What a Disaster:
The effect of extreme events on governance and decision-making processes

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Executive Summary

With the increase in natural disasters due to global climate change, national governments are being required to respond with greater frequency to major catastrophic events. Many governments are struggling to react to these challenges with comprehensive and effective policy change. The standard model around the world is for state actors to respond to natural disasters with reactive policy meant to give aid and provide relief to those affected. This is contrary to what the United Nations has insisted and what scientific evidence suggests is in the best interest of these governments. What is needed, according to international authority and based on the evidence, is proactive forward-thinking policy change. These policy changes and the actors that pursue them must seek to understand these disasters, the needs of their communities, and the potential resilience of local systems.

What this article seeks to demonstrate is that governments around the world continue to adhere to a reactionary viewpoint of natural disaster management. This will be shown through case studies from California, South Africa, and Costa Rica. In order to understand the complexity of policy change, a basic overview and then in-depth analysis will be offered. This analysis will first seek to create a common understanding of basic terms and references used throughout this article. Next, a review of international examples relating to disaster response will be offered along with the global context that these policies exist in. Following that, a focused analysis of the Republic of Costa Rica's current emergency response will be provided. This subsequent analysis seeks to understand the impact of these events and the reaction of the various government actors. Finally, this article will delve into a detailed review of the scientific measures related to floods and droughts within the Guanacaste Province of Costa Rica.

Ultimately, this article will seek to provide a basic framework for understanding policy change in relation to natural disasters. This will be done by understanding the specific scientific data related to these events, passed government reaction to these disasters, and the ever-changing global concept of what should be done. Nevertheless, additional research and analysis will be needed to fully understand what must be done for governments to best prepare for the future. Furthermore, regional variations will inevitably limit the applicability of any findings presented here. The goal of this paper and any subsequent research is to provide models and examples for governments to use in drafting their own policies, not a one size fits all roadmap.

International Concept of Policy Reaction to Natural Disasters[1]

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An Introduction and Background

Natural disasters in all their forms are an ever-present part of our world. Hurricanes, floods, periods of drought, earthquakes, and all manner of calamities have been a feature of society since time immemorial. However, as societies have developed and evolved, they have sought to mitigate such disasters with governance and management techniques that either reduce potential damage or aid in recovery.[3] Broadly, these reactions to natural disasters have come in the form of policy change.

For this analysis, the goal is to understand the impact and role of policy in relation to natural disasters. This is especially important with the rising threat of catastrophic events in the wake of climate change. The ultimate purpose of this article is to lay a groundwork of understanding government reaction in the wake of such disasters and how these disasters may influence policy change. This understanding will hopefully allow for a more robust review in later studies and with the end goal of presenting models or examples of effective disaster reduction and relief strategies to governments that currently lack such measures. For this specific portion of the analysis, the focus will be on understanding the global conception of natural disaster reduction or relief policy, including defining basic concepts for review, and to investigate various international examples of policy adaptation. With the brevity needed for this work, the focus may remain on executive action towards such events, as this tends to be the quickest and clearest form of policy change in relation to a specific event. Furthermore, to keep the discussion on point throughout the length of this article, examples will be given with particular attention to droughts and floods.

In order to have an equal connotation and understanding of the items to be reviewed in the following pages, consistent definitions must be agreed on. Rather than offer a review of the scientific debate on these terms, the succinct definitions offered in the literature will be provided below. The basic dictionary definition of key terms include:

> **Drought** (n.) \ ˈdraůt \ a period of dryness especially when prolonged; specifically: one that causes extensive damage to crops or prevents their successful growth[4]
>
> **Flood** (n.) \ ˈfləd \ a rising and overflowing of a body of water especially onto normally dry land - The flood inundated the whole area.; also: a condition of overflowing[5]
>
> **Policy** (n.) \ ˈpä-lə-sē \ a: a definite course or method of action selected from among alternatives and in light of given conditions to guide and determine present and future decisions
> b: a high-level overall plan embracing the general goals and acceptable procedures especially of a governmental body[6]

To highlight that these terms have different definitions, depending on the source, a United Nations article defines flood with more specificity as "[a] general and temporary

condition of partial or complete inundation of normally dry land areas from overflow of inland or tidal waters from the unusual and rapid accumulation or runoff of surface waters from any source."[7] A precise definition of these terms and more would certainly be necessary for more advanced research and policy drafting, however, for this review, the basic definitions offered above should be sufficient.

