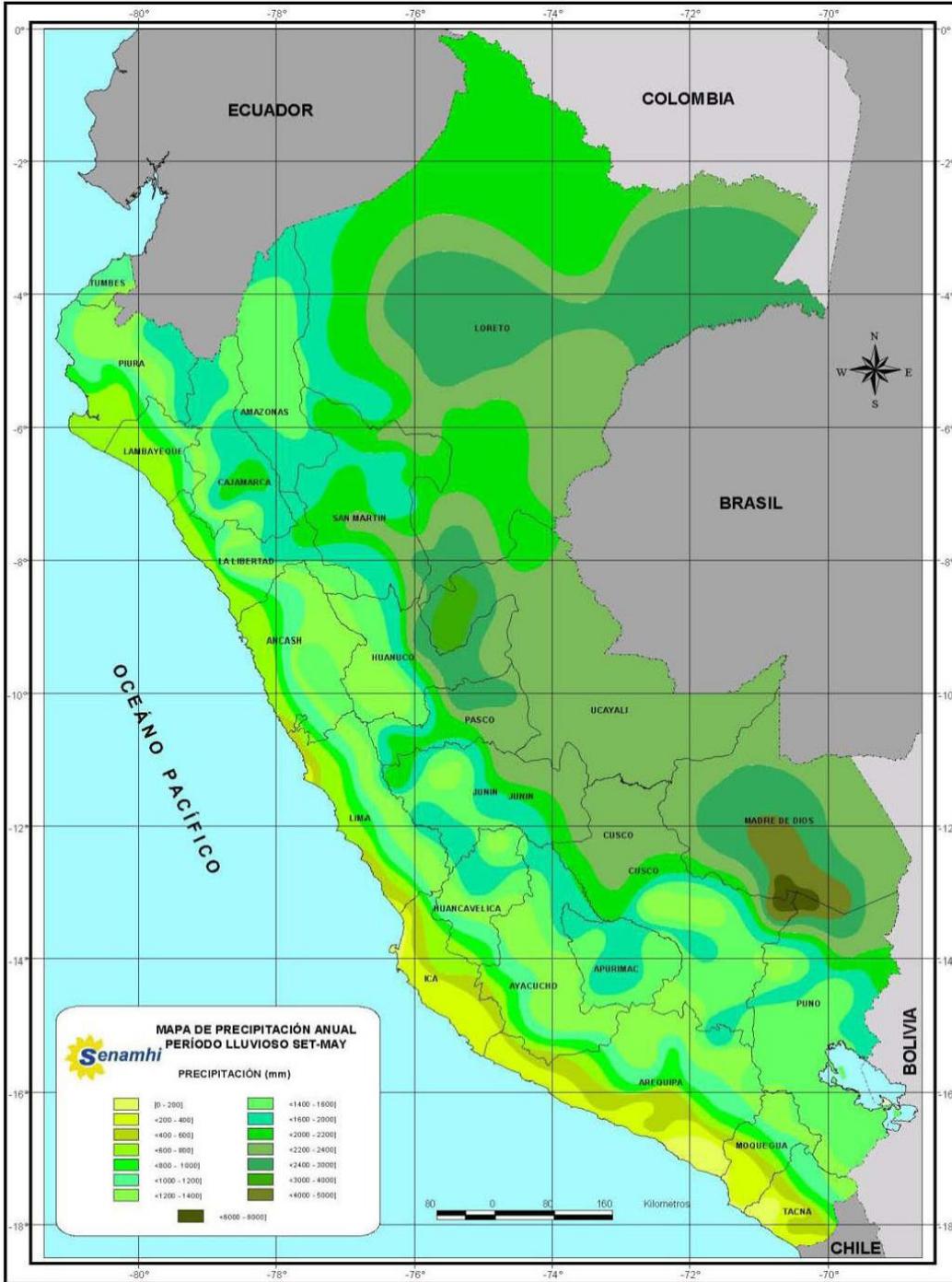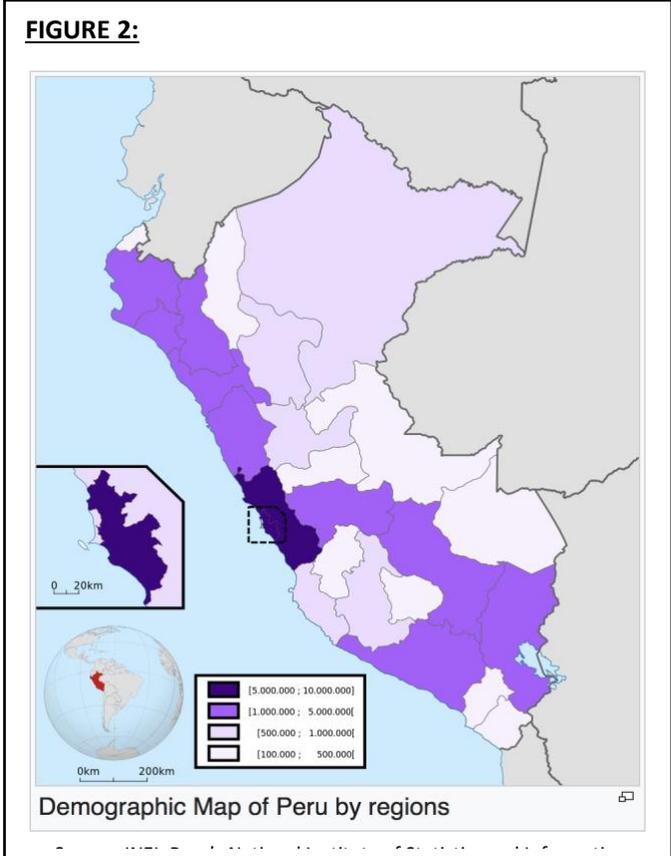
Figure 1: Map of Peru: General Precipitation Details

Source: National Information System for Disaster Response and Attention.

Peru: Geography and Demographics

Peru's 1'285,215.6 km^2 of diverse landscape ranks it as the third largest country in South America and the 20th largest in the world. Its 32 Million inhabitants represent 0.43% of the world's population, ranking it as 42nd country by population.(7) It faces the Pacific Ocean to the west and borders with Ecuador and Colombia to the north, Chile to the south and Brazil and Bolivia to the south-east. The combination of its tropical location, Andes mountains, topography variations and the ocean currents (Niño and Humboldt currents) provide Peru with a large variety of climates, including 30 of the 32 world's climates and 84 of the world's 104 known ecological regions.(8)(9) The country's landscape diversity divides it into three particular regions: Coastal, Highlands and Amazon, each with its peculiarities in climate, population characteristics and economic income.

The coast is a 2,414 km long narrow strip desert bordering the Pacific Ocean. This arid desert located in a tropical area is characterized by humid climates due to the influence of the Humboldt current. Fifty-three rivers originated in the Andes flow into the coastal area forming fertile valleys before reaching the sea. Despite it only occupies 11 percent the national territory. Fifty-nine percent of Peru's total population lives in the coast and about one third of the total population is located in the capital city's department, Lima, which by itself hosts 10 million Peruvians within its industrialized urban territory. Despite decentralization efforts, centralization due to an urbanism phenomenon remains an issue. Migration to coastal areas are mainly because of economic factors. (10) This rise in migration has led cities to become overcrowded and in a higher disaster risk. Industrialization. Ports, fishing industry, mining and agricultural access have turned the coastal area into an economic boom, transforming traditional coastal towns into potential industrial cities.

FIGURE 2:

Demographic Map of Peru by regions

The "*Cordillera de los Andes*" or Andean region involves Argentina, Bolivia, Chile, Colombia, Ecuador, Peru and Venezuela. The mountains in the Cordillera form Peru's highland area characterized by a dry and temperate weather with huge variations in temperature during the day. It occupies 30% of the national territory and it is populated by 36 percent of the Peruvian population. It's comprised mostly by smallholder farmers whose access to education, health services, transportation, financial services and other basic needs remain limited.(11) We can unequivocally state that these vulnerability - factors were the ones used by terrorist groups (MRTA and *Sendero Luminoso- world known as "Shining Path"*) to take advantage and encourage rebellion in these neglected areas.

The largest Peruvian region is the amazon rainforest, ranked as the ninth largest forest in the world. Despite its large territory, only 12% of Peru's total population live in this soil-rich area, which occupies 59% of the national territory. The amazon rainforest, covered by tropical vegetation, has a hot, tropical and rainy weather and hosts most of the country's natural reserves.(12) In the past decade, Peru's Amazon has suffered deforestation, which has had a wide-ranging impact.

In 2015, the Peruvian amazon was listed by WWF as a top deforestation front. REDD+ has ranked it fourth after Brazil, Venezuela and Bolivia. The government, private parties and NGO's are working to create consciousness and to build a culture of prevention by promoting efforts of sustainability where diverse benefits such as economic can be attained without sacrificing nature. The "Millennium Ecosystem Assessment and Human Well-being", project backed-up by United Nations, focuses on the impact human actions have on the ecosystems and how changes within these, affect human well-being. It states most ecosystem services are found in forests. They track from cultural services, food, water and timber supply, to preventing natural hazards such as landslides, something to be considered in Peru's disaster management response. (13)(14).

Disaster History

Disasters are described as a result of the combination of the exposure to a hazard and the conditions of vulnerability that are present which lead to insufficient capacity or measures to reduce or cope with the potential negative consequences. The United Nations Office for Disasters Risk Reduction define a disaster as "*A serious disruption of the functioning of a community or a society at any scale due to hazardous events interacting with conditions of exposure, vulnerability and capacity, leading to one or more of the following: human, material, economic and environmental losses and impacts*". Disaster has an impact on human physical, mental and social well-being. It causes a social economic disruption and an environmental degradation through destruction of assets, property, loss of services and economic loss creating a hardship situation.(15)

Between 1970-2016, Peru has faced more than 110 disastrous events between droughts, floods, mudslides, frosts, earthquakes and volcanic eruptions. Its location within the ring of fire favors the chance of volcanic activities and earthquakes.(16) The World Bank's Global Risk Analysis Report considers it between the countries of high risk of disaster occurrence leading to a high mortality risk from multiple hazards as well as a high economic impact.(1)

The combination of the diverse landscape, the country's location in a seismic area and different climates lead to a wide-range of disaster occurrence. Hydro-meteorological and geographical hazards have been affecting Peru for as long as Inca times. The coastal region has had a history of tsunamis and flooding, specially after El Niño events.(17) Landslides are a recurring hazard for the highland areas usually in forms of "Huaicos", a Quechuan word referring to flash-floods due to torrential rains from the high mountains. Although far from the ocean, experts suggest the abnormal warming of Pacific waters caused by El Niño remains as the main factor for these to re-occur. (18)

Table 1 compares the past strongest three damages caused by El Niño. As DesInventar and INDECI data state, even though earthquakes and hydro-meteorological might be sporadic amongst other disasters, these have the largest social and economic impact. (Table 2) Other more frequent events such as heavy rainfalls, freezes may have a smaller impact per event, but as their occurrence are more frequent the impact should be taken in account as well.