Assessing Executive Action

In the simplest forms, executive action is anything that is done by an executive; in this context that would be the executive branch of a government.[8] Numerous concepts may come to mind when hearing of the term 'executive action,' including: executive orders, memorandums, proclamations, and more. While these are all 'executive actions,' each has their own meaning and significance.[9] While this will not be an international civics lesson, there are two key takeaways; (1) 'executive action' is not law per se, but it does comport to our definition of policy, and (2) 'executive action' can be termed differently depending on the country and context.[10] An example of the latter point would be that one type of executive action in the United States is an "executive order" whereas, in Costa Rica a similar feature would be a "Presidential Decree."[11]

In relation to the discussion at hand, a common executive action would be to declare a "state of emergency."[12] Yet again, this term of art can mean a variety of things and may indeed be called something else in various locations, but in general, it is defined as "a temporary system of rules to deal with an extremely dangerous or difficult situation."[13] More specifically, this type of declaration temporarily suspends certain procedural rules, facilitates emergency response, and releases disaster funds.[14] In short, this executive action "allows the government to act more quickly than it can during non-emergency times."[15] In many places, especially in the United States, a "state of emergency" is specifically for significant weather events and natural disasters.[16]

A California Flood

In February of 2014, the State of California was in the middle of an extended drought when it was suddenly inundated with heavy winter rainstorms that caused significant flooding.[17] The sudden onset of heavy rains in this dry environment led to rock slides, power outages, and property damage.[18] The government's reaction to this natural phenomenon was to declare a "state of emergency," close roads, and order evacuations, among other actions.[19] This was shortly after Governor Jerry Brown had declared a "state of emergency" for the extended drought in the state and the passage of new policy meant to restrict water consumption.[20] A majority of the action taken by the state government was a reaction to the emergency, not in preparation of a natural disaster.[21]

In the wake of the 2014 disaster that combined both flooding and drought, and other related incidents over the following three years, the California government sought to evaluate its water management and disaster preparedness legislation and systems; it did this through its Legislative Analyst Office (LAO).[22] The LAO report offers succinct information on major ecological and political events in the state's history related to water-based natural disasters and

related policy change.[23] In addition, the report provides an overview of the key factors related to disaster relief and emergency preparedness.[24] A major set of factors that the report identifies is the overlay of institutions that respond to such natural disasters at the various local, state, and federal level.[25] As a government entity, the LAO is likely not overly critical of the government's actions, however, it is evident from the descriptions provided that a flaw in the California response system is the disconnect between the local level, where a majority of the response action occurs and the state level where the largest percentage of the funding is located.[26] In so many words, the report calls for cooperation between the different levels to mitigate any impact.[27]

The California drought would extend for another three years past 2014 and a similar series of storms would impact California in 2017.[28] Yet again, the Governor of California declared a "state of emergency" and explicitly instructed various executive departments to work together.[29] During this time, the Governor also specifically requested that the legislature allocate additional funds to respond to the disaster.[30] What is notable about this example is that even though this was an ongoing and foreseeable issue, most of the executive action that was taken was in response to these events, not in preparation of them. Of course, executive action in the form of various executive departments was ongoing during this period, but what has been absent in the literature is any major preparatory legislation, decree, or projects. It may be wished that this be an isolated incident, but as will be seen, similar actions, or lack thereof, are commonplace in the realm of emergency management.

The South African Drought

Part way across the world we find another example of natural disasters, the impact they have, and the policy response to them, this would be the exceptional drought in South Africa.[31] With numerous causes, including a prolonged drought in the entire sub-Saharan Africa region, this disaster was dubbed "Day Zero" and there was a media flurry around when Cape Town would officially run out of water.[32] In the midst of the crisis, local leaders imposed a strict 50 liter per person per day cap on water use and even resorted to shaming and fining those that used an excess amount of water.[33]

While the impact of this El Niño triggered drought was concentrated in Cape Town, it had a widespread effect on the entire country and region.[34] However, the reaction in Cape Town itself is of specific importance. The reaction by city officials was focused on managing the immediate issues and only coincidentally planning for future droughts.[35] At the moment, due in part to the emergency measures taken and the beginning of seasonal rains, the crisis has been delayed until 2019.[36] Nevertheless, this crisis shows that government actors need to be proactive on emergency management plans, specifically for droughts, because unseasonably heavy rain will not always be there to save the day.[37]