Table 01: Sectoral damages and exposure estimates across Peru for FEN events

	1982-1983	1997-1998	2017
Population Affected	1.27 Million	530, 000	1'886,186
Deaths	512	366	114
Transportation Damages	2,600 km, 51 Bridges	3,136 km, 370 Bridges	4931 km, 881 Bridges affected, 489 Destroyed
Homes affected	111,000	108,000	372,020
Homes Destroyed	98,000	48,563	66,363
Education Facilities	875 Schools	2873 Schools	2150 Schools
Health	260	580	726
Total Losses in US$	3.28 Billion	3.5 Billion	9 Billion

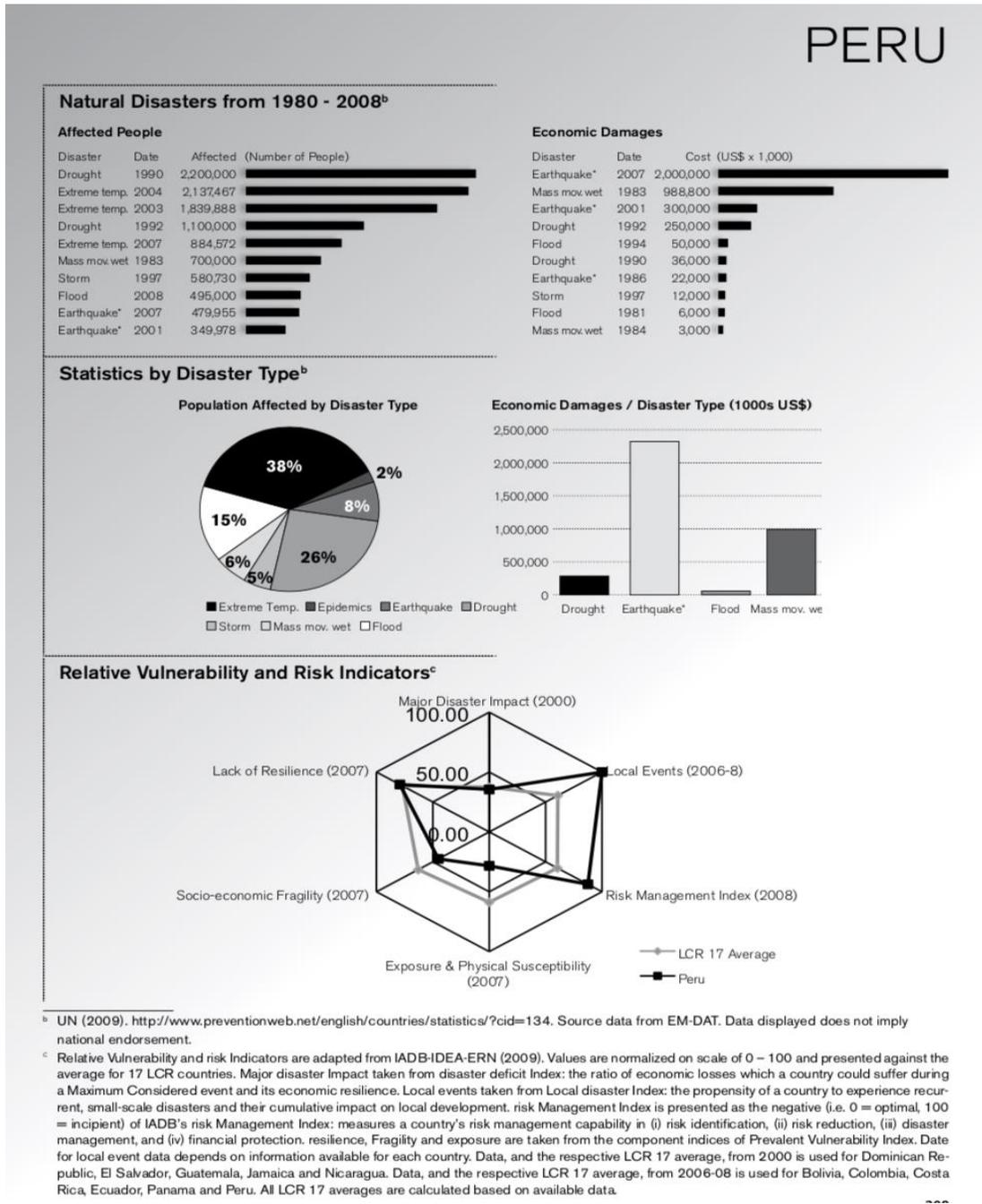Source: French and Mechler, 2017 / El Niño Costero, INDECI / DesInventar, 2017 (19)

Table 02: Damages (1995-2002) by Disaster Type

Event	Deaths	Affected	Homes Destroyed	Homes Affected	Livelihood / Affected Agricultural land (Hct)
Earthquake	104	329,398	28,223	53,178	1800
Floods	281	1,029,011	64,863	217,580	268,010
Rainfall	77	107,988	5334	24311	5526

Source: DesInventar, 2017 (19)

Heavy rainfall leads to increase in the volume and flow of rivers, which turn up flooding houses and roads, and in some cases – depending on the topographic characteristics turning into landslides.(19) 1982/1983 and 1997/1998 were the last two strong FEN events in Peru producing massive livelihood losses, vector-borne disease outbreaks and affecting millions. In July 2015, another strong FEN was predicted for 2015/2016 summer which led to preparation efforts, which were then left behind and discontinued as the season passed with no effect, until 2017 where it arrived by surprise.