In light of the expressed consequences of the 'Day Zero' emergency in South Africa and the prolonged drought-like conditions in the region, African Union (AU) members are now beginning to plan for what may be the "new normal."[38] State leaders in sub-Saharan Africa are beginning to consider the economic, social, and environmental repercussions of this "new normal."[39] These drivers are ever-present in political debate, but as of yet, there is no clear or

coherent government reaction to the prolonged issue, just short-term relief and mitigation strategies.[40] At present, many are relying on significant technologic advances in the near future as a solution to the ongoing problem.[41] While technical advances may well be on the horizon, it is uncertain exactly when they will be practical and to what extent they will remedy the situation.[42]

A Global Context

In addition to state action regarding natural disaster, there is also a global perspective taken by the United Nations Office of Disaster Risk Reduction.[43] This branch of the United Nations (UN) coordinates the UN International Strategy for Disaster Reduction (UNISDR).[44] The role of UNISDR is to promote disaster risk reduction by aiding governments in the creation and implementation of sound policy that makes communities resilient to the rise in natural threats.[45] Compared to the examples provided above, UNISDR is seeking to be proactive about policy implementation rather than reactive. The history of the UNISDR is interesting as it traces its roots back to natural disasters in the 1960s, but it is in 2007 that there is the first session of the Global Platform on Disaster Reduction.[46] This Global Platform, or workshop, is designed to increase communication among shareholders, identify deficiencies in the UNISDR, and to brainstorm ways to implement new policy.[47]

A major initiative and significant achievement for UNISDR has been the Sendai Framework.[48] The Sendai Framework is a voluntary international agreement between states that seeks to coordinate stakeholders to prepare for inevitable natural disasters and to minimize possible damage.[49] The Sendai Framework sets Seven Global Targets that focus on the reduction of social, economic, and environmental damage from natural disasters and to increase the availability of aid in the wake of such events.[50] Furthermore, the Framework encourages stakeholders to understand disasters, strengthen governance, invest in resilience, and enhance preparedness.[51] Overall, compared to the examples seen above, the UNISDR through the Sendai Framework seeks to have states be proactive about disaster preparedness and emergency management.[52]

Moving on from this broad international and global review of policy reaction to natural disaster, the subsequent sections of this paper will seek to delve deeper into the workings of policy change with relation to specific events. As a case study, this analysis will focus on the reactions within the Central American state of Costa Rica, and then more specifically on the Guanacaste Province of the country.

Endnotes

[1] Written work prepared for joint University of Florida and Organization for Tropical Studies course on International and Comparative Environmental Law, May 20 – June 18, 2018
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Droughts and Floods in Costa Rica and the Measures Taken[1]

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Application of Costa Rica

In 1991, more than 185,000 Costa Ricans were affected by floods.[3] Recently, these floods and storms have affected more livelihoods and have brought more economic damage than earthquakes.[4] Just as the international community struggles with droughts, floods, and policy guidelines that may or may not accompany them, the Republic of Costa Rica specifically is experiencing extreme droughts and floods as apart of climate change.[5] The government's responses to these natural disasters has been seen through executive orders and various forms of policy changes. However, there remains the underlying issue of whether the government will take more proactive measures with the increase of these unpredictable natural events.

Introduction

For the purposes of this research, meteorological droughts and floods are the two natural disasters at issue. The Costa Rican government has defined a meteorological drought as, "the annual precipitation levels being below their first quintile for at least two or three months."[6] It is the responsibility of the Instituto Meterológico Nacional (IMN) to declare whether a meteorological drought has, or is, occurring. This is because, specific scientific data is used when determining a droughts occurrence.[7] Likewise, a flood is the submersion in water due to the temporary rise of a river, lake, or other when conditions would normally be dry.[8] Unlike droughts, it is easier to determine when a flood is occurring. Both of these terms will be applied throughout the course of research.

Current Systems in Place

The Costa Rican government has several government-based organizations in place that specifically deal with natural disaster management and planning. These organizations currently take on a more reactive role in their responses to natural disasters. First, the Comisión Nacional de Emergencias (CNE) is in charge of coordinating aid in emergency situations.[9] Its original purpose was to promote and implement public policy guidelines for risk management.[10] In addition, CNE was initially designed to take a more proactive approach by writing national emergency plans and organizing a national prevention system.[11] However, most of CNE's current work entails coordinating groups that rehabilitate areas post natural disaster.[12]

The National Risk Management System (NRMS) is another organization that was designed to help with natural disasters.[13] The specific job of NRMS is to integrate all of the relief efforts in both the public and private sector.[14] It was created as an organizational tool between national, municipal, and regional levels by allowing for open communication between these different levels to run.[15] However, currently, NRMS is only being used post naturals disasters.

The Government's Power

The government's actions before and after natural disasters is crucial. In general, executive decrees, or state of emergencies, are declared to provide aid after an event has occurred. In Costa Rica, the president and other government ministers may issue decrees.[16] These decrees must be published in the official gazette before it may become binding.[17] The decrees associated with natural disasters are called State of Emergency Decrees.[18] Under a state of emergency, an administration can easily assign and allocate necessary resources to manage the emergency.[19] There are four provisions of a State of Emergency Decree that gives the executive branch the necessary power to provide quick aid in the case of a natural disaster. Those provisions are:

> (i) It authorizes the institutions related with the attention of the emergency to give donations to the CNE to control the emergency, (ii) it allows the Executive Power to change the destination of an item or to open additional credits to cover the urgent necessities caused by the disaster, (iii) The Executive Power can impose temporal restrictions land use restrictions to execute the management activities to control the emergency, (iv) all the local, regional and national institutions are compelled to coordinate with the CNE the action plan to control the emergency.[20]

Aside from the federal government's actions, municipalities and the Ombudsman Office may also act in declaring a state of emergency. An Ombudsman is, "an independent office attached to the legislature to whom they are accountable rather than to the government in office."[21] The Ombudsman can compel the Executive Power to declare a state of emergency. Likewise, municipalities may assemble Municipal Emergency Committees and coordinate with a local CNE official. By having these two resources, smaller municipalities can advocate for themselves to still receive the aid provided by declaring a state of emergency.

The last form of government power is by enacted law. Law No. 8488, the National Emergency and Risk Prevention Law, was designed to . . . "reduce to loss of life and the social, economic and environmental consequence induced by risk factors of natural and anthropic origin."[22] Essentially, this law is designed to help create proactive measures before natural disasters even take place. The goal is to prevent natural disaster damages, such as loss of life, by being prepared. This law specifically created the National Commission for Risk Prevention and Emergency Response whose job is designed to not only coordinate during times of emergencies but also to educate and prepare communities for natural disasters.[23] This commission shows more of the proactive steps that the Costa Rican government is taking. Also, Law No. 8488 Chapter IV reviews the state's responsibility in preventing disasters.[24] Despite the short chapter, it yet again shows a trend to move into proactive, as opposed to reactive, thinking. Law No. 8488 differs from State of Emergency Decrees and municipality meetings as it looks forward to prevention.

Action vs. Reaction: Natural Disasters and the Government's Response

The governments primarily reactive responses to these natural disasters can be seen in recent events. Despite droughts and floods being a commonly known natural disaster, there have

been recent extremes. This was especially true in 2015 when Costa Rica was hit with a series of extreme droughts and floods simultaneously.[25] In 2015, the Guanacaste region faced droughts on the Pacific side of the country.[26] At the same time, the city of Limón experienced flooding caused from heavy rainfall.[27] This rainy season in Limón was recorded as the second highest since 1971, when data collection began.[28] San José and the Greater Metropolitan Area also experienced side effects from this extreme weather with a reduction in water use.[29] This record year of extremes will not be an uncommon occurrence in the future, with El Niño events and climate change.

More specifically, the El Niño Phenomenon of 2014-2015 is one example of action versus reaction on behalf of the government.[30] This event was caused by El Niño which is a decrease of rain on the Pacific side and the generation of intense rains on the Caribbean side.[31] Because of this, there was damage to agricultural based products, a decrease in flow of natural sources (like water for human consumption), and environmental damage.[32] The government reacted by issuing Executive Decree 38642-MP-MAG.[33] This decree allowed for there to be unencumbered allocation of funds from CNE and phases of response, rehabilitation, and reconstruction.[34] This decree was a reactive measure because it was issued only to aid in the aftermath of the disaster.

Another example of the government's reactive measures can be seen in the flooding that occurred from Tropical Storm Nate.[35] In October 2017, Tropical Storm Nate killed twenty-two people in Central America and specifically eight in Costa Rica.[36] This storm left 400,000 Costa Ricans without power or running water.[37] In addition, more than 7,000 residents were forced to take refuge in shelters while schools and highways, including parts of the Inter-American Highway, were closed.[38] From an economic standpoint, Costa Rica's rice production was negatively affected by Storm Nate. Rice production declined to 130,400 MT during the 2017/2018 crop year because of the storms flooding. Despite there being predictions that rice production will "bounce back", if tropical storms and hurricanes to the caliber of Nate are to continue, then there will not be time for agriculture to grow back.[39]