**Figure 3: Natural Disasters in the Past 50 years**

Source: World Bank: Global Facility for disaster Reduction and Recovery.
Country Notes: Peru

Risks and Vulnerabilities

According to the UNISDR, a Disaster is described as "A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts which exceed the ability of the affected community or society to cope using its own resources."(20) Meaning that disasters can be portrayed as the result of the combination of a hazard exposure, the conditions of vulnerability that a community may have and the insufficient capacity or measures to reduce or cope with the potential negative consequences(21).

Young and Leon stated "*Vulnerability in Peru to natural hazards is amplified by poverty and by a disconnection between what science can predict or what people will do*."(22) There is a huge gap between science, knowledge and people's response. Events occurring during 2017 floods are not new to the Peruvian population. Although floods may have a climate factor behind, which is beyond human control, there is a way our response as a population could be reinforced to improve the population's resilience and build back better.

Figure 04: Index for Risk Management: Risk Profile Peru


Source: INFORM Index(23)
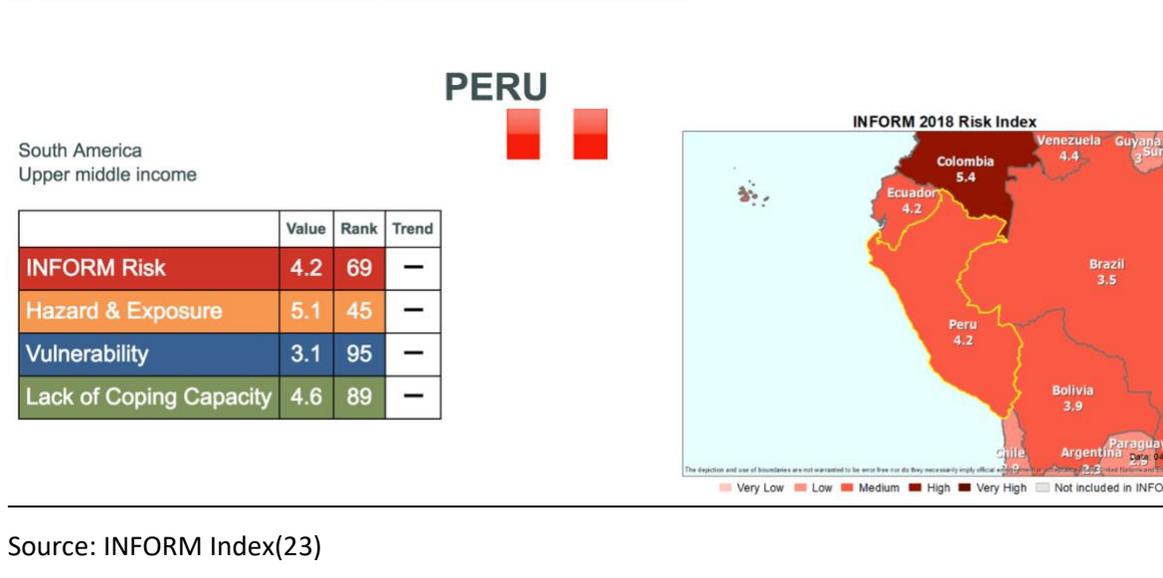
Risk and vulnerability indexes reflect the potential damage a particular event may cause. Figure 4 displays Peru's risk profile and ranking from INFORM, an open access tool to deliver information that may help assess crisis and disaster risk by providing information which will enhance decision making based on priorities.(24)

Difference in factors such as SES, development and resilience capacity are those who may be the cause of difference of magnitude and reducing inequality is critical for the whole society. Access to services and opportunities in Peru differ greatly. Just education-wise, the capital city of Lima doubles the education access compared to Huancavelica – one of the poorest regions in the country where children's malnutrition rate is ten times higher than that of Tacna (35% vs 3.7%) and surpassing countries like Angola and Congo. Huancavelica's schooling in years' index for adults is lower to African countries such as Cameroon and Congo. Peruvian Amazon's largest department, Loreto, has the highest child mortality rates in the country (40 out of 1,000 live births), similar to those of Bangladesh and Cambodia.(25)

Peru's decrease in poverty indexes and economic growth reveals the country's socioeconomic progress in the last decade. Peru's decrease in poverty indexes and economic growth in the past decade reveal the country's socio economic progress in the last decade. As shown in figure 03, WFP's VAM analysis reflects how the vulnerability index remains high within the Andean region. Despite many efforts, this map reflects vulnerability indexes and illustrates how several of Peru's regions remain with severe and very high vulnerability to aspects such as climate change, disaster risk

Figure 05: WFP Vulnerability Map
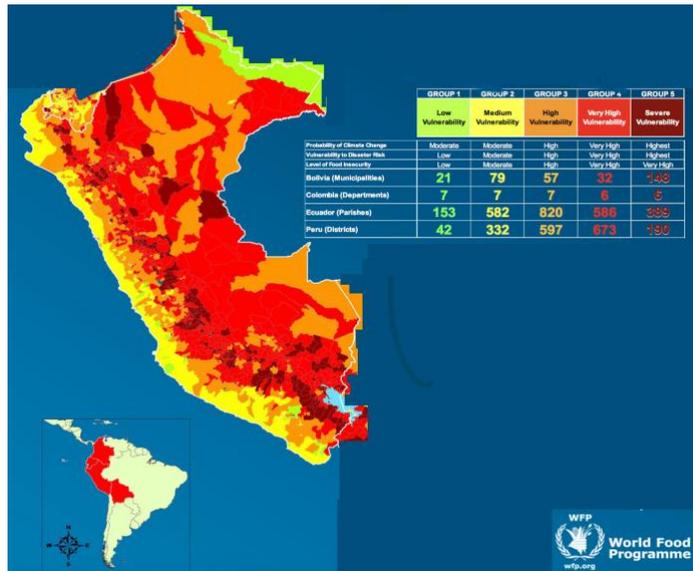
vulnerability and food insecurity.

Social Vulnerability:

When describing vulnerability parameters for one country, certain factors such as economic impact, geography, exposure, education and social elements should be addressed. Social vulnerabilities are defined as features that create a potential loss or harm. When analyzing country risk levels, an association between hazard exposure with the population's vulnerability should be taken in account. Studies have shown there is a direct link between social vulnerability reduction and lowering the risk of disasters.

One of the most common approaches for performing a social vulnerability assessments is the use of indicators that determine the population and economic influence. Age, gender, access to resources, wealth distribution, education, governance, healthcare resources and access, and urban elements such as the density of building infrastructure help compose the analysis to determine social vulnerability index. Factors such as economic wealth, knowledge and technological development have shown to have a substantial impact.(26)(27)

Despite national efforts and legal frameworks to fight racism, discrimination and intolerance, these remain omnipresent. Similar to Peru's varied landscape, climates and resources, it also holds a varied population background.(28) We can look at its roots back to the XXV century after the Spanish colonization, where indoctrination regarding fair skin equals wealth, power, success opportunities and good education while wrongly a darken skin is associated with poverty, bad education, low social status and ugliness. Social status is mainly determined not only by wealth and skin color but by ancestry, family's wealth, influence, connections, education institutions, club memberships and beach houses.(29) Peru holds high levels of inequity and exclusion, particularly in rural areas, where the most vulnerable population resides. This social inequality creates a huge gap and an inner conflict between social groups which end up in prejudice for the whole country(27). Education might be the key tool to improve disaster risk reduction and building resilient cities, the gap though between private and public education access counts as a huge social barrier where the delivery of information does not always reach neglected areas.(30)(31)

According to the World Economic Forum's latest Gender Gap Index in 2016, Peru is ranked 80 out of 144 countries in terms of proximity to gender equality. Despite this, almost one-third of Peruvian households are headed by women.(32) Reason why, there has been an increase in focusing on women empowerment by different NGOs in the past 10 years. Tables 3 and 4(33) display a summary of women's current situation in Peru.

Table 3: Peru: Gender Inequality Index

Value	0.387
Rank	73rd / 144
Maternal Mortality	67 / 100,000
Women in Parliament	21.5%
Women over 25 with complete secondary education	47.3%

Table 4: Peru: Gender Gap Index

Value	0.6787
Rank	80th / 144

Sendai framework for disaster risk reduction emphasizes the importance and impact of including minorities within the action plan. Women play a key role in organizing responding to catastrophes. Peruvian experience from several NGO's stated that it was women who were usually the ones in charge of sensing the population affected around them, organizing the shared kitchen and goods distribution.(34) Morrow remarks how women make a difference in post-disaster decisions and outcomes. The United Nations Development Program recommends strengthening women's participation as their involvement in key disaster risk reduction initiatives has shown to have great impact when building community resilience and a great value when comes to promote change.(35)(36)(37)

The South American Risk assessment tool (SARA) provided by GEM (Global Earthquake Model) can also be applied to flooding risks. Five main determinants for social vulnerability are shown in the

maps in Figure 4. Education and healthcare, remain as a top high risk in almost all the country, especially in rural areas.(38)