The Costa Rican Government responded to Tropical Storm Nate through the declaration of State of Emergency Decree No. 40677-MP.[40] In the writing of the decree, The National Commission for Risk Prevention and Emergency Response and National Meteorological Institute (IMN) worked together to issue alerts and data.[41] Specifically, the IMN reported sustained winds of 65 km/h and heavy rains that caused floods and landslides.[42] These floods and landslides caused a loss of assets, negative environmental impact, and the death and injuries of people and animals according to the IMN's last report.[43] The decree itself placed a state of emergency in multiple provinces across the country including the Province of San José, Guanacaste, and Alajuela.[44] The emergency declaration also outlined three phases of aid: response, rehabilitation, and reconstruction.[45] This executive decree was issued after the storm had arrived and was yet another reactive measure.

Both the El Niño Phenomenon and Tropical Storm Nate are examples of devastating events that resulted in the government reacting to the tragedies through state of emergency decrees. These decrees allowed for aid to be given in the regions affected. Nevertheless, there is little mention of long term action. Specifically, the repeated language of "response,"

"rehabilitation," and "reconstruction" was used in the decrees; however, there is no distinct mention of prevention or the future.[46] As seen in these two examples, natural disasters not only impact infrastructure, like highways, but also livelihoods, the economy, and the environment.[47] Due to the size and location of Costa Rica, natural disasters can strike at the same time, like in 2015, or can affect the whole country at once, like Tropical Storm Nate. Because of this, Costa Rica must start thinking of proactive measures.

Proactive Measures

With climate change and the effects of natural disasters, the government must look to be more proactive rather than reactive. As these events become more extreme and frequent, the phases of responding and rehabilitation may become more demanding or shortened. Currently, aside from Law No. 8488 and the CNE, the Costa Rican government is working to become more proactive.[48] One of the ways they are doing this is through changing building codes in both the public and private sector.[49] For now, this has only been done for earthquakes; however, there is a transition for other natural disasters. Also, Costa Rica has adopted the recommendations from the Hyogo Framework for Action (HFA).[50] HFA is an international recommendation for building resilience against disasters and the precursor to the Sandai Framework.[51]

Legislators and policy makers are also moving in a more proactive direction by creating long term policies to help. Recently, a law was reformed for victims of natural disasters. The new law allows for the Home Mortgage Bank to eliminate the second housing voucher for families affected by natural disasters.[52] Although this is not an immediate fix because it only covers 50 % of the total expenses in most cases.[53] Nevertheless, it is a step in the right direction to ensure that when natural disasters arise victims will be able to relocate securely and in a long-term location.

Conclusion and Forward Thinking

The issue of whether the government is taking action through policy changes to aid in the increase of natural disasters may or may not be clear at this time in the Republic of Costa Rica. Currently, after natural disasters occur, a State of Emergency Decree is issued as a quick and short-term way for funding and aid in the affected areas. Although this is may work for the time being, there is a sense of urgency to become more forward thinking. Since 2015, there has been extreme and unpredicted events in close proximity in the country. Because of this, the government must look to become proactive. The government's action is already clear in the implementation of Law No. 8488 and the CNE along with policy changes for home mortgages. However, there is not currently a clear answer on whether this alone will be enough.

Endnotes

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Floods and Droughts in Guanacaste[1]

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The Tempisque Watershed

The Tempisque River Basin (TRB) is a highly complex system located in northwestern Costa Rica. The basin receives water diverted from the neighboring Arenal basin which experiences a very different precipitation regime.

One important variable of the TRB is the Water availability and quality for agricultural activities as well as the National Park Palo Verde (RAMSAR site, and international convention for wetland protection). The current general climatic forecast for the region is a decline in precipitation and an increase in temperatures, which will stress even more water availability and its management. In a system where there are so many users, there is growing competition for water allocation. It is vital to understand how water availability will change in the future, and to allow stakeholders to react in a timely fashion as they prepare for the future climatic scenarios.

Through the years there has been important climatological emergencies that have put an extra stress in the management of the basin. Long droughts have impacted the region who is dependent on water for agriculture, natural systems and the livelihood of people. Also, the TRB has been impacted by floods due to heavy rains that come with tropical storms and hurricanes.

It might seem contradictory that a region that is destined to become drier has flooding events. The problem is in that the rain is not distributed evenly. During the dry season, very little rain will fall contrary to the rainy season where there can be up to 1500 mm of rainfall per year. If the dry season matched the El Niño phenomenon, the dry conditions can really create a problem like the 2014 drought that we will describe in more detail below.