Figure 06: Peru subcomponents of social Vulnerability
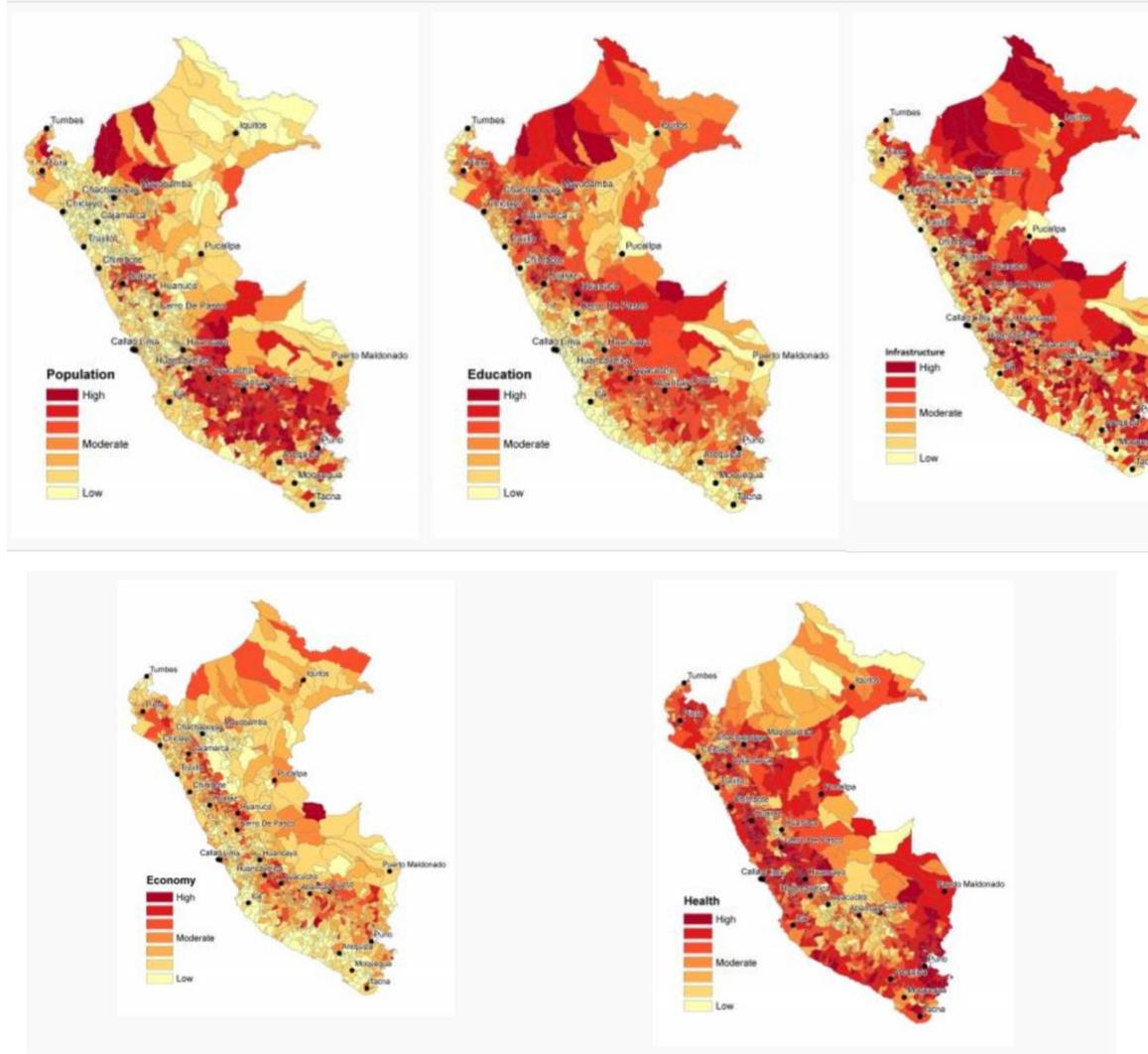
Source: SARA WIKI: South America Risk Assessment

Disaster Risk Management and Disaster Risk Reduction - Regulations

The United Nations Development Programme states that disaster risk should be given a multi-sectoral approach.(39) UNDP has helped the national governments integrate DRR and DRM into governmental plans. Peru is no exception, in 2010, a state policy which integrates DRR in development projects mandatory was integrated empowering Peru's National Civil Defense System (INDECI) which has become the disaster risk management platform. It coordinates amongst different institutions to apply national disaster prevention and management plans and consider DRR and DRM as a priority in national plans.(40)

Peru's national disaster management office (GRD), through the National plan for disaster management (PLANAGERD 2014-2021), mitigates on disaster response and awareness working side by side with SENHAMI (National Meteorology and Hydrology Service), INDECI (Civil Defense Institute), CENEPRED (National Center for estimation, prevention and reduction of disaster risk), Ministry of Finance and CEPLAN (National center for strategic planning). 2014-2021 National Plan, PLANAGERD aim to prevent, reduce and control disaster risk factors and be able to give the adequate response upon emergency situations. An addition to better understand disaster impact and how to adapt to climate variability.

PLANAGERD's main objective is to reduce vulnerability and looks to reduce the percentage of population living in vulnerable conditions through interventions by national, regional and local governments. It also aims to promote public investment, further reduce disaster risk, reinforce public structures and create urban planning awareness. Despite an established monitor plan, no information can currently be found, leaving once again good practices only in paper.

In 2016, Peru was honored as a Sendai champion for its success in the contingency plans and awareness creation on climate change. El Niño in 2015/2016 carried a death toll of twenty, which is less than 1/10th of the lives lost in FEN events of 1982/83 and 1997/98. UNISDR highlighted the death toll as a preparedness indicator and the preparedness of the contingency plan.(40) In the past 10 years, measures have taken place to encourage prevention and promote the understanding of

risk in the population which has led to partial successful results. 2010's programme application for the reduction of vulnerabilities done by the Ministry of Finance and Economics suggested interventions that when applied have led to successful resources.