El Niño and La Niña Phenomenon

One phenomenon that influences these extreme weather events is El Niño Southern Oscillation (ENSO) which is a phenomenon where sea surface temperature interacts with the atmosphere producing variations in rainfall patterns and air temperature that occur across the equatorial Pacific Ocean. The name was given by Peruvian fishermen that saw this variation in temperatures in the ocean in December, or the Child Christ There are two distinct phases of the ENSO cycle: El Niño and La Niña. [3,4]

El Niño is known as the warm phase of ENSO because sea surface temperatures are above average in the east central equatorial Pacific. This is due in part to a weakening of the Southern Hemisphere trade winds and a decrease of the upwelling of cold water along the coast of South America (see Figure 1).

La Niña is called the cold phase of ENSO because sea surface temperatures are cooler than usual. The Southern Hemisphere trade winds are stronger, and the Peruvian Ocean current is stronger which allows a tongue of cold water to be present along the coast of South America (see Figure 1).

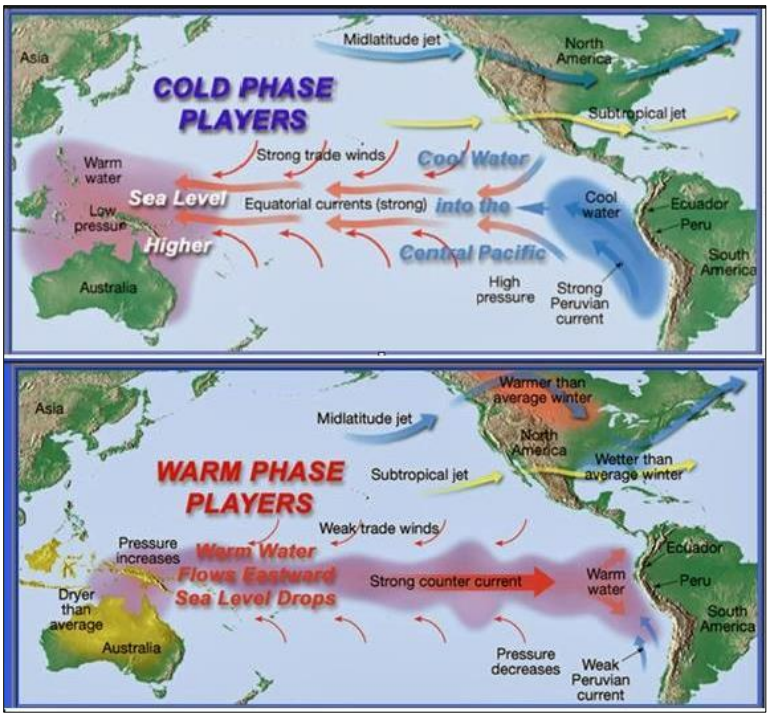

Figure 1. Climate patters for La Niña and El Niño phenomenon in the Pacific Ocean. *(Vickas, 2015)*

The impacts of both phases of the ENSO phenomenon differs on a global scale. During an El Niño event there is an increase in the precipitations in Peru and Ecuador, but in Costa Rica precipitations will decrease (Figure 2).