So, apparently, Peru's seems to have a good and strong disaster preparedness management. Institutions provide tools for capacity building, changing the focus after HFA implementation from allocation of funds to working for resilience by reducing risks and preparing for future causalities. Despite the faultless picture, institutions involved are often reformed and restructured due to political intervention. The staff turnover is probably one of the most damaging effects, limiting disaster reduction and management interventions in the long-term. After 2016 elections, SINAGERD and INDECI stopped being autonomous and were placed under the MINDEF (Ministry of Defense). This aimed to improve and maximize DRR and DRM, creating a coordination platform to shorten the communication gap between organizations involved by well simplifying leadership between DRM institutions and the thought that linking national and civil defense will be beneficial.(41) (42)

ARISE-Peru chapter was born in December 2016; it aims to strengthen the joint capacities to promote disaster prevention and promote integration of private and public entities into better investment planning. The national society of industries of Peru signed the agreement with UNISDR to promote the integration of DRR into private investment planning. (43)

Despite good intentions, planning, new policies, successful events, the involvement of different agencies and scientific communities, civil society reach a breach still remains within the civil community and political interventions. This emerging gap arouses as the government and society cannot cope with new events. When interviewing current government officials, most are not aware of intervention policies or contingency plans which reflect that lack of communication and inconsistency in planning for prevention.

Interviews to CENEPRED and INDECI's authorities report a feeling of uncertainty, as a consequence of the reform mentioned above. It continues to work training armed forces into DRR and DRM implementation such as Shelter Management, Needs Assessment evaluation and Risk Mapping. No civil intervention is mentioned.

National and regional operation centers (COER, COEN) are responsible to warn local governments about any possible threat. This centralized matter sometimes leads to inappropriate and unusual late warning methods. Several NGO's working in risk areas report information gathered from the community observers is usually more accurate and time-appropriate. Local early warning systems are rarely applied, and those working just allow live-saving time to evacuate and do not focus on a prevention mechanism.

At 2017's fifth session of the Global Platform for Disaster Risk Reduction in Mexico, Peru's statement specified its current focus relies on the "Build Back Better" approach to reduce vulnerability indexes and opens the door to innovative approaches, encouraging the scientific and technologic sector to participate in disaster mitigation and preparedness.

El Niño Phenomenon

The presence of el Niño in Peru has been described for centuries.(44) First written records go back to the Spaniards conquest time from Francisco Pizarro in 1525.(45) The name originated in the XX Century referring to the warming of coastal waters by fishermen. This temperature increase produced a change in direction of ocean resulting in weather changes.

According to UNISDR terminology, El Niño Phenomenon is described as: "*A complex interaction of the tropical Pacific Ocean and the global atmosphere that results in irregularly occurring episodes of changed ocean and weather patterns in many parts of the world, often with significant impacts over many months, such as alters marine habitats, rainfall changes, floods, droughts, and changes in storm patters*."(15)(21)

El Niño causes weather changes involving heavy rains, sea water temperature rise and has been considered as even one of the many causes for drought. The presence of El Niño directly influences varied weather patters and affects not only the mainland population but marine life leading to a multi-impact phenomenon.

2017: Analysis

Peru's March floods were ranked 4th among the world's top 10 natural disasters by economic loss (Table 5) in the first semester. Peru's main fishing industry, agricultural sector and domestic infrastructure have been severely damaged.

Table 05: Peru/s flash appeal in between top funding UN overview (GHO 2018)

DISASTER	MONTH	COUNTRY	DAMAGES (Billion US$)
Drought	Dec 15 – Feb 17	VietNam	6.75
Flood	June-July	China	3.93
Drought	Jan-15 –May17	Thailand	3.30
Flood	March	Peru	3.14
Tropical Cyclone Debbie	March/April	Australia	2.40
Flood	June	China	2.35
Flood	April-May	USA	2.00
Drought	Sep 15 – Apr 17	Ethiopia	1.40
Sorm	February	United States	1.30
Winter Storm	March	United States	1.00

Source: EM-DAT: The OFDA/CRED International Disaster Database{Citation}

Unlike other years, by December 2016 there was no warning regarding possibility of el Niño in Peru. Drought where even reported in several areas of coastal Peru and it was not until mid-January that SENHAMI's data reflected an increasing trend of ocean temperature and a heavy rainy season in the Amazon and high-land areas.(46)

By February 2017, more provinces were declared in an emergency state and by March twelve out twenty four regions were declared in severe emergency and seven in a public health emergency state.(47) Soon after flooding worsened across the country, local authorities where soon overwhelmed by demands and lack of central support limiting the ability to act. As these problems grew a national emergency was officialy declared. By March, MINDEF (Defense Ministry: Armed Forces) was officialy leading DRM nationally, the military have been involved previously in

protection and security but not in DRM. The absence of leadership turned out to be worse as new appointments to unprepared personnel from INDECI and CENEPRED where made earlier in that year. The lack of local context working and aid allocation turned a disaster into a larger unorganized one. Information flow was delayed, misenterpretated and rarely reaching regional levels.

Together with heavy rainfall, flooding and landslides came the first reports of dengue outbreaks which led to the activation of the COEN and the declaration of state of emergency in Loreto with the overflowing of rivers and livelihood damage, MINSA reported 72,831 confirmed and probable Dengue cases (3.1 times more from 2016) turning the national cumulative incidence to 228.8 cases per 100,000 people. Piura led the highest number of cases: 47,938 followed by La Libertad, Tumbes and Ica. Other mosquito-borne diseases as Zika were reported in several regions.(48)

Media took charge of showing the world the cruelest reality and start solidarity campaigns, which lead to a massive inflow of aid not always correctly distributed. Private parties took advantage of requirements and worked for their own benefit. Many formal NGO's decided to compete for funds and intervention locations, with no official reports provided to the COEN for better support.

Discussion and Conclusions: Less said, More done

A holistic approach should be considered, where we understand that a disaster main trigger is not only the hazard but vulnerability. An emphasis on looking to understand how social systems operate and include the civil population on developing strategies for a better response may be the best outcome.

The burochratic system represents an issue and delay in both warning systems and response planning. DRM should be approached as a cross-sectoral and inter-agency issue and not addressed as separate. The lack of continuity and transition due to political intervention issues have led to duplication of efforts, lack of reinforcing local capacity and communication problems. Experts who have been involved in developing response programs are not happy with the INDECI-MINDEF-PCM

process, suggestions regarding the inclusion of INDECI sit at the table with PCM and manage the situation directly should be taken in account.

PLANAGERD establishes proper lines of action against climate threats and guidelines for DRR and DRM. When planning a response, cooperation and coordination are essential. No forecast analysis was done, but the response was based on a previous contingency plan which was not adapted to this particular outburst. DRM implementation is suggested in regional and local governments but has not been happening. This might be due to lack of capacity or the appropriate human resources distribution.

Humanitarian actors such as NGO's and local charities play a major role in disaster events. The adequate approach or junction between these may lead to a better response. Due to lack of information several NGO's managed to cover only certain affecting areas without taking in account necessity and not covering SPHERE standards. There is no national board of NGO's, a creation of one may help with the adequate coordination with governmental organizations, international aid and COEN to work in a proper structured way. International and National agencies have been duplicating efforts due to missing and delayed communication. A proper protocol looking for specific outcomes and outputs should be settled in crisis situations. A proper focus on prevention ensures DRR and DRM as a priority, aiming to reduce underlying risk factors.

A main issue highlighted by private and local officials as well as NGO representatives has been the lack of proper organization, cooperation and information between them which led to duplication efforts and misusage of technical capacities. The lack of technical knowledge and capacity is reflected in the most affected: small-scale business activities and farming activities have been mainly affected due to the flooding and landslides, but as a charity approach intervention remains ongoing many families are unable to re-establish their livelihoods and commerce activities. The effort should focus on re-empowering the affected and working together to "build back better" and not building for them. Affected people have reported they are unable to reactivate economically as charity efforts continues, and that they would prefer a recovery intervention which will have a better long-lasting effect.

Despite of measures taken previously by the government to prepare infrastructure, poor mantainance remains a consistent issue, particularly in rural areas. The current political crisis, history of inadequate allocation of resources and unsuitable constructions from corrupted companies linked with political steakholders lead to national uncertainty, upheld by the absence of accountability due to embezzlement and bribe affecting quality standards. The promotion of infrastructure resilience and "building back better" is key to diminish the impact from disaster effects which end up affecting the most vulnerable population and the country's economy severly, governments should take in account long-term effects of construction. Other concepts to take in account are the restoration of ecosystems, reforestation has proven to play a crucial role in disaster risk reduction. Reforestation efforts have already shown their beneficial effect in Asia. Due to their enhanced interception, infiltration and soil's storage capacities they have proven to decrease the impact of floods and landslides as to mitigate the effects waves and water flow by absorving energy and stabilizing sand dunes and muddy areas, preventing mudslides severe effects.(49)

Peru has been working on reducing vulnerability and introducing DRR measures to properly build more resilient infrastructure and creating social safety nets. The current stage of reconstruction after FEN 2017, might be the perfect momentum to implement a harsher and more resilient urban planning model by introducing DRR measures in order to mantain safe and sustainable infrastructures. Community resilience is built by creating civil inclusion which is critical to disaster DRM.

Despite continuous earthquake drills, not much preparedness is done for flooding or in rural areas. A decentralization approach on creating public awareness promotion and building capacity in rural areas should be applied. Cooperation between private and public agencies should work together on a people centered approach ensuring the continuity of operations and planning not only during and the recovery stage but after and before the disaster phase. Hazard early warning systems should be developed to be accessed by the entire population. The elderly, women, disabled and children should be included in DRM implementation.

Children and youth are agents of change; they should be early introduced into DRR context and taught not only after the disaster but include them in prevention strategies. An experiment included children within a local community around a river basin in rural Asia into an easy report. They should report water level (according to a color on a stick in the middle of the river) to their professor. The stick was painted, in a way that when water levels rose at a certain risk level it reached orange/red levels and the professor was included to report to local authorities. Currently, the ministry of education is working building tools to teach children to better understand disasters.

Simple warning systems and what seems to be considered as primitive resilient methods should be taken into account as they have been implemented since pre-Hispanic times. Encouraging the continuous use of these from local authorities complementing with technological improvement based on such methods may provide a narrowing gap between government authorities and the community. Understanding how each community responds to persistent vulnerabilities is extremely important to develop a people-centered approach. Undocumented rural practices may have been existing and working for years. Based on a people-centered approach, the elderly, women, disabled and children should be included in DRM implementation and open our minds to understand how some old-fashioned techniques may be well implemented in today's world.

Finally, innovation is key, private and public investors should be included and encouraged to develop new user-friendly tools for better cooperation and response. After the disastrous events, a local initiative ('Segundos auxilios') developed an interactive mapping tool where NGO's and shelter coordinators report the actual status aiming to avoid duplication efforts and manage to fulfil the adequate needs of the affected population. Private stakeholders as well as education, science and technology institutions have become engaged in the study and development of innovation, but remain aside from decision-making entities. The building of national capacity and DRM interventions should turn into a national action plan more than a priority, where there is less paper, a little less talk and a lot more action.

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