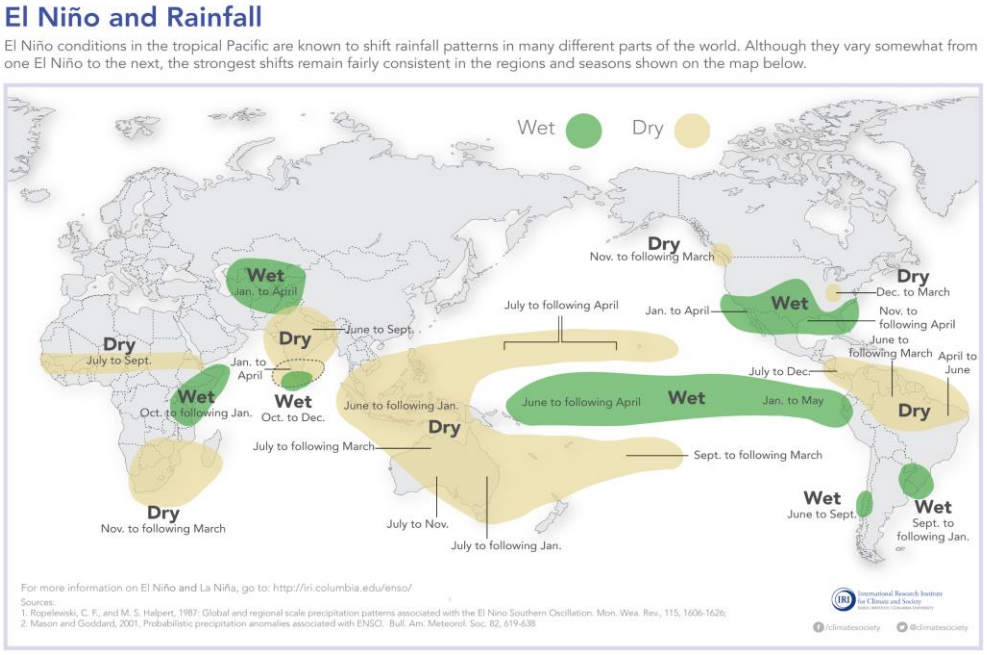

Figure 2. Rainfall patterns during an El Niño phase (International research Intitute for Climate and Society, 2001)

The 2014 Drought

The last big drought in the Guanacaste region occurred between 2014 and 2015. This is the biggest drought affecting the area since 1937.[5] Temperatures above the mean and precipitations far below the mean were felt. This led to a devastating effect in the agricultural production as well as in the public health. We are going to describe the main causes of this drought.[6]

Beginning April 2014, the regions evolve to an El Niño tendency, as shown by the above the mean sea surface temperatures in the Tropical Pacific. This led to a decrease in the rainfall in the Pacific slope of Costa Rica and the Central Valley. At this point it is still uncertain the intensity of the phenomenon. Added to this situation, there is a cooling in the Tropical Atlantic Ocean waters which creates a decrease in the humidity circulation in the country. By June 2014, the National Institute of Meteorology (IMN) can state that there is a consolidated phenomenon of El Niño. The meteorological stations in Liberia and Filadelfia register 65% less precipitation by the end of the month. The prediction models from IMN point to a warming of the Pacific Ocean for the months of July and August. It was later confirmed that the rainfall in Guanacaste decreased between a 40% and 60%, aggravating the situation. During September there was a negative balance in the rainfall in the Guanacaste area up to 30% while in the Central Valley there was a positive balance of 25% in the rainfall.

The estimations of the IMN point to an hydrometeorological drought for the Guanacaste area which affected the agricultural production and the water supply for human and animal consumption.[7]

In an interview done to Andrea Suárez, director of the Center for Water resources for Central America and the Caribbean (Hidrocec), she points that the local governments postponed for years key investments in infrastructure important to water resources of the area.[8] This helped to intensify the effects of the drought which caused losses in crops for over 25 million dollars as well as a decrease in groundwater recharge which prolonged the effect of the drought.[9]

According to the General plan for the drought emergency, the following are the expected effects due to the drought:

- "*Shortage or rationing of water for human and animal consumption.*
- *Loss of soil humidity. The impact already perceived in the agricultural and livestock activity by the loss of productivity of the crops and the pasture, extends to the dry season as a limitation of recovery of the system. This implies an increase in costs for human and animal nutrition and delay in recovery.*
- *Dry forest cover increases with fire risk and death of wild animals.*
- *Increase in the population of rodents and snakes with health complications.*
- *Increase in vectors of communicable diseases and allergies, both respiratory and skin.*
- *Impoverishment and difficulty of subsistence of agricultural and fishing settlers.*
- *Decrease of the tourist visit."*[10]

Future Climatological Outlook

Climate is changing, it is no longer a hypothesis but something that we are facing every year with extreme events occurring more frequently, putting an extra burden to countries, mainly those who are in the developing world. Understanding a country's vulnerability to this changing climate is key to be able to access where the government should put its effort and what areas have to be reinforced. To be able to do this, it is important to have a qualitative and quantitative knowledge of how the climate will look like in the future, understanding de projection of temporal and spatial patterns of the different climatological drivers.[11] This is done through the modeling of different future scenarios. According to the Intergovernmental Panel on Climate Change (IPCC), scenarios are an image of how the future might look, with different greenhouse gas emissions that are highly dependent on demographic development, socio-economic development and technological change.[12] Different narratives are developed to describe how the future will look for different demographic, social, economic, technological and environmental developments.

There are a wide variety of methodologies to create climate change scenarios, the most popular is the dynamic climatic model which is a simplified mathematical representation of the different climate drivers (atmosphere, hydrosphere, biosphere, cryosphere and land surface).[13] The results of these scenario climate modeling point to a decrease in precipitations for Central America. For Costa Rica, there are different responses depending on the slope; for the Atlantic slope, it is expected an increase in precipitation while in the Pacific slope there will be a decrease of it up to 65% for the year 2100.[14]

The El Niño phenomenon is like a window to the future, where it impact gives a hint of the climate that will be felt more frequently in the years to come.[15] Under extreme climate event like the El Niño phenomenon, the weather in the country is not homogenous: there are droughts and high temperatures but only in some parts of Costa Rica (Pacific slope).[16] Air temperature is expected to rise up to 6 degrees Celsius, mainly during the month of October and the duration and variation of these conditions is expected to last longer.[17] This not only affects the sea surface temperature but also the behavior of the population and the agricultural sector that will be in need of more water for its livelihood.

The Guanacaste region is expected to suffer the effects of Climate Variability. The Tempisque watershed will experience an increase in temperatures between 2 to 6 degrees Celsius and a decrease of precipitation between 20% to 50%.[18] For this reason, it is important to plan ahead, and the government needs to invest in research and infrastructure to tackle this future climatic condition. The current irrigation district brings water to a part of the watershed and there is another reservoir and irrigation plan for the future (Pacuume project). There is also an interest in expanding the monitoring of groundwater use which has been overexploited and these natural reservoirs are depleting without control. For this it is also important to educate the users for a conscious use of water and to implement new technologies and practices that will ensure the availability of water. The change in the waste culture needs to give room to alternative systems like rainfall harvesting trough reservoirs so the rained water will be available when there is no rain.[19]

Endnotes

[1] Written work prepared for joint University of Florida and Organization for Tropical Studies course on International and Comparative Environmental Law, May 20 – June 18, 2018
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Conclusion

This article demonstrates that much is left to be desired when it comes to government policy relating to natural disaster management. The prevailing trend has been that governments respond to natural disasters with reactionary policy that focuses on mitigating the issues from said disaster. This type of response, while needed, does not address the larger and more ominous problem. This problem being that natural disasters are on the rise largely due to climate change and that proactive policy is necessary to plan and prepare for the inevitable.

Based on the cases studies offered from California and South Africa it should be understood that while reactionary policy to aid those affected by disasters is necessary, it does not solve the problem. Declaring states of emergency and restricting water consumption work in the short-term, but they are not long-term solutions. Furthermore, the United Nations has already called for a more robust response regarding policy change for natural disasters. The Sendai Framework explicitly states that proactive planning and understanding of disasters is necessary for local leaders to improve the resilience of communities.

Just like on the international level, Costa Rica is also struggling with extreme natural disasters such as droughts and floods. Currently, the government is acting in a more "reactive" manner by responding to natural disasters through State of Emergency Decrees and phases of rebuilding. However, this method cannot sustain itself. In 2015 alone, there were two major natural disasters (one drought and one flood) occurring at the same time. The government is moving in the right direction and working on policy changes. The Law No.8488, a reduction in housing relocation costs, and the CNE are all national examples of Costa Rica becoming proactive. On the international level, Costa Rica has joined and followed the recommendations of the HFA. With these efforts Costa Rica is moving in the right direction, but will it be enough?

Within Costa Rica, and specifically the Guanacate region, the effects of natural disasters are being hard felt. Climate variability, and the El Niño and La Niña are phenomena, has affected the rainfall in Guanacaste significantly. This variability tends to exasperate the usual conditions. In 2014, the area saw a drought where rainfall decreased by up to 65%. However, the Tempisque watershed does not lack water all year round, rather, it is not distributed equally through time. The building of reservoirs where water from the rainy season can be used during the dry season has not remedied the problem. The climate in the country and the Guanacaste region is already changing and the risk of extreme events will increase if this reactive policy is maintained. Scientific data is available and shows what is in store for Guanacaste in the years to come. It is important to make the link between scientific models, scenarios, policy-making and governance.

This report should not be taken as a final work on the matter of policy change relating to natural disasters. Rather, this is a 'first step' towards a compressive review of the intricacies and issues that underlie this topic. Additional research is essential to understand the numerous actors involved in policy change and the assorted drivers of that change. Furthermore, stakeholders in such policy change must seek to find evidence-based support for any change in order to promote genuine resilience to forthcoming events. Overall, climate change has raised the risk for natural disaster response policy and the present situation is inadequate. Only through comprehensive review and cooperative efforts can genuine and positive change be achieved.